Missionary influence on the health status of African populations

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VERY PRELIMINARY AND INCOMPLETE

Abstract

Using information concerning the locations of missions during Africa's colonial period, I study the effect of European missionary activity on current healthcare outcomes. I find that exposure of African ethnic groups to missionary movement has a positive long-term impact on health status of individuals. In addition, I show that (a) the effect of exposure to missionary activity on health problems is stronger when the missions are near the ethnic group of the individual rather than the geographical location; (b) the effect withstands controls that proxy for current healthcare infrastructure; (c) the effect withstands controls that proxy for current public goods in the village of the individual; (d) the effect withstands controls for characteristics of the province which are associated with villages having a better infrastructure; and (e) the effect remains unchanged if we focus on the subsample of individuals who live in a place with no health clinic nearby. These findings raise doubts as to explanations which emphasize the persistence of missionary medical facilities over time. Moreover, they point out a mechanism by which societies' cultural and social perception of healthcare was affected by such missions. This appreciation was transmitted from generation to generation.

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1 Introduction

A recent literature has studied the link between European missionaries and current economic development in Africa. Most of the research has emphasized the consequences for education. In particular, there is extensive evidence that being exposed to Christian missionaries in the past increases present generations' results in terms of education (Gallego and Woodberry 2010, Nunn, Akyeampong, Bates, and Robinson 2011, Woodberry 2004; 2011, Wietzke 2012). Yet surprisingly, little has been done to analyze the role of Christian missionaries in shaping current health outcomes in Africa. In view of the significant historical role of missions and the relevance of healthcare problems in present Africa, it is remarkable that there have been no systematic studies on the impact of missionary activities on the health of African population. In this paper, I use information regarding the place where missions occurred during Africa's colonial period to identify the long-term impact of exposure to missionary activity on the health status of present generations.

I begin my empirical analysis by establishing a novel fact about the long-term effects of missionary activity. Using a comprehensive database of African people and a variable that captures the number of Christian missions that were near the individual's ethnic group, I find that individuals having ancestors from ethnic groups which were closer to missions during the colonial period have less health problems in the present.[1] This fact is consistent with historical records that account for the fact that the introduction of Western medicine and practices in colonial Africa was, at first, nearly everywhere undertaken by Christian missionary societies.

Nevertheless, why does an individual from an ethnic group who was exposed to missions in the past suffer from less health problems in the present? We can distinguish three (not mutually exclusive) channels through which the long-term impact might operate. First, the interest of missionary societies in providing healthcare lead them to build medical facilities such as dispensaries and hospitals. As this type of infrastructure is persistent overtime, individuals located near mission stations may have better and easier access to medical facilities in the present, which eventually let them enjoy a better health status. Second, being exposed to missionary activity may have changed ancestors' social and cultural perception of healthcare. So this change in ancestors' perception could have been transmitted from generation to generation. Third, the effect could be explained by changes in health status of the ancestors, inherited by the following generations. For example, if medical missions reduced the probability of having some diseases which are genetically transmitted, it is natural to

[1] I thank Nathan Nunn for making available the variable that to capture total missions.

observe better health status in current generations.

In order to explore these channels, I derive empirical implications from the different mechanisms. First, to differentiate between genetic and cultural/social transmission channels, I show that exposure to missionary activity not only reduces physical health problems, but also mental disorders. These disorders are are less likely to be altered by genetic intergenerational transmission, but could be triggered -or not- depending on different cultural and social habits of the individuals (AmericanPsychiatricAssociation (2013), Kirmayer et al. (2001), Castillo (1997), Phelan (2002)). Second, the infrastructure channel carries very different implications with respect to the cultural transmission channel. While the infrastructure-based explanation encloses the proximity of the missions in the current location of the individual, the other channel depend on the proximity of missions to the ethnic group of the individual. In addition, if transmission of changes in health perceptions are driving the results, the long-term impact of missions on health problems should withstand different proxies for infrastructure and public goods in the present. Consistent with the cultural tranmission channel, my empirical results show that: (a) the long term impact of exposure to missionary activity on health problems is stronger when the number of missions are assigned at the ethnic level rather than at the geographical location of the individual level; (b) the effect withstands controls that proxy for health infrastructure; (c) the effect withstands controls that proxy for the presence of other public goods in the village of the individual (i.e: public schools); (d) the effect withstands controls for characteristics of the province that are associated with better infrastructure (i.e: % of population with access to electricity); (e) the effect prevails if we focus in the sub-sample that does not have a health clinic nearby. Taken together, these results suggest that Christian missionaries changed people's perception about healthcare in the past. This new perception is transmitted from generation to generation, improving health status of descendants of individuals who were more exposed.

This paper contributes to a growing literature that studies how European missions shaped current development outcomes in Africa. Nunn (2010) finds that descendants of ethnic groups that were more exposed to missionary contact are today more likely to self-identify as Christian. An extensive literature focused on the effects on education Woodberry (2004; 2011), Gallego and Woodberry (2010), Nunn, Akyeampong, Bates, and Robinson (2011) show that christian missions have a positive long term impact on education outcomes in the present. Woodberry (2004) documents that Protestant missionaries were much more active in schooling than Catholic missionaries when country regulations benefited the Catholic Church. Similarly, using regional data for African provinces, Gallego and Woodberry (2010)

find that Protestant missionary activity in the past is more correlated with schooling than similar measures of Catholic missionary activity. However, he finds that the effect is driven by areas in which catholic missionaries were protected from competition in the past. Nunn, Akyeampong, Bates, and Robinson (2011)) shows that individuals whose ancestors were more exposed to missionary activity have higher educational level in the present. He also finds that the long term impact of protestant missions is higher. In addition, he shows that protestant missions positively affected education levels of the women, whereas catholic missions did not. Much less has be done to understand the historical legacy on health care. Berger (2009) focus on the effects of the colonial government and, using a taxation natural experiment for Nigeria, finds that those places where the British built local tax collection bureaucracies a century ago, have current local governments which have better delivery of public goods such as vaccinations than those places where the British were less active. For the case of India, Calvi, Mantovanelli, et al. (2016) show that geographical proximity to a Protestant medical mission has a positive effect on the body mass index of individuals in the present.

My paper contributes to the aforesaid literature by exploring this new dimension of the long-term impact of missionary activity in Africa. Singularly, this paper is the first one to address how missionary activity shaped current health outcomes of African's individuals. I also highlight that it is not the geographical proximity to an historical mission station what affected current health outcomes, but proximity of the ancestor of the individual, regardless of where the individual lives today.

My findings bear important policy implications. In order to seriously understand the impact of different policies on health care, it is crucial to understand how they can shape health care institutions in the long run. Variation in missionary activity in colonial Africa provides the opportunity to examine how an intervention can have lasting impacts on the long-run healthcare of the populations. On this ground, my findings spotlight that policies oriented to change people's beliefs and perceptions of healthcare relevance can affect not only present population health status, but also future generations through cultural and social transmission.

The remainder of the paper is organized as follows. In Section 2, I present the historical background and analyze case studies that accounts for the interest of missionaries in providing health care to the population. In section 3, I present the data. In section 4, I establish the main fact of the paper. In section 5, I analyze the mechanisms that are behind my results. I conclude in Section 6.

2 Historical background

In most African countries, Western medicine and public health were firstly introduced by Christian missionary societies. Theal (1896) recorded the existence of a missionary medical facility in Mozambique as early as in 1518. In the early twentieth century, Africa witnessed an explosion of missionary activity. For this reason, the provision of education and healthcare became soon the main reward used by missionaries to convert African's natives (Hailey (1957), Good (1991)). During that period, the mission settlements influenced spiritual transformation of natives to an extent which was never before experienced. With the increase of adherents, medical services grew necessary for the conversion of natives to Christianity. According to Bliss, Dwight, and Tupper (1904), before 1849 there were approximately forty medical missionaries at work in the whole world. It was not until the end of the nineteenth century and later that medical staff began to arrive in Africa as regular members of missions (Hailey (1957)).[2] In particular, medical services were used as a channel to attract people to medical treatment and relief their physical suffering, while the priest was still in charge of "cleaning their soul". The idea was to provide Africans with a more tangible service. MD. Harold Paul Adolph, who has served as Chief of Surgery since 1965 at various mission hospitals in Tanzania, Ethiopia, Liberia and Niger, in an interview for the Archives of the Billy Graham Center, displays a perfect picture about the missionaries' view as to the link between providing healthcare and gaining people's trust:

"*I think a doctor's avocation is his medicine, but his real calling is still to win people for Christ. And by being a physician in the setup that I was in, I was attracting people from all over the country to come and hear the Gospel. I think when the love of Christ can be demonstrated by accomplishing a fulfillment of a tangible recognized need, you get farther than if you tell a person you need something when they haven't recognized that they need that. So they're coming to us with their recognized need; we are taking care of that and pointing out other needs.*"

The interest of the missionaries in providing healthcare, in turn, made them be the first ones to establish medical science and the first healthcare institutions in Africa. As pointed out by Ross (1955), Christian missions have been almost everywhere the introducer of western med-

[2]In fact, there is evidence that most missionaries received an elementary medical training much before that. For instance, Brookes (1925) in his book about his fifty years of work in Swiss missions in Africa (1875-1925) describes that "from the earliest days, the Swiss missionaries received at least an elementary medical training, but it was not until 1891 that the first professional Doctor arrived in their field", p. 12

ical, surgical, and public health methods, and the pioneer trainer of Africans in these skills. There is evidence about the Christian influence on the introduction of Western healthcare to almost every African country. In numerous territories, missionary hospitals and dispensaries were in place several decades before colonial governments considered African healthcare. One of the first promoters of initiating medical work as a branch of missionary activity was David Livingstone, who obtained a medical education before he sailed to Cape Town in 1840. In his diaries, he argued about the importance of teaching healthcare best practices in mission stations, detailed the common disease among the tribes he visited, and sent reports to London about case studies and remedies administered for malaria (Livingstone (1857)). Years after, the Edinburgh Medical Society, an institution in charge of training medical students for missionary work, was founded. Similarly, the Lovedale Missionary Institution in Cape Province, South Africa, was established in 1841. The objective of this organization was the treatment of diseases, instructing African nurses, training hospital attendants, and improving healthcare practices among natives (Hailey (1957)). Modern medical missions in East Africa began with the introduction of a lay doctor at Zansibar, Tanzania, in 1863, where a missionary hospital was opened in 1887. Dating from years later, there are records of many missionaries of the United Free Church and of the Established Church of Scotland stating that there should be, at least, one medical officer in each station in Africa. Hailey (1957) describes that one of the main goals of this medical officers was "training Africans for medical work among their own people." Similarly, in 1896 the Universities' Mission to Central Africa organized medical service among Africans in Nyasaland and began training Africans for almost every station (Anderson-Morshead and Yonge (1897)). Although Hailey (1957) details that Roman Catholic missions employed less doctors and more religion members who took courses in medical work for said purpose, there is evidence they had also done efforts in providing healthcare. For instance, the White Fathers missionaries received medical training before going to the stations from as early as 1878. Their work started in Great Lakes, but then it was extended to mission stations in Belgian Congo, Northern Rhodesia, and Tanganyika (Buell (1928)). By 1910, they reported to have one hundred and twenty stations throughout Africa and two hundred and eighty-nine hospitals, dispensaries, orphanages, asylums, and related facilities in which they claimed to have treated more than one million sick people during the year (Bouniol (1929)). Other examples are the Franciscans, who established hospitals and dispensaries in Uganda and Belgian Congo, the Fathers of the Holy Ghost in West Africa, the Jesuits in Rhodesia, and the Benedicts in Central and East Africa, who dealt with providing healthcare and establishing medical institutions in

their stations. As an illustration of how missionaries encouraged better healthcare practices, in 1930 a Papal Encyclical recommended the training of nuns in midwifery and child welfare (Hailey (1957)).

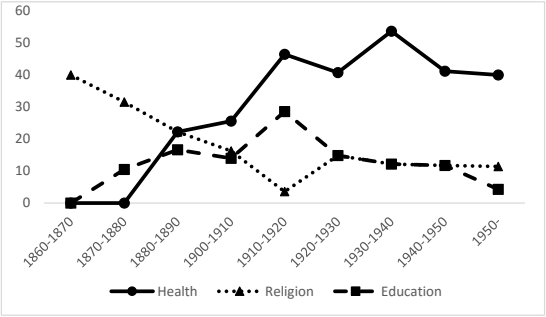
The development of medical actions by missionary activities has been extremely important for rural areas of Africa. As late as 1945, most of Africa government's hospitals and dispensaries were still situated mainly in urban sites, serving only a fraction of the total population. In many rural communities, healthcare was provided by medical missionaries alone (Medcalf, Bhattacharya, Momen, Saavedra, and Jones (2015), Addae et al. (1996)).[3] The focus of missions on rural areas was due, in large part, to the inadequacy of state provision in such places. Swiss missionary stations constitute a good example of the above-mentioned statement. They erected hospital and medical facilities in rural areas of the Gold Coast (present day Ghana), Transvaal (present day South Africa) and Tanganyika (present day Tanzania) in times when Colonial administrations were only considering health provision in urban areas. For instance, in South Africa the Public Health Act of 1889 provided the bases for government healthcare provision, but the legislation was exclusive for urban regions, segregated, and almost non-accessible to rural natives. However, medical help in countryside places such as Elim and Valdezia was provided exclusively at the Swiss Mission stations founded in 1879. Even more, in 1899 the Swiss Mission established the first hospital at Elim. [4] Actually, Elim Hospital became the point of departure for a Swiss mission healthcare system while some of the missionary health facilities, which were built later by the Swiss, eventually became hospitals. By half of nineteenth century, the Swiss missionaries in South Africa had nine health institutions in rural areas, including the three hospitals of Elim, Masana, and Shiluvane. In fact, in South Africa, government healthcare facilities were still concentrated in urban areas until 1975, while missionary medical activities were the only ones filling the gap in rural areas (Harries et al. 2015). In figure 1, I show new personnel who arrived to Swiss missions stations located in South Africa according to their profession. We can observe that from 1890 the share of new personnel with medical professions coming in rural mission stations increased remarkably. [5]

[3]Health care provision by colonial administrations was specially oriented to cover the needs of those belong to the elite groups, military men, civil servants, who worked for the government and European officials.

[4]Elim Hospital remained the only rural hospital that provided healthcare to all people regardless of class, race , and religion for fifty years.

[5]I construct this variable using data from a compilation of chronology of mission stations in South Africa by Adolphe Linder (2011). Health category includes doctors and nurses. Education includes teachers. Religion includes priest and evangelist. The reminder are wives or other categories.

Figure 1: % of new personnel of swiss missions in South Africa by occupation



The pattern of Christian missionaries having the monopoly of healthcare provision in rural areas can be observed across most African countries. The regular medical care of rural communities in Southern Rhodesia (present day Zimbabwe) was exclusively in the hands of missionaries until after 1940. In particular, government healthcare policy in the early nineteenth century was elitist and oriented to urban areas.[6] For the case of Malawi, Mkandawire (2009) argues that missionaries made a point of ensuring that hospitals and other health facilities were built in rural areas.[7] Regarding the Scottish Mission's work in South Africa, Hinchliff (1968) explains that "Hospitals were eventually added to the activities of the institution and became the first place in the country at which Africans could be fully trained as nurses." The same is true for Nigeria, where Christian missions pioneered medical provision in some rural regions when both the Colonial Government and Native Authorities had no adequate medical services and institutions. The British colonial government provided medical services in the 1870s only for Europeans and in coastal trading centers (Ityavyar (1987)). Besides, throughout the colonial period, the religious missions played a major role in the supply of modern healthcare facilities in Nigeria. The first foothold was at Badagry, a coastal rural town in the state of Lagos. Years later, in 1886, the first true missionary hospital in the country was founded in Abeokuta (Schräm et al. (1971)). A similarly story can be compiled from Kenya where the first rural hospital, Theodora Hospital, opened at Ki-

[6]The British imperial directive established that healthcare goals were preserving the health of the Europeans, preventing the spread of epidemics, and keeping the labor force in reasonable conditions (Doyal and Pennell (1979))

[7]"*Mission hospitals provided all the medical services in their institutions until up to the forties when the Government was requested to play a role. Although mission hospitals were in general still rudimentary, nonetheless they were the fore runners of health providers in the country.*",Mkandawire (2009), 63

jabe mission station.[8] We can find similar evidence related to the foundations of healthcare systems in other countries of Africa.[9]

Up to this point it should be clear that missionaries were influential to shape healthcare systems in many regions of Africa and it is plausible that they could affect healthcare outcomes in the present. Yet, the decision of missionaries about where to locate the stations may be correlated with characteristics of the region that are not orthogonal to current healthcare outcomes. Hence, a significant issue for the validity of my empirical research is controlling for characteristics that may have affected these decisions. Extensive literature has recognized five main factors which were considered by missionaries when they decided the location of the mission stations: access to a clean water supply, a high altitude, the ability to establish an external trade route with Europe to import needed supplies, initial population density, distance to the sea, and path dependence (place previously explored) (Nunn (2010), Nunn, Akyeampong, Bates, and Robinson (2011), and (Johnson (1967))). In particular, access to water was crucial for the European missionaries; high altitude and temperate climate reduced the likelihood of disease. In addition, access to European supplies was necessary for the establishment, and they continued functioning in the mission stations. Finally, the routes taken by the first missionary explorers determined which areas of Africa became relatively more well-known to Europe, which may have affected the location of subsequent missions. In my estimations, I include country fixed effects as well as village, district and province historical variables that control for these characteristics.

[8]The hospital was later renamed to Kijabe Hospital

[9]See for instance Kopoka (2000) for the case of Tanzania, Baidoo (2009) and Addae et al. (1996) for more on the case of Ghana, among others.

3 Data

I combine three datasets to obtain current and historical information of the individual, his ethnicity and the area where the individual lives. Summary statistics are presented in table A.1 in the appendix. The Afrobarometer surveys (2005) is my core database. These surveys are nationally representative, have a total of 21,232 respondents and cover 17 sub-Saharan African countries: Benin, Botswana, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mali, Mozambique, Namibia, Nigeria, Senegal, South Africa, Tanzania, Uganda, Zambia, and Zimbabwe. From the surveys, I have a potential sample of 18,822 respondents.[10]. Among other variables, in this database I can identify the location of the individual, his ethnicity, his religion, income, living conditions, education, physical and mental health problems, political considerations, occupations, perceptions about health care, proximity to medical institution (i.e: having a hospital near), affordability of health-care, access to medical treatment, access to medicines, among other relevant indicators. Health care outcomes variables at the individual level are also available in this database. In my main specifications, I use four variables constructed from this database. i) physical health problem: How frequently, in the last month, the individual suffered a physical health problem that reduced the amount of work that he could do inside or outside his home; ii) mental health problem: How frequently, in the last month, the individual was so worried or anxious that he felt tired, worn out, or exhausted; iii) I construct an index from the previous two variables by standardizing them and taking simple average.[11]; iv) I construct an indicator variable that takes value one if the individual suffered at least one health problem and 0 otherwise.[12]

The second group of databases include historical information about contact with missionary activities. In particular, my main variables come from a dataset constructed by Nathan Nunn for a series of papers that analyze the long-term effects of missionary activities. [13]. In particular, as I am interested in studying the effect of exposure to missionary activity in the past on current health status, the key variable for my estimations is the number of missions per 1000 square kilometers on land historically inhabited by an ethnic group. This variable was constructed using information from a map published by William R. M. Roome (1924). As the variable is at the ethnic level, it can be matched with the main Afrobarometer

[10]The original sample has 21322 respondents but 2800 individuals does not provide information about some of my main covariates

[11]As a robustness check, I try other procedures for creating this index. Results are qualitatively unchanged.

[12]Results are robust to excluding individuals that reported only one health problem when constructing the indicator variable.

[13]For more information about the construction of the variables, see Nunn (2010)

database. The assumption is that if the ethnic group of the individual had more contact with missionary activity in the past, it is more likely that he has an ancestor that was exposed to missions.

Furthermore, I obtain historic characteristics of villages and districts which may have affected the missionaries' locations decision. I use information as to the historic locations of railway lines, previous explorer's routes, distance from the coast, data on soil suitability, measures of the fraction of land that was suitable for cultivation, measures of the fraction of land that was within ten kilometers of a water source, and initial population density of the ethnic group. I also control for variables that according to previous literature may be correlated with missionary activity, such as historical slaves exports and current trust.

Thirdly, I construct variables that measure barriers in access to healthcare in order to proxy infrastructure. Although I acknowledge that there is no universally accepted definition of access to health services, I use the definition by Peters et al. (2008): "the timely use of service according to need". I proceed by defining two proxies for accessibility to healthcare. First, I use a variable that captures how many times an individual encountered that health services were too expensive or unapproachable in order to proxy affordability. Second, I use a variable that indicates the frequency by which individuals or any familys member have gone without medicines, medical treatment during the last month. In addition, I also use proxies for waiting times and absence of doctors in the medical facilities.

Finally, I gather sub-national (province) level information from different sources. From The Robert S. Strauss Center for International Security and Law, I obtained literacy rates, % of population with electricity in a province, % of population that attends to primary education in a province, % of population that attends to secondary education in a province, % of population with improved access to clean water, % of population with improved access to sanitation, and % of population with access to radio or TV. From the World Bank sub-national database, I acquired population of the province and poverty level.

4 Empirical results

I begin my empirical analysis by establishing the main fact of this paper: exposure to missionary activity has long-term effects on health status. The basic model is given by,

$$Healthproblems_{i,e,v,d,c} = \beta * log(Missions)_e + \{X_{i,e,v,d,c}\} + \{X_e\} + \{X_v\} + \{X_d\} + \mu_c + \epsilon_{i,e,v,d,c} \quad (1)$$

where i indexes individuals, e ethnic groups, v villages, d districts and c country. For health problems, I use four different proxies: physical health problems, mental health problems, an index of health problems and an indicator variable that takes value 1 if the individual had at least one health problem in the year of the sample.[14] $log(Mission\ stations)_e$ is the natural logarithm of total missions per 1000km around where an ethnic group was located in the past. It measures the historic exposure of ethnic group e to Christian missions. Thus, the coefficient β accounts for the long-term impact of ethnic exposure to missionary activity on health problems of the individuals in the present.[15] To control for potential unobservable heterogeneity, I include a bunch of variables at the individual, ethnic, village and district level. In particular, $X_{i,e,v,d,c}$ is a vector of variables that controls characteristics of the individuals that may be correlated with health status and missionary activity. This variables intend to proxy economic status of the respondent, education, awareness of health issues, trust and other covariates that may be correlated with health problems and with exposure to missionary activity of the ethnic group.[16] In particular, I include variables such as age, gender, indicator dummies for five scales of living conditions, access to clean water, an indicator that takes value one if the individual has gone without food last year, an indicator variable that takes value 1 if the individual has gone without income the year, ten fixed effects for level of education, 25 fixed effects for present occupation of the individual, fixed effects for religion, different measures of trust in local council and trust in neighbors and an indicator for the individual living in an urban area.

[14] Results are robust to other specifications for the dependent variable and are available upon request. In particular, they remain qualitatively unchanged if we perform an ordered probit regression and if we construct the indicator variable after excluding individuals that experienced only one health problem.

[15] The continuous nature of this variable could be misleading my results. Therefore, in the appendix I try different non-lineal specifications for the variable that captures missionary exposure. In particular, I construct categorical variables by 2nd, 3rd and 5th quantiles of exposure to missionary activity. Results remain qualitatively unchanged under these alternative specifications and are presented in table A.3 of the appendix.

[16] For instance, missionary activity near the ethnic group historical location affected their education, as shown by Gallego and Woodberry (2010), and education may have positive effects on health status.

An important concern in my empirical strategy is that mission stations' location decision depend on unobservable factors that may also affect health status of individuals in the present. For instance, access to water was identified by the literature as a key determinant for mission locations and it may also be an important determinant of the health status. In order to address this issue, I control for historical characteristics of the villages (X_v), ethnic groups (X_e) and districts (X_d) that the literature has recognized to be the most important determinants for the location of mission stations. Specifically, vectors X_e and X_v include historic locations of railway lines and explorer routes, an indicator for contact by a European explorer prior to the colonial period, data on soil suitability, fraction of land that was within ten kilometers of a water source, ethnic group population density during the colonial period, an indicator for the presence of a city as at 1400, ethnic group malaria ecology measure, distance of the village from a coast, latitude, distance from Sahara, among others. In addition, I include district level covariates (X_d) such as ethnic group fractorization. Finally, in order to control for any characteristic of the country invariant across individuals such as historic colonial policies or size of the country, I include a vector of country fixed effects (μ_c).
When it comes to inference, since my variable of interest has variability at the ethnic level, I report standard errors clustered at that level in all subsequent regressions. [17]

Results for a series of models based on equation 1 are presented in table 1. Under the four specifications, we can observe our main fact: individuals from an ethnic group that was more exposed to missionary activity have less health problems in the present. Column 1 and Column 2 report that an increase in the individual exposure to missionary activity of 100% reduce physical health problems in 0.24 (equivalent to a 30% decrease with respect to the average), while it reduces mental problems by 0.29 (equivalent to a decrease of 25% with respect to the average). In column 3, I use as outcome variable an index that summarize the two types of health problems and results remain qualitatively similar. In column 4, the interpretation of the coefficient is more intuitive since the outcome variable is an indicator that takes value 1 when the individual suffered a health problem. We can observe that being 100% more exposed to missionary activity reduces the probability of having a health problem by 0.10 (equivalent to a decrease of 28% with respect to the unconditional probability) . Importantly, the main coefficient remains negative and significant throughout all specifications.

[17] Results in this paper are robust to different clustering strategies: at the village level, at the ethnic level and multi-way clustering at the village & ethnic levels. See table A.2 in the appendix.

Table 1: Long-term impact of missionary activity on health problems

	(1) Health Problems$_i$: physical	(2) Health problems$_i$: mental	(3) Health Problems$_i$: index	(4) Pr(Health Problem)$_i$ = 1 if problem
$log(missions)_e$	-0.2477***	-0.2896***	-0.3026***	-0.1005***
	(0.0828)	(0.1094)	(0.0933)	(0.0378)
Observations	15,560	15,545	15,528	15,528
R-squared	0.1009	0.1028	0.0918	0.0848
country FE	yes.	yes.	yes.	yes.
Village level controls	yes.	yes.	yes.	yes.
District level controls	yes.	yes.	yes.	yes.
Ethnic level controls	yes.	yes.	yes.	yes.
Individual level controls	yes.	yes.	yes.	yes.

Standard errors in parenthesis are clustered at the ethnic level. ***,** and * indicates signicance at the level 1%, 5%, and 10% respectively. Results are robust to clustering at village level and multi-way clustering at the village and ethnic levels (See appendix, table A.2). Individual-level controls include age, age squared, gender, living condition fixed effects, occupation fixed effects, urban location dummy, how often the individual gone without food, how often the individual gone without clean water, how often gone without cash income, education level fixed effects, indicators for trust in neighbors and local council. Ethnicity-level and Village-level controls include an indicator variable that equals one if the ethnicity/village was contacted by a European explorer prior to the colonial period, log of population density during the colonial period, historic latitude to the centroid indicator variable that equals one if the railway line dissected the land inhabited by the ethnicity/village during the nineteenth century, a measure of centroid of ethnic group, pre-colonial reliance on fishing, the fraction of land suitable for cultivation and the fraction of land within ten kilometers of a water source, the log normalized number of slaves exported during the Atlantic and Indian Ocean slave trades, distance to the sea and average malaria ecology.

5 Potential channels

In the previous section, I showed that exposure to missionary activity had a long-term impact on health status of individuals. This fact is interesting in its own right, but it can only be fully understood when its potential mechanisms are identified. There are many channels through which exposure to missions could affect present outcomes in health status. More specifically, there are three type of stories that could be behind my results:

(i) Persistence in infrastructure: Missionaries erected medical facilities which may be persistent over time.

(ii) Transmission of changes in perception of healthcare: Missions affected individuals' social and cultural attitude toward healthcare. Then, the new perception about healthcare was transmitted from generation to generation.

(iii) Genetic transmission: Missions affected individuals' ancestor health status, and new generations inherited less health problems.

Given the time span between the missionary activity and the present, the genetic transmission channel is the less compelling one. In addition, I have already shown that that missionary activity in the past reduces not only physical health problems in the present, but also mental disorders; such as anxiety. This finding raises doubts about the possibility of genetic transmission as the unique driver of the long term impact. Medicine scholars point out that genetic predisposition, habits and social environment of the individuals are among the main causes of anxiety. However, even when genetic predisposition has been established as a cause for many anxiety disorders, the specific genes involved are in most cases still unknown (AmericanPsychiatricAssociation (2013)). Hence, it would be difficult to argue that medical missions were able to solve a puzzle that remain unsolved in the present. In contrast, differences in culture and habits appear to be an important factor that trigger these mental disorders (Kirmayer et al. (2001), Castillo (1997), phelan2002).

Once we discard that the effect is uniquely driven by the genetic transmission channel, it is important to distinguish between the infrastructure and cultural transmission channels. On this ground, empirical implications of the infrastructure channel are highly different from the cultural transmission channel. In consequence, we can use these dissimilarities to evaluate the contribution of each channel to explain my findings. While infrastructure channel is location-specific, transmission channel is ethnic-specific. Intuitively, if medical facilities erected by missionaries are persistent, they would affect health status of individuals

in the geographical location where these facilities were built, regardless of the ethnic group of the individual. In contrast, ethnicity contact with the missionaries is the key determinant of the cultural transmission channel. If missionaries altered individuals' perception about the importance of healthcare and these individuals transmitted their new beliefs and perceptions to their children, then the descendants of ethnic groups that were near missions should enjoy a more healthier life in the present, regardless of the geographical location. Naturally, these channels are not necessarily mutually exclusive and both of them could be driving the results in some extent. Nevertheless, since both channels are very different and would imply very different policy implications, I exploit the data in order to shed light on the contribution of each of these mechanisms.

First, I control for any variability coming from the health infrastructure channel. In particular, I proxy health infrastructure with affordability of healthcare, difficulties in access to medicines, difficulties in access to a medical treatment, difficulties to find a doctor, and an indicator variable which takes value 1 if the individual has a health clinic nearby. [18] In table 2, I report results for an estimation that adds health infrastructure proxies near the location of the individual to main equation 1. We can observe that the coefficients remain negative and significant in every specification. Importantly, the coefficient of interest remain quantitative unchanged. Furthermore, it is interesting to notice that control variables that proxy for barriers in healthcare access present the expected sign. Individuals who have more difficulties in accessing healthcare since it is too expensive or due to unavailability of medicines or doctors in the medical facilities are more likely to experience health problems to a greater extent. Even though these results do not discard infrastructure explanation, they suggest that the cultural and social transmission channel is playing an important role.

[18] See data section for a more exhaustive description of the variables.

Table 2: Testing channel: controlling for persistence in health infrastructure

	(1) Health Problems: physical	(2) Health problems: mental	(3) Health Problems: index	(4) Pr(Health Problem) = 1 if problem
$log(missions)_e$	-0.2635***	-0.3119***	-0.3210***	-0.1028***
	(0.0927)	(0.1027)	(0.0919)	(0.0347)
health_clinic_present	0.0065	0.0058	0.0091	0.0108
	(0.0195)	(0.0267)	(0.0234)	(0.0107)
Expensive	0.0418***	0.0704***	0.0626***	0.0184***
	(0.0105)	(0.0167)	(0.0130)	(0.0069)
Lack of medicine	0.0174	0.0238**	0.0218*	0.0074
	(0.0106)	(0.0120)	(0.0112)	(0.0057)
Absence of doctor	0.0216**	0.0180	0.0225**	0.0127***
	(0.0096)	(0.0118)	(0.0104)	(0.0047)
Observations	12,376	12,362	12,349	12,349
R-squared	0.1010	0.1150	0.0982	0.0874
country FE	yes.	yes.	yes.	yes.
district level controls	yes.	yes.	yes.	yes.
village level controls	yes.	yes.	yes.	yes.
Ethnic level controls	yes.	yes.	yes.	yes.
Individual level controls	yes.	yes.	yes.	yes.

Standard errors in parenthesis are clustered at the ethnic level. ***,** and * indicates signicance at the level 1%, 5%, and 10% respectively. Results are robust to clustering at village level and multi-way clustering at the village and ethnic levels. Individual-level not-reported controls include age, age squared, gender, living condition fixed effects, occupation fixed effects, urban location dummy, how often the individual gone without food, how often the individual gone without clean water, how often gone without cash income, education level fixed effects, indicators for trust in neighbors and local council. Ethnicity-level and Village-level controls include an indicator variable that equals one if the ethnicity/village was contacted by a European explorer prior to the colonial period, log of population density during the colonial period, historic latitude to the centran indicator variable that equals one if the railway line dissected the land inhabited by the ethnicity/village during the nineteenth century, a measure of centroid of ethnic group, pre-colonial reliance on fishing, the fraction of land suitable for cultivation and the fraction of land within ten kilometers of a water source, the log normalized number of slaves exported during the Atlantic and Indian Ocean slave trades, distance to the sea and average malaria ecology of the ethnic group.

Even though I have controlled for much of health infrastructure variability in previous table, variability from infrastructure channel could still be present throughout other public goods that were erected by the missionaries. Hence, I gather information about other public goods near the location of the individual that may have also been erected by missionaries and could influence health status in the present. Specifically, I add to the health infrastructure controls other public goods such as school present nearby, access to water pipes, and sewage.

Main coefficients are reported in table 3. Remarkably, all coefficients remain qualitatively and quantitatively unchanged, providing further evidence in favor of the the cultural transmission channel.

Table 3: Testing channels: controlling for persistence in health infrastructure and public goods

	(1) Health Problems: physical	(2) Health problems: mental	(3) Health Problems: index	(4) Pr(Health Problem) = 1 if problem
$log(missions)_e$	-0.2642***	-0.3234***	-0.3275***	-0.1044***
	(0.0944)	(0.1007)	(0.0915)	(0.0344)
school_present$_i$	-0.0167	-0.0347	-0.0269	0.0030
	(0.0314)	(0.0383)	(0.0345)	(0.0169)
piped_water_present$_i$	-0.0027	0.0566	0.0244	0.0101
	(0.0265)	(0.0346)	(0.0293)	(0.0143)
sewage_present$_i$	0.0336	0.0115	0.0292	0.0269
	(0.0446)	(0.0463)	(0.0485)	(0.0180)
Observations	12,099	12,087	12,075	12,075
R-squared	0.1006	0.1148	0.0985	0.0867
Country FE	yes.	yes.	yes.	yes.
District level controls	yes.	yes.	yes.	yes.
Village level controls	yes.	yes.	yes.	yes.
Ethnic level controls	yes.	yes.	yes.	yes.
Individual level controls	yes.	yes.	yes.	yes.
Health infrastr. controls	yes.	yes.	yes.	yes.

Standard errors in parenthesis are clustered at the ethnic level. ***,** and * indicates signicance at the level 1%, 5%, and 10% respectively. Results are robust to clustering at village level and multi-way clustering at the village and ethnic levels. Individual-level not-reported controls include age, age squared, gender, living condition fixed effects, occupation fixed effects, urban location dummy, how often the individual gone without food, how often the individual gone without clean water, how often gone without cash income, education level fixed effects, indicators for trust in neighbors and local council. Ethnicity-level and Village-level controls include an indicator variable that equals one if the ethnicity/village was contacted by a European explorer prior to the colonial period, log of population density during the colonial period, historic latitude to the centran indicator variable that equals one if the railway line dissected the land inhabited by the ethnicity/village during the nineteenth century, a measure of centroid of ethnic group, pre-colonial reliance on fishing, the fraction of land suitable for cultivation and the fraction of land within ten kilometers of a water source, the log normalized number of slaves exported during the Atlantic and Indian Ocean slave trades, distance to the sea and average malaria ecology of the ethnic group.

Third, in the same line as previous tables, to ensure that I am eliminating any variability coming directly through persistent changes in infrastructure, I also include variables at the province level that control for characteristic of the province that could be related with infras-

tructure available for the individual. In particular, I include literacy rates of the province, primary enrollment and secondary enrollment ratio to population, access to electricity to population ratio, improved sanitation to population ratio and improved water access to population ratio. Results are reported in table 4. Once again, the coefficients remain relatively unchanged and provide evidence in favor of transmission channel hypothesis.

Table 4: Testing channels: controlling for persistence of infrastructure at province level

	(1) Health Problems: physical	(2) Health problems: mental	(3) Health Problems: index	(4) Pr(Health Problem) = 1 if problem
$log(missions)_e$	-0.2285***	-0.2945**	-0.2863**	-0.1002**
	(0.0759)	(0.1246)	(0.1107)	(0.0398)
%net primary attendance$_p$	0.0043*	0.0063**	0.0057**	0.0033***
	(0.0025)	(0.0026)	(0.0025)	(0.0012)
%net secondary attendance$_p$	-0.0022	-0.0056*	-0.0042	-0.0023
	(0.0029)	(0.0033)	(0.0032)	(0.0017)
literacy rate (pop over 15)$_p$	-0.0034	-0.0014	-0.0029	-0.0004
	(0.0023)	(0.0027)	(0.0026)	(0.0012)
watercapita$_p$	0.0016	-0.0012	0.0005	-0.0007
	(0.0016)	(0.0018)	(0.0017)	(0.0008)
santiationcapita$_p$	-0.0014	-0.0032**	-0.0022*	-0.0001
	(0.0012)	(0.0012)	(0.0013)	(0.0006)
electricitycapita $_p$	-0.0069***	-0.0065**	-0.0070***	-0.0009
	(0.0024)	(0.0029)	(0.0025)	(0.0012)
Observations	8,600	8,593	8,584	8,584
R-squared	0.1113	0.1287	0.1112	0.0978
Country FE	yes.	yes.	yes.	yes.
District level controls	yes.	yes.	yes.	yes.
Village level controls	yes.	yes.	yes.	yes.
Ethnic level controls	yes.	yes.	yes.	yes.
Individual level controls	yes.	yes.	yes.	yes.
Infrastructure controls	yes.	yes.	yes.	yes.

Standard errors in parenthesis are clustered at the ethnic level. ***,** and * indicates signicance at the level 1%, 5%, and 10% respectively. Results are robust to clustering at village level and multi-way clustering at the village and ethnic levels. Individual-level not-reported controls include age, age squared, gender, living condition fixed effects, occupation fixed effects, urban location dummy, how often the individual gone without food, how often the individual gone without clean water, how often gone without cash income, education level fixed effects, indicators for trust in neighbors and local council. Ethnicity-level and Village-level controls include an indicator variable that equals one if the ethnicity/village was contacted by a European explorer prior to the colonial period, log of population density during the colonial period, historic latitude to the centran indicator variable that equals one if the railway line dissected the land inhabited by the ethnicity/village during the nineteenth century, a measure of centroid of ethnic group, pre-colonial reliance on fishing, the fraction of land suitable for cultivation and the fraction of land within ten kilometers of a water source, the log normalized number of slaves exported during the Atlantic and Indian Ocean slave trades, distance to the sea and average malaria ecology of the ethnic group. Infrastructure controls include public goods and health infrastructure proxies as described in previous table.

Fourth, I estimate the main equation for the sub-sample of individuals that do not have a health clinic nearby. Arguably, those individuals were not affected at all by the persistence in the health infrastructure. Results are presented in table 5. Notice that the coefficients remain unchanged suggesting that even for those individuals that do not have a health clinic nearby in the present, exposure of their ancestors to missionary activity is associated with less health problems. That is, even if the missionaries did not erected persistent medical facilities in an area, exposure to the ancestor to contact with missionaries has a positive effect on current health status of the individual.

Table 5: Testing channels: subsample of individuals living in a place with no health clinic present nearby.

	(1) Health Problems: physical	(2) Health problems: mental	(3) Health Problems: index	(4) Pr(Health Problem) = 1 if problem
$log(missions)_e$	-0.2223**	-0.2835**	-0.2983***	-0.1466***
	(0.0953)	(0.1366)	(0.1131)	(0.0481)
Observations	5,918	5,914	5,909	5,909
R-squared	0.1168	0.1388	0.1116	0.1054
country FE	yes.	yes.	yes.	yes.
district level controls	yes.	yes.	yes.	yes.
village level controls	yes.	yes.	yes.	yes.
Ethnic level controls	yes.	yes.	yes.	yes.
Individual level controls	yes.	yes.	yes.	yes.

Standard errors in parenthesis are clustered at the ethnic level. ***,** and * indicates signicance at the level 1%, 5%, and 10% respectively. Results are robust to clustering at village level and multi-way clustering at the village and ethnic levels. Individual-level not-reported controls include age, age squared, gender, living condition fixed effects, occupation fixed effects, urban location dummy, how often the individual gone without food, how often the individual gone without clean water, how often gone without cash income, education level fixed effects, indicators for trust in neighbors and local council. Ethnicity-level and Village-level controls include an indicator variable that equals one if the ethnicity/village was contacted by a European explorer prior to the colonial period, log of population density during the colonial period, historic latitude to the centran indicator variable that equals one if the railway line dissected the land inhabited by the ethnicity/village during the nineteenth century, a measure of centroid of ethnic group, pre-colonial reliance on fishing, the fraction of land suitable for cultivation and the fraction of land within ten kilometers of a water source, the log normalized number of slaves exported during the Atlantic and Indian Ocean slave trades, distance to the sea and average malaria ecology of the ethnic group.

Up to this point, it is clear that the cultural transmission channel must be an important driver to explain the main fact of this paper. However, evidence provided is not enough to neglect the importance of the persistence in infrastructure channel. In order to analyze more in depth in what extent the infrastructure channel could also be playing a role, I include a variable that captures the number of missionary stations in the geographic location of the individual. Specifically, the variable measures the log number of historical missions per 1000 kilometers of land area that were located in the current village of the individual. With this variable, I perform two regression exercises to account for the relevance of the infrastructure channel. First, I directly check if missions reduced infrastructure barriers in access to healthcare. Then, I include standardized versions of exposure to mission at the ethnic and village level variables and try to directly account the magnitude of the effect coming from each of the channels.

Table 6 present the results for the impact of geographical exposure to missionary activity on different proxies for infrastructure barriers in access to health care: health clinic nearby, affordability of healthcare, lack of medicines in the medical facilities, lack of doctors and the individual perception about the overall barriers in access to healthcare. I present the results in table 6. Surprisingly, location of mission stations in the past does not seem to have a significant effect on the different measures of health infrastructure in the present. Even though it is clear that missionaries were the first to introduce medical facilities for African populations, it is plausible that health infrastructure investment in other areas was able to converge to the same level during the years.

Table 6: Testing channels: Geographical location of the mission stations and current health infrastructure

	(1) health_clinic_present	(2) diff_access	(3) expensive	(4) lack_medicine	(5) lack_doctor
$log(missions)_{vill}$	0.0671	0.0613	-0.0350	0.0530	-0.1821
	(0.0922)	(0.1212)	(0.0977)	(0.1268)	(0.1180)
Observations	15,273	14,557	12,999	15,586	12,755
R-squared	0.1630	0.1012	0.1691	0.3553	0.1125
Country FE	yes.	yes.	yes.	yes.	yes.
District level controls	yes.	yes.	yes.	yes.	yes.
village level controls	yes.	yes.	yes.	yes.	yes.
Ethnic level controls	yes.	yes.	yes.	yes.	yes.
Individual level controls	yes.	yes.	yes.	yes.	yes.

Standard errors in parenthesis are clustered at the ethnic level. ***,** and * indicates signicance at the level 1%, 5%, and 10% respectively. Results are robust to clustering at village level and multi-way clustering at the village and ethnic levels. Individual-level not-reported controls include age, age squared, gender, living condition fixed effects, occupation fixed effects, urban location dummy, how often the individual gone without food, how often the individual gone without clean water, how often gone without cash income, education level fixed effects, indicators for trust in neighbors and local council. Ethnicity-level and Village-level controls include an indicator variable that equals one if the ethnicity/village was contacted by a European explorer prior to the colonial period, log of population density during the colonial period, historic latitude to the centran indicator variable that equals one if the railway line dissected the land inhabited by the ethnicity/village during the nineteenth century, a measure of centroid of ethnic group, pre-colonial reliance on fishing, the fraction of land suitable for cultivation and the fraction of land within ten kilometers of a water source, the log normalized number of slaves exported during the Atlantic and Indian Ocean slave trades, distance to the sea and average malaria ecology of the ethnic group.

Finally, as a way to conclude, I standardize the ethnic specific variable and the geographical specific variable in order to perform a regression including both variables. Results are presented in table 7. In column (1) I include only the Ethnic-specific variable. In column (2), I include only the village-specific variable. We can observe that when I include the variables separately, both of them reduce health problems in a similar magnitude. However, once we include both variables in column (3), it is clear that the effect through ethnicity is stronger both in economic and statistical terms. As I am comparing standardized coefficients, results reported in column (3) suggest that the effect through the ethnicity-level measure is more

than two times the magnitude of the effect through the village-level.

Table 7: Testing channels: comparison of magnitudes of the channels

	(1)	(2)	(3)
	Physical Health problems		
Ethnic exposure (normalized)	-0.0714***		-0.0576***
	(0.0154)		(0.0173)
Location exposure (normalized)		-0.0541***	-0.0271*
		(0.0132)	(0.0152)
Observations	11,907	11,907	11,907
R-squared	0.1013	0.1016	0.1029
Country FE	yes.	yes.	yes.
District level controls	yes.	yes.	yes.
Village level controls	yes.	yes.	yes.
Ethnic level controls	yes.	yes.	yes.
Individual level controls	yes.	yes.	yes.

Standard errors in parenthesis are clustered at the ethnic level. ***,** and * indicates signicance at the level 1%, 5%, and 10% respectively. Results are robust to clustering at village level and multi-way clustering at the village and ethnic levels. Individual-level not-reported controls include age, age squared, gender, living condition fixed effects, occupation fixed effects, urban location dummy, how often the individual gone without food, how often the individual gone without clean water, how often gone without cash income, education level fixed effects, indicators for trust in neighbors and local council. Ethnicity-level and Village-level controls include an indicator variable that equals one if the ethnicity/village was contacted by a European explorer prior to the colonial period, log of population density during the colonial period, historic latitude to the centran indicator variable that equals one if the railway line dissected the land inhabited by the ethnicity/village during the nineteenth century, a measure of centroid of ethnic group, pre-colonial reliance on fishing, the fraction of land suitable for cultivation and the fraction of land within ten kilometers of a water source, the log normalized number of slaves exported during the Atlantic and Indian Ocean slave trades, distance to the sea and average malaria ecology of the ethnic group.

Taken together, my findings in this section highlight that cultural and social transmission of new attitudes toward healthcare are important to explain the lasting effects of missionary activity on health status. Even though other channels may also play a role, evidence provided here suggests that exposure to missionary activity changed individuals perception and beliefs about the relevance of healthcare in the past. This change in perception and beliefs was transmitted to their decedents who were able to have better health status in the present.

6 Conclusion

Inequality in access to health care is an important concern for health policy in developing countries. Since health status influences human capital acquisition and labor market possibilities, health status of the population play a role in reinforcing poverty and inequality. This issue is particularly important in Africa where strengthening healthcare has been one of the top priorities during the last decade. However, even though there have been studies that account for the impact of different interventions in the short-run, little is known about how these healthcare policies can shape formal and informal health institutions in the future.

In this paper, I go back to the origins of healthcare in Africa and exploit historical variability in missionary activity during the Colonial period in order to understand better the lasting effects of health interventions. I document that exposure of African ethnic groups to missionary activity in the past reduces remarkably the probability of having a health problem in the present. By exploring alternative mechanisms, I find that the long term impact of exposure to missionary activity on health problems is ethnic specific (as opposed to geographical location specific), remains qualitatively and quantitatively unchanged after controlling for current health care infrastructure, after controlling for public goods available near the individual location, and even after considering only the sub-sample of individuals that do not have a health clinic nearby. Furthermore, I find that location of mission stations in the past do not affect health infrastructure in the present. Overall, I contend that these results illustrate a mechanism through which individuals whose ancestors where more influenced by European missions, acquired throughout generations a different perception about the importance of health care.

My findings bear important policy implications. They spotlight that policies oriented to change people's beliefs and perception of healthcare relevance can affect not only present population health status, but also future generations through cultural and social transmission of this new appreciation. Future research should track which particular health problems are reduced by the exposure to missionary activity in order to have a better understanding of the mechanisms behind the results.[19]

[19]On this ground, I have recently obtained access to the demographic and health Surveys (DHS) program (US-AID) that provide data for a wide range of monitoring and impact evaluation indicators in the areas of population, health, and nutrition. Specifically, it has information on HIV/AIDS, bednet ownership and malaria, other common diseases that the individual suffer, height and weight of the individual, ethnicity of the individual, geographical location of the individual, individual characteristics. I am currently working on matching the data with historical information in order to understand better the potential channels of transmission.

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7 Appendix

7.1 Summary statistics

Table A.1: Summary statistics

	Observations	Mean	SD	Min	Max
Health problems					
Physical health problems	21712	0.8088	0.8658	0.0000	3.0000
Mental health problems	21676	1.0053	0.9790	0.0000	3.0000
Index health problems	21650	-0.0008	0.8909	-0.9805	2.2843
Indicator Health problems	21650	0.6806	0.4663	0.0000	1.0000
Log(missions per area)	21702	0.1759	0.2126	0.0000	1.3254
Individual characteristics					
Age	21556	36.4250	14.6923	18.0000	130.0000
Male	21822	0.4997	0.5000	0.0000	1.0000
Urban	21822	0.3661	0.4818	0.0000	1.0000
Education	21744	3.0744	2.0103	0.0000	9.0000
Occupation	21730	15.7855	76.1828	0.0000	995.0000
Living conditions	21748	2.5556	1.2046	1.0000	5.0000
Run out of food	21777	3.1772	1.2702	0.0000	6.0000
Run out of income	21783	3.1740	1.3936	0.0000	6.0000
Trust local	20323	1.6654	1.1032	0.0000	3.0000
Trust neighbors	20698	1.7385	1.0101	0.0000	3.0000
Historical variables					
District ethnic fract.	21822	0.4047	0.2967	0.0000	0.9058
Historical distance sea	21702	439.8920	311.4725	1.2500	1252.6830
Historical railway contact	21702	0.4336	0.4956	0.0000	1.0000
Historical contact wexplorer	21702	0.4388	0.4962	0.0000	1.0000
Malaria ecology incidence	21702	11.5057	9.7446	0.0000	34.6398
Distance Sahara	21702	2573.8020	1635.0970	25.4201	5221.3480
log(initial pop)	18366	2.5472	1.3102	-4.2736	5.8696
Barriers in access to health					
Health clinic present	21231	0.4707	0.4992	0.0000	1.0000
Access to health expensive	18336	1.0290	1.1554	0.0000	3.0000
Lack of medicine	18221	1.4216	1.1664	0.0000	3.0000
Lack of doctor	17951	1.1089	1.1460	0.0000	3.0000
Public goods					
School present	21609	0.7835	0.4119	0.0000	1.0000
Piped water present	21486	0.4875	0.4999	0.0000	1.0000
Sewage present	21164	0.2271	0.4190	0.0000	1.0000

The sample has information about 17 countries, 2811 villages and 312 ethnic groups.

7.2 Robustness checks

7.2.1 Inference: alternative ways of clustering: ethnic level, village level and multi-way clustering at village and ethnic level

In table A.2, I report my main findings under different clustering specifications. It can be observed that results are robust to clustering at the village level and to multiway clustering at the village and ethnic levels.

Table A.2: Long-term impact of missionary activity on health problems: clustering robustness check

	(1) Health Problems: physical	(2) Health problems: mental	(3) Health Problems: index	(4) Pr(Health Problem) = 1 if problem
$log(missions)_e$	-0.2477***	-0.2896***	-0.3026***	-0.1005***
SD Cluster level				
Ethnic group	(0.0828)	(0.1094)	(0.0933)	(0.0378)
Village	(0.0556)	(0.0620)	(0.0583)	(0.0290)
Multi-way clustering:				
Village & ethnic	(0.0823)	(0.1088)	(0.0927)	(0.0376)
Observations	15,560	15,545	15,528	15,528
R-squared	0.1010	0.1031	0.0920	0.0851
country FE	yes.	yes.	yes.	yes.
village level controls	yes.	yes.	yes.	yes.
district level controls	yes.	yes.	yes.	yes.
ethnic level controls	yes.	yes.	yes.	yes.
individual level controls	yes.	yes.	yes.	yes.

Standard errors in parenthesis are clustered at the ethnic level, village or ethnic&village level. ***,** and * indicates signicance at the level 1%, 5%, and 10% respectively.Individual-level controls include age, age squared, gender, living condition fixed effects, occupation fixed effects, urban location dummy, how often the individual gone without food, how often the individual gone without clean water, how often gone without cash income, education level fixed effects, indicators for trust in neighbors and local council. Ethnicity-level and Village-level controls include an indicator variable that equals one if the ethnicity/village was contacted by a European explorer prior to the colonial period, log of population density during the colonial period, historic latitude to the centran indicator variable that equals one if the railway line dissected the land inhabited by the ethnicity/village during the nineteenth century, a measure of centroid of ethnic group, pre-colonial reliance on fishing, the fraction of land suitable for cultivation and the fraction of land within ten kilometers of a water source, the log normalized number of slaves exported during the Atlantic and Indian Ocean slave trades, distance to the sea and average malaria ecology of the ethnic group.

7.2.2 Quantiles

In this section, I try an alternative specification for the independent variable. In particular, I construct quantiles of exposure to missionary activity. In the first column, I present results for only two quantiles. Those over the median and those below the median. It can be observed that being over the median is associated with less physical health problems. In column (2) and column (3) I do the same but splitting the exposure to missions measure into three and five quantiles, respectively. Regardless of the specification that I adopt, the conclusion remains unchanged: higher exposure to missions in the past is associated with less health problems in the present.

Table A.3: Long-term impact of missionary activity on health problems: Quantiles of missions per area

Dependent variable: physical health problems			
	(1)	(2)	(3)
Missions per area (quantiles of exposure)	Two quantiles	Three quantiles	Five quantiles
2nd quantile	-0.0789**	-0.0622*	-0.0269*
	(0.0363)	(0.0352)	(0.0128)
3rd quantile		-0.1213***	-0.1062**
		(0.0447)	(0.0481)
4th quantile			-0.0973*
			(0.0507)
5th quantile			-0.1379**
			(0.0605)
Observations	15,560	15,560	15,560
R-squared	0.1001	0.1005	0.1005

Standard errors in parenthesis are clustered at the ethnic level, village or ethnic&village level. ***,** and * indicates signicance at the level 1%, 5%, and 10% respectively. Regressions include country fixed effects, individual characteristics, district, ethnic and village controls. Individual-level controls include age, age squared, gender, living condition fixed effects, occupation fixed effects, urban location dummy, how often the individual gone without food, how often the individual gone without clean water, how often gone without cash income, education level fixed effects, indicators for trust in neighbors and local council. Ethnicity-level and Village-level controls include an indicator variable that equals one if the ethnicity/village was contacted by a European explorer prior to the colonial period, log of population density during the colonial period, historic latitude to the centran indicator variable that equals one if the railway line dissected the land inhabited by the ethnicity/village during the nineteenth century, a measure of centroid of ethnic group, pre-colonial reliance on fishing, the fraction of land suitable for cultivation and the fraction of land within ten kilometers of a water source, the log normalized number of slaves exported during the Atlantic and Indian Ocean slave trades, distance to the sea and average malaria ecology of the ethnic group.