Responding to Risk:

Circumcision, Information, and HIV Prevention

May 2014

Susan Godlonton, IFPRI

Alister Munthali, University of Malawi

Rebecca Thornton[1], University of Michigan

Abstract

Understanding behavioral responses to changes in actual or perceived risk is important, because risk-reduction goals can be undermined by risk-compensating behavior. In this paper we examine the response to new information about the risk of HIV infection. Approximately 1200 circumcised (low risk) and uncircumcised (high risk) men in rural Malawi are randomly informed that male circumcision reduces the HIV transmission rate, predicting asymmetric behavioral responses. We find no evidence that the information induced circumcised men to engage in riskier sex in response to the information, while among uncircumcised men we find a reduction in risky sexual behavior. There were no significant effects of the new information on adult or child circumcisions after one year.

JEL classification: C93, D81, D84, I15, I18, J13

[1]Corresponding author: Thornton: Department of Economics, University of Michigan, 213 Lorch Hall, 611 Tappan St. Ann Arbor MI, 48109-1220, USA; rebeccal@umich.edu; Godlonton: Markets, Trade, and Institutions Division, International Food Policy Research Institute, 2033 K St., Washington, DC, 20006-1002 USA; s.godlonton@cgiar.org; Munthali: P.O. Box 278, Zomba, Malawi, amunthali@sdnp.org.mw. Funding for this study was provided by Michigan Center for Demography of Aging (MiCDA), OVPR and Rackham at the University of Michigan as well as the Institute for Research on Women and Gender. We acknowledge the extensive contributions of the field team including James Amani, Sheena Kayira, Collins Kwizombe, Denise Matthijsse, Ernest Mlenga, and Christopher Nyirenda. We also thank assistance from Kondwani Chidziwisano, Jessica Kraft, Erica Marks, Julie Moran, Jason Stanley, and Kondwani Tomoko. We thank helpful comments from seminar participants at the Development Day Conference at University of Michigan, NEUDC, Population Association of America, University of Illinois, Chicago, Princeton University, Yale University, University of Georgia, Georgia State University, DePaul, University of California Berkeley, University of Illinois Urbana-Champaign, the CSWEP CeMENT Workshop and anonymous referees.

1 Introduction

Beginning with the seminal work of Peltzman (1975), economists have sought to understand behavioral responses to changes in actual or perceived risk. Much of the empirical literature has focused on measuring behavioral responses to the introduction of risk-reducing regulations such as mandatory seat belt laws, or risk-reducing technologies including protective sports gear, sunscreen, treatment for high cholesterol, or vaccines.[2] Although these innovations strictly decrease personal risk, the net impact of their introduction is ambiguous because risk-compensating behavior may offset their positive technological effects. In contrast to the introduction of risk-reducing technologies where the effects of risk compensation may be offset by safety benefits, the net behavioral effect of the introduction of information about risk relies exclusively on the direction and extent to which individuals change their behavior.

In this paper, we study asymmetric responses to information about personal risk in which new information informs individuals of their type, either high or low risk. Individuals learning their type should revise their beliefs about personal risk either upwards or downwards, predicting opposite behavioral responses. While the new information may be used beneficially by one risk type, the same information may cause the other type to engage in potentially harmful risk-compensating behavior. The theoretical predictions of the behavioral responses to information about risk are straight forward yet testing these predictions empirically is more difficult. Access to information about risk is typically correlated with unobserved characteristics that introduce bias to causal inference. Moreover, it is difficult to identify a setting in which information is likely to induce an asymmetric response. The most common strategy within the economics literature is to measure how information about risk interacts with ex-ante beliefs (See for example Gong, forthcoming; Boozer and Philipson, 2000; Wilson, Xiong and Mattson, 2014).[3]

[2] Blomquist (1988) provides an extensive review of the literature on safety belt regulations and car safety technologies (Other recent examples include: Evans and Graham 1991; Cohen and Einav, 2003). Other papers examine the use of protective gear in risky sports (Walker, 2007; Braun and Fouts, 1998; Williams-Avery, 1996), increased sun exposure with the availability of sunscreen (Autier et al., 1998; Dickie and Gerking, 1997), poor eating habits and increased BMI with the introduction of high cholesterol treatment (Kaplan, 2012), and risky sexual behavior in response to receiving the HPV vaccination (Lo, 2006; Kapoor, 2008).

[3] Other examples of studies that examine behavioral responses to information about risk are Dupas (2011) and Bennear et al. (2013). Dupas (2011) finds that after an information session on the relative risk of HIV infection by partners' age, teenagers substitute away from older partners towards same-age partners. In the context of water-source choices, Bennear et al. (2013) examine how learning the level of arsenic in one's well affects the decision to change water sources.

The specific context of risk examined in this paper is the risk of HIV infection. We estimate the response to learning new information – that male circumcision is partially protective against HIV infection – among two types of men: men who are circumcised (low risk) and men who are uncircumcised (high risk). We expect both low- and high-risk men to change behavior in response to learning their type by practicing either safer or riskier sex. This context is uniquely suitable to analyze asymmetric responses to information about risk in that the information is newly available, highly relevant, and provides clear theoretical predictions of behavior change. Ultimately, the net impact of the dissemination of this information is an empirical question.

As background, recent randomized control trials in South Africa, Kenya, and Uganda find that male circumcision is up to 60 percent effective in reducing HIV transmission risk (Auvert, 2005; Bailey et al., 2007; Gray et al., 2007).[4] Shortly after the release of the results of these trials, organizations such as the WHO and UNAIDS set an ambitious goal to circumcise 80 percent of men ages 15 to 49 in 14 priority countries by 2015, making voluntary medical male circumcision one of the key components of HIV prevention strategies. While the medical evidence points to male circumcision as a viable HIV prevention strategy, one concern that has prevented the rapid scale-up of male circumcision provision in several African countries is the potential behavioral responses to learning that male circumcision is partially protective against HIV infection. Some policy makers have noted the need to "proceed with caution" (Namangale, 2007) and researchers have noted that risk compensation may reduce the overall estimated benefit of male circumcision (Kalichman, Eaton and Pinkerton, 2007; Cassel et al., 2006). More recently, a panel of Nobel Prize economists ranked "scaling up male circumcision" as priority 7 out of 18 other HIV prevention strategies, ranked low mainly due to concerns of dis-inhibition behaviors. The panel noted "*Circumcision is protective, but only to a certain extent. It is possible that, as a consequence of large-scale male circumcision with an accompanying information campaign about its protective effect, males and their partners opt for less safe sexual practices and for example become less likely to use condoms or more likely to engage in concurrent partnerships*" (RethinkHIV, 2012).

Behavioral responses to circumcision surgery have been the subject of some research. Using panel data, several papers have found no evidence of increased risky sexual behavior after receiving a

[4] Across the three trials there were 11,054 HIV negative men who were willing to be circumcised. Approximately half of these were randomly assigned to be offered circumcision surgery, while the others remained uncircumcised. All participants were extensively counseled in HIV prevention. The studies found 61 percent reduction in risk in the South African trial, a 53 percent reduction in the Kenyan study, and a 48 percent reduction in the Ugandan study.

circumcision (Agot, 2007; Gray et al., 2012; Mattson et al., 2008).[5] In a paper most similar to ours, Wilson, Xiong and Mattson (2014) examines behavioral responses to receiving a medical circumcision, differentially by subjective baseline beliefs. In that paper the authors take baseline beliefs about male circumcision and HIV transmission risk as exogenous and compare behavior among those who were randomly assigned to receive a circumcision with a control group, differentially by prior beliefs. In contrast, our paper takes circumcision status as exogenous and randomizes the information about male circumcision and HIV transmission risk. The advantage to our approach is that we estimate the causal effect of information, rather than the causal effect of being circumcised. This is a relevant parameter of interest both for policymakers concerned with effects of large-scale information campaigns as well as for testing theoretical predictions of asymmetric responses to learning one's risk type. Using a similar experiment as in this study, Chinkhumba, Godlonton and Thornton (2014) measure the demand for male circumcision when relaxing both information and price constraints. That study is unable to address the question of asymmetric responses to information about transmission as that sample is restricted to urban uncircumcised men.

This study was conducted in a high HIV prevalence area of rural Malawi between 2008 and 2009, shortly after the information about male circumcision became available. Our sample consists of approximately 900 circumcised and 300 uncircumcised men, who are unlikely to have had prior exposure to the information. We randomize information about male circumcision and HIV transmission risk to causally estimate behavioral responses. Information was randomized across villages to limit information spillovers within villages. Approximately one year after the information intervention, the project revisited respondents to measure sexual behavior and whether the uncircumcised men or any young male dependents had been circumcised in the previous year.

We find that uncircumcised men who receive the information about circumcision and HIV transmission risk practice safer sex with approximately two fewer sexual acts in the past month (a 26 percent reduction) and one additional condom used in the past month (an increase of 65 percent). These results are consistent across marital status of the respondent, albeit stronger for non-marital sexual encounters. We document an asymmetric response to the information by circumcision status; however, we find no evidence of risk compensation on average among circumcised men. Circumcised men who

[5] Grund and Hennink (2012) using qualitative methods also do not find evidence of risk dis-inhibition.

receive the information treatment are not significantly more or less likely to practice riskier sex than those who do not.

We also examine how receiving the information about male circumcision and HIV transmission risk affects the demand for circumcision among initially uncircumcised men. One year after the information treatment only seven uncircumcised respondents (two control and five treatment) report receiving a circumcision with no statistically significant difference between those who receive the information and those who do not. Although the information has a significant effect on increasing men's reported desire for their male dependents to be circumcised (among both circumcised and uncircumcised respondents), there are no effects on actual circumcisions of male children.

Circumcised men in the treatment group significantly update their ex-ante beliefs about male circumcision and HIV transmission risk. For uncircumcised respondents of whom we have a smaller sample, we are unable to detect significant effects of the treatment on average. However, we are also unable to reject that the treatment effect on beliefs are different than the treatment effect among circumcised men.

To determine whether respondents are responding to factors other than asymmetric information about their risk type, we explore other possible channels. First, circumcised and uncircumcised men differ in underlying characteristics other than their risk of HIV infection. However, we do not find the same asymmetric responses to the information intervention with respect to these underlying differences. Second, we test whether the information about male circumcision and HIV transmission risk changes respondents' subjective life expectancy or HIV testing behavior, two potential channels of behavioral change. We find that circumcised men receiving the information treatment significantly increase their likelihood of testing. There are no significant differences in perceived life expectancy for either circumcised or uncircumcised men. Third, similar to the approach by Wilson, Xiong and Mattson (2014), we consider the role of ex-ante beliefs in response to the information about male circumcision and HIV transmission risk. Specifically, we examine whether men with correct or incorrect prior beliefs about male circumcision and HIV transmission risk (at baseline) respond differentially to receiving the information treatment. Among both circumcised and uncircumcised men, there are no significant differences in the effect of receiving the information treatment between those with correct and those with incorrect baseline beliefs.

Despite the fact that men in the control group did not directly receive the information treatment in our study, we observe significant increases in knowledge about male circumcision and HIV transmission risk between the baseline and follow-up among men in the control group. We provide evidence that this is unlikely due to informational spillovers and discuss other potential contributors to the increased knowledge in the control group such as media exposure to HIV/AIDS messages.

In addition to providing an empirical test of asymmetric responses to information about risk, this paper is an important contribution to current policy debates on HIV prevention. To our knowledge, it provides the first causal evidence of the impact of information about male circumcision and HIV risk on sexual behavior among either traditionally circumcised or uncircumcised men. The findings of no significant treatment effect on risk compensation among circumcised men and significant treatment effects on safer sex practices among uncircumcised men mitigates, at least in part, some concern of the potential negative externalities from learning the information about male circumcision and HIV transmission risk. While we caution generalizing the results to other settings, the main findings are consistent with studies of men receiving a medical male circumcision either using longitudinal, or experimental approaches (Agot, 2007; Mattson et al., 2008; Wilson, Xiong and Mattson 2014).

This study also provides one of the first causal estimates of the impact of information on the demand for actual circumcisions. The low adoption rate of male circumcision among uncircumcised men and their male dependents at the follow-up point to the fact that additional factors may be important for scaling up male circumcision rather than simply providing information about male circumcision and HIV risk alone (See also Chinkhumba, Godlonton, and Thornton, forthcoming; Pierotti and Thornton, 2013).

The paper proceeds as follows: Section 2 presents background information about male circumcision and Malawi. Section 3 outlines the data and experiment. Section 4 presents the empirical strategy and Section 5 presents the main results. Section 6 discusses potential channels of behavioral change and possible threats to validity; Section 7 concludes.

2 Background

Circumcision is not only one of the oldest surgical procedures in the world it is also one of the most commonly practiced for both religious and non-religious reasons (Marck, 1997; Doyle, 2005). In Africa approximately 62 percent of adult men are circumcised with significant heterogeneity across religion, ethnic group, and location (Drain et al., 2004). Male circumcision is commonly associated with the practice of Islam and adolescent initiation practices (Marck, 1997). In Malawi, where this study is conducted, approximately 19 percent of adult men report being circumcised (MDHS, 2011). The majority of these circumcisions are conducted using traditional methods in non-clinical settings, usually among boys between the ages of eight and 18. As in other African countries, circumcision is highly correlated with religion and ethnicity. Among the Yaos, 85 percent report being circumcised, as well as a significant percentage of Lomwes (30 percent). Other ethnic groups have much lower rates of circumcision such as the Chewas (eight percent) and Tumbukas (one percent). In addition, approximately 94.2 percent of Muslims in Malawi are circumcised compared to 10.7 percent among non-Muslims (MDHS, 2011).

With one of the highest HIV prevalence rates in the world estimated at approximately 11 percent (UNAIDS, 2010), the potential benefits of rolling out male circumcision could be very high (Njeuhmeli et al., 2011). However, national policy makers in Malawi have moved cautiously in adopting medical male circumcision as an important HIV prevention strategy. In early 2007, the Minister of Health warned about the need for caution because "misinformation over circumcision might erode the gains made in the fight against HIV and AIDS" (Namangale, 2007). Not until late 2011, well after the completion of this study, did Malawi include male circumcision in its national HIV prevention plan (Tunikekwathu News, 10 October 2011). As in other priority sub-Saharan countries, concern of risk compensation has been one barrier to the full scale-up of medical male circumcision services.

3 Data and Experimental Design

The study was conducted in 2008 in the Southern Region of Malawi. The location was chosen specifically for its diverse ethnic and religious population consisting of both circumcised and uncircumcised men. Within one traditional authority, 69 villages were randomly selected and a census of all households in each village was conducted. Men between the ages of 25 to 40 were eligible for participation in the study.[6] This age range was chosen to maximize the likelihood that the respondents were both sexually active and had sons near the average age of male circumcisions traditionally conducted in that area. To balance the sample across circumcision status respondents would ideally be selected from households, stratifying on their circumcision status. However, given the likely systematic differences in reporting the circumcision status of male household members by the gender of household enumeration respondents, men were randomly selected to participate in the study by stratifying on religious affiliation. In each village, a maximum of 20 Christian and 20 Muslim men were selected.

The baseline questionnaire asked men about their knowledge and attitudes about male circumcision and HIV transmission risk and their sexual behavior in the past year. In addition, each respondent listed all of his sons or other male dependents under the age of 18. The circumcision status of each boy was recorded.

Approximately one year after the baseline survey, attempts were made to re-interview each man who was interviewed at baseline. A total of 77.6 percent were found and completed follow-up surveys. The attrition rate is similar to other studies conducted in the area, where it is documented that in comparison to other areas of rural Malawi, marriages are more unstable, men are engaged in highly mobile occupations such as business and fishing, and matri-local residential patterns are common, resulting in high attrition in panel studies (Anglewicz et al., 2009).

During the follow-up survey, men were asked questions about their sexual behavior in the past year as well as their beliefs about male circumcision and HIV transmission risk. All men were asked about their preference for their male dependents to be circumcised and if any male dependents had been circumcised in the past year. Uncircumcised men were asked whether or not they had undergone a circumcision surgery.[7] At the end of the survey, each man was given 30 kwacha (~20 cents), and was offered the opportunity to purchase condoms.[8]

The analytical sample for the analysis in this paper consists of a total of 1,228 male respondents who were interviewed at baseline and at follow-up. Table 1, Column 1 presents the summary statistics for these men. The men are on average 32 years old. Most are married (90 percent) and have fathered

[6] In total, 67 percent of those who were randomly selected from the household enumeration completed baseline surveys mainly due to the high mobility of men in the study area, rather than survey refusals. There is no significant difference in baseline survey completion across treatment status or village characteristics.
[7] HIV tests were not administered at baseline or follow-up due to budgetary constraints.
[8] A similar approach was used as in Thornton (2008). Condoms were sold at one condom for two kwacha or a package of three condoms for five kwacha. Men could only purchase using the money they were given from the interviewers.

almost two sons. The two majority tribes in the sample consist of the Nyanja (41 percent) and the Yao (36 percent). Men have had on average almost six years of schooling. Over half (62 percent) of the respondents are farmers who report having on average 4.4 assets out of a list of 13 different possible assets.[9] Few respondents (13 percent) report having salaried employment. The average age at sexual debut was 17 years with an average of 4.3 lifetime sexual partners. Less than half (40 percent) of the men report ever using a condom. While most men report being sexually active in the last month (75.5 percent), only 11.3 percent of their sexual encounters in the last month are considered "safe" (defined as the proportion of protected sex acts). Although most men are married, there is considerable scope for safer sexual behavior in the form of condom use, number of partners, or frequency of sex.

Respondents were asked if they believe that circumcision is related to an increased, decreased, or no difference in HIV transmission risk relative to not being circumcised. On average, 36 percent correctly believe circumcision is related to lower HIV transmission risk. On the other hand, 13 percent believe it is related to higher HIV transmission risk, and 48 percent believe the risk is equal for circumcised and uncircumcised men. Baseline beliefs therefore suggest substantial scope for an intervention to provide new or correct information about male circumcision and HIV risk in these communities.[10]

We also measure the perceived per-sex act risk of infection by asking respondents to report the number of circumcised or uncircumcised men out of 100 that they believe would be infected if each has one unprotected sexual encounter with an HIV positive woman.[11] On average, respondents report 81.5 circumcised men and 91.3 uncircumcised men would be infected after one unprotected sexual act with an HIV positive woman. The median and modal perceived per-sex act risk of infection – for both circumcised and uncircumcised respondents – is 100, reflecting that most express certainty of HIV infection after one unprotected sex act with an HIV positive woman. Consistent with the broader literature, respondents vastly overestimate the probability of HIV transmission, which is under one percent (Anglewicz and Kohler, 2009; Kerwin, 2014; Sterck, 2013 and 2014; Gray et al., 2001). For the majority, providing information about male circumcision and HIV transmission risk can only influence

[9] These assets include: bed, mattress, sofa, table, chairs, paraffin lamp, television, radio, mosquito net, bicycle, motorcycle, ox-cart and landline phone.
[10] Three percent did not respond.
[11] The continuous variables (as measured at baseline) are used to construct discrete categorical beliefs which are consistent with the categorical belief variables (i.e believes circumcision is related to increased, decreased or equal risk of HIV transmission). Recoding the continuous variables we find: 32.1 percent believe the rate is lower for circumcised men, 2.5 percent believe the rate is lower for uncircumcised men, and 65.4 percent believe the risk is equal.

the perceived per-sex act rate of infection of circumcised men – the per-sex act rate of infection of uncircumcised men for most is at its maximum value even before the information intervention.

Despite the attempt to balance the sample equally across circumcision status, 73.7 percent of the men in our sample are circumcised. As expected, most Muslim respondents are circumcised (94.2 percent); a surprisingly large percentage of Christians are also circumcised (60.9 percent; Appendix Table A). The circumcision prevalence rates of the Chewa and Nyanja tribes are also significantly higher than the national level; they are, however, comparable with the circumcision rates found in surveys conducted in nearby locations. Appendix Table A presents baseline circumcision rates in our study site, in Balaka (a nearby and similar district; Malawi Diffusion and Ideational Change Project, 2008), and in rural Zomba (the same district as the location of our study site; MDHS, 2011). Circumcision rates are similar across all three data sources.

Prior to the baseline survey, half of the villages were randomly assigned to the treatment group, stratified by the distance of each village to the nearest mosque.[12] Respondents in the treatment villages were given the information about male circumcision and HIV transmission risk immediately after the baseline survey. Using a standardized information sheet, interviewers discussed the three randomized control trials in Uganda, South Africa, and Kenya, and the results – that male circumcision is partially protective against the risk of HIV transmission. Information was also provided about medical reasons why circumcision is partially protective. Respondents were encouraged to ask questions during the discussion lasting approximately ten minutes.[13] Although the total amount of time spent discussing male circumcision and HIV was relatively short, research suggests that hearing new information directly significantly increases comprehension and retention of information (Guadagno and Cialdina, 2002 and 2007; Valley, Moag and Bazerman, 1998; Valley et al., 2002).

Our main identification assumption is that due to randomization, the treatment and control groups are not statistically different across observables and unobservables, other than the information given to

[12] The selection of villages and assignment to treatment was conducted in the following manner. First, all villages from the 2008 census in the traditional authority were listed; duplicate village names were deleted; the locations of churches and mosques provided by the National Statistics Office were merged into the village list. Then the distance to the nearest mosque from each village was constructed. Villages were then divided into groups of ten villages and were randomly divided into the treatment and control groups.

[13] All control interviews were conducted prior to the treatment interviews (at baseline) and over time interviewers become more accustomed to the questionnaire reducing the time taken to conduct an interview. Controlling for day of interview, the estimated average difference in survey time between treatment and control group respondents is approximately 11 minutes. An alternative explanation driving the difference in the treatment and control time of interview is that the interviewers intentionally skipped more questions over time. We find no evidence that there was an increase in non-response or missing values correlated with either day of interview or treatment status.

the treatment group. This allows us to estimate an unbiased measure of the causal effect of receiving information about the relationship between male circumcision and HIV transmission risk. To provide verification of this, Table 1, Columns 2 and 3 presents the means of baseline characteristics by treatment group. We test for balance across men living in treatment and control villages by regressing baseline characteristics on a treatment indicator; Column 4 presents the p-values on the coefficient of the treatment indicator from separate regressions. Along some dimensions, there are significant differences between men in the treatment and control groups. For example, respondents assigned to the control group are slightly wealthier as indicated by number of assets and likely to be salaried. There are no differences across the treatment and control groups in ethnicity or religious composition as can be expected as we stratified randomization across religion. Baseline beliefs about male circumcision and HIV are also generally balanced across treatment and control. Appendix Table B reproduces Table 1 separately for uncircumcised and circumcised respondents. We observe some systematic differences among the circumcised men by treatment status, but our results are robust to including or excluding covariates.

Attrition is not significantly associated with treatment status. Respondents in the treatment group are 3.7 percentage points more likely to complete a follow-up survey than respondents in the control group but this difference is not statistically significant (s.e. 0.032; p-value 0.251). There is also no statistically significant differential attrition across treatment and control groups correlated with baseline characteristics such as age, education, marital status, sexual behavior, or beliefs about male circumcision and HIV. To test for this, for each baseline characteristic, we separately regress an indicator of follow-up survey completion on an indicator of treatment status, the baseline variable, and the interaction between the treatment indicator and the baseline variable; Table 1, Column 5 presents the p-value of the interaction term. Baseline characteristics of attritors are balanced across treatment status either in the pooled sample (Table 1, Column 5) or separately by circumcision status (Appendix Table B).

5 Empirical Strategy

Holding all else constant, uncircumcised and circumcised men who learn that circumcision reduces HIV transmission risk learn they are a high or low risk type, respectively, implying asymmetric responses to the information treatment by baseline circumcision status. We therefore estimate the following interacted model:

(1) $Y_{ij} = \alpha + \beta_1 Treatment_j + \beta_2 Treatment * Circumcised_{ij} + \beta_3 Circumcised_{ij} + \gamma X' + \varepsilon_{ij}$

We look at three main categories of outcomes for individual i living in village j – measures of sexual behavior, demand for male circumcision, and beliefs about male circumcision and HIV transmission risk.

Collecting accurate reports about sexual behavior can be challenging given the sensitive nature of the questions. Respondents may under-report sexual encounters or over-report preventive behaviors because they feel social pressure to report behavior they consider acceptable (Fenton et al., 2001; Jamison, Karlan and Raffler, 2013; Chong et al., 2014). On the other hand, other research suggests that accounts of sexual behavior within reported relationships can be generally reliable (Clark, Kabiru and Zulu, 2011) and in fact, some measures of sexual behavior are more reliable in face-to-face interviews than with ACASI (Audio Computer-Assisted Self-Interviewing) (Mensch et al., 2008). In our study, systematic differences in over or under-reporting between treatment and control and by circumcision status would be necessary at the follow-up which is unlikely. Several different measures of sexual behavior are used as outcomes including condoms purchased from the interviewer, pregnancy status, condom use, number of partners, and sexual activity in the previous month and year. To address the issue of multiple inferences we also create an index of risky sexual behavior (RSB) which is equal to the mean of the normalized value for nine self-reported measures of sexual behavior (Kling, Liebman and Katz, 2007).[14]

In addition to measuring the impact of information on sexual behavior, we estimate the impact of the information treatment on the demand for male circumcision among young male dependents and uncircumcised adult men. We examine three main dependent variables: an indicator of whether the respondent got circumcised between the baseline and follow-up survey (restricting the sample to uncircumcised men at baseline), an indicator of whether the respondent reported being willing to circumcise any of his young male dependents (among those with male dependents under the age of 18), and if any of these youth were actually circumcised between the baseline and follow-up. When examining the response to information on having a child circumcised, we have no reason to hypothesize asymmetric responses to the treatment between circumcised and uncircumcised men; however, effects

[14] The nine measures used in constructing this index are: whether the respondent's wife is pregnant; the man had sex in the last month; the number of sexual interactions had in last month; the number of condoms used in last month; the fraction of sexual encounters that the respondent used a condom; the number of sexual partners had in the last month; the number of partners had in the last year; number of condoms that were purchased in the last month; and the number of free condoms that the respondent was given in the past month.

may be different in magnitude across these two groups. Therefore, we estimate demand using the specification in equation (1).

Lastly, we estimate how the treatment impacts beliefs pertaining to the relationship between male circumcision and HIV transmission risk at follow-up. To measure ex-ante beliefs, we use both the categorical measure of the relationship between male circumcision and HIV transmission risk, and the continuous measure of perceived per-sex act HIV transmission rate for circumcised and uncircumcised men as described above.

The analyses include a vector of baseline controls for age, marital status, log income, years of education, number of assets, whether the respondent had sex in the last week, ethnicity and religious denomination dummy indicators and exposure to media messages related to HIV prevention. Including these baseline controls helps increase statistical precision although the results are robust to their exclusion. Results without baseline controls are presented in Appendix C using our three main outcome variables, the constructed index of risky sexual behavior (RSB), reported willingness to circumcise a male dependent, and whether the respondent believes that circumcision is related to lower HIV transmission risk. We cluster standard errors by village.

The results are also robust to using a probit model in the case of indicator outcome variables. Appendix Table D presents the results using a probit model for the two key binary outcome variables, reported willingness to circumcise a young male dependent, and whether the respondent believes that circumcision is related to lower HIV risk. The results are also consistent, although not always statistically significant when we measure treatment effects on differences in outcomes between the baseline and the follow-up. See Appendix Table E for the results on our three main outcomes.

Because the information was randomized at the village-level, control villages could be located in close proximity to treatment villages increasing the likelihood of information spillovers HIV from the treatment to the control respondents.[15] In the presence of such spillovers, the estimates of the effect of information would underestimate the true program treatment effect (Miguel and Kremer, 2004). We exploit the variation in the distance between men living in control and treatment villages to explore the extent of spillovers in our sample and find little evidence of these spillovers. Therefore, our main

[15] To mitigate spillovers in beliefs and behavior across time within and across villages at the baseline, control villages were interviewed before treatment villages. There was no specific order to conducting treatment and control interviews during the follow-up survey.

specifications do not control for the existence of spillovers. We discuss this as well as the potential effect of media exposure that occurred during the study period in Section 6.

There are clear theoretical predictions of the coefficients in equation (1). The coefficient on the treatment indicator, β_1 , represents the difference in outcomes between the treatment and control group among uncircumcised men. Taking the outcome, Y, as a measure of risky sex, if as predicted uncircumcised men practice safer sex because they learn that they are more at risk than circumcised men, then $\beta_1 < 0$. The coefficient on the interaction term, β_2, represents the asymmetric response to the information treatment by circumcision status; we predict that $\beta_2 > 0$.

To test for risk-compensation among circumcised men who receive the information treatment, we test the null hypothesis that $\beta_1 + \beta_2 = 0$. Rejecting the null provides evidence of risk compensation. If we cannot reject the null, we may either be under-powered, or there is no risk compensation. We are fairly well powered to detect behavioral responses. For example, among circumcised men we can detect an increase in the index of risky sex to at least 0.10 standard deviations at 0.80 power and to at least 0.11 standard deviations at 0.90, thus being powered to rule out moderate effects.[16]

6 Results

Sexual behavior

Table 2 reports the effect of receiving the information about male circumcision and HIV transmission risk on sexual behavior. We find large and statistically significant effects of the information treatment among uncircumcised men. Uncircumcised men in the treatment group report 1.6 to 2 fewer acts of sex in the past month (Columns 3 and 4; 21 to 26 percent reduction), use approximately one additional condom in the past month (Column 5; 65 percent increase), increase the fraction of safe sex by 8.7 percentage points (Column 6; 43 percent increase), decrease the number of partners by 0.14 (Column 7; 17 percent decrease), and report purchasing almost one more condom in the past month (Column 9; 83 percent increase). The indicator of risky sex, RSB, indicates a large and significant reduction of almost 0.18 standard deviations on overall risky behavior (Column 12). Other coefficients, such as pregnancy status or the likelihood of purchasing any condoms from the interviewer at the follow-up, while not statistically significant are, consistent with the other measures of sexual behavior, in the direction of safer sex (Columns 1 and 11).

[16] The intra-class correlation coefficient between villages of RSB is 0.01 with an average of ten circumcised men in each village.

The sign of the interaction term between circumcision and treatment (β_2) is typically the opposite of the sign of the treatment effect for uncircumcised men (β_1). In addition, the magnitude of β_2 is about the same as that of β_1 suggesting a complete offset. For example, in Column 12, the treatment effect on the index of risky sexual behavior is a significant 0.176 standard deviation for uncircumcised men and an insignificant 0.008 (-0.176 + 0.184) for circumcised men, suggesting a large reduction in risky sex among uncircumcised men but no response among circumcised men.

In each column we present p-values of the joint test of significance that $\beta_1 + \beta_2 = 0$ to test for risk compensation in response to the information about male circumcision and HIV transmission risk among circumcised men. We cannot reject the null hypothesis of no impact of the treatment among circumcised men for any measure of sexual behavior. For our index of risky sexual behavior, we are not powered to detect significant treatment effects below 0.10 standard deviations. However, our point estimates of the effects among circumcised men suggest any potential dis-inhibition behavior is small (0.008 standard deviations for the risky sexual behavior index).

Behavioral responses to the information about male circumcision and HIV transmission risk may be larger for non-marital interactions. Appendix Table F presents results on non-marital sexual behavior which are consistent with the findings discussed above; namely, uncircumcised men who are exposed to the information treatment significantly reduce risky sexual behaviors and we do not find a significant treatment effect among circumcised men (Columns 1-5). Appendix Table F, Column 6 shows that the adoption of safer sex practices among the uncircumcised men is driven primarily by unmarried men.

Circumcisions

In addition to measuring the effect of information on sexual behavior, this paper provides a causal estimate of information on actual circumcisions. Prior studies examining the demand for male circumcision have been limited by the constraints of cross-sectional data and in most cases studies rely on uncircumcised men providing hypothetical answers to whether they are willing to be circumcised, rather than observing their actual behaviors (Lagarde et al., 2003; Nnko et al. 2001; Bailey et al., 2002; Halperin et al., 2002; Rain-Taljaard et al., 2003; Ngalande et al., 2006; Kebaabetswe et al., 2003).[17]

Respondents living in study villages had access to both traditional and medical male circumcisions for themselves and their male dependents. The nearest formal health provider – a private mission

[17] One exception to this is Chinkhumba, Godlonton and Thornton (2014).

hospital located approximately 15 km from the villages in the study – routinely offered adult and child circumcisions during the time of the study; the cost of a circumcision for children under 14 was 600 kwacha (4 dollars) and 900 kwacha (6 dollars) for adults.

One year after the information intervention, a total of seven men report having been circumcised between the time of the baseline and follow-up survey: five in the treatment and two in the control; this difference is not statistically significant (Table 3, Panel A).[18]

There are several reasons to hypothesize a larger response to information for circumcisions among children than among adults. The opportunity costs for children are lower than adults given that men would likely lose several days wages during recovery. In addition, cultural barriers to circumcision are likely to be lower for children because circumcisions are commonly performed on young boys rather than adults in this setting. While a father learning about the protective benefits of circumcision may be hesitant to undergo the procedure himself, he may be motivated to have his son circumcised.

During the baseline survey, respondents were asked to report the circumcision status of each male dependent under age 18. For each uncircumcised boy, respondents reported whether they wanted him to be circumcised in the future. During the follow-up survey, men were again asked to list their male dependents, report their circumcision status, and willingness to have each male dependent circumcised. In total, 1,449 young male children were listed at the baseline survey and of these, 92 percent were again listed at follow-up with no significant difference between the treatment and control.[19] We report the impact of the information treatment on two main outcomes at the respondent level – being willing to have any male dependent circumcised, or having any male dependent actually receive a circumcision between the baseline and the follow-up survey (Table 3, Panel B). There are large statistically significant effects of learning about male circumcision and HIV transmission risk on a respondent's willingness to have any of his male dependents circumcised, differing in magnitude by the respondent's own circumcision status. Among uncircumcised men, being exposed to information about male circumcision and HIV risk increases the likelihood of being willing to have a male dependent

[18] Some differences between those who got circumcised as compared to those who did not are worth noting. All seven men who were circumcised were married (compared to 86.3 percent who were not circumcised) and they reported significantly fewer sexual partners in the past year. The men were slightly younger and poorer (although more likely to be self-employed). Only one out of the seven men was circumcised in the clinic, the remaining six were either circumcised at home or traditionally. The men reported their main reasons for getting circumcised with "for health reasons" and "to set an example for a younger relative" as the most common; only one man reported getting circumcised to reduce the risk of HIV.

[19] Three percent of those not listed at baseline were sons born after the baseline survey. Five percent of male dependents listed at baseline were not listed at follow-up due to death, being over age 18, or no longer being considered the respondent's dependent.

circumcised by 25.1 percentage points. The treatment effect is lower among circumcised respondents, although still statistically significant (p-value 0.072). Despite the increased willingness, there is no impact of the information treatment on actual child circumcisions after one year (Table 3, Panel B, Column 2).

Belief Updating

Prior to the baseline survey and intervention, access to accurate information about male circumcision and HIV transmission risk was limited.[20] Our baseline data indicate that the majority of individuals held incorrect beliefs about the relationship between male circumcision and HIV transmission risk

Evidence from the follow-up survey suggests that respondents in the treatment group updated their beliefs. Table 4 presents the effects of the information treatment on knowledge about male circumcision and HIV transmission risk using both discrete (Columns 1-3) and continuous (Columns 4-5) measures of beliefs. Circumcised respondents in the treatment group are more likely to report that circumcision is associated with a lower risk of infection (Table 4, Column 2; p-value of the joint test of significance of $\beta_1 + \beta_2 = 0$ is 0.103), substituting away from believing that circumcision is associated with an equal risk of HIV infection (Table 4, Column 3; p-value 0.038). Although there are no significant effects of the information treatment among uncircumcised men on discrete measures of beliefs, we are unable to reject the null hypothesis that the treatment effect for uncircumcised men is equal to the effect for circumcised men.

Turning to beliefs measured as a continuous per-sex act transmission rate, circumcised respondents exposed to the information treatment report significantly lower rates of perceived HIV transmission risk for circumcised men (Column 4). Among both circumcised and uncircumcised respondents there is no significant effect of the information treatment on increasing the reported per-sex act transmission rate for uncircumcised men (Column 5). This is not surprising given that the median and modal reported transmission rate is at its maximum value of 100 at baseline.

[20] At the time of our baseline survey in October/November of 2008, the information about HIV transmission and circumcision was not widely disseminated in Malawi. Several national meetings of experts, sponsored by the National AIDS Commission in Malawi had been held to discuss a national plan in relation to circumcision. However, after each of these meetings, several newspaper articles were printed and there was some radio coverage, discussing the findings from the randomized controlled trials as well as the outcome of the national meetings. Respondents could have been exposed to some of this information. Despite some newspaper coverage, there was no accepted national policy regarding male circumcision for HIV prevention. In fact, even as late as September 2010, one of the leading HIV/AIDS officials in Malawi claimed that there was not enough evidence supporting the medical benefits of male circumcision (Tenthani, 2010).

6 Channels of Behavioral Change and Validity

Our results point to asymmetric responses to information about HIV transmission risk by individuals learning their risk type. It is possible that rather than responding to the information differentially after learning their risk type, the effects we find could be driven by some other factor. For example, circumcised and uncircumcised men differ in underlying characteristics which may drive the asymmetric responses to the information delivered about male circumcision and HIV transmission risk. There may also be differential responses to the information treatment that affect subjective life expectancy or HIV testing behavior, two other potential channels of behavioral change. Lastly, we consider the role of ex-ante beliefs as well as examine whether informational spillovers could have affected the empirical results.

Other Underlying Differences

While circumcised and uncircumcised men differ in their underlying risk of HIV infection, there are also other underlying characteristics that differ by circumcision status. Examination of baseline characteristics separately by circumcision status suggests stark differences between circumcised and uncircumcised men (Appendix Table B). In addition to the large differences by religion and ethnicity, circumcised men tend to have less education, are more likely to be self-employed, have more lifetime sexual partners, and are more likely to have correct beliefs about male circumcision and HIV transmission risk at baseline. The large and frequently statistically significant coefficients on the circumcised indicator variable in our main tables, Table 2 through 4 also suggest important differences in sexual behavior, demand for male circumcision, and beliefs. For example, circumcised men in the control group score 0.123 standard deviations lower on our risky sex measure than uncircumcised men in the control group (Table 2, Column 12). Rather than the asymmetric response to the information treatment due to differences in risk type, it may be that some other underlying factor correlated with circumcision status is important in determining the direction and extent of behavioral responses.

We test whether differences that are correlated with circumcision status may be driving the results with the following specification:

$$(2)\ Y_{ij} = \alpha + \beta_1 Treatment_j + \beta_2 Treatment * Circumcised_{ij} + \beta_3 Treatment * BaseVar_{ij} + \beta_4 BaseVar * Circumcised_{ij} + \beta_5 Circumcised_{ij} + \beta_6 BaseVar_{ij} + \gamma X' + \varepsilon_{ij}$$

for our three main outcome variables: our index of risky sex (RSB), willingness to have a son circumcised, and the belief that circumcision is associated with lower HIV risk. We omit the triple interaction as we are interested in whether controlling for the baseline variable interacted with treatment status diminishes our key parameters of interest: β_1 and β_2, rather than estimating heterogeneity of behavioral responses with respect to circumcision status and baseline characteristics. Using this specification, if the differential effects are not driven by circumcision status but rather by some other difference correlated with circumcision status then we should observe large changes to β_1 and β_2.

In Appendix Tables G, H and I we present the results showing our main estimates of β_1 and β_2. For each outcome variable, our estimates are relatively unchanged even when controlling for these other factors. It is unlikely that other inherent differences between circumcised and uncircumcised respondents are driving the asymmetric responses.

HIV Testing and Life Expectancy

Another channel through which information about male circumcision and HIV transmission risk could affect behavior is through changes to HIV testing behavior in response to the information, which in turn affects behavior. Similarly, behavior may be influenced by changes in perceptions about life expectancy after learning about male circumcision and HIV, or after testing. At the follow-up survey individuals were asked about their HIV testing behavior and perceived life expectancy.[21] Using our main empirical specification (1), we estimate how the treatment affected these outcomes. Table 5 presents these results.

Among uncircumcised men, there were no significant effects of the treatment on HIV testing or on perceived life expectancy. Although circumcised men in the treatment group significantly increased their likelihood of having an HIV test by seven percentage points (p-value 0.077), there were no significant differences between treatment and control in perceived life expectancy suggesting that these factors are not likely to be important channels driving our results. Moreover, studies have found limited average effects of HIV testing suggesting that the seven percentage point increase in the likelihood of testing among circumcised men is unlikely to impact subsequent behavior (e.g. Thornton, 2008; Thornton, 2012).

[21] To elicit beliefs about life expectancy individuals were asked a series of yes/no questions about whether they thought they would survive up to various ages.

Ex-ante Knowledge about Male Circumcision and HIV

Our main empirical strategy in this paper is to measure responses to experimentally varied information about male circumcision and HIV transmission risk, holding all else constant. Yet, individuals' responses to information may vary with their ex-ante beliefs about male circumcision and HIV transmission risk. Several papers have examined how information interacts with baseline beliefs (Gong, forthcoming; Boozer and Philipson, 2000), or, in the case of Wilson, Xiong and Mattson (2014), how getting circumcised interacts with baseline beliefs.

Using our measures of baseline beliefs about male circumcision and HIV transmission risk, we can measure differential responses by interacting prior beliefs as follows:

(3) $$Y_{ij} = \alpha + \beta_1 Treatment_j + \beta_2 Treatment * Circumcised_{ij} + \beta_3 Circumcised_{ij} + \beta_4 Correct_{ij} + \beta_5 Circumcised * Correct_{ij} + \beta_6 Treatment * Correct_{ij} + \beta_7 Treatment * Circumcised * Correct_{ij} + \gamma X' + \varepsilon_{ij}$$

In this specification, β_1, β_2, and β_3 can be interpreted as in equation (1) for men who have incorrect baseline beliefs about the relationship between male circumcision and HIV risk. According to Gong (forthcoming) and Boozer and Philipson (2000), those with incorrect beliefs will respond more to new information than those who have correct ex-ante beliefs.

Table 6 presents these results. For simplicity we focus on three key outcomes: the risky sexual behavior index (RSB), willingness to circumcise a son, and having the correct ex-post belief that circumcision reduces HIV transmission risk. The coefficients β_1 and β_2 (*Treatment* and *Treatment * Circumcised*) are very similar in magnitude to the estimates in Tables 2, 3, and 4. Among uncircumcised men, β_6 (*Treatment * Correct*) indicates the difference in the treatment effect between men with correct and incorrect prior beliefs. For each outcome, we are unable to reject the null hypotheses of no differential treatment effect by baseline beliefs. Among circumcised men, we also find no significant differences in the effect of the information treatment by ex-ante beliefs (Joint test of significance $\beta_6 + \beta_7 = 0$: *Treatment * Correct* + *Treatment * Correct * Circumcised* = 0).

Spillovers and Media Exposure

Information interventions are difficult to evaluate given the ease with which information can be shared. In the presence of such spillovers, the estimated treatment effects could be attenuated. To determine whether spillovers are a concern for our estimates, we first compare changes in knowledge about male circumcision and HIV transmission risk across baseline and follow-up surveys among men in control villages. Overall, 35 percent of the respondents in the control group at the baseline report that male circumcision is associated with a lower HIV transmission risk (41 percent circumcised, 20 percent uncircumcised). At the follow-up, this rate increases to 61 percent in the control group (67 percent circumcised, 46 percent uncircumcised). Similarly, there is a significant change in the distribution of beliefs using our continuous measure of the per-sex act rate of HIV risk among respondents in the control group at the follow-up survey. Figures 1a and b present the CDFs of the distribution of beliefs of the per-sex act rates of HIV transmission among treatment and control men at the baseline and follow-up separately for circumcised and uncircumcised respondents. The shifts in beliefs about male circumcision and HIV transmission risk suggest potential information spillovers from the treatment to the control group during the study, or, a general increase in learning about the relationship between male circumcision and HIV transmission risk between surveys that may have occurred even without the presence of the information intervention. Figure 1b also shows that the distribution of beliefs among uncircumcised respondents at baseline is somewhat different. In particular, uncircumcised respondents in the control group are less likely to believe that the per-sex act transmission rate is 100 percent.

To estimate the extent of information spillovers that may have occurred due to the geographic proximity of the treatment and control respondents we use the following specification:

$$(4) Y_{ij} = \alpha + \beta_1 Treatment_j + \beta_2 Treatment * Circumcised_{ij} + \beta_3 Circumcised_{ij} + \beta_4 MinDist_{ij} + \beta_5 MinDist * Circumcised_{ij} + \beta_6 MinDist * Treatment_{ij} + \beta_7 MinDist * Treatment * Circumcised_{ij} + \gamma X' + \varepsilon_{ij}$$

where $MinDist_i$ indicates the minimum distance in kilometers to a treatment neighbor residing in a different village, for each individual, *i*. This allows for and measures differential treatment effects by the geographical distance from a treated respondent residing in a different village. The average distance to the nearest treated respondent in a different village is approximately half a kilometer (Table 1). There is some imbalance at baseline to the nearest treated neighbor which is primarily driven by three control villages that are on average further away from any treatment village. An alternative specification would be to regress outcomes on the fraction of treated neighbors controlling for the total number of neighbors (Miguel and Kremer, 2004; Godlonton and Thornton, 2012). However, because treatment was randomized at the village level, we lack variation in the percentage of neighbors who are treated. The majority of the respondents (78.2 percent) are surrounded by either zero or 100 percent treated neighbors within a 200m radius (52.4 percent within a 400m radius). Moreover, there is limited common support between the treatment and control groups for these network measures given the village-level assignment to treatment.

Table 7 presents the estimates from this specification on the index of risky sexual behavior (RSB), willingness to circumcise sons, and the belief that circumcision is associated with lower HIV transmission risk. The additional effect of living close to treatment respondents for circumcised and uncircumcised men is measured with the coefficients, β_6 and β_7. Each of the coefficients containing *MinDist* is small and statistically insignificant across each of the three main outcome variables (Table 7, Columns 1-3). Moreover, the coefficients on *Treatment* (β_1) and *Treatment * Circumcised* (β_2) are roughly similar to those in Tables 2, 3, and 4 suggesting that treatment neighbors are not having even moderate effects on men living in control villages.

Rather than spillovers due to the information intervention, respondents may have been exposed to information about male circumcision and HIV transmission risk through a variety of channels including media or John Henry effects related to the experiment.[22] Therefore, our estimates may present a lower bound on the estimated effect of information.

8 Conclusion

Over the last several decades, there has been growing interest and resulting literature focused on behavioral responses to various interventions, especially new risk reducing technologies or policies. This literature has found mixed results. In cases of new technologies, risk-compensation may offset the positive technological effects. The net impact of disseminating new information about risk, however, depends entirely on behavioral responses. Understanding how individuals respond to new information is important not only for policy makers planning dissemination strategies, but also to economists studying uncertainty as well as the role of positive or negative information on beliefs and behavior.

Risk compensation related to HIV and sexual behavior has been recognized within public health as an important consideration for HIV prevention and treatment programs as well as for the dissemination of information about HIV risk (Cassel et al., 2006; Eaton and Kalichman, 2007, 2009 and 2014; Lakdawalla, Sood, and Goldman, 2006). However, empirically measuring responses to risk or

[22] Participation in the survey may have increased interest or knowledge. Each respondent received an HIV brochure at the end of the baseline survey mentioning HIV-prevention strategies. Lastly, survey enumerators themselves were recruited locally and many lived in the study villages.

information about risk is difficult. Related papers using non-randomized methods, examine the possible disinhibiting effects of access to, or knowledge of antiretroviral therapy (Chan, Hamilton and Papageorge, 2013; Crepaz, Hart and Marks, 2004; Friedman, 2014; Guest et al., 2008; Marcus et al. 2013, Stolte et al., 2001; de Walque, Kazianga and Over, 2012). Kajubi et al. (2005) measures the responses to condom-use promotion campaigns. These papers find somewhat mixed results.[23]

Our paper studies information about risk in a unique setting in which there is newly available information for a population with clear asymmetric predictions; this information is randomly disseminated enabling us to measure causal behavioral responses. We see large decreases in risky sex among uncircumcised men living in treatment villages one year after the information was shared. While it is difficult to precisely quantify the impact these changes in sexual behavior would have on the HIV epidemic on the whole, simulations show that even small increases in condom use or safe sex can reduce the spread of HIV (Bracher, Santow and Watkins, 2004).[24] Our results are generally consistent with those in Wilson et al. (2014) who find that individuals who ex-ante believe male circumcision is partially protective, engage in less risky sex after getting circumcised. Importantly, we find no evidence, on average and differentially by ex-ante beliefs about risk, that circumcised men practice riskier sex upon learning new information about their risk type.

Our results also provide some of the first empirical evidence on the demand for medical male circumcision. For uncircumcised adult men, we find no significant effects of the information on receiving a circumcision. In fact, a total of only seven adult men were circumcised, indicating that providing information alone is not enough to increase demand for voluntary medical male circumcision. We do find significant increases in the reported willingness to have young male dependents circumcised, although there were no significant impacts on actual circumcisions. These results are important in

[23] Other papers have examined responses to HIV prevalence rates (Oster, 2012; Fortson, 2011; Fortson 2009; Kalemli-Ozcan and Turan, 2011; Young 2005; Young, 2007; Kerwin 2014); community HIV testing (Godlonton and Thornton, 2013).

[24] While most HIV prevention studies have found limited evidence of behavioral change (McCoy, Kangwende and Padian, 2010) there are some examples of success. Dupas (2011) finds that girls who learn about HIV transmission risk with older men are 12 percentage points more likely to use a condom at last intercourse. In response to a cash grant experimentally offered to men and women in Tanzania conditional on staying STI-free, individuals were significantly less likely to be infected with STIs after 12 months, after controlling for baseline variables (de Walque et al., 2012). In a similar conditional cash transfer study conducted in Malawi, Kohler and Thornton (2011) find no significant effects of a financial incentive on sexual behavior, but find that women receiving a moderate cash grant were 7.4 percentage points less likely to have sex. Receiving cash (either unconditionally, or conditional on school attendance) also had an impact on adolescent girls in Malawi, significantly reducing rates of HIV and HSV-2 (Baird et al., 2012).

considering strategies to stimulate demand and scale up medical male circumcision and consistent with the findings in Chinkhumba, Godlonton and Thornton, 2014.

While our results indicate that information can have lasting effects on knowledge and behavior, there are reasons to believe that the responses to information may depend on the setting. First, our results may depend on the level of government support or existing male circumcision resources in Malawi at the time of the study. Second, it is important to note that the circumcised men in our sample were circumcised at young ages due to cultural or ethnic reasons. Our results may not generalize to risk compensation among men who become circumcised as adults as a strategy for HIV prevention although there is evidence that this is also not a significant concern (Mattson et al., 2008). Third, the results are based on a sample of rural men, the majority of whom are married. We provide suggestive evidence that the risk-reducing behaviors among uncircumcised men may in fact be larger in samples comprised of unmarried men and therefore also in the general population. Fourth, the findings are limited to self-reported measures of behavior; however, these measures are consistent over many outcomes and with pregnancy status and actual condom purchases offered at the end of the survey. Lastly, while information alone did not have an impact on men or boys receiving a circumcision, information may be a crucial factor for circumcision take-up after the removal of other barriers.

Despite the limited prior empirical evidence about the effects of receiving risk-reducing health information, there is a widespread fear, especially among health providers and experts, that information about reduced risk may induce individuals to take fewer precautions. This concern induces some to withhold information, without empirical evidence of a negative effect, and slows the release of potentially beneficial information. We believe this paper presents some of the first evidence that these fears may be unwarranted, and may do more harm than good by preventing higher risk groups the ability to respond, but encourage more research on understanding beliefs and behavioral responses. In addition to the policy importance of the results, this paper contributes to the growing literature in economics on behavioral responses to information about risk, risk compensation, belief updating, and the adoption of health technologies.

References

Agot, K., J.N. Kiarie, H.Q. Nguyen, J. Odhiambo, T.M. Onyango, and N.S. Weiss. (2007). "Male Circumcision in Siaya and Bondo Districts, Kenya: Prospective Cohort Study to Assess Behavioral Dis-inhibition Following Circumcision." *JAIDS Journal of Acquired Immune Deficiency Syndromes*. 44(1):66-70.

Anglewicz, Philip and Hans-Peter Kohler. (2009). "Overestimating HIV infection: The construction and accuracy of subjective probabilities of HIV infection in rural Malawi." *Demographic Research*. 20(6): 65–96. doi: 10.4054/DemRes.2009.20.6

Anglewicz, Philip, Jimi Adams, Francis Obare, Hans-Peter Kohler, and Susan C. Watkins. (2009). "The Malawi Diffusion and Ideational Change Project 2004–06: Data collection, data quality, and analysis of attrition." *Demographic Research*. 20(21): 503-540.

Autier, P., J.F. Doré, M.S. Cattaruzza, F. Renard, H. Luther, F. Gentiloni-Silverj, E. Zantedeschi, M. Mezzetti, I. Monjaud, M. Andry, et al. (1998). "Sunscreen Use, Wearing Clothes, and Number of Nevi in 6- to 7-Year-Old European Children." *Journal of the National Cancer Institute*. 90(24).

Auvert, Bertran, Dirk Taljaard, Emmanuel Lagarde, Joëlle Sobngwi-Tambekou, Rémi Sitta, and Adrian Puren. (2005). "Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: The ANRS 1265 trial." *PLoS Med* 2: e298.

Bailey, R. C., Muga, R., Poulussen, R., and Abicht, H. (2002). "The acceptability of male circumcision to reduce HIV infections in Nyanza Province, Kenya." *AIDS Care*. 14(1): 27–40.

Bailey, Robert C., Stephen Moses, Corette B. Parker, Kawango Agot, Ian Maclean, John N, Krieger, Carolyn F.M. Williams, Richard T. Campbell,Jeckoniah O. Ndinya-Achola. (2007). "Male circumcision for HIV prevention in young men in Kisumu, Kenya: a randomised controlled trial." *The Lancet*. 369 (9562): 643–656.

Baird, Sarah J., Richard S. Garfein, Craig T. McIntosh, Berk Özler. (2012). "Effect of a cash transfer programme for schooling on prevalence of HIV and herpes simplex type 2 in Malawi: a cluster randomised trial." *Lancet*, 379: 1320-1329.

Bennear, Lori, Alessandro Tarozzi, Alexander Pfaff, Soumya Balsubromanya, Kazi M. Ahmed, Alexander van Geen. (2013). "Impact of a randomized controlled trial in arsenic risk communication on household water-source choices in Bangladesh." *Journal of Environmental Economics and Management*. 65(2): 225 – 240.

Blomquist, Glenn C. (1988). “The Regulation of Motor Vehicle and Traffic Safety.” Boston, MA: Kluwer Academic.

Boozer, Michael A. and Tomas J. Philipson. (2000). “The Impact of Public Testing for Human Immunodeficiency Virus.” *Journal of Human Resources*. 31(3): 419 – 446.

Bracher, Michael, Gigi Santow, Susan C. Watkins. (2004). “Assessing the Potential of Condom Use to Prevent the Spread of HIV: A Microsimulation.” *Studies in Family Planning*. 35(1): 48-64

Braun, Curt C., and Jason W. Fouts. (1998). “Behavioral response to the presence of personal protective equipment.” *Hum. Factors Ergon. Soc.* 2, 1058–1063.

Cassell, Michael M., Daniel T. Halperin, James D. Shelton and David Stanton. (2006). "Risk compensation: the Achilles' heel of innovations in HIV prevention?" *BMJ*. 332(7541): 605-607.

Chan, Tat Y., Barton H. Hamilton, and Nicholas W. Papageorge. (2013). “Health and the Option Value of Medical Innovation.” Working paper.

Chinkumba, Jobiba, Susan Godlonton, and Rebecca Thornton. “The Demand for Male Circumcision” (forthcoming). *American Economic Journal, Applied Economics*.

Chong, Alberto, Marco Gonzalez-Navarro, Dean Karlan and Martin Valdivia. (2013). “Effectiveness and Spillovers of Online Sex Education: Evidence from a Randomized Evaluation in Colombian Public Schools.” *University of Toronto Mimeograph.*

Clark, Shelly, Caroline Kabiru, and Eliya Zulu. (2011). “Do Men and Women Report Their Sexual Partnerships Differently?: Evidence From Kisumu, Kenya.” *International Perspectives on Sexual and Reproductive Health.* 37(4):181-90. doi: 10.1363/3718111.

Cohen, Alma and Liran Einav. (2003). “The Effects of Mandatory Seat Belt Laws on Driving Behavior and Traffic Fatalities.” *Review of Economics and Statistics*, 85(4): 828-843.

Crepaz, Nicole, Trevor A. Hart and Gary Marks. (2004). “Highly active antiretroviral therapy and sexual risk behavior: a meta-analytic review.” *JAMA.* 292: 224 – 236.

de Walque, Damien, William H. Dow, Rose Nathan, Ramadhani Abdul, Faraji Abilahi, Erick Gong, Zachary Isdahl, Julian Jamison, Boniphace Jullu, Suneeta Krishnan et al. (2012). “Incentivizing Safe Sex: a Randomized Trial of Conditional Cash Transfers for HIV and Sexually Transmitted Infection Prevention in Rural Tanzania.” *BMJ Open* 2:e000747.

de Walque, Damien, Harounan Kazianga, and Mead Over. (2012). “Antiretroviral Therapy Perceived Efficacy and Risky Sexual Behaviors: Evidence from Mozambique," *Economic Development and Cultural Change*, 61(1): 97-126.

Dickie, Mark and Shelby Gerking. (1997). “Genetic Risk Factors and Offsetting Behavior: The Case of Skin Cancer.” *Journal of Risk and Uncertainty*, 15(1): 81-97.

Doyle, D. (2005). “Ritual Male Circumcision: A Brief History.” *J R Coll Physicians Edinb* 35: 279-285.

Drain, Paul K., Jennifer S. Smith, James P. Hughes, Daniel T. Halperin, and King K. Holmes. (2004). "Correlates of national HIV seroprevalence: An ecological analysis of 122 developing countries." *J Acquir Immune Defic Syndr*. 35: 407-420.

Dupas, Pascaline. (2011). “Do Teenagers Respond to HIV Risk Information? Evidence from a Field Experiment in Kenya.” *American Economic Journal: Applied Economics.* 3 (1):1-36.

Eaton, Lisa A., and Seth C. Kalichman. (2007). “Risk compensation in HIV prevention: implications for vaccines, microbicides, and other biomedical HIV prevention technologies.” *Current HIV/AIDS Reports* (4): 165-172.

Eaton, Lisa A. and Seth C. Kalichman. (2009) Behavioral aspects of male circumcision for the prevention of HIV infection. *Current HIV/AIDS Reports*, 6(4):187–93.

Eaton, Lisa A. and Seth C. Kalichman (eds). (2014). Biomedical Advances in HIV Prevention, Springer Science and Business Media, New York.

Evans, William N. and John D. Graham. (1991). “Risk Reduction or Risk Compensation? The Case of Mandatory Safety-Belt Use Laws.” *Journal of Risk and Uncertainty*, 4:61-73

Fenton, Kevin A., Anne M. Johnson, Sally McManus, and Bob Erens. (2001). “Measuring sexual behaviour: methodological challenges in survey research.” *Sexually Transmitted Infections.* 77: 84-92.

Fortson, Jane. (2009). “HIV/AIDS and fertility." *American Economic Journal: Applied Economics*, 1(3): 170-194.

Fortson, Jane. (2011). “Mortality Risk and Human Capital Investment: The Impact of HIV/AIDS in Sub-Saharan Africa," *Review of Economics and Statistics*, 93(1): 1-15.

Friedman, Willa. (2014). “Antiretroviral drug access and behavior change.” *Center for Global Development Mimeograph*.

Godlonton, Susan and Rebecca Thornton. (2012). "Peer Effects in Learning HIV Results." *Journal of Development Economics.* 97(1): 118-129.

Godlonton, Susan, and Rebecca Thornton. (2013). "Learning from Others' HIV Testing: Updating Beliefs and Responding to Risk." *American Economic Review Papers and Proceedings*, 103(3):439-444.

Gong, Erick. (forthcoming). "HIV Testing and Risky Sexual Behavior." *The Economic Journal*.

Gray Ronald H., Godfrey Kigozi, Xiangrong Kong, Victor Ssempiija, Frederick Makumbi, Stephen Wattya, David Serwada, Fred Nalugoda, Nelson K. Sewenkambo and Maria J. Wawer. (2012). "The effectiveness of male circumcision for HIV prevention and effects on risk behaviors in a posttrial follow-up study." *AIDS* 26(5):609–15

Gray, Ronald H., Godfrey Kigozi, David Serwadda, Frederick Makumbi, Stephen Watya, Fred Nalugoda, Noah Kiwanuka, Lawrence H. Moulton, Mohammed A. Chaudhary, Michael Z. Chen et al. (2007). "Male circumcision for HIV prevention in men in Rakai, Uganda: a randomised trial". *Lancet.* 369 (9562): 657–666.

Gray, R.H., M.J. Wawer, R. Brookmeyer, N.K. Sewankambo, D. Serwadda, F. Wabwire-Mangen, T. Lutalo, X. Li, T. van Cott, T.C. Quinn, Rakai Project Team. (2001). "Probability of HIV-1 transmission per coital act in monogamous, heterosexual, HIV-1-discordant couples in Rakai, Uganda." *Lancet.* 357(9263):1149-53.

Grund, J.M., M.M. Hennink. "A qualitative study of sexual behavior change and risk compensation following adult male circumcision in urban Swaziland." AIDS Care. 24(2):245–51

Guadagno, Rosanna E. and Robert B. Cialdina. (2002). "Online persuasion: an examination of gender differences in computer mediated interpersonal influence." *Group Dynamics: Theory Research and Practice*. 6(38-51).

Guadagno, Rosanna E. and Robert B. Cialdina. (2007). "Persuade him by email, but see her in person: Online persuasion revisited." *Computers in Human Behavior.* 23: 999-1015.

Guest, G., D. Shattuck, L. Johnson, B. Akumatey, E.E. Clarke, P.L. Chen, and K.M MacQueen. (2008). "Changes in sexual risk behavior among participants in a PrEP HIV prevention trial." *Sexually Transmitted Diseases*. 35: 1002-1008.

Halperin, D.T., H.A. Weiss, R. Hayes, B. Auvert, R.C. Bailey, J. Caldwell, T. Coates, N. Padian, M. Potts, A. Ronald, R. Short, B. Williams, and J. Klausner. (2002). "Response to Ronald Gray, Male circumcision and HIV acquisition and transmission: cohort studies in Rakai, Uganda." *AIDS.* 16(5): 810-812.

Jamison, Julian, Dean Karlan, and Pia Raffler. (2013). "Mixed Method Evaluation of a Passive mHealth Sexual Information Texting Service in Uganda." *Information Technology and International Development*, 9(3).

Kalemli-Ozcan, Sebnem and Turan, Belgi, 2011. "HIV and fertility revisited," *Journal of Development Economics*, 96(1): 61-65.

Kahneman, Daniel and Amos Tversky. (1979). "Prospect Theory: An Analysis of Decision under Risk." *Econometrica*, 47(2): 263-292

Kajubi, Phoebe, Moses R. Kamya, Sarah Kamya, Sanny Chen, Willi McFarland, and Norman Hearst. (2005). "Increasing Condom Use Without Reducing HIV Risk: Results of a Controlled Community Trial in Uganda." *Journal of Acquired Immune Deficiency Syndrome*. 40(1): 77- 82.

Kalichman, Seth, Lisa Eaton, Steven Pinkerton. (2007). "Circumcision for HIV Prevention: Failure to Fully Account for Behavioral Risk Compensation." *PLoS Med*. 4(3): e138. doi:10.1371/journal.pmed.0040138

Kaplan, Cameron. (2012). "Risk compensation and treatment for high cholesterol." *University of Pittsburgh Mimeograph.*

Kapoor, S. (2008) "The HPV vaccine and behavioral disinhibition." *Journal of Adolescent Health.* 42:105.

Kebaabetswe, P., S. Lockman, S. Mogwe, R. Mandevu, I. Thior, M. Essex and R.L. Shapiro. (2003). "Male circumcision: an acceptable strategy for HIV prevention in Botswana." *Sex Transm Infect.* 79: 214-219.

Kerwin, Jason. (2014). "Rational Fatalism": Non-Monotonic Choices in Response to Risk." *University of Michigan Mimeograph.*

Kohler, Hans-Peter and Rebecca Thornton. (2011). "Conditional Cash Transfers and HIV/Aids Prevention: Unconditionally Promising?" *World Bank Economic Review*. 26: 165-190.

Kling, Jeffrey R., Jeffrey B. Liebman, and Lawrence F. Katz. (2007). "Experimental Analysis of Neighborhood Effects." *Econometrica*. 75(1): 83-119.

Lakdawalla, Darius, Neeraj Sood, and Dana Goldman (2006). "HIV breakthroughs and risky sexual behavior." *The Quarterly Journal of Economics*, 121(3): 1063-1102.

Lagarde, E., T. Dirk, A. Puren, R.T. Reathe, and A. Bertran. (2003). “Acceptability of male circumcision as a tool for preventing HIV infection in a highly infected community in South Africa.” *AIDS.* 17(1): 89-95.

Lo, Bernard. (2006). “HPV vaccine and adolescents’ sexual activity.” *BMJ*. 332: 1106 – 1107.

Marcus, Julia L., David V. Glidden, Kenneth H. Mayer, Albert Y. Liu, Susan P. Buchbinder, K. Rivet Amico, Vanessa McMahan, Esper G. Kallas, Orlando Montoya-Herrera, Jose Pilotto, Robert M. Grant. (2013). “No Evidence of Sexual Risk Compensation in the iPrEx Trial of Daily Oral HIV Preexposure Prophylaxis.” *PLoS One*. 8(12):e81997. doi: 10.1371/journal.pone.0081997.

Mann, Henry B., and Donald R. Whitney. (1947). “On a test whether one of two random variables is stochastically larger than the other.” *Annals of Mathematical Statistics*. 18: 50-60.

Marck, Jeff. (1997). "Aspects of male circumcision in sub-equatorial African culture history." *Health Transition Review Supplement to Volume* 7: 337-359.

Mattson, Christine L., Richard T. Campbell, Robert C. Bailey, Kwawango Agot, Jeckoniah O. Ndinya-Achola and Stephen Moses. (2008). “Risk Compensation Is Not Associated with Male Circumcision in Kisumu, Kenya: A Multi-Faceted Assessment of Men Enrolled in a Randomized Controlled Trial.” *PLoS ONE*. 3(6): e2443.

McCoy, Sandy I., Rugare A. Kangwende, Nancy S. Padian. (2010). “Behavior change interventions to prevent HIV infection among women living in low and middle income countries: a systematic review.” *AIDS Behav.* 14(3):469-82. doi: 10.1007/s10461-009-9644-9.

MDHS. (2010). Malawi Demographic and Health Survey. Zomba, Malawi and Calverton, MD: National Statistical Office [Malawi] and ICF Macro.

Mensch, Barbara S., Paul C. Hewett, Richard Gregory, and Stephane Helleringer. (2008). “Sexual Behavior and STI/HIV Status among Adolescents in Rural Malawi: An Evaluation of the Effect of Interview Mode on Reporting.” *Studies in Family Planning*. 39(4): 321-334

Miguel, Edward and Michael Kremer. (2004). "Worms: Identifying Impacts of Education and Health in the Presence of Treatment Externalities." *Econometrica.* 72(1): 159-217.

Namangale, Frank. (2007). “Approach Male Circumcision with Caution.” *Malawi Daily Times*. March 9, 2007.

Ngalande, Rebecca C., Judith Levy, Chrissie P.N. Kapondo, and Robert C. Bailey.(2006). "Acceptability of Male Circumcision for Prevention of HIV Infection in Malawi." *AIDS and Behavior*. 10(4): 377-385.

Njeuhmeli, Emmanuel, Steven Forsythe, Jason Reed, Marjorie Opuni, Lori Bollinger, Nathan Heard, Delivette Castor, John Stover, Timothy Farley, Veena Menon et al. (2011). "Voluntary Medical Male Circumcision: Modeling the Impact and Cost of Expanding Male Circumcision for HIV Prevention in Eastern and Southern Africa." *PLoS Medicine.* 8(11): e1001132. doi:10.1371/journal.pmed.1001132

Nnko, Soori, Robert Washija, Mark Urassa, J. Ties Boerma. (2001). "Dynamics of Male Circumcision Practices in Northwest Tanzania." *Sexually Transmitted Diseases*. 28: 214-218.

Oster, Emily. (2012). "HIV and Sexual Behavior Change: Why Not Africa?" *Journal of Health Economics*, 31(1): 35-49.

Peltzman, Sam. (1975). "The Effects of Automobile Safety Regulation." *Journal of Political Economy*. 83(4): 677-726.

Pierotti, Rachael, and Rebecca Thornton. (2013). "Contemplating Circumcision: The influence of social networks on decision-making." *University of Michigan Mimeograph*.

ReThinkHIV (2012). Priorities: Georgetown University Expert Panel. http://www.rethinkhiv.com/experts/113-rethinkhiv-expert-panel-outcome. Accessed January 30, 2012

Rabin, Matthew and Joel L. Schrag. (1999). "First Impressions Matter: A Model of Confirmatory Bias." *Quarterly Journal of Economics*. 114(1): 37-82.

Rain-Taljaard, R.C., E. Lagarde, D.J. Taljaard, C. Campbell, C. MacPhail, B. Williams and B. Auvert. (2003). "Potential for an intervention based on male circumcision in a South African town with high levels of HIV infection." *AIDS Care*. 15(3): 315-327.

Sterck, Olivier. (2013). "Why testing rates are so low in Sub-Saharan Africa? Misconceptions and strategic behavior." *Forum of Health Economics and Policy*, 16(1): 219 – 257.

Sterck, Olivier. (2014). "HIV/AIDS and Fatalism: Should Prevention Campaigns Disclose the Transmission Rate of HIV?" *Journal of African Economies*, 23(1): 53 – 104.

Stolte, I.G., N.H Dukers, J.B. de Wit, J.S. Fennema, and R.A. Coutinho. (2001). "Increase in Sexually Transmitted Infections among Homosexual men in Amsterdam in relation to HAART." *Sexually Transmitted Infections*. 77(3): 184 – 186.

Tenthani, Raphael. (2010). “Malawi Rules Out Circumcision for AIDS Prevention”. Associated Press.

Thornton, Rebecca. (2008). "The Demand for and Impact of Learning HIV Status: Evidence from a Field Experiment." *American Economic Review*. 98(5): 1829 – 63.

Thornton, Rebecca. (2012). “HIV Testing, Subjective Beliefs and Economic Behavior.” *Journal of Development Economics*. 99(2): 300-313.

Tunikekwathu News 10 October 2011 (p.8)

UNAIDS. (2010). “UNAIDS global report on the AIDS epidemic.”

Valley, Kathleen L., Joseph Moag, and Max H. Bazerman. (1998). “A matter of trust: Effects of communication on the efficiency and distribution of outcomes.” *Journal of Economic Behavior and Organization.* 34(2): 221-238.

Valley, Kathleen L., Leigh Thompson, Robert Gibbons and Max H. Bazerman. (2002). “How Communication Improves Efficiency in Bargaining Games.” *Games and Economic Behavior*. 38: 127-155.

Walker, Ian. (2007). “Drivers overtaking bicyclists: Objective data on the effects of riding position, helmet use, vehicle type and apparent gender.” *Accident Analysis & Prevention*. 39(2): 417-425.

Wilcoxon, Frank. (1945). “Individual comparisons by ranking methods.” Biometrics 1: 80-83.

Williams-Avery R.M., and D.P. MacKinnon. (1996). “Injuries and use of protective equipment among college in-line skaters.” *Accident Analysis and Prevention*. 28(6): 779-784.

Wilson, Nicholas, Wentao Xiong and Christine L. Mattson. (2014). “Is Sex Like Driving? Risk Compensation Associated with Male Circumcision in Kisumu, Kenya”. *Journal of Development Economics*, 106(1): 78-91.

Wilson, Nicholas (2010). “Antiretroviral Therapy and Demand for HIV Testing: Evidence from Zambia," *Reed College Mimeograph.*

Young, Alwyn (2005). “The Gift of the Dying: The Tragedy of AIDS and the Welfare of Future Generations," *The Quarterly Journal of Economics*. 120(2):423-466.

Young, Alwyn (2007), “In Sorrow to Bring Forth Children: Fertility Amidst the Plague of HIV," *Journal of Economic Growth*. 12(4): 283-327.

Zimet, Gregory D, Nicole Lidden, Susan L. Rosenthal, Eduardo Lazcano-Ponce and Betania Allen. (2006). “Psychosocial aspects of vaccine acceptability”. *Vaccine*. 24(S3): S201 – S209.

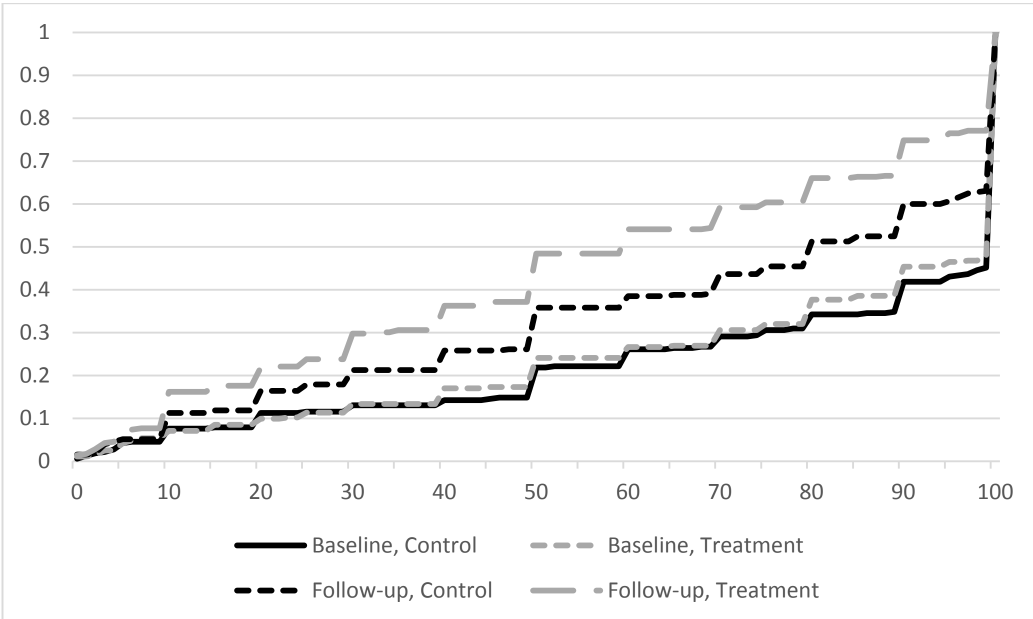

Figure 1a: Baseline and Follow-up CDF of Perceived Circumcised Men Transmission Rate among circumcised men

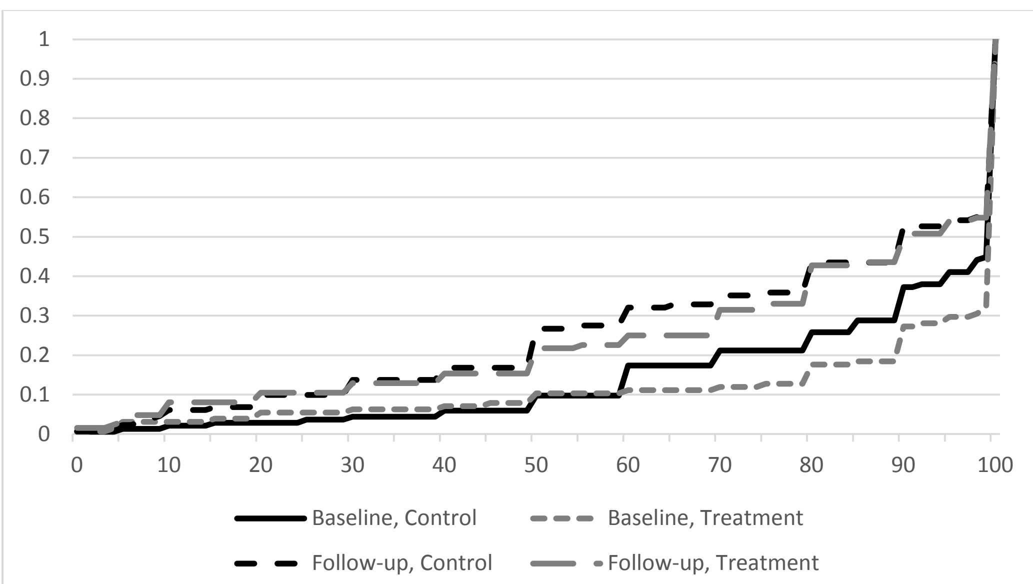

Figure 1b: Baseline and Follow-up CDF of Perceived Circumcised Men Transmission Rate among uncircumcised men

Notes: This figure presents the distribution of the question at baseline and follow-up survey: *"If 100 circumcised men each had unprotected sex with a woman who was HIV positive last night, how many of them would become infected?"*

Table 1: Baseline Characteristics

		Mean	SD	Control	Treatment	Balance p-value	Attrition p-value
		(1)		(2)	(3)	(4)	(5)
Demographics:	Age	31.779	6.847	31.838	31.718	0.772	0.326
	Married	0.896	0.306	0.889	0.903	0.445	0.246
	Years of Education	5.878	3.626	6.123	5.629	0.066	0.559
	Circumcised	0.737	0.441	0.728	0.745	0.658	0.653
	Number of sons ever born	1.664	1.413	1.738	1.589	0.073	0.336
Tribe:	Chewa	0.050	0.219	0.050	0.051	0.953	0.014
	Lomwe	0.169	0.375	0.131	0.207	0.030	0.917
	Nyanja	0.405	0.491	0.417	0.401	0.774	0.375
	Yao	0.355	0.479	0.380	0.330	0.434	0.760
Religion:	Christian	0.539	0.499	0.525	0.553	0.573	0.604
	Muslim	0.389	0.488	0.396	0.383	0.788	0.504
Wealth:	Income (logged)	8.882	1.814	8.944	8.964	0.862	0.751
	Assets	4.436	2.372	4.661	4.207	0.010	0.314
	Farmer	0.621	0.485	0.621	0.621	0.992	0.823
	Salaried	0.132	0.339	0.170	0.094	0.001	0.586
	Self-Employed	0.357	0.479	0.342	0.371	0.320	0.897
Sexual Behavior:	Age at sexual debut	17.116	3.403	17.022	17.211	0.400	0.609
	Had sex in the last month	0.755	0.430	0.765	0.744	0.409	0.397
	# of sexual partners across lifetime	4.294	4.542	4.348	4.239	0.709	0.669
	# of sexual partners in last 12 months	1.115	0.764	1.151	1.078	0.106	0.776
	Ever used a condom	0.401	0.490	0.414	0.388	0.469	0.275
	Fraction of safe sex encounters in past month	0.113	0.265	0.122	0.103	0.323	0.499
Media:	Number of messages about HIV in last 30 days[1]	11.930	17.629	12.571	11.275	0.236	0.103
Spillovers:	Distance to nearest treatment respondent[2]	0.493	0.665	0.399	0.587	0.018	0.098
Beliefs:	Transimssion rate for circumcised men[3]	81.510	29.155	81.742	81.272	0.787	0.959
	Transimssion rate for uncircumcised men[3]	91.263	19.996	90.389	92.160	0.133	0.953
	Circumcised at higher risk of HIV	0.126	0.332	0.103	0.149	0.039	0.146
	Circumcised at lower risk of HIV	0.362	0.481	0.351	0.374	0.509	0.859

Notes:

The main sample consists of 1,228 men residing in Zomba district in Malawi who agreed to participate in the baseline survey conducted in

[1] The number of media messages about HIV in the last 30 days combines respondent responses to the following two questions: "How many times have you heard radio spots or messages with regards to HIV/Aids in the last 30 days?" and "How many times have you read articles, messages, or advertisements about HIV/Aids in a magazine or newspaper in the last 30 days?"

[2] The distance to nearest neighbor is measured as the distance in kilometers to the closest treated respondent in a different village.

[3] Perceived HIV transmission probabilities are measured by the following: i) "If 100 circumcised men each slept with a woman who is HIV positive last night, how many of them do you think would get HIV?"; and ii) "If 100 uncircumcised men each slept with a woman who is HIV positive last night, how many of them do you think would get HIV?"

Table 2: Impact of Information on Sexual Behavior

Dependent Variable:	Wife Pregnant	Had sex last month	# sex acts per month with wife	# sex acts per month (all partners)	# condoms used past month	Fraction safe sex in past month	# partners last month	# partners last year	# condoms purchased last month	# condoms received free last month	Purchased any condoms from survey team	RSB
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Treatment	-0.031	-0.071	-1.558*	-1.978**	1.101*	0.087*	-0.144*	0.037	0.902**	1.047	0.094	-0.176***
	[0.051]	[0.052]	[0.892]	[0.916]	[0.558]	[0.045]	[0.078]	[0.091]	[0.441]	[1.070]	[0.059]	[0.059]
Treatment * Circumcised	0.004	0.083	1.916*	2.268*	-0.824	-0.066	0.239**	0.017	-0.250	-1.461	-0.043	0.184***
	[0.056]	[0.061]	[1.112]	[1.145]	[0.675]	[0.053]	[0.094]	[0.104]	[0.787]	[1.112]	[0.072]	[0.058]
Circumcised	-0.020	-0.002	0.101	-0.235	0.820*	0.098**	-0.149**	-0.004	1.084*	1.673*	0.046	-0.124***
	[0.041]	[0.050]	[0.790]	[0.812]	[0.459]	[0.040]	[0.074]	[0.069]	[0.634]	[0.842]	[0.055]	[0.044]
Constant	0.384**	0.289	-0.429	-0.329	0.895	0.361**	0.385	1.308***	0.347	5.048	0.667***	-0.437**
	[0.175]	[0.180]	[2.632]	[2.794]	[1.331]	[0.179]	[0.319]	[0.479]	[1.983]	[3.284]	[0.232]	[0.190]
Observations	871	937	937	937	712	712	937	937	937	937	931	937
R-squared	0.023	0.087	0.037	0.037	0.025	0.052	0.021	0.024	0.022	0.018	0.033	0.068
Joint test of significance: $\beta_1 + \beta_2 = 0$	0.340	0.707	0.571	0.633	0.500	0.513	0.270	0.495	0.299	0.559	0.214	0.830
Ave dep var (control)	0.164	0.766	7.369	7.753	1.688	0.201	0.856	1.098	1.081	3.402	0.375	-0.011

Notes: Robust standard errors are clustered by village. Additional controls used include: age, marital status, years of education, assets, logged income, whether they had sex in the past week (at baseline), ethnicity dummies (Chewa, Nyanja, Lomwe and Yao), and an indicator for religious denomination; exposure to HIV messages on the radio and TV as measured by number of messages heard in past month relating to HIV/AIDS. RSB is a composite measure of nine sexual behavior indicators: Wife is currently pregnant; Whether respondent had sex last month; Number of times had sex last month (all partners); Number of partners in the last month; Number of partners in the last year; Number of condoms used in the past month; Fraction of safe sexual encounters in the last month; Number of condoms purchased in the last month; Number of condoms received free in the last month. This is measured as the mean of the standardized value for each of these measures of sexual behavior.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3: Impact of Information on Circumcisions

Panel A: Adult Circumcision Takeup	Got circumcised	
	(1)	(2)
Treatment	0.025	0.022
	[0.022]	[0.023]
Constant	0.015	0.052
	[0.010]	[0.060]
Includes Control Variables	No	Yes
Observations	257	257
R-squared	0.006	0.048
Ave dep var (control)	0.015	

Panel B: Circumcisions of Boy Children	Willing to circumcise any son	Any son circumcised in past year
	(1)	(2)
Treatment	0.251***	-0.022
	[0.074]	[0.033]
Treatment * Circumcised	-0.194**	0.005
	[0.075]	[0.037]
Circumcised	0.326***	0.037
	[0.057]	[0.036]
Constant	0.680***	-0.063
	[0.223]	[0.181]
Observations	671	671
R-squared	0.182	0.054
Joint test of significance: $\beta_1 + \beta_2 = 0$	0.072	0.448
Ave dep var (control)	0.735	0.097

Notes: Robust standard errors are clustered by village. Additional controls used in Panel A column 2 include and in Panel B: age, marital status, years of education, assets, logged income, whether they had sex in the past week (at baseline), ethnicity dummies (Chewa, Nyanja, Lomwe and Yao), and an indicator for religious denomination; exposure to HIV messages on the radio and TV as measured by number of messages heard in past month relating to HIV/AIDS.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Responses to Information: Subjective HIV Transmission Perceptions at Follow-up Survey

	Believes circumcision is related to:			Perceived HIV transmission rate of: Circumcised men	Uncircumcised Men	Fraction correct classification of countries
Dependent Variable:	Higher risk	Lower risk	Equal risk	Follow-up rate	Follow-up rate	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.041	0.035	-0.068	0.272	0.445	0.053*
	[0.048]	[0.062]	[0.056]	[3.809]	[2.215]	[0.027]
Treatment*Circumcised	-0.044	0.038	0.002	-10.823***	-2.533	-0.028
	[0.053]	[0.068]	[0.058]	[4.032]	[2.643]	[0.031]
Circumcised	-0.035	0.151***	-0.111**	-1.190	-0.588	0.013
	[0.042]	[0.052]	[0.045]	[3.452]	[1.844]	[0.024]
Constant	0.247*	0.664***	0.025	56.428***	85.287***	-0.001
	[0.141]	[0.150]	[0.138]	[12.275]	[5.915]	[0.001]
Observations	947	947	947	938	938	935
R-squared	0.022	0.071	0.074	0.085	0.022	0.015
Joint test of significance: $\beta_1 + \beta_2 = 0$	0.945	0.103	0.038	0.000	0.171	0.163
Ave dep var (control)	0.131	0.609	0.240	70.850	89.204	0.641

Notes: Robust standard errors are clustered by village. Additional controls used include: age, marital status, years of education, assets, logged income, whether they had sex in the past week (at baseline), ethnicity dummies (Chewa, Nyanja, Lomwe and Yao), and an indicator for religious denomination; exposure to HIV messages on the radio and TV as measured by number of messages heard in past month relating to HIV/AIDS. The wording for the question in Column (4) asks: "The wording of the question was “If 100 circumcised men slept with an HIV positive women last night, how many of them would acquire HIV?” A similar question was asked in reference to uncircumcised men for Column (5).

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Impact of Information on HIV Testing, and Life Expectancy

Dependent Variable:	HIV test post treatment	Perceived life expectancy
	(1)	(2)
Treatment	0.009	0.333
	[0.052]	[2.091]
Treatment * Circumcised	0.061	0.088
	[0.062]	[2.520]
Circumcised	0.043	1.520
	[0.043]	[2.067]
Constant	-0.002	0.423***
	[0.002]	[0.101]
Observations	947	908
R-squared	0.050	0.034
Joint test of significance: $\beta_1 + \beta_2 = 0$	0.077	0.813
Ave dep var (control)	0.468	66.813

Notes: Robust standard errors are clustered by village. Additional controls used include: age, marital status, years of education, assets, logged income, whether they had sex in the past week (at baseline), ethnicity dummies (Chewa, Nyanja, Lomwe and Yao), and an indicator for religious denomination; exposure to HIV messages on the radio and TV as measured by number of messages heard in past month relating to HIV/AIDS.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Impact of Information by Baseline Beliefs

Dependent Variable:	RSB	Willingness to circumcise son	Circumcised at lower risk
	(1)	(2)	(3)
Treatment	-0.208***	0.231***	0.012
	[0.075]	[0.083]	[0.071]
Treatment*Circumcised	0.230***	-0.166*	0.098
	[0.073]	[0.086]	[0.085]
Circumcised	-0.156***	0.291***	0.120**
	[0.051]	[0.064]	[0.052]
Correct	-0.043	-0.017	0.249**
	[0.120]	[0.140]	[0.113]
Circumcised * Correct	0.106	0.116	-0.027
	[0.129]	[0.141]	[0.118]
Treatment * Correct	0.139	0.084	0.022
	[0.153]	[0.165]	[0.142]
Treatment * Circumcised * Correct	-0.175	-0.118	-0.124
	[0.171]	[0.169]	[0.160]
Constant	-0.420**	0.694***	0.622***
	[0.195]	[0.230]	[0.146]
Observations	937	671	947
R-squared	0.071	0.190	0.108
Joint test of significance: $\beta_6 + \beta_7 = 0$ (*Treatment*Correct + Treatment*Circumcised*Correct = 0*)	0.539	0.557	0.131
Ave dep var (control)	-0.011	0.735	0.609

Notes: Robust Standard Errors are clustered by village. Additional controls used include: age, marital status, years of education, assets, logged income, whether they had sex in the past week (at baseline), ethnicity dummies (Chewa, Nyanja, Lomwe and Yao), and an indicator for religious denomination; exposure to HIV messages on the radio and TV as measured by number of messages heard in past month relating to HIV/AIDS. RSB is a composite measure of nine sexual behavior indicators: Wife is currently pregnant; Whether respondent had sex last month; Number of times had sex last month (all partners); Number of partners in the last month; Number of partners in the last year; Number of condoms used in the past month; Fraction of safe sexual encounters in the last month; Number of condoms purchased in the last month; Number of condoms received free in the last month. This is measured as the mean of the standardized value for each of these measures of sexual behavior. 'Correct' indicates a correct baseline belief about male circumcision and HIV transmission risk

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7: Spillovers

Dependent Variable:	RSB	Willingness to circumcise son	Circumcised at lower risk
	(1)	(2)	(3)
Treatment	-0.175**	0.352***	0.066
	[0.082]	[0.094]	[0.075]
Treatment*Circumcised	0.198**	-0.299***	-0.013
	[0.080]	[0.098]	[0.083]
Circumcised	-0.141**	0.416***	0.177**
	[0.064]	[0.084]	[0.071]
Min distance	-0.012	0.093	0.015
	[0.048]	[0.092]	[0.063]
Min distance*Circumcised	0.054	-0.092	-0.039
	[0.057]	[0.099]	[0.076]
Min distance*Treatment	0.023	-0.133	-0.033
	[0.054]	[0.100]	[0.076]
Min distance*Treatment*Circumcised	-0.040	0.136	0.079
	[0.066]	[0.108]	[0.090]
Constant	-0.435**	0.620***	0.641***
	[0.198]	[0.219]	[0.149]
Observations	919	658	928
R-squared	0.067	0.192	0.075
Joint test of significance: $\beta_1 + \beta_2 = 0$	0.602	0.243	0.294
Ave dep var (control)	-0.011	0.735	0.609

Notes: Robust Standard Errors are clustered by village. Additional controls used include: age, marital status, years of education, assets, logged income, whether they had sex in the past week (at baseline), ethnicity dummies (Chewa, Nyanja, Lomwe and Yao), and an indicator for religious denomination; exposure to HIV messages on the radio and TV as measured by number of messages heard in past month relating to HIV/AIDS. RSB is a composite measure of nine sexual behavior indicators: Wife is currently pregnant; Whether respondent had sex last month; Number of times had sex last month (all partners); Number of partners in the last month; Number of partners in the last year; Number of condoms used in the past month; Fraction of safe sexual encounters in the last month; Number of condoms purchased in the last month; Number of condoms received free in the last month. This is measured as the mean of the standardized value for each of these measures of sexual behavior. Min distance is measured as the minimum distance between the respondent and a treatment respondent in a different village.

* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix A: Circumcision Rates by Religion and Ethnicity

		TA Kuntamanji 2008 N = 1214	MDICP 2008 (Balaka) N = 391	MDHS 2010 (Zomba) N = 268
		(1)	(2)	(3)
Religion:	Christian	0.606	0.587	0.358
	Muslim	0.942	0.994	0.942
Ethnicity:	Chewa	0.667	0.720	0.378
	Lomwe	0.561	0.459	0.339
	Ngoni	0.400	0.368	0.462
	Nyanja	0.657	0.737	0.320
	Yao	0.928	0.992	0.825

Notes:

The TA Kuntumanji sample constitutes all men in the baseline sample conducted in 2008 for which their circumcision status and religion is known (1216 respondents in 70 different villages) or ethnicity and circumcision status is know (1,214); there are 14 observations excluded as these respondents did not report their circumcision status. The MDICP sample (2008) constitues all male respondents in the Balaka district for which a VCT questionnaire and survey was administered totalling 391 observations. The Malawi DHS sample constitutes only those men in rural Zomba district totalling 167 respondents.

Appendix Table B: Baseline Characteristics, Balance and Attrition by Circumcision Status

Panel A: Circumcised Men		Mean (1)	SD (1)	Control (2)	Treatment (3)	Balance p-value (4)	Attrition p-value (5)
Demographics:	Age	31.474	6.677	31.770	31.179	0.211	0.222
	Married	0.906	0.292	0.906	0.906	1.000	0.308
	Years of Education	5.606	3.543	5.728	5.484	0.316	0.976
	Number of sons ever born	1.722	1.438	1.846	1.598	0.013	0.649
Tribe:	Chewa	0.045	0.207	0.045	0.045	1.000	0.159
	Lomwe	0.128	0.335	0.089	0.167	0.022	0.514
	Nyanja	0.366	0.482	0.364	0.368	0.943	0.583
	Yao	0.446	0.497	0.480	0.413	0.353	0.499
Religion:	Christian	0.445	0.497	0.420	0.471	0.370	0.817
	Muslim	0.496	0.500	0.509	0.482	0.630	0.914
Wealth:	Income (logged)	8.956	1.642	8.947	8.965	0.891	0.976
	Assets	4.432	2.379	4.696	4.167	0.010	0.067
	Farmer	0.613	0.487	0.611	0.614	0.923	0.673
	Salaried	0.129	0.335	0.159	0.099	0.015	0.518
	Self-Employed	0.370	0.483	0.358	0.381	0.502	0.676
Sexual Behavior:	Age at sexual debut	16.918	3.309	16.809	17.027	0.361	0.817
	Had sex in the last month	0.761	0.427	0.770	0.752	0.545	0.199
	Number of sexual partners across lifetime	4.430	4.743	4.563	4.297	0.476	0.404
	Number of sexual partners in last 12 months	1.104	0.637	1.146	1.063	0.073	0.406
	Ever used a condom	0.414	0.493	0.440	0.388	0.173	0.195
	Fraction of safe sex encounters in past month	0.118	0.270	0.135	0.100	0.092	0.298
Media:	Number of messages about HIV in last 30 days[1]	11.953	17.720	13.118	10.788	0.064	0.404
Spillovers:	Distance to nearest treatment respondent[2]	0.482	0.637	0.404	0.560	0.044	0.146
Beliefs:	Transimssion rate for circumcised men[3]	79.590	30.414	79.949	79.232	0.739	0.592
	Transimssion rate for uncircumcised men[3]	91.128	20.265	89.579	92.674	0.036	0.091
	Circumcised at higher risk of HIV	0.133	0.340	0.103	0.163	0.014	0.078
	Circumcised at lower risk of HIV	0.416	0.493	0.408	0.424	0.716	0.716

Notes:

The main sample consists of 1,228 men residing in Zomba district in Malawi who agreed to participate in the baseline survey conducted in 2008.

[1] The number of media messages about HIV in the last 30 days combines respondent responses to the following two questions: "How many times have you heard radio spots or messages with regards to HIV/Aids in the last 30 days?" and "How many times have you read articles, messages, or advertisements about HIV/Aids in a

[2] The distance to nearest neighbor is measured as the distance in kilometers to the closest treated respondent in a different village.

[3] Perceived HIV transmission probabilities are measured by the following: i) "If 100 circumcised men each slept with a woman who is HIV positive last night, how many of them do you think would get HIV?"; and ii) "If 100 uncircumcised men each slept with a woman who is HIV positive last night, how many of them do you think would get HIV?"

Appendix Table B: Baseline Characteristics, Balance and Attrition by Circumcision Status

Panel B: Uncircumcised Men		Mean	SD	Control	Treatment	Balance p-value	Attrition p-value
		(4)		(2)	(3)	(4)	(5)
Demographics:	Age	32.478	7.042	31.946	33.059	0.207	0.922
	Married	0.866	0.342	0.844	0.889	0.386	0.730
	Years of Education	6.644	3.734	7.168	6.072	0.028	0.137
	Number of sons ever born	1.525	1.341	1.449	1.608	0.316	0.519
Tribe:	Chewa	0.063	0.242	0.054	0.072	0.506	0.092
	Lomwe	0.281	0.450	0.246	0.320	0.227	0.846
	Nyanja	0.534	0.500	0.563	0.503	0.388	0.004
	Yao	0.097	0.296	0.114	0.078	0.385	0.002
Religion:	Christian	0.809	0.393	0.808	0.810	0.967	0.072
	Muslim	0.084	0.278	0.096	0.072	0.543	0.120
Wealth:	Income (logged)	8.955	1.633	8.945	8.966	0.898	0.526
	Assets	4.425	2.372	4.533	4.307	0.369	0.132
	Farmer	0.646	0.479	0.651	0.641	0.856	0.914
	Salaried	0.144	0.352	0.205	0.078	0.002	0.843
	Self-Employed	0.324	0.469	0.295	0.355	0.281	0.850
Sexual Behavior:	Age at sexual debut	17.623	3.597	17.610	17.636	0.951	0.513
	Had sex in the last month	0.744	0.437	0.758	0.728	0.514	0.798
	Number of sexual partners across lifetime	3.796	3.008	3.808	3.781	0.939	0.738
	Number of sexual partners in last 12 months	1.116	0.888	1.108	1.125	0.863	0.765
	Ever used a condom	0.366	0.482	0.344	0.390	0.375	0.728
	Fraction of safe sex encounters in past month	0.100	0.252	0.086	0.116	0.374	0.629
Media:	Number of messages about HIV in last 30 days[1]	11.866	17.401	11.102	12.699	0.401	0.135
Spillovers:	Distance to nearest treatment respondent[2]	0.528	0.751	0.388	0.663	0.022	0.430
Beliefs:	Transimssion rate for circumcised men[3]	86.862	24.563	86.443	87.325	0.754	0.379
	Transimssion rate for uncircumcised men[3]	91.614	19.275	92.497	90.645	0.359	0.152
	Circumcised at higher risk of HIV	0.113	0.316	0.108	0.118	0.786	0.502
	Circumcised at lower risk of HIV	0.225	0.418	0.204	0.248	0.392	0.522

Notes:

The main sample consists of 1,228 men residing in Zomba district in Malawi who agreed to participate in the baseline survey conducted in 2008.

[1] The number of media messages about HIV in the last 30 days combines respondent responses to the following two questions: "How many times have you heard radio spots or messages with regards to HIV/Aids in the last 30 days?" and "How many times have you read articles, messages, or advertisements about HIV/Aids in a magazine or newspaper in the last 30 days?"

[2] The distance to nearest neighbor is measured as the distance in kilometers to the closest treated respondent in a different village.

[3] Perceived HIV transmission probabilities are measured by the following: i) "If 100 circumcised men each slept with a woman who is HIV positive last night, how many of them do you think would get HIV?"; and ii) "If 100 uncircumcised men each slept with a woman who is HIV positive last night, how many of them do you think would get HIV?"

Appendix Table C: Impact of Information: Behavior, Circumcision and Beliefs (no covariates)

Dependent Variable:	RSB	Willingness to circumcise son	Circumcised at lower risk
	(1)	(2)	(3)
Treatment	-0.149**	0.249***	0.026
	[0.062]	[0.078]	[0.062]
Treatment*Circumcised	0.148**	-0.188**	0.040
	[0.061]	[0.078]	[0.067]
Circumcised	-0.067	0.401***	0.206***
	[0.042]	[0.057]	[0.047]
Constant	0.037	0.437***	0.462***
	[0.041]	[0.058]	[0.048]
Observations	937	671	947
R-squared	0.007	0.136	0.048
Joint test of significance: $\beta_1 + \beta_2 = 0$	0.984	0.0547	0.124
Ave dep var (control)	-0.011	0.7345133	0.609

Notes: Robust standard errors are clustered by village. Additional controls used include: age, marital status, years of education, assets, logged income, whether they had sex in the past week (at baseline), ethnicity dummies (Chewa, Nyanja, Lomwe and Yao), and an indicator for religious denomination; exposure to HIV messages on the radio and TV as measured by number of messages heard in past month relating to HIV/AIDS. RSB is a composite measure of nine sexual behavior indicators: Wife is currently pregnant; Whether respondent had sex last month; Number of times had sex last month (all partners); Number of partners in the last month; Number of partners in the last year; Number of condoms used in the past month; Fraction of safe sexual encounters in the last month; Number of condoms purchased in the last month; Number of condoms received free in the last month. This is measured as the mean of the standardized value for each of these measures of sexual behavior.

* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix Table D: Impact of Information: Behavior, Circumcision and Beliefs (probit models)

Dependent Variable:	Willingness to circumcise son	Circumcised at lower risk
	(1)	(2)
Treatment	0.669***	0.088
	[0.200]	[0.155]
Treatment*Circumcised	-0.393*	0.129
	[0.231]	[0.179]
Circumcised	0.903***	0.378***
	[0.163]	[0.134]
Constant	0.741	0.504
	[0.772]	[0.430]
Observations	671	947
Joint test of significance: $\beta_1 + \beta_2 = 0$	0.069	0.093
Ave dep var (control)	0.789	0.640

Notes: Robust standard errors are clustered by village. Additional controls used include: age, marital status, years of education, assets, logged income, whether they had sex in the past week (at baseline), ethnicity dummies (Chewa, Nyanja, Lomwe and Yao), and an indicator for religious denomination; exposure to HIV messages on the radio and TV as measured by number of messages heard in past month relating to HIV/AIDS.

* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix Table E: Impact of Information: Behavior, Circumcision and Beliefs (Differences)

Dependent Variable:	RSB	Willingness to circumcise son	Circumcised at lower risk
	(1)	(2)	(3)
Treatment	-0.048	0.208**	-0.020
	[0.069]	[0.089]	[0.085]
Treatment*Circumcised	0.085	-0.183*	0.161
	[0.072]	[0.093]	[0.102]
Circumcised	-0.027	-0.106	-0.049
	[0.053]	[0.066]	[0.059]
Constant	-0.024	0.218	0.401
	[0.226]	[0.221]	[0.258]
Observations	937	671	938
R-squared	0.119	0.084	0.028
Joint test of significance: $\beta_1 + \beta_2 = 0$	0.456	0.513	0.015
Ave dep var (control)	-0.013	0.029	0.157

Notes: Robust standard errors are clustered by village. Additional controls used include: age, marital status, years of education, assets, logged income, whether they had sex in the past week (at baseline), ethnicity dummies (Chewa, Nyanja, Lomwe and Yao), and an indicator for religious denomination; exposure to HIV messages on the radio and TV as measured by number of messages heard in past month relating to HIV/AIDS. RSB is a composite measure of nine sexual behavior indicators: Wife is currently pregnant; Whether respondent had sex last month; Number of times had sex last month (all partners); Number of partners in the last month; Number of partners in the last year; Number of condoms used in the past month; Fraction of safe sexual encounters in the last month; Number of condoms purchased in the last month; Number of condoms received free in the last month. This is measured as the mean of the standardized value for each of these measures of sexual behavior.

* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix Table F: Impact of Information on non-Marital Sexual Behavior and Heterogeneity by Marital Status

	Non-Marital Sexual Behavior					Heterogeneity by Marital Status
Dependent Variable:	Non-marital partner in last year	Current non-marital partner	# Sex per month with non-marital partner	Fraction safe sex with non-marital partner in last month	Use condom at last sex with non-marital partner	RSB
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.008	-0.015	-0.175	0.194	0.558***	-0.353**
	[0.032]	[0.024]	[1.260]	[0.156]	[0.199]	[0.169]
Treatment * Circumcised	-0.001	0.015	1.440	-0.143	-0.369	0.459*
	[0.038]	[0.028]	[1.944]	[0.204]	[0.244]	[0.249]
Circumcised	-0.036	-0.012	0.519	-0.015	-0.029	0.026
	[0.025]	[0.025]	[0.893]	[0.168]	[0.180]	[0.148]
Treatment * Married						0.194
						[0.195]
Treatment * Circumcised * Married						-0.298
						[0.281]
Married * Circumcised						-0.176
						[0.172]
Married						0.398**
						[0.156]
Constant	0.723***	0.341***	-3.727	0.983**	0.155	-0.518**
	[0.116]	[0.094]	[2.806]	[0.396]	[0.599]	[0.234]
Observations	896	887	81	81	76	937
R-squared	0.232	0.249	0.195	0.108	0.275	0.079
Joint test of significance: $\beta_1 + \beta_2 = 0$	0.744	0.953	0.313	0.617	0.212	0.5749
Joint test of significance: *Treatment* + *Treatment* Married* = 0			N/A			0.0216
Ave dep var (control)	0.097	0.052	1.512	0.775	0.439	-0.011

Notes: Robust standard errors are clustered by village. Additional controls used include: age, marital status, years of education, assets, logged income, whether they had sex in the past week (at baseline), ethnicity dummies (Chewa, Nyanja, Lomwe and Yao), and an indicator for religious denomination; exposure to HIV messages on the radio and TV as measured by number of messages heard in past month relating to HIV/AIDS. RSB is a composite measure of nine sexual behavior indicators: Wife is currently pregnant; Whether respondent had sex last month; Number of times had sex last month (all partners); Number of partners in the last month; Number of partners in the last year; Number of condoms used in the past month; Fraction of safe sexual encounters in the last month; Number of condoms purchased in the last month; Number of condoms received free in the last month. This is measured as the mean of the standardized value for each of these measures of sexual behavior.

* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix Table G: Impact of Information on Sexual Behavior - RSB (Other underlying differences)

Dependent Variable: RSB

'Base' Variable ------->	Years of schooling (1)	Yao (2)	Muslim (3)	Married (4)	Assets (5)	Self-employed (6)	# sex partners (lifetime) (7)	Ever condom (8)
Treatment	-0.063	-0.172***	-0.169***	-0.189	-0.134	-0.124*	-0.160**	-0.133**
	[0.071]	[0.061]	[0.058]	[0.141]	[0.084]	[0.064]	[0.061]	[0.061]
Treatment * Circumcised	0.162***	0.144**	0.139**	0.196***	0.181***	0.194***	0.191***	0.164**
	[0.058]	[0.065]	[0.063]	[0.058]	[0.058]	[0.057]	[0.060]	[0.062]
Treatment * Base	-0.016*	0.079	0.075	0.003	-0.009	-0.153**	-0.005	-0.059
	[0.008]	[0.069]	[0.064]	[0.149]	[0.014]	[0.062]	[0.008]	[0.066]
Base * Circumcised	-0.003	-0.160**	-0.292***	-0.306**	-0.015	-0.130**	-0.003	0.016
	[0.009]	[0.078]	[0.107]	[0.138]	[0.014]	[0.064]	[0.012]	[0.084]
Circumcised	-0.094	-0.087	-0.071	0.137	-0.057	-0.084	-0.110	-0.109**
	[0.078]	[0.054]	[0.052]	[0.121]	[0.074]	[0.051]	[0.069]	[0.050]
Base	0.006	0.156	0.280**	0.477***	0.022	0.149**	0.006	-0.103
	[0.008]	[0.127]	[0.113]	[0.133]	[0.014]	[0.065]	[0.010]	[0.078]
Constant	-0.494**	-0.458**	-0.458**	-0.599***	-0.493**	-0.465**	-0.447**	-0.453**
	[0.195]	[0.192]	[0.192]	[0.218]	[0.188]	[0.199]	[0.189]	[0.183]
Observations	937	937	937	937	937	932	929	881
R-squared	0.072	0.071	0.074	0.077	0.069	0.076	0.066	0.065
Joint test of significance: $\beta_1 + \beta_2 = 0$	0.063	0.603	0.593	0.960	0.463	0.164	0.520	0.463
Joint test of significance: $\beta_1 + \beta_3 = 0$	0.233	0.266	0.224	0.004	0.061	0.000	0.008	0.019
Ave dep var (control)				-0.011				

Notes: Robust standard errors are clustered by village. Additional controls used include: age, marital status, years of education, assets, logged income, whether they had sex in the past week (at baseline), ethnicity dummies (Chewa, Nyanja, Lomwe and Yao), and an indicator for religious denomination; exposure to HIV messages on the radio and TV as measured by number of messages heard in past month relating to HIV/AIDS. RSB, the dependent variable, is a composite measure of nine sexual behavior indicators: Wife is currently pregnant; Whether respondent had sex last month; Number of times had sex last month (all partners); Number of partners in the last month; Number of partners in the last year; Number of condoms used in the past month; Fraction of safe sexual encounters in the last month; Number of condoms purchased in the last month; Number of condoms received free in the last month. This is measured as the mean of the standardized value for each of these measures of sexual behavior.

* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix Table H: Impact of Information on Willingness to Circumcise Son (Other underlying differences)

Dependent Variable: Willingness to Circumcise Son

'BaseVar': Baseline Variable ---->	Years of schooling	Yao	Muslim	Married	Assets	Self-employed	# sex partners (lifetime)	Ever condom
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	0.165	0.271***	0.263***	0.491***	0.267***	0.275***	0.229***	0.247***
	[0.101]	[0.075]	[0.076]	[0.152]	[0.099]	[0.076]	[0.073]	[0.079]
Treatment * Circumcised	-0.177**	-0.168**	-0.154*	-0.186**	-0.191**	-0.202***	-0.198**	-0.181**
	[0.077]	[0.081]	[0.082]	[0.075]	[0.075]	[0.074]	[0.075]	[0.073]
Treatment * BaseVar	0.013	-0.110	-0.104	-0.250*	-0.004	-0.043	0.007	-0.021
	[0.009]	[0.071]	[0.064]	[0.142]	[0.013]	[0.065]	[0.007]	[0.062]
BaseVar * Circumcised	0.019	-0.161	-0.115	-0.451***	0.011	0.117	0.014	-0.034
	[0.012]	[0.142]	[0.133]	[0.134]	[0.016]	[0.083]	[0.009]	[0.081]
Circumcised	0.198**	0.333***	0.319***	0.758***	0.276***	0.293***	0.259***	0.309***
	[0.099]	[0.066]	[0.068]	[0.134]	[0.093]	[0.063]	[0.074]	[0.064]
BaseVar	-0.030**	0.251	0.235*	0.423***	-0.005	-0.068	-0.014	0.055
	[0.013]	[0.181]	[0.121]	[0.107]	[0.015]	[0.085]	[0.008]	[0.082]
Constant	0.762***	0.659***	0.670***	0.382*	0.706***	0.660***	0.751***	0.342
	[0.225]	[0.223]	[0.225]	[0.205]	[0.227]	[0.230]	[0.223]	[0.249]
Observations	671	671	671	671	671	668	665	651
R-squared	0.190	0.189	0.186	0.190	0.183	0.188	0.187	0.184
Joint test of significance: $\beta_1 + \beta_2 = 0$	0.829	0.034	0.035	0.033	0.240	0.061	0.522	0.119
Joint test of significance: $\beta_1 + \beta_3 = 0$	0.067	0.091	0.085	0.002	0.005	0.008	0.002	0.004
Ave dep var (control)				0.735				

Notes: Robust Standard Errors are clustered by village. Additional controls used include: age, marital status, years of education, assets, logged income, whether they had sex in the past week (at baseline), ethnicity dummies (Chewa, Nyanja, Lomwe and Yao), and an indicator for religious denomination; exposure to HIV messages on the radio and TV as measured by number of messages heard in past month relating to HIV/AIDS.

* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix Table I: Impact of Information on Belief that Circumcised are at Lower Risk (Other underlying differences)

Dependent Variable: Holds Belief that Circumcised are at Lower Risk								
'Base' Variable ------->	Years of schooling	Yao	Muslim	Married	Assets	Self-employed	# sex partners (lifetime)	Ever condom
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-0.049	0.027	0.036	0.148	0.043	0.033	-0.030	-0.004
	[0.101]	[0.063]	[0.061]	[0.113]	[0.091]	[0.068]	[0.070]	[0.075]
Treatment * Circumcised	0.050	0.049	0.016	0.046	0.037	0.045	0.032	0.031
	[0.072]	[0.075]	[0.075]	[0.069]	[0.068]	[0.068]	[0.071]	[0.077]
Treatment * Base	0.013	-0.005	0.041	-0.132	-0.002	-0.014	0.016*	0.071
	[0.009]	[0.070]	[0.065]	[0.115]	[0.014]	[0.055]	[0.009]	[0.064]
Base * Circumcised	-0.005	0.110	-0.092	-0.018	-0.002	0.008	0.004	-0.028
	[0.009]	[0.109]	[0.121]	[0.088]	[0.014]	[0.085]	[0.012]	[0.075]
Circumcised	0.174*	0.132**	0.172***	0.163**	0.158**	0.144**	0.134*	0.170**
	[0.089]	[0.058]	[0.055]	[0.077]	[0.074]	[0.064]	[0.076]	[0.066]
Base	-0.002	-0.118	0.169	0.056	0.002	-0.027	-0.004	0.011
	[0.010]	[0.142]	[0.138]	[0.098]	[0.015]	[0.067]	[0.013]	[0.078]
Constant	0.679***	0.675***	0.656***	0.613***	0.656***	0.661***	0.697***	0.648***
	[0.174]	[0.152]	[0.148]	[0.158]	[0.162]	[0.158]	[0.162]	[0.170]
Observations	947	947	947	947	947	942	939	890
R-squared	0.074	0.072	0.072	0.073	0.071	0.071	0.081	0.074
Joint test of significance: $\beta_1 + \beta_2 = 0$	0.984	0.227	0.342	0.097	0.312	0.164	0.520	0.463
Joint test of significance: $\beta_1 + \beta_3 = 0$	0.703	0.793	0.403	0.813	0.616	0.000	0.008	0.019
Ave dep var (control)				0.609				

Notes: Robust Standard Errors are clustered by village. Additional controls used include: age, marital status, years of education, assets, logged income, whether they had sex in the past week (at baseline), ethnicity dummies (Chewa, Nyanja, Lomwe and Yao), and an indicator for religious denomination; exposure to HIV messages on the radio and TV as measured by number of messages heard in past month relating to HIV/AIDS.

* significant at 10%; ** significant at 5%; *** significant at 1%