# Religion and HIV:
# Evidence Using the Expansion of Faith-Based Radio in Uganda*

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**Abstract**

We study the impact of faith-based health education on reproductive behavior in Uganda, using the expansion of Catholic radio broadcasts as identification strategy. Our outcomes follow the components in the so-called ABC policy ("abstinence", "be faithful" and "condoms"). We find that exposure to Catholic radio has a negative impact on the fraction of individuals that cite condoms as an effective means to avoid HIV/AIDS, a negative impact on the number of reported sex partners, but no impact on the fraction of individuals who claim to practice sexual abstinence.

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# 1 Introduction

The impact of faith-based organizations on HIV prevention is a controversial issue. At the heart of the controversy is the attitudes toward modern contraceptives. On April 19, 2009, the World Health Organization and expert organs at the United Nations jointly declared that condoms were "the single, most efficient, available technology to reduce the sexual transmission of HIV and other sexually transmitted infections" (UNAIDS 2009). The statement was an immediate response to a comment made by the Pope earlier the same week: that the distribution of condoms would not only fail to solve the HIV/AIDS epidemic but even "increase the problem". But the role of condoms in HIV prevention is controversial also within the academic community. While a Lancet editorial criticized the Pope for spreading "outrageous and wildly inaccurate statement about HIV/AIDS" (Lancet 2009), epidemiologists and public health experts have emphasized the key role of church-based initiatives in promoting partner reduction over condom use in Africa (Potts et al. 2008), and there is epidemiological and experimental evidence suggesting condoms partly off-set partner reduction through risk compensation (Kajubi et al. 2005; Cassell et al. 2006). In a response to the Lancet editorial, Green and Hearst (2009) suggested that "a little bit of condom use might be like a little bit of antibiotic use – not ultimately helpful".

This paper attempts to shed new light on the role of faith-based communication and the complementarities between sexual behavior, partner reduction and condom use. The empirical field venue is Uganda, which has been widely cited as a prime example of a country with a successful HIV policy. Faith-based organizations have been at the center of this success. At the end of the eighties, HIV prevalence was 29 % in the country. At this point, faith-based health education in Uganda sprung from a collaboration between the major religions in the country (Catholic, Anglican and Muslim), with funding from the World Health Organization, USAID and the Ugandan Ministry of Health. A key part of the campaign was the focus on partner reduction through the so-called "zero gracing iniative" – promoting condoms was a lower priority (Green et al. 2006). Today the HIV prevalence in Uganda has gone down to 7.2 %.

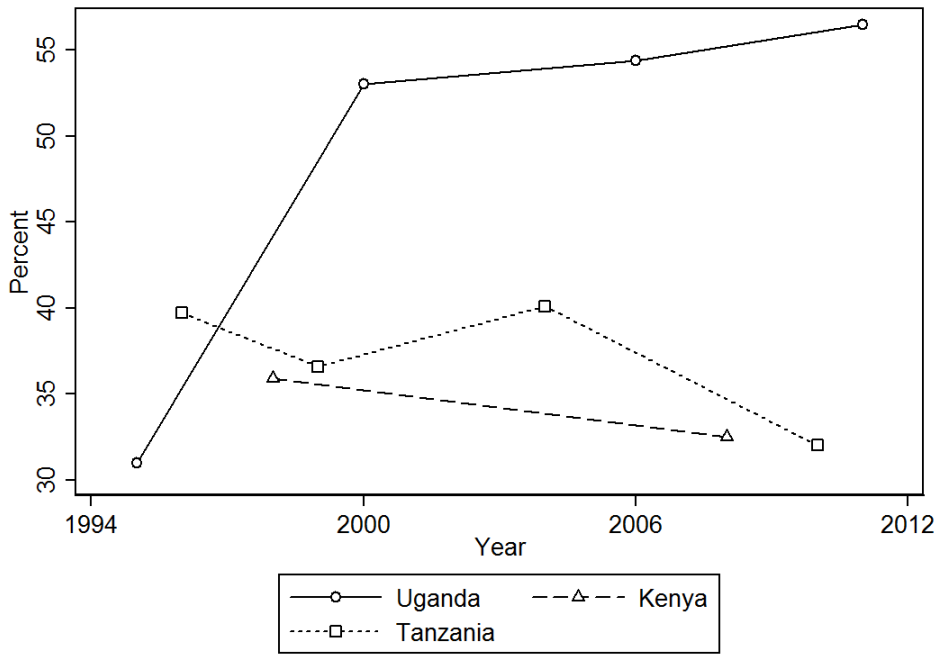
Although there is little question that churches and faith-based organizations have influenced beliefs about HIV/AIDS in Uganda and elsewhere,[1] the explicit impact of faith-based initiatives in Uganda is not fully explored. The existing evidence of the policy impact is circumstantial. It is clear that partner reduction has been a central mechanism behind the HIV decline and it is also clear that faith-based organizations prioritized "being faithful" over "use condoms" as policy advice (Stoneburner and Low-Beer 2004; Green et al. 2006; Epstein 2007). However, to conclude from these observations that the faith-based organizations had a direct impact on partner reduction requires strong assumptions about the counterfactual outcome. An alternative explanation has recently been advanced by Oster (2012), who suggests that the decline in risky sex behavior in Uganda can be attributed to reduced exports during the same period – leading to less people mobility (trucking), less job migration and fewer sex workers.

[1] Evidence on the interplay between religion and reproductive behavior has been found for Ghana (Addai 1999; Takyi 2003), Nigeria (Smith 2004) and South Africa (Krakauer and Newbery 2007).

We attempt to provide more direct evidence of the link between faith-based education, reproductive behavior, and the HIV/AIDS decline in Uganda. To serve this aim, we exploit the expansion of radio as a tool for missionary outreach among faith-based organizations in Uganda. A notable development in Uganda in the mid-nineties was the establishment of radio as a central communication technology among faith-based organizations, in particular among Catholic organizations. The radio broadcasts became key instruments in educating people about the threat of HIV/AIDS – often through dramatization and other easy-accessible forms broadcasts. Mushengyezi (2003) writes that during the anti-AIDS campaigns in Uganda, the radio announcements were preceded by a drumbeat used to alert people to calamity or danger. There is anecdotal evidence that these radio broadcasts were effective in reducing HIV rates, in particular among populations with low literacy (Kanyunyuzi-Asaba and Mwesigye 1998). The anecdotal evidence is also consistent with data at the aggregated level, which indicate a stronger expansion of radio in Uganda relative comparative countries. As seen in Figure 1, as radio expanded in Uganda, it became one of the most widely cited sources of family planning messages, a development which appears less pronounced in neighboring countries.

To identify the causal effect of Catholic radio broadcasts, we use variation in broadcast coverage across time and space, using the roll out of the Catholic radio station Radio Pacis in Arua. We use the technical data for each transmitter to generate coverage maps using COVWEB, which we match at the local level using GPS data. We then combine the information on coverage with GPS information on sampled villages using data from the Demographic and Health Surveys (DHS). The merged data is then used in an impact analysis of the difference-in-difference variety.

Figure 1: Percent who cite radio as a source of family planning information: Uganda, Kenya and Tanzania. Source: Measure DHS.



We first document that the expanded radio coverage increased actual outreach: our intention-to-treat variable has a significant impact on the share of individuals who listen to radio regularly. Being exposed to Catholic radio also affects the probability of hearing family planning messages on the radio. We then study how the expansion of radio affected reproductive behavior, partner reduction and attitudes toward condoms. We divide the outcomes according to the components of the ABC-policy ("abstinence", "be faithful" and "use condoms"). We find evidence that being exposed to Catholic radio reduces beliefs in condom effectiveness, particularly among men. We also find evidence that the Catholic radio expansion lead to partner reduction. We find no effects on the fraction of women who claim to be abstaining from sex. Our effects are typically stronger for Catholics, but we also find significant effects for households of different religious faith living in the targeted regions.

We interpret the results as the marginal effects of additional Catholic health education, that is, the effects beyond the education provided through other initiatives, which constitute the baseline effect. Our findings indicate that being exposed to family planning messages through Catholic radio reduces faith in condoms, but also leads to partner reduction, relative to the baseline. What this implies in terms of the net-impact on HIV rates is difficult to simulate since the survey questions cannot be used to fully characterize risk, and we lack multiple rounds of data to conduct a reduced-form estimation of radio broadcasts on HIV/AIDS. However, using supplementary data, we find that Catholics have higher infection rates relative other religions in regions reached by Catholic radio broadcasts.

Our estimates of a causal effect of faith-based radio broadcasts on sexual behavior and attitudes towards reproductive health appears to be a novel contribution to the literature. Our paper also contributes to at least two additional themes in the economic literature. A first theme is the efficiency of faith-based organizations in missionary outreach. This research points to important efficiency gains through the intrinsic motives of nonprofit workers (Reinikka and Svensson 2003), but has also highlighted the differential impact of faith-based organizations across different followers Bengtsson (2013). A second theme highlights the role of political and social communication through radio broadcasts and other media (Strömberg 2004), which has been particularly important in developing countries (Jensen and Oster 2009; Olken 2009; Yanagizawa-Drott 2010).

The paper is structured as follows. Section 2 is a short background to Catholic radio in Uganda. In Section 3 we explain the empirical strategy in detail. Section 4 provides the results and Section 6 concludes.

# 2 Background

## 2.1 Religion and HIV in Uganda

Religion is important in Uganda, not least shown by the fact that only 0.9 per cent of the population in 2002 viewed themselves as non-religious (Uganda Bureau of Statistics 2002).[2] The largest religious denomination is Catholicism with approximately 42 per cent followers, followed by Anglicans (36 per cent) and Muslims (12 per cent). The highest proportion of Catholics can be found in the Northern region, while the Iganga District has the highest share of Muslims (United States Department of State 2009). With around 30 hospitals, 230 smaller health units and several nurse-training schools, the Catholic Church constitutes Uganda's second largest health provider after the government (Mubanda Rasmussen 2011).

According to UNAIDS, approximately 7.2 per cent of the Ugandan population are infected by the human immunodeficiency virus (HIV), amounting to 1.4 million people (UNAIDS 2013). The first case of AIDS in Uganda was diagnosed in 1982 (Serwadda et al. 1985). Since Yoweri Museveni came to power in 1986, Uganda has funded a number of campaigns to reduce HIV. At this time, HIV prevalence amounted to 29 per cent of the population (Hooper 1990), which was the highest number in the world. The earliest media campaigns focused on abstinence and faithfulness, but started to include information on the use of condoms in the 1990s (Knight 2008). The threefold policy has been labeled the ABC approach, where the "A" stands for Abstinence from sex, "B" for Be faithful and "C" for Use a condom. In 1991, HIV prevalence was down to 15 per cent of the population (Stoneburner and Low-Beer 2004).

The earliest HIV-prevention campaigns went under the motto "Love carefully" (Seidel 1990) and was followed by the so called "zero gracing" campaign (O'Manique 1990), both focused towards abstinence and faithfulness. During this time, the Ugandan Catholic Church (via Uganda Catholic Medical Bureau) promoted what they called "Love faithfully", which involved more Christian moral teachings compared to the aforementioned campaigns. Leaflets stated that "having sex outside marriage exposes you and your potential spouse and children to risk" (Seidel 1990). They also said that the use of condoms is "an abuse of God's gift". This prevention campaign was later to be accomodated by the Ugandan government who also turned their focus to the A and B in the ABC policy. However, the Center for American Progress (Evertz 2010) has attributed this new policy to George W. Bush's President's Emergency Plan for AIDS Relief (PEPFAR), that allegedly emphasized abstinence over the promotion of condoms. HIV prevalence has indeed increased since 2006 when it was down on its lowest level of 6.4 per cent (UNAIDS 2013). On the one hand, it is ambigous how this is attributed to PEPFAR or the Catholic Church since more people now have access to antiretroviral drug treatment (ART) so that infected individuals can live longer. Still, 62 per cent of HIV infected adults receive treatment, and only 32 per cent of infected children can access Standard Antiretroviral Therapy (ART; see Uganda AIDS Commission 2012. On the other hand, it is clear that the share of

[2]The 2002 census conducted by Uganda Bureau of Statistics is the latest reliable source on religious affiliation at this time.

Ugandans using condoms during their last intercourse is very low: in 2011, 15.7 per cent of women reported using a condom, and 13.3 per cent of men (Uganda AIDS Commission 2012).

## 2.2 Radio Pacis

Due to data availability, this paper only focuses its attention on the analysis of Radio Pacis in northern Uganda. As will be described in the following, several technical variables are essential to determine radio coverage. Since coverage predictions based on *almost* all the necessary information are not reliable, we restrict the analysis to the one station for which we have all essential variables, and for which we have been able to get those variables confirmed by the station.

Radio Pacis is a community based radio funded by the Catholic Diocese of Arua and broadcasts 24 hours per day every day of the week. The Catholic identity of the station is very strong. For example, on the station's website they state that one of the goals of Radio Pacis is to "uphold the teachings of the Catholic Church in regard to ecumenism and dialogue" and that "Radio Pacis is a means of fostering evangelization and the growth of the Christian communities." Radio Pacis launched the station in 2004 (the frequency is 90.9), and was aired by a 2000 W radio transmitter placed in Arua. In 2007, a second frequency (94.5) was launched from the same transmitter.

The Catholic focus is explicit in several religious radio programs. For example, Radio Pacis broadcasts shows called Bible for the Kids, Amazing Life, Catechist Hour, Faith Matters and Diocese this Week. They also send Vatican Radio's 30 minute broadcast English for Africa every Sunday and American Catholic Radio. Perhaps most importantly in light of this study, Radio Pacis has weekly programs run by diocesan officials. These officials come from the bishop's office, the Caritas department and the health department. The Catholic Church of Arua, for which these officials work, is highly present in the Arua area, not least compared to the Anglican Church which constructed a new cathedral only in 2009 (although nearly 20 per cent of the sample in the West Nile region state that they are Anglicans). Their view on HIV prevention is very much in line with Catholic doctrine in general. For example,Mubanda Rasmussen (2011) noted in her thesis on AIDS treatment in Ugandan Catholic organizations that:

> There was in my experience a stark contrast between the context of HIV prevention and the context of counselling people living with HIV/AIDS. In the Catholic HIV prevention seminars I have observed in KCCC [Kamwokya Christian Caring Community in Kampala], Arua Diocese and in Reach Out [Catholic community-based AIDS initiative], condoms were most often presented as a morally inferior prevention method, which may protect you from HIV infection but not from the consequences of sinful behaviours, such as "adultery" and "fornication".

The dichotomy in HIV-prevention methods between, on the one hand, arguing for abstinence and, on the other hand, arguing for condoms as facilitators of sinful behavior is thus observed within the Arua Diocese too.

### 2.3 Potential Biases

In the above is a description of Radio Pacis and the Catholic Diocese of Arua. The station's coverage determines who are treated and who are not treated in the subsequent analysis. It is important to note that since we only focus on one station while there are several other Catholic radio stations in Uganda, our estimates are to be treated as marginal effects of additional Catholic health education. That is, potential effects from Radio Pacis are those beyond a baseline effect constituted by other initiatives. Moreover, there are at least two arguments for why our estimates would suffer from an upward bias. First, it could be that some specific areas outside Radio Pacis' coverage have coverage from radio stations that push for the opposite HIV-prevention methods. Second, since the placement of Radio Pacis' transmitter is endogenous to how many Catholics live in the surrounding area, it could be that those individuals with coverage also are affected by Catholic doctrine in other ways that increase the effect. To explore these possibilities, we need to know more about the control group.

According to the Ugandan Communications Commission (Ugandan Communications Commission 2012), there were 285 licensed radio stations in Uganda as of June 30th 2012. Among these, we have identified seven Catholic radio stations on 17 frequencies.[3] Radio Maria is the most widespread station with frequencies in Gulu, Hoima, Kampala, Lira, Masaka, Mbale, and Mbarara.[4] Other Catholic stations are situated in Kasese and Soroti. Thus, there are Catholic radio stations across all parts of Uganda, which speaks for an interpretation of our estimates as marginal. It is also clear that there is no other Catholic station in the Arua area and so the effect of Catholic radio should go through Radio Pacis. To our knowledge, one other religious station is present in the area, namely Voice of Life, which was founded by the Anglican Church of Uganda in 1997.

Although many Catholics live in the Northern region of Uganda, they are quite evenly spread out across the country. In our sample, 12.8 per cent of all Catholics live in the West Nile region which is approximately equal to the share in the Eastern region and lower than the share who lives in the Central region (excluding Kampala, the capital). It is thus not the case that most Catholic listeners can be reached by setting up a transmitter in Arua. Nevertheless, 60 per cent of the sample in the West Nile region are Catholics, compared to 20 per cent Anglicans and Muslims. These numbers are worrying if they entail a more intense Catholic activity compared to other areas. However, the Catholic Church's role in the Arua area goes back to the first missionary establishment in 1918 and the Catholic presence has been extremely visible ever

[3]The Catholic radio stations are Radio Pacis (three frequencies), Radio Maria (nine frequencies), Radio Sapientia, Kasese Guide Radio, Grace Radio, Radio Wa and Kyoga Veritas Radio. Although we do not have any information on the station, Radio Delta is a recent addition to Catholic radio stations in Uganda. Some of these stations are local partners to the consultancy the Catholic Media Council (CAMECO) and was identified through them. Based on interviews with personnel at the UCC, information from CAMECO (CAMECO 2013), and mail contact and telephone interviews with some of the stations, we are rather confident that those stations identified as Catholic are the relevant ones. Interviews and information collection were conducted in Kampala during two weeks in April 2013.

[4]Radio Maria in Uganda works under the umbrella of World Family of Radio Maria (Radio Maria's website 2013), a non-governmental organization with the goal to spread an evangelical message through educational broadcasting in, foremost, less-developed countries.

since. (Mubanda Rasmussen 2011) Other than the chance that Catholic activities in Arua changed during our period of study (something we do not have indications of), there is no reason to believe that a potential effect of Catholic radio actually was due to other Catholic activity. Furthermore, Radio Pacis covers more areas than those in the immediate proximity to the Catholic Church in Arua.

Lastly, we cannot directly account for the possibility that other stations outside Radio Pacis' coverage affect HIV-prevention outcomes in an opposite direction (and thus exacerbate the estimated effect of Radio Pacis). Yet, since this paper sets out to explore whether Catholic radio affects the probability to get infected by HIV in two opposing directions as entailed by anecdotal evidence, such a situation would only arise if other stations argue for less sexual abstinence, less fidelity and/or more condom use. The first two alternatives are highly unlikely in the Ugandan context, albeit possible. On the contrary, the third alternative, to propagate for condom use, is very likely among radio stations driven by certain NGOs and even the Anglican Church who do not oppose condom use within marriage. Although coverage from such stations within the control group could potentially lead us to overestimate the effect of Catholic radio on trust in condoms, it is not unreasonable to assume that the likelihood of their presence is equally high in our treatment area. In other words, since Catholic radio coverage is widespread throughout Uganda, a crowding-out effect of stations who support the use of condoms because of the presence of Catholic radio would essentially mean that such stations do not exist in the country.

# 3 Data and Empirical Strategy

## 3.1 Coverage Technicalities and Outcome Data

The identification strategy used in this paper exploits variation across time and space in radio coverage from Radio Pacis' broadcasts (see for example Yanagizawa-Drott (2010) for a similar identification strategy). To generate treatment and control groups, we must know who are covered by Radio Pacis' broadcasts and who are not. Thus, in order to predict radio coverage for each transmitter, we use data provided by the station on the transmitter's location (longitude and latitude), the transmitter's height above ground (m), transmission power (W), frequency (MHz), antenna gain (dBi), polarization and several geographical variables. The resulting coverage maps are created in COVWEB, designed by the Communications Research Center Canada, that calculates the coverage of each transmitter through the Irregular Terrain Model propagation prediction model, developed by the US Institute for Telecommunications Science.[5] The two maps are shown in Figure 1. As stated earlier, the 101.4 frequency is however not broadcasting on a regular basis and is thus not included in the analysis.[6] The red-colored area closest to the

[5]The Irregular Terrain Model is a modification of the Longley-Rice standard model. It is nowadays considered standard in predicting radio coverage for commercial use because of its accuracy. See for example Chamberlin & Luebbers (1982), Hufford (1995) and Longley (1968).

[6]If the 101.4 frequency had been active, only a very small share of our sample would have had the possibility to listen to the station (those in the 2011 sample interviewed in October, November or December).

transmitter location indicates a strong radio signal and the dark-blue colored area a medium-strong radio signal. With these higher signal levels, a simple radio receiver is enough for listening to a broadcast without interference from other broadcasts. The light-blue colored areas indicate a weak signal strength. Within those areas it is still possible to listen to Radio Pacis' broadcasts, but there is a higher probability of static noise and some interference from other broadcasts. We consider signal strengths below this level (i.e. below 45 dBV/m) as having no signal at all, since a listener would need a more sophisticated radio receiver to be able to tune in to these specific broadcasts.

We then import the coverage prediction map into ArcGIS[7] to combine the information on coverage with GPS information on sampled villages from 2000, 2006 and 2011 Ugandan Demographic and Health Surveys (DHS). For example, Figure 2 displays such villages for 2000 and 2006. Thus, using these maps, we can locate which clusters have coverage from Radio Pacis and which do not.

The outcome data comes from DHS and is for the years 2000/2001, 2006 and 2011. For the year 2011, there also exists a so called AIDS Indicator Survey (AIS), apart from the Standard Demographic and Health Surveys. Among the datasets, the AIS is the only one that includes information on HIV infections, while the other surveys comprise the behavioral outcomes of interest to this study. We however start out the analysis by exploring the effect of Catholic radio on actual outreach. To this end, we regress our model on the probability to own a radio, whether or not the individual states that he or she never listens to radio, and the likelihood to have heard family-planning messages conveyed via radio. From Table 1 it is clear that 65 per cent of the sample own a radio and have heard family-planning messages, while slightly less than 20 per cent state that they never listen to radio.

As our main outcomes, we have chosen to focus on three behavioral outcomes that are meant to capture the ABC policy mentioned earlier. First, we analyze the effect of Catholic radio on the probability that the individual is currently abstaining from sex (the "A" in "ABC"). Looking at the summary statistics in Table 1, around nine per cent of the sample state that they are currently abstaining. In turn, this sample only includes women and the variable is not available in the AIS sample. Second, the "B" (be faithful) in this analysis is defined as how many sex partners other than the husband the individual has had the last year. The average is approximately 0.19 infidelities, but the mean is exacerbate by a couple of extreme outliers. This variable is available in all samples, but only for women. Lastly, to capture condom behavior, we create an indicator variable equal to one if the individual believes that the chance of getting infected by HIV/AIDS is reduced by always using a condom during sex. The variable exists for all 51018 observations and thus includes men. 75 per cent of women and 82 per cent of males believe that condoms protect against HIV.

As mentioned above, data on actual HIV infections is only available in the 2011 AIS dataset (20759 observations). Almost seven per cent of individuals carry the human immunodeficiency

[7] A geographic information system for working with, for example, maps. See www.esri.com. In practice, the coverage map is copied and then scanned to jpeg format and later exported to ArcGIS.

virus in the sample, which is comparable to UNAIDS estimates for the entire population in 2012. The data collection was carried out by the Ministry of Health and all interviewed adults were asked to voluntarily provide a blood sample.

As for control variables, we can briefly note that a majority of individuals define themselves as being Catholic (42 per cent) and a majority live on the countryside (55 per cent). Approximately 2.4 per cent of our sample have a strong coverage from Radio Pacis, 3.6 per cent have medium coverage, and 5 per cent have weak coverage.

### 3.2 Identifying Effects on ABC Outcomes

To compare individuals that are and are not exposed to coverage from Radio Pacis, before and after exposure, we estimate the following OLS regression, using several control variables, $\mathbf{X}$[8]:

$$Y_{ivt} = \alpha + \gamma C_v + \lambda D_t + \delta \left( C_{vt} * D_{vt} \right) + \eta_r + \mu_m + \mathbf{X}\beta + u_{ivt} \tag{1}$$

for individual $i$ in village $v$ at time $t$. $C_v$ is an indicator for having radio coverage, and $D_t$ is a dummy for post exposure. Since entire villages have radio coverage, but we utilize data on an individual level, we cluster the standard errors on the village level in all specifications. We are interested in $\delta$ that can be interpreted as the difference-in-differences estimate where treatment is exposure to radio signals. Thus, the impact of Radio Pacis' broadcasts on our outcomes is the estimated double difference over time and across individuals. $\eta_r$ are region fixed effects to account for time-invariant characteristics that could potentially influence our outcomes and $\mu_m$ are month fixed effects that control for seasonality factors such as weather conditions.

Since we only have data on HIV infections for one year, we have to rely on a cross-section identification. The equation takes the following form:

$$HIV_{iv} = \alpha + \gamma C_v + \eta_r + \mu_m + \mathbf{X}\beta + u_{iv} \tag{2}$$

where $C_v$ again is an indicator for having coverage from Radio Pacis and $\mathbf{X}$ captures the above controls.

As previously mentioned, the data used in this paper is for the years 2000, 2006 and 2011. Radio Pacis started broadcasting in 2004 from their first transmitter and opened another frequency from the same transmitter (with the same coverage) in 2007. On one hand, since the station was launched before 2006, we cannot test the crucial assumption that the growth paths were the same in the two groups pre exposure. That is, we cannot test whether the trends in outcomes of individuals living in coverage areas were parallel to those of individuals living in non-coverage areas. On the other hand, having data for 2006 and 2011, we can estimate both short- and long-run effects of Catholic radio coverage. Thus, we display results for the effect of Catholic radio between 2000 and 2006, as well as from 2000 on outcomes in 2011.

[8]Included covariates are indicators for religious denomination, indicators of place of living, altitude, distance to radio transmitter, age of respondent, years of education, and the signal strength.

Finally, we would ideally want to estimate the effect of Catholic radio on our outcomes for individuals who we know listen to Radio Pacis. Since that is impossible with this dataset, we could run the regressions for those who own a radio or those who state that they listen to radio frequently. However, as will be apparent below, coverage from the station induces a higher radio ownership and more frequent listening so that those variables are endogenous to treatment. Instead, we try to solve this issue by estimating the effect of Catholic radio for the poorest three-fifths of individuals in the sample. With lower literacy rates and lower incomes to spend on other information, this segment of the population should have a higher propensity to satisfy their informational needs through radio. The DHS data includes a so called wealth index which is divided into quintiles; the first quintile constitutes the poorest individuals and the fifth quintile the richest. Hence, we run some of our regressions without the two richest quintiles.

# 4 Results

## 4.1 Effects of Catholic Radio on Radio Behavior

As an introduction to the main results on the ABC outcomes, Table 7 displays estimates of the effect of Catholic radio on individuals' radio behavior. The three outcomes are binary variables equal to one if, first, the individual owns a radio, second, the individual states that he or she never listens to radio broadcasts, and third, the individual states that he or she has heard family planning messages via radio the last month. The first row gives the short-run estimates and the second row shows the long-run estimates.

Evident from Table 7, there are significant effects on outreach both in the short- and long run as a consequence of Catholic radio coverage. Also, the size of the effects seem to be stable over time. First, the probability to own a radio receiver increases with around 12 to 13 percentage points, which amounts to a close to 20 percent increase in radio ownership compared to the baseline. Indeed, this finding is supportet by the second estimate which states that around 20 percentage points fewer individuals never listen to radio. This effect increases to a negative 25 percentage points in the long run. Lastly, we analyze the effect of Catholic radio on the probability to have recently heard family-planning information conveyed through broadcasts. Family planning can perhaps most straightforwardly be explained as the use of birth control and thus the planning of when or if to have children. Both in the short- and the long run, the likelihood to have heard family planning via radio increases with approximately 20 percentage point. This number can be compared to a mean value of 65 per cent.

In summary, the effects of Catholic radio on outreach seem to be strong. Since all our main outcome variables relate to family planning, those results are particularly important to have in mind as we proceed to the analysis of the ABC outcomes.

### 4.2 Effects of Catholic Radio on ABC Outcomes

Table 2 to 5 display the results for the effect of Catholic radio on sexual abstinence (A), sexual-partner reduction (B) and the individual's belief in condoms as protection against HIV (C). The first three columns for each set of estimations (i.e. the short-run panel and the long-run panel) are results without control variables, with control variables, and with region and month fixed effects respectively.[9] The fourth column only includes individuals who belong among the poorest three-fifths. Columns 5 to 7 display heterogeneous effects between Catholics, Protestants (Anglicans in this case) and Muslims.

Looking at Table 2, the point estimates on the probability that the individual is currently abstaining are positive in all cases but two. A positive sign is what we would expect from the Catholic Church's doctrine. However, it is only in the short run and for the poorest individuals we find significant effects. In turn, this effect seems to be driven by Protestants who in the short run have an increased probability to abstain amounting to 16 percentage points. While it is not unlikely that Anglicans react to messages conveyed through Catholic radio, especially in a region so heavily influenced by the Catholic Church, it is conspicuous that we find no significant effect on the sample of Catholics. In general, however, the estimates are very imprecise and thus difficult to interpret.

Similar to the aforementioned results, the ones on the number of sex partners outside the woman's relationship seem to follow our ex ante believes about Catholic doctrine. That is, as a consequence of Catholic-radio coverage, the amount of sex partners outside the relationship decrease, at least in the short run. Those estimates point to a decrease amounting to approximately 5 to 13 percentage points. We find strong negative effects for Catholics and Protestant, while the effect on Muslims are highly imprecise. In the longer run, the effect of Catholic radio still holds for Catholics and vanishes for Protestants. Here, we find suggestive evidence of a decrease in sexual partners also among Muslims. Looking at the summary statistics, it is clear that these estimates are very large, comparing to a baseline of around 19 percent. This comparison indeed speaks for the worry that we have upward-biased estimates.

Based on the Catholic Church's views on the use of condoms, not least evident from comments by recent Popes, our preassumption of the impact of Catholic radio on believes about condoms as protection against HIV is that it should be negative. Table 4 display the results for women from regressing coverage and post exposure on an indicator equal to one if the individual agrees with the notion that HIV is avoidable if one uses condoms during intercourse. As stated above, this outcome is available for both genders and so Table 5 give the results for men. Four main patterns can be discerned, looking at the two tables. First, in line with our a priori believes, the effect of Catholic radio on the trust in condoms seems to be strongly negative. Second, the effect on men is more obvious, especially in the long run where they are highly significant and large. For example, in Table 5, the long-run effect on the probability that men believe in condoms as protection against HIV decreases with around 40 percentage points due to Catholic radio. This

[9] These regions are Central, East Central, Eastern, Kampala, Karamoja, Northern, South Western, West Nile and Western.

result can be compared to the sample mean of 82 per cent of men who trust condoms. The fact that we find stronger effects for men might make sense, given that men are the actual users of condoms (there are of course female condoms, but this particular survey question does not relate to those). Thirdly, as opposed to the above findings on the "A" and the "B", we find more evidence in the estimations for men of both a short run and a long run effect of Catholic radio, although the results for the shorter run are more scattered. Lastly, the effects are strongest for Catholics. In the short run, the probability to trust condoms decreases with 28 percentage points for Catholic women. The effect is similar for Protestant women, although not as precisely estimated. No significant effects for Muslims can be discerned. For Catholic men, the short run effect of Catholic radio on the belief in condoms as protection against HIV is a negative 20 percentage points. This effect decreases further to a huge negative 70 percentage points in the long run. Again, compared to the baseline of a 75 percent trust in condoms among the entire sample, the long-run estimate for Catholic men indicates that our results are overstated.

There is a possibility that the results described above are driven by changes in some of the included covariates among our treatment group. This worry is explored in Table 8 where we regress the same model as in the main estimations on some relevant covariates. As is evident from the table, no significant differences between the treated and the non-treated group over time due to treatment seem to be discernable. Rather, the point estimates are highly imprecise with the exception of a significant, negative long-run effect on Protestants. Whether this last result is an artifact of running several regressions or not is hard to determine; no indications of anti-Protestant broadcasts from Radio Pacis exist to our knowledge.

Table 6 display the results from estimating the effect of Catholic-radio coverage on HIV infections. The outcome is an indicator equal to one if the individual is infected with HIV. Evident from the table, no general effects of Catholic radio coverage are obvious. However, as the sample is decreased to the poorest three-fifths, a small positive effect is discernable. Moreover, this effect increases slightly when we only explore the effect on Catholics, while we find no significant effect on Protestants and Muslims. Having in mind that these results come from estimations on a cross-section sample of individuals and that they are imprecisely estimated, it seems as if Catholic radio coverage increases the probability to be infected by HIV by around 3.3 percent for Catholics.

Above, we have explored the effect of Catholic radio on three different outcomes that together capture the ABC policy. While increased abstinence, faithfulness and condom use decrease HIV infections, we hypothesized that exposure to Catholicism would increase abstinence and faithfulness, but that it would decrease condom use. In other words, at least ex ante, Catholicism would affect HIV infections in two opposing directions. In summary, the results point to just that, but the negative effect on believes in condoms stands out due to its consistency over both the short- and the long run. This result might in turn give further explanational power to the findings from the cross-section analysis of Catholic-radio coverage on HIV infections in Table 6. More specific, interpreting the results of this study, it seems as if the propaganda for the non-use of condoms dominates that of sexual abstinence and faithfulness.

# 5 Concluding remarks

We study the impact of faith-based family planning on reproductive behavior in Uganda, using the expansion of Catholic radio broadcasts as identification strategy. We find that exposure to Catholic radio has a negative impact on the fraction of individuals that cite condoms as an effective means to avoid HIV/AIDS, a negative impact on the number of reported sex partners, but no impact on the fraction of individuals who claim to practice sexual abstinence.

Our approach appears to be a novel contribution to the discussion about the impact of faith-based organizations on HIV/AIDS. However, it is important to note that our estimates are to be interpreted as marginal effects of additional Catholic health education, beyond the education provided through other initiatives, which constitute the baseline effect. Several anti-HIV campaigns were launched in Uganda in the eighties, and a limitation of our study is that the data does not allow a deep characterization of counterfactual trends. Our estimates of the impact of Catholic radio broadcasts are thus relative: the data can not tell us whether the baseline health education was more balanced while the Catholic radio broadcasts focused all its resources on promoting partner reduction, or whether Catholic radio was more balanced and the baseline treatment involved a strong emphasis on condoms.

What our estimates imply in terms of development policy is not immediately clear, and a question that merits further research. Since faith-based organizations "work for god" rather than profit, a policymaker can regard the existence of faith-based organizations as a given that will promote partner reduction at a low cost but not condom use. It might be tempting for secular agencies to focus on condoms in such cases, but this might create an unproductive polarization between different aid organizations. The role of coordination vs. competition between religious and secular NGO's in Africa appear surprisingly understudied in this regard.

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Table 1: SUMMARY STATISTICS

| | N | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| OUTCOME VARIABLES | | | | | |
| Currently abstaining | 23390 | 0.0886 | 0.2842 | 0 | 1 |
| Sex outside relationship | 44511 | 0.1869 | 0.7841 | 0 | 87 |
| Believe in condoms | 51018 | 0.7545 | 0.4304 | 0 | 1 |
| HIV | 20759 | 0.0699 | 0.2550 | 0 | 1 |
| Owns radio | 44513 | 0.6571 | 0.4747 | 0 | 1 |
| Not listening | 51018 | 0.1814 | 0.3854 | 0 | 1 |
| Heard FP on radio | 29884 | 0.6446 | 0.4786 | 0 | 1 |
| CONTROL VARIABLES | | | | | |
| Age | 51018 | 29.3 | 10.6 | 15 | 59 |
| Altitude | 23390 | 1243.192 | 265.1519 | 615 | 3573 |
| Catholic | 51018 | 0.4239 | 0.4942 | 0 | 1 |
| Protestant | 51018 | 0.3375 | 0.4729 | 0 | 1 |
| Muslim | 51018 | 0.1308 | 0.3372 | 0 | 1 |
| Countryside | 51018 | 0.5541 | 0.4971 | 0 | 1 |
| Town | 51018 | 0.0447 | 0.2066 | 0 | 1 |
| Years of education | 51014 | 5.7637 | 4.0725 | 0 | 21 |
| Strong coverage | 51011 | 0.0238 | 0.1525 | 0 | 1 |
| Medium coverage | 51011 | 0.0358 | 0.1859 | 0 | 1 |
| Weak coverage | 51011 | 0.0509 | 0.2198 | 0 | 1 |

The entire sample consists of 51018 observations. However, some variables only exists for women or are not included in the 2011 AIS sample, as indicated in the first column. 75 per cent of women and 82 per cent of males believe that condoms protect against HIV. "Heard FP on radio" is an indicator equal to one if the individual has heard family planning radio messages the last month. The data comes from Demographic and Health Survey.

Table 2: CURRENTLY ABSTAINING

| | (1) | (2) | (3) | (4) | (5) Catholics | (6) Protestants | (7) Muslims |
|---|---|---|---|---|---|---|---|
| **SHORT RUN** | | | | | | | |
| Coverage x Post Exposure | 0.0164 | 0.00972 | 0.0153 | 0.0653** | 0.0405 | 0.161*** | 0.112 |
| | (0.0229) | (0.0261) | (0.0284) | (0.0331) | (0.0402) | (0.0494) | (0.0776) |
| $R^2$ | 0.00483 | 0.0155 | 0.0289 | 0.0305 | 0.0296 | 0.0289 | 0.0726 |
| N | 14969 | 14965 | 14965 | 8295 | 3765 | 3412 | 763 |
| **LONG RUN** | | | | | | | |
| Coverage x Post Exposure | -0.000420 | 0.0127 | 0.0124 | 0.0405 | 0.0552 | 0.0751 | -0.0382 |
| | (0.0218) | (0.0206) | (0.0217) | (0.0250) | (0.0369) | (0.0548) | (0.0523) |
| $R^2$ | 0.00377 | 0.0141 | 0.0228 | 0.0245 | 0.0242 | 0.0347 | 0.0453 |
| N | 15320 | 15316 | 15316 | 8110 | 3636 | 3313 | 858 |
| Controls | No | Yes | Yes | Yes | Yes | Yes | Yes |
| Region FE | No | No | Yes | Yes | Yes | Yes | Yes |
| Month FE | No | No | Yes | Yes | Yes | Yes | Yes |
| Poorest 3/5 | No | No | No | Yes | Yes | Yes | Yes |

Clustered standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
The outcome is an indicator equal to one if the individual is currently abstaining from sex and the data only exists for women. Controls include indicators for religious belonging (Catholic, Muslim or Protestant), age of respondent, indicators for residence (countryside, Kampala or town), altitude, distance to radio transmitter, and indicators of signal strength. The data comes from Demographic and Health Survey.

Table 3: SEX PARTNERS OTHER THAN HUSBAND

| | (1) | (2) | (3) | (4) | (5) Catholics | (6) Protestants | (7) Muslims |
|---|---|---|---|---|---|---|---|
| **SHORT RUN** | | | | | | | |
| Coverage x Post Exposure | -0.0552** | -0.0655*** | -0.115*** | -0.107*** | -0.111*** | -0.132*** | -0.133 |
| | (0.0271) | (0.0207) | (0.0234) | (0.0241) | (0.0338) | (0.0373) | (0.0918) |
| $R^2$ | 0.0148 | 0.0478 | 0.0694 | 0.0590 | 0.0737 | 0.0624 | 0.0728 |
| N | 14967 | 14963 | 14963 | 8294 | 3765 | 3411 | 763 |
| **LONG RUN** | | | | | | | |
| Coverage x Post Exposure | -0.00736 | -0.0257 | -0.0182 | -0.0449* | -0.0771** | 0.00697 | -0.103* |
| | (0.0298) | (0.0249) | (0.0256) | (0.0256) | (0.0386) | (0.0345) | (0.0538) |
| $R^2$ | 0.00164 | 0.0125 | 0.0166 | 0.0288 | 0.0344 | 0.0251 | 0.0490 |
| N | 36441 | 36437 | 36437 | 20106 | 9304 | 8029 | 2076 |
| Controls | No | Yes | Yes | Yes | Yes | Yes | Yes |
| Region FE | No | No | Yes | Yes | Yes | Yes | Yes |
| Month FE | No | No | Yes | Yes | Yes | Yes | Yes |
| Poorest 3/5 | No | No | No | Yes | Yes | Yes | Yes |

Clustered standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
The outcome gives how many men the individual has had sex with other than her husband during the last year and is thus only available for the sample of women. Controls include indicators for religious belonging (Catholic, Muslim or Protestant), age of respondent, indicators for residence (countryside, Kampala or town), altitude, distance to radio transmitter, and indicators of signal strength. The data comes from Demographic and Health Survey.

Table 4: WOMEN'S BELIEF IN CONDOMS AS PROTECTION AGAINST HIV/AIDS

| | (1) | (2) | (3) | (4) | (5) Catholics | (6) Protestants | (7) Muslims |
|---|---|---|---|---|---|---|---|
| **SHORT RUN** | | | | | | | |
| Coverage x Post Exposure | -0.116* | -0.150** | -0.197*** | -0.247*** | -0.275*** | -0.242* | -0.183 |
| | (0.0610) | (0.0670) | (0.0600) | (0.0755) | (0.0807) | (0.133) | (0.177) |
| $R^2$ | 0.0206 | 0.0388 | 0.0773 | 0.0848 | 0.0899 | 0.0812 | 0.167 |
| N | 11874 | 11870 | 11870 | 6250 | 2714 | 2673 | 612 |
| **LONG RUN** | | | | | | | |
| Coverage x Post Exposure | 0.00235 | -0.0100 | -0.0177 | -0.0425 | -0.0924 | -0.0146 | 0.00919 |
| | (0.0470) | (0.0514) | (0.0534) | (0.0824) | (0.0688) | (0.120) | (0.0971) |
| $R^2$ | 0.00504 | 0.0137 | 0.0256 | 0.0318 | 0.0357 | 0.0287 | 0.0702 |
| N | 31084 | 31080 | 31080 | 16270 | 7256 | 6681 | 1807 |
| Controls | No | Yes | Yes | Yes | Yes | Yes | Yes |
| Region FE | No | No | Yes | Yes | Yes | Yes | Yes |
| Month FE | No | No | Yes | Yes | Yes | Yes | Yes |
| Poorest 3/5 | No | No | No | Yes | Yes | Yes | Yes |

Clustered standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
The outcome is an indicator equal to one if the individual agrees with the notion that HIV is avoidable if one uses condoms during sex. Controls include indicators for religious belonging (Catholic, Muslim or Protestant), age of respondent, indicators for residence (countryside, Kampala or town), altitude, distance to radio transmitter, and indicators of signal strength. The data comes from Demographic and Health Survey.

Table 5: MEN'S BELIEF IN CONDOMS AS PROTECTION AGAINST HIV/AIDS

| | (1) | (2) | (3) | (4) | (5) Catholics | (6) Protestants | (7) Muslims |
|---|---|---|---|---|---|---|---|
| **SHORT RUN** | | | | | | | |
| Coverage x Post Exposure | -0.106** | -0.117** | -0.0804 | -0.106* | -0.204* | -0.160* | 0.241 |
| | (0.0471) | (0.0505) | (0.0494) | (0.0612) | (0.108) | (0.0824) | (0.174) |
| $R^2$ | 0.00244 | 0.0101 | 0.0425 | 0.0686 | 0.0734 | 0.0756 | 0.214 |
| N | 3916 | 3916 | 3916 | 2108 | 966 | 910 | 177 |
| **LONG RUN** | | | | | | | |
| Coverage x Post Exposure | -0.366*** | -0.410*** | -0.381*** | -0.521*** | -0.701*** | -0.618*** | -0.173 |
| | (0.0788) | (0.0869) | (0.0853) | (0.0969) | (0.111) | (0.147) | (0.108) |
| $R^2$ | 0.0461 | 0.0716 | 0.0969 | 0.142 | 0.166 | 0.146 | 0.246 |
| N | 3840 | 3840 | 3840 | 1971 | 926 | 803 | 206 |
| Controls | No | Yes | Yes | Yes | Yes | Yes | Yes |
| Region FE | No | No | Yes | Yes | Yes | Yes | Yes |
| Month FE | No | No | Yes | Yes | Yes | Yes | Yes |
| Poorest 3/5 | No | No | No | Yes | Yes | Yes | Yes |

Clustered standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
The outcome is an indicator equal to one if the individual agrees with the notion that HIV is avoidable if one uses condoms during sex. Controls include indicators for religious belonging (Catholic, Muslim or Protestant), age of respondent, indicators for residence (countryside, Kampala or town), altitude, distance to radio transmitter, and indicators of signal strength. The data comes from Demographic and Health Survey.

Table 6: HIV: CROSS-SECTION ANALYSIS

| | (1) | (2) | (3) | (4) | (5) Catholics | (6) Protestants | (7) Muslims |
|---|---|---|---|---|---|---|---|
| Catholic Radio Coverage | -0.00721 | -0.00833 | 0.0160 | 0.0259* | 0.0328* | 0.0207 | -0.0901 |
| | (0.00805) | (0.0143) | (0.0147) | (0.0151) | (0.0193) | (0.0171) | (0.0612) |
| $R^2$ | 0.0000833 | 0.0133 | 0.0181 | 0.0163 | 0.0213 | 0.0192 | 0.0300 |
| N | 20759 | 20759 | 20759 | 11803 | 5561 | 4644 | 1211 |
| Controls | No | Yes | Yes | Yes | Yes | Yes | Yes |
| Region controls | No | No | Yes | Yes | Yes | Yes | Yes |
| Poorest 3/5 | No | No | No | Yes | Yes | Yes | Yes |

Clustered standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
The outcome is an indicator equal to one if the individual is infected with HIV. Controls include indicators for religious belonging (Catholic, Muslim or Protestant), age of respondent, indicators for residence, distance to radio transmitter, and the signal strength. The data comes from Demographic and Health Survey.

Table 7: RADIO BEHAVIOR

| | Owns radio | Not listening | Heard FP on radio | Owns radio | Not listening | Heard FP on radio |
|---|---|---|---|---|---|---|
| Short Run | 0.125** | -0.218*** | 0.181*** | | | |
| | (0.0601) | (0.0594) | (0.0477) | | | |
| Long Run | | | | 0.130*** | -0.254*** | 0.198*** |
| | | | | (0.0467) | (0.0414) | (0.0426) |
| $R^2$ | 0.162 | 0.218 | 0.156 | 0.143 | 0.166 | 0.140 |
| N | 14965 | 14965 | 14962 | 15316 | 15316 | 15313 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Region FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Month FE | Yes | Yes | Yes | Yes | Yes | Yes |

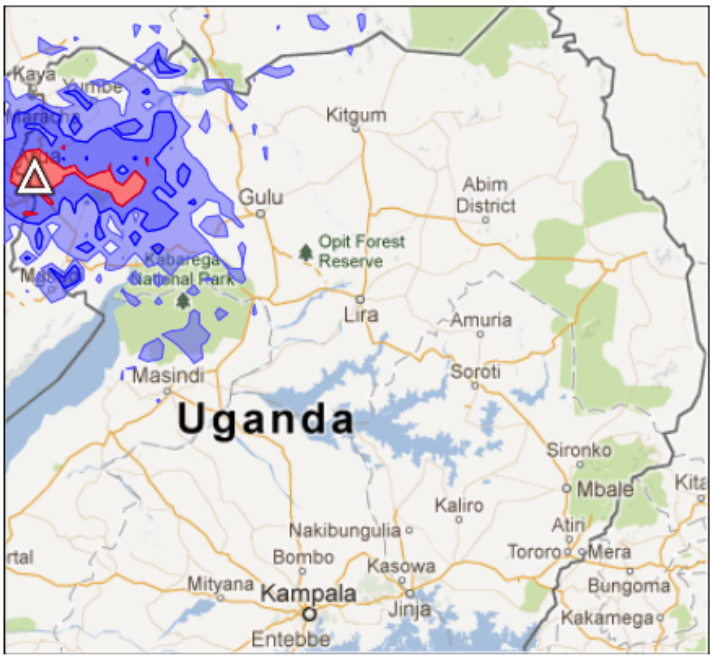
Clustered standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
The outcome variable "Not listening" is an indicator equal to one if the individual never listens to radio. A negative sign thus means that more individuals listen to radio as a consequence of coverage and post exposure. "Heard FP on radio" is an indicator equal to one if the individual has heard family planning radio messages the last month. All regressions include the same covariates as in the earlier tables, apart from the one used as outcome in each column. The data comes from Demographic and Health Survey.

Table 8: ENDOGENEITY CHECKS

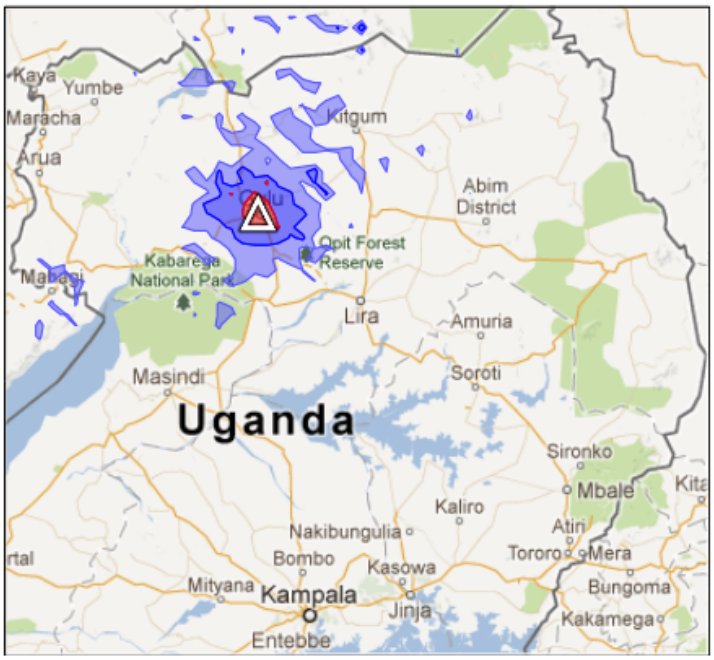
| | Age | Altitude | Catholic | Protestant | Muslim | Years of education | Age | Altitude | Catholic | Protestant | Muslim | Years of education |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Short Run | -0.331 | -19.49 | 0.0161 | -0.0123 | -0.0417 | 0.600 | | | | | | |
| | (0.636) | (84.08) | (0.103) | (0.0815) | (0.105) | (0.470) | | | | | | |
| Long Run | | | | | | | -0.510 | -87.43 | 0.0494 | -0.160** | 0.0524 | 0.708 |
| | | | | | | | (0.708) | (86.36) | (0.111) | (0.0688) | (0.120) | (0.440) |
| $R^2$ | 0.0588 | 0.393 | 0.0784 | 0.0561 | 0.0754 | 0.274 | 0.0457 | 0.445 | 0.0859 | 0.0811 | 0.0768 | 0.249 |
| N | 14965 | 14965 | 14965 | 14965 | 14965 | 14965 | 15316 | 15316 | 15316 | 15316 | 15316 | 15316 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Region FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Month FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Clustered standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
The outcomes are those control variables included in the main estimations. All regressions include the same covariates as in the earlier tables, apart from the one used as outcome in each column. The data comes from Demographic and Health Survey.

Figure 2: COVERAGE OF RADIO PACIS

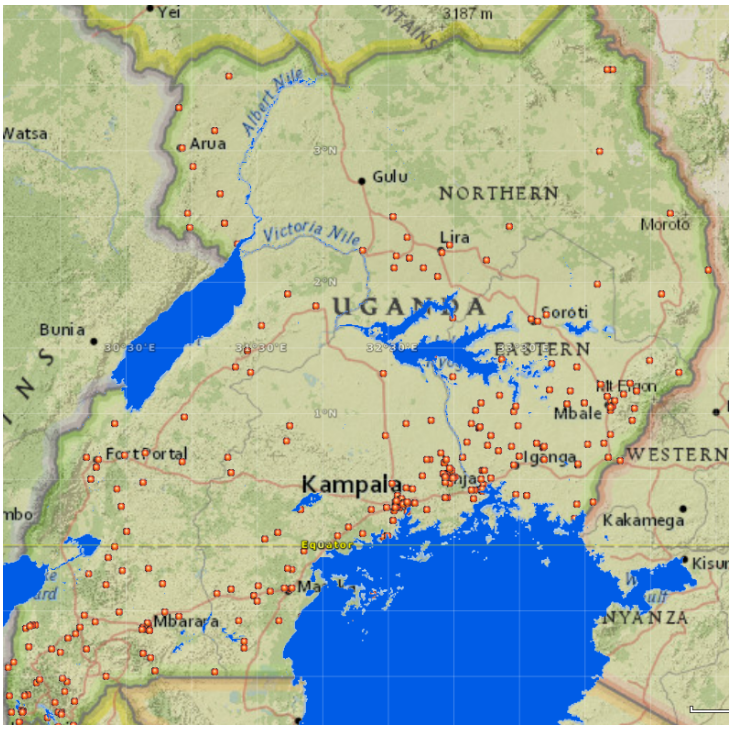



(a) Radio Pacis 90.9 and 94.5 frequencies

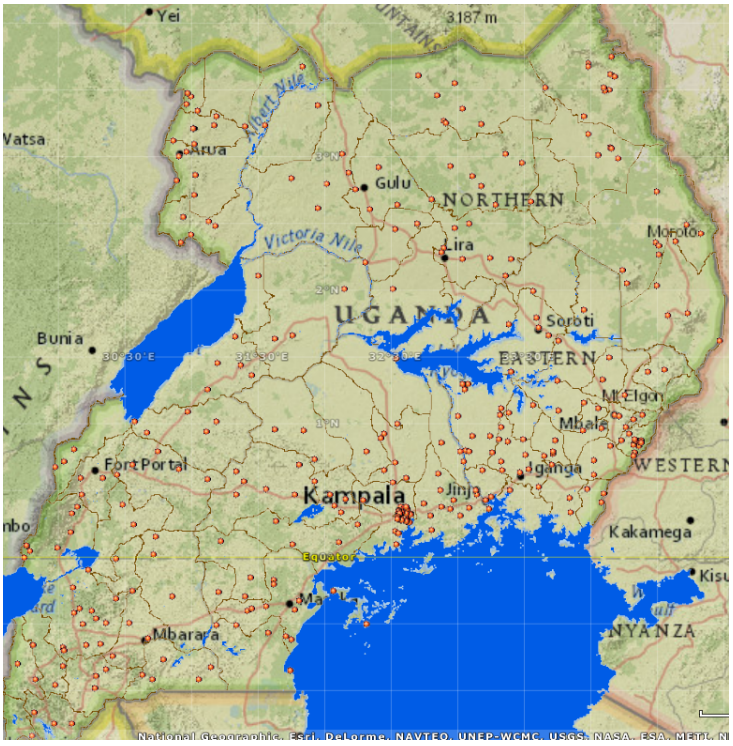



(b) Radio Pacis 101.4 frequency

Figure 3: SAMPLED VILLAGES FROM DHS




(a) Clusters in the 2000 DHS sample




(b) Clusters in the 2006 DHS sample