Safe male circumcision

Young men's willingness to undergo Safe Male Circumcision (SMC) decreases with increased educational attainment in some rural areas of Central Uganda

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Abstract

Safe male circumcision (SMC) decreases risk of HIV transmission (Weiss et al., 2008a). Mathematical modeling indicates that in order to yield significant declines in HIV prevalence in sub-Saharan Africa, wide adoption of SMC is necessary (Nagelkerke, Moses, de Vlas & Bailey, 2007). Therefore, research about trends and determinants of uptake of SMC among historically non-circumcising groups in this region is essential. This cross-sectional study explored the relationship between educational attainment and young men's willingness to undergo SMC in rural areas of central Uganda. Sub-counties were randomly selected in three districts (Mukono, Wakiso and Kiboga) and a standardized survey was administered to 297 male youths (aged 18-24). Focus group discussions were also held in each district to gauge attitudes towards SMC. Survey data was analyzed using stepwise logistic regression in STATA 11.0. Respondents with higher educational attainment had lower willingness to undergo SMC after adjusting for selected demographic variables [OR=0.20; p=0.0010]. In parametric path analysis, there was marginal evidence, p= 0.0597 (Goodman test), that awareness of SMC benefits is a partial mediator in the causal pathway between education and willingness. These findings indicate that willingness to undergo SMC in central Uganda decreases with increased educational attainment. This disparity could decrease the impact of SMC on HIV prevalence in Uganda.

Introduction

Uganda is often lauded as a success story in the fight against HIV/AIDS, having reduced prevalence from over 18% (in rural areas) and 25-30% (in urban areas) in the early 1990s to current national estimates of 6.5% (UNAIDS, 2010). This has been largely attributed to the government's Abstain, Be faithful, Use Condoms (ABC) campaign, which was rigorously implemented in both rural and urban areas. However, this rapid decline phase was followed by stabilization in prevalence between 6.1% and 6.5% and has remained here since 2000 (UNAIDS, 2010), highlighting the limitations of the ABC strategy in decreasing prevalence. This stall in the decline of HIV prevalence has led to calls for a broader and more comprehensive prevention strategy that integrates different empirically-proven prevention approaches with the ABC campaign (Piot, Kazatchkine, Dybul & Lob-Levyt, 2009). One such approach is safe male circumcision (SMC), which has been shown to decrease risk of HIV transmission (Weiss et al., 2008a).

The effectiveness of SMC in decreasing HIV prevalence has been shown by previous ecological and observational studies that demonstrate an inverse relationship between male circumcision (SMC) prevalence and HIV-1 prevalence (Weiss, Quigley & Hayes, 2000; Bailey et al., 2007). Similarly, a meta-analysis of randomized controlled trials conducted in Uganda, Kenya, and South Africa revealed that SMC decreased heterosexual risk of HIV-1 transmission by approximately 60% (Weiss et al., 2008a). The results of these trials led the WHO to recommend in 2006 that SMC be included among global HIV prevention strategies (WHO, 2006). As a result, numerous countries in sub-Saharan Africa with high HIV prevalence and low SMC prevalence are now integrating SMC into their HIV prevention programs. In Uganda, the Ministry of Health drafted SMC policy in 2010 with the goal of including SMC as part of a comprehensive national HIV prevention program (MOH, 2010). This policy is relevant to the fight against HIV in Uganda, as the 2005 National Sero-behavioral Survey reported that only 24.9% men aged 15-59 were circumcised (MOH, 2006). The survey also found regional disparities in circumcision prevalence with highest prevalence observed in the Eastern region (54.7%) and lowest prevalence in the Northern region (less than 10%) (MOH, 2006).These findings are largely a result of cultural factors. For instance, Eastern Uganda is heavily populated by two traditionally circumcising tribes: the Gishu and the Sebei.

Table 1: Distance to Nearest Health Facility of Households by District

District	Up to 5km*(%)	Over 5km**(%)
Mukono	130,843(70.00)	57,124 (30.00)
Kiboga	29,175(56.90)	22,130 (43.10)
Wakiso	186,128(36.80)	32,014 (63.20)

* Indicates close proximity to health facility.
**Indicates substantial distance to health facility.
Source: Uganda Bureau of Statistics Census Report, 2002.

Despite the potential of SMC to reduce HIV prevalence, concerns remain about uptake in regions where SMC rates have historically been low (Muula, 2007). Consequently, numerous studies have investigated the determinants of uptake of SMC among different groups, including women, young men and other individuals from traditionally non-circumcising tribes (Bailey, Muga, Poulussen & Abicht, 2002; Kebaabetswe et al., 2003; Lukobo & Bailey, 2007; Mattson, Bailey, Muga, Poulussen & Onyango, 2005; Scott, Weiss & Viljoen, 2005). But most of these studies are qualitative, leaving little quantitative data about the determinants of SMC uptake. In Uganda, for instance, only one study (Wilcken, Miiro-Nakayima, Hizaamu, Keil & Balaba-Byansi, 2010) has quantitatively assessed the determinants of SMC. That study found that among youth (both males and females) aged 18-24 (n= 185) in rural areas, those with higher educational attainment (completed primary education vs. completed secondary education) had lower awareness of SMC's role in preventing HIV (SMC benefits) (Wilcken et al., 2010). In analysis, the study found marginal evidence that

educational attainment was the main explanatory variable for this difference (Wilcken et al., 2010), suggesting a possible negative relationship between educational attainment and awareness of SMC for HIV prevention among youth in rural areas. In addition, since awareness of SMC benefits is likely to lead to uptake of the procedure, these results suggest that more educated youth might be less willing to undergo SMC.

The purpose of this study was to investigate the relationship between educational attainment (completion of primary education only vs. completion of secondary education and higher) and young males' (ages 18-24) willingness to undergo SMC in rural areas of central Uganda.

Selection of explanatory variables

The World Health Organization identifies some of the determinants of global SMC prevalence in a review of the literature (WHO, 2007). Religion, ethnicity, social desirability (cultural reasons), knowledge of SMC benefits and socioeconomic factors (income and education) are described as important determinants of SMC prevalence in that review (WHO, 2007). In sub-Saharan Africa, for example, the review notes that Muslims are more likely to be circumcised compared to men of other religions, and that SMC prevalence varies by tribe. The influence of socioeconomic status on SMC is also discussed, with consistent trends observed in developed countries (there is a positive relationship between SMC prevalence and higher socioeconomic status). However, this pattern is ambiguous in Africa. For instance, in Lesotho, there is a negative relationship between higher socioeconomic status and SMC prevalence, while the reverse is true in Tanzania, for example (Fig 1).

Acceptance of SMC among non-circumcising groups in sub-Saharan Africa has been studied in numerous qualitative studies (Bailey, Muga, Poulussen & Abicht, 2002; Kebaabetswe et al., 2003; Lukobo & Bailey, 2007; Mattson, Bailey, Muga, Poulussen & Onyango, 2005; Scott, Weiss & Viljoen, 2005). These studies generally report knowledge of SMC benefits (hygiene, decreased risk of HIV/AIDS, STIs and other factors) as an essential determinant of acceptability. But these studies do not report quantitative measures of association and have largely focused on awareness of SMC benefits as a determinant, leaving little information about the influence of other determinants of SMC. Moreover, a search of the literature revealed that in Uganda, for example, only one study (Wilcken et al., 2010) has used a quantitative approach to investigate the determinants of SMC. In that study education, age, sex, employment status, district, ethnic group and circumcision status were intuitively selected as predictors of awareness of SMC, with educational attainment emerging as an important determinant of awareness of SMC benefits among youth.

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From the above studies, awareness of SMC benefits, socio-demographic factors and socioeconomic status emerge as important determinants of SMC. But socio-demographic and socioeconomic variables present a number of concerns in model building, ranging from internal validity issues (from the use of proxies) in measuring socioeconomic status to potential multicollinearity resulting from high correlation between some of these predictors (Gorman, 2010). One study (Achia et al., 2010) addressed some of these concerns in an analysis of socioeconomic determinants, using DHS data from Kenya. In a forward stepwise logistic modeling approach examining socioeconomic status as the outcome, a best-fit model of socioeconomic predictors was determined. This model contained the following explanatory variables: education, age, region, religion, type of residence (rural vs. urban) and ethnicity, indicating that these variables are essential indicators of socioeconomic status in sub-Saharan Africa (Achia et al., 2010).

Based on the above review, the following variables were included in our model as some of these capture socioeconomic and sociodemographic variables simultaneously, reducing the potential for collinearity and improving model parsimony: education (explanatory variable of interest), religion, ethnicity (tribal affiliation), district and marital status. Age, SMC status, sex and type of residence (rural) were all constants in our model. Owing to the dearth of quantitative studies examining the effect of these variables on SMC, we opted to use a forward stepwise approach in our analysis, introducing explanatory variables at each stage, as recommended in exploratory research (Menard, 1995).

Table 2: Multivariate Logistic Regression
Independant Variable **
Dependent Variable: Personal Willingness to Undergo SMC

Type	OR	P-Value	ln(OR)	Var(lnOR)	Δ Var	Bias²	MSE
Crude (unadj)	0.28	0.002	-1.28	-1.76	0.27	0.096	0.366
Saturated	0.20	0.001	-1.59	-1.49	0.00	0.000	0.000
District	0.22	0.001	-1.50	-1.66	0.17	0.008	0.178
Marital	0.29	0.005	-1.23	-1.66	0.17	0.130	0.300
Tribal Affiliation	0.25	0.001	-1.38	-1.72	0.23	0.044	0.274
Religion	0.28	0.002	-1.28	-1.74	0.25	0.096	0.346

**Independent Variable in the Crude Model==Educational Attainment. The saturated model is fully adjusted and contains all the suspected confounder variables (Region, Marital Status, Tribe, and Religion).

Methods

This cross-sectional study was conducted in rural areas of 3 districts (Mukono, Wakiso and Kiboga) in central Uganda from June to August 2011. Rural areas in Uganda are defined as areas with mostly poor road infrastructure (predominantly marum roads), limited motorized transportation in the area and high prevalence of subsistence farming (Kobusingye, Guwattude & Lett, 2001). We used a mixed methods approach, collecting quantitative data by means of survey administration and qualitative data using focus group discussions.

Approval to conduct the study was sought from Duke University's Institutional Review Board (IRB) and the Uganda National Council of Science and Technology (UNCST).

Sampling:

We used privately-owned software (Research Randomizer™) to randomly select counties in which to administer surveys (Urbaniak & Plous, 2011). Using the same software, we randomly selected secondary schools from an online database. In power calculations, using Russ Lenth's power and sample size calculator (Lenth, 2006), we generated a sample size of 283 participants (margin of error of 0.0495, 95% CI).

To control for non-response from some of the participants, we adjusted the sample size to 300 participants (assuming a 95% response rate).

Selection of study participants:

In Uganda, the majority of secondary schools (ages 12 through 18) are boarding schools. This factor necessitated a convenience sampling strategy on our part, since sampling in the community (such as at local markets or other gathering areas) would have skewed the data towards participants with lower education (since they are not in school). So, we sought to collect data from two groups—currently in-school participants and currently out-of-school participants—dividing our sample equally between the two groups. We believed that this approach would enable us capture an array of educational attainment among study participants, with in-school participants mostly having

Table 3: Stratifying the relationship between educational attainment and willingness based on district

District	OR(crude)	OR(adjusted)
Mukono	1.17(p=0.84)	1.09 (p=0.929)
Kiboga	0.18(p=0.041)	0.25 (p=0.132)
Wakiso	0.11(p=0.001)	0.04 (p=0.001)

higher educational attainment and out of school participants having lower education.

For in-school participants, we sought 150 survey participants (18-24). Dividing this across the three districts, the target sample of schools per district was set to five schools, each in a different sub-county within the districts, with a goal of collecting ten surveys per school. We selected ten schools per district in order to compensate for defunct schools (since the Ministry of Education's records are not regularly updated, some defunct schools appear on the list) as well as unwillingness to participate in the study. For out-of-school participants, we surveyed 150 casual laborers/ working cohorts, such as boda-boda cyclists and car-wash bay workers, divided equally among the three districts, in the same sub-counties as the selected schools. These individuals tend to congregate in small groups called "stages." In order to decrease the potential for selection bias introduced by this convenience sampling strategy, we administered a maximum of ten surveys at each "stage." The inclusion criterion for these participants was restricted to fulfillment of the age requirement (ages between 18 and 24).

Pre-testing & data collection:

Surveys were pre-tested by our study collaborators (Communication for Development Foundation Uganda—CDFU) among a randomly selected group of ten young men in Kawempe, resulting in minimal changes to the instrument. The surveys were also translated in to "Luganda" (the tribal language predominantly spoken in this area) and back-translated into English to ensure accuracy. Survey administration was self-administered among in-school participants and literate out-of-school participants. For out-of-school participants with low educational attainment, survey administration was conducted by interviewers, who received two-day training facilitated by CDFU.

> Decreased willingness to undergo SMC among more educated youths in Uganda initially seems counterintuitive, and the reasons behind this observation are not entirely clear.

Variables and Measurement

Independent Variable

The independent variable in this study was educational attainment. This variable was measured using an ordinal scale (ranging from no education to completed secondary education) adapted, with modifications, from the 2009 Tanzania MOH MC Situational Analysis Report (MOHSW, 2009) (see appendix). The range of this scale ensured accurate measurement of a respondent's educational attainment, especially for those who had dropped out before completing a particular level.

Dependent Variable

The dependent variable in this study was willingness to undergo SMC, which was assessed using an open-ended question after the respondent's circumcision status had been determined. First, the circumcision status of participants was assessed using the closed-ended question "Are you circumcised?" (Yes/No). Then, for uncircumcised men, the primary outcome of the study was assessed using the question "Would you be willing to undergo SMC?"(Yes/No/Undecided) followed by the open-ended question 'Why or why not?" To avoid bias, survey participants were not given any information regarding SMC benefits until after they completed the survey.

Statistical Analysis

We used stepwise logistic regression in STATA 11.0 to assess the relationship between the independent variable (educational attainment) and the outcome of interest (willingness to undergo SMC given that one was currently uncircumcised). We also conducted parametric path analysis (MacKinnon, 1994) to investigate the indirect and direct effects between educational attainment and willingness to undergo SMC, mediated by awareness of SMC benefits.

Coding variables

The independent variable (educational attainment) was coded as a disjoint indicator variable with 3 levels: Education=0: had no education and those who did not complete primary school; Education=1 (referent group): had completed primary school but had not completed their O-level (the first four years of secondary school); Education=2: Anyone who had completed O-level education and higher (see appendix). Owing to power concerns, we used "completed primary" as our referent group (note that we had only one participant who had no education at all, for example).

The dependent variable (willingness to undergo SMC) was coded as a dummy variable (0=not willing to undergo SMC, 1=willing to undergo SMC).

Multivariate Analysis

We used a stepwise approach to investigate whether the relationship between the independent variable and outcome of interest was affected by other variables. We individually introduced selected explanatory variables into a crude (unadjusted) model and then observed whether the newly introduced variable substantially changed the effect measure estimate (OR), and whether this change was statistically significant ($p<0.05$). We then computed a Mean Squared Error (MSE) for each adjustment, comparing these to the fully-adjusted model, using the formula MSE = (bias)2+(Δvariance). This step enabled us to assess any projected loss in precision arising from inclusion of the explanatory variable in the model.

Results

Demographics

We had a total of 297 respondents for the surveys, nearly equally distributed among the three districts: 101 respondents in Kiboga (34.01%), 94 respondents in Mukono (31.65%) and 102 respondents in Wakiso (34.34%). The respondent ages ranged from 17 to 40 years, with 94.61% falling in the desired 18-24 age range. Participants outside the desired age range were not included in analysis. Distribution of participants was also equal among both cohorts (in school and out of school), with 49.49% of total respondents being in school and the remainder (50.51%) being out of school. Educational attainment differed between the two cohorts as over 80% of in-school participants had completed O-level compared to only about 20% of out of school participants.

We found 18.75% prevalence of circumcision among traditionally non-circumcizing groups. We also found that in Wakiso and Kiboga, SMC prevalence was higher among more educated individuals. In Mukono, however, lower-educated participants had higher SMC prevalence (Fig 3).

Logistic Regression Analysis

Multivariate Analysis

In a stepwise approach, we introduced selected explanatory variables into our crude model (district, marital status, tribal affiliation and religion) and computed MSE values for adjustments to the model. In the crude model, we obtained an odds ratio of 0.28 indicating that the odds of willingness to undergo SMC among those who completed a secondary school education were 0.28 times the odds of those who completed only a primary education (p=0.002; CI: 0.12-0.62).

We found the OR in the fully adjusted model (OR=0.20; p=0.001) slightly lower than the OR in the crude model (OR=0.28; p=0.002), indicating minor confounding or possible effect measure modification by some of the explanatory variables. When we computed MSE values for the explanatory variables, we found that marital status introduced the most bias in the adjusted model (bias = 0.130; MSE = 0.30). Conversely, we found that district introduced the least bias in the adjusted model (bias = 0.008; MSE = 0.178) and the highest change in the coefficient of the OR, so we stratified the data based on district (Table 3).

What role does awareness of SMC benefits play in the pathway between educational attainment and SMC willingness?

Previous studies indicate a positive correlation between awareness of SMC benefits and willingness to undergo SMC, although they do not compute a measure of association. These findings imply that awareness might be a mediator in the pathway between educational attainment and willingness (see Fig 2). To investigate this assumption, we used the Barron & Kenny parametric method of mediation analysis (MacKinnon, 1994) as explained below:

Pathway based on study conceptual model (see Fig 2 for complete conceptual model):

Educational attainment (X) --> Awareness of SMC Benefits (M) --> Willingness to undergo SMC (Y)

(1) Y = c X + e1 The independent variable (X) causes the outcome variable (Y)

(2) M = a X + e2 The independent variable (X) causes the mediator variable (M)

(3) Y = c' X + bM + e3 The mediator (M) causes the outcome variable (Y) when controlling for the independent variable (X). This must be true (MacKinnon, 1994; Judd & Kenny, 1981a; Judd & Kenny, 1981b)

From this analysis, we observe that c' <c (table 5 (2)), fulfilling the condition for partial mediation by M in the causal pathway (MacKinnon, Fairchild & Fritz, 2007), with 14% of the total effect mediated by M. A Sobel-Goodman test (Preacher & Leonardelli, 2001) for the significance of the mediated effect revealed a marginally statistically significant p-value of 0.0597 (Goodman test) for the indirect effect in the pathway.

Discussion and conclusion

Key findings of the study

The distribution of circumcision prevalence among our participants was similar to that reported in the 2005 Sero-Behavioral Survey (MOH, 2006), with Muslims and Bagishu most likely to be circumcised. At least 32% of participants reported being circumcised, a percentage that is higher than the national average of about 22%. When we excluded participants from traditionally circumcising groups (Muslims, Bagishu,Sebei and Sabinyi), we found SMC prevalence close to the national average (18.75%).

In the18-24 age group, we found a negative relationship between educational attainment and willingness to undergo SMC, although results from Mukono were not statistically significant. This relationship is potentially mediated by awareness of SMC benefits, indicating that lower awareness of SMC benefits among more educated youth is partly responsible for decreased willingness to get circumcised.

During focus group discussions, participants with awareness of SMC for HIV prevention frequently stated radio as the source of this information, highlighting the importance of this medium in disseminating information. Participants also mentioned hygiene and increased sexual sensitivity as key reasons to get circumcised (appendix).

Discussion

Decreased willingness to undergo SMC among more educated youths in Uganda initially seems counterintuitive, and the reasons behind this observation are not entirely clear. One factor that could explain this trend, as we demonstrate in this study, is lower awareness of SMC benefits among those with higher educational attainment. Lack of awareness of SMC benefits in this cohort might be a result of narrowly-focused HIV prevention education programs targeted towards this group. Official HIV prevention education programs for youth in school, for example the Presidential Initiative on Aids Strategy for Communication to Youth (PIASCY), often focus on abstinence while simultaneously shunning other methods of HIV prevention (Human Rights Watch, 2005). Critics argue that this strategy is not only impractical, but also potentially counterproductive as it leaves these youth uninformed about other methods of HIV prevention (Human Rights Watch, 2005). Moreover, Uganda's SMC policy (MOH, 2010) does not state whether SMC will be included as part of HIV prevention education campaigns in secondary schools. It remains unclear to what extent such policies contribute to decreased awareness of SMC benefits and, subsequently, willingness to undergo the procedure in this cohort.

The disparity in willingness to undergo SMC between those with high education and those with low education could potentially decrease the impact of SMC on HIV prevalence.

But, lack of awareness of SMC benefits is only a partial mediator in the causal pathway between educational attainment and willingness to undergo SMC, pointing to influence by other factors. One such factor could be differences in access and awareness of other HIV prevention methods. For instance, the 2005 serobehavioral survey (MOH, 2006) found that youth with higher educational attainment were more likely to have used a condom at first intercourse compared to their less educated peers (Table 4). So, access to other HIV prevention methods might lead more educated youth to perceive SMC as unnecessary. Conversely, youth with lower education, due to lack of access to other HIV prevention methods, might view SMC as an economically-efficient method of HIV prevention. Moreover, it appears that stated willingness is more likely to translate to uptake among the less educated than among the more educated. For instance, in Mukono, the district with the highest proportion of households with close proximity to a health center (used as a proxy for better access) among all districts in our study, SMC prevalence is nearly double among the less educated yet stated willingness to undergo SMC is nearly similar between both groups (Figure 3; Table 1). These findings suggest that in regions with high access to health facilities, individuals with lower education are more likely to seek SMC services.

The disparity in willingness to undergo SMC between those with high education and those with low education could potentially decrease the impact of SMC on HIV prevalence. For instance, there is a potential to avert more cases of HIV among youth currently enrolled in secondary school, since they are less likely to have reached sexual debut compared to their counterparts with less education (Table 5) (MOH, 2006). But, with decreased willingness to undergo SMC in this cohort, this opportunity could be missed. This could also have economic ramifications, since averting premature mortality and morbidity in this cohort promises future economic benefits for Uganda in terms of a healthy and highly educated workforce.

Increased willingness to undergo SMC among less educated youth should be interpreted cautiously as it could signal inaccurate in-

Table 4:HIV risk profile by educational attainment among youth (15-25) in Uganda

Educational Level	Had sex before 18 (%)	Condom use at first sex (%)
No Education	53.50	18.70
Primary Complete	50.20	24.80
Secondary+	43.20	48.30

formation about SMC benefits in this cohort. Exaggerated views about the protective role of SMC can lead to risk compensation. This observation is evident in Lesotho, where an econometric analysis found that SMC does not appear significant in explaining HIV status; moreover, it appears as a risk factor for HIV in this setting (Keeletsang, 2010). In Lesotho, SMC prevalence among those with no education is nearly three times SMC prevalence among those with secondary education (WHO, 2007). Yet, HIV prevalence among those with low education is nearly double the prevalence among those with higher education (Keeletsang, 2010). This anomaly could be attributed in part to potential risk compensation among those with lower education who undergo SMC (Keeletsang, 2010). These trends raise a crucial question: Do the less educated eagerly seek out SMC because they think that it confers full protection from HIV? Factors driving increased willingness among the less educated should be investigated.

Limitations of the Study

Our study was conducted in central Uganda, a region that is predominantly occupied by the Baganda. As such, the results of this study cannot be generalized to the entire country.

This study was conducted in three districts and the sample size was 297. While in power calculations we determined this to be sufficient to detect differences between in-school and out-of-school youth, a study with greater sample size and district coverage could provide more power and results that are more generalizable to other regions in Uganda.

Since circumcision status was self-reported, there could have been some misclassification bias, which could have affected the circumcision prevalence reported in our results section. This bias has been reported in previous studies, whereby some participants who self-reported as circumcised were found to be misclassified after physical examination (Weiss et al., 2008b). But that study also found that 99% of uncircumcised males self-report correctly. Since this was the group used in analysis, it is highly unlikely that this bias affected our effect measures.

This was a cross-sectional study and as such does not provide information about how willingness changes over a longer time frame. Future studies could use a prospective study design to account for time.

There might have been some selection bias in selection of in-school participants, since participation depended on availability when we arrived at the schools. But during study design, we attempted to decrease selection bias using randomization to select sub counties and schools.

We are also unable to guarantee the honesty of participants' responses, when they were asked about willingness and whether willingness translates into uptake of SMC.

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