# Male Circumcision and HIV Infection: The Case of Malawi*

Michelle Poulin**
Post-Doctoral Fellow
Population Studies Center
University of Pennsylvania
poulinmj@pop.upenn.edu

Adamson S. Muula
Department of Community Health
University of Malawi, College of Medicine
Blantyre, Malawi
muula@email.unc.edu

*Paper prepared for presentation at the 2007 Population Association of America's Annual Meeting, New York, New York.

**Corresponding author. The findings in this paper are preliminary; please kindly contact the author before citing or circulating.

**Abstract:**
Observational studies in various settings have found consistent, significant, and negative associations between male circumcision and HIV infection, and circumcision's protective effect has been confirmed recently by randomized control trials in South Africa, Uganda, and Kenya. Yet population-based data from husbands and wives (N=2240) from the 2004 wave of the Malawi Diffusion and Ideational Change Project (MDICP) present an interesting anomaly. When comparing HIV prevalence rates across the MDICP's three study sites in the country's three main administrative regions, we find that the region home to the highest HIV prevalence (8.6%) is also where most husbands (80%) are circumcised. Individual-level analyses using logit/probit models within this region, southern Balaka, do show a negative relationship between circumcision and infection status, but our data further find that certain behaviors, and possibly STI status, supersede the protective effect of male circumcision. These findings are expected to be important considerations for prevention policies.

## Introduction

For several years, a sizeable number of observational and randomized controlled studies found a significant, negative association between male circumcision and HIV prevalence in sub-Saharan Africa and elsewhere (e.g., Auvert et al. 2001; Bailey et al. 2001; Cameron et al. 1989; Reynolds et al. 2004; Weiss 2000). The recently published and widely publicized randomized, controlled experiments conducted by Auvert and colleagues (2005) in Orange Farm, South Africa, Bailey et al. (2007) in Kenya and Gray et al. (2007) in Rakai, Uganda, casually confirm the protective effects of MC on the acquisition of HIV for men. Biological mechanisms, such as a reduction in the total number of HIV target cells (which are numerous in the foreskin) and a reduction in the viability of HIV on the penis after sexual contact, as the main direct factor accounting for the protective effect. Across the continent of Africa, ecological mappings of HIV prevalence with male circumcision depict areas that in areas where male circumcision is generally practiced (West Africa), HIV prevalence is lowest (West Africa), and where circumcision is not typically practiced, HIV prevalence is highest (see Halperin and Bailey 1999; also Werker, Ahuja, and Wendell 2006). Subsequently, policy-makers and the research community are now emphasizing the importance of making MC available in high-afflicted countries as a means to prevent infection (e.g. Szabo and Short 2006).

A few studies do *not* find a correlation between MC and HIV infection (e.g. de Walque 2005). de Walque (2005) finds no association between MC and HIV in five countries in sub-Saharan Africa using DHS data, and that religion, ethnicity, wealth, and education do not explain this lack of a relationship. De Walque (2005) does show

significant correlations between circumcision and risky sexual behaviors, even after controlling for a "long range of personal characteristics" suggesting that unobservable traits might be associated with those characteristics (p. 17)[1]. In several countries higher rates of circumcision, for instance, are associated with a greater number of non-spousal sexual partnerships. These population-based data take on greater salience when considering that many MC-HIV observational studies are based on high-risk groups. In the present paper, we explore further the relationship between male circumcision and HIV by using also a population-based sample of women and men (N=2240) in rural Malawi.

Population-based data from rural Malawi—the setting of current inquiry—finds, however, an interesting anomaly, with the aggregate association between MC and HIV standing in contrast to these other works. Using the Malawi Diffusion and Ideational Change Project (MDICP)'s 2004 wave, our data show that at a macro-level, in the central and northern regions of the country, where circumcision is not practiced, the prevalence of HIV is lower than it is the southern region, where male circumcision is much more common, typically among the Yao as part of initiation ceremonies. This paper is an exploration of this finding.

**Data**

Data for this research come from the 3rd wave of the Malawi Diffusion and Ideational Change Project (MDICP). The MDICP is an ongoing, four-phase panel study with 125 villages in total and generally aims to investigate the role of social processes in

[1] De Walque (2005) is careful to point out that his evidence does not suggest male circumcision to be unprotective against HIV.

modern family planning and HIV/AIDS. The MDICP takes place in three districts of the country—Rumphi in the north, Balaka in the south, and Mchinji in the center—that are contrasted from each other in important socio-demographic, economic, and cultural ways. The Yaos in the south, for instance, are mostly Muslim, follow a matrilineal inheritance tradition and matrilocal pattern of residence following marriage. The Tumbukas are Protestant, follow a patrilineal inheritance pattern and patrilocal marriage residence. In Mchinji, these demarcations are blurred, and the mostly Chewa ethnic group who reside there may follow either pattern or some combination of them. In addition, the Yaos practice male circumcision during initiation ceremonies, whereas Tumbuka and Chewa men do not usually get circumcised. Our data show that many non-Yaos in Balaka are also circumcised.[2]

Investigators at the University of Pennsylvania and the University of Malawi began the MDICP in 1998 with an initial sample of approximately 1500 ever-married women and their spouses (see www.malawi.pop.upenn.edu). In 2004 (Wave 3), the project added a sample of 973 adolescents and young women and men aged 15-24, both never-married and ever-married, and a biomarker data collection component to test for sexually transmitted infections (STIs) including HIV for all consenting respondents. For the present analyses, we use the sample of married women and their spouses who had an HIV test, yielding a total of 1239 married women (aged 15 and older), and their husbands (N=1001). [3]

[2] In Balaka, among the ever-married women in the 2004 MDICP data 93% of Yao and 53% of women of another ethnic group report being married to a circumcised husband. The predominant of this ethnic group is the Chewa, followed by Lomwe.

[3] The difference in number of wives and husbands accounts for polygynous unions and also sample attrition, both of which will be addressed in the paper.

The survey collected extensive information from husbands and wives about their past and current sexual partners (including non-spousal partners), and recent sexual behaviors. Respondents were asked not only about their sexual partners in the last year, but for each partner, they were asked when the relationship began, how frequently they had sex, whether condoms were used, and whether they thought their partner was infected with HIV. For all ever-married men and women, the survey collected full marital histories and detailed information about spouses. Women were asked about their husband's circumcision status. While such self-reports may not be an ideal measure, within each of the three regions, the proportion of wives reporting their husbands to be circumcised matches very well with the known circumcision rituals of their respective ethnic groups (see Table 1). In addition, interviews were held in private, secluded locations and in the absence of other family members including spouses, thereby increasing our confidence in the accuracy of self-reports.

The analyses conducted thus far and those to be conducted will investigate key aspects of a number of important determinants of HIV infection across the three regions of the MDIC project, and will give due consideration to all potential confounding factors. The main dependent variables are sexually transmitted infections, including HIV. The right-hand side variables will include individual characteristics such as age, wealth, and risk behavior—such as number of lifetime partners, having non-spousal partnerships, the age at first sex, use of condoms, measures of recent sexual activity, and marriage and divorce rates—as well as more aggregate-level variables such as village and region. All independent variables will be considered as they relate (or not) to male circumcision, and whether they are associated with the varying STI prevalence rates of regions and of

individuals. While our data are cross-sectional and thus can not determine the causal impact of male circumcision on STI/HIV acquisition, our data do have several advantages. Notably, because it is population-based, we are able to derive a snapshot of the current prevalence of HIV as it exists in a population. Second, since we have information for married couples, we further exploit our data by examining the effect of a man's circumcision status on his HIV prevalence as well as on his wife. The RCTs in South Africa, Kenya, and Uganda demonstrate the protective effect of male circumcision on female-to-male HIV acquisition, and, while rarer, others have also found that the reverse, male-to-female transmission, is also protective in cases where men are circumcised (eg. Auvert 2005). Moreover, we intend to use the findings from the 3rd wave as round 1 in a two-panel design for future work (data for the MDICP's 4th 2006 round is expected to be ready for use in the late spring of 2007), which will then allow us to compare the infection rates of circumcised men and their wives with those who are uncircumcised.

**Preliminary Results**

In Rumphi and Mchinji, the Tumbuka and Chewa ethnic groups do not generally practice circumcision (Zulu 1996). In our sample, 6% of women in Mchinji and 2% of women in Rumphi report their husbands to be circumcised. Compared with Balaka, the predominant Yao (69% of our sample) undergo initiation ceremonies inclusive of circumcision, and 79% of all women in Balaka report having circumcised spouses. Balaka is also the region with the highest HIV prevalence rate, with 11.1% of women and 8.8% of men being HIV positive (see Table 1). In these analyses, all subsequent analyses

(beyond Table 1), are for the married sample of adult women (N=1239). We will include STI outcomes for women, and HIV/STIs for husbands in all future analyses.

Table 2 presents parsimonious probit models for women's HIV status on husbands' circumcision, and confirms the percentages shown in Table 1 suggesting relationships between region, circumcision, and HIV status. We use the dprobit to quantify the effects of the model used, with each coefficient representing the discrete change from 0 to 1, or the probability of a respondent being HIV+ at the mean. Model 1 finds no association between husband's circumcision status and women's HIV status. Once region variables are added and using Balaka as the omitted dummy variable in model 2, women with circumcised husbands are significantly less likely to be HIV +. Including controls for age and a household measure of wealth is unrelated to women's infection status. We can thus interpret the coefficient for 'husband circumcised' in Model 2 as indicating that for the average aged rural, Malawian woman, who resides Balaka, having a circumcised husband decreases her propensity to be HIV infected substantially, by eight percentage points, consistent with the RCTs and other studies demonstrating a clear physiological component of circumcision on reduction of risk of infection.

To further explore the findings in Table 2 that (1) in the aggregate, and across the three sites, a husband's circumcision does not correlate at all with a woman's HIV status, but that (2), if we control for regional effects, it does, in Table 3 we present data for women residing in Balaka only. Model 1 in Table 3 shows that a woman with a circumcised husband has a significantly decreased likelihood of being HIV+. The inclusion of the potential confounder "Yao" ethnicity does not change the significance of the circumcision coefficient in Model 2. Put in other words, being Yao in Balaka does

significantly correlate with a wife being HIV positive, net of age, a measure of wealth, and her husband's circumcision status. In short, we can conclude from Tables 2 and 3 that while across rural Malawi circumcision is unrelated HIV, in a more contained area with a mixture of ethnic groups and circumcision practices, it is.

The creation of husband-wife links are near completion for the 2004 MDICP data set, and will allow us to examine the male circumcision with his own HIV and other STI infection status. Upcoming analyses will estimate for both women and men the marginal effects of socio-demographic variables and sexual behaviors, including frequency of sex, condom use, "lots" of sex partners, the level of recent sexual activity, and non-spousal partnerships. In addition, marriage and divorce rates will also be examined as potentially influential factors that are related to circumcision and infection. Table 4 presents compares selected sexual behavior and marriage characteristics of husbands in our sample. On these measures, men in Balaka appear to have riskier behaviors, with a greater proportion having been married more than twice, a higher proportion having had sex in the last year, a greater number of lifetime partners, and more with a total number of lifetime partners over five. These variables, as well as others, will be included in more regression analyses to determine the predictive strength on infection status. In addition, we will divide our Balaka sample according to circumcision status, and compare these measures across these two groups.

These preliminary findings show that while male circumcision may be protective against the acquisition of HIV, this is not always the case, and for Malawian wives, this seems to depend on the level of analyses one is conducting. Upon completion of further regressions, we expect to find that in the southern region of Balaka, Malawi, where 80%

of married women report having circumcised husbands, men's sexual behavioral practices is associated with increased risk of infection than is found in Mchinji and in Rumphi. Analyses will consider the possibility that other confounding factors are linked with MC and sexual behavior, such as religion. Further, specifications will account for the possibility of non-linear relationships between right-hand side variables and HIV status. For instance, "frequency of sex" may not be linearly related to HIV infection, but that there is some particular threshold that significantly increases one's risk.

## References


Auvert, B., Buve, A., Lagarde E. (2001). Male circumcision and HIV infection in four cities in sub-Saharan Africa. *AIDS*; 15(suppl 4):S31-S40.

Auvert, B., D. Taljaard, E. Lagarde, J. Sobngwi-Tambekou, R. Sitta, and A. Puren, (2005). Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: The ANRS 1265 Trial. *PLoS Medicine, 2*(11) 1112-1122.

Bailey, R.C. et al. (2001). Male circumcision and HIV prevention: current knowledge and future research directions. *Lancet Infectious Diseases*, 1:223-231.

Bailey, R.C., S. Moses, C. B. Parker, K. Agot, I. Maclean, J. N. Krieger, C. F. Williams, R. T. Campbell, J. D. Ndinya-Achola. (2007). Male circumcision for HIV prevention in Kisumu, Kenya: a randomised controlled trial. *Lancet 3969*, (643-56).

Cameron D.W., J.N. Simonsen, L.J. D'Costa, A.R. Ronald, G.M. Maitha et al. (1989) Female to male transmission of human immunodeficiency virus type 1: Risk factors for seroconversion in men. *Lancet* 2: 403–407.

De Walque, D. (2005). Who gets AIDS and how? The determinants of HIV infection and sexual behaviors in Burkina Faso, Cameroon, Ghana, Kenya and Tanzania. No 3956, Policy Research Working Paper Series from The World Bank

Halperin, D. T. and R. C. Bailey. (1999). Male circumcision and HIV infection: 10 years and counting. *The Lancet* 354

Gray, R. H., M. J. Wawer, R. Brookmeyer, N. K. Sewankambo, D. Serwadda, F. Wabwire-Mangen, T. Lutalo, X. B. Li, T. vanCott, and T. C. Quinn (2001). Probability of HIV-1 transmission per coital act in monogamous, heterosexual, HIV-1-discordant couples in Rakai, Uganda. *Lancet 357*(9263), 1149–1153.

Gray R.H., G. Kigozi, D. Serrwada, F. Makumbi, S. Watya, F. Nalugoda, N. Kiwanuka, L. H. Moulton, M. A. Chaudhary, M. Z. Chen, N.K. Sewankambo, F. Wabwire-Mangen, M.C. Bacon, C.F. Williams, P. Opendi, S.J. Reynolds, T. C. Laeyendecker, T. C. Quinn, M. J. Wawer. (2007). Male circumcision for HIV prevention in men in Rakai, Uganda: a randomised trial. *Lancet 369*, 657-66.

Reynolds S.J., Shepherd M.E., Risbud A.R., Gangakhedkar R.R., Brookmeyer R.S., et al. (2004). Male circumcision and risk of HIV-1 and other sexually transmitted infections in India. *Lancet 363,* 1039–1040.

Szabo, R. and R. V. Short (2000). How does male circumcision protect against HIV infection? *British Medical Journal 320,* 1592-1594.

Weiss, H., M.A. Quigley, and R.J. Hayes. (2000). Male circumcision and risk of HIV infection in sub-Saharan Africa: a systematic review and meta-analysis. *AIDS*, *14*(15):2361-2370.

Werker, E., A. Ahuja, and B. Wendell. (2006). Male circumcision and AIDS: The macroeconomic impact of a health crisis. Unpublished working paper, Harvard School of Business.

Zulu, E. (1996). Sociocultural factors affecting reproductive behavior in Malawi. Unpublished PhD Dissertation. The University of Pennsylvania.

**Table 1. Husbands circumcision and HIV prevalence rate by region.**

| | % Husbands circumcised | HIV prevalence rate | |
|---|---|---|---|
| Region | | Women | Men |
| Balaka | 79.5 | 11.1 | 8.8 |
| Mchinji | 6.4 | 9.2 | 7.4 |
| Rumphi | 2.3 | 6.5 | 4.6 |
| (N) | (1239)* | (1239) | (1001) |

*Notes*: Data come from MDICP's 3rd round of data collection, 2004.

*Conditional upon having had an HIV/STI test.

**Table 2. Women's HIV status on current/recent husbands' circumcision.**

| | HIV Positive | |
|---|---|---|
| | **Model 1** | **Model 2** |
| | (DF/Dx) | (DF/Dx) |
| Husband Circumcised | (.010) | -.078* |
| | (.018) | (.027) |
| Age | | -.001 |
| | | (.001) |
| Housing Material[a] | | .007 |
| | | (.014) |
| Rumphi[b] | | -.095* |
| | | (.023) |
| Mchinji | | -.088* |
| | | (.025) |

*Notes*: Robust standard errors are in parentheses.

Data come from MDICP's 3rd round of data collection, 2004, N=1239.

[a]A three point scale: 1=mud house, 2=sun-burnt brick, 3=fire-burnt brick

[b]The reference category for region is Balaka.

*$p < .01$

**Table 3. Women's HIV status and current/recent husbands' circumcision**

| | HIV Positive | |
|---|---|---|
| | **Model 1** | **Model 2** |
| Husband Circumcised | -.087** | -.106** |
| | (.044) | (.053) |
| Age | | -.001 |
| | | (.001) |
| Housing Material | | .009 |
| | | (.032) |
| Yao | | -.000 |
| | | (.040) |

*Notes*: Balaka only, N=472.
**p<.05

**Table 4. Selected measures of husband's sexual behavior/marriage by region**

| | **Balaka** | **Rumphi** | **Mchinji** |
|---|---|---|---|
| Proportion married >twice | .25 | .21 | .18 |
| Proportion had sex past 12 months | .88 | .78 | .85 |
| Mean # of lifetime partners (truncated at 20) | 4.32 | 3.85 | 4.28 |
| Proportion with > 5 lifetime partners* | .29 | .23 | .26 |

*Notes*: Sample comes from MDICP, 2004 wave of male spouses, N=1001
*25% of sample reported having more than 5 lifetime partners