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Circumcision Status and Time to First Sex Among Never-Married Young Men in Malawi: Evidence from the Demographic and Health Survey

Paul Mkandawire · Isaac Luginaah · Jenna Dixon · Frederick Armah · Godwin Arku

Abstract This study examines the association between circumcision status and the timing of first sexual intercourse among adolescents in Malawi. Results of survival models applied to nationally representative sample of never-married young men aged between 15 and 24 obtained from the Demographic and Health Survey data show that being circumcised is associated with earlier initiation of sexual activity in Malawi. Young men who reported being circumcised experienced their first sexual intercourse earlier in life than their uncircumcised counterparts. Although the introduction of theoretically relevant knowledge, socio-cultural, demographic, and socioeconomic variables in the multivariate models attenuated the association between circumcision and earlier sexual initiation, the relationship nonetheless remained robust. The study concludes by discussing the implications of these findings and suggests relevant policy recommendations.

Resumen Este estudio examina la relación entre la circuncisión y la edad al primer contacto sexual de jóvenes en Malawi. Los resultados muestran una asociación entre el estado de circuncisión y el primer encuentro sexual en jóvenes de temprana edad en Malawi. Los resultados previos provienen de Encuestas Demográficas y de Salud aplicadas a modelos de sobrevivencia en muestras representativas de jovenes previamente nocasados entre 15 y 24. Hombres jóvenes quienes reportaron ser circuncidados experimentaron el primer encuentro sexual a una temprana edad comparado con sus contrapartes sin circuncidar. La relación entre la circuncisión y el primer contacto sexual en los modelos multivariados persistió a pesar de la introducción de variables atenuadoras tales como el conocimiento socioeconómico y sociodemográfico. El estudio discute las implicaciones de los resultados y las recomendaciones de relevancia política las cuales podrían hacer a los hombres circuncidados más susceptibles a la prevención de VIH en Malawi.

P. Mkandawire (✉)
Institute of Interdisciplinary Studies, Carleton University, 1125 Colonel By Drive, Ottawa, ON K1S 5B6, Canada
e-mail: Paul_Mkandawire@carleton.ca

I. Luginaah
Department of Geography, The University of Western Ontario, Social Science Centre 1409, London, ON N6A 5C2, Canada
e-mail: iluginaa@uwo.ca

J. Dixon · F. Armah
Department of Geography, The University of Western Ontario, Social Science Centre 1424, London, ON N6A 5C2, Canada
e-mail: jdixon22@uwo.ca

F. Armah
e-mail: farmah@uwo.ca

G. Arku
Department of Geography, The University of Western Ontario, Social Science Centre 2427, London, ON N6A 5C2, Canada
e-mail: garku@uwo.ca

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Introduction

This paper examines association between self-reported circumcision status and age at first sexual intercourse in young never-married men in Malawi. Early initiation of sexual activity among youth is generally considered to be

associated with high risk of HIV infection [1–3]. Adolescents' greater propensity for risky sexual behaviour is often attributed to lack of adequate and correct knowledge about how sexually transmitted infections (STIs), including HIV/AIDS, are prevented, and their inability to successfully negotiate for safer sex at this stage of life [4, 5]. More recent studies in Sub-Saharan Africa (SSA) point to the importance of other issues beyond mere lack of information, such as poor social and material conditions, as predisposing factors for early sexual debut in youth. For example, some studies have found that being an orphan is an important predisposing factor for early sexual debut among youth in SSA [5, 6].

In contributing to efforts to reduce the spread of HIV/AIDS, recent studies have revealed that male circumcision has considerable potential to reduce the spread of HIV in areas where the epidemic is mainly driven by heterosexual sex, especially in SSA [7, 8]. Male circumcision can curtail the risk of HIV/AIDS by reducing the total number of HIV target cells which tend to be high on the penile foreskin [9]. Penile circumcision can also reduce the risk of perpetual lesions, rendering the penis less vulnerable to infection during sexual contact [10]. Thus, by diminishing the risk of genital ulcers and associated sexually transmitted diseases and associated genital ulcers, penile foreskin removal can reduce the risk of HIV infection.

Motivated by this understanding, several empirical studies have found strong association between the wide spread practice of male circumcision and low HIV/AIDS prevalence in some parts of SSA. For instance, an ecological study conducted in Yaoundé in Cameroon and Cotonou in Benin, the two cities with West Africa's lowest HIV/AIDS prevalence, found that 99 % of men had actually been circumcised [7]. Similarly, research in East Africa's high HIV/AIDS prevalence region mirrors these findings. In the province of Kisumu in Kenya, a notable study revealed that the relative risk of infection in circumcised young men was 53 % lower than in those who were uncircumcised [8]. In Uganda's Rakai district, it was reported that penile circumcision considerably reduced the incidence of HIV/AIDS [11]. In light of this evidence, it has been surmised that male circumcision can confer considerable protective effects to both men and women in SSA, as it is generally associated with lower rates of cervical cancer and HIV/AIDS [12]. Furthermore, it has been hypothesized that clinical circumcision could avert more than 2 million new HIV infections and over 300,000 HIV/AIDS-related deaths in the general population in SSA over a 10 year period [13]. In response, the World Health Organization (WHO) has recommended that male circumcision be considered as an additional important intervention for reducing the risk of heterosexually acquired HIV infection in men in countries currently struggling with high rates of heterosexually transmitted HIV [14].

However, while agreeing with the biologic basis of the need for circumcision, critics have expressed skepticism regarding the theorized epidemiological impacts of the practice of penile foreskin removal in the general population. Some of these critics argue that the presumed benefits of male circumcision should be understood within the broader context of the practicalities of scaling up clinical circumcision in the general population [15, 16]. In emphasizing practical challenges, it has been contended, for instance, that using a surgical blade instead of a knife when performing clinical circumcision may alter the cultural significance of the practice, and consequently undermine widespread acceptance of the procedure [17]. Other skeptics have underscored the importance of perceptions in shaping potential efficacy of clinical circumcision as a strategy for HIV prevention. For instance, a recent study conducted in Botswana revealed that concerns around peer/partner acceptance and sexual functionality hampered the scale-up of male-circumcision [18]. Skepticism has also been linked to instances where male circumcision is associated with other cultural practices that condone sexual activity. For instance, in some settings the practice of penile foreskin removal symbolizes the end of childhood such that sexual activity may be tolerated in order to mark a successful transition into adulthood [19].

Some researchers have further argued that penile foreskin removal may have an independent effect on risky sexual behaviour over and above the foregoing sociocultural influences, especially when performed later in life [20, 21]. Drawing on the idea of risk compensation, it has been argued that individuals tend to adjust their sexual behaviour in response to perceived change in their sense of vulnerability to disease [16]. Unlike neonatal circumcision, which is believed to confer the least interference with an individual's sexual risk perception, preadolescent and adolescent circumcision is said to be especially implicated in the notion of sexual risk compensation because it takes place at a particularly delicate developmental stage.

In addition to the concern that circumcision may provide a false sense of safety, it has also been argued that the desire to avoid sexual dissatisfaction from condom use, rather than the need to reduce the risk of HIV/AIDS per se, may constitute an overriding motive for undergoing a clinical circumcision procedure. This tendency may further offset the presumed benefits of circumcision [21].

Studies which have empirically examined the hypothesized relationship between male circumcision and risky sexual behaviour in the general population are still scarce except for a notable few, though this may change with growing interest in male circumcision. A study conducted in Kisumu, Kenya, for instance, found no evidence of risk compensation [22] while another study in Uganda reported a reduction in risky behaviour such as a decline in

non-marital relations following circumcision [23]. However, other studies from Southern Africa have found that male circumcision was associated with more risky sexual behaviour. For instance, being circumcised was associated with decreased condom use among youth in Johannesburg in South Africa [24]. A study conducted in Swaziland similarly reported a tendency for more risky sexual behaviour among those who have been circumcised [25].

Such contradictions suggest that relationship between circumcision and sexual behaviour is complex and may vary from place to place depending on socio-cultural conditions. This paper contributes to this debate by examining the association between male circumcision and the age at first sexual intercourse in the context of Malawi. Two notable studies have examined the links between circumcision and risky sexual behaviour in Malawi [26, 27]. Ngalande et al. [26] found a tendency among women to prefer circumcised men as such men were thought to be more likely to be HIV negative, STI free, and sexually more pleasurable. Godlonton et al. [27] also reported that Malawian men who have been circumcised were less likely to buy and use condoms relative to those who have not been circumcised. However, while both studies provide important insights into patterns of sexual behaviour in relation to circumcision, they are not amenable to generalization to the broader Malawian population based on the methods that were used. The former study used a qualitative approach while the later was based on a relatively small sample drawn from a district located in the southern region of the country. This study uses a nationally representative sample from the Malawi Demographic and Health Survey to test this hypothesis in the general population, controlling for theoretically relevant covariates.

The current study's focus on time to first sexual intercourse vis-à-vis circumcision status is informed by the fact that early initiation of sex can heighten vulnerability to HIV/AIDS. In areas that are heavily affected by HIV/AIDS, youth who initiate sex earlier in life subsequently tend to be less predisposed to use condoms and are more likely to have multiple casual sexual partners, thereby having higher level of risky sexual exposure than those who initiate sex later in life [1, 2]. Thus, delaying sexual onset is considered as a barometer of positive sexual behaviour change in regions worst affected by the HIV/AIDS epidemic [28].

Recognizing the importance of correct information in influencing sex decisions, socio-psychological theories of health stress the centrality of knowledge in shaping sexual behaviors [29]. Indeed, some studies have found a positive relationship between knowledge and sexual behaviour [30]. However, other studies have found little or no association [6, 31]. Furthermore, other studies have actually found the opposite effect whereby individuals engage in risky sexual practices despite being fully aware of ways of preventing HIV/AIDS [32, 33]. Myths surrounding HIV transmission and spread mainly rooted in cultural and religious norms, and superstitious beliefs also tend to undermine correct knowledge [34].

Various studies also emphasize that notwithstanding the influence of modernity, religion and ethnicity remain considerably important forces shaping sexual decisions in the context of SSA. As such, it has been argued that inability to control for these factors represents an important flaw in many studies examining vulnerability to HIV/AIDS in this region [35]. For example, some religious teachings continue to link the spread of the epidemic with supernatural powers, alleging that the disease is a divine punishment for sexual depravity [36, 37]. Similarly, social norms and behaviour rooted in ethnicity bear important influences on allowable forms of sexual conduct [38, 39]. As these collective sexual moralities vary across ethnic groups, there tends to be differences in socio-cultural systems, such as sexual initiation rites resulting in different sexual behaviour norms in different youth groups.

Previous studies have also shown that individual vulnerability to HIV/AIDS in Malawi is related to place context, including social, cultural, demographic and socioeconomic features of places [40]. For example, close proximity to an urban center can facilitate access to better livelihood opportunities, health services, information about HIV/AIDS, and adoption of health seeking behaviour such as condom use, thereby reducing the risk of HIV/AIDS [41]. However, these benefits must be tempered by the fact that proximity to urban areas, which generally have high HIV prevalence, can also enhance the risk of HIV transmission through greater availability of paid sex and multiple sexual partners [42]. Similarly, poor health service delivery and certain adverse cultural practices associated with rural areas can create an environment that can inhibit positive sexual behavior change [42]. In order to account for the mediating role of these factors, we also control for respondent's place of primary residence. We also consider relationship between the respondent and the head of household given that the nature of the relationship one has with the household head in a home can shape sexual risk.

Finally, recognizing the need to understand sexual behavior in its broader socioeconomic context, the socioeconomic environment is captured through consideration of the influences of both respondent's household wealth status and his highest level of education attainment. While some research has shown that wealth can buffer young people from risky sexual intentions and practices [43, 44], others studies have demonstrated the opposite relationship, where high household economic status is associated with elevated propensity for risky sexual behaviour, such as multiple sexual partners [45, 46]. Similarly, education is an

important inhibitor of HIV risk in SSA and has been shown, for instance, to greatly enhance the ability to comprehend health-related information and increase self-esteem required to negotiate terms of sex [47, 48]. However, other studies have indicated that as educated individuals tend to be desired or can use their social status to extort sexual favors, thereby being rendered more prone to risky sexual behaviour [49]. Against this background, we control for both household wealth and respondent's highest level of education.

Study Context

Malawi provides a particularly appropriate context for examining the question of the links between circumcision status and age at first sex. This is not only because it has one of the highest adult HIV/AIDS prevalence levels in the world, but also because the government launched the Voluntary Male Medical Circumcision Campaign (VMMCC) in 2009 with technical and financial support from the World Health Organization [50, 51]. This new policy is aimed at reducing the spread of HIV/AIDS in the country in a context where an estimated 10.6 % of the adult population (15–49 years) already lives with the virus [52]. This figure represents an increase from a recorded low of about 2.6 % in 1985, when the disease was first officially reported [51]. The reported national prevalence level, however, masks considerable spatial variations, with the southern region being the most affected at 20.5 %. Prevalence levels in adults in the central and northern regions are 10.7 and 10.2 %, respectively [51].

There are also significant rural–urban differences, with prevalence nearly two times higher in urban and semi-urban areas (17.1 %) than in rural areas (10.8 %). Malawi's changing age structure also complicates HIV/AIDS response given the existence of a large, sexually active population. It is estimated that 65 % of the population is now aged below 24 years, and the median age currently stands at 17 years [52]. This means that prospects for reversing the trend of HIV/AIDS in Malawi rest largely on dramatic changes in sexual behaviour in this particular cohort, making youth an important focus for HIV/AIDS prevention policy.

With an estimated 65 % of the people living below the poverty line (<US$2 per day), Malawi is also one of the poorest countries in the world [53]. In addition, the literacy level remains low at 65 % despite the government's introduction of free primary education nearly 20 years ago. Furthermore, even this meager literacy level is characterized by stark gender difference in a context where 78 % of men are literate, compared with only 52 % of women [51]. These factors further compound efforts to reduce HIV/

AIDS. Both poverty and illiteracy are more serious problems in rural areas, where 85 % of Malawians still live. Religion is an important aspect of life in Malawi. It is estimated that 83 % of Malawians are Christians, 13 % Moslems, 2 % Traditionalists, and about 1 % of the population has no religious affiliation.

Although Malawi is generally a non-circumcising country, circumcision has a long history in those specific ethnic groups which traditionally circumcise. The Yao, for instance, adopted the practice following contact with Moslem traders more than 100 years ago. They observe the typical Bantu pattern of rituals with boys being circumcised in the "bush" until the wounds heal and then large festivities occurring when they are released back into their communities now as "men". Beyond reasons linked to religious identity and rite of passage to manhood, circumcision has historically also been practiced for reasons of genital hygiene (especially to avoid *madeya* or husks), and in order to reduce the risk of penile ulceration and sexually transmitted diseases [26, 54]. These grounds have oftentimes been used to justify circumcision and continue to form major topics when counseling new initiates alongside other issues such as sexuality and good behavior during youth initiation ceremonies [26].

Although the Tumbuka and other ethnic groups (e.g., Ngoni, Tonga) are predominantly Christian, and do not usually circumcise, male circumcision is reported to exist to some extent among this tribe and, in fact, it has increased recently. However, this increase is generally unrelated to religious or cultural reasons, but rather has been linked with notions of penile hygiene and ideas such as lower risk of contracting sexually transmitted diseases [26]. The Chewa, the largest ethnic group in Malawi, occupies an intermediate ground. Although the Chewa do not customarily circumcise, the growing presence of Moslems among them due to migration and intermarriages coupled with other secondary benefits of circumcision have facilitated gradual diffusion of the practice among them. The importance of penile cleanliness in terms of hygiene and STI prevention benefits is generally appreciated among the non-circumcising ethnic groups in Malawi although, instead of ceding to circumcision, these groups tend to resort to alternative rituals such as pre-wedding counseling. The notion that penile foreskin can encourage the transmission of STI explains why *aunties* advise intending spouses, among other issues, about the need for proper hygiene after sexual intercourse as a way of preventing 'dirt' and infection with STI [19, 53].

Traditionally, official government policy in Malawi has primarily relied on sexual abstinence, mutual faithfulness, consistent condom use (ABC) as key strategies for HIV prevention. Later on, strategies such as voluntary HIV testing (VCT), prevention of mother-to-child transmission

(PMTCT), and anti-retroviral therapy were also introduced to complement the ABC strategy. Thus, VMMCC represents the most recent public health intervention adopted by the government in an effort to stem the tide of the epidemic, making Malawi one of the 13 WHO priority countries in east and southern Africa with low circumcision prevalence currently implementing the intervention [50]. This new policy is being implemented against a backdrop where adult HIV prevalence in the country is higher (10 %) in circumcised men aged 15–49 than in those who have not been circumcised (8 %) [46]. Demonstrating the government's commitment to the initiative, the 2009–2013 National HIV Prevention Strategy singles out the low prevalence of male circumcision in the country as a major barrier to reducing new HIV infections in the country [52]. In keeping with the new policy a total of 1,296 circumcisions were performed in designated hospitals in Malawi during the year 2010, with official estimates suggesting that male circumcision could avert more than 265,000 new adult infections between 2009 and 2025 in Malawi [50]. The Malawian government also launched a social mobilization campaign targeting youth that aims to promote mass male circumcision. Being a group that is especially vulnerable to HIV/AIDS, youth are an important target of the VMMCC in Malawi.

Methods

Data

This study used data from the most recent Malawi Demographic and Health Survey (DHS) conducted in 2010. The Malawi DHS is a nationally representative dataset collected by Malawi National Statistical Office with funding and technical assistance from the MEASURE DHS program in Calverton in Maryland, USA. The present analysis focuses on 2,459 never-married young men aged between 15 and 24 years.

Measures

The 2010 MDHS has a measure of age at first sexual intercourse. Respondents were asked 'At what age did you have your first sexual intercourse?' In response participants gave their completed ages at their sexual debut. The focal independent variable in this study, circumcision status, was constructed from responses to the question 'Have you been circumcised?' Thus, the variable is dichotomous coded '0' if the respondent is uncircumcised and '1' if the respondent reported being circumcised, with '0' as the reference category.

Two single-item indicators measuring knowledge about HIV/AIDS were used. The first variable was constructed from responses to the question as to whether abstinence is an effective strategy for preventing the transmission of HIV. Similarly, for the second variable, respondents were asked as to whether using a condom during sexual intercourse was an effective strategy for HIV prevention. Respondents who answered in the negative to these questions were coded '0', and those who answered in the affirmative were coded '1', with '0' as the reference category. Transmission myths were created using Principal Component Analysis from responses to questions about whether HIV/AIDS can be transmitted through supernatural means, kissing, and mosquito bites. Responses were coded '0' if youth rejected the myths and '1' if they responded in the affirmative. These measures loaded on a single construct and factor loadings ranged from 0.61 to 0.78 (Cronbach's alpha = 0.59), with higher scores representing acceptance of myths.

Ethnicity and religion also received independent consideration in this study given that existing literature suggests that these factors provide an important context for sexual norms and behaviors. The effect of religion was captured by using four categories coded '1' if the respondent was Christian, '2' Moslem, '3' No religion, and '4' Traditionalist, with Christian as the reference category. The variable measuring ethnicity was coded '1' Chewa, '2' Tumbuka, '3' Llomwe, '4' Tonga, '5' Yao, '6' Sena, '7' Ngoni and '8' Other. The 'Other' category represents an aggregation of various, relatively small ethnic groups, including but not limited to Ndalie, Sukwa and Mang'anya. In this study, the primary place of residence of the respondent was coded '0' if they reported residing in urban and '1' if rural, with urban as the reference category. The variable capturing respondent's relationship with household head was coded '1' Son, '2' if respondent himself was the head of the household, '3' Brother, and '4' Other, with Son as the reference category.

Beyond knowledge and socio-demographic factors, socioeconomic status also received consideration. The variable tapping into socioeconomic status was measured by using a wealth index which is also available in the 2010 MDHS. The MDHS dummies this wealth index into poorest, poorer, middle, richer, and richest quintiles. The wealth quintiles were constructed from weighted scores capturing household ownership of a typical bundle of consumer items as well as attributes tapping into dwelling characteristics. Of the five response categories, 'poorest' was the reference category. We also controlled for education as an additional variable tapping into respondent's socioeconomic status, coded as '1' no formal education, '2' primary education, '3' secondary education, and '4' higher, with 'no formal education' as the reference category.

Data Analysis

Survival analysis (log-normal hazard model) was used to examine the independent effect of circumcision status on the time to first sex among youth while controlling for theoretically relevant covariates. The log-normal model was chosen over other parametric models because the underlying distribution of the hazard function in this study sample approximates the normal distribution (see Fig. 1).

The log-normal model parameterizes in accelerated failure time metric and estimates directly time to first intercourse [55, 56]. Using Stata 11 SE, we obtained time ratios (TR) that show how early or late circumcised young men in Malawi experience first sexual intercourse, relative to those who are uncircumcised (reference category). A TR of magnitude of less than one signifies faster timing or initiating sex earlier in life, whereas TR of magnitude greater than one indicates slower timing or initiating sex later, compared to the reference category. Frailty was also introduced into all the multivariate models to account for unobserved heterogeneity between individuals in the sample, and in order to obtain more statistically robust parameter estimates.

Results

Sample Characteristics

The results of this study show that 57.8 % of respondents lived with their natal parents at the time of this study. Only 4.8 % were heads of households themselves, 10 % lived with grandparents, 7.1 % lived with a brother/sister, 6.1 % reported no clear biological relationship with the household head, and 4.1 % explicitly stated being adopted. The rest

were either nephews or nieces of the head of the household in which they lived. The majority of youth in this sample (56.1 %) lived in large households with family members between 6 and 10, 30.1 % lived in homes with 3–5 members, and 6.5 % live in a household with more than 10 family members.

Of the total sample, 20.5 % reported being circumcised, with the overwhelming majority (91 %) stating that they were circumcised outside the hospital setting. The majority of the people in this sample (97 %) were circumcised after the age of 10 years, and the median age at circumcision is 15 years. Nearly all respondents reporting being circumcised (98.1 %) also stated they had heard about HIV/AIDS prior to the survey through various sources such as radio, posters, billboards, community volunteers, and health workers.

Of all those who reported being sexually active, 25.1 % had their last sexual encounter <1 month before the survey, 13.2 % between 1 and 3 months, 4.3 % between 4 and 6 months, 10.2 % between 7 months and 1 year and 47.3 % more than 1 year prior to the study. Of all the respondents 11.7 % had ever paid for sex in the past 12 months. A significantly higher proportion of circumcised young men reported being sexually active, with 31.3 % of them indicating being involved in a sexual encounter in the 4 months prior to this study compared to 20.75 % in the uncircumcised group ($\chi^2 = 38.74$; $p < 0.001$). In addition, a higher average number (3.1) of life lifetime partners was reported by circumcised youth compared to those who were uncircumcised (1.6). Furthermore, 67 % of circumcised youth who had already initiated sex reported not using a condom at their most recent sexual act compared to 56 % among the uncircumcised ($\chi^2 = 10.18$; $p < 001$). Similarly, a considerably high proportion of circumcised youth (28 %) reported ever paying for sex compared to the uncircumcised cohort (19 %) ($\chi^2 = 7.540$; $p < 0.05$) (Table 1).
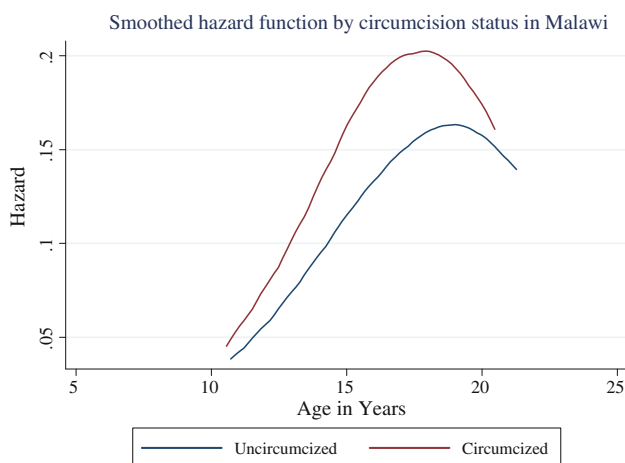
The Hazard

A hazard is a conditional probability that captures the possibility that an event will happen given that it has not yet happened [57, 58]. The shape of the smoothed hazard function (Fig. 1 below) indicates that circumcised and uncircumcised young men in Malawi generally initiate sex at around the same age (10 years). However, while the hazard of first sex increases in both groups, the profiles of the two hazards reveal that across time this risk is higher in the cohort that have been circumcised relative to those who have not been circumcised. As a measure of risk, the hazard function implies that at any age between 10 and 24 years youth who have undergone circumcision are generally more likely to experience their first sexual act

Smoothed hazard function by circumcision status in Malawi

Fig. 1 The hazard function

Table 1 Selected sample characteristics

Characteristic	Percent (number)
Ever had sex	
No	39.7 (977)
Yes	60.3 (1,482)
Circumcised	
Yes	18.2 (447)
No	81.8 (2,012)
Place of circumcision	
Village	90.5 (404)
Health facility	9.5 (43)
Ever had sex as part of cultural practice	
No	98.5 (1,325)
Yes	1.4 (19)
Knows place to test for HIV/AIDS	
No	5.5 (123)
Yes	94.5 (2,336)
Ever paid for sex last 12 months	
No	85.3 (1,148)
Yes	14.7 (197)
Condom used when paid for sex	
No	50 (60)
Yes	50 (60)
Smokes cigarettes	
No	95.8 (2,336)
Yes	4.2 (122)
Used condom at first sexual intercourse	
No	69.9 (1,031)
Yes	30.1 (451)
Used condom at last sexual intercourse	
No	47.7 (707)
Yes	52.2 (775)
Time in months since last intercourse	
<1 month	14.6 (216)
Between 1 and 3 months	12.6 (186)
Between 4 and 6 months	4.4 (65)
Between 7 months and 1 year	11.4 (168)
Between 1 and 2 years	5.2 (77)
More than 2 years	51.8 (769)
Household size	
One member	2.4 (58)
Two member	4.9 (121)
Between 3 and 5 members	30.1 (740)
Between 6 and 10 members	56.1 (1,380)
More than 10 members	6.5 (272)
Relationship to household head	
Head	4.8 (118)
Son/daughter	57.9 (1,423)
Grandchild	10.4 (256)
Brother/sister	7.0 (172)

Table 1 continued

Characteristic	Percent (number)
Adopted/foster child	4.1 (102)
Not related	5.1 (149)
Niece/nephew by blood	2.9 (71)
Other	8.0 (196)

earlier or are less likely to remain virgins if they have not already initiated sex, compared to those who have not been circumcised youth.

Bivariate Analysis

Table 2 below presents the sample size and time ratios from the hazard models built with each independent variable.

Circumcised young men had their first sex earlier compared to those who were uncircumcised (TR = 5.6 %, $Z = -2.55$, $p < 0.001$). Compared to male youth who did not know, those who knew that sexual abstinence can prevent HIV transmission delayed initiating sex (TR = 6.6 %, $Z = 2.81$, $p < 0.05$). On the contrary, those who reported knowing that using a condom consistently can prevent HIV/AIDS initiated their first sex earlier (TR = 3.3 %, $Z = -2.61$, $p < 0.05$) than those who did not know.

With respect to the influence of religion, being a Moslem was associated with earlier sexual intercourse (TR = 5.7 %, $Z = -2.49$, $p < 0.05$) compared to being a Christian (reference category). Similarly, having no religious affiliation was associated with earlier sexual intercourse (TR = 4.5 %, $Z = -3.59$, $p < 0.001$) than being Christian. The bivariate results also show that young males whose ethnic background is Tumbuka tended to initiate sex later (TR = 7.5 %, $Z = 3.05$, $p < 0.05$) than those with a Chewa background (reference category). On the other hand, young men from Sena ethnic background were associated with earlier sexual initiation (TR = 5.4 %, $Z = -2.50$, $p < 0.05$) than those from Chewa background. Living in rural Malawi was associated with earlier sexual debut (TR = 2.8 %, $Z = -2.01$, $p < 0.05$) than living in an urban area. Respondents who reported being household heads themselves were more likely to initiate sex compared to those who reported being sons in the household in which they lived (TR = 2.9 %, $Z = -2.02$, $p < 0.05$). Young men in richest (TR = 4.2 %, $Z = 3.49$, $p < 0.05$) and richer (TR = 3.1 %, $Z = 3.21$, $p < 0.05$) wealth quintiles delayed their first sex compared to those in the poorest quintile. In addition, having a primary level of education was associated with earlier sexual debut (TR = 8.9 %, $Z = -2.91$, $p < 0.001$) than having no formal education at all.

Table 2 Bivariate analysis of the hazard

Independent variable	Number (%)	Time ratio (CI)
Circumcision status		
Uncircumcised (ref)	2,012 (81.8)	1.00
Circumcised	447 (18.2)	0.944 (0.92–0.97)**
Knowledge and behaviour variables		
Abstinence		
No (ref)	576 (23.4)	1.00
Yes	1,183 (76.6)	1.066 (1.01–1.11)*
Condom		
No	667 (27.5)	1.00
Yes	1,782 (72.5)	0.967 (0.94–0.99)**
Transmission myths	2,459	0.997 (0.98–1.00)
Socio-demographic variables		
Religion		
Christian (ref)	1,850 (75.2)	1.00
Muslim	312 (12.8)	0.943 (0.91–0.97)**
No religion	155 (6.3)	0.955 (0.91–0.99)**
Traditionalist	142 (5.7)	0.971 (0.89–1.16)
Ethnicity		
Chewa (ref)	443 (18.1)	1.00
Tumbuka	385 (15.7)	1.075 (1.02–1.11)**
Lomwe	96 (3.9)	0.977 (0.92–1.03)
Tonga	209 (8.5)	1.018 (0.97–1.06)
Yao	816 (33.2)	0.991 (0.96–1.02)
Sena	245 (10.5)	0.946 (0.91–0.98)**
Ngoni	201 (6.7)	1.011 (0.98–1.05)
Other	64 (2.6)	0.997 (0.98–1.00)
Residence		
Urban (ref)	418 (17.0)	1.00
Rural	2,041 (83.0)	0.972 (0.94–0.99)*
Relationship to h/head		
Son	1,423 (57.8)	1.00
Head themselves	118 (0.05)	0.971 (0.95–0.99)*
Brother	172 (0.06)	1.050 (0.99–1.15)
Other	746 (30.3)	0.972 (0.95–1.10)
Socioeconomic status		
Wealth quintile		
Poorest (ref)	373 (15.2)	1.00
Poorer	457 (18.6)	0.988 (0.95–1.02)
Middle	431 (17.5)	0.985 (0.95–1.02)
Richer	551 (22.4)	1.031 (1.00–1.06)*
Richest	647 (26.3)	1.042 (1.01–1.07)*
Education		
No education (ref)	172 (6.9)	1.00
Primary	1,410 (57.3)	0.911 (0.85–0.97)*
Secondary	730 (29.6)	0.970 (0.91–1.03)
Higher	147 (5.9)	1.031 (0.93–1.13)

Statistical significance * $p < 0.05$; ** $p < 0.001$; *** $p < 0.0001$

Multivariate Analysis

Three multivariate models are fitted as shown in Table 3. In the first model, we examine the effects of circumcision status and knowledge variables on the timing of sexual onset. The second model adds sociocultural and demographic variables; religion, ethnic identity, and primary place of residence. The third model controls for variables tapping into socioeconomic status; wealth and level of education. We also control for unobserved heterogeneity in all the three multivariate models.

Circumcision status is a significant predictor of time to first sex (Table 3 Model 1). Young men who were circumcised experienced their first sexual intercourse earlier (TR = 5.6 %, $Z = -4.48$, $p < 0.001$) than those who were uncircumcised. Unlike in the bivariate analysis where young men who knew that using a condom would prevent HIV/AIDS experienced their sexual debut earlier, this relationship changed in the multivariate analysis. Thus, young men reporting that consistent use of condoms can prevent HIV/AIDS delayed their sexual debut (TR = 2.1 %, $Z = 2.07$, $p = < 0.05$) compared to those who did not know.

When sociocultural and demographic variables are controlled in model 2, young men who identified themselves as Moslem experienced their first sex earlier (TR = 2.5 %, $Z = -2.36$, $p < 0.01$) than youth who reported being Christian. However, unlike in the bivariate analysis, having no religious affiliation lost statistical significance and was no longer associated with earlier sexual debut in the multivariate models. With regard to ethnicity, being of Lomwe origin was associated earlier time to first sexual intercourse (TR = 3.5 %, $Z = -2.67$, $p < 0.05$), compared to being Chewa. In addition, Yao ethnic group also picked up significance in the multivariate models and became associated with earlier sexual intercourse (TR = 1.7 %, $Z = -2.02$, $p < 0.05$), compared to the Chewa. Living in rural Malawi was associated with earlier sexual intercourse (TR = 2.7 %, $Z = -2.47$, $p < 0.05$) than living in the urban area. Although respondent's relationship with the household head was not significantly related with time to first sexual intercourse in the multivariate models, the variable was nonetheless retained in the multivariate models on theoretical grounds.

Socioeconomic variables are entered in model 3. Young men in the richest wealth quintile delayed their sexual debut (TR = 3 %, $Z = 2.99$, $p < 0.05$) compared to those in the poorest wealth quintile. Similarly, young men who reported having a primary (TR = 1.1 %, $Z = 2.01$, $p = < 0.05$) or higher than secondary level of education (TR = 3.1 %, $Z = 3.11$, $p < 0.05$) also reported delaying sexual debut compared with those with no formal education.

It must be emphasized that even though knowledge, socio-demographic, and socioeconomic variables somewhat

Table 3 Hazard analysis of age at first sex

Independent variables	Model 1 TR (95 % CI)	Model 2 TR (95 % CI)	Model 3 TR (95 % CI)
Circumcision status			
Un-circumcised (ref)	1.00	1.00	1.00
Circumcised	0.944 (0.92–0.96)**	0.953 (0.92–0.98)**	0.967 (0.93–0.98)*
Knowledge			
No (ref)	1.00	1.00	1.00
Abstinence	0.993 (0.96–1.01)	0.99 (0.97–1.02)	0.982 (0.96–1.03)
Condom	1.025 (1.00–1.06)*	1.029 (1.00–1.09)*	1.021 (1.00–1.05)*
Transmission myths	1.005 (0.99–1.01)	1.010 (0.99–1.01)	1.001 (0.99–1.02)
Socio-demographic variables			
Religion			
Christian (ref)		1.00	1.00
Muslim		0.975 (0.95–0.99)*	0.979 (0.94–0.99)*
No religion		0.953 (0.87–1.04)	0.963 (0.88–1.05)
Traditionalist		1.001 (0.88–1.15)	1.032 (0.89–1.18)
Ethnicity			
Chewa		1.00	1.00
Tumbuka		1.023 (0.99–1.05)	1.015 (0.98–1.04)
Lomwe		0.965 (0.92–0.98)*	0.974 (0.92–0.99)*
Tonga		1.024 (0.98–1.07)	1.015 (0.97–1.05)
Yao		0.983 (0.94–0.99)*	0.955 (0.92–0.98)*
Sena		0.991 (0.95–1.09)	0.982 (0.96–1.01)
Ngoni		0.980 (0.92–1.03)	0.982 (0.93–1.03)
Other		0.971 (0.93–1.02)	0.970 (0.94–1.02)
Residence			
Urban		1.00	1.00
Rural		0.971 (0.94–0.99)*	0.973 (0.94–0.99)*
R/ship to h/head			
Son (ref)		1.00	1.00
Head themselves		1.031 (0.98–1.11)	1.041 (0.99–1.07)
Brother		0.993 (0.97–1.05)	0.990 (0.96–1.03)
Other		1.017 (0.97–1.26)	1.028 (0.97–1.14)
Socioeconomic status			
Wealth quintile			
Poorest	1.00	1.00	1.00
Poorer			0.991 (0.96–1.03)
Middle			0.989 (0.95–1.02)
Richer			1.014 (0.97–1.04)
Richest			1.017 (1.00–1.07)*
Education			
No education	1.00	1.00	1.00
Primary			1.03 (1.01–1.06)*
Secondary			0.994 (0.93–1.06)
Higher			1.043 (1.01–1.09)*
Sample size	2,459	2,459	2,459
Log pseudo	−738.941	−669.711	−599.12
Model sig (Wald)	24.76**	38.81**	77.94**

Time ratios are reported for all models

Statistical significance
* $p < 0.05$; ** $p < 0.001$

attenuated some of the effect of circumcision on the time to first sexual intercourse, its influence remained robust and persisted throughout the multivariate models.

Discussion and Conclusions

Findings of this study show that circumcision status may be associated with earlier initiation of sexual activity in never-married young men in Malawi. Given the links between early sexual debut and increased risk of HIV infection in regions heavily affected by the epidemic, findings of this study draw attention to informational, sociocultural and behavioral factors that need to be addressed in order to make male circumcision a more viable strategy for HIV prevention [20, 21].

This study also shows that of the three indicators measuring knowledge, only factual knowledge related to condom use maintained significance in the analysis. Specifically, young men who knew that a condom can reduce the risk of HIV/AIDS transmission experienced their first sexual intercourse later than those who did not know. This is generally consistent with the view that access to accurate information about HIV/AIDS is still vital for protecting youth against sexual risk [29].

The relationship between religion and the time to first sexual intercourse seems at odds with religious teaching in Malawi. Early initiation of sexual activity among Moslems suggests that while religion is an important force in proscribing sexual norms in Malawi, secular influences exerted by increasing migration and urbanization may be chipping away at some of these mores [59]. In addition, earlier age at first sexual intercourse among Lomwe and Yao youth may in part be due to the uniqueness of their cultural tradition as both ethnic groups traditionally practice sexual initiation rites for both girls and boys, including male circumcision. Studies have shown that these rites can reinforce a tendency for young men to initiate sex earlier as a sign of successful transition to adulthood [19].

This study also highlights the role of place context in shaping the risk of HIV/AIDS. Earlier sexual debut among rural young men may be linked to the fact that rural Malawi remains a hotbed of traditional cultural practices, including initiation rites. Some studies have argued that in preparing young people for adolescence and reproductive responsibilities in Malawi, more emphasis is often placed on teaching girls about reproductive implications of menarche, relative to what is expected of boys as sexual beings, leading to boys' greater indulgence in risky sexual practices [19, 26]. This underscores the need for policies aimed at changing religious and cultural practices which encourage early sexual onset, including raising awareness about dangers of early sexual initiation and the fact that circumcision does not provide full protection against HIV.

The protective effect of both wealth and education on early sexual intercourse as evident in this study raises important HIV/AIDS policy issues. Unlike other studies which have argued that individuals from economically well-off backgrounds are more likely to indulge in risky sexual behaviour because they tend to be desired or can use their social status to extort sexual favours [42], findings of this study are consistent with emerging studies which assert that household wealth can reduce adolescents' sexual risk-taking intentions and practices [43, 44]. This study therefore suggests that in a country devastated by poverty, economic empowerment at household level can help to restrain youth from engaging risky sexual practices and prevent the further spread of HIV. In this regard, the Malawi Social Cash Transfer Scheme—a pilot social safety net project introduced to reduce for ultra-poor and labour constrained households—holds a lot of promise regarding contributing to a reduction in risky sexual behaviour among youth in Malawi. This initiative, however, should be properly integrated within broader efforts to reduce the spread HIV/AIDS, as has been the case in other areas in Uganda [44]. Similarly, promoting schooling in young men can play a vital role in reducing risky sexual practices through improved ability to comprehend information about HIV/AIDS and increased sense of self-esteem and hope required for youth to be able to desist from risky sexual encounters. Thus, while the introduction of free primary education system in Malawi must certainly be lauded, findings of this study underscore the need to further improve access and retention of students in secondary and higher education as part of wider HIV prevention strategy.

The attenuation of time to first sexual intercourse among circumcised youth after controlling for knowledge, demographic, socio-cultural, and socioeconomic variables—implies that the link between circumcision and early sexual activity is in part accounted for by these factors. However, the fact that these well-known factors did not fully explain the increased propensity for early sexual initiation among circumcised youth raises interesting questions about additional factors that might account for the excess hazard in this particular group. Since the majority of the youth in Malawi are currently circumcised in their preteen and teenage, a possible explanation may be found in the theory of risk compensation. Our bivariate analysis revealed that compared to those who have not been circumcised, those who have been circumcised were also more likely to have a higher mean number of lifetime sexual partners, more likely to pay for sex, and less likely to use a condom during their last sexual act.

When viewed in light of previous published studies, the findings of this study are generally consistent with emerging evidence which has linked to circumcision to both a change in the public risk perception of HIV and a

possible change in sexual practices in Malawi [26, 27]. However, findings of this study also resonate with studies from elsewhere in the SSA region. In Kenya, for instance, while constraints such as the high cost of clinical circumcision and the fear of pain were allegedly important concerns, perceptions of greater sexual satisfaction and women's growing preference for circumcised young men nonetheless emerged as vital incentives for uptake of male circumcision [60].

The close association between circumcision and early sexual initiation as revealed in this study does not imply causation or that circumcision is primarily responsible for the high HIV prevalence in Malawi. In fact circumcision prevalence is still relatively low in the general population in Malawi. Indeed this low prevalence may be a barrier that undermines efforts to control the spread of the disease as stipulated in the country's current HIV/AIDS policy. However, in view of the findings of this study, the manner in which the male circumcision initiative is scaled up may have a profound effect on the epidemiology of HIV in Malawi. For instance, if a large number of youth decide to undergo circumcision with the belief of securing protection against infection or re-infection, the disease may accelerate. Similarly, longer waiting times and hygiene practices required for proper penile healing may be difficult to monitor and enforce if circumcision is scaled up in Malawi given the country's poor state of the public health infrastructure, low level of education and widespread poverty [61]. Furthermore, against a backdrop of unequal social relations of gender and high illiteracy, widespread male circumcision can exacerbate the vulnerability of women to HIV in Malawi.

These concerns underscore the need for targeted information and education aimed at challenging cultural practices that encourage sexual activity after circumcision and promote awareness that circumcision does not provide full protection against HIV. These findings also suggest that in order to improve the effectiveness of the male circumcision strategy, there is need for more emphasis on abstinence and consistent condom use, especially in newly circumcised youth. Targeted condom campaigns aimed at the newly circumcised should also be strengthened. Thus, the implementation of male circumcision as a strategy for HIV prevention may warrant an even more stringent policy emphasis on sexual abstinence or more consistent condom use.

Findings and conclusions of this study have potential limitations. Firstly, the findings may have been affected by potential cultural sensitivity associated with discussing sexual matters. An inclination to provide socially desirable responses may have introduced some bias in the data because the MDHS did not physically verify respondents' circumcision status, or validate the completeness of penile foreskin removal. Another potential limitation is that, by using cross-sectional data from an emergent social context, we are unable to draw causal inferences between age at first sex and circumcision status or make temporal predictions. The significance of this study should therefore be understood within the context that it provides valuable insights into the correlation between the practice of penile skin removal and sexual initiation in young unmarried Malawian men in ways that approximates trends in the existing population at the time of the study. While certainly not an evaluation of the male circumcision initiative, this study however, makes important contributions to the theoretical understanding of the links between circumcision and risky sexual behaviour, and stands to provide valuable input to the male circumcision program in Malawi.

References

1. Akwara AP, Madise JN, Hinde A. Perception of risk of HIV/AIDS and sexual behaviour in Kenya. J Biosoc Sci. 2003;35: 385–411.
2. Hallet TB, Gregson S, Lewis JJC. Sexual debut cross-generational sex and delaying age at epidemics: impact of reducing cross-generational sex and delaying age at sexual debut. Sex Transm Infect. 2007;83:i50–4. doi:10.1136/sti.2006.023606.
3. Hulton LA, Cullen R, Khalokho SW. Perceptions of the risks of sexual activity and their consequences among Ugandan adolescents. Stud Fam Plann. 2000;31(1):35–46.
4. Harrison A, Xaba N, Kunene P. Understanding safe sex: gender narratives of HIV and pregnancy prevention by rural South African school-going youth. Reprod Health Matters. 2001;9: 63–71. doi:10.1016/S0968-8080(01)90009-6.
5. Mkandawire P, Tenkorang E, Luginaah I. Orphan status and time to first sexual intercourse in Malawi. AIDS Behav. 2013;17:939–50. doi:10.1007/s10461-011-0120-y.
6. McGrath N, Nyirenda M, Hosegood V, Newell M-L. Age at first sex in rural South Africa. Sex Transm Infect. 2009;85:49–55.
7. Auvert B, Taljaard D, Lagarde E, Sobngwi-Tambekou J, Sitta R, Puren A. Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: the ANRS 1265 trial. PLoS Med. 2005;2:1112–22. doi:10.1371/journal.pmed.0020298.
8. Bailey RC, Moses S, Parker C, Agot K, Maclean I, Krieger JN, et al. Male circumcision for HIV prevention in young men in Kisumu, Kenya: a randomized controlled trial. Lancet. 2007;2007(369): 643–56.
9. Halperine DT, Bailey RC. Male circumcision and HIV prevention: 10 years and counting. Lancet. 1999;354:1813–5.
10. Szabo R, Short R. How does male circumcision protect against HIV infection? BMJ. 2000;320:1592–4.
11. Gray RH, Kigozi G, Serwadda D, Makumbi F, Watya S, Kiwanuka N, et al. Male circumcision for HIV prevention in men in Rakai, Uganda: a randomized trial. Lancet. 2007;367:657–66.
12. Drain P, Halperin DT, Hughes J, Klausner JD, Bailey C. Male circumcision, religion, and infectious diseases: an ecologic analysis of 118 developing countries. BMC Infect Dis. 2006;6:172. doi:10.1186/1471-2334-6-172.
13. Williams BG, Lloyd-Smith JO, Gouws E, Hinkins C, Getz W, Hargrove J, et al. The potential impact of male circumcision on HIV in sub-Sahara Africa. PLoS Med. 2006;3(7):1032–40.

14. World Health Organization. New data on male circumcision and HIV prevention: policy and implications. Geneva: WHO and UNAIDS; 2007.
15. Ntozi JPM. The East African AIDS epidemic and the absence of male circumcision: what is the link? Health Transit Rev. 1995;5:95–117.
16. Pinkerton SD. Sexual risk compensation and HIV/STD transmission: empirical evidence and theoretical considerations. Risk Anal. 2001;21:727–36.
17. Marck J. Aspects of male circumcision in sub-equatorial African culture history. Health Transit Rev. 1997;7:337–59.
18. Oluwemimo J, Dryden-Peterson S, Okui L, Smeaton L, Megetse J, Makori L, et al. Acceptability of male circumcision among adolescent boys and their parent, Botswana. AIDS Behav. 2012;16:340–9. doi:10.1007/s10461-011-9929-7.
19. Munthali A, Zulu E. The timing and role of initiation rites in preparing young people for adolescence and responsible sexual and reproductive behaviour in Malawi. Afr J Reprod Health. 2007;11(3):150–6720.
20. Cassells M, Halperin DT, Shelton JD, Shanton D. Risk compensation: the Achilles' heel of innovations in HIV prevention. BMJ. 2006;2006(332):605–7.
21. Kalichman S, Eaten L, Pinkerton S. Circumcision for HIV prevention: failure to fully account for behavioural risk compensation. PLoS Med. 2007;4(3):e135–6.
22. Mattson CL, Campbell R, Bailey RC, Agot K, Ndinya-Achola JO, Moses S. Risk compensation not associated with male circumcision in Kisumu, Kenya: a multi-faceted assessment of men enrolled in a randomized control trial. PLoS One. 2008;3(6):e2443.
23. Kong X, Kigozi G, Nalugoda F, et al. Assessment of changes in risk behaviours during 3 years of posttrial follow-up of male circumcision trial participants uncircumcised at Trial Closure in Rakai, Uganda. Am J Epidemiol. 2012;178(10):875–85.
24. Bridges JFP, Selck FW, Gray GE, McIntyre JA, Martinson NA. Condom avoidance and determinants of demand for male circumcision in Johannesburg, South Africa. Health Policy Plan. 2011;2:298–306.
25. Grund JM, Hennink M. A qualitative study of behavioural change and risk compensation following adult male circumcision in urban Swaziland. AIDS Care. 2011;24(2):245–51.
26. Ngalande RC, Levy J, Kapondo CPN, Bailey RC. Acceptability of male circumcision for prevention of HIV infection in Malawi. AIDS Behav. 2006;10:377–85.
27. Godlonton S, Munthali A, Thornton R. Behavioral response to information? Circumcision, information, and HIV prevention. University of Michigan Working Paper; 2011.
28. Bongaarts J. Late marriage and the HIV epidemic in sub-Saharan Africa. Popul Stud. 2007;61(1):73–83.
29. Fisher JD, Fisher WA. Changing AIDS-risk behavior. Psychol Bull. 1992;3:455–74.
30. Zellner SL. Condom use and accuracy of AIDS knowledge in Cote d'Ivoire. Int Fam Plan Perspect. 2003;29(1):43–7.
31. Barden-O'Fallon J, deGraft-Johnson J, Bisika T, Sulzbach S, Banson A, Tsui AO. Factors associated with HIV/AIDS knowledge and risk in rural Malawi. AIDS Behav. 2004;8(2):131–40.
32. Campbell C. Migrancy, masculine identities and AIDS: the psychosocial context of HIV transmission on the South African gold mines. Soc Sci Med. 1997;45(2):273–81.
33. Luginaah I. Local gin (akpeteshie) and HIV/AIDS in the Upper West Region of Ghana: the need for preventive health policy. Health Place. 2008;14:806–16.
34. Tenkorang E, Gyimah S, Maticka-Tyndale E, Adjei J. Superstition, witchcraft and AIDS prevention in sub-Saharan Africa: the case of Ghana. Cult Health Sex. 2011;13(9):1001–14.
35. Urassa M, James T, Ties J, Hayes R, Isingo R. Male circumcision and susceptibility to HIV infection in Tanzania. AIDS. 1997;11(1):73–80.
36. Heike B. The rise of occult powers, AIDS and the Roman Catholic Church in Western Uganda. J Relig Afr. 2007;37:41–58.
37. Trinitapoli JA, Regnerus MD. Religion and HIV risk behaviors among married men: initial results from a study in rural sub-Saharan Africa. J Sci Study Relig. 2006;45:505–28.
38. Ntseane PG, Preece J. Why HIV/AIDS prevention strategies fail in Botswana: considering discourses of sexuality Peggy Gabo. Dev South Afr. 2005;22(3):347–63.
39. Leclerc-Madlala S. Cultural scripts for multiple and concurrent partnerships in southern Africa: why HIV prevention needs anthropology. Sex Health. 2009;6(2):103–10.
40. Feldacker C, Emch M, Ennett S. The who and where of HIV in Malawi: exploring the effects of person and place on individual HIV status in Malawi. Health Place. 2010;16:996–1006.
41. Benson T, Chamberlin J, Rhinehart I. An investigation of the spatial determinants of local prevalence of poverty in rural Malawi. Food Policy. 2005;30:523–50.
42. Chirwa W. Migrant labour, sexual networking and multi-partnered sex in Malawi. Int Migr Rev. 1997;S3(7):5–15.
43. Ssewamala F, Han C, Neilands T, et al. Effects of assets on sexual risk-intentions among orphaned adolescents in Uganda. Am J Public Health. 2010;100(3):483–8.
44. Kim JC, Watts CH, Hargreaves JR, et al. Understanding the impact of a microfinance-based intervention on women's empowerment and the reduction of intimate partner violence in South Africa. Am J Public Health. 2007;97(10):1794–802.
45. Msisha WM, Kapinga SH, Earls F, Subramanian SV. Socioeconomic status and HIV seroprevalence in Tanzania: a counterintuitive relationship. Int J Epidemiol. 2008;37:1297–303.
46. Kimuna SR, Djamba YK. Wealth and extramarital sex among men in Zambia. Int Fam Plan Perspect. 2005;31(2):83–9.
47. Guiella G, Madise NJ. HIV/AIDS and sexual-risk behaviour among adolescents: factors influencing the use of condoms in Burkina Faso. Afr J Reprod Health. 2007;11(3):182–96.
48. Michelo C, Sandøy IF, Knut F. Marked HIV/AIDS prevalence declines in higher educated young people; evidence from population-based surveys (1995–2003) in Zambia. AIDS. 2006;20(7):1031–8.
49. Hargreaves JR, Glynn JR. Educational attainment and HIV-1 infection in developing countries: a systematic review. Trop Med Int Health. 2002;7:489–98.
50. World Health Organization. Progress in scale-up of male circumcision for HIV prevention in east and southern Africa. Geneva: WHO; 2010.
51. Government Malawi. Malawi Demographic and Health Survey Report. Lilongwe: Ministry of Health; 2010.
52. Government Malawi. Malawi HIV prevention strategy 2009–2013. Lilongwe: National AIDS Commission; 2009.
53. Government Malawi. Malawi welfare monitoring survey report. Zomba: Malawi Government; 2009.
54. Rennie S, Muula AS, Westreich D. Male circumcision and HIV prevention: ethical, medical and public health tradeoffs in low income countries. J Med Ethics. 2007;33:357–61.
55. Lawless JF. Statistical models and methods for lifetime data. New York: Wiley; 1982.
56. Royston P. The lognormal distribution as a model for survival time in cancer, with an emphasis on prognostic factors. Stat Neerl. 2001;55:89–104.
57. Willet JD, Singer JB. Applied longitudinal data analysis: modeling change and event history. New York: Oxford University Press; 2003.
58. Tabachnick BG, Fidell LS. Using multivariate statistics. Boston: Pearson; 2008.
59. Bryceson DF, Fonseca J. Risking death for survival: peasant responses to hunger and HIV/AIDS in Malawi. World Dev. 2006;348:1654–66.

60. Mattson CL, Bailey RC, Muga R, Poulussen R, Onyango T. Acceptability of male circumcision and predictors of circumcision preference among men and women in Nyanza Province, Kenya. AIDS Care. 2005;17(2):182–94.

61. Lie RK, Miller FG. What counts as reliable evidence for public health policy: the case of circumcision for preventing HIV infection. BMC Med Res Methodol. 2011;11:34. http://www.biomedcentral.com/1471-2288/11/3454.