

Male circumcision programmes in Kenya: lessons from the Kenya AIDS Indicator Survey 2007

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Objective To provide guidance for male circumcision programmes in Kenya by estimating the population of uncircumcised men and investigating the association between circumcision and infection with the human immunodeficiency virus (HIV), with particular reference to uncircumcised, HIV-uninfected men.

Methods Data on men aged 15 to 64 years were derived from the 2007 Kenya AIDS Indicator Survey, which involved interviews and blood collection to test for HIV and herpes simplex virus 2 (HSV-2). The prevalence of HIV infection and circumcision in Kenyan provinces was calculated and the demographic characteristics and sexual behaviour of circumcised and uncircumcised, HIV-infected and HIV-uninfected men were recorded.

Findings The national prevalence of HIV infection in uncircumcised men was 13.2% (95% confidence interval, CI: 10.8–15.7) compared with 3.9% (95% CI: 3.3–4.5) among circumcised men. Nyanza province had the largest estimated number of uncircumcised, HIV-uninfected men (i.e. 601 709), followed by Rift Valley, Nairobi and Western Province, respectively, and most belonged to the Luo ethnic tribe. Of these men, 77.8% did not know their HIV status and 33.2% were HSV-2-positive. In addition, 65.3% had had unprotected sex with a partner of discordant or unknown HIV status in the past 12 months and only 14.7% consistently used condoms with their most recent partner. However, only 21.8% of the uncircumcised, HIV-uninfected men aged 15 to 19 years were sexually active.

Conclusion The Kenyan male circumcision strategy should focus on the provinces with the highest number of uncircumcised, HIV-uninfected men and target young men before or shortly after sexual debut.

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Introduction

Of an estimated 33.4 million people living with human immunodeficiency virus (HIV) infections worldwide, approximately 22.4 million live in sub-Saharan Africa and, of these, 1.5 million live in Kenya.¹ Most HIV transmission in sub-Saharan Africa and Kenya is heterosexual. In the past two decades, observational studies have provided evidence that male circumcision has a protective effect against HIV infection and sexually transmitted infections in general.^{2,3} In addition, three randomized controlled trials indicated that male circumcision reduces the acquisition rate for HIV infection by approximately 60%.^{4–6} Consequently, the World Health Organization (WHO) and the Joint United Nations Programme on HIV/AIDS (UNAIDS) recommended that countries include male circumcision as part of HIV prevention interventions and expand its implementation, prioritizing areas with a low male circumcision rate and a high prevalence of HIV infection.⁷

Kenya's population comprises over 40 ethnic groups, many of which have a cultural tradition of male circumcision. However, despite a high rate of migration from rural to urban areas and the resulting heterogeneous mixing of people with different ethnic and cultural practices, individuals' cultural and religious practices, including their attitude to circumcision,

tend to remain unchanged. The 2003 Kenya Demographic Health Survey estimated that 84% of men in the country were circumcised: the rate ranged from 46.4% in Nyanza province to 100% in North Eastern Province.⁸

Optimizing the expansion of male circumcision services depends on having nationally representative data on the size of the population and the distribution of uncircumcised men and on their demographic characteristics and sexual behaviour. Suitable data only became available with the 2007 Kenya AIDS Indicator Survey, which was used by the Kenyan Ministry of Public Health and Sanitation to develop a national strategy for male circumcision in 2009.⁹ The aim was to circumcise 80% of all eligible men aged 15 to 49 years between 2009 and 2013 and, consequently, to avert an estimated 100 000 HIV infections over 10 years.¹⁰ The male circumcision strategy targets men in four provinces with relatively large male adult populations where traditionally few men are circumcised (i.e. Nairobi, Nyanza, Rift Valley and Western Province).⁹ The strategy involves a phased approach over more than 10 years in which progressively younger males are circumcised, starting with men aged 15 years and older in regions with a high prevalence of HIV infection and a low circumcision rate and concluding with infant circumcision, where acceptable (personal communication, Kenyan Ministry of Public Health and Sanitation).

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We conducted an in-depth analysis of national male circumcision data from the 2007 Kenya AIDS Indicator Survey with the aim of: (i) describing the prevalence of male circumcision in Kenya and the association between the prevalence of circumcision and the prevalence of HIV infection; (ii) describing the demographic characteristics and sexual behaviour of circumcised, uncircumcised, and uncircumcised HIV-uninfected men in Kenya; (iii) estimating the number of circumcised, uncircumcised, and uncircumcised HIV-uninfected men in Kenya; and (iv) deriving implications for male circumcision planning in Kenya. Although the national circumcision strategy targets both HIV-infected and HIV-uninfected men,⁹ our analysis paid particular attention to uncircumcised, HIV-uninfected men since there is little evidence that circumcising uncircumcised HIV-infected men reduces the risk of HIV transmission to sexual partners.¹¹

Methods

The 2007 Kenya AIDS Indicator Survey involved a representative sample of households from all eight provinces in Kenya and was carried out between August and December 2007.¹² It was designed to provide national and provincial data on the sociodemographic, behavioural and biological correlates of HIV infection.¹³ All individuals aged 15 to 64 years who were either usually resident in the selected households or visiting the household on the night before the survey were eligible to participate. Interviewers obtained information on the participants' demographic characteristics and sexual behaviour using a structured questionnaire. In addition, a venous blood sample was taken to test for the presence of HIV or herpes simplex virus 2 (HSV-2) infection. All those who participated in the interview and gave a blood sample provided informed consent. The study was approved by the Kenya Medical Research Institute's ethical review committee and the institutional review board of the Centers for Disease Control and Prevention in the United States of America (USA).

The interviewers obtained information on: (i) male circumcision, including whether, where and by whom it had been performed and age at circumcision; (ii) self-reported HIV status, based on the results of previous HIV testing;

(iii) consistent condom use with the most recent sexual partner in the last 12 months, where consistent use was defined as using a condom each time the respondent had sexual intercourse with this partner; (iv) the number of sexual partners of unknown or discordant HIV status, based on the self-reported HIV status of partners, in the last 12 months; and (v) unprotected sex with a partner of unknown or discordant HIV status during at least one of the three most recent sex acts in the last 12 months. Individuals who performed male circumcision were classified as either medical practitioners, traditional practitioners or home health workers. No physical examination was conducted to verify circumcision.

Laboratory tests were performed by the Kenya National Public Health Laboratories¹² and quality assurance was carried out at the laboratory of the Centers for Disease Control and Prevention and the Kenya Medical Research Institute in Nairobi. The Vironostika HIV-1/2 test (Bio-Mérieux Diagnostics, Marcy l'Etoile, France) was used to screen for HIV infection and all samples that tested positive were confirmed using the Murex HIV.1.2.O enzyme immunoassay (Abbott Laboratories, Abbott Park, USA). Samples that gave discordant results on the two tests were retested using the two assays and, if there were two sets of discordant results, the Roche HIV DNA version 1.5 polymerase chain reaction test (Hoffmann La Roche, Basel, Switzerland) was performed. All samples that tested positive for HIV and 5% of those that tested negative were retested at the quality assurance laboratory using the same procedure. Testing for HSV 2 was carried out using the Kalon enzyme immunoassay (Kalon Biological Limited, Guildford, United Kingdom of Great Britain and Northern Ireland). All samples that tested positive were retested using the Kalon test by a second laboratory technician. For quality control, all samples that tested positive for HSV 2, 5% of those that tested negative and all those that gave indeterminate results were retested at the quality assurance laboratory using the same procedure. Samples that gave discordant results at the two laboratories were reported as indeterminate.

We calculated the number of men in Kenya who had not been circumcised from estimates of the population and of the prevalence of circumcision and HIV

infection in each province. We used the 1999 Kenyan Population and Household Census to estimate the size of the adult population.¹⁴ However, because data from the 2007 Kenya AIDS Indicator Survey on the number of uncircumcised men in some provinces included fewer than 25 observations, we calculated uncertainty bounds for the population estimates based on 95% confidence intervals (CIs) derived from survey data. All analyses were performed using the procedures for surveys in SAS software version 9.2 (SAS Institute Inc., Cary, USA). The analysis took into account the stratified cluster design of the survey and each response was weighted to take its sampling probability into account and to adjust for the nonresponse rate.

Results

Of the 19 840 individuals eligible to participate in the survey, 91% were interviewed and 80% gave blood samples. In total, 8883 were men. Of these, 7701 (86.7%) participated in the interview: 6586 (74.1%) reported being circumcised and 1092 (12.3%) reported being uncircumcised, whereas 23 (0.26%) did not report their circumcision status. Of the 1092 uncircumcised men, 979 (89.7%) were tested for HIV infection during the survey.

The overall prevalence of HIV infection in uncircumcised men was 13.2% compared with 3.9% in circumcised men (Table 1). The prevalence was substantially higher among uncircumcised men aged 25 to 54 years than in those aged 15 to 24 years and peaked among men aged 35 to 44 years at 30.2% (Fig. 1).

Table 2 shows the estimated number of men aged 15 to 64 years in the eight provinces in Kenya who were or were not circumcised or infected with HIV. The number of HIV-uninfected men who were uncircumcised at the time of the survey was estimated to be around 1.2 million, which corresponded to 13% of the total male population in Kenya aged 15 to 64 years. Nyanza and Rift Valley Provinces had the highest estimated number of uncircumcised, HIV-uninfected men (601 709 and 235 688, respectively), followed by Nairobi Province with 135 271 and Western Province with 113 692 (Table 2). These four provinces accounted for nearly 90% of all uncircumcised, HIV-uninfected men in the country.

Table 1. **Circumcised and uncircumcised men aged 15–64 years, Kenya AIDS Indicator Survey 2007**

Variable	Circumcised men (n = 6 586)		Uncircumcised men (n = 1 092)	
	No.	Weighted % ^a (95% CI)	No.	Weighted % ^a (95% CI)
Total	6586	3.9 (3.3–4.5)	1092	13.2 (10.8–15.7)
Age group, years				
15–24	2008	31.6 (30.0–33.3)	505	48.8 (45.2–52.4)
25–34	1654	24.5 (23.1–25.9)	227	20.1 (17.3–22.8)
35–44	1249	19.0 (17.8–20.2)	161	14.4 (12.1–16.7)
45–54	953	13.8 (12.9–14.7)	125	10.2 (8.3–12.1)
55–64	722	11.0 (10.1–11.9)	74	6.6 (4.8–8.3)
Total	6586	100 (NA)	1092	100 (NA)
Province				
Nairobi	792	8.9 (7.3–10.5)	133	10.2 (5.7–14.7)
Central	1072	16.0 (14.4–17.7)	49	4.3 (2.6–6.0)
Coast	794	8.6 (7.3–9.9)	28	1.5 (0.8–2.3)
Eastern	1243	20.6 (18.0–23.3)	52	4.5 (2.4–6.6)
North-Eastern	325	2.0 (1.6–2.4)	9	0.3 (0.0–0.6)
Nyanza	533	8.6 (7.2–10.1)	566	52.9 (46.3–59.4)
Rift Valley	970	23.0 (20.3–25.6)	120	16.7 (12.2–21.2)
Western	857	12.2 (10.6–13.8)	135	9.7 (5.2–14.1)
Total	6586	100 (NA)	1092	100 (NA)
Area of residence				
Rural	4880	77.2 (74.1–80.3)	836	79.8 (74.2–85.4)
Urban	1706	22.8 (19.7–25.9)	256	20.2 (14.6–25.8)
Total	6586	100 (NA)	1092	100 (NA)
Educational level				
No primary	605	6.5 (5.4–7.6)	54	6.4 (3.7–9.1)
Incomplete primary	1696	27.2 (25.3–29.1)	429	41.1 (36.5–45.6)
Complete primary	1580	24.6 (23.2–26.1)	259	23.5 (20.4–26.5)
Secondary or higher	2705	41.7 (39.3–44.1)	350	29.0 (24.8–33.3)
Total	6586	100 (NA)	1092	100 (NA)
Marital status				
Never married or cohabited	2301	35.3 (33.6–37.0)	489	46.9 (43.1–50.8)
Currently married or cohabiting	3918	58.8 (57.0–60.7)	551	48.6 (44.9–52.3)
Separated or divorced	288	4.5 (3.9–5.1)	34	2.8 (1.6–3.9)
Widowed	79	1.3 (1.0–1.7)	18	1.7 (0.8–2.5)
Total	6586	100 (NA)	1092	100 (NA)
Ethnic tribe				
Embu	101	1.6 (0.9–2.3)	2	0.2 (0.0–0.5)
Kalenjin	545	11.0 (8.8–13.1)	41	5.9 (2.4–9.3)
Kamba	809	13.6 (10.5–16.8)	6	0.8 (0.0–1.8)
Kikuyu	1590	25.2 (22.6–27.7)	54	4.8 (2.8–6.9)
Kisii	509	8.2 (6.8–9.5)	5	0.4 (0.0–0.8)
Luhya	1161	17.0 (15.0–18.9)	81	5.7 (2.1–9.2)
Luo	147	2.3 (1.6–2.9)	739	66.7 (60.5–72.9)
Masai	68	2.0 (0.7–3.3)	3	0.4 (0.0–0.8)
Meru	438	7.5 (6.3–8.7)	32	3.1 (1.5–4.8)
Mijikenda	448	5.0 (4.0–6.0)	0	
Somali	383	2.4 (2.0–2.9)	5	0.2 (0.0–0.4)
Taita/Taveta	110	1.0 (0.7–1.3)	2	0.1 (0.0–0.2)
Swahili	10	0.1 (0.0–0.1)	0	
Other	267	3.2 (2.2–4.2)	122	11.7 (7.3–16.1)
Total	6586	100 (NA)	1092	100 (NA)

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Variable	Circumcised men (n = 6 586)		Uncircumcised men (n = 1 092)	
	No.	Weighted % ^a (95% CI)	No.	Weighted % ^a (95% CI)
Self-reported HIV status				
Never tested or unknown ^b	4833	76.2 (74.6–77.8)	791	75.7 (71.8–79.5)
Negative	1530	23.3 (21.7–24.9)	239	22.0 (18.2–25.9)
Positive	29	0.5 (0.3–0.7)	27	2.3 (1.3–3.3)
Total	6392	100 (NA)	1057	100 (NA)
HSV-2 infection				
No	4355	75.8 (74.3–77.4)	546	59.3 (55.6–63.1)
Yes	1320	24.2 (22.6–25.7)	396	40.7 (36.9–44.4)
Total	5675	100 (NA)	942	100 (NA)
Consistent condom use with most recent partner in the last 12 months				
Yes	601	12.3 (11.1–13.5)	124	16.1 (12.7–19.4)
No	4389	87.7 (86.5–88.9)	633	83.9 (80.6–87.3)
Total	4990	100 (NA)	757	100 (NA)
Number of sexual partners of unknown or discordant HIV status in the last 12 months				
0	1037	23.4 (21.8–25.0)	136	20.2 (15.5–24.9)
1	2962	66.8 (65.1–68.5)	423	63.2 (58.1–68.2)
2	371	8.5 (7.5–9.5)	92	12.9 (9.9–15.8)
3 or more	56	1.3 (0.9–1.7)	29	3.8 (2.3–5.3)
Total	4426	100 (NA)	680	100 (NA)
Unprotected sex in the last 12 months^c				
With partner of unknown or discordant status	3143	65.0 (62.9–67.0)	463	63.1 (56.8–69.3)
With partner of concordant status	1137	23.3 (21.5–25.1)	156	21.1 (17.0–25.2)
Did not have unprotected sex	566	11.7 (10.5–13.0)	118	15.8 (12.4–19.3)
Total	4846	100 (NA)	737	100 (NA)

CI, confidence interval; HIV, human immunodeficiency virus; HSV-2, herpes simplex virus 2; NA, not applicable.

^a Each man's response was weighted to take its sampling probability into account and to adjust for the nonresponse rate.

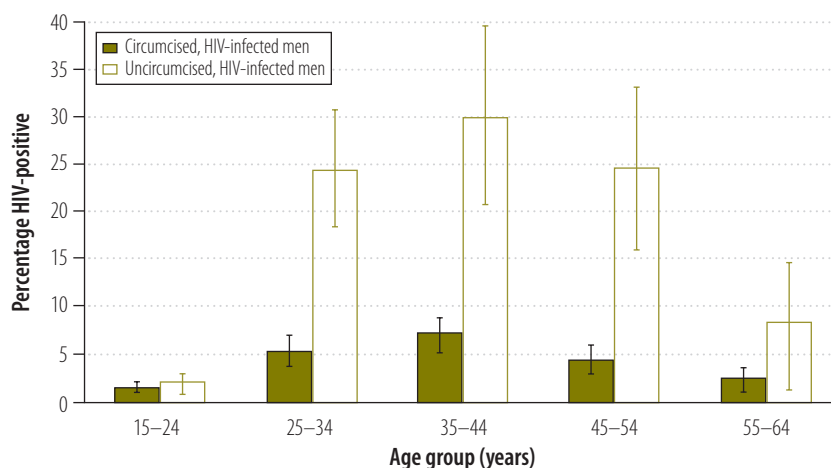
^b In total, 74 circumcised men and 26 uncircumcised men had been tested but did not know their HIV status.

^c An individual was classified as having had unprotected sex in the last 12 months if he had unprotected sex during at least one of the three most recent sex acts in the last 12 months.

Circumcised versus uncircumcised men

The median age of the 6586 circumcised men included in the survey was 32 years (interquartile range, IQR: 23–45) and their median age at the time of circumcision was 13 years (IQR: 10–16 years). The median time since circumcision was 20 years (IQR: 10–32). Overall, 83.9% (95% CI: 82.5–85.3) were circumcised under the age of 25 years and 1.7% reported being circumcised at 1 year of age or younger. Most circumcised men lived in rural areas, had completed at least primary education, were currently married or cohabiting with a partner and had never been tested for HIV (Table 1). More of these men belonged to the Kikuyu ethnic tribe than to any other ethnic tribe. Nearly one quarter

Fig. 1. Prevalence of HIV infection among men aged 15–64 years, by circumcision status and age, Kenya AIDS Indicator Survey 2007



Note: The bars represent 95% confidence intervals.

had an HSV-2 infection. In total, 87.7% of sexually-active, circumcised men reported that they had not consistently used a condom with their most recent partner in the last 12 months, 76.6% had had at least one partner of unknown or discordant HIV status in the last 12 months and 65.0% reported that they had unprotected sex with a partner of unknown or discordant HIV status in the last 12 months.

Among circumcised men, 45.5% (95% CI: 43.0–48.1) reported having been circumcised at a health facility, whereas 52.4% (95% CI: 49.9–54.9) were circumcised at home (data not shown). Only 2.1% (95% CI: 1.5–2.7) were circumcised at another location or did not know who circumcised them. Of those circumcised at home, 21.8% (95% CI: 19.3–24.3) were circumcised by a home health worker or medical practitioner and 77.7% (95% CI: 75.2–80.2) were circumcised by a traditional practitioner. Overall, 57.1% (95% CI: 54.8–59.4) had been circumcised by a health worker or medical practitioner, irrespective of whether it took place at home or at a health facility, whereas 42.7% (95% CI: 40.2–44.7) had been circumcised by a traditional practitioner.

The median age of the 1092 uncircumcised men included in the survey was 26 years (IQR: 18–40). The majority lived in rural areas and almost half did not complete primary education (Table 1). In addition, almost half of all uncircumcised men were unmarried, the majority came from the Luo ethnic tribe and most had never been tested for HIV. Overall, 40.7% were infected with HSV 2. Among sexually-active, uncircumcised men, 83.9% reported that they did not consistently use a condom with their most recent partner, 79.8% had at least one partner of unknown or discordant HIV status in the last 12 months and 63.1% had unprotected sex with a partner of unknown or discordant status in the last 12 months.

Compared with circumcised men, uncircumcised men were younger, less well educated, less likely to be married or cohabitating with a partner and more likely to be infected with HSV 2 ($P < 0.0001$ for all; Table 1). Uncircumcised men were more likely to report consistent condom use with their most recent partner in the last 12 months ($P = 0.0212$) and having had two or more partners of unknown or discordant HIV status in the last 12 months ($P = 0.0012$). They were less likely to report unpro-

Table 2. Male population aged 15–64 years in Kenya, by province, circumcision status and HIV infection status, 2007

Province	No. of men aged 15–64 years ^a	% male circumcision rate ^b	No. of circumcised men aged 15–64 years	No. of uncircumcised men aged 15–64 years	HIV infection in uncircumcised men aged 15–64 years ^c		No. of HIV-infected men/total no. ^d	% (95% CI)	No. of uncircumcised, HIV-infected men aged 15–64 years		Uncircumcised, HIV-uninfected men aged 15–64 years	
					No. of HIV-infected men	% (95% CI)			No.	Uncertainty bound ^e	No.	Uncertainty bound ^e
Nairobi	1 009 000	83.2	839 488	169 512	21/122	20.2 (12.8–27.5)	122 896–147 814	135 271	122 896–147 814	135 271	122 896–147 814	
Central	1 160 000	95.5	1 107 800	52 200	0/43	0 (NA)	NA	NA	NA	NA	NA	
Coast	759 000	97.0	736 230	22 770	5/24	15.3 (6.9–23.6)	17 396–21 199	19 309	17 396–21 199	19 309	17 396–21 199	
Eastern	1 380 000	96.3	1 328 940	51 060	1/49	0.9 (0.0–2.6)	49 732–51 060	50 549	49 732–51 060	50 549	49 732–51 060	
North-Eastern	361 000	97.3	351 253	9 747	1/9	7.2 (0.0–18.5)	7 944–9 747	9 055	7 944–9 747	9 055	7 944–9 747	
Nyanza	1 408 000	48.2	678 656	729 344	96/501	17.3 (13.3–21.2)	572 535–632 341	601 709	572 535–632 341	601 709	572 535–632 341	
Rift Valley	2 242 000	88.7	1 988 654	253 346	12/112	7.0 (2.0–11.9)	223 198–248 279	235 688	223 198–248 279	235 688	223 198–248 279	
Western	1 000 000	87.8	878 000	122 000	8/119	6.8 (2.0–11.6)	107 848–119 560	113 692	107 848–119 560	113 692	107 848–119 560	
Total	9 319 000	85.0	7 909 021	1 409 977	144/979	13.2 (10.8–15.7)	1 188 627–1 257 717	1 223 877	1 188 627–1 257 717	1 223 877	1 188 627–1 257 717	

CI, confidence interval; HIV, human immunodeficiency virus; NA, not applicable.

^a Estimated using data from the Kenyan 1999 Population and Household Census.

^b Derived from the Kenya AIDS Indicator Survey 2007.

^c Derived from the Kenya AIDS Indicator Survey 2007.

^d The number of HIV-infected, uncircumcised men and the total number of uncircumcised men were those included in the Kenya AIDS Indicator Survey 2007 for each province.

^e The uncertainty bounds were based on the 95% confidence intervals from the Kenya AIDS Indicator Survey 2007.

tected sex and unprotected sex with a partner of unknown or discordant HIV status in the last 12 months ($P=0.0087$).

Although some sociodemographic differences between circumcised and uncircumcised men, such as marital status, were influenced by the difference in median age between the groups, some differences remained statistically significant even when age was taken into account. For example, circumcised men aged 15 to 34 years were less likely than uncircumcised men of the same age to be from Nyanza province (9.4% [95% CI: 7.7–11.0] versus 49.3% [95% CI: 42.2–56.4], respectively), to belong to the Luo ethnic tribe (2.4% [95% CI: 1.6–3.1] versus 64.0% [95% CI: 57.2–70.7], respectively) and to have an HSV-2 infection (12.1% [95% CI: 10.7–13.5] versus 26.4% [95% CI: 22.0–30.9], respectively).

Uncircumcised, HIV-uninfected men

Table 3 shows the sociodemographic characteristics and reported sexual behaviour of the 835 uncircumcised, HIV-uninfected men in the survey. These men are representative of the priority target group for voluntary medical male circumcision in Kenya. The median age of this group was 26 years (IQR: 18–40): 55.0% were aged under 25 years and 72.5% were aged under 35 years (Table 3). Overall, 80.2% lived in rural areas and 93.7% had been educated to primary school level at least. In addition, 52.5% were neither married nor cohabiting with a partner at the time of the survey. Among those who were married or cohabiting, 13.7% (95% CI: 9.9–17.6) were in a polygamous marriage. In total, 63.1% were from the Luo ethnic tribe, whereas 5.5% and 6.7% were from the Luhya and Kalenjin ethnic tribes, respectively. The Kikuyu ethnic tribe, a community in which circumcision predominates, accounted for 5.8%.

Of the 835 uncircumcised, HIV-uninfected men, 22 (2.6%) did not respond to the question on HIV status, and 77.8% reported that they did not know their HIV status (Table 3). However, 33.2% had HSV-2 infections. In addition, 63.4% (95% CI: 58.8–68.1) of those aged 15 to 64 years and 21.8% (95% CI: 16.2–27.4) of those aged 15 to 19 years were sexually active. Of the sexually-active, uncircumcised, HIV-uninfected men aged 15 to 64 years,

Table 3. **Uncircumcised, HIV-uninfected men aged 15–64 years, Kenya AIDS Indicator Survey 2007**

Variable	Uncircumcised, HIV-uninfected men (n = 835)	
	No.	Weighted % ^a (95% CI)
Age group, years		
15–24	439	55.0 (51.2–58.9)
25–34	155	17.5 (14.2–20.8)
35–44	94	11.1 (8.9–13.4)
45–54	86	9.2 (7.2–11.1)
55–64	61	7.2 (5.1–9.3)
Total	835	100 (NA)
Province		
Nairobi	101	9.9 (5.5–14.3)
Central	43	4.9 (2.9–6.9)
Coast	19	1.4 (0.5–2.3)
Eastern	48	5.3 (2.8–7.9)
North-Eastern	8	0.4 (0.0–0.7)
Nyanza	405	49.3 (42.4–56.3)
Rift Valley	100	18.4 (13.1–23.8)
Western	111	10.3 (5.8–14.9)
Total	835	100 (NA)
Area of residence		
Rural	640	80.2 (74.6–85.8)
Urban	195	19.8 (14.2–25.4)
Total	835	100 (NA)
Educational level		
No primary	40	6.3 (3.3–9.2)
Incomplete primary	341	42.5 (37.7–47.2)
Complete primary	191	22.5 (19.2–25.7)
Secondary or higher	263	28.8 (24.4–33.1)
Total	835	100 (NA)
Marital status		
Never married or cohabited	421	52.5 (48.6–56.5)
Currently married or cohabiting	382	44.1 (40.4–47.7)
Separated or divorced	22	2.2 (1.1–3.3)
Widowed	10	1.2 (0.2–2.2)
Total	835	100 (NA)
Ethnic tribe		
Embu	2	0.3 (0.0–0.6)
Kalenjin	36	6.7 (2.2–11.2)
Kamba	6	1.1 (0.0–2.3)
Kikuyu	47	5.8 (3.2–8.3)
Kisii	4	0.4 (0.0–1.0)
Luhya	62	5.5 (2.1–8.9)
Luo	540	63.1 (56.5–69.6)
Masai	3	0.5 (0.0–1.1)
Meru	29	3.6 (1.6–5.6)
Mijikenda	0	0 (NA)
Somali	5	0.3 (0.0–0.6)
Taita/Taveta	2	0.1 (0.0–0.2)
Swahili	0	0 (NA)
Other	99	12.8 (7.9–17.7)
Total	835	100 (NA)
Self-reported HIV status^b		
Never tested or unknown ^c	627	77.8 (73.9–81.8)
Negative	185	22.1 (18.1–26.1)

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Variable	Uncircumcised, HIV-uninfected men (n = 835)	
	No.	Weighted % ^a (95% CI)
Positive	1	0.1 (0.0–0.3)
Total	813	100 (NA)
HSV-2 infection		
No	526	66.8 (63.4–70.3)
Yes	275	33.2 (29.7–36.6)
Total	801	100 (NA)
Consistent condom use with most recent partner in the last 12 months		
Yes	83	14.7 (11.2–18.1)
No	465	85.3 (81.9–88.8)
Total	548	100 (NA)
No. of sexual partners of unknown or discordant HIV status in last 12 months		
0	120	21.8 (16.2–27.5)
1	340	62.9 (56.5–69.3)
2	65	11.6 (8.5–14.6)
3+	23	3.7 (2.0–5.3)
Total	548	100 (NA)
Had unprotected sex in the last 12 months^d		
With partner of unknown or discordant HIV status	345	65.3 (58.8–71.8)
With partner of concordant HIV status	108	19.8 (15.2–24.5)
Did not have unprotected sex	80	14.9 (11.3–18.4)
Total	533	100 (NA)

CI, confidence interval; HIV, human immunodeficiency virus; HSV-2, herpes simplex virus 2; NA, not applicable.

^a Each man's response was weighted to take its sampling probability into account and to adjust for the nonresponse rate.

^b Only 813 of the 835 uncircumcised, HIV-uninfected men responded to the question regarding known HIV status.

^c HIV status was unknown for 16 men.

^d An individual was classified as having had unprotected sex in the last 12 months if he had sex without protection during at least one of the three most recent sex acts in the last 12 months.

14.7% reported that they had consistently used a condom with their last partner and 78.2% reported they had at least one sexual partner of unknown or discordant HIV status in the 12 months before the survey. In addition, 65.3% reported unprotected sex with a partner of unknown or discordant HIV status during the three most recent sex acts in the last 12 months (Table 3).

Discussion

We found that the prevalence of HIV infection was three times lower in uncircumcised men than in circumcised men, which provides evidence for a strong association between circumcision and HIV infection and confirms the need for interventions to expand male circum-

cision in Kenya. Overall, 15% of men aged 15 to 64 years in Kenya were not circumcised in 2007 and an estimated 90% of these men lived in the Nyanza, Rift Valley, Nairobi or Western Province, which are the main target regions of the national strategy for male circumcision.

Uncircumcised, HIV-uninfected men were typically young and lived in a rural area. The majority were educated to at least primary school level, were not married or cohabiting, belonged to the Luo ethnic tribe and had never been tested for HIV. Almost 80% reported having had sex with a partner of unknown or discordant HIV status in the last 12 months and few used condoms during these high-risk sex acts. However, there was a low level of sexual activity among HIV-uninfected men

under 20 years of age, suggesting that, to reduce HIV transmission among newly sexually-active individuals, this age group should be targeted by the national programme for male circumcision and HIV testing, preferably before or soon after the men's sexual debut.

We found that circumcision was mainly performed during adolescence and at home, with a high proportion being performed by traditional providers. However, traditional circumcision in a nonmedical setting has been associated with a high rate of adverse events, such as bleeding or infection.^{15,16} The national strategy for male circumcision includes plans to increase the use of safer surgical practices by trained health-care workers. This will involve engaging traditional male circumcision providers and educating communities and parents on the safety benefits for preadolescent boys.

We found that the prevalence of HSV-2 infection was significantly higher in uncircumcised than circumcised men. Although it has been shown that male circumcision has a protective effect against HSV-2 and human papillomavirus infections,³ approximately one third of uncircumcised, HIV-uninfected men in Kenya in 2007 were already infected with HSV 2. Given that the risk of infection increases with age, performing male circumcision before young men become sexually active could help reduce the risk of acquiring both HSV-2 and HIV infections. Finally, since the majority of uncircumcised men were from the Luo ethnic group, continuous engagement with elders and leaders of the Luo community could facilitate cultural acceptance of male circumcision.

Our study had limitations. First, cross-sectional surveys cannot establish a direct relationship between cause and effect. Second, physical examinations were not performed to determine whether there was any bias in the reporting of male circumcision. Third, we recorded information on whether circumcision was performed at home or in a health-care facility but not on whether it was performed as part of a community ritual, which is common practice in traditionally circumcising communities. Fourth, since sexual behaviour was self-reported, participants may have been reluctant to disclose some sexual risk factors. Fifth, some subgroup comparisons were limited by small sample sizes. Finally, due to cultural sensitivity concerning ethnic-

ity and provinces in Kenya, we did not amalgamate ethnic tribes and provinces with small sample sizes. As a result, uncertainty in estimates derived using these samples may be large and the figures should be interpreted with caution.

The 2009 national male circumcision strategy stipulates that 80% of men in Kenya should be circumcised by 2014.^{9,17} In Nyanza province, implementation began in October 2008 and, by the end of September 2011, approximately 210 000 men had been circumcised, which is 50% of the target for 2014 (Athanasius Ochieng, personal communication). The use of outreach and mobile units involving dedicated teams has been recommended as the best approach for reaching men aged between 15 and 49 years in the first phase of the national strategy.¹⁸ However, efforts will be required to increase the acceptability of male circumcision since only 65% (range: 29–87) of uncircumcised men in sub-Saharan Africa find the procedure acceptable.¹⁹

In summary, our findings confirm that male circumcision programmes in Kenya should focus on four specific

provinces, that circumcision by medical providers in traditionally circumcising regions should be increased and that comprehensive messages about the prevention of HIV transmission should be provided at the time of circumcision. In addition, our results suggest that circumcision programmes should specifically target younger men before or shortly after their sexual debut when they may still be free of HIV and HSV-2 infections. National survey data on sexual behaviour and the prevalence of HIV infection can be useful for resource allocation and for planning male circumcision programmes in sub-Saharan Africa in addition to providing essential data for HIV prevention. The 2007 Kenya AIDS Indicator Survey provided baseline data for the national male circumcision strategy for 2009 to 2014. It is anticipated that the 2012 Kenya AIDS Indicator Survey will inform the development of the new strategy for 2014 to 2019. ■

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ملخص

برامج ختان الذكور في كينيا: الدروس المستفادة من مسح مؤشر الإيدز في كينيا لعام 2007

مقاطعة نيانزا أعلى عدد للرجال غير المختونين غير المصابين بعدوى فيروس العوز المناعي البشري (601709 شخص)، تلتها مقاطعة ريفت فالي ونيروبي والمقاطعة الغربية على التوالي، وكان معظمهم ينتمي إلى قبيلة لولو العرقية. ولم يعرف 77.8% من هؤلاء الرجال حالة فيروس العوز المناعي البشري لديهم، وكانت نسبة 33.2% منهم إيجابية لفيروس الهربس البسيط النمط 2. وعلاوة على ذلك، تورطت نسبة 65.3% في ممارسات جنسية غير محمية خلال الاثني عشر شهراً الماضية مع شريك حالة فيروس العوز المناعي البشري لديه غير متوافقة أو غير معروفة ولم يستخدم سوى 14.7% العازل الذكري بانتظام مع أحدث شريك. بيد أنه لم تكن سوى نسبة 21.8% من الرجال غير المختونين، وغير المصابين بعدوى فيروس العوز المناعي البشري، ممن تتراوح أعمارهم بين 15 إلى 19 سنة نشطاء جنسياً.

الاستنتاج يتعين أن تركز استراتيجية ختان الذكور في كينيا على المقاطعات التي تضم أعلى عدد من الرجال غير المختونين وغير المصابين بعدوى فيروس العوز المناعي البشري وأن تستهدف الشباب قبل النشاط الجنسي أو بعده بفترة قصيرة.

الغرض تقديم الإرشادات لبرامج ختان الذكور في كينيا من خلال تقدير عدد السكان من الرجال الذين لم يخضعوا للختان والتحقيق في الارتباط بين الختان والعدوى بفيروس العوز المناعي البشري (HIV)، بالإشارة على وجه الخصوص إلى الرجال الذين لم يخضعوا للختان غير المصابين بفيروس العوز المناعي البشري.

الطريقة تم استخلاص البيانات المتعلقة بالرجال الذين تتراوح أعمارهم بين 15 إلى 64 سنة من مسح مؤشر الإيدز في كينيا لعام 2007، والذي اشتمل على مقابلات وجمع عينات الدم لاختبارها بغية اكتشاف الإصابة بفيروس العوز المناعي البشري وفيروس الهربس البسيط النمط 2 (HSV-2). وتم حساب انتشار العدوى بفيروس العوز المناعي البشري والختان في المقاطعات الكينية وتم تسجيل الخصائص الديمغرافية والسلوك الجنسي للرجال المختونين وغير المختونين والمصابين بعدوى فيروس العوز المناعي البشري وغير المصابين بعدوى فيروس العوز المناعي البشري.

النتائج بلغت نسبة انتشار العدوى بفيروس العوز المناعي البشري على الصعيد الوطني لدى الرجال غير المختونين 13.2% (فاصل الثقة 95%، فاصل الثقة: 10.8 إلى 15.7) مقارنة بنسبة 3.9% (فاصل الثقة 95%: 3.3 إلى 4.5) بين الرجال المختونين. وضمت

摘要

肯尼亚男性包皮环切计划：肯尼亚2007年艾滋病指标调查的经验教训

目的 通过肯尼亚未进行包皮环切男性人群数据估测，以及特别以未进行包皮环切、未感染HIV男性人群为参照进行的包皮环切与艾滋病毒（HIV）感染相关性研究，为肯尼亚男性包皮环切计划提供指导。

方法 采用的15岁至64岁男性的数据来源于2007年肯尼亚艾滋病指标调查，其中涉及访视和采血进行艾滋病毒和单纯疱疹病毒2型（HSV-2）检测。计算肯尼亚各省艾滋病毒感染率和包皮环切普及率，记录进行包皮环切和未进行包皮环切、受艾滋病毒感染和未受艾滋病毒感染的男性人口特征和性行为。

结果 包皮环切的男性的HIV感染率为3.9%（95%置信区间：3.3-4.5），未进行包皮环切的男性HIV感染率为13.2%（95%置信区间：10.8-15.7）。尼安萨省未进行包皮环

切、未感染HIV的男性估计人数最多（即601709），其次分别是东非大裂谷、内罗毕和西部省，大部分属于卢奥民族部落。这些男性中，77.8%的男性不知道自己的HIV感染状况，33.2%男性的HSV-2为阳性。此外，65.3%男性在过去12个月中与艾滋病毒单阳或未知的的性伙伴有过不安全的性行为，只有14.7%的男性在最近期与性伙伴的性行为中始终使用避孕套。然而，在未进行包皮环切、未感染艾滋病毒的15至19岁的男子中，只有21.8%男性处于性活跃状态。

结论 肯尼亚男性包皮环切战略应将重点放在未进行包皮环切、未感染HIV人数最高的各省，并以初次性行为之前或之后不久的年轻男性为目标。

Résumé

Programmes de circoncision masculine au Kenya: leçons tirées de l'enquête de 2007 sur les indicateurs du SIDA au Kenya

Objectif Conseiller des programmes de circoncision masculine au Kenya en estimant le nombre d'hommes non circoncis et en recherchant l'association entre la circoncision et l'infection par le virus de l'immunodéficience humaine (VIH), avec une référence particulière aux hommes non circoncis et non infectés par le VIH.

Méthodes Des données sur des hommes âgés de 15 à 64 ans ont été obtenues de l'enquête de 2007 sur les indicateurs du SIDA au Kenya, impliquant des entretiens et des prises de sang afin de rechercher la présence du VIH et du virus de l'herpès simplex 2 (VHS-2). La prévalence de l'infection par le VIH et la circoncision dans les provinces kenyanes a été calculée, et les caractéristiques démographiques ainsi que le comportement sexuel des hommes circoncis et non circoncis, des hommes infectés et non infectés par le VIH ont été enregistrés.

Résultats La prévalence nationale de l'infection par le VIH chez les hommes non circoncis s'élevait à 13,2% (intervalle de confiance de 95%, IC: 10,8–15,7) par rapport à un pourcentage de 3,9% (IC de 95%: 3,3–4,5) chez les hommes circoncis. La province de Nyanza présentait l'estimation

du plus grand nombre d'homme non circoncis et d'hommes non infectés par le VIH (601 709), suivie de la vallée du Rift, de Nairobi et de la province occidentale, respectivement, dont la plus grande partie appartenait à la tribu ethnique des Luo. Chez ces hommes, 77,8% ne connaissaient pas leur séropositivité et 33,2% étaient positifs au VHS-2. De plus, 65,3% d'entre eux avaient eu des rapports sexuels non protégés avec une partenaire de statut HIV inconnu ou discordant au cours des 12 derniers mois, et seuls 14,7% d'entre eux utilisaient constamment des préservatifs avec leur dernière partenaire. Cependant, seuls 21,8% des hommes non circoncis et non infectés par le VIH âgés de 15 à 19 ans étaient sexuellement actifs.

Conclusion La stratégie de circoncision des hommes kenyans doit s'orienter sur les provinces présentant le plus grand nombre d'hommes non circoncis et non infectés par le VIH, mais aussi cibler les jeunes hommes avant ou peut de temps après leur première expérience sexuelle.

Резюме

Программы по обрезанию крайней плоти у мужчин в Кении: уроки, извлеченные из Индикаторного исследования СПИДа в Кении, 2007 г.

Цель Обеспечить руководство программами по обрезанию крайней плоти у мужчин в Кении посредством оценки численности мужчин, не подвергшихся обрезанию, и исследование связи между обрезанием крайней плоти и инфицированием вирусом иммунодефицита человека (ВИЧ) с особым акцентом на ВИЧ-неинфицированных мужчинах, не подвергшихся обрезанию.

Методы Данные по мужчинам возрастной группы от 15 до 64 лет были получены из Индикаторного исследования СПИДа в Кении, 2007 г., которое включало опросы и взятие крови для проведения теста на наличие ВИЧ и вируса простого герпеса 2 (ВПГ-2). Были собраны данные по распространенности ВИЧ-инфекции и обрезанию крайней плоти в провинциях Кении, а также регистрировались демографические показатели и сексуальное поведение мужчин, подвергшихся и не подвергшихся обрезанию крайней плоти, ВИЧ-инфицированных и ВИЧ-неинфицированных мужчин.

Результаты Национальная распространенность ВИЧ-инфекции у мужчин, не подвергшихся обрезанию, составила 13,2% (95% доверительный интервал, ДИ: 10,8–15,7) в сравнении с 3,9% (95% ДИ: 3,3–4,5) среди мужчин, подвергшихся обрезанию. В провинции Ньянза зарегистрировано наибольшее число мужчин, подвергшихся обрезанию крайней плоти, ВИЧ-инфицированных мужчин (т. е. 601 709), за которой следуют долина Рифт, Найроби и Западная провинция, соответственно. Большинство мужчин из данного числа принадлежат этническому племени Луо. Из этого числа мужчин, 77,8% не знали о своем ВИЧ-статусе и 33,2% имели ВПГ-2 антитела положительных образцов. Кроме того, 65,3% вступали в незащищенный половой контакт с партнером с дискордантным или неизвестным ВИЧ статусом за последние 12 месяцев и только 14,7% постоянно использовали презервативы при половом контакте с последним партнером. Тем не менее, только 21,8% ВИЧ-неинфицированных мужчин,

не подвергшихся обрезанию, в возрастном диапазоне от 15 до 19 лет вели активную половую жизнь.

Вывод Кенийская стратегия по обрезанию крайней плоти у мужчин должна быть сконцентрирована на провинциях

с высоким числом ВИЧ-неинфицированных мужчин, не подвергшихся обрезанию, и направлена на юношей до или вскоре после начала половой жизни.

Resumen

Los programas de circuncisión masculina en Kenia: lecciones de la Encuesta de indicadores del SIDA en Kenia 2007

Objetivo Proporcionar orientación para los programas de circuncisión masculina en Kenia calculando la población de hombres circuncidados e investigando la relación entre la circuncisión y la infección con el virus de la inmunodeficiencia humana (VIH), haciendo alusión especial a los hombres no circuncidados ni infectados por el VIH.

Métodos Los datos acerca de los hombres con edades comprendidas entre 15 y 64 años se obtuvieron de la Encuesta de indicadores del SIDA en Kenia del año 2007, que incluyó entrevistas y la recogida de muestras de sangre para realizar las pruebas del VIH y del virus del herpes simple de tipo 2 (VHS-2). Se calculó la prevalencia de la infección por el VIH y la circuncisión en las provincias de Kenia y se registraron las características demográficas y el comportamiento sexual de los hombres circuncidados y no circuncidados, infectados y no infectados con el VIH.

Resultados La prevalencia nacional de la infección por VIH en los hombres circuncidados fue del 13,2% (intervalo de confianza del 95%, IC: 10,8 – 15,7) comparada con el 3,9% (IC 95%: 3,3 – 4,5) entre

los hombres circuncidados. La provincia de Nyanza tuvo el mayor número estimado de hombres no circuncidados y no infectados por el VIH (esto es, 601 709), seguida por la provincia Rift Valley, Nairobi y la provincia Occidental, respectivamente, y la mayoría de ellos pertenecía a la tribu étnica Luo. De esos hombres, el 77,8% no conocía su estado serológico y el 33,2% estaba infectado con el VHS-2. Además, el 65,3% había mantenido relaciones sexuales sin protección con una pareja serodiscordante o que no conocía su estado serológico en los últimos 12 meses y sólo el 14,7% había empleado preservativos de manera sistemática con su pareja más reciente. No obstante, sólo el 21,8% de los hombres circuncidados e infectados por el VIH con edades entre los 15 y los 19 años era sexualmente activo.

Conclusión La estrategia de circuncisión masculina en Kenia debería centrarse en las provincias con el mayor número de hombres no circuncidados y no infectados por el VIH y dirigirse a los hombres jóvenes antes o poco después de la primera relación sexual.

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