Men's Health Study: A Cross Sectional Study of HIV among Men Who Have Sex with Men in Kisumu, Kenya

By

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Thesis
Submitted as partial fulfillment of the requirements
for the degree of Masters of Science in Public Health Sciences (Epidemiology)
in the Graduate College of the
University of Illinois at Chicago, 2012

Chicago, Illinois

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ACKNOWLEDGMENTS

I would like to thank the extraordinary men in Kisumu, without their courage, cooperation and trust this study would have been impossible. Also, I would like to thank the dedicated staff of the Men's Health Study, University of Nairobi, Illinois and Manitoba, Project and KIPE and to Nyanza Reproductive Health Society and the University of Nairobi Institute of Tropical and Infectious Diseases who made conducting this study possible.

This study was funded by Population Council via contract to Nyanza Reproductive Health Society. Supplemental funding was generously provided by the 2009 Douglas Passaro Global Horizons Scholarship. The scholarship was established by Lanny and Terry Passaro and Sherry Nordstrom, MD, and is continuously supported by Doug's family and friends.

Special thanks to Scott Geibel, MPH, PhD, KIPE Executive Director Marc van der Giessen, Marisa Young and Nelli Westercamp, MPH, MBA for their advice and assistance with the study and overall morale boosting, and thesis committee member Chevy T. Williams, MPH, PhD for her support and comments on the thesis.

Very special thanks to Supriya Mehta, MHS, PhD for her incisive criticism, guidance and encouragement.

And to Robert C. Bailey, PhD, MPH, I am extremely grateful and fortunate to have benefited from his experiences, keen observations and mentorship.

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LIST OF ABBREVIATIONS

95% CI	95% Confidence Interval
ACASI	Audio Computer Assisted Self Interview
aOR	Adjusted Odds Ratio
ARTIS	Antiretroviral Therapy Impact Study
AUDIT	Alcohol Use Disorders Identification Test
CIRCIS	Circumcision Impact Study
CT	Chlamydia trachomatis
HIV	Human Immunodeficiency Virus
HSV-2	Herpes Simplex Virus 2
KIPE	Kisumu Initiative for Positive Empowerment
MHS	Men's Health Study-Kisumu
MMC	Medical Male Circumcision
MSM	Men who have sex with men
MSME	Men who have sex with men exclusively
MSMW	Men who have sex with men and women
NG	Neisseria gonorrhoeae
OR	Odds Ratio
p	P-value
RCT	Randomized Controlled Trial on Male Circumcision in Kisumu, Kenya
RDS	Respondent Driven Sampling
RDSAT	Respondent Driven Sampling Analysis Tool

LIST OF ABBREVIATIONS (continued)

STI	Sexually Transmitted Infection
TPHA	Treponema Pallidum Hemaglutination Assay
TV	Trichomonas vaginalis
UIAI	Unprotected Insertive Anal Intercourse
UNIM	University of Nairobi, Illinois, and Manitoba
URAI	Unprotected Receptive Anal Intercourse
UVI	Unprotected Vaginal Intercourse

SUMMARY

In Kisumu, Kenya a cross-sectional study was implemented to sample men who have sex with men (MSM) to determine the prevalence of Human Immunodeficiency Virus (HIV) and other sexually transmitted infections (STIs) among them and to identify demographic and behavioral factors associated with HIV infection. Due to the highly stigmatized nature of same sex activity in Kenya, a sampling technique efficient at identifying members of hard to reach populations called respondent driven sampling (RDS) was employed. The enrolled men completed a behavioral questionnaire and underwent rapid HIV testing and subsequent STI testing.

Adjusting for sampling design, HIV prevalence was 11%, twice as high as the Kenyan national prevalence among men, but comparable to sexually active men in Kisumu, Kenya. Controlling for age, ethnicity and highest educational attainment, prevalent Herpes Simplex Virus 2 (HSV-2) infection, past history of genital ulcerative disease and unprotected vaginal intercourse at last sex with a woman were factors strongly associated with prevalent HIV infection.

I. INTRODUCTION

Once overlooked, the HIV epidemic among MSM in sub-Saharan Africa is gaining recognition as a significant contributor to the HIV epidemic in the region. In several sub-Saharan African countries, MSM experience HIV burden exceeding that among heterosexual men from the same area (Smith et al., 2009). In Sudan and Senegal, where the national HIV prevalence is low (less than 5%) MSM HIV prevalence was 9 to 21 times greater than HIV prevalence among heterosexual men (Wade et al., 2005; Elrashied, 2006; UNAIDS, 2009). The national HIV prevalence in Tanzania is greater than 5%, but for MSM the HIV prevalence was 2.5 times greater than the HIV prevalence among heterosexual men (Smith et al., 2009; UNAIDS, 2009; Dahoma et al., 2009). Similarly, in Malawi, Namibia and Botswana, where the national HIV prevalence exceeds 10%, the HIV prevalence among MSM was 1.1 to 2.2 times greater than the HIV prevalence among heterosexual men (Smith, 2009; UNAIDS, 2009; Baral et al., 2009). Overall, these results suggest a greater burden of HIV among MSM compared to heterosexual men in sub-Saharan Africa.

World-wide, MSM are at a high risk for HIV, yet in many sub-Saharan African countries where health policies and community health programs do not target this population's specific needs, these men are particularly vulnerable. Cross-sectional and observational studies have reported high rates of sexual risk behaviors and low rates of protective behaviors among MSM. In Soweto, South Africa, Lane and colleagues estimated that 38.7% of MSM had at least 6 sexual partners in the past 6 months (Lane et al., 2009) and Sanders et al. reported that MSM in Mombasa, Kenya had a median number of 2 casual partners and 1 regular partner in the past month (Sanders et al., 2007). Consistent condom use during anal sex with a male partner in the last 6 months ranged from 23.9 to 45.8% among MSM in Nigeria (Merrigan et al., 2011).

In Tanzania only 14.5% and 9.2% of participants reported consistent condom use during receptive and insertive anal sex, respectively with non-paying male partners in the past month (Dahoma et al., 2009). Although only a few studies on MSM in sub Saharan Africa have reported prevalence

estimates of STIs, the reported measurements provide some insight into the behavioral vulnerability of MSM to HIV and a susceptibility to increased HIV acquisition and transmission. Estimates of gonococcal and non-gonococcal urethritis in Senegal were 2.6 % and 3.2% respectively (Wade et al., 2005), and in Mombasa, Kenya were 3.2% and 12.9% (Sander et al., 2007). Sanders et al. also reported the prevalence of symptomatic genital and peri-anal ulcerative disease of 3.9% and 2.5% and a syphilis prevalence of 3.5%. Wade et al. reported a smiliar syphilis prevalence of 3.4% and a HSV-2 prevalence of 20.6% (Wade et al., 2005; Sanders et al., 2007).

Additionally, MSM vulnerabilities to HIV infection are mitigated by legal and cultural factors. Same sex sexual activity is criminalized in 76 countries world-wide, 38 countries in Africa, and can be punishable with multiple year jail sentences, hard labor, and death (Ottoson, 2010); in Kenya, conviction of same sex sexual activity can result in imprisonment for 5 to 14 years (Kenya Law Reports, 2009). In addition to legal discrimination, MSM are further stigmatized by community and family members enduring harassment and abuse (Onyango-Ouma et al., 2009; Okal et al., 2009; Geibel et al., 2010). Such legal and social pressures act as a barrier preventing MSM from accessing or benefiting from necessary prevention services. Men who have sex with men who experience discrimination may not seek out health care services (Fay et al., 2011) or fully disclose their sexual behavior with other men to health care workers, obtaining inadequate or no HIV prevention counseling (Lane et al., 2009) or treatment for STIs. The appropriate delivery of preventative services and treatment to MSM is ultimately important for both MSM and the general population, as the HIV epidemic among MSM and in the general population is interconnected.

High proportions of MSM who also have sex with women (MSMW) have been reported, ranging from 43.6% to 87% in Malawi, Botswana, Namibia, Tanzania and South Africa (Dahoma et al., 2009; Baral et al., 2009; Lane et al., 2009), and genetic analysis from Kenya and Senegal suggests evidence of HIV strains circulating between the general population and MSM (Smith et al., 2009; Tovanabutra et al., 2010; Ndiaye et al., 2009). This implies that MSM and the general population are linked via sexual contacts and preventative measures need to address both the general population and MSM.

Although research into the HIV prevalence and sexual risk behaviors among MSM in sub-Saharan Africa is nascent, the emerging evidence highlights the need to develop targeted prevention approaches informed by surveillance and observational studies and to evaluate the impact of interventions on reducing risk behaviors and preventing new infections within this highly stigmatized and vulnerable population.

In Kenya, there have been several studies on HIV and sexual risk behaviors among MSM in Mombasa and Nairobi, but none in Kisumu. Kisumu is the third largest city in Kenya and the capital of Nyanza province, which has the highest overall HIV prevalence in Kenya at 14% (Kenya National Bureau of Statistics, 2010). The HIV prevalence among MSM in Kisumu is unknown, and there are no published measures of behavioral and other factors associated with risk of HIV infection in this population. This study sought to assess HIV and STI prevalence, and sexual risk factors associated with HIV infection among sexually active MSM in Kisumu, Kenya.

II. METHODS

This study took place at Kisumu Initiative for Positive Empowerment (KIPE) a community health organization in Kisumu, Kenya from June 26, 2010 to November 1, 2010. Kisumu Initiative for Positive Empowerment was selected as the site location since it has provided a safe space for an MSM support group to meet and provided HIV prevention and care activities. Men were sampled from the MSM population in Kisumu using respondent driven sampling (Heckathorn, 1997; Salganik and Heckathorn, 2002). Respondent driven sampling is a network based sampling method that utilizes peer recruitment and a dual incentive system to recruit members of a socially networked population typically difficult to identify through population based sampling methods.

A. Formative Research

Prior to enrollment, meetings were held with 20–25 MSM to gauge the motivations for participation and concerns at two MSM support groups. Additionally, the appropriateness of the participant compensation amount, the suitability of the study site location, potential logistical challenges with transportation of participants and study procedures, the referral coupon design, and the members' likelihood to engage and recruit MSM friends into the study were explored.

B. Seed Selection

In RDS, recruitment chains begin with seeds, participants selected by the investigator, who have many social ties within the target population and who collectively represent a diverse mix of social characteristics of the population. Seeds are the only participants recruited by the investigator; all other participants are recruited by other participants.

Potential seeds were identified by community informants and then were invited to complete a standardized face to face interview with the investigator and a trained research assistant. The interview

ascertained study eligibility, collected demographic information, identified the number of MSM peers they knew, and assessed the potential seed's motivation to participate in the study. The characteristics used to inform final seed selection were age, education, residence in Kisumu, ethnicity, whether they engaged in sex work, and employment status. A total of 11 seeds were enrolled in the study. Initially, we selected 10 seeds to recruit participants. Our decision to select 10 seeds was based on a systematic review by Malekinejad and colleagues of HIV biological and behavioral RDS studies conducted from 2003 to 2007 which reported among 39 MSM studies employing RDS that a median number of 9.5 seeds per study were implemented to achieve sample sizes of 100–658 (Malekinejad et al., 2008). However, during the course of the study, enrollment slowed, and the sample's age distribution was heavily skewed towards participants under the age of 25 years. We attempted to increase overall enrollment and the enrollment of older participants by selecting an eleventh seed who was of older age.

C. Informed Consent and Enrollment

Eligible participants were men were 18 years and older, who lived in Kisumu, had anal and/or oral sex with another man in the past 6 months, and provided written consent to study procedures including HIV testing. Eligible participants also were required to bring the recruitment coupon their recruiter gave them to the site to be enrolled. Referral coupons included an ID number, the study name, directions to the study site, days and hours of operation, and the contact number and were translated into Kiswahili and Dholuo. Potential participants were excluded if they were currently enrolled in the study or could not provide informed consent because they were intoxicated or cognitively impaired. Informed consent was conducted in the participant's language of choice (English, Dholuo, or Kiswahili).

Fingerprinting was employed to reduce participant duplication (Heckathorn et al., 2002). Microsoft Fingerprint Reader was used to scan the image of participants' fingerprint into Desktop Identity (Griaule Biometrics) a software system that generates a unique alphanumerical code based on uniquely defining characteristics of a fingerprint. This code is linked to the participant ID number printed on the recruitment coupon the potential participant brought to the study site. Images of the fingerprints were not

stored electronically. In one case, a participant was not able to use the scanner due to a physical condition and instead an algorithm utilizing the participant's name, residence and date of birth was used to generate a unique and reproducible identification code.

D. **Behavioral Questionnaire**

Audio Computer Assisted Self Interview (ACASI) (Questionnaire Development System, Version 2.6, Nova Research Company) was chosen to administer the behavioral questionnaire to reduce response bias to sensitive behavioral questions and eliminate interviewer bias (Rogers et al., 2005; Ghanem et al., 2005; van der Elst et al., 2005). Participants were administered a 213 item questionnaire and could elect to complete the questionnaire in English, Dholuo, or Kiswahili. The questionnaire was designed to ascertain demographic information, harmful and/or hazardous drinking using the Alcohol Use Disorders Identification Test (AUDIT) (Babor et al., 2001) and drug use, sexual behavior with male and female sexual partners by type (regular, non-regular, and paying partners), condom and lubricant use, HIV knowledge, HIV testing history, history of STI symptoms, use of health care services, experiences of abuse and discrimination, and experience with MSM support services. Respondents' personal network size was ascertained using responses to the following questions, "Approximately, how many other men who have sex with men do you know by name, who live in or around Kisumu, and you know how to contact them?" and "Of those, about how many do you think are 18 years of age or older?" The survey was administered on 1 laptop computer and 2 touch-screen computers in a separate room.

A research staff member directed participants into the room, logged in the participant, provided a brief explanation, remained nearby to answer any questions, and logged off the participant when the survey was complete. The first set of questions in the questionnaire consisted of test questions to acquaint the participant with how to respond to several types of questions. All participants used headphones to listen to the questionnaire and sat at separate computer stations spaced apart from each other to provide the most amount of privacy.

E. Urogenital Exam and Sexually Transmitted Infection Testing

Following completion of the questionnaire, participants underwent a standardized urogenital exam by a trained clinical officer or nurse counselor[1] for signs of STIs and to assess circumcision status. Venous blood (5 ml), first-void urine (20 ml) and rectal specimens using Dacron swabs were collected by the clinical officer or nurse counselor.

Urine was tested for *Trichomonas vaginalis* (TV) using InPouch™ TV test (Biomed Diagnostics, Oregon, United States) and *Chlamydia trachomatis* and *Neisseria gonorrhoeae* by COBAS Amplicor CT/NG (Roche Diagnostics, New Jersey, United States). Rectal swabs were collected by the clinical officer or nurse counselor and were tested for chlamydia and gonorrhea using the Roche Amplicor system. Due to the high false-positive rate of the Roche diagnostic system in detecting positive rectal gonococcal infection, all rectal specimens positive for gonorrhea using the Roche system were retested using Gen-probe Aptima Combo 2 Assay (Gen-Probe, California, United States), which has a higher sensitivity and specificity (Schachter et al., 2008). Blood specimens were tested for syphilis, using BD Macro-Vue RPR cards (Becton Dickinson, Maryland, United States) and Treponema Pallidum Haemagglutination assay (TPHA), for confirmation (Randox Laboratories Ltd., Ardmore, United Kingdom). Herpes Simplex Virus Type-2 (HSV-2) was detected using Kalon HSV2 Assay (Kalon Biological; Guilford, United Kingdom).

Tests for syphilis, HSV-2, and TV were performed at the UNIM lab in Kisumu. Initial urethral and rectal chlamydia and gonorrhea urine detection with Roche diagnostic system was conducted at the University of Nairobi Institute of Tropical and Infectious Diseases in Nairobi and subsequent testing to identify false positives was conducted at University of Nairobi/University of Washington/Mombasa HIV/STD Research Laboratory.

All participants who tested positive for syphilis, gonorrhea, chlamydia, or trichomoniasis were administered the standard treatment based on Kenya National AIDS and STI Control Programme

[1] The clinical officer and nurse counselor underwent additional training to identify STI symptoms and circumcision status at the University of Nairobi, Illinois and Manitoba clinical facility.

(NASCOP) guidelines (Republic of Kenya Ministry of Health, 2006). Participants testing positive for HSV-2 were provided acyclovir treatment for outbreaks if they were symptomatic and they were counseled on how to reduce risk of transmission to their partners.

F. Human Immunodeficiency Virus Testing

Following the urogenital exam and specimen collection, participants underwent pre-test counseling[2] for HIV and were then asked if they wanted to be tested for HIV. Participants who agreed to testing after pre-test counseling were tested using parallel rapid HIV testing with Determine HIV 1/2 (Inverness Medical; Stockport, United Kingdom) and Uni-Gold Recombigen (Trinity Biotech; Wicklow, Ireland). Concordant results were final. Discordant results were resolved using SD Bioline HIV 1/2 (Standard Diagnostics; South Korea). Participants were then counseled appropriately based on their HIV test results. Participants testing positive were provided referrals for facilities that provide care for people living with HIV at various locations throughout Kisumu, including KIPE, so that participants could select the facility closest to them or the one they felt the most comfortable attending.

G. Recruitment and Compensation

After completing the questionnaire, physical exam, STI testing and HIV voluntary counseling and testing, all participants, including seeds, were informed of their follow up visit date to obtain their STI test results and were given a reminder slip. Three referral coupons were given to participants to recruit their peers into the study. Participants were instructed to give their referral coupons to other MSM whom they knew and who met the study eligibility criteria. Also they were asked to briefly describe the study to their recruits and to encourage recruits to go to the study site within 2 weeks of receiving the referral coupon. The ID numbers of enrolled participants and the ID numbers of all referral coupons were maintained in a written and electronic log to track recruitments.

[2] The nurse counselor and clinical officer had completed a certificate program in HIV counseling and testing and prior to study enrollment underwent a refresher course in HIV counseling and testing at UNIM.

Participants were given 400 Kenyan shillings (U.S. $4.71), the equivalent of a day's labor or round trip transportation costs, as compensation for completing the study procedures. Three hundred Kenyan shillings (U.S. $3.53) were provided to participants for returning for their STI test results and treatment when indicated and 200 Kenyan Shilling ($2.35) was provided for each person they successfully recruited. Recruits only had to be eligible for participation, but did not have to enroll in order for their recruiter to receive compensation for recruitment. The compensation was based on the amount provided by previous studies conducted in Kisumu and was assessed for appropriateness during the formative phase. A flow diagram of study procedures is provided in Figure 1.

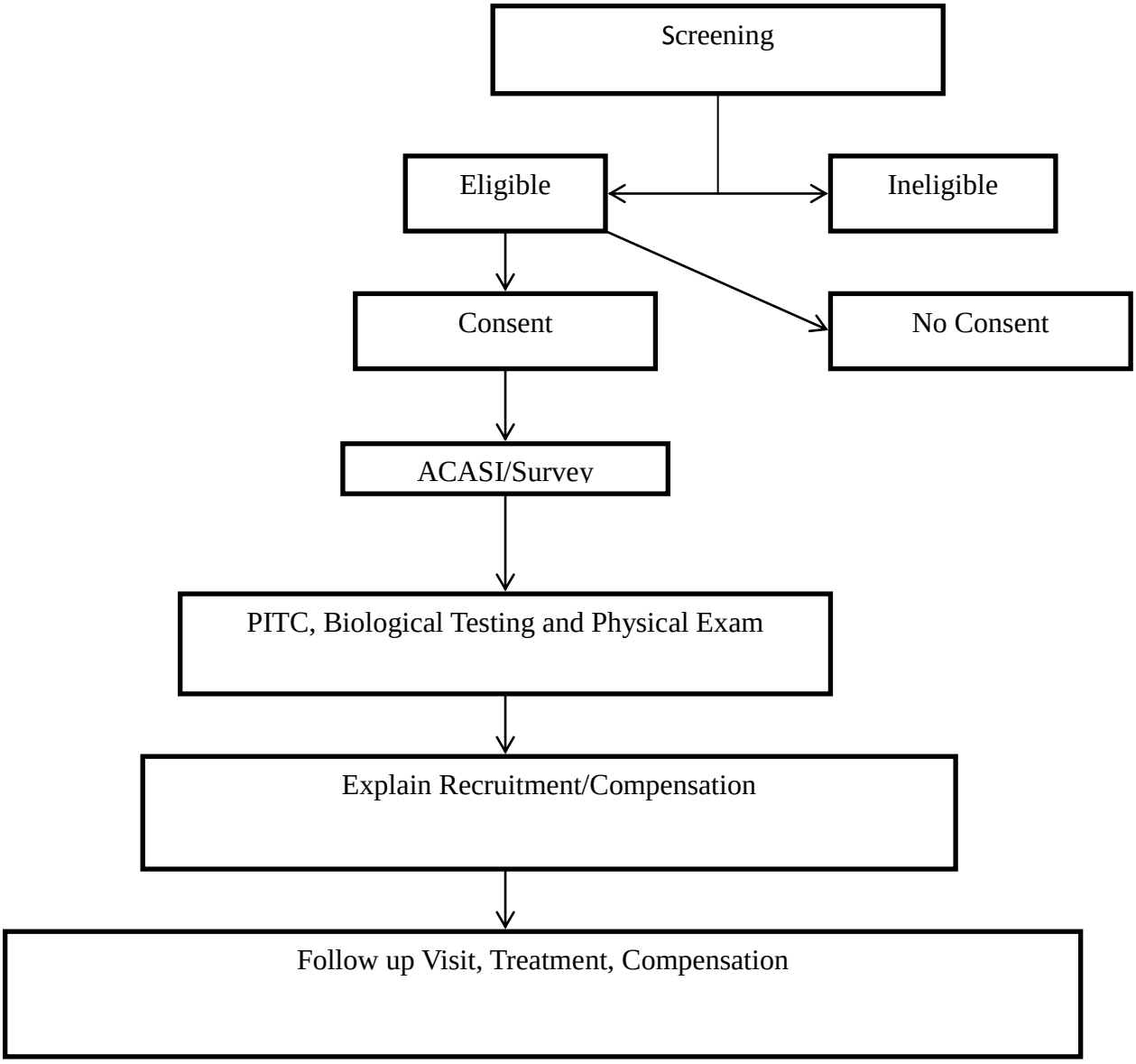

Figure 1. Order of study procedures.

H. Sample Size Calculations

A target sample size of 600 MSM was calculated to measure a 10% change in HIV prevalence over time, assuming an HIV prevalence of 20% with a design effect of 2.0, power of 80% and a type I error of 0.05 (Salganik, 2006). The target sample size was calculated with the consideration that MSM in Kisumu would be re-sampled at a later time point using RDS to evaluate change in HIV prevalence and risk behaviors.

I. Data Analysis

The sample was monitored for progress towards the target sample size and equilibrium with regards to age, ethnicity, education, sex-work status, and marital status throughout the study. Equilibrium is the state in which the addition of new recruits does not change by more than 2% the proportion of the sample characteristics being monitored (Heckathorn, 1997). Demographic characteristics, HIV/STI prevalence and sexual behavior proportion estimates and 95% confidence intervals were estimated using Respondent Driven Sampling Analysis Tool (RDSAT), version 6.0[3] (Volz et al., 2007). All 415 participants were offered HIV counseling and testing, but 20 individuals (4.8 %) refused HIV testing. Human Immunodeficiency Virus testing was conducted on all collected blood specimens for quality control and results on all participants were used to estimate the overall HIV prevalence. However, those individuals who refused HIV testing where excluded from bivariate and multivariable analysis.

The main outcome for analysis was HIV infection. Explanatory variables were demographic characteristics, STI infection, and sexual behaviors. Individual sampling weights were estimated for the outcome (HIV) using RDSAT, version 6.0. Sampling weights were then imported into Statistical Analysis System (SAS), version 9.2 and applied in logistic regression to estimate RDS adjusted univariate associations between the explanatory variable and HIV status (Heckathorn, 2007). Wilcoxon tests

[3] RDSAT v.6.0 options: We used enhanced data smoothing, 15,000 re-samples for bootstrapping and alpha = 0.025 to obtain 95% Confidence Intervals. All other options remained at default values.

detected no difference in number of partners and HIV status among regular and non regular partners by gender, but detected differences in the number of paying partners and HIV by gender. Kruskal Wallis tests detected no differences in number of partners and HIV status between regular and non-regular partners by gender and were combined to measure total number of non-paying partners by gender. Chi-square tests detected no difference in condom use at last sex and HIV by partner type and a composite variable for condom use at last sex was created. The Bonferroni method was applied to adjust the chi-square p-value for multiple comparison testing.

Prior to model entry, potential explanatory variables were evaluated for correlation. Unprotected vaginal intercourse (UVI) was strongly correlated with marital status and non-paying female partners. Age and educational attainment are strongly associated with HIV prevalence and sexual risk behaviors and Luo ethnicity is a strong marker for HIV burden and other sexual risk factors in Kisumu, therefore, these three characteristics were retained in all models. Explanatory variables significant at a p-value less than 0.20 by univariate likelihood ratio p-values were included in the initial model. A manual backwards elimination approach was employed to select the final model; variables with a log likelihood ratio p-value less than or equal to 0.05 were retained in the model. Sexual risk differences between men ages 18–24 and men 25 and older was hypothesized a-priori therefore interactions including age and the other explanatory variables remaining significant in the multivariable model were evaluated for significance at the p-value less than or equal to 0.05.

J. **Ethical Approval**

The Men's Health Study-Kisumu (MHS) was reviewed and approved by four institutional review boards: the Centers for Disease Control and Prevention, Population Council Institutional Review Board, Kenyatta National Hospital/University of Nairobi Ethics and Research Committee, and the University of Illinois at Chicago.

III. RESULTS

A. Recruitment

From June to October 2010, the MHS enrolled 415 MSM. Of eleven seeds selected to recruit participants, three were unsuccessful. A total of 1,074 referral coupons were issued and 639 coupons (59.6%) were returned. Two hundred twenty-one men (34.6%) were excluded at screening. Of those excluded, 191 (86.4%) had not had oral or anal sex with another man in the past 6 months, 25 (11.3%) were under the age of 18, 4 (1.8%) lived outside Kisumu, and 1 (0.5%) had a forged coupon. Due to the design of the screening instrument, we were unable to determine whether men were excluded because they had never engaged in sex with men or because they were sexually inactive with men in the last 6 months. Of the 418 eligible men, 417 men provided consent and 2 self-withdrew. Recruitment waves ranged from 1 to 15 (See Figure 2). Key characteristics (age, ethnicity, sex-work status, and marital status) reached equilibrium by recruitment wave 10.

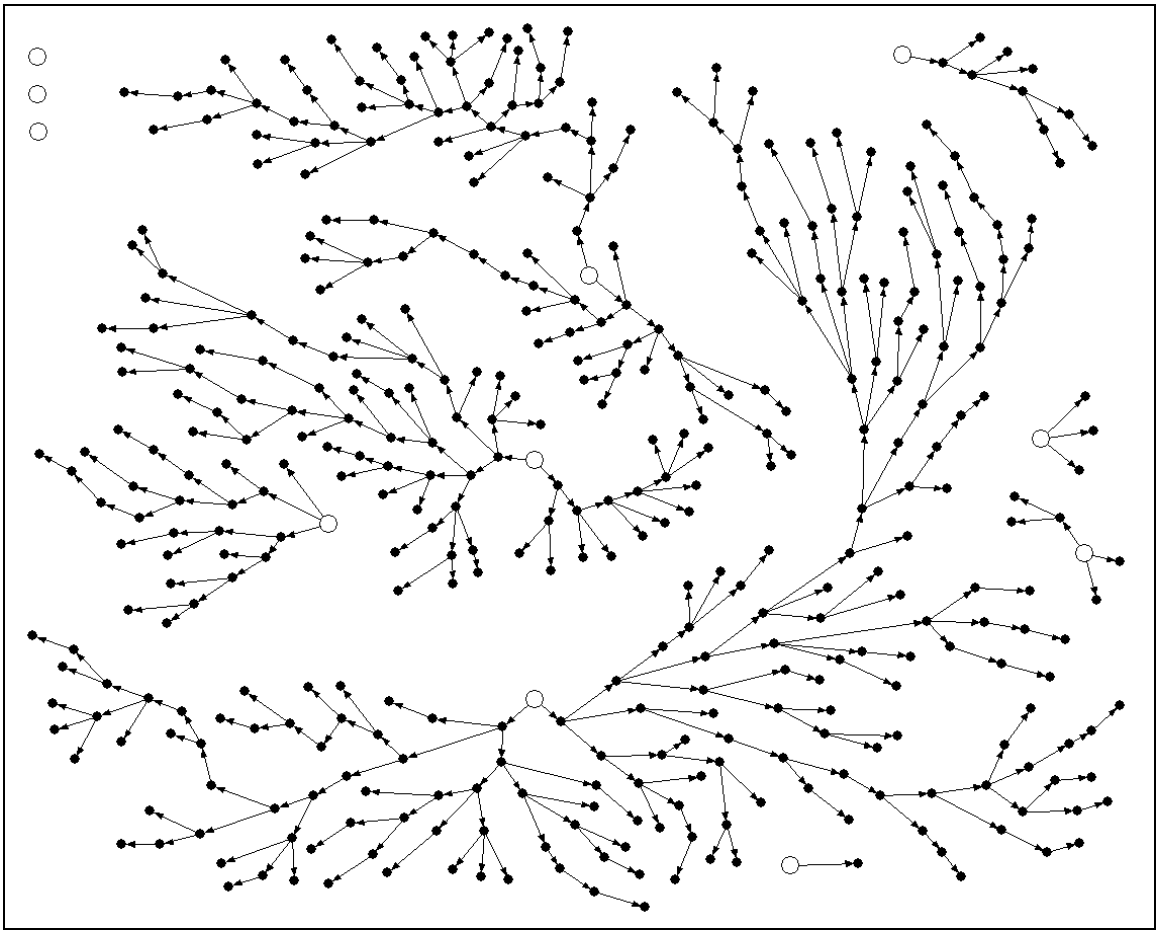

Figure 2. RDS recruitment graph of MSM sampled in Kisumu, Kenya, 2010. Large circles represent seeds and small circles represent recruits.

B. **Demographic Characteristics and Sexual Identity**

The socio-demographic and behavioral characteristics of the participants are provided in Table 1. The participants ranged in age from 18 to 62 years; the median age was 21 years (inter quartile range (IQR): 19–25 years). Most participants (84%) were of Luo ethnicity and 31.1% had completed secondary education. Men from urban and rural areas of Kisumu were recruited in approximately equal proportions. Nearly one-third of the participants were unemployed (29.3%) and 21.6% of participants reported sex

work as their main occupation. The majority of MSM had never been married (82.1%). Participants identified with a wide range of sexual identities, but they self-identified predominately as gay/homosexual (74%), bisexual (9.9%), and Shoga[4] (9.4%); seven men (1%) identified as heterosexual.

[4] Shoga is a Kiswahili term for gay or homosexual. Outside the MSM community this term can be used derogatorily. However, within MSM communities in Kenya this term can be used to describe MSM who are often perceived as the receptive sexual partner.

TABLE I

SOCIO-DEMOGRAPHIC CHARACTERISTICS AND SEXUAL BEHAVIORAL RISKS AMONG MSM IN KISUMU, KENYA.

Characteristic	RDS Unadjusted % (n/N)	RDS Adjusted % (95% Confidence Interval)
Age (years)		
18 to 19	29.7 (123/415)	33.0 (25.6–40.9)
20 to 24	44.8 (186/415)	43.7 (36.4–50.6)
≥ 25	25.5 (106/415)	23.3 (16.8–30.6)
Ethnicity		
Non-Luo[a]	15.7 (65/415)	16.8 (12.1–22.3)
Luo	84.3 (350/415)	83.2 (77.7–87.9)
Education Level		
None to any primary	28.7 (117/408)	32.4 (25.0–40.6)
More than primary	71.3 (291/408)	67.6 (59.4–75.0)
Occupation		
Unemployed	29.5 (117/396)	30.2 (23.9–36.3)
Sex Work	21.7 (86/396)	22.1 (16.9–27.8)
Skilled/Unskilled manual labor	22.0 (87/396)	22.4 (17.1–28.1)
Professional/Office/Service/Arts	26.8 (106/396)	25.3 (20.3–31.1)
Religion		
Christian	79.4 (323/407)	75.8 (69.7–81.3)
Muslim	12.5 (51/407)	14.7 (9.8–19.9)
Other	0.2 (1/407)	0.1 (0–0.3)
None	7.9 (32/407)	9.3 (5.8–13.6)
Marital Status		
Never Married	83.2 (338/406)	82.1 (76.7–87.0)
Currently or Ever Married	16.8 (68/406)	17.9 (13.0–23.3)
Sexual Identity		
Gay/Homosexual	71.2 (289/406)	74.0 (67.4–79.7)
Bisexual	11.1 (45/406)	9.9 (6.2–14.2)
Shoga	9.1 (37/406)	9.4 (5.5–14.0)
Heterosexual	1.7 (7/406)	1.0 (0.2–2.1)
Other[b]	6.9 (28/406)	5.7 (2.8–9.2)

[a]Non-Luo ethnicity includes: Kamba, Kikuyu, Kisii, Luhya, Mikijenda, Nande, and Teso.

[b]Other sexual identity includes: Basha, Kuchu, King, Queen, and Trans.

Table I (continued)

Characteristic	RDS Unadjusted % (n/N)	RDS Adjusted % (95% Confidence Interval)
Sex with women, ever	64.0 (261/408)	65.4 (59.4 –71.5)
Circumcision Status	54.1 (218/403)	54.4 (47.0–61.1)
HIV Positive	14.0 (58/415)	11.1 (7.5–15.9)
Syphilis	1.5 (6/414)	1.8 (0.3–3.5)
Any Urethral or Rectal NG/CT	4.2 (17/405)	3.6 (1.7–6.0)
HSV-2	23 (95/414)	21.9 (16.7–27.6)
AUDIT Risk Categories		
Abstinent/Low risk drinking (0–7)	35.5 (145/408)	38.7 (31.9–46.0)
Hazardous drinking (8–15)	28.9 (118/408)	26.8 (21.1–32.8)
Harmful drinking (16–19)	12.0 (49/408)	11.6 (7.8–15.0)
Alcohol dependence (20–40)	23.5 (96/408)	23.0 (17.7–28.9)
Cocaine Use	3.3 (13/396)	3.3 (1.3–5.9)
Injection drug use in the last 12 months	10.2 (41/401)	10.2 (6.7–13.8)
Shared needles used for injecting drugs in the last 12 months	5.3 (21/399)	5.4 (2.7–8.4)
Age at sexual debut with women		
≤ 15	50.8 (125/246)	48.6 (39.9–57.8)
> 15	49.2 (121/246)	51.4 (42.2–60.1)
Age at sexual debut with men		
≤ 15	31.6 (125/396)	31.2 (25.4–37.4)
> 15	68.4 (271/396)	68.8 (62.6–74.6)
Initiated sex with women before men		
No sex with women	37.4 (147/393)	36.1 (30.1–42.5)
No	18.3 (72/393)	20.6 (15.6–26.0)
Yes	44.3 (174/393)	43.3 (36.4–50.0)
Total Number of Male and Female Sex Partners[c]		
0 to 2	10.0 (41/410)	10.4 (**)
3 to 5	20.5 (84/410)	23.5 (**)
6 to 12	33.4 (137/410)	34.6 (**)
> 12	36.1 (148/410)	31.5 (**)

** Unable to estimate standard error.

[c]Recall period for number of partners varied by partner type: 12 months for regular partners, 6 months for non-regular partners, and 2 months for paying partners.

Table I (continued)

Characteristic	RDS Unadjusted % (n/N)	RDS Adjusted % (95% Confidence Interval)
Total number of non-paying male partners		
0 to 2	22.3 (91/409)	24.7 (19.5–31.0)
3 to 5	36.9 (151/409)	40.2 (34.4–45.6)
≥ 6	40.83 (167/409)	35.0 (29.1–40.8)
Total number of paying male partners		
0	33.8 (137/405)	37.2 (31.1–43.5)
1 to 2	34.3 (139/405)	35.0 (28.7–41.4)
3 to 5	19.5 (79/405)	19.8 (15.0–25.1)
≥ 6	12.4 (50/405)	8.1 (4.9–11.5)
Total number of non-paying female partners		
0	50.3 (199/396)	48.0 (41.3–54.6)
1 to 2	17.4 (69/396)	17.5 (12.7–22.8)
3 to 5	16.7 (66/396)	18.3 (13.5–23.5)
≥ 6	15.7 (62/396)	16.2 (11.3–21.3)
Total number of paying female partners		
0	73.7 (288/391)	72.8 (66.7–78.9)
1 to 5	17.1 (67/391)	18.2 (13.1–23.5)
6 to 12	6.9 (27/391)	6.5 (3.7–9.6)
> 12	2.3 (9/391)	2.5 (0.6–4.8)
Unprotected Receptive Anal Intercourse with last partner, in last 30 days	48.5 (199/410)	48.8 (**)
Unprotected Insertive Anal Intercourse with last partner, in last 30 days	20.2 (83/410)	20.2 (**)
Unprotected Vaginal Intercourse (last 30 days with last partner)	11.6 (47/405)	11.1 (7.2–15.7)
In the Past 12 Months Ever Experienced		
Urethral Discharge	23.2 (94/405)	21.1 (16.4–25.9)
Anal Discharge	20.6 (83/403)	19.6 (14.7–24.9)
Penile Ulcer	16.8 (68/405)	16.2 (11.6–21.1)
Anal Ulcer	21.8 (88/403)	21.9 (16.6–27.8)
Dysuria	31.1 (126/405)	28.6 (22.9–34.3)
Oropharyngeal Ulcer	18.3 (74/405)	18.9 (14.0–24.1)

** Unable to estimate standard error.

C. **Human Immunodeficiency Virus and Sexually Transmitted Infections Prevalence**

The HIV prevalence among the men in the sample was 14% and the RDS adjusted HIV prevalence was 11.1% (95% CI: 7.5–15.9). Univariate logistic regression of demographics and sexual risk factors with HIV status are provided in Table II. Human Immunodeficiency Virus prevalence varied by age group and was lowest among men 18 to 19 years and highest among men 25 years and older. Men in ages 18 to 19 years had an RDS adjusted HIV prevalence of 2.1%. Focusing on only the RDS-adjusted results, HIV prevalence increased to 10.3% among men in ages 20 to 24 years and further increased to 23.3% among men ages 25 years and older. Educational attainment above primary school was observed to have 56 % lower odds and men of non-Luo ethnicities were 80 % less likely than men of Luo ethnicity to have HIV. Men who were currently married or had ever been married were over 2 times (OR: 2.44 (95% CI: 1.18–5.06), p = 0.02) more likely to have HIV than men who had never been married, but no difference was detected between men who exclusively had sex with men and men who have sex with men and women. Over half the participants (55.4%) were circumcised, but no difference in HIV prevalence was detected, p = 0.50.

All participants were tested for syphilis, trichomoniasis, gonorrhea, chlamydia, and HSV-2. The most common STI was HSV-2 (21.9%). The overall prevalence of gonorrhea or chlamydia was 3.6% (2% gonorrhea, 1.4% chlamydia, and 0.2% co-infection). Urethral gonorrhea and chlamydia were 0.9% and 2.2%; rectal gonorrhea and chlamydia were 0.6% and 0%. Syphilis prevalence was 1.8% (active: 1%, latent: 0.8%). There were no cases of trichomoniasis detected. No statistically significant association with HIV and any of the bacterial STIs (syphilis, gonorrhea, or chlamydia) was detected. However, HSV-2 positive MSM were nearly four times more likely to be infected with HIV than HSV-2 negative men, (OR: 3.91 (95% CI: 2.04–7.52)). Past history of symptoms for a STI was reported by up to 28.6% of participants, but a statistically significant relationship with HIV was detected only among those who reported experiencing a penile ulcer in the last 12 months (OR: 3.18 (95% CI: 1.54–6.57), p <0.01).

TABLE II

CHARACTERISTICS ASSOCIATED WITH HIV INFECTION AMONG MSM IN KISUMU, KENYA.

Characteristics	RDS Unadjusted HIV Positive (%) n/N	RDS Adjusted HIV Positive % (95% CI)	OR	RDS Adjusted 95% CI	p-value
Age					
18 to 19	4.2 (5/119)	2.8 (0.3–4.5)	ref		
20 to 24	10.2 (18/176)	10.3 (4.7–16.8)	6.16	(1.53–24.82)	0.01
≥25	30.0 (30/100)	23.3 (13.8–37.3)	18.25	(4.58–72.76)	< 0.01
Education					
None to Any Primary	20.4 (22/108)	19.0 (10.1–27.8)	ref		
More than Primary	10.4 (29/280)	8.9 (5.9–15.4)	0.44	(0.23–0.86)	0.02
Ethnicity					
Luo	14.6 (48/330)	12.8 (8.6–18.9)	ref		
Non Luo	7.7 (5/65)	3.0 (0.3–7.3)	0.20	(0.05–0.86)	0.03
Sex Work (Reported Main Occupation)					
No	11.5 (34/296)	7.7 (4.6–12.9)	ref		
Yes	18.8 (15 /80)	22.5 (10.2–34.8)	3.09	(1.54–6.24)	< 0.01
Shoga Identified					
No	12.2 (43/352)	10.5 (6.9–16.0)	ref		
Yes	25.5 (8/34)	23.4 (8.3–41.4)	2.01	(0.79–5.11)	0.14
Sex with women, ever					
No	12.0 (17/142)	11.7 (5.1 – 199)	ref		
Yes	14.2 (35/246)	11.5 (6.8 – 17.9)	1.04	(0.52 – 2.04)	0.92
Marital Status					
Never Married	11.1 (36/324)	10.1 (6.2–15.5)	ref		
Currently/Ever Married	25.8 (16/62)	19.4 (9.0–34.1)	2.44	(1.18 – 5.06)	0.02
Circumcision Status					
Not Circumcised	15.3 (27/177)	8.6 (4.3 – 13.9)	ref		
Circumcised	11.5 (24/208)	13.1 (6.9 – 19.7)	1.25	(0.65 – 2.40)	0.50
HSV-2					
Negative	8.5 (26/307)	7.1 (3.6 – 11.1)	ref		
Positive	31.0 (27/88)	24.0 (14.7 – 38.8)	3.91	(2.04 – 7.52)	< 0.01

TABLE II (continued)

Characteristics	RDS Unadjusted HIV Positive (%) n/N	RDS Adjusted HIV Positive % (95% CI)	RDS Adjusted OR	95% CI	p-value
Hazardous/Harmful Drinking(AUDIT >15)					
No	10.8 (27/251)	9.5 (5.2-15.2)	ref		
Yes	18.3 (25/137)	14.8 (7.6-24.0)	1.75	(0.91-3.36)	0.09
Cocaine Use					
No	12.3 (45/366)	10.6 (6.8 -15.0)	ref		
Yes	36.4 (4/11)	47.1 (0.0 - 81.9)	9.16	(2.72 -30.87)	< 0.01
Injection Drug Use in the Last 12 Months					
No	13.0 (45/345)	10.9 (6.9 - 16.2)	ref		
Yes	18.9 (7/37)	18.5 (5.2 - 38.9)	1.83	(0.71- 4.72)	0.21
Shared Needles Used for Injecting Drugs in the Last 12 Months					
No	12.7 (46/362)	10.9 (7.2-16.2)	ref		
Yes	27.8 (5/18)	26.7 (2.3-60.0)	3.15	(1.05 – 9.44)	0.04
Age at Sexual Debut with Women					
≤ 15	9.2 (11/119)	6.3 (1.3 - 16.5)	ref		
> 15	19.3 (22/114)	15.9 (8.3 - 25.0)	2.08	(0.87 - 5.02)	0.10
Age at Sexual Debut with Men					
≤ 15	15.7 (19/121)	14.2 (6.4 - 24.0)	ref		
> 15	12.1 (31/257)	9.8 (5.9 - 16.0)	0.66	(0.34 - 1.30)	0.24
Total Number of Male and Female Sex Partners across Partner Type					
1 to 2	10.0 (4/40)	12.5 (**)	ref		
3 to 5	14.8 (12/81)	10.8 (**)	1.02	(0.30-3.45)	0.97
6 to 12	9.4 (12/128)	7.8 (**)	0.87	(0.27-2.83)	0.82
> 12	18.4 (26/141)	16.6 (**)	1.63	(0.53-5.03)	0.40
Total number of non-paying male partners					
0 to 2	9.4 (8/85)	10.3 (3.7-18.9)	ref		
> 2	14.5 (44/304)	11.7 (7.3-17.9)	1.42	(0.64-3.16)	0.39

**RDSAT was unable to estimate standard error.

TABLE II (continued)

Characteristics	RDS Unadjusted HIV Positive (%) n/N	RDS Adjusted HIV Positive % (95% CI)	RDS Adjusted OR	95% CI	p-value
Total number of paying male partners					
0	9.2 (12/130)	7.7 (2.9 -14.7)	ref		
≥ 1	15.3 (39/255)	14.2 (8.6-20.7)	2.06	(0.97-4.38)	0.06
Total number of non-paying female partners					
0-5	11.6 (37/318)	8.7 (5.5 - 13.6)	ref		
≥ 6	18.6 (11/59)	18.5 (5.2- 34.4)	2.26	(1.02-5.01)	0.05
Total number of paying female partners					
0-5	11.6 (42/363)	9.3 (6.1 -13.9)	ref		
≥ 6	44.4 (4/9)	46.8 (2.7-95.6)	6.81	(1.71-27.09)	< 0.01
Unprotected Receptive Anal Intercourse with last partner, among all partner types in last 30 days					
No	12.1 (24/199)	11.8 (**)	ref		
Yes	14.7 (28/191)	11.6 (**)	1.00	(0.52-1.90)	0.83
Unprotected Insertive Anal Intercourse with last partner, among all partner types in last 30 days					
No	12.3 (38/309)	10.3 (**)	ref		
Yes	17.3 (14/81)	18.4 (**)	1.63	(0.78-3.90)	0.10
Unprotected Vaginal Intercourse (last 30 days with last partner)					
No	11.1 (38/341)	9.3 (5.5 - 14.1)	ref		
Yes	29.6 (13/44)	29.0 (15.0 - 48.2)	3.70	(1.68 – 8.13)	< 0.01
In the Past 12 Months Ever Experienced Penile Ulcer					
No	11.2 (36/322)	9.0 (5.1 - 13.5)	ref		
Yes	23.8 (15/63)	23.6 (11.4 - 40.6)	3.18	(1.54 - 6.57)	< 0.01

D. **Alcohol and Drug Use**

About 63% of MSM reported non-alcohol drug use in the past 12 months, with marijuana (24.9%) and khat (18.3%) being the most common. Other substances used were cocaine (3.3%), heroin (4.9%), and rohypnol (1.5%). Reported cocaine users (n = 13) were 9 times more likely than non-cocaine users to be HIV infected (OR: 9.16 (95% CI: 2.72–30.87), $p < 0.01$). Ten percent of MSM reported ever injecting drugs in the past year, and out of all MSM, 5.4% reported sharing syringes or needles to inject drugs in the past year. No statistically significant association was found between injection drug use and HIV, but MSM sharing needles for injection drug use had greater odds of HIV infection than those who did not (OR: 3.15 (95% CI: 1.05–9.44), $p = 0.04$).

About one-third of men (34.6%) scored 16 and above on the AUDIT scale, indicating a high proportion of harmful drinking. The AUDIT scale was not used as a clinical diagnostic tool during the study and participants' total score was calculated after data collection. Although HIV prevalence was greater among men with higher AUDIT risk categories, (9.5% among abstinent/low risk drinkers, 8.5% among hazardous drinkers, 16.8% among harmful drinkers, and 14.3% among alcohol-dependent men) only a marginally statistically significant difference was detected between participants who scored into the harmful drinking or above categories compared to those who scored below (OR: 1.75 (95% CI: 0.91–3.36), $p = 0.09$).

E. **Sexual Behaviors**

The median age at sexual debut with another man was 17 years (IQR: 15–20 years) with more than two-thirds of participants initiating sexual activity with men after the age of 15. Sixty-four percent of the men reported ever having had sex with a woman. The median age at sexual debut with a woman was 15 years (IQR: 14–18 years). Forty-three percent of the participants initiated sex with women before having sex with men. The total number of sexual partners reported in the past year, totaled across gender and partner type was high (median: 9 (IQR: 5–17)). Over one-third of men (34.5%) reported having a total of 1 to 5 sexual partners in the past year, another third (34.4%) reported having a total of 6 to 12

sexual partners in the past year and almost a third (31.2%) reported having over 12 sexual partners in the past year.

Among all male partner types, unprotected receptive anal intercourse (URAI) at last anal sex was reported by 48.8% of participants, while unprotected insertive anal intercourse (UIAI) at last sex was 20.2%. No statistically significant difference in HIV prevalence was detected by condom use at last anal sex with respect to sexual position of the participant. Over 10% of the MSM reported engaging in UVI at last sex and the HIV prevalence among these men was 29.0% compared to 9.3% among men who did not report UVI at last sex (OR: 3.70 (95% CI : 1.68–8.13), $p < 0.01$) including MSM who have never had sex with a woman.

F. Results of RDS-Adjusted Multivariable Logistic Regression: Factors Associated with Human Immunodeficiency Virus Infection

Variables statistically significant at the p-value less than 0.20 from univariate logistic regression included age, ethnicity, highest educational attainment, currently/ever married, HSV-2 status, ever tried cocaine in the past year, ever shared needles for injection drug use, being a sex worker, age at sexual debut with a woman, UIAI, UVI, and ever having a penile ulcer in the past year. The remaining variables: HSV-2 infection, currently/ever married, ever tried cocaine in the past year, shared used needles used for injecting drugs, reporting sex work as main occupation, UVI, and ever having a penile ulcer in the last 12 months were included in the initial model, along with age, ethnicity and highest education attainment. A manual backwards elimination process was used to obtain the final model; explanatory variables significant at p-value less than or equal to 0.05 were retained. Results of multivariable logistic regression are included in Table III.

Adjusting for age, highest educational attainment and ethnicity, the final multivariable model included three explanatory variables, that were statistically significant at the p-value less than or equal to 0.05: HSV-2 (adjusted odds ratio (aOR) = 3.08 (95% CI: 1.44–6.56)), ever experiencing a penile ulcer in the past year (aOR= 2.79 (95% CI: 1.24–6.27)) and UVI (aOR = 3.10 (95% CI: 1.27 –7.57)). No interaction terms were statistically significant.

TABLE III

RDS-ADJUSTED MULTIVARIABLE LOGISTIC REGRESSION FOR HIV INFECTION AMONG MSM IN KISUMU, KENYA.

Characteristic	Adjusted OR	95% CI	Wald p-value
Age			
18–19	ref		
20–24	4.37	(1.05–18.21)	0.04
≥ 25	7.54	(1.77–33.18)	< 0.01
Education			
None to Any Primary	ref		
> Primary	0.55	(0.26–1.16)	0.12
Ethnicity			
Luo	ref		
Non-luo	0.18	(0.04–0.83)	0.03
HSV2			
Negative	ref		
Positive	3.08	(1.44–6.56)	< 0.01
UVI			
No	ref		
Yes	3.10	(1.27–7.57)	0.01
Penile Ulcer, in past 12 months			
No	ref		
Yes	2.79	(1.24–6.27)	0.01

IV. DISCUSSION

We identified a high HIV prevalence of 14% among the young sample of MSM, and adjusting for sampling design, estimate a prevalence of 11.1%. The estimated HIV prevalence among MSM in Kisumu is nearly two times greater than the HIV prevalence in the general population of Kenya, ages 15–49 years (6.3%) and approximately 2.5 times the prevalence of Kenyan men in the adult population, ages 15–49 (4.3%) (Kenya Bureau of Statistics, 2010), a finding consistent with other studies measuring HIV prevalence among MSM in sub-Saharan Africa (Baral et al., 2007). However, when compared to age-specific HIV prevalence estimates among other adult men in Kisumu, the results are mixed.

A comparison of HIV prevalence estimates for our sample of MSM in Kisumu to HIV prevalence estimates for men in the general population in Kisumu from several other studies is presented in Figure 2. Compared to results from the Antiretroviral Therapy Impact Study (ARTIS), a 2006 population based study of randomized households in Kisumu municipality our estimated age-specific HIV prevalence estimates for MSM in Kisumu are comparable or slightly lower than the age-specific HIV prevalence among men in the general population (Cohen et al., 2009). Men ages 18–19 in general population had a HIV prevalence of 4% while MSM ages 18–19 had an estimated HIV prevalence of 2.8%; likewise, men ages 20–24 in the general population had a slightly higher HIV prevalence of 13% compared to the 10.3% HIV prevalence estimated among 20–24 year old MSM. In contrast, unpublished results collected in 2011 from another population based study in Kisumu, the Circumcision Impact Study (CIRCIS), suggests the opposite, that HIV burden is 2 to 2.5 times greater among MSM than men in the general population . No HIV was detected among men in the general population ages 18–19, but for men ages 20–24, the HIV prevalence was 3.9% and for men ages 25 and older, 10.4% (Westercamp, 2012, personal communication). Men who have sex with men ages 25 and older had an estimated HIV prevalence of 23%, twice as high as in the general male population of this study.

In comparison to results from screening data from the Randomized Controlled Trial on Male Circumcision in Kisumu, Kenya (RCT), the age-specific HIV prevalence estimates among MSM are comparable to those of men in the general population (Bailey et al., 2007) (see Figure 3).

A possible explanation for these different results could be the differences in eligibility criteria used in the studies for comparison. The eligibility criteria of population based studies allows for individuals to be surveyed who may not be sexually active or have been sexually inactive for more than 6 months. The clinical trial study is more comparable to the design of this study on MSM, as participants for the trial had to be sexually active in the past year and the men in this study had to be sexually active in the last 6 months. Additionally, the individuals who enrolled in this study may be at a lower risk for HIV than others who did not enroll. One method to assess this in the future would be to offer HIV testing to enrolled and unenrolled individuals and determine the HIV prevalence differences between the groups. Despite the differences in the studies being compared, the results suggest that overall the HIV burden among sexually active MSM is at least comparable to the HIV burden among sexually active men in the general population of Kisumu indicating that MSM in Kisumu are burdened by a high HIV prevalence.

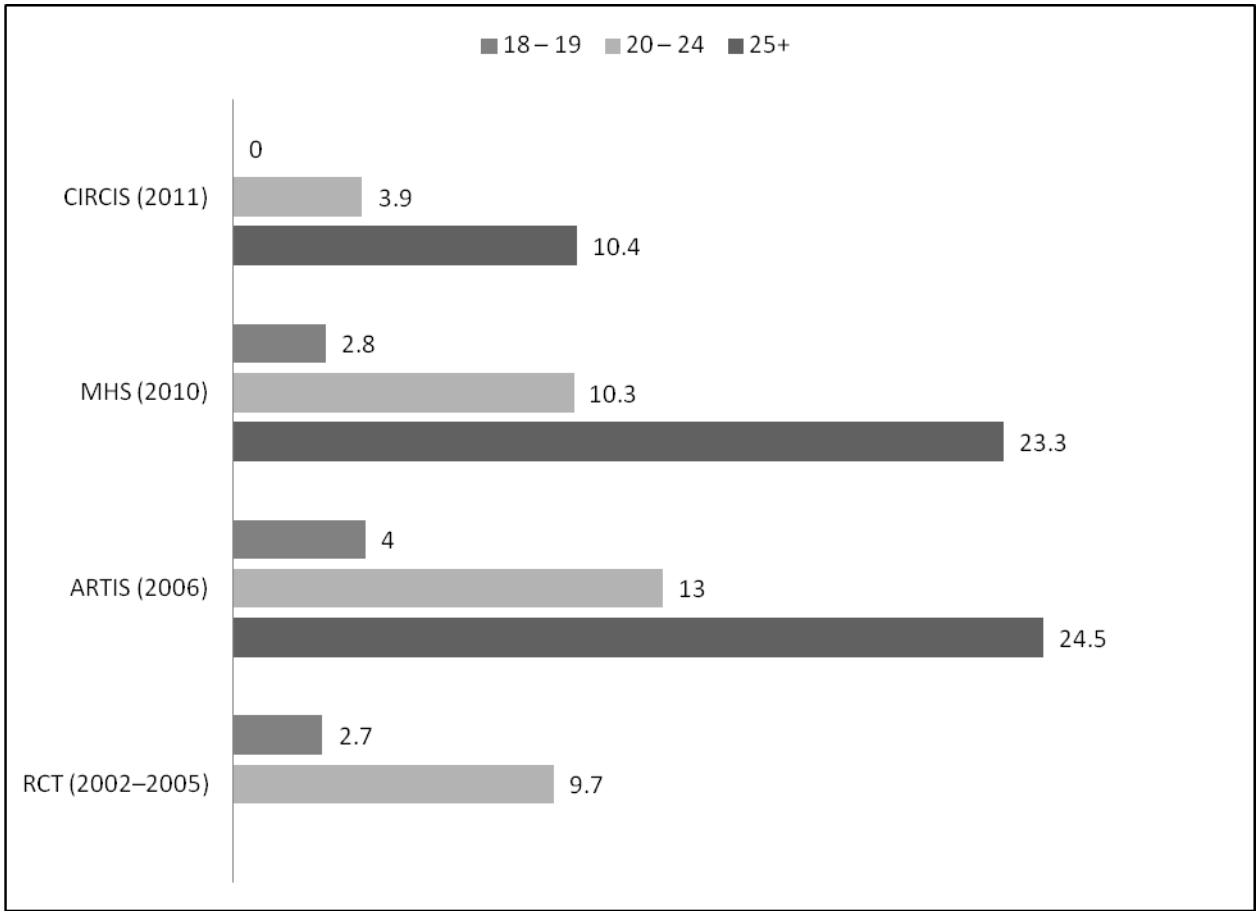

Figure 3. Age Specific HIV Prevalence Rates (%) among Men in Kisumu, Kenya. Data obtained from ARTIS, CIRCIS, RCT, and MHS.

Many studies have presented evidence describing the synergistic relationship between HSV-2 and HIV leading to increased risk for acquisition and transmission (del Mar Pujades Rodriguez et al., 2002; Freeman et al., 2006; Barnabas et al., 2011), yet few studies investigating HIV and risk factors among MSM in sub-Saharan Africa have reported HSV-2 prevalence. In this study, we observed a prevalence of HSV-2 (22%) among MSM in Kisumu, though this prevalence was not disproportionately different from HSV-2 prevalence (28%) among sexually active heterosexual men in Kisumu (ages 18–24 and uncircumcised) (Mehta et al., 2008). Our analysis estimates that MSM infected with HSV-2 are three

times more likely to be co-infected with HIV than MSM uninfected by HSV-2, a finding consistent with other observational and case-control studies (van de Perre et al., 2008). Furthermore, a past history of genital ulcer disease within the last year was also found to be independently associated with HIV in our multivariable logistic regression model, adjusting for HSV-2 infection, suggesting the involvement of other ulcerative STIs such as Chancroid and *Lymphogranuloma venereum* in the HIV epidemic among MSM in Kisumu. Human Immunodeficiency Virus and STI control programs targeting MSM should include a clinical assessment to identify current and/or past ulcerative STIs, provide treatment, and prevention counseling.

Among MSM sampled in this study, sex with women was more frequent than anticipated (64%) and has been reported to be common among MSM in many sub-Sahara African countries, ranging 43.6% to 87% (Dahoma et al., 2009; Baral et al., 2009; Lane et al., 2009). This study found that MSMW who had unprotected vaginal sex were three times more likely to have HIV than MSMW who used a condom at last vaginal sex and MSM who have never had sex with women. Non-significant positive univariate associations between UVI and prevalent HIV infection among MSM in Botswana, Namibia, and Malawi have been reported (Baral et al., 2009). However, a previous study in Soweto, South Africa demonstrated a negative association between UVI and prevalent HIV infection among MSM. Lane and colleagues reported that MSM who engaged in UVI were 50% less likely to have HIV than other men (aOR: 0.5 (95% CI: 0.4–0.6)) and they reported a lower HIV prevalence among men who have a regular female partner (5.8%) compared to men who have a regular male partner (14.9%) (Lane et al., 2009).

Sanders and colleagues reported that among MSM sampled in Mombasa, Kenya, men who have sex with men exclusively (MSME) were six times more likely to have HIV than MSMW (aOR: 6.3 (95% CI: 2.3–17.0)) (Sanders et al., 2007). They reported that MSME in Mombasa were more likely to engage in only receptive anal sex or both receptive and insertive anal sex than MSMW who were more likely to engage in only insertive anal sex which may explain the difference in HIV prevalence between MSME and MSMW. Crude incidence estimates reported by Sanders et al. appear to corroborate this relationship between sexual position and HIV; HIV incidence for insertive anal sex only was 8.8 per 100 person-years

of observation, whereas HIV incidence for receptive anal sex only or both insertive and receptive anal sex were higher at 12.9 and 20.4 per 100 person-years of observation. In our study of MSM in Kisumu, we did not find a significant difference in HIV prevalence between MSME and MSMW (11.8% versus 11.2%) which may be attributed to the similar proportions of both receptive and insertive anal sex among MSME (89.3%) and MSMW (81.6%).

No relationship between male circumcision status and prevalent HIV infection was identified in this study, a finding consistent with other studies evaluating the association between male circumcision status and HIV infection among MSM (Millet et al., 2008; Wiysonge et al., 2011). In instances where men's sexual behavior is defined as primarily insertive, there is some indication that male circumcision may have a protective effect for MSM (Lane et al., 2009, Wiysonge et al., 2011). Data assessing the effect of male circumcision among MSMW are sparse, but given the positive association between UVI and HIV infection observed in this study, the high proportion of MSM ever having sex with women in sub-Sahara Africa, and that 43.6% initiated sex with women before men, medical male circumcision (MMC) may be a useful prevention strategy to reduce HIV transmission between women and MSMW. A prospective study is needed to delineate the relationship between UVI and HIV, to better assess potential behavioral risk differences between MSME and MSMW in Kisumu, and to further evaluate male circumcision as a preventative strategy for HIV among MSMW.

The objective of the study was to identify sexual risk behaviors and other factors associated with HIV among sexually active MSM in Kisumu and as such our findings may not be generalizable to all MSM in Kisumu. We excluded individuals under the age of 18; therefore our results may not be consistent with behaviors among sexually active MSM youth in Kisumu. Also, we excluded men who had not been sexually active with another man in the six months preceding screening. If the excluded men were not sexually active in the last six months because of positive HIV status, were married, or were sexually active more than six months from when they were recruited, then we may have underestimated the HIV prevalence and risk behaviors among MSM in Kisumu. We were not able to recruit any non-African Kenyans into the study. Community informants reported that some non-African Kenyan men

engage in sexual relationships with African Kenyan men, usually through transactional encounters, but there was little indication of social relationships existing between these non-African Kenyan men. Prior to the beginning of enrollment, a non-African Kenyan MSM was identified and attempts were made to enroll him as a seed, but he declined to participate. Respondent driven sampling was an efficient method at recruiting MSM in Kisumu, but barriers remained for recruiting older MSM. Only 23% of the recruited participants were 25 years or older; therefore our findings may not accurately reflect HIV status and risk patterns among older MSM.

The behavioral questionnaire was administered through ACASI to eliminate interviewer bias, and minimize other reporting inaccuracies due to social desirability and memory recall. However, quantifying the impact of ACASI use on reporting biases is challenging as no gold standard is available. Several studies in the United States and Kenya and a systematic review comparing face to face interviewing to computer assisted interviewing suggest that participants provide less biased responses, as observed through an increase in reporting of sensitive behaviors to behavioral questions administered through computer assisted interviews than by face-to-face interviews (van der Elst et al., 2009; Metzger et al., 2000; Mensch et al., 2003; Schroder et al., 2003; Langhaug et al., 2010). Furthermore, our findings may be confounded by unaccounted factors and as this is a cross-sectional study, the temporality of events could not be discerned.

Respondent driven sampling was used to sample the MSM population and estimate population level characteristics. We obtained equilibrium on all key variables indicating that theoretically we obtained a sample whose characteristics are independent of the seeds' characteristics; and although recruitment did not reach the target sample size of 600 men, this does not affect the RDS adjusted estimates. Respondent driven sampling estimates are theoretically unbiased; however, caution should be used in interpreting RDS adjusted estimates and results from RDS weighted multivariable analysis. A recent study evaluating the validity of current RDS estimators to estimate population estimates of a known population suggests that RDS estimators do not always adequately adjust for bias (McCreesh et al., 2012). Additionally, other studies have suggested that the confidence intervals generated by RDSAT

may underestimate the true variance (Wejnert, 2009; Goal and Salganik, 2010). Respondent driven sampling analysis tool generated sampling weights for prevalent HIV infection were applied to multivariable logistic regression modeling to account for homophily and peer network size (Heckathorn, 2007), yet few studies have assessed the adequacy of this method to adjust for these biases in multivariable logistic regression.

V. CONCLUSION

Men who have sex with men in Kisumu experience twice the burden of disease than men in the general population of Kenya, but likely experience a comparable burden of HIV to other sexually active men in the general population of Kisumu. Although the HIV burden among MSM in Kisumu may not be disproportionate to other men in the district, they remain a particularly vulnerable population whose specific prevention needs cannot be met by prevention activities that may be effective for heterosexual men and do not include them or where policies foster an inhospitable environment, preventing MSM from receiving adequate health services. Common HSV-2 and high HIV prevalence, high partner number and low condom use among the MSM sampled in this study indicates an urgent need for prevention activities combining high coverage of HIV/STI testing and treatment, behavioral interventions reducing the number of sexual partners, and improving condom use regardless of partner type or partner gender. Diagnostic evaluation and counseling for alcohol and drug abuse are indicated as areas that should be included in intervention efforts. A prospective study is needed to determine the incidence of HIV and other STI's among MSM in Kisumu, and to further assess the relationships and factors identified in this study as potential risk factors in the HIV epidemic among MSM.

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