Status of Voluntary Medical Male Circumcision in Kenya: Findings From 2 Nationally Representative Surveys in Kenya, 2007 and 2012

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Abstract

Background—The Kenyan Ministry of Health initiated a voluntary medical male circumcision (VMMC) program in 2008. We used data from 2 nationally representative surveys to estimate trends in the number, demographic characteristics, and sexual behaviors of recently circumcised and uncircumcised HIV-uninfected men in Kenya.

Methods—We compared the proportion of circumcised men between the first and second Kenya AIDS Indicator Survey (KAIS 2007 and KAIS 2012) to assess the progress of Kenya's VMMC program. We calculated the number of uncircumcised HIV-uninfected men. We conducted descriptive analyses and used multivariable methods to identify the variables independently associated with HIV-uninfected uncircumcised men aged 15–64 years in the VMMC priority region of Nyanza.

Results—The proportion of men who reported being circumcised increased significantly from 85.0% in 2007 to 91.2% in 2012. The proportions of circumcised men increased in all regions, with the highest increases of 18.1 and 9.0 percentage points in the VMMC priority regions of Nyanza and Nairobi, respectively. Half (52.5%) of HIV-uninfected and uncircumcised men had never been married, and 84.6% were not using condoms at all times with their last sexual partner.

Conclusions—VMMC prevalence has increased across Kenya demonstrating the success of the national program. Despite this accomplishment, the Nyanza region remains below the target to

circumcise 80% of all eligible men aged 15–49 years between 2009 and 2013. As new cohorts of young men enter into adolescence, consistent focus is needed. To ensure sustainability of the VMMC program, financial resources and coordinated planning must continue.

Keywords

circumcision; HIV; VMMC; Kenya; prevention

INTRODUCTION

In 2007, the first Kenya AIDS Indicator Survey (KAIS 2007) found that the national prevalence of HIV in Kenya was 7.1% among persons aged 15–64 years.[1] KAIS 2007 also found that 85.0% of men in Kenya had been circumcised, and that the national prevalence of HIV infection in circumcised men was 3.9% [95% confidence interval (CI): 3.3 to 4.5] compared with 13.2% (95% CI: 10.8 to 15.7) in uncircumcised men.[1] The highest prevalence of HIV (14.9%) and the lowest prevalence of male circumcision (46.4%) were both in Nyanza region.[1]

In November 2008, Kenya's Ministry of Health began the implementation of an ambitious voluntary medical male circumcision (VMMC) program.[2,3] The program was initiated after the results of 3 randomized controlled trials showed that male circumcision could reduce the risk of acquiring HIV infection among men by approximately 60%.[4–6] The World Health Organization and Joint United Nations Programme on HIV/AIDS subsequently issued recommendations encouraging the use of VMMC as an effective HIV prevention intervention.[7] Additionally, 1 modeling study showed that 5 HIV infections could be averted for every 36 men circumcised, saving up to 6200 US dollars per every HIV infection averted before 2025 in Kenya's Nyanza region.[8] Planning for the VMMC program in Kenya relied heavily on data from the 1999 census, the 2003 Kenya Demographic and Health Survey, and KAIS 2007, which showed that 15% of Kenyan men aged 15–64 years were uncircumcised.[1,9,10] Circumcision prevalence varied by region, with Nyanza region having the lowest prevalence (46.4%) followed by Nairobi, Rift Valley, and Western regions.[1] The number of HIV-uninfected men who were uncircumcised at the time of KAIS 2007 was estimated to be 1.2 million, and the Nyanza and Rift Valley regions were estimated to have the largest number of uncircumcised HIV-uninfected men (601,709 and 235,688, respectively). Together with Nairobi and Western regions, these 4 regions accounted for nearly 90% of all uncircumcised HIV-uninfected men in the country.[1]

Kenya set a strategic target to increase the percentage of circumcised men nationally from 85% to 94% in 3–5 years by performing 860,000 VMMCs (80% of estimated need) in men aged 15–49 years by 2013. The brief duration was designed to maximize the public health impact[11] and was planned to result in the reduction of the percentage of uncircumcised men from 15% to 9% nationally. Programmatic data indicated that 560,000 VMMCs had been completed in Kenya by the end of December 2012, bringing the national VMMC program achievement to within 65% of its strategic target. Moreover, 80% of these VMMCs were in the Nyanza region alone (Personal Communication, Kenya Ministry of Health, June 26, 2013).

Using data from the second Kenya AIDS Indicator Survey (KAIS 2012), we describe the progress that has been made in the Kenya VMMC program from 2007 to 2012. We further describe the current unmet need, including comparing the characteristics of the uncircumcised HIV-uninfected and the recently circumcised men in Kenya.

METHODS

Study Design

KAIS 2012 was a national population-based cross-sectional study, which sampled households across 9 programmatic regions of Kenya between October 2012 and February 2013. Details of its methods have been described elsewhere.[12] Because of regional insecurity, the North Eastern region was not included in the survey. A 2-stage cluster sampling design was used to derive estimates of the prevalence and sociodemographic, behavioral, and biological correlates of HIV infection that were representative at the regional level for the study's adult and adolescent population (aged 15–64 years).

Study Population

All individuals aged 15–64 years, who were either usual residents or had stayed overnight in the household on the night before the survey, were eligible to participate. For this analysis, we have restricted our study population to men aged 15–64 years.

Measurements

Trained interviewers administered structured questionnaires that included sociodemographic characteristics and sexual behaviors. The questionnaire administered to men included items on knowledge of the benefits of male circumcision, intention to be circumcised, and for circumcisions that had occurred in last 3 years, where, when, and by whom the circumcision had been performed. To eliminate data entry time lag and ensure high standards of data quality, the survey used low-cost portable netbooks for data capture in the field (Mirus Innovations, Mississauga, Ontario, Canada). The netbooks allowed on-screen validations and data management quality checks, minimizing data transcription errors while simultaneously increasing data security and confidentiality.[13] In addition, a blood sample was taken for biologic testing at the National HIV Reference Laboratory in Nairobi.

Laboratory Tests

As a service to study participants, respondents were given the opportunity to learn their HIV status within their homes through home-based testing and counseling using venous blood samples collected for the survey or a separate capillary sample. Methods for home-based testing and counseling were consistent with national guidelines for HIV testing.[14] All specimens for centralized testing were transported from the field to the National HIV Reference Laboratory, where HIV tests were performed. Specimens were screened with Vironostika HIV-1/2 UNIF II Plus O Enzyme Immunoassay (BioMérieux, Marcy l'Etoile, France). Specimens testing negative by the screening assay were reported as a final result negative. Specimens testing positive by the screening assay were confirmed using the Murex HIV.1.2.O HIV Enzyme Immunoassay (DiaSorin SpA, Saluggia, Italy). Samples showing discordant results after confirmatory testing were tested again with the 2 assays. Polymerase

chain reaction (Cobas AmplicorHIV-1 Monitor Test, version 1.5; Roche Molecular Diagnostics, Pleasanton, CA) was performed to resolve specimens with twice-discordant results. All positive specimens and 5% of negative specimens were retested for quality assurance purposes using the same testing algorithm at the Kenya Medical Research Institute Laboratory.

Data Analysis

We compared the proportion of circumcised men between KAIS 2007 and KAIS 2012 to assess the progress of Kenya's VMMC program. We also calculated the number of HIV-uninfected men who had not been circumcised from estimates of the population and of the prevalence of circumcision and HIV infection in each region. National and regional numbers of circumcised, uncircumcised, and HIV-uninfected uncircumcised men were estimated based on the observed prevalence of circumcision and 2012 projected population estimates from the 2009 Kenyan Population and Household Census.[15] Uncertainty bounds were calculated for the population estimates based on 95% confidence intervals (CI). Final population estimates presented were rounded to the nearest 1000 persons. We also conducted descriptive analyses to examine the demographic characteristics and risk and protective behaviors of recently circumcised and uncircumcised HIV-uninfected men. Finally, using multivariable logistic regression analysis, we calculated adjusted odds ratios (aOR) and 95% CI to identify variables independently associated with being HIV-uninfected and uncircumcised in the VMMC priority region of Nyanza. We selected variables with a *P* value of < 0.1 in bivariate analyses for final multivariable models and used backwards elimination, if they did not remain significant at a *P* value of < 0.05. We performed all analyses using the procedures for surveys in SAS software (version 9.3; SAS Institute Inc., Cary, NC). Analyses accounted for the stratified cluster design of the survey. Each response was weighted to account for its sampling probability and adjusted for survey nonresponse. As estimates based on small sample sizes are unreliable and are not likely to be nationally or regionally representative, we suppressed estimates based on denominators less than 25 observations.

Ethical Considerations

We obtained verbal informed consent from all participants for both the interview and blood sample. The study was approved by the Kenya Medical Research Institute's Ethical Review Committee, the Institutional Review Board of the US Centers for Disease Control and Prevention, and the Committee on Human Research of the University of California, San Francisco.

RESULTS

We identified 16,383 eligible adults in 9189 eligible households. Of these, 7452 (45.4%) were men; 5766 (77.3%) were interviewed, and 4836 (64.8%) provided blood specimens.

Overall, 91.2% of men (95% CI: 89.7 to 92.7; n = 5229) reported being circumcised, 8.8% (95% CI: 7.3 to 10.3; n = 509) reported being uncircumcised, 0.1% (n = 8) did not report their circumcision status, and 0.3% (n = 20) had missing data. The overall prevalence of

HIV infection in uncircumcised men was 16.9% (95% CI: 13.1 to 20.7) compared with 3.1% (95% CI: 2.5 to 3.8; *P* < 0.001) in circumcised men.

The proportion of men who reported being circumcised increased by 6.2% (95% CI: 5.1 to 7.3; *P* < 0.001) from 85.0% (95% CI: 83.2 to 86.8) in KAIS 2007 to 91.2% (95% CI: 89.7 to 92.7) in KAIS 2012 (Table 1). The proportion of circumcised men increased in all age groups, with the largest increase of 9.4% (95% CI: 7.2 to 11.6; *P* < 0.001) in men aged 15–24 years and lowest increase of 1.9% (95% CI: −1.2 to 5.0; *P* = 0.541) in men aged 55–64 years. Proportions of circumcised men increased from 2007 to 2012 in all regions, with highest increases of 18.1% (95% CI: 13.6 to 22.6; *P* < 0.001), 9.0% (95% CI: 5.9 to 12.1; *P* < 0.001), 4.1% (95% CI: 1.7 to 6.5; *P* = 0.001), and 5.1% (95% CI: 2.3 to 7.9; *P* < 0.001) in VMMC priority regions of Nyanza (from 48.2% to 66.3%), Nairobi (from 83.2% to 92.2%), Rift Valley (88.7%–92.8%), and Western regions (87.8%–92.9%), respectively. Increases in circumcision prevalence by age group were highest in the Nyanza region, where the proportion increased by 25.2% (95% CI: 18.2 to 32.2; *P* < 0.001) and 21.8% (95% CI: 12.4 to 31.2; *P* < 0.001) in men aged 15–24 years and aged 25–34 years, respectively (Table 1). The biggest percentage increases in circumcision prevalence by ethnic groups were among men belonging to the Luo tribe (30.6%, 95% CI: 26.0 to 35.2; *P* < 0.001) and among men belonging to smaller tribes, for which individual tribal affiliation was not collected and were categorized as "Other" (25.9%, 95% CI: 20.5 to 31.3; *P* < 0.001). The Other category included Teso and the traditionally noncircumcising tribes who reside in the Turkana region.

Table 2 shows the estimated number of men aged 15–64 years in the 7 former provinces of Kenya by circumcision and HIV status. The percentage of HIV-uninfected men who were uncircumcised at the time of the survey was estimated to be 7.3% of the total population of men aged 15–64 years, which corresponded to 756,000 men. The priority regions of Nyanza, Rift Valley, and Nairobi continued to have the highest HIV prevalence among uncircumcised men aged 15–64 years [25.9% (95% CI: 20.5 to 31.3), 10.2% (95% CI: 2.7 to 17.7), and 9.5% (95% CI: 2.3 to 16.7), respectively] and large estimated numbers of uncircumcised HIV-uninfected men (345,000, 180,000, and 85,000, respectively) (Table 2). These 3 regions account for 80.7% of all uncircumcised HIV-uninfected men in the country. The priority region of Western, however, had the lowest HIV prevalence at 4.2% (95% CI: 0.0 to 10.7) and the lowest estimated number of uncircumcised HIV-uninfected men at 73,000.

The majority (84.9%, 95% CI: 80.8 to 88.9) of HIV-uninfected men who were circumcised in the last 3 years were aged 15–24 years, and 28.0% (95% CI: 21.1 to 35.0) were from the Luo ethnic tribe (Table 3). More than half lived in Rift Valley (34.8%, 95% CI: 27.1 to 42.5) or Nyanza region (22.5%, 95% CI: 16.2 to 28.9), 68.2% (95% CI: 62.0 to 74.5) lived in rural areas, and 43.0% (95% CI: 35.8 to 50.1) had reported secondary education or higher education. The majority (86.8%, 95% CI: 82.9 to 90.7) had never married or cohabited, and 52.2% (95% CI: 46.1 to 58.3) were not yet sexually active. Most (57.6%, 95% CI: 50.7 to 64.4) reported ever having been tested for HIV, and over half (52.6%, 95% CI: 43.6 to 61.5) of those sexually active in the past 12 months used a condom with the last sexual partner.

Among HIV-uninfected men who were uncircumcised, 51.4% (95% CI: 46.0 to 56.8) were aged 15–24 years and 52.5% (95% CI: 47.0 t 58.0%) had never married or cohabited (Table 3). The majority (61.2%, 95% CI: 53.9 to 68.5) were from the Luo ethnic tribe, and nearly half (46.7%, 95% CI: 39.2 to 54.3) lived in the Nyanza region. The majority of sexually active HIV-uninfected and uncircumcised men (84.6%, 95% CI: 79.8 to 89.5) were not using condoms at all times with their last sexual partner in the past 12 months, and 40.4% (95% CI: 34.2 to 46.7) reported never having been tested for HIV. The majority (72.1%, 95% CI: 66.1 to 78.1), however, knew circumcision protected men somewhat from HIV, and over half (53.0%, 95% CI: 46.7 to 59.2) reported that they intended to be circumcised in the future. Intention to be circumcised was highest among young men aged 15–24 years (69.6%, 95% CI: 61.7 to 77.4) and men who had never married or cohabited (73.6%, 95% CI: 66.1 to 81.1) (data not shown).

In Nyanza region, of the 772 men we surveyed, 13.4% (95% CI: 8.7 to 18.2) (n = 104) were HIV-uninfected and recently circumcised (past 3 years), and 26.3% (95% CI: 18.9 to 33.7) (n = 198) were HIV-uninfected and uncircumcised (data not shown). Over half (51.8%, 95% CI: 41.2 to 62.3) of men aged 15–24 years compared with 93.9% (95% CI: 87.6 to 100.0) of men aged 45–64 years were HIV-uninfected and uncircumcised (Table 4). Seventy-five percent (75.8%, 95% CI: 67.1 to 84.4) of men with secondary or higher level of education were HIV-uninfected and uncircumcised compared with 59.1% (95% CI: 50.1 to 68.1) of men who had completed primary level education. A higher proportion of men who were married or cohabiting (80.5%, 95% CI: 72.3 to 88.8) were HIV-uninfected and uncircumcised compared with men who had never married or cohabited (46.6%, 95% CI: 36.0 to 57.2). Overall, 81.9% (95% CI: 74.1 to 90.0) of men who did not use a condom consistently with the last sex partner in the past 12 months compared with 50.5% (95% CI: 36.4 to 64.5) of men who did were HIV-uninfected and uncircumcised. Moreover, 74.3% of men who reported 4 or more lifetime number of sex partners compared with 42.0% (95% CI: 21.3 to 62.7) of men who reported no partners were HIV-uninfected and uncircumcised.

In multivariable logistic regression, being younger [aged 15–24 years (aOR: 0.12, 95% CI: 0.03 to 0.55) and 25–34 years (aOR: 0.13, 95% CI: 0.03 to 0.57)] was significantly associated with lower odds of being HIV-uninfected and uncircumcised compared with men aged 45–64 years. In addition, men who reported condom use with the last sexual partner in the past 12 months had significantly lower odds of being HIV-uninfected and uncircumcised (aOR: 0.31, 95% CI: 0.16 to 0.60).

DISCUSSION

We found a significant increase in the proportion of men aged 15–64 years who reported being circumcised from 2007 to 2012. The highest increase in VMMCs was observed in regions and subpopulations where Kenya's National VMMC program has targeted since 2008, including Nyanza region, men from the Luo tribe, and men aged 15–44 years. The gains made in VMMC coverage over the past 5 years can be attributable to adoption of focused strategies for scaling up VMMC.

Kenya's minimum VMMC package includes provider-recommended and offered HIV testing and counseling, risk-reduction counseling and behavior change communication, sexually transmitted infection screening and treatment, condom promotion and provision, and medical circumcision surgery as per World Health Organization guidelines. Circumcised men are also advised to abstain from sex for 6 weeks after circumcision to allow for healing and to use condoms when sexual behavior resumes.[11] The vast majority of recently circumcised men reported ever having been tested for HIV. Almost half of the HIV-uninfected men who were recently circumcised reported consistently using condoms, and over half reported using a condom at last sex, suggesting that risk compensation is not as widespread as was originally feared, and that many of those who were recently circumcised are heeding the prevention messages included in the complete package of circumcision services.[16]

Conversely, HIV-uninfected uncircumcised men are still engaging in risky behaviors, with only 21% reporting that a condom was used with the last sexual partner in the past 12 months. However, the difference in condom use between those recently circumcised compared with uncircumcised HIV-uninfected men may also be because of the factors unrelated to exposure to prevention messages in the minimum package. Recently circumcised men may be more disposed to prevention approaches overall, leading to an increase in uptake of both circumcision and condom use. It is also possible that many of the uncircumcised men are older and in monogamous married relationships and therefore feel no need to adhere to either prevention intervention.

It is critical that Kenya's VMMC program remains robust and explores approaches to promote and encourage HIV-uninfected uncircumcised men to access VMMC, offered as part of a comprehensive HIV prevention package, which allows access to other prevention benefits, including risk-reduction counseling, HIV testing, and condom use. Targeted strategies are needed for those men in Nyanza region who are HIV-uninfected and uncircumcised, the majority of whom are aged 15–24 years, report first sex between the ages of 15–19 years, live in rural areas, have never married or cohabited, and have previously been tested for HIV infection. A positive finding is that more than half of all uncircumcised men stated an intention to be circumcised. This finding was strongest among young men aged 15–24 years and men who had never been married or cohabited.

We recognize the limitations of our study, including the fact that comparison of the KAIS 2007 and KAIS 2012 data must be done with caution because the sampling frameworks of the 2 surveys were slightly different. North Eastern region was not included in KAIS 2012 and had high rates of circumcision in KAIS 2007, so overall prevalence of circumcision in KAIS 2012 is potentially underestimated. Circumcision status, condom use, and sexual behavior were measured through participants' self-report, and, therefore, responses may have been biased toward socially desirable answers. Some noncircumcising tribes, for example, Turkana and Teso, were combined with other smaller tribes and could not be analyzed separately. Additionally, sample sizes were small for some subgroups and resulted in reduced precision in the estimates presented. Finally, because of the cross-sectional study design, the directionality of associations cannot be established.

Notwithstanding these limitations, our study presents nationally representative population-based data on VMMC that demonstrated substantial progress toward bringing an evidence-based biomedical intervention to scale within a short period. The success of the Kenyan VMMC program should encourage other countries that are at various stages of scaling up VMMC to continue implementing VMMC actively for HIV prevention. For example, the success of Kenya's 2009, 2010, and 2011 Rapid Results Initiative informed the Swaziland Male Circumcision Task Force's decisions to adopt surgical, nonsurgical, and human resource efficiencies in scaling up VMMC.[17] Overall, KAIS 2012 data show increased uptake of VMMC across Kenya, demonstrating the success of the national VMMC program. Despite this accomplishment, the Nyanza region remains below the target to circumcise 80% of all eligible men aged 15–49 years between 2009 and 2013, with the aim of averting an estimated 900,000 HIV infections over 20 years.[11] Moreover, KAIS 2012 found that men with the highest HIV prevalence were aged 45–49 years.[18] Therefore, strategies are needed to continue targeted messaging about the benefits of VMMC is needed, especially in Nyanza region and among older men.

Furthermore, as new cohorts of young men enter into adulthood, they will also require consistent targeting. Finally, as part of the long-term strategy of the national VMMC program, implementation and scale-up of infant circumcision services, integrated into routine maternal and child health services, is expected to maximize the long-term public health impact of VMMC on the HIV epidemic.[2] To ensure sustainability of the VMMC program, continued financial resources and coordinated planning are necessary.

Acknowledgments

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TABLE 1

Proportion of Circumcised Men Aged 15–64 Years by Selected Sociodemographic Characteristics: Kenya AIDS Indicator Survey 2007 and 2012

Sociodemographic Characteristics, Variable	KAIS 2007 Circumcised Men			KAIS 2012 Circumcised Men			Change % (95% CI)	P
	Unweighted, n	Unweighted, N	Weighted % (95% CI)	Unweighted, n	Unweighted, N	Weighted % (95% CI)		
Total	6586	7678	85.0 (83.2 to 86.8)	5229	5738	91.2 (89.7 to 92.7)	6.2 (5.1 to 7.3)	< 0.001
Age group, yrs								
15–24	2008	2513	78.7 (75.4 to 81.9)	1690	1911	88.1 (86.1 to 90.2)	9.4 (7.2 to 11.6)	< 0.001
25–34	1654	1881	87.4 (85.5 to 89.3)	1435	1538	93.4 (91.8 to 95.0)	6.0 (4.1 to 7.9)	< 0.001
35–44	1249	1410	88.2 (85.9 to 90.5)	994	1070	93.0 (90.8 to 95.1)	4.8 (2.5 to 7.1)	< 0.001
45–54	953	1078	88.5 (86.4 to 90.7)	657	725	90.7 (88.0 to 93.4)	2.2 (−0.6 to 5.0)	0.136
55–64	722	796	90.5 (87.8 to 93.2)	453	494	92.4 (89.6 to 95.2)	1.9 (−1.2 to 5.0)	0.541
Region								
Nairobi	792	925	83.2 (75.9 to 90.5)	719	784	92.2 (89.0 to 95.4)	9.0 (5.9 to 12.1)	< 0.001
Central	1072	1121	95.5 (93.8 to 97.2)	632	652	97.5 (95.9 to 99.0)	2.0 (0.3 to 3.7)	0.022
Coast	794	822	97.0 (95.6 to 98.4)	704	713	99.1 (98.3 to 99.8)	2.1 (0.7 to 3.5)	0.002
Eastern	1243	1295	96.3 (94.6 to 98.0)	1050	1085	97.7 (96.3 to 99.1)	1.4 (0.0 to 2.8)	0.307
Nyanza	533	1099	48.2 (42.0 to 54.3)	518	772	66.3 (57.0 to 75.6)	18.1 (13.6 to 22.6)	< 0.001
North Eastern [*]	325	334	97.3 (95.2 to 99.5)					
Rift Valley	970	1090	88.7 (85.4 to 91.9)	977	1056	92.8 (90.8 to 94.9)	4.1 (1.7 to 6.5)	0.001
Western	857	992	87.8 (82.0 to 93.5)	629	676	92.9 (89.2 to 96.7)	5.1 (2.3 to 7.9)	< 0.001
Age group (Nyanza), yrs								
15–24	222	469	46.5 (38.4 to 54.6)	194	268	71.7 (62.1 to 81.3)	25.2 (18.2 to 32.2)	< 0.001
25–34	103	217	47.5 (40.2 to 54.8)	130	185	69.3 (60.1 to 78.5)	21.8 (12.4 to 31.2)	< 0.001
35–44	82	170	47.4 (38.4 to 56.3)	68	119	57.6 (42.7 to 72.6)	10.2 (−1.4 to 21.8)	0.136
45–54	81	155	53.5 (45.8 to 61.2)	72	117	59.1 (44.7 to 73.4)	5.6 (−6.3 to 17.5)	0.127
55–64	45	88	51.0 (36.1 to 66.0)	54	83	64.5 (49.5 to 79.4)	13.5 (−1.2 to 28.2)	0.065
Residence								
Rural	4880	5716	84.6 (82.6 to 86.6)	3206	3518	91.2 (89.3 to 93.1)	6.6 (5.3 to 7.9)	< 0.001

Sociodemographic Characteristics, Variable	KAIS 2007 Circumcised Men		KAIS 2012 Circumcised Men			Change % (95% CI)	P
	Unweighted,N	Weighted % (95% CI)	Unweighted, n	Unweighted, N	Weighted % (95% CI)		
Urban	1706	86.5 (82.3 to 90.7)	2023	2220	91.1 (88.6 to 93.5)	4.6 (2.7 to 6.5)	< 0.001
Highest educational attainment							
No primary	605	85.2 (79.1 to 91.3)	348	376	92.1 (86.0 to 98.2)	6.9 (3.1 to 10.7)	< 0.001
Incomplete primary	1696	79.0 (75.7 to 82.2)	388	447	86.7 (82.4 to 90.9)	7.7 (4.1 to 11.3)	< 0.001
Complete primary	1580	85.6 (83.3 to 88.0)	1710	1885	90.4 (88.5 to 92.3)	4.8 (2.7 to 6.9)	< 0.001
Secondary or higher	2705	89.1 (87.2 to 91.0)	2781	3028	92.1 (90.4 to 93.8)	3.0 (1.5 to 4.5)	< 0.001
Marital status							
Never married/never cohabited	2301	81.0 (78.2 to 83.9)	2024	2248	89.8 (88.1 to 91.6)	8.8 (6.9 to 10.7)	< 0.001
Married/cohabiting	3918	87.3 (85.6 to 89.0)	2963	3221	92.1 (90.3 to 93.9)	4.8 (3.5 to 6.1)	< 0.001
Ethnic group							
Embu	101	97.9 (94.9 to 100)	71	71	100	2.1 (−0.7 to 4.9)	0.238
Kalenjin	545	91.4 (87.1 to 95.7)	541	580	93.4 (91.6 to 95.3)	2.0 (−1.0 to 5.0)	0.854
Kamba	809	98.9 (97.8 to 100)	526	527	99.8 (99.4 to 100)	0.9 (0.1 to 1.7)	0.030
Kikuyu	1590	96.7 (95.5 to 98.0)	1073	1100	97.9 (96.9 to 98.9)	1.2 (0 to 2.4)	0.208
Kisii	509	99.1 (98.2 to 100)	397	398	99.7 (99.1 to 100)	0.6 (−0.4 to 1.6)	0.181
Luhya	1161	94.5 (91.0 to 97.9)	859	886	96.9 (94.5 to 99.2)	2.4 (0.7 to 4.1)	< 0.001
Luo	147	16.1 (11.9 to 20.4)	297	629	46.7 (41.8 to 51.5)	30.6 (26.0 to 35.2)	< 0.001
Masai	68	96.8 (93.3 to 100)	80	81	99.3 (97.8 to 100)	2.5 (−2 to 7)	0.250
Meru	438	93.2 (89.8 to 96.6)	230	241	94.9 (91.8 to 98.0)	1.7 (−1.9 to 5.3)	0.235
Mijikenda	448	100	318	319	99.9 (99.6 to 100)	−0.1 (−0.4 to 0.2)	1.764
Somali	383	98.5 (97.1 to 99.9)	39	39	100[†]	1.5 (0.3 to 2.7)	0.476
Taita/Taveta	110	98.6 (96.7 to 100)	118	118	100	1.4 (−0.8 to 3.6)	0.145
Other	267	61.1 (49.5 to 72.6)	671	740	87.0 (81.1 to 92.9)	25.9 (20.5 to 31.3)	< 0.001

NA, not applicable.

* North Eastern region was not surveyed in KAIS 2012.

[†] The estimate is based on a sample size between 25 and 49 observations and may be unreliable.

TABLE 2

Estimated Number of Men Aged 15–64 Years by Region, Circumcision Status, and HIV Infection Status, Kenya AIDS Indicator Survey 2012

Region	N	Number Circumcised	Weighted Circumcised, %	Number Uncircumcised	HIV-Infected, Uncircumcised			HIV-Uninfected, Uncircumcised	
					Weighted Prevalence, %	95% CI	No. HIV-Infected, Uncircumcised	Number	95% CI
Nairobi	1,202,000	1,108,000	92.2	94,000	9.5	2.3 to 16.7	9000	85,000	78,000 to 92,000
Nyanza	1,380,000	915,000	66.3	465,000	25.9	20.5 to 31.3	120,000	345,000	319,000 to 370,000
Rift Valley	2,792,000	2,591,000	92.8	201,000	10.2	2.7 to 17.7	21,000	180,000	165,000 to 196,000
Western	1,073,000	997,000	92.9	76,000	4.2	0 to 10.7	3000	73,000	68,000 to 76,000
Other*	3,906,000	3,828,000	98.0	78,000	5.9	0 to 13.8	5000	74,000	67,000 to 78,000
Total†	10,353,000	9,438,000	91.2	914,000	16.9	13.1 to 20.7	158,000	756,000	725,000 to 794,000

N, population estimate from KAIS 2012 non-normalized weights.

*
Other includes Central, Coast, and Eastern region. It does not include North Eastern region.

†
Numbers may not add up to total eligible because of rounding error.

TABLE 3

Select Characteristics Among HIV-Uninfected Men Aged 15–64 Years by Circumcision Status, Kenya AIDS Indicator Survey 2012

Variable	Unweighted, N (N = 874)	HIV-Uninfected, Recently Circumcised (N = 435)		HIV-Uninfected, Uncircumcised (N = 439)	
		Unweighted, n	Weighted % (95% CI)	Unweighted, n	Weighted % (95% CI)
Sociodemographic characteristics					
Age group, yrs					
15–24	587	368	84.9 (80.8 to 88.9)	219	51.4 (46.0 to 56.8)
25–34	122	44	9.4 (6.5 to 12.4)	78	17.1 (13.5 to 20.6)
35–44	69	14	3.9 (1.8 to 6.0)	55	12.8 (9.2 to 16.4)
45–64	96	9	1.8 (0.6 to 2.9)	87	18.7 (15.0 to 22.5)
Age at first sex, yrs					
10–14	101	54	29.1 (20.1 to 38.2)	47	16.6 (11.5 to 21.6)
15–19	266	110	58.2 (49.5 to 66.9)	156	56.9 (50.6 to 63.2)
20–35	101	28	12.7 (7.8 to 17.6)	73	26.6 (20.4 to 32.7)
Region					
Nairobi	108	48	8.8 (5.7 to 11.8)	60	11.1 (7.3 to 14.9)
Central	71	52	13.1 (9.6 to 16.5)	19	4.0 (1.8 to 6.2)
Coast	18	10	*	8	*
Eastern	94	59	7.1 (5.1 to 9.2)	35	4.6 (1.9 to 7.2)
Nyanza	302	104	22.5 (16.2 to 28.9)	198	46.7 (39.2 to 54.3)
Rift Valley	174	101	34.8 (27.1 to 42.5)	73	23.3 (17.3 to 29.3)
Western	107	61	12.1 (5.6 to 18.6)	46	9.3 (4.7 to 13.9)
Residence					
Rural	564	296	68.2 (62.0 to 74.5)	268	61.4 (54.0 to 68.8)
Urban	310	139	31.8 (25.5 to 38.0)	171	38.6 (31.2 to 46.0)
Highest educational attainment					
No primary/incomplete primary	163	81	16.1 (10.8 to 21.4)	82	14.8 (9.9 to 19.7)
Complete primary	326	187	40.9 (35.2 to 46.6)	139	32.8 (28.0 to 37.5)
Secondary or higher	385	167	43.0 (35.8 to 50.1)	218	52.4 (46.8 to 58.0)
Marital status					
Never married/never cohabited	586	372	86.8 (82.9 to 90.7)	214	52.5 (47.0 to 58.0)

Variable	Unweighted, N (N = 874)	HIV-Uninfected, Recently Circumcised (N = 435)		HIV-Uninfected, Uncircumcised (N = 439)	
		Unweighted, n	Weighted % (95% CI)	Unweighted, n	Weighted % (95% CI)
Married/cohabiting	261	58	13.2 (9.3 to 17.1)	203	47.5 (42.0 to 53.0)
Ethnic group					
Embu	6	6	*	0	*
Kalenjin	107	68	24.7 (16.0 to 33.4)	39	13.4 (8.2 to 18.5)
Kamba	6	5	*	1	*
Kikuyu	105	78	18.0 (13.2 to 22.8)	27	5.6 (3.0 to 8.2)
Kisii	9	8	*	1	*
Luhya	84	58	13.7 (6.6 to 20.7)	26	5.8 (1.8 to 9.8)
Luo	397	133	28.0 (21.1 to 35.0)	264	61.2 (53.9 to 68.5)
Masai	10	9	*	1	*
Meru	27	16	$4.1^{\dagger}$ (2.1 to 6.0)	11	$3.5^{\dagger}$ (0.8 to 6.1)
Mijikenda	6	5	*	1	*
Other	117	49	3.9 (1.4 to 6.5)	68	9.8 (4.9 to 14.8)
Behavioral characteristics					
Ever been tested for HIV					
No	360	184	42.4 (35.6 to 49.3)	176	40.4 (34.2 to 46.7)
Yes	514	251	57.6 (50.7 to 64.4)	263	59.6 (53.3 to 65.8)
Consistent condom use with last sexual partner in the past 12 months					
No	310	90	55.1 (45.4 to 64.9)	220	84.6 (79.8 to 89.5)
Yes	105	63	44.9 (35.1 to 54.6)	42	15.4 (10.5 to 20.2)
Used a condom with last sexual partner in the past 12 months					
No	282	77	47.4 (38.5 to 56.4)	205	79.2 (74.1 to 84.2)
Yes	133	76	52.6 (43.6 to 61.5)	57	20.8 (15.8 to 25.9)
Life time number of sex partners					
0 partner	347	223	52.2 (46.1 to 58.3)	124	32.8 (26.3 to 39.3)
1 partner	115	62	15.1 (10.7 to 19.4)	53	14.4 (9.8 to 19.1)
2–3 partners	146	67	17.4 (13.0 to 21.9)	79	20.8 (16.5 to 25.1)
4 or more partners	182	64	15.3 (11.2 to 19.4)	118	32.0 (26.1 to 37.8)

Variable	Unweighted, N (N = 874)	HIV-Uninfected, Recently Circumcised (N = 435)		HIV-Uninfected,Uncircumcised (N = 439)	
		Unweighted, n	Weighted % (95% CI)	Unweighted, n	Weighted % (95% CI)
Knowledge and attitudes around circumcision					
Does circumcision protect men from HIV?					
Protects completely	32	21	$6.2^{\dagger}$ (3.4 to 9.1)	11	$3.8^{\dagger}$ (1.7 to 6.0)
Protects somewhat	532	266	65.5 (58.5 to 72.5)	266	72.1 (66.1 to 78.1)
Does not protect at all	199	112	28.3 (22.0 to 34.5)	87	24.1 (18.4 to 29.7)
Circumcised men do not need to use condom for HIV prevention					
Agree	26	12	$2.9^{\dagger}$ (0.9 to 4.9)	14	$4.0^{\dagger}$ (1.9 to 6.1)
Disagree	771	402	97.1 (95.1 to 99.1)	369	96.0 (93.9 to 98.1)
Circumcised men can have many partners and not get HIV					
Agree	15	9	*	6	*
Disagree	796	411	97.3 (95.3 to 99.3)	385	98.5 (97.3 to 99.8)
Planning to be circumcised					
No	204	NA	NA	204	47.0 (40.8 to 53.3)
Yes	217	NA	NA	217	53.0 (46.7 to 59.2)

NA, not applicable.

*
The estimate is suppressed due to denominator < 25 observations.

$\dagger$
The estimate is based on a denominator between 25 and 49 observations and may be unreliable.

TABLE 4

Factors Associated With Being Uncircumcised Among HIV-Uninfected Men Aged 15–64 Years, Nyanza Region, Kenya AIDS Indicator Survey 2012

Variable	Unweighted, N (N = 302)	HIV-Uninfected, Uncircumcised (N = 198)		Unadjusted OR (95% CI)	Adjusted OR (95% CI)
		Unweighted, n	Weighted % (95% CI)		
Age group, yrs					
15–24	145	73	51.8 (41.2 to 62.3)	0.07 (0.02 to 0.23)	0.12 (0.03 to 0.55)
25–34	60	38	63.4 (53.4 to 73.3)	0.11 (0.04 to 0.33)	0.13 (0.03 to 0.57)
35–44	40	34	84.1† (70.1 to 98.0)	0.34 (0.08 to 1.41)	0.41 (0.07 to 2.48)
45–64	57	53	93.9 (87.6 to 100)	1.0	1.0
Age at first sex, yrs					
10–14	39	22	57.1† (41.3 to 73.0)	0.46 (0.21 to 0.97)	0.71 (0.21 to 2.42)
15–19	135	95	72.9 (63.8 to 82.1)	0.92 (0.45 to 1.89)	1.49 (0.50 to 4.42)
20–35	40	30	74.5† (62.1 to 86.9)	1.0	1.0
Residence					
Rural	202	129	49.3 (35.7 to 62.9)	0.72 (0.39 to 1.32)	0.87 (0.30 to 2.55)
Urban	100	69	59.1 (50.1 to 68.1)	1.0	1.0
Highest educational attainment					
No primary/incomplete primary	34	18	49.3† (35.7 to 62.9)	0.31 (0.16 to 0.59)	—
Complete primary	123	73	59.1 (50.1 to 68.1)	0.46 (0.25 to 0.85)	—
Secondary or higher	145	107	75.8 (67.1 to 84.4)	1.0	—
Marital status					
Never married/never cohabited	137	63	46.6 (36.0 to 57.2)	0.24 (0.13 to 0.46)	—
Married/cohabiting	150	123	80.5 (72.3 to 88.8)	1.0	—
Ever been tested for HIV					
No	51	39	74.2 (60.4 to 88.0)	1.0	—
Yes	251	159	64.4 (57.8 to 71.0)	0.63 (0.31 to 1.27)	—
Consistent condom use with last sexual partner in past 12 months					
No	153	120	81.9 (74.1 to 90.0)	1.0	—
Yes	53	26	50.5 (36.4 to 64.5)	0.26 (0.13 to 0.53)	—
Used a condom at last sexual intercourse in the past 12 months					
No	140	114	79.6 (71.2 to 88.0)	1.0	1.0

Variable	Unweighted, N (N = 302)	HIV-Uninfected, Uncircumcised (N = 198)			Unadjusted OR (95% CI)	Adjusted OR (95% CI)
		Unweighted,n	Weighted % (95% CI)			
Yes	66	32	50.3 (35.1 to 65.5)		0.23 (0.11 to 0.45)	0.31 (0.16 to 0.60)
No. lifetime sex partners						
0 partners	51	22	42.0 (21.3 to 62.7)		0.25 (0.08 to 0.74)	—
1 partner	36	20	59.7[†] (45.6 to 71.7)		0.51 (0.25 to 1.07)	—
2–3 partners	66	39	58.7 (45.6 to 71.7)		0.49 (0.24 to 0.98)	—
4 or more partners	85	62	74.3 (65.4 to 83.2)		1.0	—
Does circumcision protect men from HIV?						
Protects completely	5	3	*		0.59 (0.15 to 2.35)	—
Protects somewhat	260	166	64.7 (57.6 to 71.9)		0.82 (0.34 to 1.99)	—
Does not protect at all	25	17	69.1[†] (50.9 to 87.3)		1.0	—
Circumcised men do not need to use condom for HIV prevention						
Agree	6	4	*		0.86 (0.38 to 1.94)	—
Disagree	284	183	65.3 (58.6 to 71.9)		1.0	—
Circumcised men can have many partners and not get HIV						
Agree	3	2	*		0.85 (0.29 to 2.56)	—
Disagree	288	185	64.9 (58.1 to 71.6)		1.0	—

*
The estimate is suppressed due to denominator < 25 observations.

[†]
The estimate is based on a denominator between 25 and 49 observations and may be unreliable.