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Abstract

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JEL Classification: D72, N37, N77, O33, Z12, Z13

Keywords: historical persistence, missions, health investments, HIV/AIDS, sexual behavior

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Sex and the Mission: The Conflicting Effects of Early Christian Investments on the HIV Epidemic in sub-Saharan Africa*

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January 2018

Abstract

This article investigates the long-term historical impact of missionary activity on the prevalence of HIV/AIDS in sub-Saharan Africa. On the one hand, missionaries were among the first to invest in modern medicine in a number of countries. On the other hand, Christianity influenced sexual beliefs and behaviors. We build a new geocoded dataset locating Protestant and Catholic missions in the early 20th century, as well as their health investments. Using a number of different empirical strategies to address selection in missionary locations and into health investments, we show that missionary presence has conflicting effects on HIV today. Regions close to historical mission stations exhibit higher HIV prevalence. This negative impact is robust to multiple specifications accounting for urbanization, and we provide evidence that it is specific to STDs. Less knowledge about condom use is a likely channel. On the contrary, among regions historically close to missionary settlements, proximity to a mission with a health investment is associated with lower HIV prevalence nowadays. Safer sexual behaviors around these missions are a possible explanatory channel.

Keywords: historical persistence; missions; health investments; HIV/AIDS; sexual behavior; abstinence.
JEL No: D72, N37, N77, 033, Z12, Z13

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1 Introduction

Did Christian missionary history affect HIV/AIDS prevalence? This article studies the long-term historical impact of missionary activity on HIV/AIDS prevalence nowadays in sub-Saharan Africa.[1]

The history of modern medicine in sub-Saharan Africa is closely linked to the development of missionary activity. Missionaries were among the first to invest in modern medicine in this region of the world (Vaughan, 1991, Ch.3).[2] According to the World Missionary Atlas (Beach and Fahs, eds, 1925), there were 150 missionary physicians in Africa in 1925 and more than 235 nurses working with nearly 500 trained native nurses in 116 hospitals and 366 dispensaries. In this article, we investigate the long-term consequences of these early health investments.

Health investments are not the only channel through which historical missions may affect HIV prevalence nowadays. The missions' ultimate objective, after all, was to convert the local population to Christianity, a religion that imposes a great number of explicit and implicit constraints on sexual behaviors (monogamy, abstinence outside and before marriage, frequent rejection of contraception, etc.). Given that conversion persisted (Nunn, 2010), especially around Protestant missions, we can expect that missions affect the HIV epidemic through sexual behaviors and attitudes towards sex-education.[3]

Furthermore, the Christian influence has strongly shaped the prevention campaigns against HIV. Many of the initiatives to spread information about HIV on the field are conducted in churches (Mash and Mash, 2013), and the HIV prevention curricula taught in schools are still very often impregnated with this Christian influence. Dupas (2011) and Duflo et al. (2015) highlight the strong emphasis of these curricula on abstinence and monogamy, and their frequent silence on the spreading of information about condoms or the prevalence of HIV across age groups. The second goal of this article is thus to disentangle the possibly negative effects of these restrictive messages from the effect of health investments on HIV prevalence.

We built and geocoded an entirely new dataset of Protestant and Catholic mission settlements in sub-Saharan Africa.[4] For each settlement, we documented the exact geographic

[1] While prevalence is very high in this region of the world, it also varies strongly from one country to the other. See online Appendix Figure B.1.

[2] A number of medical campaigns were also implemented by colonial governments (see e.g. Lowes and Montero, 2017b).

[3] Fenske (2015) for example shows that parts of sub-Saharan Africa that received more missions have lower polygamy rates today.

[4] More precisely, as to Protestant missions, we rely on an original dataset we built for a previous article

location, the geographic and historical characteristics, as well as the health-related investments. Producing this data is our first contribution. Our second contribution is to identify the long-term effects of these investments, and to disentangle them from the missionary impact on values and social norms.

Using contemporary geocoded data from the Demographic and Health Survey (DHS), we show that regions close to historical mission settlements exhibit higher HIV prevalence today. On average, a one-standard deviation increase in the logarithm of the proximity to a mission increases HIV prevalence by 4 to 6 percent of a standard deviation. This effect is not only statistically but also economically significant. Our estimates suggest that if each town in a 26-million inhabitants country (our sample's average) were located 10km closer from an historical mission, then we would observe *ceteris paribus* $24,000$ additional HIV cases in the country.[5] Importantly, the higher prevalence observed around missions is robust to multiple specifications accounting for urbanization. In particular, greater prevalence is still observed close to missions when restricting the sample to urban areas only.

We argue that conversion and the missionary influence on sexual beliefs may partly drive the negative impact of missionary activity, and find several strands of evidence supporting this hypothesis. First, we find no effect of proximity to a mission when focusing on towns where the majority of the population is Muslim. Second, we show that in regions close to historical missions, there is less knowledge about condom supply. Third, we observe heterogeneity between Catholic and Protestant missions. While the negative effect of proximity to a Protestant mission is statistically significant, proximity to a Catholic mission is not. This may be due to the fact that Catholics were less successful than Protestants in their conversion enterprise in Africa (Foster, 2013), an eventuality that we document in our sample. Finally, we investigate the long-term impact of proximity to a mission on non-sexually transmitted diseases. Using the case of anemia, we show that, unlike for HIV, proximity to missions is not associated with higher prevalence of anemia, while proximity to missions with a health center is associated with lower anemia. Taken together, these results support conversion and the missionary influence as plausible explanatory channels for the correlation between historical missionary locations and HIV prevalence.

There is heterogeneity in the effect of proximity to missions depending on the type of

(Cagé and Rueda, 2016). We complemented this data here by building an entirely new dataset on Catholic missions.

[5] This number is not an exact projection, and should not be treated as such. It is the result of a thought experiment and should just be considered as an order of magnitude.

investments they conducted. Among regions historically close to missionary settlements, proximity to a health investment (a hospital or a dispensary) is positively associated with lower prevalence rates. A one-standard deviation increase in the logarithm of the proximity to an health investment decreases HIV prevalence by 6 percent of a standard deviation. Our results suggest that close to historical missions that invested in health, sexual behaviors are less risky. In particular, we show that the share of men buying the services of sex workers is lower closer to an historical health investment.

Our econometric analysis attempts to move beyond two forms of selection. First, historical and geographical characteristics might have determined mission station location, preventing the comparison between regions close and far from these settlements. Missionaries, either Protestant or Catholic, did choose to locate in geographically favored areas (Johnson, 1967; Nunn, 2010; Akyeampong et al., eds, 2014; Cagé and Rueda, 2016). Second, different missionary stations invested in different activities such as health or education. There may be endogenous selection of missions into these activities.

To address selection in missionary locations, we follow Cagé and Rueda (2016) and restrict our sample to regions near historical mission settlements. Because regions near missions shared similar geographic, institutional and cultural environments, this restriction isolates the specific effect of the investments from other possible long-term determinants of development that might be correlated with missionary location.

To address selection of missions into health investments, we first control for observable covariates.[6] The set of observable covariates comprises geographic and historical characteristics, including suitability to Tse-Tse fly (Alsan, 2015), as well as distance to historical mission stations that invested in health, or in non-health investments. We then develop a matching strategy that aims at isolating the effect of proximity to a mission with a health investment from the effect of proximity to a mission with similar characteristics, but without this specific investment. The results are robust to this approach and of similar order of magnitude. Furthermore, we assess the bias due to unobservables using the sensitivity of the treatment to added controls (Oster, 2016). From this approach, it seems unlikely that the entire estimated effect of the distance to a health investment is driven by unobserved variables. Finally, using light density, we show that it is unlikely that our effects are driven by differences in

[6]We also control extensively for the determinants of HIV prevalence that have been highlighted in the existing literature, in particular the distance to the originating point of the epidemic and road density (Oster, 2005, 2012b).

urbanization patterns around missions with and without health investments.[7]

Despite the attempts to control for observable factors, our estimates might be driven by unobserved confounders of long-term development and proximity to a historical mission settlement endowed with a health investment. The long-term effects of missions with health investments on HIV prevalence seem specific to missions with health investments and is not related to other observed mission characteristics. Although we cannot ultimately separate the effect of health investments per se from other mission characteristics, our results suggest that historical missionary presence played a role in the geographical distribution of HIV prevalence.

[Figure 1 about here.]

Related literature The literature in Economics on the HIV/AIDS epidemic in sub-Saharan Africa continues to grow. A number of papers have aimed at understanding differences in prevalence. Oster (2005) shows theoretically that differences between African countries can be attributed to differences in sexual behavior (e.g. the number of sexual partners), male circumcision, and the timing of the epidemic. Oster (2012b) provides empirical evidence of a positive relationship between exports and new HIV infections. Bertocchi and Dimico (2015) study the long-term effects of family structure and sexual behavior (in particular polygyny) on HIV prevalence in sub-Saharan Africa, and Alsan and Cutler (2010, 2013) investigate the mechanisms behind HIV decline in Uganda. We contribute to this literature by investigating the role played by historical determinants. To the extent of our knowledge, Mantovanelli (2016) is the only paper considering the impact of missionary activities on HIV. However, he focuses exclusively on the impact of missions on moral values and culture, while we focus in this article on the heterogeneity of missionary influence of HIV.

This paper is also related to the literature in Development Economics that highlights the limitations of sex education curricula focused only on abstinence before marriage and monogamy, in view of reducing HIV prevalence (Dupas, 2011; Duflo et al., 2015).[8] In a recent paper, Dupas et al. (2018) perform a field experiment in Cameroon and show that a number of different HIV prevention interventions – all discussing condom use as a key strategy rather than exhorting abstinence – can be effective to reduce teen pregnancy, their proxy for risky

[7] This is of particular importance given that HIV is a disease that has propagated faster in more densely populated areas.

[8] See also Baird et al. (2012) who find that in Malawi, monthly cash transfers to the families of out-of-school girls significantly reduced HIV infection rates after 18 months.

sexual behaviors. In accordance with this literature, we show that the Christian influence can be associated with an increased HIV prevalence. Moreover, we document the role played by sexual behaviors.[9] More generally, our paper complements the growing literature in Economics on HIV prevention (see e.g. DellaVigna and Ferrara, 2015).

Finally, our article is more broadly related to the literature on the persistent effect of historical events on Economic Development.[10] As noticed by Feyrer and Sacerdote (2009) and Huillery (2009, 2011), historical events can explain heterogeneous development dynamics. Micro-oriented studies isolate specific channels through which a development dynamic can be durably established (Nunn, 2008; Huillery, 2009; Alesina et al., 2011; Michalopoulos and Papaioannou, 2013, 2016; Voigtländer and Voth, 2012; Jha, 2013; Grosfeld and Zhuravskaya, 2015; Dell et al., 2017). Early investments are of particular importance in the case of sub-Saharan Africa (see e.g. Wantchekon et al., 2015).[11] Lowes and Montero (2017b) document the extent to which exposure to colonial medical campaigns affect trust in modern medicine nowadays, and in particular consent to take a blood test for HIV. They also consider health outcomes and provide evidence that the colonial medicine campaigns are associated with higher levels of HIV, at least in Cameroon.

The early work of Protestant missionaries has been largely associated with improving development in the long-term, through an increase in social capital (Woodberry, 2012; Cagé and Rueda, 2016), human capital (Gallego and Woodberry, 2010; Acemoglu et al., 2014; Valencia-Caicedo, 2014; McCleary, 2015), or gender equality (Akyeampong et al., eds, 2014, Chap. 16). Calvi and Mantovanelli (2015) study the positive long-term consequences of Protestant missions in India on health outcomes nowadays (individuals' body mass index). In this article, we tell a more nuanced story as we establish that Christian missions had conflicting effects on the geographic distribution of HIV prevalence.[12]

The rest of the paper is organized as follows. Section 2 presents a brief historical background on missionary activity in sub-Saharan Africa, the early investments in modern medicine and the focus of a number of religious groups on abstinence until marriage. Section 3 describes

[9] Thornton (2008) finds that when people learn they are HIV positive they increase their purchase of condoms.

[10] For a recent review of the literature on Africa's colonial and precolonial legacies, see Michalopoulos and Papaioannou (2017).

[11] There is also an extensive literature on the long-run impacts of colonial institutions. See e.g. Dell (2010); Dell and Olken (2017) and Lowes and Montero (2017a) among many others.

[12] On the long-term determinants of beliefs and behaviors and the cultural origins of comparative development, see also Miguel et al. (2008); Grosjean (2014); Grosjean and Khattar (2014); Michalopoulos et al. (2016); Moscona et al. (2017).

the data and presents summary statistics. In Section 4, we provide empirical evidence on the long-term impact of missionary activity on HIV/AIDS prevalence nowadays, and disentangle between the positive effect of health investments and the negative effect of the focus on abstinence. Section 5 presents a number of robustness checks. The endogenous selection of missions into health investments is extensively discussed. Section 6 investigates the role played by family values, sexual behaviors and beliefs. Section 7 concludes.

2 Historical background

The missionary roots of modern medical provision in sub-Saharan Africa. The history of modern medicine in sub-Saharan Africa is closely linked to the development of missionary activity. Missionaries were among the first to provide modern health care until the middle of the twentieth century (Vaughan, 1991, Ch.3). Missionary work was often conducted by doctors or nurses. David Livingstone – probably the best-known figure in the history of African missionaries – was a doctor himself. Although Livingstone's ultimate goal was the promotion of trade with local tribes as means to improve development and end the slave trade, he emphasized the crucial role of health and education because in his view, *"neither civilization nor Christianity can be promoted alone. In fact, they are inseparable."*

From the end of the nineteenth century to the early twentieth century, there was a rapid increase in the activity of medical work among missionaries. The Edinburgh Medical Missionary Association was founded in 1841. In 1891, the Church Mission Society established a new "Medical Committee" that was specifically in charge of managing the medical work of the society. Medical missionaries had a central role in the provision of health care through the construction of hospitals, dispensaries, the provision of midwifery services, the treatment of leprosy, vaccination campaigns, and the training of lay health workers. Although the colonial methods employed, such as the segregation of lepers in asylums, are now questioned, the case remains that an important part of the provision of health care was initiated by missionaries. Moreover, secular investments in health partly relied on the Christian missionary networks. For a more detailed history, we can refer to Vaughan (1991, Chap. 5) .

The early Christian provision of health-care thus persisted after colonization and has been particularly influential in the design of contemporary health-care in low-income countries (Idler, 2014). In 1968, for instance, the World Council of Churches established the Christian Medical Commission (CMC), institutionalizing the long-lasting tradition of Chris-

tian medical and healing work around the world.[13] In 2001, the World Christian Encyclopedia inventoried 37 different Christian societies working on the provision of health-care in sub-Saharan Africa (unfortunately, more detailed statistics are not reported). The Christian Medical Fellowship (CMF), a modern medical Christian society, also illustrates the extent of the Christian influence in contemporary medical provision. It inventories on its website 64 Christian partner hospitals[14], many of them with satellite institutions and mobile clinics. In countries like Malawi or Rwanda, the CMF's partner institutions alone account for up to 9% of the country's total hospital beds.

The Christian roots of modern health provision. Missionaries' central objective was to convert the local population to the Christian faith, and to some extent, missionary medicine was considered by some as instrumental towards this goal. The notion of healing the body and soul is indeed deeply rooted in the Christian dogma. For instance, the Gospel of Matthew 10:1 reads: *"Jesus called his twelve disciples to him and gave them authority to drive out impure spirits and to heal every disease and sickness"*. Medical work – a form of *"healing authority"* – was *"part of a programme of social and moral engineering through which Africa would be saved"* (Hardiman, ed, 2006). The following excerpt from Vaughan (1991, p. 72), narrating an encounter between a missionary doctor and a traditional healer, is also illustrative of how medical missionary work was sometimes conceived as embedded in the evangelization work, rather than as an independent scientific activity.

> I asked him [the traditional healer] if he had any medicine that would make a man live forever. He fumbled in his basket, (...) he showed me some earth, scraped from the surface of a cliff on a river bank, and told me that it should be mixed with castor oil and used for anointing the body, so that the body may prosper. 'But even so', he added pathetically, 'we still die'. I told him that WE HAVE the Medicine for immortality (. . .) and it was to be had in Church.

Therefore, when studying the legacy of missionary activity on health outcomes, we need to bear in mind that missionary medicine was a part of a larger conversion enterprise. The

[13] E.g., according to Pr. Dan Kaseje's address to the WHO on the contribution of the CMC to health-care in Africa, policies such as the essential drugs initiative in 1987 (or Bamako initiative), that aimed at *"solving the problems in the financing of primary health-care"* and lead to the commitment of Africa health ministers to ensure a regular supply of drugs, were put together by the WHO and UNICEF following the guidelines of the CMC. A transcript of this speech can be found online, with additional examples of joint projects between the CMC and the WHO.

[14] These hospitals are located in Angola, Cameroon, Central African Republic, Chad, Congo, DRC, Ethiopia, Kenya, Madagascar, Malawi, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Tanzania, Uganda, Zambia, and Zimbabwe.

history of the early colonial and missionary campaigns targeting STDs illustrates the tension between the Christian and the scientific response to these diseases. In Uganda, there was a large increase in the prevalence of syphilis from the mid-nineteenth century, which led to the first public health campaigns launched in sub-Saharan Africa by the colonial powers (Setel, 1999, p.99).[15] The priority of the campaigns was not the treatment of patients or the diffusion of scientifically accurate information, but the fight against what colonial authorities considered to be the innate sinfulness of the African society (Vaughan, 1991). This moral combat was in turn supposed to eradicate the *"disease of immorality"*, the term used by missionary doctor Albert Cook to refer to syphilis in Uganda (Vaughan, 1991, p. 138). The interventions by colonial powers, missionaries, and local authorities to fight the crisis took different forms, but they always implied the necessity to change sexual behaviors by incentivizing monogamous marriages at a younger age. Missionaries campaigned for the recognition of customary law marriages in 1918, capping the levels of required bride wealth, banning divorce for reasons other than adultery, and imposing restriction on women's mobility (Doyle, 2013).

However, the prioritizing of morality over medical responses cannot be generalized to all missionaries. The case of Reverend Lattimer Fuller's response to the syphilis problem in South Africa, and its difference with the Ugandan case illustrates this heterogeneity. Fuller was a doctor for the United Society for the propagation of the Gospel (USPG). Around 1907, as a response to the USPG's inquiry on the needs of their missionaries on the field, he replied with a letter that reads rather like a public health report than a moralizing pamphlet, despite its antiquated language. Without references to morality, he just emphasizes the need for dispensaries ("cottage hospitals"): [16]

> "The usual medical estimate of the health of the million Natives in this diocese is that seventy five percent of them suffer more or less from syphilis, and not less than twenty five percent from incipient or advanced phthisis. (...) At this stage [the phthisis] can be easily and successfully treated, only there is no one to treat it. (...) Nothing would be really of much use in such densely populated a district [Johannesburg] except something in the way of a cottage hospital where two or three native girls would be trained to look after the sick.

Today, this heterogeneity is still very present. For instance, in 2009, the United Church

[15] The medical history of the Ugandan syphilis outbreak has actually shown that the event was largely overestimated, because an endemic and non-dangerous form of syphilis was initially mistaken by the venereal syphilis (Davies, 1956). This, however, does not affect our historical analysis.

[16] "Papers of the United Society for the Propagation of the Gospel – Papers of the Medical Mission Department" (Bodleian Library, 1701-1980, MM Box 48, 39). We reproduce the letter in its entirety in the online Appendix Section. D.

of Christ HIV/AIDS Ministry Network released a statement recommending that houses of worship and faith-based education institutions distribute condoms and provide comprehensive sexual education. Other AIDS-relief programs also run by faith-based organizations are less clear on the importance of distributing condoms.[17] In this article, we capture this heterogeneity by comparing the effect of missions that specialized in health provision to those that did not. We show indeed that only regions around missions that invested in health exhibit lower HIV prevalence today.

The contemporary Christian influence on HIV prevention campaigns. Today, the focus of the campaigns against HIV/AIDS is often on teaching the ABC approach: "Abstain, Be Faithful, Condomize". But while religious groups have been open to teaching this message, there is qualitative evidence that "Condomize" section is often ignored. Many churches – in particular Pentecostal churches – indeed still consider the use of condoms as a sin (Mash and Mash, 2013). Religious groups are also heavily involved in the design of sex-education curricula delivered in many public schools. According to Duflo et al. (2015), in Kenya as well as in many other sub-Saharan African countries, the resulting curriculum teaches the biology of AIDS and HIV transmission, how to care for people living with AIDS, and prevention. The prevention component stresses abstinence before marriage, followed by marital faithfulness as the most effective ways to prevent STIs. The official textbook does not mention condoms nor contraception.[18]

Yet, it has been shown in the literature that HIV curricula stressing abstinence before marriage do not reduce risky sexual behaviors, whereas those that do explain the use of condoms are effective in the reduction of STDs (Dupas, 2011; Duflo et al., 2015). In this article, we show that the historical provision of public goods by Christian missions has conflicting effects on HIV/AIDS prevalence that reflect the problematic approach of Christianity to STDs. While historical Christian health investments are associated with lower prevalence of HIV/AIDS, Christian attitudes towards contraception and condom use are associated with

[17] We do not wish to dismiss the importance of such relief programs, as they have devoted substantial amounts of financial and human resources to support local community initiatives that provide treatment care for patients. Although they do discuss sexual education, their focus is often shifted, in terms of prevention, towards highlighting the importance of monogamy and the Christian life ("The untold story of African AIDS relief." United Methodist News, 28 March 2013).

[18] *'The curriculum does not mention condoms and provides only limited scope for teachers to discuss protected sex in response to students' questions. It does not cover partner selection, and although they cover love relationships between same age boys and girls, the official textbooks do not mention cross-generational relationships (and their associated risk)"* (Dupas, 2011).

higher prevalence rates.

3 Data and missionary locations

3.1 Historical data

Different sources were used to construct the dataset of missions and historical controls.

3.1.1 Protestant missionary investments

Regarding Protestant missions, we originally compiled the data of missionary investments and their locations in a previous article (Cagé and Rueda, 2016). We constructed the mission-level data and geocoded the maps of sub-Saharan African regions from the *Geography and Atlas of Christian Missions* (Beach, ed, 1903). The maps locate all the Protestant mission stations in 1903 (an example of these maps is provided in Figure 2b).

As opposed to other available geographic datasets of Protestant missions (Akyeampong et al., eds, 2014, Chap. 16), the one generated for this article contains detailed information for each mission settlement. In the *Geography and Atlas of Christian Missions*, each mission station is uniquely identified in a statistical appendix, which provides information on the mission's size (number of students, of missionaries, etc.) and a detailed record of its activities and investments. For example, we know whether each mission had a printing press, a school, or a health facility. The exhaustive list of variables and a reproduction of one page of the statistical index are provided in the online Appendix to Cagé and Rueda (2016). Our sample of sub-Saharan African missions includes a total of 723 Protestant missions out of which 99 had a dispensary, and 38 had a hospital.

3.1.2 Catholic missionary investments

This paper complements the data from Cagé and Rueda (2016) with new information on Catholic missionary activity. We exploit the information from the 1929 *Atlas Hierarchicus*, which is the official publication of the Vatican (the Fides service) that inventories Catholic activities worldwide and locates all the Catholic missionary stations in the world on a series of maps (Streit, 1929).[19] An example of these maps is provided in Figure 2a. The Atlas also

[19] Alternatively, we could have used the previous (1913) *Atlas Hierarchicus*. We chose to focus on the 1929 one because Catholic missionary activity expanded later than Protestant activity. The 1929 Atlas locates significantly more hospitals and missions than the previous one.

gives some statistical information about the investments at the mission level, although it is less detailed than the Protestants' *Geography and Atlas of Christian Missions*. Notwithstanding this limitation, it does report the location of missionary hospitals; which is enough for the scope of our study.

Our sample of sub-Saharan African missions includes a total of 536 Catholic missions out of which 36 had a hospital. Unfortunately, smaller-scale health units like dispensaries are not recorded.

[Figure 2 about here.]

The map in Figure 3 reports the historical location of both the Catholic and Protestant missions as well as their health investments. To the extent of our knowledge, we are the very first to produce such a dataset. Overall, we provide information for a total of 1,259 missions.

[Figure 3 about here.]

3.1.3 Additional historical controls

Geo-referenced data on historical population density is taken from the History Database of the Global Environment (HYDE), computed by the Dutch Environmental Assessment Agency. We geocode these data at the mission and DHS cluster levels.

We compute the distance to 1400 and 1800 cities using GIS and the information on the location of cities provided by Nunn and Wantchekon (2011). Information on explorer contact and railway contact is also from Nunn and Wantchekon (2011).

Finally, we control for the tsetse fly suitability index (TSI) developed by Alsan (2015). The tsetse transmits a parasite harmful to humans and lethal to livestock, and has been shown to affect current economic performance (Alsan, 2015). The TSI is the standardized value of the steady-state tsetse population.

3.2 Contemporary data

3.2.1 Demographic and Health Survey

Using the Demographic and Health Survey (DHS), we estimate HIV prevalence at the subnational level, and the contemporary characteristics of the regions of interest. HIV prevalence is measured as the number of adults with HIV infection, whether or not they have developed symptoms of AIDS, expressed as a percentage of the total adult population.

The DHS are standardized nationally representative surveys in developing countries. Women and men answer questions related to their anthropometrics, living conditions, health, sexual reproduction behaviors, and attitudes and beliefs regarding different health outcomes; in particular, the HIV epidemic.

Moreover, since the 2000s, the DHS also collect biomarker data on Sexually Transmitted Diseases (STDs). Biomarkers are objective physical or biologic measures of health conditions. Using field-friendly technologies, the DHS surveyors can collect biomarker data relating to a wide range of health conditions, including STDs, chronic illnesses (such as diabetes, micronutrient deficiencies), and exposure to environmental toxins.[20] Hence, our measure of HIV infection is based on actual HIV contamination information, not on self-reported surveys where the mean rates of HIV infection are likely to be severe underestimates.[21]

We use the DHS data for sub-Saharan African countries where both GPS information and biomarker data on HIV are provided. Figure 4 shows the locations of these clusters. There is a total of 13,307 clusters distributed among 20 countries: Burkina Faso, Burundi, the Democratic Republic of Congo, Côte d'Ivoire, Cameroon, Ethiopia, Ghana, Guinea, Kenya, Liberia, Lesotho, Mali, Malawi, Mozambique, Rwanda, Senegal, Swaziland, Uganda, Zambia, and Zimbabwe. The information is collected in several rounds, from 2003 to 2014. Unfortunately, not all the countries are systematically surveyed so the resulting pseudo-panel is extremely unbalanced. As a result, we only construct HIV prevalence rates, and cannot compute HIV incidence rates.[22] Prevalence rates are an imperfect measure of the risk of contracting the disease, but can be used to document the accumulation of the disease over time. As we are interested in the historical determinants of the infection's spread, this is the relevant measure for us to use. Online Appendix Table C.2 provides descriptive statistics on HIV prevalence. On average, the HIV prevalence rate is equal to 6.6%; and to 7.2% in towns located 100 km away or closer to the closest mission.

Note that because the use of biomarkers requires the data to be anonymous, we do not

[20] Dried blood spots (DBS) on filter paper are increasingly used for HIV testing. This method of specimen collection has eliminated the need for cold chain and/or refrigeration of specimens, reducing considerably the complexity of storage in the field and transport to the laboratory. For more information, visit the DHS website.

[21] Another empirical issue comes nonetheless from the fact that individuals have to consent to HIV tests, and their propensity to do so may be affected by colonial medical campaigns (Lowes and Montero, 2017b). Reassuringly, in Section 5, we show that this does not drive our findings.

[22] HIV prevalence is a stock. Another possible measure of HIV is its incidence, i.e. the flow of new cases. While incidence rates tell us how likely it is to get the disease in a given region (or how fast the epidemic is moving), prevalence rates indicate how widespread the disease is. Incidence rates require yearly data on prevalence and mortality from HIV/AIDS. Previous research that focused on incidence rates typically uses country-level estimates (Oster, 2010, 2012b).

have individual level data, but average for towns.[23] However, given that our "treatment" (distance from the closest mission with and without a health investment) is at the town level, this town-level data is similar to an estimation with individual-level data and two-way clustering at the closest mission and town levels.

[Figure 4 about here.]

3.2.2 Geographical data

Following Michalopoulos and Papaioannou (2013, 2014), we use light density data as a proxy for urbanization and regional GDP.[24] To control for geographic characteristics at the town and mission-level, we use the *Global Agro-Ecological Zones* (GAEZ) data compiled by the Food and Agriculture Organization (FAO). From this source, it is possible to extract precipitation levels, number of growing days per year, malaria ecology, and terrain ruggedness for each location.

The data relating to African roads comes from the NASA Socio Economic Data and Application Center. This data set combines the best available roads data by country into a global roads coverage, using the UN Spatial Data Infrastructure Transport (UNSDI-T) version 2 as a common data model. The date range for road network representations ranges from the 1980s to 2010 depending on the country. Updated data for 27 countries and 6 smaller geographic entities were assembled by Columbia University's Center for International Earth Science Information Network (CIESIN), focused largely on developing countries with the poorest data coverage (Socio-Economic Data and Application Center , SEDAC)

3.3 Determinants of mission location and investments

Johnson (1967), Nunn (2010), Akyeampong et al., eds (2014, Chap. 16), and Cagé and Rueda (2016) extensively discussed the determinants of missionary location. Due to potential selection in missionary location, our empirical analysis restricts the focus to regions near historical mission settlements. Moreover, our specifications always control for all the geographic and historical characteristics that may have influenced location choice, such as the malaria ecology, proximity to the coast, suitability for rainfed crops, and proximity to historical rail lines and explorer routes. In the online Appendix summary statistics Table C.3, we perform a t-test on

[23] HIV testing is anonymous. Personal identifiers are delinked from the dried blood spots (DBS) containing filter paper card, and respondents who agree to be tested are not told their results.

[24] For a recent survey of the literature on the use of light density data, see Donaldson and Storeygard (2016).

the equality of means for geographic and historical characteristics of towns located near (less than 100km) and far (more than 100km) from a historical mission settlement.

Before turning to the empirical analysis, we analyze the determinants of missionary investments. Table 1 compares the geographic and historical characteristics of missions that did invest in health with those that did not. Protestants and Catholics are analyzed separately. Missions that invested in health facilities were, on average, not located in more geographically favored areas. None of the geographical indicators are indeed significantly different between the two groups, except elevation which is lower for missions that invested in a hospital.[25]

Historical characteristics exhibit a different pattern, but this pattern slightly varies depending on whether a mission was Protestant or Catholic. Regarding Catholic missions, we find that missions working in health had more favorable historical characteristics: they were closer to historical cities and to explorer routes, and were located in places with higher precolonial population density. Protestant missions with a health investment were similarly closer to historical cities and located in places with higher precolonial population density; however, they are further from explorer routes. All our specifications control for these characteristics.

[Table 1 about here.]

4 Empirical analysis

4.1 Specification

We can examine the correlation between proximity to missions (with and without health investments) and HIV/AIDS prevalence by estimating the following equation:

$$y_{rct} = \mathbf{Dis'}_r\boldsymbol{\beta} + \mathbf{X'_{rt}}\boldsymbol{\gamma_1} + \mathbf{W'_r}\boldsymbol{\gamma_2} + \zeta_r + \theta_c + \varepsilon_{rct}. \quad (1)$$

where y_{rct} is the average HIV prevalence rate as estimated from the DHS biomarkers, in the DHS cluster r, in country c, and year t. In the remainder of the paper, the DHS clusters are referred to as "towns". $\mathbf{Dis_r}$ is a vector of distances. It includes the explanatory variables of interest: the logarithm of the distance between town r and the closest historical mission settlement, and the logarithm of the distance between town r and the closest mission with a

[25] We also find a statistical difference regarding ruggedness – lower in places with an hospital – but it only applies to Protestant missions.

health investment (a hospital or a dispensary). Online Appendix Table C.1 presents summary statistics on these distances.

The vector $\mathbf{X_{rt}}$ contains town-level controls from each round of the DHS. These are the proportion of women in town; the share of married couples; and the average age and age squared.[26]

The vector $\mathbf{W_r}$ contains geographical and historical-level controls for town r in country c. The geographical controls are distance to the capital city; distance to the coast; the average malaria ecology of the land; the ruggedness of the terrain; the elevation; the number of growing days; Tse-Tse fly suitability index (Alsan, 2015); and the suitability for rainfed crops in the town. The historical controls are the distances to cities in 1400 and 1800; estimates of precolonial population density from HYDE; and distance to colonial railways and to initial explorer routes (Nunn, 2008). Following Oster (2012b), we include distance to the originating point of the epidemic as a control in all our regressions.[27] We also control for road density.

Finally, ζ and θ are country and year fixed effects. All the regressions' standard errors are clustered at the closest mission level.

4.2 Results

Proximity to a mission and HIV Prevalence First, we estimate the long-term effect of proximity to a mission station on the average HIV prevalence today. We restrict the sample to regions close to historical mission settlements (we consider towns that fall in a 100 km radius buffer around missions – further down, we show that our results are robust to a less parametric estimation). We do this because regions near historical mission settlements have on average better geographic conditions than regions further away; in particular, missions located in places with historically higher population density. Yet higher population density, through an agglomeration effect, can increase HIV prevalence. Moreover, all the mission stations invested in activities that are probably correlated with long-term development. This

[26] We do not introduce contemporary controls that may be bad controls in the sense of Angrist and Pischke (2009), in particular contemporary religion. However, in Section 6, we show that there is no effect of distance to missions in predominantly Muslim towns. We also document a positive correlation between proximity to the historical location of a mission and contemporary religion. Furthermore, in Section 5, we show that our results do not depend on the set of controls included.

[27] We use distance to Kinshasa, as it has been documented to be the most likely originating point of the HIV-1 virus (Faria et al., 2014). However, Pépin (2011, Chap. 2) shows that Kinshasa might not be the originating point.

restriction therefore aims to correct for possible selection in mission location.[28]

The results are reported in Table 2 (columns (1) to (3)). We find that the baseline correlation between HIV prevalence and distance to a mission is negative and statistically significant. A one percent increase in the distance to a mission is associated with a 0.005 percent decrease in HIV prevalence (column (1)), and with a 0.009 decrease if we focus on Protestant missions (column 2). In terms of magnitude, a one standard deviation increase in the logarithm of the proximity to a Protestant mission increases HIV prevalence by 6.2% of a standard deviation.[29]

A thought experiment can help get a sense of the meaning of these numbers. Consider a 26-million inhabitants country (our sample average) and assume that, everything else equal, all the towns are 10 km closer from a mission that what they actually are. This would imply – absent any general equilibrium effects – a $24,000$ increase in the number of HIV cases. In comparison, according to the most recent estimates, 26 million people are living with HIV in sub-Saharan Africa nowadays (UNAIDS).

This negative impact of missionary proximity on HIV does not hold for Catholic missions, however. On the contrary, we show that HIV prevalence is lower close to Catholic missions (column (3)). The magnitude of the effect is low, though: a one standard deviation increase in the proximity to a Catholic mission decreases the HIV prevalence rate by 4% of a standard deviation. Moreover, this positive effect is no longer statistically significant once we control for the distance to a mission with an health investment. We come back to this point in Section 6.

Missionary health investments and HIV prevalence The long-term effects of missionary activity on HIV prevalence may be heterogeneous regarding the investments performed by the missions. We investigate the long-term effects of missionary health investments on HIV prevalence today. To do so, we regress HIV prevalence on distance to the closest mission and distance to the closest mission with a health investment.[30] Columns (4) to (6) of Table 2 present the results.

We find that proximity to a missionary health investment decreases HIV prevalence: a

[28] In the online Appendix Table C.4, we present the results when we relax this restriction. This is important to interpret the external validity of the estimated effects, given that when we perform the within-mission analysis, the comparison group is always a place close to a mission. While the value of the point estimates is obviously affected by this change in the empirical strategy, it is important to highlight that qualitatively our main results remain similar.

[29] Table C.5 in the online Appendix reports the standardized coefficients (beta coefficients).

[30] We simply state "distance" here for the sake of simplicity, but as before we use the logarithm of the distance.

one-percent increase in the logarithm of the distance to a mission with a health investment is associated with a 0.006 percent increase in HIV prevalence (column (4)). Furthermore, this positive effect holds both for Protestant (column (5)) and for Catholic missions (column (6)), and is of similar magnitude in both cases: a one-standard deviation increase in the proximity to a mission with a health investment decreases the HIV prevalence rate by 8.9% of a standard deviation for Protestant missions, and by 9.4% for Catholic missions. Note moreover that for Protestant missions, once we control for proximity to a health investment, the magnitude of the negative effect of proximity to the mission *per se* increases (similarly, the magnitude of the positive effect for Catholic missions decreases and is no longer statistically significant).

We perform the same thought experiment as before to interpret these estimates. Regarding Protestant missions, they suggest that, everything else equal, if in a 26-million inhabitants country all the towns were 10 km further to a mission with an health investment that they actually are, we would observe an increase by around $10,000$ in the number of HIV cases. For Catholic missions, the same approximations would imply a $4,000$ increase in the number of cases.

A variance decomposition of the results show that our covariates from columns (4)-(6) explain 3 to 5% of the total variation in HIV prevalence (compared to a model with just country and year fixed effects). Of this 3 to 5%, 5% (column (6)) to 22% (column (2)) is explained by the distances to a mission and to a mission with a health investment.

[Table 2 about here.]

Proximity to health investments likely captures the supply of medical services nowadays, as medical care and health care on the field are still largely supplied or coordinated by Christian institutions today. However, other factors can also play a role, as missions with a health investment can either be located in more favorable areas or also be of a different type compared to the other ones. In the next section, when specifically addressing endogeneity, we make sure that our effects are not driven by selection on the location of health investments within the missions.

Non-parametric effect of distance Figure 5 shows the locally weighted scatter-plot smoothing (LOWESS) estimations of HIV prevalence as a function of the distance to a mission with a health investment. This graph shows the non-parametric estimation of HIV prevalence, conditional on distance to a health investment. The Figure is consistent with the hypothesis

of a positive linear relationship between HIV prevalence and the log-distance of the health investment. There is a small deviation from the negative linear relationship, but it is mostly located at the tail of the sample where the estimation is the least efficient.

[Figure 5 about here.]

Urbanization HIV is a disease of cities (Pépin, 2011; Oster, 2012a; Faria et al., 2014), and missions catalyzed city formation in sub-Saharan Africa (see e.g. Woodberry, 2004, among others). Therefore, we need to check that our results are not fully explained by differences in urbanization patterns. To to so, we use an alternative specification, focusing our analysis on highly-urbanized places. We restrict the sample to urban areas (as defined in the DHS), located in regions with an average road density larger than the country's 75th percentile, and that are located close to the coast ($\leq$150km), a major determinant of missionary location.[31] Then, in this sample of 126 urban areas, we regress HIV prevalence on the same controls as before, and on a binary variable equal to one if the area is located in a buffer around a historical mission settlement. Figure 6 presents the results. To be as little parametric as possible, we report the effect of the mission categorical variable for different values of the buffer used to define proximity.

It appears clearly that cities with Protestant missions still exhibit higher HIV prevalence than cities without, whereas consistently with the findings of Table 2 no clear pattern emerges for Catholic missions. Therefore, it is unlikely that urbanization alone fully explains the effect of proximity to a mission on HIV.

[Figure 6 about here.]

Geographical heterogeneity The recent biological history of HIV has emphasized the likely role of health institutions in the early spread of the epidemic in the Central African region.[32] Pépin (2011) claims that the widespread use of non-sterilized needles in mass health campaigns to treat sleeping sickness, leprosy, and other diseases during the colonial times is likely to have been a key vector of transmission for the disease in its early phase. This transmission is what catalyzed the formation of a large-scale epidemic (see also Lachenal,

[31] The results we obtain does not depend on these specific thresholds, and are for example robust to restricting the sample to an average road density larger than the 80th percentile or than the 70th percentile. These results are available upon demand. The key point here is to highlight that even when focusing on places that are largely urbanized, our results on the negative impact of proximity to a mission still hold.

[32] Central African countries are shaded in grey in Figure 4.

2014).[33] For this reason, proximity to a health mission, where many of these campaigns were also organized, might not have had a positive effect in Central African countries. We examine whether this is the case by considering separately Central African and non-Central African countries.

Table 3 presents the results. Columns (1) to (3) focus on Central African countries. The previously described results does not hold for Central Africa, with no statistically significant effects. Columns (4) to (6) perform the same analysis, but for non-Central African countries. The results are similar – both in terms of statistical significance and of magnitude – to the ones presented in Table 2. These findings are consistent with Pépin's hypothesis and with Lowes and Montero (2017b)'s findings.

[Table 3 about here.]

5 Robustness checks

5.1 Endogenous location of missionary investments

In order to overcome the challenge of the endogenous location of missions, we use a "within-missions approach": the sample is restricted to regions close to missions. However, it remains possible that our results might be driven by selection of missions into health investments. As Table 1 shows, there are indeed systematic differences between missions with and without health investments. In particular, missions with an health investment tended to be located in regions closer to urban areas and more populated. This section addresses the issue of selection into health investments. Notice however that such differences should predict *higher* and not *lower* prevalence rates around those health investments, as HIV is mainly a disease of urban areas.

Following Cagé and Rueda (2016), we develop a matching strategy to tackle the possibility of an endogenous selection of missions into health investments. At the mission-level, we regress a binary variable indicating whether missions are endowed with a health investment on all the observable characteristics available at the mission level (these observables correspond to the variables reported in Tables 1). From this regression we compute the propensity score, which is the estimated probability of a mission station having a health investment. We then

[33] Lowes and Montero (2017b) document the negative long-run effect of French colonial medical campaigns on trust in modern medicine nowadays.

match each mission with a health investment to the mission with the closest propensity score using a one-to-one matching. The sample of missions with a health investment is called H. Each town in the DHS is then associated to the closest mission in the sample $\left\{\overline{H} \cup H\right\}$. A map of all the missions in the sample $\left\{\overline{H} \cup H\right\}$ is shown in Figure 7. We then construct the following variables:

- Distance to health or similar$_r$: the distance from town r to the closest mission station in the sample $\left\{\overline{H} \cup H\right\}$.
- "Treat Health"$_r$: a binary variable equal to one if town r is treated by a health investment (i.e. the closest mission in the sample $\left\{\overline{H} \cup H\right\}_r$ actually has the investment, meaning that it belongs to H). This term captures the treatment effect of being close to a mission with a health investment.
- " Interaction$_r$": is the interaction term

$$\text{Distance to health or similar}_r \times \text{Treat health}$$

Equation (2) describes the identification:

$$\begin{aligned} \mathrm{y}_{rt} = \lambda_1 &\text{Distance to health or similar}_r + \lambda_2 \text{Treat H}_r + \lambda_3 \text{Interaction}_r \\ &+ \mathbf{X'_{rt}\gamma_1^*} + \mathbf{W'_r\gamma_2^*} + \zeta_r^* + \theta_c^* + \varepsilon_{rt}^* \end{aligned} \tag{2}$$

where the vectors of controls $\boldsymbol{X'_{rt}}$ and $\boldsymbol{W_r}$ are the same as before, and y_{rt} is the HIV/AIDS prevalence rate. This specification aims to disentangle the effect of proximity to a health investment from the effect of proximity to a mission with similar characteristics.

The results are described in Table 4. Columns (1) and (2) report the results for all the towns in our sample, and columns (3) to (4) focus on non-Central African countries. In all the specifications, the treatment effect "Treat Health" is negative, as expected, and statistically significant. Moreover, we find no impact of distance to similar missions but without health investments. The robustness of our results to the matching strategy is reassuring: it is unlikely that all of the effects found are driven by confounder determinants of missionary investment and HIV prevalence.

[Figure 7 about here.]

[Table 4 about here.]

5.2 Selection on unobservables compared to selection on observables

Using the insights from Oster (2016), we check the likelihood that our results are driven by the bias due to unobservables. This method, which we implement using her Stata module `psacalc`, assesses how large the bias due to unobservables should be, compared to that on observables in order to explain away the results. This ratio is called δ. To determine this quantity, we need to hypothesize the value of the R^2 when controlling for both observables and unobservables, called R_{max}. Figure B.2 in the online Appendix reports the estimated δ for the coefficient on distance to a mission with a health investment, as a function of R_{max}. For values below 0.75, a conservative value for our field (Oster, 2016), the implied bias from unobservables required to explain away our results should be 1 to 5 times larger than the bias from observables, which is unlikely. δ then becomes lower than one for $R_{max} > 0.75$. [34]

5.3 Additional robustness checks

In this article, we emphasize the heterogeneity of the long-term effects of missionary activity on HIV prevalence. Our interpretation is that this heterogeneity could result from the varying importance given by churches to comprehensive sexual education compared to Christian family values. This interpretation could be wrong; for instance the differences observed could be due to poorer health in general around regions close to missions without health investment. Another possibility would be that missions that invested in health were located in areas that are less urbanized today. This would be a problem since HIV is mostly a disease of urbanization (Pépin, 2011; Oster, 2012b). Finally, the results could also be driven by differences in education. In this section, we explore the likelihood of these alternative hypotheses. The detailed results for these tests are available in the online Appendix.

Anemia Table C.6 in the online Appendix reports the results of estimating equation 1 when the dependent variable is the proportion of women who are anemic in town. Anemia is measured by the DHS program and the results of the test are given in the main questionnaire for women. The results show that, unlike for HIV, proximity to missions is not associated with different prevalence in anemia. When focusing only on urban centers, proximity to missions with a health centers is associated with lower anemia. These results cast doubt on the idea that our results are not specific to STDs, and that they would be driven instead by

[34] Our baseline regression controls for fixed effects and distance to any mission.

poorer health conditions in general around historical missionary settlements without health investments.

Light density In section 4, we show that it is unlikely that the higher prevalence of HIV around mission stations is fully explained by urbanization. In this section, we address whether proximity to a mission with a health investment is associated with different urbanization patterns. This would be a problem as HIV is a disease that has propagated faster in more densely populated areas. Table C.7 in the online Appendix reports the results of estimating equation 1 when the dependent variable is the (log of) light density in a 1x1km pixel around each town. The results show that – not surprisingly – distance to missions is negatively associated with light density: the greater the distance, the lower the light density (problem addressed in section 4). Reassuringly for the estimates regarding proximity to health investments, no statistically significant effect of the health investments on light density is found. Moreover, even if not statistically significant, the coefficient on distance to health is of the same sign than the coefficient on distance to any mission. In other words, missions that invested in health do not seem to differ regarding urbanization. It thus seems unlikely that all of our effect would be driven by differences in urbanization patterns around missions with and without health investments.

Education The long-lasting effects of missionaries on education have been studied thoroughly (Woodberry, 2004; Valencia-Caicedo, 2014; McCleary, 2015). If individuals living in regions close to missions with health investments tend to be more educated, then our results could be driven by human capital rather than by differences in sexual behaviors. Although the existing literature has found no relation between education (in general) and STDs at the micro level (Duflo et al., 2015), we cannot rule out the role of human capital at a more macro level. Table C.8 in the online Appendix reports the results of estimating equation 1 when the dependent variable is the number of years of education. As expected, proximity to a mission is correlated with more education for Protestant missions, which are the ones this channel has been documented for the most (in particular due to the principle of the *Sola Scriptura*, central to the Protestant doctrine). Importantly, we find no statistically significant relationship between proximity to missions that invested in health and the number of years of schooling. It is thus unlikely that all of our effect would be driven by human capital accumulation.

Consent to test Our estimates rely on the availability of HIV test results for each town. One problem related to this is that regions with higher mistrust in medicine will have fewer individuals consenting to HIV tests. Given the persistence of mistrust in medicine in regions where colonial medical campaigns were established (Lowes and Montero, 2017b), lack of consent in regions close to missions could pose a potential threat to the estimation. Table C.9 in the online Appendix shows that proximity to a missionary station (in general or with a health investment) is neither a strong nor a statistically significant predictor of consent to HIV testing.

Controls Finally, we show that our results do not depend on the set of controls included. Online Appendix Table C.10 shows that our results are robust to excluding the town-level contemporary controls (proportion of women in town, share of married couples and age controls), and Table C.11 to excluding all the contemporary and historical controls. The only change we observe when we do so is that the positive coefficient associated with distance to a Catholic mission turns out no longer to be statistically significant. The magnitude and the statistical significance of the other coefficients is not affected by this change. In particular, we still obtain a negative effect to proximity to any missions or to Protestant missions, but a positive impact of proximity to a mission with a health investment.

6 Channels

Taken together, the results of this article show that historical missionary activity has heterogeneous and sometimes conflicting effects on HIV prevalence today. In this section, we discuss the channels that could explain this relationship. We hypothesize that conversion is a possible explanatory channel. Christianity outlasted missions themselves, and contemporary Christian leaders, by opposing or avoiding the discussion about safer sex practices might have impeded a reduction in the spread of the disease. Mash and Mash (2013) show that local churches have an active role in the contemporary design of HIV-prevention campaigns and that they encounter difficulties when addressing the topics about safer sex. While we do not think that this is the only explanatory channel, this section aims at showing that it is a plausible one. We also investigate whether sexual behaviors are correlated with historical missionary settlements and whether missionary effects are heterogeneous. Many of these behaviors depend on potential "bad controls", and so the results presented in this section must be interpreted with

caution.

Denominational heterogeneity and the role of conversion The results presented in Table 2 and Figure 6 suggest that Protestant missionary presence is the one consistently associated with higher HIV prevalence. This result strikes as a surprise; after all, the most well-known opposition to anti-HIV policies favoring access to condoms was the Vatican's official publication "Family Values versus Safe Sex", of which the first chapter is entitled " The Catholic Church's Criticism of the Condom in AIDS-Prevention Programmes" (López-Trujillo, 2003). Although surprising, the denominational heterogeneity in the results is consistent with an understanding of the phenomenon where conversion is an important channel.

Catholic missionaries arrived later in Africa, and were not as successful in their conversion enterprise as Protestants. The introductions of the 1913 and the 1929 *Atlas Hierarchicus* remind that the Vatican worried about lagging behind Protestant missions in the Empire.[35] Moreover, Catholic missions were particularly concentrated in former French and Belgium colonies. If Woodberry's claim that as a result of secularism, "French Catholic missions evaporated never to regain much strength" is probably overstated (Woodberry, 2004, p.26), it is nonetheless true that the religious activities of Catholic missionaries might have been more difficult in a political environment with rising hostility against Catholicism. Looking at the case of Sénégal, Foster (2013, Chap. 2) reinforces the intuition that conversion might have been less successful for Catholics. She shows how, due to a lack of trained colonial personnel and a poor understanding of local languages and customs, the French colonial administrations relied on local – mostly Wolof – Muslim chiefs to enforce their authority, which gave in turn more power to Islam and created incentives for colonial officers to push back against conversion.[36]

Figure 8 plots the distribution of the contemporary share of Christians separately for towns close to Protestant and to Catholic missions (< 30 km). The cumulative distribution function for towns close to Catholic missions is above the one for Protestant missions for all the shares

[35] Both publications reveal worry about the fact that Islam spreads "further and further" (p.47 in the 1913 version), and colonial authorities are criticized for "promoting Mohammedan officers". The limitations of the Catholic enterprise are also noted with subtlety: despite it being a Vatican's publication, only "the lively activity of Protestantism" gets credits for winning "considerable precedence" over Islam.

[36] There was collaboration in that missionary investments (schools, hospitals, even penitentiaries) were accepted and used, but the colonial administration tried, without always succeeding, to guarantee a freedom of conscience that would guarantee them peace with their Muslim and anti-clerical allies. This observation is corroborated by the *Atlas Hierarchicus*, as it states that missions mostly succeeded in building schools and hospitals, but "the formation of a native clergy has not yet been possible".

of Christians below 60%: we can conclude from this Figure that towns close to Protestant missions are significantly more likely to have more Christians nowadays. This result holds for different thresholds defining proximity to a mission (online Appendix Figure B.3).

[Figure 8 about here.]

Towns where a majority of the population is Muslim If conversion plays a role in the negative impact of missionary activity, then the impact of historical missionary presence should not matter in regions that are not Christian. In Table 5, we run the baseline regression while restricting the analysis to towns where more than half (columns (1) to (3)) or three quarters (columns (4) to (6)) of the population is Muslim. No statistically significant impact of missionary activity on HIV is found. Point estimates are close to zero for Catholic missions. The effect of proximity to a Protestant missionary station is noisier, which is understandable as conversion is not the only determinant involved.

[Table 5 about here.]

Family values Christian associations emphasize the importance of abstinence before marriage, early marriage, and faithfulness. These values are often promoted by faith-based organizations as a central component of public campaigns against HIV (Duflo et al., 2015; Mash and Mash, 2013). To further understand how conversion can act as a channel for the results we obtain, we evaluate whether there is a correlation between these particular behaviors and historical missionary settlements; we consider the following variables: abstinence before marriage, age at marriage, and the number of sexual partners per year since the respondent has been sexually active. These variables are imperfect proxies for adherence to Christian family values. As imperfect proxies, or "poorly measured confounders", it is better to gauge whether they are likely channels by considering them as outcomes of the baseline specification rather than as additional controls (Pei et al., 2017).

Table 6 presents the results depending on the gender of the respondent. In all specifications, people in towns close to any mission tend to be less abstinent before marriage, marry when they are older, and have more sex partners per year. These are patterns in accordance with urban family structures. Therefore, efforts by faith-based organizations to encourage Christian family values as HIV prevention in these areas do not seem to be successful. This

result is consistent with previous findings such as those by Dupas (2011), who shows that encouraging abstinence until marriage is inefficient at reducing risky sexual behaviors.

Abstinence before marriage is higher in regions close to a mission with a health investment, reflecting safer sexual behaviors in those regions. These results are robust to restricting the analysis to urban areas.[37]

Sexual behaviors and beliefs Sex and HIV education programs also include explanations on HIV transmission. This implies openly discussing the importance of safe sex (condom use) and the risks involved in sexual practices with more risky partners (sex workers and older partners) (Dupas, 2011; Duflo et al., 2015; Dupas et al., 2018). To capture the extent of risky sexual behaviors and general knowledge about prevention, we consider five different outcomes: (i) the proportion of men using the services of sex workers over their lifetime (column (1)); (ii) the proportion of men using the services of sex workers in the year of the survey (column (2)); (iii) the age difference in the couple[38] (column (3)); (iv) the proportion of individuals who thinks that condoms efficiently protect against HIV (column (4)); and (v) the proportion of women who know where to find condoms (column (5))[39].

The results are presented in Table 7. They show that proximity to a mission with a health service is consistently correlated with safer sexual behaviors. Individuals living in regions close to health investments declare lower use of sex workers' services, over a lifetime or in the year of the questionnaire. Sex workers have been shown to be a crucial vector of transmission of HIV (Pépin, 2011). Finally, women in these areas are also more likely to know where to find condoms (column (5)). Column (4) is the only one that does not support the stronger correlation between safer sexual behaviors and proximity to missions that invested in health, as individuals are less likely to declare that "using condoms during sex" decreases the chances of getting HIV. Another possible channel that unfortunately we cannot test for is the reduction of mother-to-child transmission of HIV in places close to historical health investments, as well as the reduction in HIV transmission associated with better treatment of other, treatable STDs, in particular those generating genital ulcers.[40] Finally, the age gap within households does not depend on the proximity to missions with health investments.

[37] Results available upon demand.

[38] A positive age difference here means that the husband is older than the wife.

[39] This question is only asked in the women's questionnaire.

[40] According to the UNAIDS, more than 90% of infant and young child infections occur through mother-to-child transmission, either during pregnancy, labor and delivery, or breastfeeding. STDs, such as syphilis or chancroid that lead to genital ulcers can importantly increase the risk of HIV transmission.

To summarize, proximity to a mission with a health investment is correlated with family values and sexual behaviors that decrease HIV prevalence, but not with all of them. In particular, we find a strong and robust correlation with abstinence before marriage and a reduced use of the sex workers' services. The fact that a correlation with all sexual behaviors is not observed is not surprising, as contemporary beliefs and behaviors are unlikely to be fully determined by historical events

With the constraint of the sparsely available data, the general picture that emerges is that regions influenced by missions which invested in health are more likely today to have, broadly speaking, lower HIV prevalence and safer sexual behaviors nowadays. Regions close to Protestant missions in general tend to be more Christian today, and have a lower knowledge of condom availability, despite being located in more urban areas. It is likely then that the higher prevalence of HIV around Protestant missions can be partially associated to religious conversion and not uniquely to urbanization. Regarding proximity to missions with health care, there are multiple persistence mechanisms explaining these general results: (i) the persistence of health-care infrastructure where HIV prevention policies can be implemented and that can decrease the HIV risk by providing treatment for other STDs; (ii) and the influence of less fervent missionary societies (the ones involved in health care) that are more likely to have left a legacy suitable for better, more holistic, programs of HIV prevention.

[Table 6 about here.]

[Table 7 about here.]

7 Conclusion

Sub-Saharan Africa accounts for more than two thirds of the world's HIV infections. In this paper, we provide new empirical evidence on the long-term effects of missionary activities in sub-Saharan Africa. We highlight two possible countervailing effects of missions on HIV prevalence. On the one hand, early missionary investments in health have a positive long-term impact on HIV prevalence. On the other hand, the impact of missionary activity without a health investment tends to be negative, to the exception of Catholic missions. The higher HIV prevalence around mission stations is robust to multiple specifications accounting for urbanization. Less knowledge about condom supply is a potential channel. On the contrary, in regions close to missions that invested in health, safer sexual behaviors are more common.

While the existing literature has mostly focused on missionary presence *per se*, we highlight the importance of distinguishing the investments performed by the missions from the effects of conversion. The devil is in the details, and depending on how much missionaries were inclined towards the provision of health services, or how fervent they were, the effect of missionary activity on the prevalence of HIV can go from negative to significantly positive.

Finally, we think that our results may be of use in the future to improve our understanding of the implications of different HIV prevention policies. In the United States, religious conservatives strongly support abstinence-until-marriage (AUM) as a key element of HIV prevention efforts, and this policy periodically receives a large share of the Federal funding. In fiscal years 2006 to 2008, one third of the President's Emergency Plan for AIDS Relief's budget was to be spent on abstinence.[41] While the social conservatives' war on condoms does not seem to be over and in a number of sub-Saharan African countries – e.g. Nigeria - American and local religious conservatism seem to converge in the shaping of HIV prevention programs (see e.g. Jappah, 2013), the results outlined in this paper show that in a long-term perspective, a focus on only abstinence has thus far most likely been inefficient.

[41] Launched in 2003, PEPFAR is a United States governmental initiative to address the global HIV epidemic, primarily in Africa. When the then congressman Mike Pence's advocated for PEPFAR in Congress in 2003, he said: *"Abstinence and marital faithfulness before condom distribution are the cure for what ails the families of Africa. (...) It is important that we not just send the money, but that we send them values that work."* Beginning in 2006, PEPFAR specified that 33% of all prevention funds (and two-thirds of funds for sexual transmission) would be earmarked for AUM programs (see e.g. Santelli et al., 2013).

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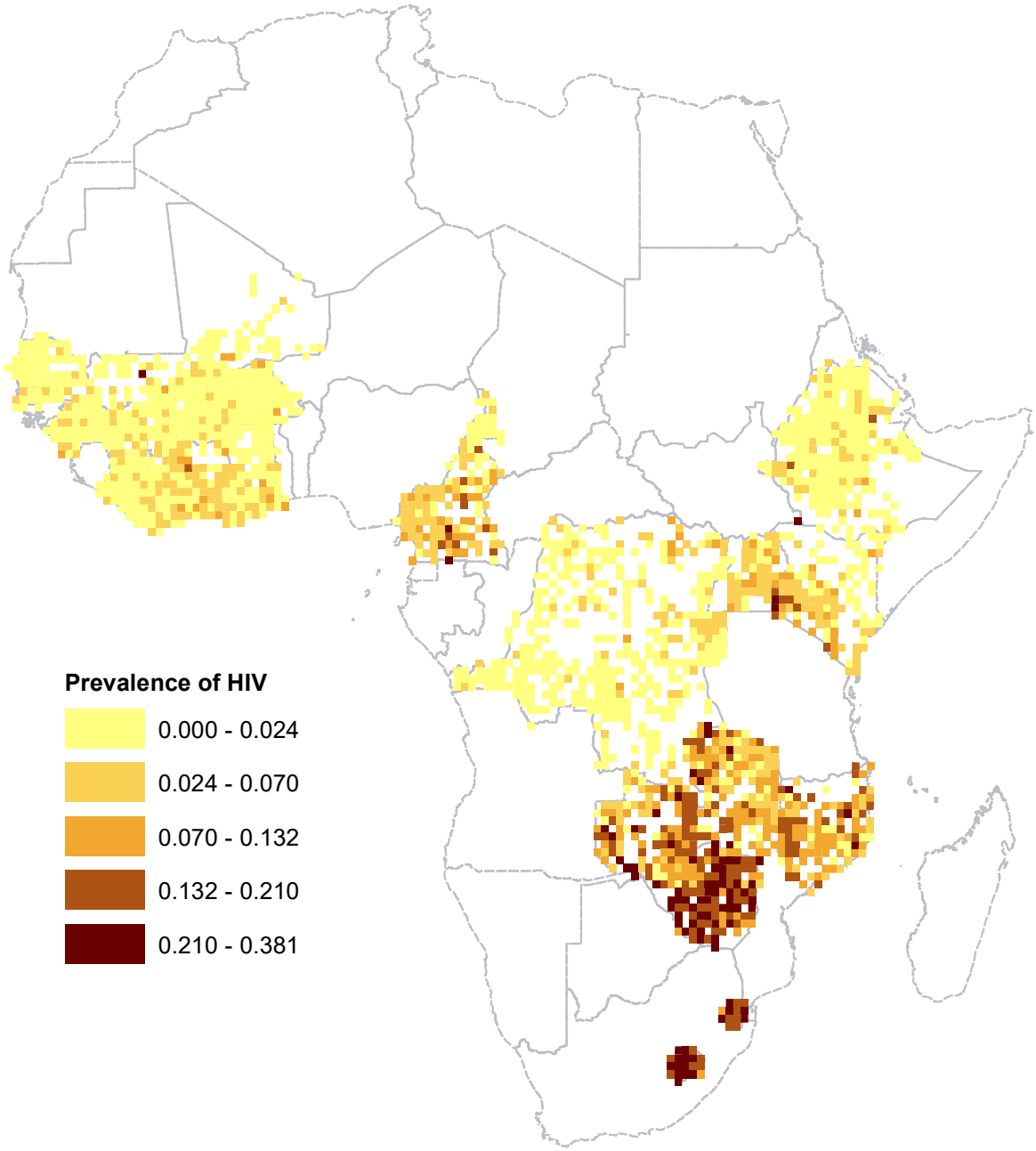
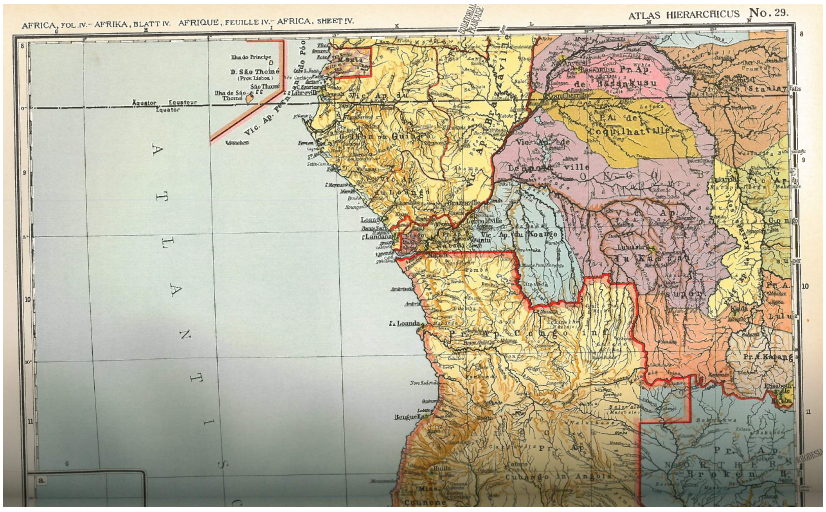


Figure 1: HIV prevalence estimates at the subnational level

Notes: The figure shows the average prevalence rates from DHS clusters, estimated by the authors using available biomarker data from 2003 to 2013. The figure hows the average estimated prevalence from all the DHS cluster in a 50x50 km grid.



(a) Plate representing the Catholic missionary stations in 1929 (Vatican's Atlas Hierarchicus)

(b) Plate representing the Protestant missionary stations in 1903 (Geography Atlas of Protestant missions)

Notes: The figure reproduces a plate locating Catholic missionary stations (upper figure) and a plate locating Protestant missionary stations (bottom figure).

Figure 2: Plates representing all (Catholic and Protestant) missionary stations

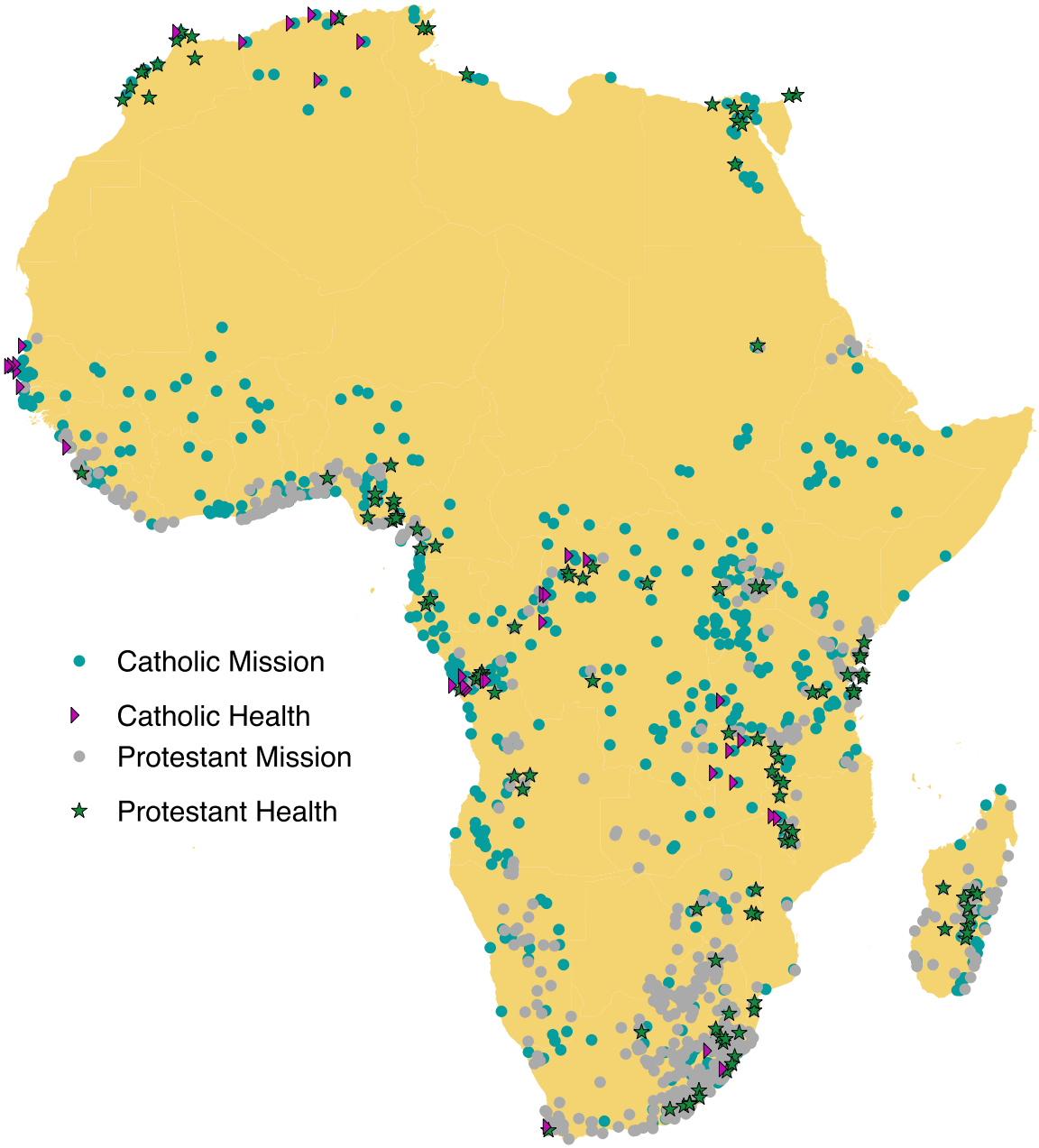


Figure 3: Catholic and Protestant mission stations with and without health investments

Notes: This map is a digitized and geocoded version of two geography atlas. For Protestant missions, we used digitized and geocoded plates 14 to 18 of Dennis, Beach, and Fahs (1903), from Cagé and Rueda (2016). Health investments include dispensaries and hospitals. For Catholic missions, the map is a digitized and geocoded version of the 1929 *Atlas Hierarchicus*. The geocoding was conducted by the authors. Health investments include hospitals.

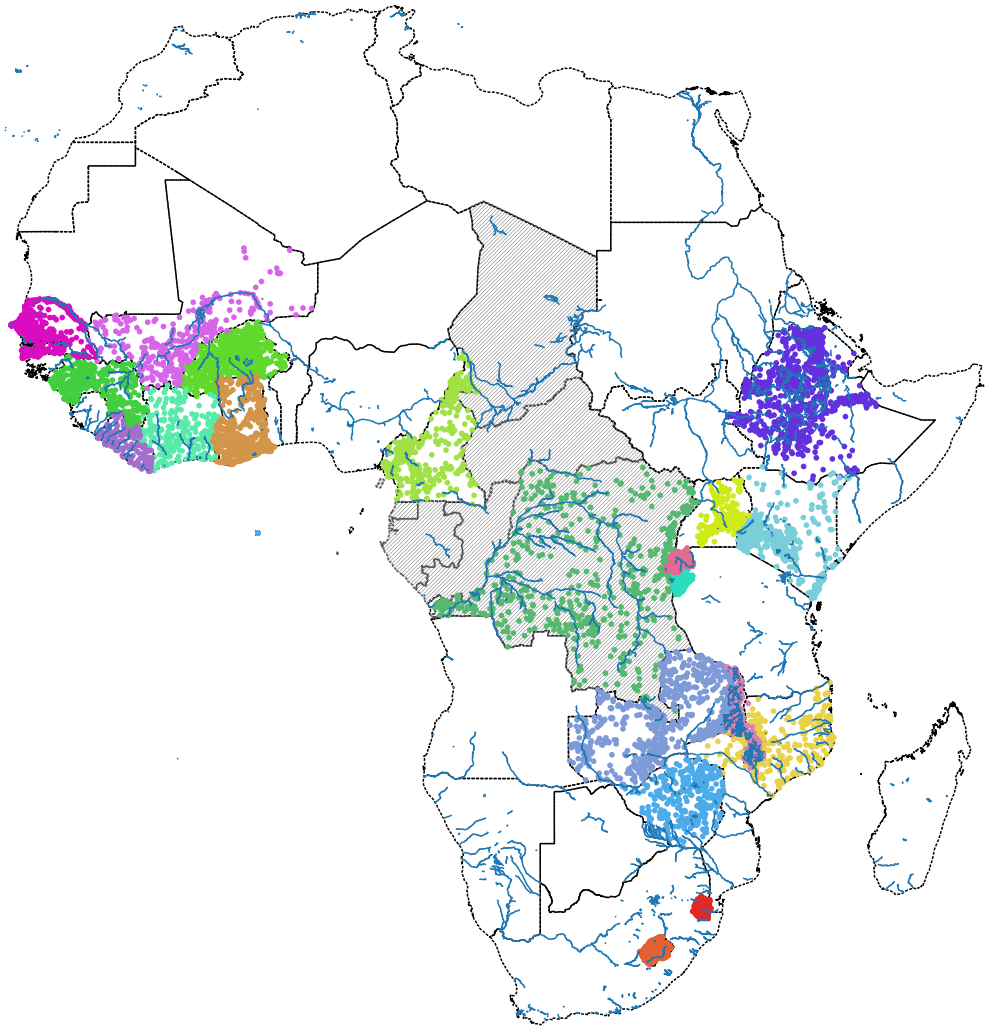


Figure 4: DHS locations

Notes: The figure shows the location of DHS clusters in sub-Saharan Africa that report both HIV biomarker data and GPS information. Each color represents a different country. The countries shaded in grey are countries are Central Africa countries: Cameroon, Chad, Rwanda, Burundi, Congo, the Democratic Republic of Congo, Gabon, the Central African Republic, and Equatorial Guinea.

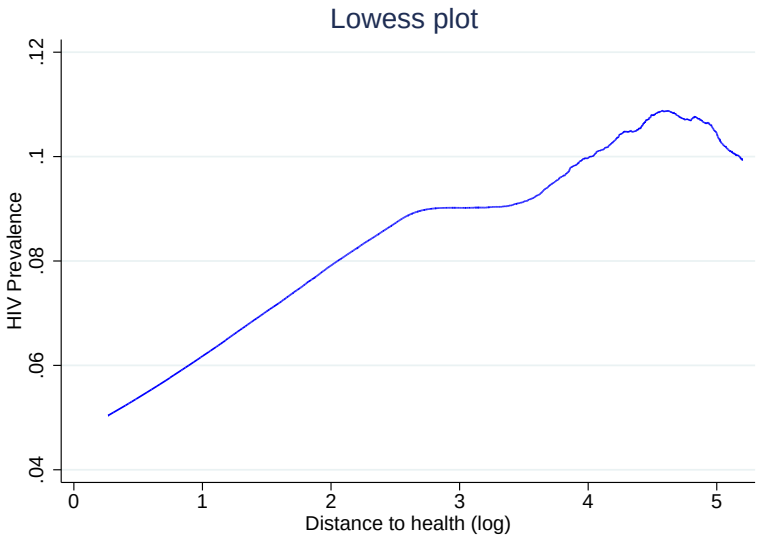
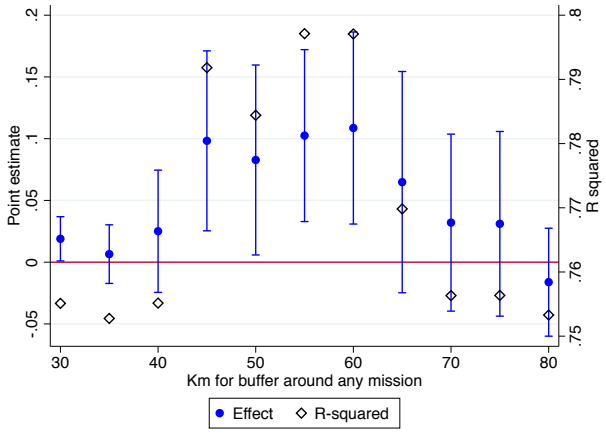


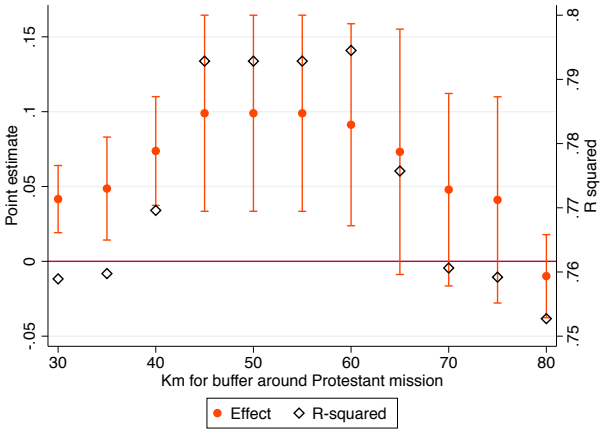
Figure 5: Effect of Distance to a health Investment on HIV Prevalence. Locally Weighted Scatterplot Smoothing

Figure 6: HIV prevalence in urban areas close and far from missions

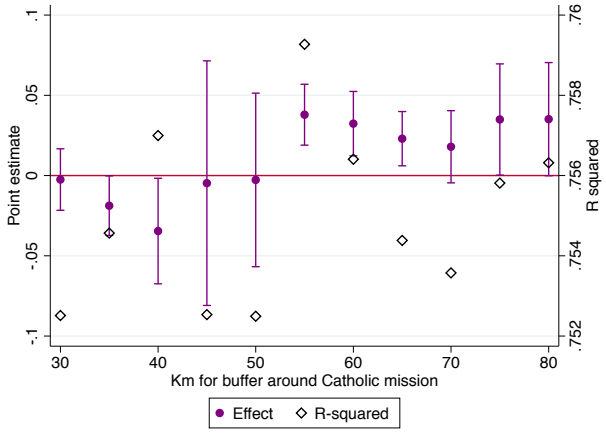
(a) Any Mission



(b) Protestant missions



(c) Catholic missions



Notes: The figure shows the difference in average HIV prevalence between regions inside and outside a buffer around missions. The x-axis represents the size of the buffer in km. The left y-axis reports the estimated coefficients, and the right y-axis the R-square of the estimations. The sample is restricted to urban areas close to the coast (≤150 km), that have a road density network above the country's 75th percentile and that are located close to the coast. It includes a total of 126 areas. The vertical bars represent 95% confidence intervals.

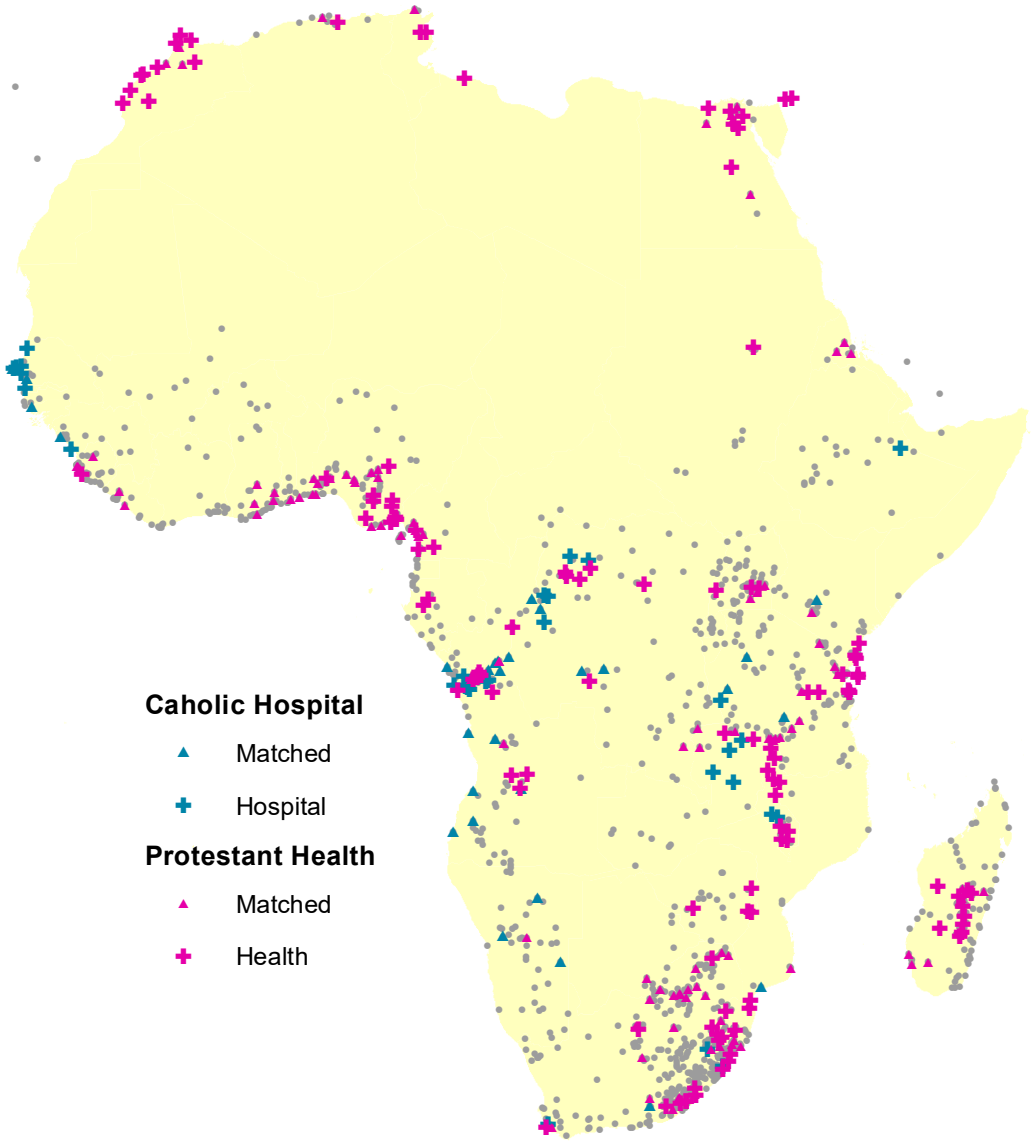
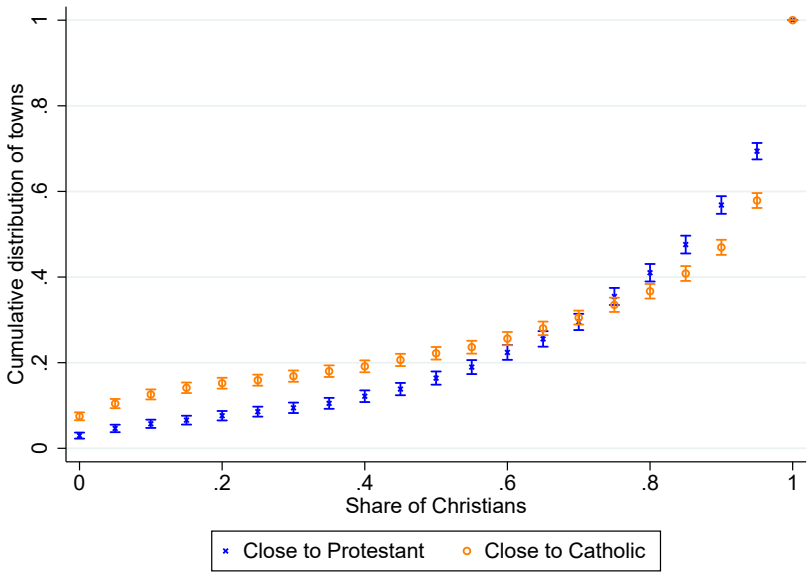


Figure 7: Map of treated and matched missions

Figure 8: Distribution of the share of Christians, depending on the proximity to Protestant or Catholic missions



Notes: The Figure plots the cumulative distribution functions of the share of Christians in towns close to Catholic (orange diamond) or Protestant missions (blue ×). Proximity is defined here using a 30 km threshold. Similar graphs are obtained when using alternative cutoffs for proximity and are available in the online Appendix Figure B.3).

Table 1: Determinants of the location of the health investments (comparing missions with and without a health investment)

	(1) No Hospital	(2) Hospital	(3) Diff
Panel A: Protestant			
Number of growing days (%)	53.541	52.896	0.645
			(2.613)
Mean temperature	18.247	16.056	2.191*
			(1.170)
Average precipitation per day (over year)	3.484	2.891	0.593
			(0.625)
Distance to 2000 city (100km)	2.695	2.563	0.132
			(0.197)
Distance to the coast (100km)	2.252	2.239	0.014
			(0.280)
Elevation	760.469	507.614	252.855***
			(60.775)
Ruggedness	92.727	69.410	23.317**
			(10.029)
Malaria ecology	5.132	7.802	-2.670**
			(0.810)
Railway contact	0.246	0.177	0.069
			(0.043)
Distance to explorer route (100 km)	0.136	0.212	-0.076**
			(0.036)
Precolonial population	11.060	22.101	-11.041**
			(4.369)
Distance to 1400 city (100km)	8.995	6.235	2.760***
			(0.486)
Distance to 1800 city (100km)	15.923	10.348	5.575***
			(0.989)
Tse-tse fly index	-0.716	0.010	-0.726***
			(0.160)
Observations	610	113	723
Panel B: Catholic			
Number of growing days (%)	61.752	56.812	4.940
			(4.488)
Mean temperature	22.465	21.936	0.529
			(1.071)
Average precipitation per day (over year)	12.781	10.845	1.936
			(1.165)
Distance to 2000 city (100 km)	1.865	1.381	0.484*
			(0.259)
Distance to the coast (100 km)	4.306	3.890	0.416
			(0.820)
Elevation	735.735	512.416	223.318*
			(116.291)
Ruggedness	92.665	57.506	35.159
			(21.710)
Malaria ecology	9.658	9.396	0.261
			(1.725)
Railway contact	0.699	0.833	-0.134
			(0.085)
Distance to explorer route (100 km)	0.281	0.106	0.175**
			(0.064)
Precolonial population	13.278	55.808	-42.530***
			(11.171)
Distance to 1400 city (100km)	8.365	5.954	2.411**
			(0.859)
Distance to 1800 city (100km)	10.382	14.256	-3.874**
			(1.564)
Tse-tse fly index	0.074	0.277	-0.203
			(0.229)
Observations	512	30	542

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table compares the characteristics of the places where missions with and without a health investment did locate. Panel A presents the results for Protestant missions, and Panel B for Catholic missions. In both panels, column (1) presents the results for missions without a hospital. Column (2) presents the results for missions with a hospital. In column (3), we perform a t-test on the equality of means (robust standard errors are in parentheses). Variables are described in the online Appendix.

Table 2: Missionary Investments and HIV Prevalence: Baseline Specification

	(1) b/se	(2) b/se	(3) b/se	(4) b/se	(5) b/se	(6) b/se
Distance to any mission	-0.005***			-0.007***		
	(0.002)			(0.002)		
Distance to any health				0.006**		
				(0.002)		
Distance to Protestant		-0.009**			-0.012***	
		(0.004)			(0.004)	
Distance to Protestant health					0.008**	
					(0.004)	
Distance to Catholic			0.005**			0.003
			(0.002)			(0.002)
Distance to Catholic Health						0.008***
						(0.003)
Observations	9,876	4,983	8,644	9,876	4,983	8,644
Country and Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
Historical and Geo Controls	Yes	Yes	Yes	Yes	Yes	Yes
Contemporary controls	Yes	Yes	Yes	Yes	Yes	Yes
Mission Clusters	434	200	265	434	200	265
R-sq	0.46	0.42	0.47	0.46	0.42	0.47
Mean DepVar	0.07	0.11	0.07	0.07	0.11	0.07
Sd DepVar	0.11	0.13	0.11	0.11	0.13	0.11

Notes: * p<0.10, ** p<0.05, *** p<0.01. The Table reports OLS estimates. The unit of observation is the town. The dependent variable is the average prevalence rate of HIV in town. Standard errors in parentheses are clustered at the closest mission level. All regressions restrict the analysis to regions at least 100 km close to missions. Controls are described in the text.

Table 3: Missionary Investments and HIV Prevalence: Central and Non-Central Africa

	Central Africa			Not Central Africa		
	(1)	(2)	(3)	(4)	(5)	(6)
	b/se	b/se	b/se	b/se	b/se	b/se
Distance to any mission	-0.001			-0.009***		
	(0.002)			(0.003)		
Distance to any health	0.001			0.007**		
	(0.002)			(0.003)		
Distance to Protestant		-0.004			-0.013**	
		(0.003)			(0.005)	
Distance to Protestant health		0.003			0.008*	
		(0.002)			(0.005)	
Distance to Catholic			0.000			0.004
			(0.002)			(0.002)
Distance to Catholic Health			0.001			0.010**
			(0.003)			(0.004)
Observations	1,756	416	1,696	8,120	4,567	6,948
Country and Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
Historical and Geo Controls	Yes	Yes	Yes	Yes	Yes	Yes
Contemporary controls	Yes	Yes	Yes	Yes	Yes	Yes
Mission Clusters	132	45	97	312	158	177
R-sq	0.13	0.25	0.13	0.45	0.40	0.47
Mean DepVar	0.03	0.03	0.03	0.08	0.12	0.08
Sd DepVar	0.05	0.04	0.05	0.12	0.13	0.11

Notes: * p<0.10, ** p<0.05, *** p<0.01. The Table reports OLS estimates. The unit of observation is the town. The dependent variable is the average prevalence rate of HIV in town. Standard errors in parentheses are clustered at the closest mission level. Controls are described in the text. All regressions restrict the analysis to regions at least 100 km close to missions.

Table 4: Missionary Investments and HIV Prevalence: Matching

	All towns		Not Central Africa	
	b/se	b/se	b/se	b/se
Distance to Protestant health or similiar	-0.002		-0.004	
	(0.003)		(0.003)	
Treat Protestant health	-0.031*		-0.043**	
	(0.018)		(0.020)	
Protestant interaction	0.006		0.008	
	(0.005)		(0.005)	
Distance to Catholic health or similiar		-0.001		0.000
		(0.003)		(0.004)
Treat Catholic health		-0.047***		-0.042**
		(0.017)		(0.019)
Catholic interaction		0.008**		0.006
		(0.004)		(0.004)
Observations	4,766	8,324	4,358	6,699
Country and Wave FE	Yes	Yes	Yes	Yes
Historical and Geo Controls	Yes	Yes	Yes	Yes
Contemporary controls	Yes	Yes	Yes	Yes
Mission Clusters	199	264	157	177
R-sq	0.44	0.49	0.42	0.49

Notes: * p<0.10, ** p<0.05, *** p<0.01. The Table reports OLS estimates. The unit of observation is the town. The dependent variable is the average prevalence rate of HIV in town. Standard errors in parentheses are clustered at the closest mission level. Controls are described in the text. All regressions restrict the analysis to regions at least 100 km close to missions.

Table 5: Missionary Investments and HIV Prevention, Only Predominantly Muslim Towns

	50%			75%		
	(1)	(2)	(3)	(4)	(5)	(6)
	b/se	b/se	b/se	b/se	b/se	b/se
Distance to any mission	-0.005*			-0.005		
	(0.003)			(0.003)		
Distance to any health	0.005**			0.007**		
	(0.003)			(0.003)		
Distance to Protestant		-0.008			-0.008	
		(0.006)			(0.007)	
Distance to Protestant health		0.011			0.029**	
		(0.009)			(0.013)	
Distance to Catholic			-0.001			-0.002
			(0.002)			(0.002)
Distance to Catholic Health			0.004*			0.004
			(0.002)			(0.003)
Observations	2,448	1,007	2,291	2,034	879	1,914
Country and Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
Historical and Geo Controls	Yes	Yes	Yes	Yes	Yes	Yes
Contemporary controls	Yes	Yes	Yes	Yes	Yes	Yes
Mission Clusters	188	74	141	140	56	105
R-sq	0.57	0.49	0.59	0.58	0.50	0.60
Mean DepVar	0.05	0.12	0.05	0.06	0.12	0.06
Sd DepVar	0.11	0.15	0.11	0.12	0.16	0.12

Notes: * p<0.10, ** p<0.05, *** p<0.01. The Table reports OLS estimates. The unit of observation is the town. The dependent variable is the average prevalence rate of HIV in town. Standard errors in parentheses are clustered at the closest mission level. Controls are described in the text. All regressions restrict the analysis to regions at least 100 km close to missions, and to towns whose share of Muslim population is at least 50% (columns (1) to (3)) or at least 75% (columns (4) to (6)).

Table 6: Missionary Investments and HIV Prevention, Family Values

	Abstinence before marriage		Age at marriage		Sex partners per year	
	men	women	men	women	men	women
Distance to any mission	0.015***	0.024***	-0.243***	-0.301***	-0.018*	-0.009**
	(0.004)	(0.004)	(0.056)	(0.043)	(0.009)	(0.004)
Distance to any health	-0.022***	-0.020***	0.182***	0.106	0.008	0.002
	(0.004)	(0.005)	(0.059)	(0.064)	(0.011)	(0.004)
Observations	9866	9876	9633	9856	6635	6650
Mission Clusters	434	434	432	433	430	430
R2	0.40	0.65	0.24	0.44	0.28	0.22
Mean DepVar	0.19	0.44	24.08	18.63	0.63	0.33
Sd DepVar	0.20	0.23	3.26	2.20	0.46	0.18
Distance to Protestant	0.020***	0.028***	-0.359***	-0.272***	-0.021*	-0.004
	(0.005)	(0.007)	(0.091)	(0.060)	(0.012)	(0.005)
Distance to Protestant health	-0.013***	-0.020**	0.214**	0.113	0.018	-0.002
	(0.005)	(0.008)	(0.104)	(0.113)	(0.017)	(0.007)
Observations	4974	4983	4811	4969	3471	3487
Mission Clusters	200	200	200	200	197	197
R2	0.22	0.59	0.25	0.41	0.22	0.27
Mean DepVar	0.13	0.36	23.93	18.66	0.71	0.34
Sd DepVar	0.16	0.21	3.39	2.29	0.48	0.16
Distance to Catholic	0.005	0.010**	-0.141**	-0.263***	-0.007	-0.009*
	(0.004)	(0.005)	(0.059)	(0.051)	(0.010)	(0.005)
Distance to Catholic Health	-0.029***	-0.021***	0.143**	0.058	0.003	0.006
	(0.006)	(0.007)	(0.064)	(0.053)	(0.011)	(0.005)
Observations	8635	8644	8427	8629	5716	5724
Mission Clusters	265	265	265	265	263	263
R2	0.42	0.64	0.23	0.43	0.29	0.22
Mean DepVar	0.20	0.45	24.14	18.62	0.62	0.33
Sd DepVar	0.20	0.23	3.23	2.13	0.45	0.19
All regressions controls for historical and geo characteristics, contemporary controls and country and wave FE						

Notes: * p<0.10, ** p<0.05, *** p<0.01. The Table reports OLS estimates. The unit of observation is the town. The dependent variables are, respectively, the share of individuals who are abstinent before marriage, the average age at marriage, and the average number of sex partners per year since sexually active. Standard errors in parentheses are clustered at the closest mission level. Controls are described in the text. All regressions restrict the analysis to regions at least 100 km close to missions

Table 7: Missionary Investments and HIV Prevention, Sexual Behaviors

	Sex worker services		Household age gap	Condoms-beliefs	Condoms-where
	men - lifetime	men - year	all	all	women
Distance to any mission	-0.005	-0.001	-0.181***	-0.014***	0.021***
	(0.004)	(0.002)	(0.064)	(0.003)	(0.006)
Distance to any health	0.025***	0.005***	0.011	0.015***	-0.011*
	(0.004)	(0.002)	(0.059)	(0.005)	(0.006)
Observations	6697	6519	9876	9876	9876
Clusters	366	423	434	434	434
R2	0.290	0.173	0.541	0.386	0.539
Distance to Protestant	-0.006	-0.002	-0.120	-0.013***	0.026***
	(0.007)	(0.003)	(0.075)	(0.004)	(0.008)
Distance to Protestant health	0.018**	0.007*	0.149**	0.010*	-0.006
	(0.009)	(0.004)	(0.075)	(0.006)	(0.008)
Observations	2741	3218	4983	4983	4983
Clusters	156	190	200	200	200
R2	0.222	0.131	0.440	0.338	0.519
Distance to Catholic	-0.006	0.001	-0.127*	-0.014***	0.020***
	(0.004)	(0.002)	(0.070)	(0.004)	(0.007)
Distance to Catholic Health	0.027***	0.005**	-0.188***	0.020***	-0.021***
	(0.005)	(0.002)	(0.061)	(0.005)	(0.008)
Observations	6088	5789	8644	8644	8644
Clusters	240	262	265	265	265
R2	0.289	0.159	0.565	0.394	0.524
All regressions control for historic and geo characteristics and for country and wave FE					

Notes: * p<0.10, ** p<0.05, *** p<0.01. The unit of observation is the town. The dependent variables are, respectively, the share of men who use the services of sex workers in their lifetime, in the year of the survey, the average age gap in households, the share of individuals who report that condoms efficiently protect against HIV, and the share of women who know where to find condoms. Standard errors in parentheses are clustered at the closest mission level. Controls are described in the text. All regressions restrict the analysis to regions at least 100 km close to missions