The Protective Effect of Male Circumcision on HIV Infection in Kenya

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Abstract

This paper uses data from the 2003 Kenya Demographic and Health Survey, a nationally representative sample, to examine the association between male circumcision and HIV infection. The results show that 4.6 percent of men were HIV positive; 86 percent of all men in the sample were circumcised. The prevalence of HIV was significantly higher among uncircumcised men (12%), as compared to the circumcised ones (3%). We also found significantly higher prevalence of HIV among richer men. The logistic regression results show that male circumcision is the most important and significant predictor of HIV in Kenya. Net of the effects of socio-demographic variables, age at first sexual intercourse and use of paid sex, uncircumcised men were 86 percent more likely to be HIV positive than circumcised men. Given this strong protective effect of male circumcision, we recommend that HIV advocates and activists, scholars, bio-medical communities, and political leaders find ways to include this oldest surgical procedure in their HIV/AIDS discourses and programs in sub-Saharan Africa.

Introduction

The AIDS epidemic has been around for more than 30 years, but there are still unanswered questions about the variations in the infectivity among regions, nations, and even among different ethnic and racial groups within the same geographic areas. The most troubling fact is the magnitude of variations across Africa. Although the overwhelming majority of HIV/AIDS cases (nearly 63% of world cases of children and adults living with HIV/AIDS) are found in sub-Saharan Africa (AVERT 2006), there are substantial variations between countries. For example, whereas the percentage of HIV/AIDS infection among adults aged 15-49 years is still below one percent in Mauritania and Senegal, the world's highest HIV/AIDS rates are found in Botswana (24%) and Swaziland (33%), according to recent epidemiological estimates (Population Reference Bureau 2006). Such wide variations suggest that sexual behavior alone cannot explain the differences in magnitude of the HIV/AIDS pandemic.

Expanding the scope of investigation to understand differences in rates of HIV infection, researchers are now considering the influence of new factors, including age marriage (Bongaarts 2006), sexual practices (Djamba 2004), and male circumcision (Gray et al. 2004; Williams et al. 2006). The later has been widely cited as a very important factor that significantly protects against HIV infection for men in heterosexual relations (Bongaarts et al. 1989; Centers for Disease Control and Prevention 2006). According to some estimates, male circumcision may be equivalent to vaccine or increased condom use (Williams et al. 2006). However, up to now, the majority of such studies have been based on clinical trials (Auvert et al. 2005; Meier et al. 2006), small area samples (Urassa et al. 1997), or ecological analyses (Auvert et al. 2001). Due in part

to the lack of national studies, there are still speculations and some uncertainties in explaining the potential protective effects of male circumcision on HIV/AIDS.

This paper uses data from the 2003 Kenya Demographic and Health Survey (KDHS), a nationally representative sample of adults, to examine the association between male circumcision and HIV infection at the national level. The 2003 KDHS is the fourth survey in the international Demographic and Health Survey program to include HIV testing, and the first which allows to anonymous link the HIV results with the key behavioral, social, and demographic factors, as well as male circumcision status. As such, this paper represents the first effort to analysis the net effect of male circumcision on HIV status, controlling for socio-demographic and behavioral variables.

Male Circumcision and HIV Infection

Male circumcision is the oldest surgical procedure (Alanis and Lucidi 2004); it involves the removal of the foreskin (or prepuce) from the penis. This practice is found in many parts of the world by there are substantial variations among nations and ethnic groups (Williams et al. 2006; Laumann, Masi, and Zuckerman 1997). According to biomedical literature, the foreskin of the penis has higher density of chemical substances that facilitate HIV transmission (Patterson et al. 2002).

The thesis that male circumcision can reduce men's ability of getting and transmitting sexual infections in heterosexual relations is not new. Already in the 19th century, Hutchinson proposed that circumcised men have lower risk of sexually transmitted infection (Hutchinson 1885, cited in Bailey, Plummer, and Moses 2001).

However, those against male circumcision argue that the foreskin membrane can be easily traumatized and even has small cuts during intercourse (Szabo and Short 2000). Such tinny and usually invisible cuts, they say, can be optimal passageways for sexually transmitted infections, including HIV. Other voices against male circumcision as a preventive tool for HIV/AIDS are more philosophical and ideological. For example, the fact that male circumcision has been historically linked to the Jews and some Christian religious traditions raises emotional questions from those who see themselves outside of that religious heritage. Understandably, we observe activist voices from both some scholars and parents who think they have to protect their children against penis foreskin cutting.

Nonetheless, current evidence suggests that male circumcision is associated with reduced risk of HIV/AIDS in sub-Saharan Africa (Weiss, Quigley, and Hayes 2000). In addition, male circumcision also reduces the risk of HIV infection indirectly by lowering the risk of other sexually transmitted infections, which, if present, heighten the chance of HIV. In general, the foreskin of penis facilitates the passage of pathogens and viruses to bloodstream. This paper contributes to this debate by showing the association between male circumcision and HIV infection on a national probability sample of men.

Data and Methods

The analysis is based on a sample of 4,377 men aged 15-54 years who participated in the 2003 KDHS. The 2003 KDHS is national probability sample of men (15-54 years) and women (15-49). Like its predecessors, this 2003 survey was a household based study designed to collect information on a variety of variables including

fertility and its proximate determinants, mortality, marriage, as well as circumcision status. This information was obtained through face-to-face interview survey.

The innovative aspect of this 2003 KDHS is that blood samples were also obtained for HIV testing. This was done by asking all men and women who were living in households that were selected for Men Questionnaire and who were eligible for the individual interview to voluntary give a few drops of blood. The blood samples were collected by a pre-trained health worker who was also part of each of the interview team. Respondents' participation was very high. Seventy percent of men selected for HIV testing gave their blood samples, 13 percent refused, 12 percent were absent at the time of blood sample collection, and nearly 5 percent did not participate or some of their information was missing from the final data file.

The fieldwork was carried out between April 18 and September 15, 2003. The research team provided counseling service to all survey participants who were interested in learning about their HIV status. More details about the survey organization and data collection methods are available in the study report published by the research organizations (Central Bureau of Statistics [Kenya], Ministry of Health [Kenya] and ORC Macro 2004).

To examine the association between HIV status and socio-demographic variables, including male circumcision, we matched male HIV result file with the corresponding male DHS file. The resulting working file contains 3,413 cases. To assess the link between circumcision and HIV, we considered the following variables that are usually associated with sexual behavior: age, level of education, marital status, religion, type of

place of residence, wealth/poverty, timing of first sexual activity, and participation in commercial sex.

Results

Characteristics of the sample

The socio-demographic characteristics of the respondents are given in Table 1. Some of the important features of this population include the early debut of sexual activity and paid sex. Twenty three percent of respondent had their first sexual experience before age 15. In addition, nearly 15 percent of respondents reported having ever paid for sex. Although this is a lifetime report, this two-digit figure suggests that commercial sex is common in Kenya. The data in Table 1 also show that the majority of men (86%) were circumcised. Finally, more than half of the men in this sample were married at the time of the interview. Most married men had one wife; only about 6 percent of men in this study were married to more than one wife.

HIV rate across socio-demographic characteristics

The descriptive results in Table 2 show that 4.6 percent of men were HIV positive. The prevalence of HIV was significantly higher among uncircumcised men (12%) as compared to their counterparts who were circumcised (3%). In the same way, the effect of age is statistically significant. The prevalence of HIV infection is higher among men in the age group 35-44, followed by those in the 25-34 years group. Since the frequency of intercourse is usually higher at those ages (25-44), this result suggests that HIV infectivity is associated with sexual activity.

The effect of education is marginally significant, with the highest rate of HIV infection found among respondents with secondary education. Interestingly, married respondents had higher rates of HIV than unmarried ones. Among those in monogamous unions, 6 percent were HIV positive, as well as nearly 9 percent of those in polygamous marriages. Never married, presumably younger men, had a lower rate of infection (about 2%). We found no significant association between religious affiliation or age at first sex and HIV level.

As one would expect, the rate of infection was twice higher in urban areas as compared to rural areas. Surprising, and as has been echoed at the third annual US President's Emergency Plan for AIDS Relief meeting, the HIV prevalence was significantly higher among richer men. For example, compared to the poorest men in the sample, richest men were more than two times more likely be HIV positive. Finally, paying for sex, which suggests having sex with prostitutes, significantly increases the risk of HIV infection.

The next effects of circumcision on HIV infection

Before analyzing data in multivariate models, it is important to discuss the timing of circumcision, sexuality, and HIV infection in this population. As discussed below, we assume the following sequential order: circumcision → sexual activity → HIV. We recognize that not all respondents would go through this path. However, in societies where the majority of HIV infection is transmitted through heterosexual relations, this model is conceptually useful in analyzing and interpreting data.

Although we don't have information on age at circumcision, this practice is commonly held during infancy and childhood. Therefore, it is reasonable to assume that

for most men in Kenya, circumcision occurs before the initiation of sexual activity. In addition, given that most HIV infections over there are due to heterosexual contacts, we assume that HIV infection occur after people have had sexual relations. Having said that, we can reasonably suggest the existence of causal effect in our regression models where circumcision is considered as a precursor to HIV infection.

Results from logistic regression show that male circumcision is the best and most significant predictor of HIV in Kenya. Hence, net of the effects of age, education, marital status, religion, place of residence, wealth, age at first intercourse, and access to paid sex, uncircumcised men were almost 86 percent more likely to be HIV positive than circumcised men. This finding confirms results from meta-analysis (Weiss et al. 2000), as well as prospective studies which showed that male circumcision is associated with significant reduction in HIV infection in sub-Saharan Africa (Gray et al. 2004; Meier et al. 2006; Urassa et al. 1997). The protective effect of male circumcision is so high here that we feel compelled to agree with Auvert and colleagues (Auvert et al. (2005) who argued that this surgical practice is equivalent to a vaccine of high efficacy.

We also found that three other variables in our model are statistically significant: age, education, and type of place of residence. Compared to younger men (those aged 15-24 years), men between ages of 25 and 44 were significantly more likely to be HIV positive. Those in older age group (45-54) were not statistically different from the men in the younger age group.

As for educational levels, we found significant risk of HIV infection among those educated respondents, as compared to uneducated ones. The last significant factor of HIV infection is place of residence. As noted in descriptive analysis, respondents living in

urban areas were more likely to be HIV positive than their counterparts in rural places. This result suggests that urban residence provides more opportunities for sexual relations that are conducive to HIV transmission than rural areas.

Surprisingly, marital status, religious affiliation, wealth level, age at first sex, and paid sex do not have a significant association with HIV risk among Kenyan men, when all other variables are included in the regression model. Yet, removing circumcision from the logistic regression model makes marital status statistically significant, with polygamous men being more like to be seropositive than monogamous and never married men. This finding shows that that male circumcision provides a protective effect that is more than that of marital status, when it comes to HIV infection in Kenya.

Discussion

This study provides the first socio-demographic analysis of the association between circumcision and HIV infection on a national probability sample. The results clearly show that male circumcision has a substantial protective effect. Net of the effects of all other socio-demographic factors examined in this paper, circumcision was associated with nearly 86 percent of reduction in HIV infection among Kenyan men. As some scholars have argued (Auvert et al. 2001), this strong association between HIV and male circumcision leads to the conclusion that sexual behavior alone cannot explain differences in AIDS epidemic in sub-Saharan Africa.

We are not advocating male circumcision as the unique approach to HIV prevention. Nonetheless, we argue that given the overwhelming evidence resulting from this study and previous research (Gray et al. 2004; Weiss et al. 2000; Williams et al.

2006), serious thoughts should be given to male circumcision. Certainly circumcision does not fully protect against HIV/AIDS in heterosexual relations. However, this is equally true of any other method, including condoms. However, the present data and previous study provide compelling evidence of a substantial protective effect of male circumcision against HIV.

Moreover, the fact that male circumcision remained the most powerful predictor of HIV infection in this national probability sample suggests that scholars should now have the courage and the honesty to acknowledge the fact. Circumcised men have significantly a lower risk of contracting HIV through heterosexual contacts than uncircumcised men. Understandably, there are those who rely on religious aspects of circumcision to cast doubts on the protective effect of this oldest surgical operation. But time has come to set seek life over death, to choose protection over disease.

While we strongly recommend that abstinence, condom use, and other protective methods be used to combat the spread of HIV in sub-Saharan Africa, we also recognize that health profession, political leaders, HIV activists and social and biomedical scholars explain to the population that being circumcised can substantial reduce the risk of infection and that great results will be achieved for those who still continue to be faithful, use condoms in casual relations while circumcised. After all, as show in recent biomedical literature, male circumcision could prevent as much as 6 million new HIV infections and 3 million deaths over a period of 20 years in sub-Saharan Africa (Kaiser 2006).

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Table 1. Characteristics of the Study Sample, Kenyan Men: 2003 KDHS

Characteristics	Number of cases[a]	Percentage[b]
Age		
15-24	1479	43.3
25-34	847	25.6
35-44	649	19.0
45-54	411	12.0
Level of education		
No education	286	8.4
Primary	1827	53.5
Secondary	934	27.4
Higher	366	10.7
Marital status		
Never married	1584	46.4
Married monogamous	1640	48.1
Married polygamous	189	5.5
Religious affiliation		
Catholic	864	25.4
Protestant/other Christian	1964	57.7
Muslim	372	10.9
No religion	204	6.0
Type of place of residence		
Urban	1100	32.2
Rural	2313	67.8
Wealth index		
Poorest	522	15.3
Poorer	524	15.4
Middle	596	17.5
Richer	713	20.9
Richest	1058	31.0
Had sex before age 15?		
Yes	790	23.2
No	2611	78.8
Ever paid for sex?		
Yes	412	14.5
No	2426	85.5
Circumcised?		
Yes	2911	85.5
No	494	14.5
Total	3413	100.0

[a] Due to missing values, the total number of cases for some variables may be smaller than the total reported on the last row of this table.
[b] The percentage may not add up to 100 for some variables, due to rounding.

Table 2. Percentage of Kenyan Men Who Were HIV Positive by Socio-Demographic Characteristics, 2003 KDHS

Characteristics	Percent HIV positive	Chi-Square	Level of significance
All	4.6		
Circumcised	3.0	66.622	0.000
Uncircumcised	11.6		
Age			
15-24	1.5	53.613	0.000
25-34	6.9		
35-44	8.2		
45-54	3.5		
Level of education			
No education	1.3	7.341	0.062
Primary	4.3		
Secondary	5.3		
Higher	4.7		
Marital status			
Never married	1.9	38.419	0.000
Married monogamous	6.3		
Married polygamous	8.7		
Religious affiliation			
Catholic	4.6	3.188	0.364
Protestant/other Christian	4.6		
Muslim	2.4		
No religion	4.3		
Type of place of residence			
Urban	6.9	17.707	0.000
Rural	3.3		
Wealth index			
Poorest	2.8	18.671	0.001
Poorer	3.9		
Middle	2.2		
Richer	4.7		
Richest	6.7		
Had sex before age 15?			
Yes	5.4	2.485	0.115
No	4.0		
Ever paid for sex?			
Yes	7.1	4.219	0.040
No	4.6		

Table 3. Logistic Regression Model Predicting the Likelihood of Being HIV Positive, Kenyan Men: 2003 KDHS

Characteristics	Coefficient (B)		Standard Error	Odds ratio
Circumcised	-1.932	***	0.228	0.145
Uncircumcised	--		--	1.000
Age				
15-24	--		--	1.000
25-34	1.445	***	0.426	4.526
35-44	1.709	***	0.465	5.526
45-54	0.720		0.532	2.054
Level of education				
No education	--		--	1.000
Primary	1.840	*	0.776	6.298
Secondary	1.984	*	0.794	7.269
Higher	1.390	+	0.846	4.014
Marital status				
Never married	-0.608		0.380	0.544
Married monogamous	--		--	1.000
Married polygamous	0.243		0.346	1.275
Religious affiliation				
Catholic	-0.267		0.238	0.766
Protestant/other Christian	--		--	1.000
Muslim	-0.037		0.505	0.964
No religion	0.347		0.439	1.414
Type of place of residence				
Urban	--		--	1.000
Rural	-0.599	*	0.299	0.549
Wealth level				
Poorest	--		--	1.000
Poorer	0.507		0.426	1.661
Middle	0.112		0.468	1.118
Richer	0.668		0.419	1.950
Richest	0.449		0.468	1.567
Had sex before age 15?				
Yes	0.265		0.228	1.303
No	--		--	1.000
Ever paid for sex?				
Yes	0.449		0.468	1.567
No	--		--	1.000
Constant	-2.178	***	0.307	0.113
- 2 Log Likelihood	745.209			
Number of cases	2,306			

+ $p \leq 0.10$ * $p \leq 0.05$ ** $p \leq 0.001$