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ABSTRACT

Human Capital Affects Religious Identity: Causal Evidence from Kenya*

We study how human capital and economic conditions causally affect the choice of religious denomination. We utilize a longitudinal dataset monitoring the religious history of more than 5,000 Kenyans over twenty years, in tandem with a randomized experiment (deworming) that has exogenously boosted education and living standards. The main finding is that the program reduces the likelihood of membership in a Pentecostal denomination up to 20 years later when respondents are in their mid-thirties, while there is a comparable increase in membership in traditional Christian denominations. The effect is concentrated and statistically significant among a sub-group of participants who benefited most from the program in terms of increased education and income. The effects are unlikely due to increased secularization, because the program does not reduce measures of religiosity. The results help explain why the global growth of the Pentecostal movement, sometimes described a “New Reformation”, is centered in low-income communities.

JEL Classification: C93, O12, Z12

Keywords: religion, identity, human capital, Kenya

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1. Introduction

Religion plays a central role in many people's social and economic lives, and this makes it crucial to understand the forces, including economic factors, that shape religiosity and the choice of religious denomination (Henrich et al. 2010; Clingingsmith, Khwaja, and Kremer 2009; Bryan, Choi, and Karlan 2021; Campante and Yanagizawa-Drott 2015; Squicciarini 2020). Motivated by the classic secularization hypothesis that dates back to the European Enlightenment, much scholarly attention has focused on exploring whether economic development, and education in particular, reduces *religiosity*, i.e., the extent to which people believe in supernatural forces and participate in religious rituals. This idea has been tested and received some support in wealthy Western countries (Brown and Taylor 2007; Gulesci and Meyersson 2016; McCleary and Barro 2006). At the same time, the observation that religiosity remains high and stable in many parts of the world despite decades of rapid economic growth has led certain scholars to be skeptical about the broad validity of the secularization hypothesis (Berger 1999; Stark 1999; Iannaccone 1998).

This reservation is particularly relevant for much of Sub-Saharan Africa and Latin America, settings with high average levels of religiosity and thriving religious “marketplaces” in which churches may adapt to local religious preferences and people can choose between multiple denominations (Stark and Bainbridge 1985; Iannaccone, Laurence 1992; Iannaccone 1998). Thus, an important open question that has (to our knowledge) so far largely escaped rigorous empirical inquiry is whether and how in such settings differences in human capital and economic living standards shape religious landscape, by affecting individual demand for different *forms of religion* (i.e., religious denominations and cults) or *religious identities*, without necessarily affecting the level of religiosity per se. Here we empirically test the hypothesis that individual human capital causally influences the choice of religious denomination using a unique data set from an African

setting, namely, Kenya. In particular, we examine the decision to convert from the traditionally locally dominant Christian churches – namely, the Catholic and Anglican churches – to recently emerging churches that are part of the “Renewal” or “Pentecostal” movement of Protestant Christianity. Pentecostal Churches are characterized by beliefs in the active and miraculous role of God and spirits in everyday life, including the power to alleviate hardship (Gifford 2016), and are associated with more conservative views on various social and moral issues (The Pew Forum on Religion and Public Life 2006).

The relative lack of causal evidence about how individual human capital and economic well-being shapes demand for particular forms of religion and religious identities is not necessarily surprising due to several well-known empirical challenges. The first challenge is econometric identification of causal impacts and the risk of reverse causality: simple comparisons of religious beliefs across people with different levels of human capital can be misleading because underlying religious beliefs may affect human capital investments and socio-economic status (Bryan, Choi, and Karlan 2021). Further, individuals may possess unobserved personal or family characteristics that affect both human capital and religious choices (omitted variable bias). Similarly, certain types of churches may strategically choose to locate branches in advantaged (or disadvantaged) localities in an attempt to gain more adherents. Failure to consider these and other confounding factors could lead to spurious correlations.

Addressing these concerns requires an exogenous source of variation in individual human capital and economic living standards. A key challenge is practical: most human capital investments take place during childhood and adolescence, while religious practices and identities may evolve for many decades afterwards, and therefore estimating causal impact of human capital investments necessitates the ability to track and survey individuals long after the original

intervention. This is particularly challenging in low and middle-income country (LMIC) settings without established panel data collection infrastructure. A further challenge is the limited availability of measures of stated religiosity and religious denomination or identity, which are typically not collected in administrative records (when such records even exist).

This study attempts to address these core empirical challenges in Kenya. We utilize a long-term (20-year) panel dataset with detailed longitudinal information on religiosity as well as religious beliefs, practices and identity, in tandem with a randomized experiment (school-based deworming) that exogenously boosted individual human capital (health and education) and living standards into adulthood. To our knowledge, this is the first study to estimate causal impacts of human capital investments on long-run individual religious outcomes using experimental variation.

As background for our setting, the Pentecostal movement emphasizes the work of the Holy Spirit in people's everyday lives, and promises material benefits in terms of alleviating economic hardship during one's own lifetime through religious contributions and practice (Auriol et al. 2020; Gifford 2016). The move away from more established forms of Christianity is among the most important global religious dynamics of the last half century (The Pew Forum on Religion and Public Life 2006), and is often described as a "New Reformation" or the "Pentecostal Reformation"; some commentators argue that its social and political consequences could in time rival those of the 16th century Protestant Reformation (Botha 2007; C. G. Brown 2011; Jenkins 2011; Kobyliński 2017; Thelen 2017). Numbers of Pentecostal adherents have been rising rapidly: out of two billion self-identified Christians globally, around half a billion are currently members of churches that can be classified as Pentecostal or Pentecostal-like (so-called "Charismatic" churches). The movement's growth has predominantly taken place during the last three decades,

and Sub-Saharan Africa has been one of the main areas experiencing exploding growth (with Latin America another), although there are rising numbers in scores of countries. At the current rate of growth, some researchers predict there will soon be one billion followers (McClung 2006), replacing Catholicism as the world's largest Christian denomination in terms of followers.

Beyond differences in religious practices and beliefs, evidence from our sample and other data sets suggests that members of Pentecostal churches have more conservative social and moral attitudes on a range of issues, from gender roles to alcohol consumption. The Pew Forum on Religion and Public Life (2006) shows in samples from Brazil, US, Kenya and Philippines that members of Pentecostal churches are more likely than members of traditional Christian churches to consider drinking alcohol, divorce and abortion as never justified. In line with these patterns, in Table 1 we find in our sample that members of Pentecostal churches hold more conservative views on gender roles and are less likely to consume alcohol and tobacco. We also show that they are less interested in politics. Moving beyond descriptive evidence, recent work of Buccione and Mello (2021) suggests greater exposure to Pentecostal TV channel increases fertility rate and lowers female labor force participation. Thus, the move to Pentecostal churches from other Christian faiths may have important social and economic consequences.

In Kenya, we examine whether improvements in individual human capital and economic circumstances reduce or increase the appeal of converting to Pentecostal denominations and away from the Catholic and Anglican churches that have traditionally been numerically dominant. To do so, we utilize a unique longitudinal dataset, the Kenya Life Panel Survey (KLPS), which has tracked and regularly surveyed more than 5,000 Kenyan individuals over twenty years, from early adolescence (median age 12 years at baseline) into adulthood (median age 35 years in the most recent round). This is an important period of life to focus on for the analysis, since previous work

suggests that adolescence and young adulthood are formative periods featuring a large share of religious conversions, as individuals search for the best “match” between their preferences and characteristics and the context in which they consume religion (Barro, Hwang, and McCleary 2010; Iannaccone 1990). The dataset contains unusually rich individual religious histories, which allows us to document prevalence of conversions from traditional Christian churches to Pentecostal churches (and vice versa), as well as conversions to other denominations and other religious outcomes.

To start, we use the 20-year KLPS dataset to generate descriptive evidence on patterns of religious conversion over time. We first show that there is a massive shift in religious affiliation during the 1998-2021 period, with approximately 30% of individuals leaving traditional churches and joining Pentecostal churches (Figure 1). This mirrors past discussions regarding the rapid spread of Pentecostal and related beliefs, and demonstrates that this is driven not just by shifts across cohorts but also by religious conversions among individuals over time. We then present a large and highly significant correlation between individual human capital and living standards – measured in terms of years of schooling, cognitive skills, and earnings – and the likelihood of these conversions, where individuals with lower levels of human capital are far more likely to switch to Pentecostal churches. At the same time, we find no systematic link between these human capital or living standards measures and levels of self-reported religiosity (e.g., as captured in stated strength of belief or by frequency of attendance at religious services).

While this descriptive use of the KLPS panel data does alleviate some concerns regarding omitted variables bias, it cannot fully resolve them. Finally, and in what is (in our view) this study’s most novel contribution, we move beyond descriptive longitudinal evidence and estimate the *causal* role of the human capital investment that took place during participants’ youth, by

comparing those who were randomly assigned to receive additional years of a school-health program (a randomized school-based deworming intervention) to a control group. The Primary School Deworming Project (PSDP) has produced positive impacts on individual health, education and economic well-being, as well as on the sector of economic employment and the likelihood of urban residence, over two decades (Baird et al. 2016; Hamory et al. 2021; Miguel and Kremer 2004a). We focus on estimating the overall effect of this human capital intervention on later individual religious denomination and religiosity, noting that any effects could operate through multiple sub-channels (e.g., health gains, income, urban residence) that we are unable to fully disentangle.

The experimental estimates indicate that those individuals who exogenously received the human capital investment (deworming) are more likely to remain affiliated with traditional churches rather than switching to Pentecostal denominations, but there is no detectable change in their overall level of religiosity (mirroring the descriptive patterns noted above). These effects are concentrated and statistically significant among a subgroup of the KLPS sample – namely, those individuals who were above median age at baseline – who experienced the largest deworming treatment effects in terms of education and earnings, providing further suggestive evidence that impacts are working through those channels. Taken together, the panel evidence from the longitudinal KLPS dataset and the experimental variation induced by the deworming treatment tell a consistent story, and indicate that the persistence of relatively low levels of education and living standards could be contributing to the rapid rise of the Pentecostal movement in Kenya. As noted below, several observers of the rise of Pentecostalism in African countries have advanced related hypotheses (Martin 2002; McClung 2006; Gifford 2016).

This study adds to a nascent literature utilizing randomized control trials to explore fundamental questions related to the economics of religion. Researchers have made progress in identifying the causal effect of religion on attitudes and behaviors by exploiting a lottery allocating visas for the Islamic Hajj pilgrimage (Clingsmith, Khwaja, and Kremer 2009), and by randomizing participation in a Protestant Evangelical values and theology education program (Bryan, Choi, and Karlan 2021). In terms of economic determinants of religion, randomized provision of formal insurance was shown to reduce the size of religious donations among believers of a large Pentecostal church in Ghana (Auriol et al. 2020). This latter study is particularly relevant for us, and its evidence suggests that Pentecostal adherents perceive God to be an active force in their personal economic lives and that individual church donations are seen as a way to receive divine protection against expected future negative economic shocks.

Further, the investigation of what drives people and societies to be more or less religious has a rich tradition in the social sciences, but there is a relative lack of empirical studies that explore causal determinants of the demand for different forms of religion or religious identity. Existing work made progress in analyzing individual-level data to study the relationship between the education levels and religious participation, with most studies finding a negative relationship between the two (Deaton 2009; Ruiter and van Tubergen 2009), with some exceptions (Sacerdote and Glaeser 2008). More recent research has taken advantage of educational reforms that can be viewed as natural experiments (Hungerman 2014; Gulesci and Meyersson 2016), and finds support for the interpretation that the link between higher education and lower religious participation is causal in Turkey and Canada. Relatedly, city-level education was found to be negatively related to church attendance in pre-WWI Germany, in an analysis that controls for city fixed effects (Becker, Nagler, and Woessmann 2017). However, little well-identified evidence exists outside of

rich countries (Iyer 2016). Yet, understanding how recent advances in education, health and economic well-being affect religious demand is especially important for LMIC's, and in Sub-Saharan Africa in particular, in which recent human capital improvements have been dramatic. Most of the limited evidence on the determinants of religious conversions is correlational and focuses on the role of country-level characteristics (Barro, Hwang, and McCleary 2010), or basic demographics such as gender and age (Smith and Denton 2009; Greeley 1994). Recently, non-experimental approaches have been employed to estimate the effects of economic conditions on conversions in Latin America. Costa, Marcantonio, and Rocha (2022) find that regions more exposed to negative economic shocks experience rise in Pentecostal church membership in Brazil, which is broadly in line with our observation that economic disadvantage makes Pentecostal churches more attractive among Christians. On the other hand, in an analysis using a regression discontinuity design in the allocation of cash subsidies in Ecuador greater income was found to be positively linked to church attendance and the likelihood of being a member of a Protestant Evangelical denomination rather than the Catholic Church (Buser 2015). Turning to non-economic determinants of Pentecostalism, Buccione and Mello (2021) exploit the expansion of church-affiliated TV channels in Brazil and document that exposure to this media fosters religiosity and conversions to Pentecostal churches.

This study provides the first field experimental evidence on the impacts of human capital investment on choice of religious identity. Specifically, it aims to contribute to the existing literature by (i) focusing on data from an LMIC (Kenya); (ii) employing longitudinal data over 20 years (from the KLPS), to explore when in the life cycle the impacts of increased human capital emerge on religious choices and whether they persist; (iii) measuring individual religiosity, and the choice of religious denomination over time; and finally, (iv) utilizing a randomized control

trial of a child school-health intervention (deworming) to provide causal evidence on the impact of individual human capital on religious choices into adulthood.

2. Pentecostalism and Religion in Kenya and Beyond

The set of beliefs and practices offered by Pentecostal churches¹ are sometimes hypothesized as being particularly attractive for the poor and socially marginalized (Martin 2002). Although there are important differences across particular Pentecostal churches, Pentecostalism's unifying and most prominent feature is that religious teachings consider the relationship with God and spiritual world as being personal and "this-worldly" (Gifford 2009; Botha 2007; Gifford 2016). Poverty, health problems, or a lack of success in business and education are attributed to individual relationships with spirits and God rather than to structural constraints. Pastors emphasize how spiritually meritorious actions, such as participation in rituals and financial contributions, unleash God's blessing, helping to address material and other problems, and to reduce the risks of negative future shocks. Pentecostal preachers across Africa describe a God who does not want His people to be poor or to suffer (Gifford 2016; Auriol et al. 2020).² The time frame of expected benefits is

¹ This diverse branch of Christianity is difficult to label with a single term. For simplicity, we will use the term "Pentecostal churches" broadly, when referring to churches which belong to a historical Pentecostal denomination (such as the Assemblies of God and the Church of God in Christ) as well as to newer, largely independent and often smaller churches with similar beliefs and practices to the more established Pentecostal churches.

² For example, Olukoya, the pastor of the Mountain of Fire and Miracle Ministries in Nigeria, writes "*Every born again Christian is destined for an all-round success. Success is your kingdom right. It is your covenant and redemptive right*" (46, p. 15) ... but we are all prey to spiritual forces determined "*to pollute, trap and destroy people's destiny*" (47, p.24)

short, in contrast to Catholic, Anglican and other Christian denominations, where religious behavior is generally thought to influence mainly “afterlife consumption” (Azzi and Ehrenberg 1975).

In addition to these “material” benefits of having access to an interventionist God, Pentecostal worship is generally less formal and more emotionally expressive than that of other Christian traditions. Preaching relies more on stories and less on textual analysis, and Pentecostal pastors are often untrained lay people who use simpler language than Catholic clergy (Botha 2007). Much Pentecostal worship is designed to bring about an experience of God's presence and services often incorporate experiences such as divine healings, speaking in tongues and other miraculous signs of the Holy Spirit. Finally, Pentecostal churches do not have a formal or fixed theological orthodoxy, allowing for more flexibility to relate worship patterns, rituals and practices to traditional local belief systems and thus for more syncretic approaches (Botha 2007; Gifford 2016); see Online Appendix A for more background on Pentecostal churches.

Kenya is a particularly relevant setting for studying the individual decision to change religious denomination and its determinants in relation to the rise of Pentecostalism. Kenya is currently in the process of a dramatic shift away from traditional Christian churches (Catholic and Anglican) towards Pentecostal churches, as we document below. At the same time, Kenya is a highly religious country, in which religion plays a crucial role in people's everyday lives. In our sample, 95% of people report that religion is very important in their lives (as compared to, for example, 53% in the US (Pew Research Center 2018)), 75% report attending church regularly, and respondents spend a non-negligible share of their household budgets (4%) on church donations. The religious landscape is also characterized by high levels of local diversity and pluralism: Pentecostal churches are present throughout the country, together with nearby Catholic and

Anglican churches, and thus most Kenyans can in principle relatively easily switch between denominations.

3. Experimental Design and Data

We use data from the longitudinal Kenya Life Panel Survey (KLPS), which tracks individuals from childhood into adulthood. Sample individuals attended the 75 rural primary schools in Busia district (in western Kenya) that participated in the Primary School Deworming Project (PSDP) starting in 1998. This project was an early experimental study in development economics, and used a list randomization to assign the order in which these 75 schools received deworming drugs, where the phase-in of treatment was necessitated by the financial and logistical constraints of the implementing NGO. Pupils in the 50 randomly selected Group 1 and Group 2 schools (which we refer to as the treatment group here) were assigned to receive deworming starting in 1998 or 1999, and thus received on average 2.4 more years of deworming than pupils from the 25 Group 3 (or control) schools, which started receiving deworming in 2001.³ Table A1 documents that the treatment and control groups were well-balanced along a range of baseline characteristics; see (Miguel and Kremer 2004b; Baird et al. 2016; Hamory et al. 2021) for more details.

KLPS was designed to follow and survey a representative sample of approximately 7,500 participants of the deworming program. Survey tracking rates have remained high across rounds, with effective survey rates of approximately 85% in all four rounds, balanced across the treatment

³ All schools were public secular schools and none of them were private. In some cases, there is a traditional affiliation with the local church but in practice they are all teaching the same government curriculum. Thus, it is unlikely that religious teaching favoring either Catholic or Anglican churches would drive our results.

and control groups, and nearly 90% of individuals being surveyed at least once across the four survey rounds collected to date, namely, KLPS-1 (2003-2005), KLPS-2 (2007-2009), KLPS-3 (2011-2014), and the 20-year follow-up round KLPS-4 (2017-2021). Data collection thus covers a period from childhood (PSDP baseline median age 12 years, 10-90 age range 9-16 years old) into adulthood (median age 35 years, 10-90 age range 32-39 years old in KLPS-4). High tracking rates are, in part, due to the decision to track migrants beyond the original study region, to other parts of Kenya, East Africa, and beyond, including a large share who have moved to urban areas, including the large cities of Nairobi and Mombasa, over time (see Figure A5).⁴

While the KLPS sample is not nationally-representative, Busia district is close to the Kenyan national median along several leading socio-economic measures (Kenya National Bureau of Statistics 2010), and the PSDP's school-based sample captures the vast majority of local children since 96% of Busia children 6-17 years old had "ever attended" school at baseline. The percentage of Busia population with secondary education in 2009 (10%) was comparable with the national median (11%), in 2005 75% of Busia adults were literate compared to 80% nationally, and 62% of Busia households fell below the poverty line compared to 41% nationally. The fact that Busia was somewhat poorer than average for Kenya arguably makes the KLPS population more representative of Sub-Saharan Africa as a whole, because Kenyan income levels are somewhat higher than the Sub-Saharan African average (44, p. 464). In terms of religious landscape at the outset of our study, the 1999 Census shows that the high level of religious plurality

⁴ The tracking of respondents involves two stages. In the second stage when the pace of locating respondents slows down, a representative random sub-sample containing approximately one quarter of still-unfound respondents is drawn and those are tracked very intensively. We re-weight those chosen for the intensive sample to maintain representativeness of the sample.

is not specific to Busia but characterizes Kenya as a whole, although there were some differences in the relative size of different religious groups between Busia and Kenya as a whole. In Busia county there was a higher fraction of Christians (94% vs. 84%), especially Catholics (49% vs. 28%), and a lower fraction of Muslims (2% vs. 8%). Online Appendix B contains more details about the PSDP experimental design and the KLPS sample.

Several previous studies have estimated the short to long run impacts of the PSDP on individual human capital and economic life outcomes. Over the first two years of the deworming program, there were gains in self-reported health and pupil absenteeism in treatment schools fell by one quarter (Miguel and Kremer 2004b). Ten years after the intervention, individuals in the treatment group (as compared to the control group) had better self-reported health, had higher educational attainment (by 0.3 years on average), test scores and secondary schooling attainment, as well as higher income among wage earners (20% gains) (Baird et al. 2016). Up to 20 years later, individuals in the treatment group experienced higher household consumption expenditures (by 14%), hourly earnings (by 13%), non-agricultural work hours (by 9%) and were more likely to live in urban areas (by 9%), and the program was shown to have a high social internal rate of return given the very low cost of purchasing and delivering deworming drugs (Hamory et al. 2021).

Importantly, the observed deworming effects are driven by a sub-sample of respondents who were above the median age (12 years old) at baseline⁵, experiencing greater gains in schooling

⁵ Note that for some respondents there are inconsistencies in the reported year of birth across different rounds of data collection. We construct the variable “year of birth” by using the most recent response available. An alternative way would be to use the earliest responses available. We believe using later responses is more reliable, since adults are more likely to know and report their year of birth precisely. The uncertainty about year of birth among respondents

levels, consumption and earnings (see Columns 1 and 2, Table 3). For instance, the deworming treatment effect on schooling attainment is 0.45 additional years of schooling for the older group (significant at 99% confidence), while for younger individuals it is close to zero and not significant. Hamory et al. (2021) contains a detailed discussion of why this pattern could prevail. To briefly recap here, this pattern is consistent with the marginal benefit of deworming declining with each additional year of treatment received. Among the younger sub-sample, pupils in both the treatment and the control group received some deworming, with those in the treatment group receiving on average 2.4 years more. While this gap between treatment and control is the same among the older sub-sample, many older pupils in the control group did not receive any deworming at all because they graduated or left their school (as a drop out) before 2001 when control schools were phased in. Thus, among the older subgroup, the treatment versus control effect is driven by those who received some deworming versus those (in the control group) who received close to no deworming on average. In the analysis below, we take advantage of these earlier findings and, in addition to estimating the average effects, test whether program effects on religious choices are concentrated among the older subgroup which experiences larger gains in human capital and living standards.

The main outcomes of interest in the analysis are (i) choice of religious denomination and (ii) measures of religiosity. In each KLPS round, the participants reported their religious denomination at the time of the interview by choosing from an extensive list of possible churches and religions (although only a small share of respondents, at 6.3%, report non-Christian affiliations, mainly Islam or no affiliation). They also reported changes in religious denomination

in the initial waves is also indicated by a relatively large fraction of missing responses in the baseline survey. For completeness, we report the main estimates when using the alternative approach in Table A.18 and the results are qualitatively similar.

and the year and month in which it had occurred. We construct two main variables of interest regarding religious affiliation and identity, namely, first, a variable indicating the religious denomination at the time of the interview (e.g., Pentecostal, or a traditional Church affiliation), and second, a variable indicating the share of time a respondent belonged to a Pentecostal denomination since the last interview. While there might be somewhat more “noise” in the second variable due to imperfect recall about the specific timing of any religious switches, this measure does conceptually provide a more comprehensive picture of individuals’ religious denomination history, as compared to the snapshot measure of religious denomination elicited at the time of each interview round. In any case, as discussed below patterns are qualitatively the same using both measures.

To assess the level of religiosity, respondents answered a set of seven questions on the importance of religion (importance of religion in life, importance of religious identity, changes in religiosity in the past year) and on religious behavior (regular church attendance, recent church attendance, monetary and labor donations to church). We construct a mean effects index of “Religiosity” by taking the sum of the standardized values of each of these components (and then re-standardizing it so that it has mean zero and standard deviation one). The first set of questions on importance of religion can also be seen as measures of intrinsic religiosity, which refers to a private relationship with God, while the second set of questions on religious behavior can be seen as measures of extrinsic religiosity capturing the social dimension of being religious (Bentzen 2019). In some of the analysis, we construct two sub-indices, in order to analyze the effects on intrinsic and extrinsic religiosity separately. Online Appendix C provides the survey wording of all the relevant questions and more detailed information on how the index is constructed.

Since we aim to shed light on the transition from traditionally dominant Christian churches to Pentecostal ones, we classify churches into three broad and analytically relevant categories. The first category, labeled “Traditional Christian”, includes the Catholic and Protestant Anglican denominations. To define the second category of churches, labeled “Pentecostal”, we use two approaches. “Pentecostal (broad classification)” includes churches that belong to one of the historically large Pentecostal denominations (e.g., Church of God, Assembly of God Church, Pentecostal Church) and newer indigenous churches closely resembling Pentecostalism (e.g., Roho Church, Legio Maria Church). We also include many smaller churches into this category, since in most cases their name and results of internet searches suggest that they likely belong to the Pentecostal movement (e.g., Jesus Praise Center, Jesus Restoration Gospel, Miracle Church, among many others). We alternatively also employ a more conservative approach in constructing the “Pentecostal (conservative classification)”, in which we exclude this latter group of smaller and usually independent churches, which are more difficult to unambiguously classify. We again show that the main results are similar when using the more conservative classification.

Given our interest in the distinction between traditional versus Pentecostal churches in Kenya, in the most recent round of data collection (KLPS-4) we added a survey module with a more detailed set of questions on individual religious beliefs and practices (see Online Appendix C). As expected, individuals who self-identify as members of churches that we classify as Pentecostal are far more likely to report that their church employs characteristic Pentecostal practices during services, to report personally experiencing miraculous signs of the Holy Spirit (e.g., prophecy, exorcism, speaking in tongues) and to believe in salvation (Table A2). These beliefs and practices are similar for members of larger Pentecostal churches, as well as of smaller churches in the Pentecostal category (Table A3). Interestingly, a non-trivial share of members of

the Traditional Christian churches also report related beliefs and practices, suggesting that these practices have to some extent been adopted by Traditional churches as well, but rates are substantially lower than for members of Pentecostal churches.

Finally, a third analytical category are “Other” denominations, including other Christian churches that are neither traditionally dominant in Kenya nor part of the Pentecostal movement (e.g., Baptists, Methodists, Jehovah’s Witnesses, Seventh Day Adventists, etc.), as well as followers of Islam and the very small number of those who state they follow traditional local religions or do not state a religious affiliation (see Table A4). This category represents just 6% of the sample and the proportion is relatively stable during the study period, in contrast to the other two categories, as we describe below.

4. Results: Descriptive Evidence

We find clear evidence that religious denomination is not fixed in the KLPS sample but evolves dynamically during adolescence and early adulthood: 38% of respondents report having changed their religious denomination from Traditional Christian to Pentecostal churches, or from Pentecostal to Traditional Christian churches, while 39% report always belonging to a Traditional Christian church and 15% to a Pentecostal denomination. Note that these numbers provide a somewhat conservative perspective on the prevalence of all switches among religious denominations because they do not include changes within the group of Traditional Christian denomination (i.e., from Catholic to Anglican or vice versa, at 7% of the sample) or among Pentecostal churches (a sizeable 25%).

We find a strong shift from Traditional Christian churches to Pentecostal churches over time, as shown graphically in Figure 1: the share of respondents reporting they belong to a Traditional Christian church dropped from 72% in the first follow-up round collected during 2003-5 (KLPS-1) down to 42% in KLPS-4, while the share of those reporting belonging to a Pentecostal church increased sharply by an almost identical amount, from 22% to 50%. The drop is observed for both those initially affiliated with the Catholic and Anglican denominations. The increased membership in Pentecostal Churches is mainly driven by individuals joining the larger and more established Pentecostal churches (see Figure A1). As noted above, the share of respondents reporting they belong to the residual “Other” category is relatively constant, between 5% and 8% across the four KLPS rounds. The real action in terms of religious identity in this sample is between the traditionally dominant churches and upstart Pentecostal denominations. In terms of proxies for religiosity, we find that the self-reported importance of religion is high and stable over time, while church attendance decreases slightly with age (Figure A2).

We document robust statistical associations between individual human capital and earnings measures and religious denomination: respondents with less human capital (e.g., years of schooling) are significantly more likely to belong to a Pentecostal church and they are less likely to belong to Traditional Christian churches. Table 2 presents the pairwise correlations between respondents’ religious denomination and years of schooling measured in KLPS-3, i.e., at a point in time when most respondents are in their mid-20’s and the vast majority have completed their education. The correlations are sizable and highly statistically significant. In a linear regression framework, each additional year of completed schooling is associated with a reduced likelihood of belonging to a Pentecostal church of 3.1 percentage points (and an increased likelihood of belonging to a Traditional Christian church of 3.3 points) in KLPS-3. This link holds for other

human capital proxies, namely respondent's cognitive skills as measured by a Raven's Matrices test and the education of the respondent's parents (both mother and father), which is informative about the socioeconomic status of their childhood household. In line with these patterns, higher income is also negatively associated with being a member of a Pentecostal church and positively associated with being a member of a Traditional Christian church. When exploring a more detailed classification of churches (Table A5), we find similar patterns for both types of Traditional Christian churches (Catholic and Anglican), and also for both types of Pentecostal churches (larger versus smaller ones).

Yet in contrast to the choice of religious denomination, we do not detect a systematic link between the various measures of human capital, economic well-being and the stated level of religiosity: the overall index of religiosity is positively correlated with education, but not correlated with income (Column 4 of Table 2), and both sets of correlations tend to be far smaller in magnitude than those documented for religious denomination. Similarly, when examining specific components of the index (Table A6), we find that most are positively correlated with years of schooling but negatively correlated with total earnings, but most relationships are not statistically significant. Taken together, there is not strong evidence that higher levels of individual human capital and living standards translate into reduced religiosity in this setting.

A next natural question is whether the observed statistical correlation between individual human capital and religious identity is causal. To shed light on this, we exploit the experimental deworming treatment program.

5. Results: Causal Evidence from a School Health Program

The estimation strategy builds on (Baird et al. 2016; Hamory et al. 2021).⁶ We focus on intention-to-treat (ITT) effects of the deworming program, i.e., the difference in outcomes for individuals from treatment schools (who received approximately 2.4 additional years of deworming treatment in childhood) versus from control schools, and we begin with pooled regressions which utilize data from all four KLPS rounds to improve the precision of the estimates. The main coefficient of interest is the coefficient on the indicator variable for assignment to a treatment school, and we further control for covariates used in the stratification for the randomization and in KLPS sampling, including baseline school characteristics (average test score, population, number of students within 6 km, and administrative zone indicators), baseline individual characteristics (gender and grade), indicators for the KLPS survey calendar month, calendar year, wave and round and an indicator for inclusion in the control group of two other interventions not examined here (namely, vocational training and cash grants); details are provided in Online Appendix D. Following (Baird et al. 2016; Hamory et al. 2021) we present the results for the entire sample and then separately for the older (baseline age greater than 12) and younger respondents.

To start, and mirroring the observational analysis above, there is no evidence of systematic impacts of the deworming human capital investments on the overall index of self-reported religiosity: the coefficient estimate on deworming treatment is small in magnitude and not significant, for the full sample as well as for the sub-samples of older and younger respondents

⁶ Since the deworming intervention and collection of most of the data we use (namely, rounds KLPS-1, KLPS-2 and KLPS-3) took place before pre-analysis plans became common in the social sciences, we did not pre-specify the following econometric analysis in a pre-analysis plan, similarly to (Baird et al. 2016). Thus, the readers should treat the analysis as follows as more exploratory compared to studies that utilize a pre-analysis plan.

(Column 8 of Table 3). Further, there are no meaningful effects on the indices measuring intrinsic and extrinsic religiosity, as well as on separate components of the religiosity index (Table A7).

Once again in parallel to the correlations in Table 2 above, the data do suggest that the exogenous deworming human capital treatment affects the choice of religious denomination (Columns 3-7 of Table 3, Panel A): treatment group respondents are somewhat more likely to report to belong to a Traditional Christian denomination (by 3.4 percentage points, Column 3) and less likely to belong to a Pentecostal church (by 2.5 percentage points, Column 4), although these full sample effects are not significant at traditional confidence levels. We find meaningful heterogeneity across older and younger subgroups and a pattern that lines up closely with these subgroups' experienced education and living standards gains. The effects of deworming on affiliation with a Traditional Christian church are far larger in magnitude and statistically significant among the older respondents (Panel B) – the same subgroup that showed the largest gains in education and earnings – while they are close to zero for younger respondents (Panel C). Specifically, for the older respondents, being allocated to the treatment group reduces the probability of belonging to a Pentecostal church by 6.5 percentage points (p-value = .024), while the probability of belonging to a Traditional Christian denomination increases by 7.3 percentage points (p-value = .027).⁷ The deworming treatment also leads to a reduction in the share of time

⁷ Estimated effect magnitudes are large. For a speculative calculation, recall that the deworming human capital intervention leads to an increase in educational attainment of 0.449 years on average for the older respondents. If we were to impose the strong (and untestable) assumption that the effect of deworming on the choice of religious denomination operates solely via increased years of education (and that this effect is linear), one additional year of education among the older subgroup would lead to a reduction in affiliation with a Pentecostal church by 14.5 percentage points on a base rate (over the entire study period) of 45%, in other words a sizeable reduction of 32%

respondents report belonging to a Pentecostal church, based on the monthly history of their religious denomination constructed from the answers to retrospective survey questions (Columns 6-7, $p\text{-value} < 0.01$).

Effects are if anything somewhat stronger statistically when the more conservative classification of the Pentecostal churches is used: among the older participants, the program reduces the likelihood of being a member of a large Pentecostal church by 6.4 percentage points (Column 4 of Table 3, $p\text{-value} < 0.01$), while the effects are positive but smaller and not statistically significant when considering membership in small Pentecostal churches alone (Table A8). Thus, the dynamics of the conversions over time as well as the mitigating effect of the human capital intervention are mainly driven by reducing conversions to the larger and more established Pentecostal churches.

While the previous analyses pooled data from all four KLPS rounds, we next take advantage of longitudinal structure of KLPS to gauge the evolution of these effects over time and their persistence by separately estimating effects for each round (Figure 2, Tables A9-11). Among the older respondents, the effects emerge during adolescence and persistently increase in size over the next fifteen years that we follow respondents, i.e., into their mid-thirties on average. Specifically, the deworming treatment reduces the probability of belonging to a Pentecostal church (broad classification) among older respondents by 6 percentage points in KLPS-1 ($p\text{-value} = .044$), by 4.1 p.p. in KLPS-2 ($p\text{-value} = .219$), by 9.2 p.p. in KLPS-3 ($p\text{-value} = .016$) and by 8.5 p.p. in KLPS-4 ($p\text{-value} = .004$). We observe very similar patterns when focusing on the conservative

percent. This calculation is for illustrative purposes only since it is plausible that multiple channels are operative, e.g., higher earnings, urban residence, and possibly even changes in health status, beyond the effects of schooling alone.

classification of Pentecostal churches (Figure A3): deworming treatment reduces the likelihood of belonging to one of these churches by 4.1 percentage points in KLPS-1 (p-value = .145), by 4.2 p.p. in KLPS-2 (p-value = .151), by 8.8 p.p. in KLPS-3 (p-value = .000) and by 9.5 p.p. in KLPS-4 (p-value = .000). We conclude that program effects on the choice of religious denomination are long-lasting, spanning the adolescent and early adult period of the life cycle during which most people make a host of crucial economic, family and social decisions, including regarding their religious identity, as we find. As expected, for the sub-sample of younger participants, we do not detect any meaningful treatment effects across the four rounds. Moreover, there is no meaningful heterogeneity by respondent gender (Table A12).

In order to gauge whether the treatment may operate via indirect effects through a peer group that is exposed to the same treatment, we tested whether the religious conversions are clustered within school cohorts. We estimated intra-cluster correlation that measures the proportion of the overall variance that is explained by within group variance for the following variables: (i) conversions to Pentecostal churches in general, (ii) conversions to Pentecostal churches specifically from Traditional churches and (iii) being currently member of a Pentecostal church. For all these variables, we find that the intra-cluster correlation is very low (below 0.005) (Table A.16). Further, we find that the number of schoolmates who later became pastors, and thus were potentially influential peers in the religious domain, is not positively related to the likelihood of converting (Table A.17). These patterns suggest that peer influences are unlikely to play an important role in explaining the treatment effects.

Expert prior beliefs. Are these results surprising? We measure prior beliefs elicited from expert predictions (related to the approach in (DellaVigna and Pope 2018)). Before sharing any empirical

results with the scientific community, we elicited predictions in 2019 from a large number of academic experts on religion across various disciplines (N = 149), mostly sociologists (37%), economists (32%), political scientists (13%) and psychologists (13%), as well as other research fields (5%). We explained the deworming intervention and its 10- and 15-year impacts on human capital and economic outcomes, and provided summary statistics on the average reported importance of religion, church attendance, church membership and the frequency of conversions among respondents. The experts were asked to predict the effects on conversions and on two components of the religiosity index (church attendance and the stated importance of religion) fifteen years after the intervention (in KLPS-3).

In general, the expert survey does not indicate a clear collective prior belief that the deworming intervention would reduce conversions from Traditional to Pentecostal churches. The experts' predictions vary substantially: approximately one third expected no impact at all, one third expected positive effects and another third negative effects. The expected effects (both positive and negative) were often relatively small in magnitude, and they are broadly similar across scholars from different disciplines. In our view, this *ex ante* lack of consensus among experts suggests that the impact of improved human capital and living standards on choices of religious denomination in contexts like ours are currently not well understood, and that our evidence provides a novel input to the scholarly debate. Online Appendix E provides further details about the design and results of the expert survey.⁸

⁸ Further, approximately half of the experts surveyed expected negative (mostly small) effects of the treatment on both measures of religiosity, one quarter predicted zero effects, and a quarter positive impacts. This pattern suggests that, on average, the experts believe the treatment might slightly reduce stated religiosity, broadly in line with the classic secularization hypothesis.

6. Discussion

Despite extensive academic and popular debates over many decades, there remains limited econometrically well-identified, experimental evidence on how improvements in individual human capital and economic well-being affect people's religious lives in low- and middle-income countries. We provide causal evidence indicating that improved individual human capital does not lead to a reduction in the stated importance of religion in people's lives using a rich set of proxies of religiosity. The findings align with the observation that most Kenyans in our sample remain very religious throughout the entire study period: the fraction of respondents who report not adhering to any religion remains in the range of 1%. The results are consistent with the view that belief in supernatural forces and participation in religious rituals are deeply rooted in human societies and will not automatically fade away with economic development, in line with aggregate trends showing that religiosity has not diminished in many settings outside of Western Europe despite the massive global increase in income and wealth in recent decades.

At the same time, we provide several new pieces of evidence indicating that individual human capital can shape the demand for particular forms of religion and religious identities. The unusual KLPS panel data on individual religious histories reveals that switching between different Christian denominations is extremely prevalent in Kenya, and that during the 20-year period we study, the proportion of the sample affiliated with Pentecostal churches has increased by more than 20 percentage points, while the share in Catholic and Anglican churches has declined nearly one-for-one. The exogenous variation in health, education and living standard generated by the Primary School Deworming Project indicates that human capital plays a causal role in this religious transformation, echoing the strong observational correlations documented in the KLPS data: in both cases, there is a strong negative association between the level of human capital and the

likelihood of being a member of a Pentecostal church. The deworming impacts are driven by the sub-group of older sample individuals who benefited the most from the program in terms of increased education and adult income, suggesting that these channels are key. The process of economic development is characterized by advances along various dimensions, especially in education, health, income levels, and ultimately in greater migration to cities. It is noteworthy that the deworming intervention causes changes in all of these dimensions, and thus the detailed micro-level evidence that we provide here from KLPS may also be relevant for thinking about how economic development more broadly could affect the decision to join Pentecostal churches. At the same time, the experimental design here cannot credibly separate which particular channel – e.g., better health, higher education, income, or urban residence – or which combination of channels, is the key driver of the choice of religious identity.⁹ It is also possible that the effects we observe are partly due to a supply side response: Pentecostal Churches may specifically target relatively disadvantaged households, perhaps because of awareness of a greater receptiveness of this segment of the population to Pentecostal belief sets. These are interesting areas for future research to explore.¹⁰

⁹ The effects are unlikely to be due to a direct effect of the deworming treatment on generally higher confidence in modern science and medicine, rather than miracles. In Table A15 we show that the treatment has virtually no influence on the likelihood the respondents ensure their own children receive vaccinations and use bed nets.

¹⁰ Empirically separating supply and demand channels is notoriously difficult. In this context, a couple of observations are noteworthy. First, Pentecostal churches are not concentrated only in poorer, rural areas. We find that the proportion of respondents who reported being members of Pentecostal churches was 43% among those living in rural areas at the time of interview and 39% among those living in urban areas, suggesting that Pentecostal churches are available across localities. Second, in Table A.16 we show that intra-cluster correlation in conversions to Pentecostal churches is very

The results are consistent with the view that religious identity is a dynamic, adaptive cultural construct, which may evolve differently across societies. The findings suggest that people who are relatively disadvantaged in terms of human capital and economic well-being are more receptive to forms of religion, like Pentecostalism, that feature an interventionist God who rewards spiritually meritorious people over immediate timeframes and more conservative values. Thus, the findings may help to explain arguably the most seismic shift in global religion during the last half century, namely, the rapid spread of Pentecostalism in the LMIC's of Sub-Saharan Africa and Latin America, and among disadvantaged communities within more affluent societies.

It is noteworthy that at the aggregate level, improvements in human capital and economic conditions coincide with the spread of Pentecostalism in most LMIC's. Our results suggest this aggregate relationship might be misleading if interpreted causally and that other factors are driving the growth of Pentecostalism. In fact, our results lend some support to a speculation that the progress in terms of human capital and economic well-being may have slowed down the growth of this new variant of Christianity. It is also possible that one's *relative* standing in society, in terms of human capital and economic vulnerability, rather than absolute levels, may affect the appeal of Pentecostal denominations.

We end with some speculation about how awareness of the shifts in religious preferences caused by human capital could affect the strategic behavior of the leadership of various

low, indicating that the treatment effects are not primarily driven by factors common for classmates, for example, by Pentecostal churches specifically targeting and opening new churches in localities where respondents who received less treatment lived. Nevertheless, we acknowledge this evidence is only indirect and to the best of our knowledge there is no database of churches, their location and date of establishment, which would allow us to test more directly whether new Pentecostal churches are targeting disadvantaged localities.

denominations. If church leaders were aware that low levels of education and living standards make individuals more likely to move from Traditional Christian churches to Pentecostal churches, they may face different incentives to invest in clinics, schools and other components of the social safety net that promote living standards. In particular, the findings may help to explain why Catholic and Anglican churches are seen as taking the lead in supporting education and health programs in Africa, including building schools, clinics and organizing child sponsorship programs, while Pentecostal churches are much less active in organized economic development programs (Gifford 2016). The relative lack of concern among Pentecostal leaders about structural barriers to economic growth (Gifford 2016) may in part originate in fears that rising education and living standards will stymie their church's own growth: recall that (Auriol et al. 2020) found that providing greater access to insurance products among Pentecostal members in Ghana led to a reduction in their church contributions.

While the micro-empirical approach we take in this study has some advantages, most importantly in allowing us to exploit the randomized deworming experiment, it does present several important limitations. First and foremost, changes in religious practice occur not just at the individual level but also in terms of the broader norms and expectations of society as a whole. We are unable to examine how human capital changes at the aggregate level – say, for Kenya as a whole – are affecting the evolution of religious practice, identity and religiosity. Other studies that examine city-wide or regional variation in education policies may be more promising approaches to gauge these changes (Gulesci and Meyersson 2016; Hungerman 2014; Becker, Nagler, and Woessmann 2017). Finally, while the 20-year longitudinal dataset we exploit is unusually rich for an individual panel survey, two decades is a short timeframe in the evolution of religious and cultural norms, and as such longer-term data will be needed to continue to assess these changes in

Kenyan and other societies. That said, the rapid changes we document since 1998 in Kenya are noteworthy and suggest that a massive realignment of religious identity is already well underway.

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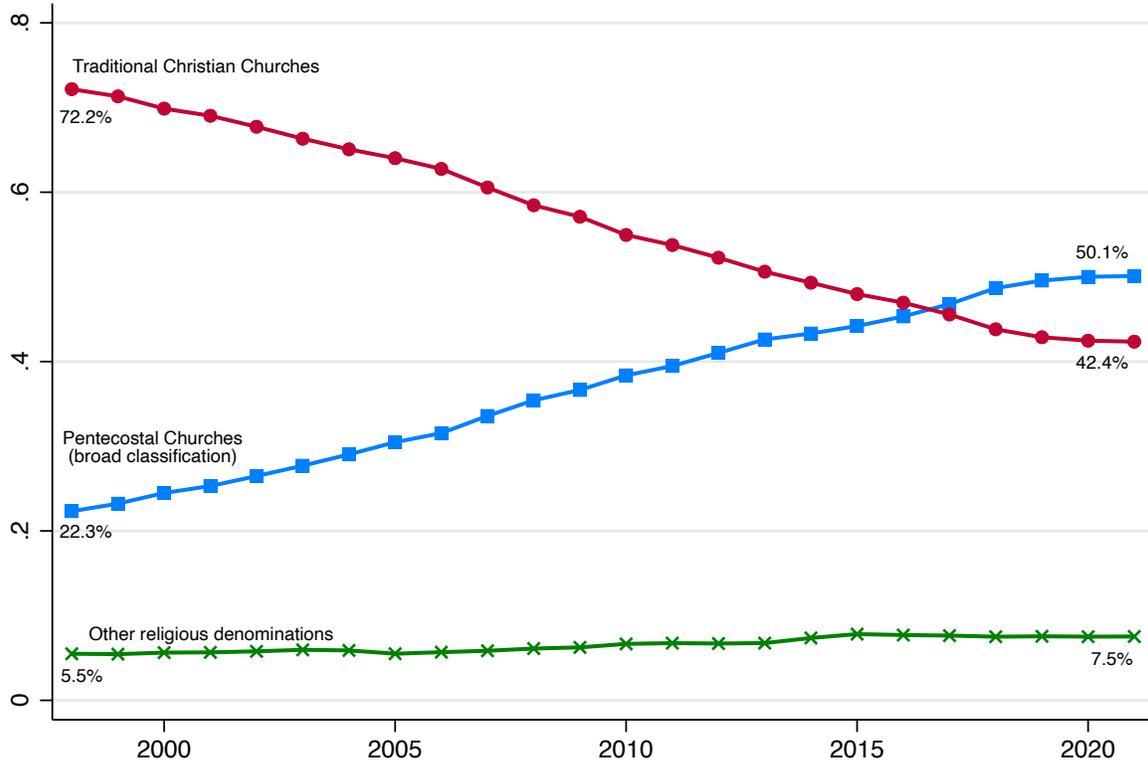
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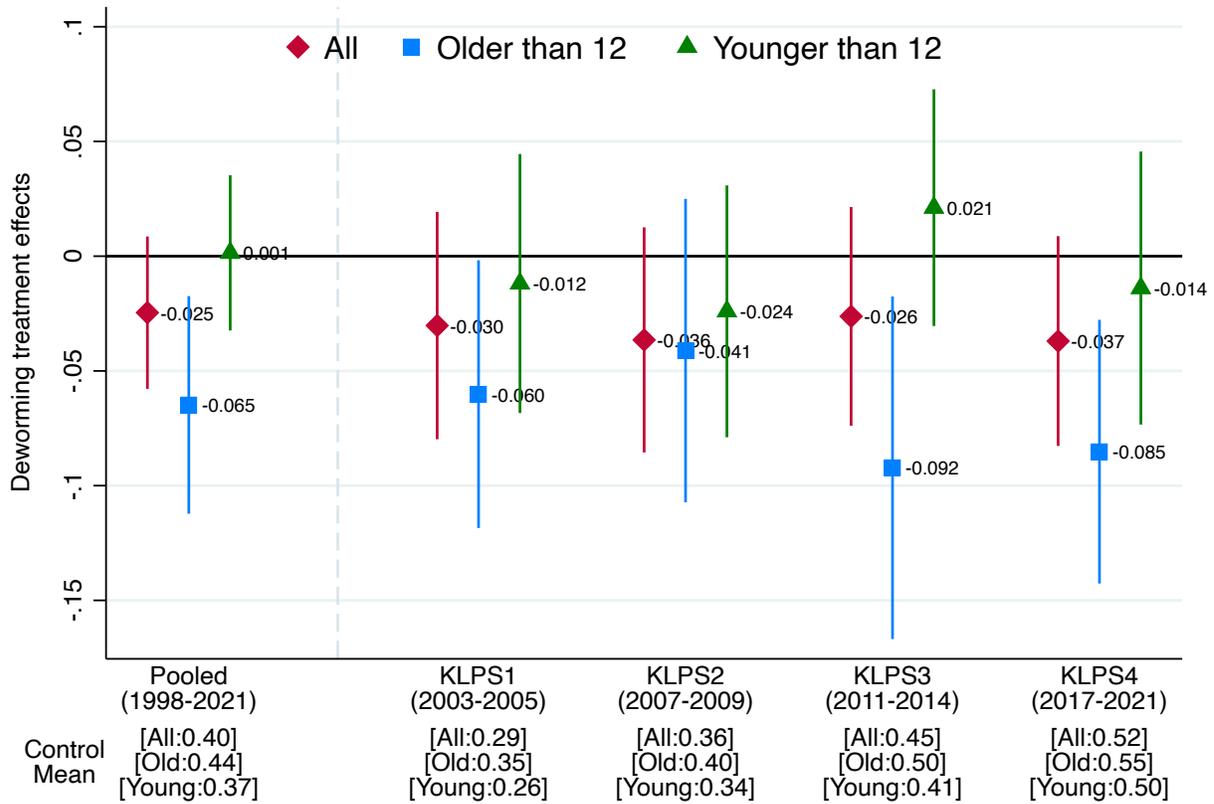
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Figure 1: Development of the share of respondents affiliated with Traditional Christian, Pentecostal and Other religious denominations



Notes: This figure plots the share of members of Traditional Christian Churches, Pentecostal Churches and Other religious denominations from 1998 to 2021. Using data collected in KLPS-1, KLPS-2, KLPS-3 and KLPS-4 on current religious denomination as well as history of religious conversions in the five years preceding the survey, we construct a yearly measure of the share of respondents belonging to each denomination. “Traditional Christian Churches” includes the Catholic and Protestant Anglican denominations. “Pentecostal Churches” includes churches that belong to one of the historically large Pentecostal denominations as well as newer and typically smaller churches closely resembling Pentecostalism. “Other religious denominations” include other Christian churches that are neither traditionally dominant in Kenya nor part of the Pentecostal movement (e.g., Baptists, Methodists, Jehovah’s Witnesses, Seventh Day Adventists, etc.), as well as followers of Islam and traditional local religions. For a more granular list of religious denominations and more details on classification, see Table A4.

Figure 2: The effects of the deworming treatment on the likelihood of being a member of Pentecostal churches, across the four survey rounds



Notes: This figure plots estimated deworming treatment effects by survey round on the choice of religious denomination. The dependent variable is being a member of Pentecostal churches (conservative classification), which is an indicator variable equal to one if the last reported religious denomination fell into this category. The whiskers denote 95% confidence intervals. The estimation strategy and the set of control variables is the same as in Table 3. For each wave, we report estimates for (i) all observations (red diamond), (ii) the sub-sample of respondents who were older than 12 years at baseline (blue square) and (iii) the sub-sample of respondents who were 12 years old or younger at baseline (green triangle). Tables A9-11 present the regression results in detail.

Table 1: Church Affiliation difference in view on gender roles, consumption of substance, political views, and trust in others

Variable	Pentecostal (broad classification)		Traditional Christian		Pairwise t-test	
	N	Mean/(SE)	N	Mean/(SE)	N	Mean difference
Panel A: Views about gender roles						
Female can be mechanic	2119	0.907 (0.005)	1788	0.92 (0.005)	3907	-0.013*
Male should make family decisions	2119	0.603 (0.009)	1789	0.562 (0.01)	3908	0.041***
Husband should help with chores	2118	0.785 (0.007)	1788	0.799 (0.008)	3906	-0.014
Female should be encouraged to join elections	2119	0.904 (0.006)	1789	0.922 (0.006)	3908	-0.018**
Female should be subject to traditional laws	2118	0.103 (0.006)	1790	0.105 (0.006)	3908	-0.002
Husband has the right to beat wife	2119	0.113 (0.006)	1790	0.102 (0.007)	3909	0.012
Panel B: Consumption of tobacco and alcohol						
Consumed tobacco last 7 days	2067	0.036 (0.004)	1743	0.055 (0.005)	3810	-0.019***
Amount of alcohol last 7 days (Trimmed Top)	1973	0.192 (0.02)	1634	0.611 (0.04)	3607	-0.419***
Panel C: Political views						
Participated in political rallies lst 12 mth	2119	0.086 (0.006)	1790	0.104 (0.007)	3909	-0.019**
Participated in demonstrations lst 12 mth	2119	0.013 (0.002)	1790	0.016 (0.003)	3909	-0.003
Discussed about politics lst 12 mth	2119	0.235 (0.009)	1790	0.299 (0.011)	3909	-0.064***
Voted in the 2017 election	2119	0.825 (0.008)	1790	0.846 (0.009)	3909	-0.021*
Democracy is preferable	2119	0.803 (0.007)	1790	0.827 (0.007)	3909	-0.024**
Politics are very important	2119	0.423 (0.008)	1790	0.472 (0.008)	3909	-0.049***
Leaders should be chosen through elections	2117	0.947 (0.003)	1790	0.952 (0.004)	3907	-0.004
Panel D: Trust						
Can trust most people	2119	0.048 (0.005)	1790	0.05 (0.005)	3909	-0.002
Can trust fellow tribe members	2119	0.351 (0.01)	1790	0.361 (0.011)	3909	-0.011
Can trust other tribe members	2119	0.238 (0.009)	1790	0.261 (0.01)	3909	-0.023*
Can trust fellow church members	2119	0.588 (0.011)	1790	0.54 (0.012)	3909	0.048***
Can trust other church members	2118	0.344 (0.01)	1790	0.321 (0.011)	3908	0.023

Notes: This table reports a series of t-tests on gender roles, consumption of substance, political views, and trust of others, by church affiliation. The first column summarizes the Pentecostal (broad classification) church members' view and activities on gender roles, consumption of substance, political views, and trust of others. The second column measures the same variables for Traditional Church members. The third column conducts t-tests on the variables and measure if members of the Pentecostal (broad classification) church and members of the Traditional Church on average differ from each other in these variables. The variables are measured in KLPS4, and thus the table uses KLPS4 sample only. All variables, except alcohol consumption, are normalized into a range of 0-1 for easier comprehension.

Table 2: Human capital, the choice of religious denomination and religiosity: Descriptive evidence

	Traditional Christian (1)	Pentecostal (broad classification) (2)	Pentecostal (conservative classification) (3)	Religiosity (index) (4)
<i>Panel A: Sample - all participants</i>				
Education (years)	.177***	-.165***	-.125***	.073***
Raven's test score	.089***	-.075***	-.053***	.040***
Father's education (years)	.124***	-.104***	-.070***	.010
Mother's education (years)	.116***	-.101***	-.055***	.004
Total earnings (USD)	.088***	-.090***	-.044***	-.015
<i>Panel B: Sample - older participants</i>				
Education (years)	.163***	-.150***	-.116***	.078***
Raven's test score	.068***	-.050***	-.037**	.027
Father's education (years)	.108***	-.079***	-.066***	.018
Mother's education (years)	.121***	-.088***	-.041**	.015
Total earnings (USD)	.116***	-.115***	-.080***	-.017
<i>Panel C: Sample - younger participants</i>				
Education (years)	.185***	-.176***	-.129***	.065***
Raven's test score	.099***	-.090***	-.060***	.045***
Father's education (years)	.132***	-.121***	-.069***	-.002
Mother's education (years)	.107***	-.108***	-.060***	-.011
Total earnings (USD)	.069***	-.072***	-.018	-.014

Notes: This table reports pairwise correlation coefficients between relevant measures of human capital and living standards and the main outcomes of interest using data pooled across KLPS-3 and KLPS-4. Panel A reports the correlations for the full sample. Panel B reports estimates for the sub-sample of respondents who were older than 12 years at baseline. Panel C reports estimates for the sub-sample of respondents who were 12 years old or younger at baseline. Education is calculated as respondent's years of schooling measured in KLPS-3. The Raven's test score is the result of a standard Raven's matrix test the respondents took in KLPS-3. Father's and mother's education measure the highest years of schooling attained by each parent. Total earnings are annual amounts calculated as the sum of wage employment across all jobs, non-agricultural self-employment profit across all business, and individual farming profit. Pentecostal Churches (both broad and conservative classifications) and Traditional Christian Churches are survey-round varying indicator variables equal to one if the last reported religious denomination fell into the corresponding category. Online Appendix C provides additional details on the construction of variables. * denotes significance at 10%, ** denotes significance at 5%, and *** denotes significance at 1%.

Table 3: The effect of the deworming treatment on the choice of religious denomination and religiosity

	Human Capital		Religious Identity				Religiosity Index	
	Educational Attainment	Annual individual earnings	Traditional Christian	Pentecostal (broad classification)	Pentecostal (conservative classification)	Share of time in Pentecostal (broad classification)	Share of time in Pentecostal (conservative classification)	Religiosity (index)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Sample - all participants								
Deworming treatment	.258 (.173)	124.114** (57.570)	.034 (.020)	-.025 (.017)	-.020 (.012)	-.028 (.017)	-.022* (.012)	-.011 (.025)
Control Mean	9.30	1026.66	.53	.40	.25	.38	.25	-.00
Control SD	2.90	-	.50	.49	.44	.46	.4	.97
Treatment Effect (%)	2.77	12.09	6.39	-6.12	-7.71	-7.24	-8.85	-
R-squared	.09	-	.06	.05	.06	.06	.06	.03
Number Individuals	4588	-	6740	6740	6740	6740	6740	5823
Number Observations	4588	12929	18958	18958	18958	18958	18958	10713
Panel B: Sample - older participants								
Deworming treatment	.449*** (.157)	250.085*** (83.433)	.073*** (.027)	-.065*** (.024)	-.064*** (.018)	-.077*** (.026)	-.072*** (.017)	-.051 (.042)
Control Mean	8.34	1060.28	.48	.45	.29	.43	.29	-.00
Control SD	2.60	-	.50	.50	.45	.47	.42	1.00
Treatment Effect (%)	5.38	23.59	15.27	-14.43	-22.18	-17.90	-25.23	-
R-squared	.25	-	.06	.05	.06	.06	.07	.05
Number Individuals	1938	-	2917	2917	2917	2917	2917	2496
Number Observations	1938	5468	7926	7926	7926	7926	7926	4588
Panel C: Sample - younger participants								
Deworming treatment	.044 (.208)	39.326 (64.032)	.008 (.022)	.001 (.017)	.008 (.013)	.004 (.017)	.009 (.012)	.011 (.032)
Control Mean	9.98	1004.29	.56	.37	.23	.35	.22	.00
Control SD	2.92	-	.50	.48	.42	.45	.38	.95
Treatment Effect (%)	.44	3.92	1.36	.39	3.51	1.09	4.11	-
R-squared	.17	-	.06	.06	.07	.07	.07	.03
Number Individuals	2650	-	3823	3823	3823	3823	3823	3327
Number Observations	2650	7461	11032	11032	11032	11032	11032	6125

Notes: This table reports treatment effects for numerous outcomes, using data pooled across KLPS-1, KLPS-2, KLPS-3, and KLPS-4 unless otherwise indicated. In Column 1, the dependent variable is educational attainment, measured in years of schooling at KLPS-3. In Column 2, the dependent variable is annual individual earnings (measured at KLPS-2, KLPS-3, KLPS-4), calculated as the sum of wage employment across all jobs, nonagricultural self-employment profit across all business, and individual farming profit. Columns 3-7 report treatment effects on religious identity. Pentecostal (broad and conservative) and Traditional Christian are survey-round varying indicator variables constructed using data pooled across KLPS-1, KLPS-2, KLPS-3 and KLPS-4. Each indicator variable is equal to one if the last reported religious denomination fell into the corresponding categorization. For a more granular list of religious denominations reported by respondents and more details on classification, see Table A4. The share of time in Pentecostal (broad and conservative classification) is computed as the share of the five years preceding each survey date in which the respondent belonged to a Pentecostal denomination. Both variables are built from information collected in KLPS-1, KLPS-2, KLPS-3 and KLPS-4. In Column 8, the dependent variable is a religiosity index constructed as the sum of the standardized values of answers to a set of seven questions (importance of religion in life, importance of religious identity, changes in religiosity in the past year, regular church attendance, recent church attendance, monetary and labor donations to church). Since four questions from this set were added to the survey in the middle of KLPS-2, Column 8 uses data from KLPS-2 (wave 2), KLPS-3 and KLPS-4. Deworming treatment is an indicator variable equal to one for PSDP worm groups 1 and 2, which received additional 2.4 years of deworming, on average, compared to group 3. Online Appendix C provides additional details on variable construction and question wording. Panel A reports the overall treatment effects for the full sample. Panel B reports estimates for the subsample of respondents who were older than 12 years at baseline. Panel C reports estimates for the subsample of respondents who were 12 years old or younger at baseline. Covariates follow (Hamory et al. 2021) and include controls for baseline 1998 primary school population, geographic zone of the school, survey wave, month and year of interview, a female indicator variable, baseline 1998 school grade fixed effects, the average school test score on the 1996 Busia District mock examinations, total number of primary school pupils within 6 km, and a cost-sharing school indicator. Those treated in a separate vocational training intervention (Technical and Vocational Vouchers Program, VocEd) which occurred prior to KLPS-3 are dropped from the KLPS-3 and KLPS-4 samples. Those treated in a separate small grant intervention (Startup Capital for Youth, SCY) which occurred after KLPS-3 are dropped from the KLPS-4 sample. Observations are weighted to be representative of the original PSDP population, and include KLPS population weights, SCY and VocEd control group weights, and KLPS intensive tracking weights. Standard errors are clustered at the 1998 school level. * denotes significance at 10%, ** denotes significance at 5%, and *** denotes significance at 1%.

Online Appendix for

Human Capital Affects Religious Identity: Causal Evidence from Kenya

Livia Alfonsi, Michal Bauer, Julie Chytilová, Edward Miguel

This PDF file includes:

Online Appendix A: Pentecostalism

Online Appendix B: Experimental design and sample

Online Appendix C: Wording of questions and construction of variables

Online Appendix D: Estimating the causal impacts: identification strategy

Online Appendix E: Expert survey: More details about design and results

Figures A1-A6

Tables A1-A18

ONLINE APPENDIX A

PENTECOSTALISM

Pentecostalism is a form of Protestant Christianity that emphasizes the direct experience of the presence of God by the believer. Pentecostalism is not a single church, but a movement that involves different churches with similar practices. It is highly decentralized and comprises hundreds of independent churches. The term Pentecostal is derived from a key event in the life of the early Christians: on the day of Pentecost, the Holy Spirit descended on the followers of Jesus Christ, leading them to speak in many languages as evidence that they had been baptized in the Spirit. Pentecostal churches take a variety of forms, including small village churches, places of worship in shopping malls or at taxi-stands, as well as mega churches, the largest one being The Hand of God Cathedral of Salvation Ministries in Nigeria with an auditorium of 120,000 seats. Often it is difficult to recognize at first glance whether a church is Pentecostal because of the movement's decentralization and as many churches do not include the word "Pentecostal" in their name.

Beliefs and practices

In contrast with traditional Christianity, in which religious life is mostly understood as an investment into one's *after life*, in Pentecostalism individuals' relationship with the spiritual world is believed to affect *everyday life*. The relationship with God is very direct, personal and "this-worldly" (Gifford 2009). The members of Pentecostal churches believe they are driven by the power of God moving within them. A key requirement of Pentecostalism is that one be "born again". In such spiritual rebirth, the believers are regenerated by the work of the Holy Spirit and many claim to have a personal relationship with Jesus Christ. Some scholars describe Pentecostalism as "miraculous religiosity" since it is based on the conviction that extraordinary phenomena, such as healings described in the Bible, could occur to believers in the 21st century, similarly to the times of the Apostles (Kobyliński 2017). In contrast to Calvinism, another major branch of Protestantism, which taught that a predestined select few would be saved, Pentecostalism emphasizes that salvation is available to everyone (Synan 1997). The direct experience of God is revealed by gifts of the Spirit such as speaking in tongues (a vocal phenomenon when believers vocalize fluent, unintelligible utterances or articulate a natural language previously unknown to them), prophecies, divine

healings and miracles. Spirits are believed to be responsible for many types of misfortune, including illness, poverty, hunger, reproductive health problems and business failure.

Pentecostals believe that a Christian is destined for success in every aspect of life, but that there are obstacles that originate in the spiritual world. The churches promise to help their followers to overcome those obstacles and achieve their divine right, by participating in divine rituals and by contributing to their church financially.

Compared to traditional Christian churches, Pentecostal worship is substantially less formal and more emotionally expressive. The church services often include experiencing the gifts of the Spirit, such as divine healings and speaking in tongues. Participants worship not only with their minds, but also with their body. The worshippers are actively involved, they often dance and clap, respond to sermon with applause, in some churches with shouts of amen and hallelujah. Sermons rely more on stories and less on textual analysis. The resulting atmosphere in the church is supposed to feel like the service is actually led by the Spirit as participants experience their direct relationship with God.

One potential explanation behind the success of Pentecostal churches in Africa is that Pentecostalism adapts easily to local traditional beliefs and practices. Earlier forms of Christianity transported to Africa mostly from Europe largely ignored prevalent African traditional beliefs in spirits and demons and left explaining every-day life events to science. In contrast, Pentecostalism is similar to many African traditional beliefs in its strong focus on the important role of spirits in every-day life (Freeman 2015). In many traditional African religions, spirits have powers to shape human life and religion offers ways to eliminate negative spiritual forces. Gifford (2016) and other scholars argue that pastors of Pentecostal churches have often started to replace the traditional healers and shamans in dealing with negative spirits. Besides their congruence with traditional beliefs, Pentecostal churches are also open to adapting to local culture, for example, by incorporating local music into worship.

Differences in beliefs and practices between Catholic and Pentecostal churches are also reflected in their understanding of the sources of and ways to address poverty (Gifford 2009, 2016). In traditional Christianity, poverty and individual misfortunes are perceived to be outcomes of structural problems, such as a lack of access to educational and health care facilities. This may explain why mission-based churches in Africa have been involved in building schools and hospitals, provision of microcredit and other services. In contrast, Pentecostalism attributes responsibility for poverty and misfortunes to spiritual powers and demons who operate and affect individual well-being on daily basis. This may explain why Pentecostal churches do not tend to organize large-scale development projects, but instead encourage individual members to start businesses and aim for personal success (Freeman 2015).

History and prevalence

Pentecostalism emerged in the early 20th century in the United States. Its founders expected God to spiritually renew the Christian church. In 1900, Charles Parham, an evangelist and faith healer started to teach that speaking in tongues was an evidence of Spirit baptism. One of his students and a preacher, William J. Seymour, founded the three-year-long Azusa Street Revival. During this event, large crowds gathered in the streets of Los Angeles to attend spontaneous worship with services going almost around the clock. People preached and testified as moved by the Spirit, spoke and sung in tongues, the sick were reportedly healed and sinners received salvation. The revival attracted both religious and secular media attention and resulted in the growth of Pentecostalism throughout the United States and the rest of the world as participants brought their experience to their home areas and it spread.

Initially, the Pentecostal movement experienced only slow or moderate levels of growth. The dynamics sharply changed in the second half of the 20th century when the movement started to expand rapidly and the process has further intensified in the last few decades (Kobyliński 2017). The phenomenal uptake of Pentecostalism is commonly described as “the largest global shift in the religious market place” in recent years (Martin 2002) and a “New Reformation” which, according to numerous commentators, may have larger social consequences than the 16th century European Reformation (Brown 2011). In the beginning of the 21st century, Pentecostalism had more than 580 million adherents worldwide (Blumhofer 2006), and thus was the largest Christian denomination after Catholicism. According to some estimates, the predicted number of Pentecostals in 2025 would reach one billion, most located in Africa, Latin America and Asia (McClung 2006). The influence of the Pentecostal movement can also be seen in the responses of traditional Christian churches, which are increasingly adopting beliefs and practices similar to Pentecostalism, a trend that is commonly referred to as the Charismatic movement (The Pew Forum on Religion and Public Life 2006).

One of the first regions outside the US affected by the movement was Africa, where Pentecostal missionaries were established in Liberia (in 1907) and South Africa (in 1908). Although Pentecostalism has been present in Africa since the beginning of the 20th century, it began to grow massively since 1980s, similar to other world regions (Freeman 2015). The process includes both the spread of larger trans-national Pentecostal churches and formation of many local autonomous churches with similar beliefs and practices as Pentecostal churches. The boom of new Pentecostal and Pentecostal-like churches is documented by the statistics from Kenya, which requires registration of new churches. In 2007, the country had 8,520 registered churches, with 6,740 applications pending and 60 new applications filed every month (Gifford 2008).

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ONLINE APPENDIX B

EXPERIMENTAL DESIGN AND SAMPLE

This section draws heavily on descriptions of the experimental design and sample provided in earlier papers studying the effects of the PSDP deworming intervention on economic, education and health outcomes (see Miguel and Kremer 2004; Baird, Hicks, Kremer, and Miguel 2016; Hamory, Miguel, Walker, Kremer, and Baird 2021).

The deworming project

The primary study area is Busia District, a largely agrarian region in western Kenya that is fairly representative of rural Kenya in terms of living standards.

In 1998 the non-governmental organization International Child Support (ICS) launched the Primary School Deworming Program (PSDP) in two divisions of the district, in 75 primary schools with a total of 32,565 pupils. Parasitological surveys indicated that baseline helminth infection rates were over 90% in these areas. Using modified WHO infection thresholds, over one third of the sample had moderate-heavy infections with at least one helminth, a high but not atypical rate in African settings.

The schools were experimentally divided into three groups (Groups 1, 2, and 3) of 25 schools each: the schools were first stratified by administrative sub-unit (zone), zones were listed alphabetically within each geographic division, and schools were then listed in order of pupil enrollment within each zone, with every third school assigned to a given program group. Table A1 shows that the three groups were well-balanced along baseline characteristics. Due to ICS's administrative and financial constraints, the schools were phased into deworming treatment during 1998-2001: Group 1 schools began receiving free deworming in 1998, Group 2 schools in 1999, and Group 3 in 2001. Children in Group 1 and 2 schools were thus assigned 2.41 more years of deworming than Group 3 children on average, and these early beneficiaries are the treatment group in the analysis. Take-up rates were approximately 75% in the treatment group and 5% in the control group. See Figure A4 for project details.

The Kenya Life Panel Survey (KLPS) data

The Kenya Life Panel Survey was launched in 2003 to track a representative sample of approximately 7,500 respondents enrolled in the PSDP schools at baseline. During round 1 (2003-2005), sample respondents were still mainly teenagers and few were active in the labor market. The subsequent survey rounds were collected in 2007-2009 (KLPS-2), 2011-2014 (KLPS-3) and 2018-2021 (KLPS-4). From the start, KLPS enumerators have traveled throughout Kenya and beyond to interview respondents (Figure A5). The spread of mobile phones in Kenya during the study period has greatly facilitated tracking, and as a result, the effective tracking rate has remained high across KLPS rounds (Table A13). In KLPS-4, the effective survey rates were 85% for the E+ Module (collecting largely economic and labor market data) and 87% for the I Module (collecting information on health, migration, attitudes, and religion, among other topics). Rates are similar and not statistically significantly different across the treatment and control groups, and the same holds by gender and among those above and below median age (specifically, baseline age 12). Notably, rates are similarly high and balanced in earlier rounds. In all, 88.1% of the KLPS sample was surveyed at least once during the 10, 15 or 20 year rounds.

Two other cross-cutting experiments are relevant for the analysis. First, in 2001 the NGO required cost-sharing contributions from parents in a randomly selected half of the Group 1 and Group 2 schools, reducing deworming drug take-up from 75% to 18%; Group 3 schools received free deworming treatment in 2001. In 2002-2003, the NGO again provided free deworming in all 75 schools. In the regression analysis, we control for this exogenous variation in exposure to deworming. Second, in early 2009, approximately 1,500 individuals in the KLPS sample additionally took part in a vocational training voucher RCT prior to the start of the KLPS-3, and a subset of these also took part in a randomized cash grant program prior to KLPS-4; 1,070 of these individuals were randomly selected to receive a training voucher and/or cash grant. To focus the present analysis on deworming impacts, and avoid possible interactions with other programs, these individuals are dropped from the analysis for survey rounds after their assignment to the other treatments. The randomly assigned voucher and cash control group (non-recipient) individuals are retained throughout, and given greater weight in the econometric analysis to maintain the representativeness of the original PSDP sample.

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ONLINE APPENDIX C

WORDING OF QUESTIONS AND CONSTRUCTION OF VARIABLES

#	QUESTION	OPTIONS
Q.1	Since January <i>#year_last_interview</i> , have you changed your religion or denomination?	Y/N
Q.2	(If yes) To what religion or denomination did you change immediately after <i>#religion_last_interview</i> ?	List of denominations with the option of specifying one non-listed
Q.3	In about what month and year did you change from <i>#prev_religion_name</i> to <i>#new_religion_name</i> ?	MM/YYYY
Q.4	After this religion or denomination, did you change to another religion or denomination?	Y/N
Q.5	Is your religion somewhat important, very important or not very important to your life?	Somewhat/Very/Not very
Q.6	Do you attend church / mosque regularly?	Y/N
Q.7	Did you attend church / mosque last week?	Y/N
Q.8	In the past 30 days, what is the value of cash or goods you donated to your church / mosque?	KSH
Q.9	In the past 30 days, how many hours of time, outside of regular worship or bible study, have you donated to working for, helping or organizing in your church / mosque?	# Hours
Q.10	In the last 12 months, would you say you've become more religious, stayed the same, or become less religious?	More/Same/Less
Q.11	In the past 12 months, have you served as a pastor?	Y/N
Q.12	How often do you speak or pray in tongues?	
Q.13	When you attend religious services, how often do they include people speaking in tongues, prophesying, praying for miraculous or divine healings, or displaying physical signs of the spirit such as laughing and shaking?	Always/Frequently/Occasionally/Never
Q.14	Have you ever experienced or witnessed a divine healing of an illness or injury?	Y/N
Q.15	Have you ever given or interpreted prophecy?	Y/N
Q.16	Have you ever experienced or witnessed the devil or evil spirits being driven out of a person?	Y/N

READ: Please tell me if you completely agree, mostly agree, mostly disagree or completely disagree with the following statements.		
Q.17	God will grant material prosperity to all believers who have enough faith.	4 item Likert Scale
Q.18	God will grant good health and relief from sickness to believers who have enough faith.	
Q.19	Traditional religious beliefs have spiritual power.	
Q.20	Have you ever experienced or witnessed the spiritual power of traditional religious beliefs?	Y/N
Q.21	Are you saved?	Y/N
Q.22	Do you believe in afterlife?	Y/N
Q.23	We have spoken to many people and they have all described themselves in different ways. Some people describe themselves in terms of their language, religion, race, gender, and others describe themselves in economic terms, such as working class, middle class, or a farmer. Besides being a Kenyan (Ugandan), which specific group do you feel you belong to first and foremost?	1. Ethnicity/ Language 2. Religion 3. Class/ Occupation 4. Gender 5. Other (Specify)

DEPENDENT VARIABLES

Religious denomination

“Traditional Christian”: An indicator variable equal to one if the last reported religious denomination by a respondent was “Catholic” or “Anglican”. The variable was collected in KLPS-1, KLPS-2, KLPS-3 and KLPS-4.

“Pentecostal (broad classification)”: An indicator variable equal to one if the last reported religious denomination by a respondent was one of the denominations listed in Panel D of Table A4. The variable was collected in KLPS-1, KLPS-2, KLPS-3 and KLPS-4.

“Pentecostal (conservative classification)”: An indicator variable equal to one if the last reported religious denomination by a respondent was one of the denominations listed in Panel C of Table A4. The variable was collected in KLPS-1, KLPS-2, KLPS-3 and KLPS-4.

“Share of time in Pentecostal (broad classification)”: Share of the five years preceding each survey date in which the respondent belonged to a Pentecostal Denomination (broad classification). The variable is built from information collected in KLPS-1, KLPS-2, KLPS-3 and KLPS-4.

“Share of time in Pentecostal (conservative classification)”: Share of the five years preceding each survey date in which the respondent belonged to a Pentecostal Denomination (conservative classification). The variable is built from information collected in KLPS-1, KLPS-2, KLPS-3 and KLPS-4.

Religiosity

“Religiosity (index)”: We take the sum of the standardized values of the following components and re-standardize it:

- “Importance of religion in life”: A scale variable which takes value 3 for “Very Important”, 2 for “Somewhat Important” and 1 for “Not Important”. The variable was collected in KLPS-1, KLPS-2, KLPS-3 and KLPS-4.
- “Religion most important identity (after Kenyan)”: An indicator variable equal to one if religion is the most important identity beside being Kenyan. The variable was collected in KLPS-2 (Wave 2 only), KLPS-3 and KLPS-4.
- “Became more religious in past year”: A Scale variable which takes value 3 for “Become more religious”, 2 for “Stayed the same” and 1 for “Become less religious”. The variable was collected in KLPS-2 (Wave 2 only), KLPS-3 and KLPS-4.
- “Attends church regularly”: An indicator variable equal to one if the respondent attends church regularly. The variable was collected in KLPS-1, KLPS-2, KLPS-3 and KLPS-4.
- “Attended church last week”: An indicator variable equal to one if the respondent attended church last week. The variable was collected in KLPS-1, KLPS-2, KLPS-3 and KLPS-4.
- “Work donations to church”: A continuous variable which measures the number of hours donated in the form of work/help to the church. The variable was collected in KLPS-2 (Wave 2 only), KLPS-3 and KLPS-4.
- “Monetary donation to church”: A continuous variable which measures donations in monetary form (KSH)The variable was collected in KLPS-2 (Wave 2 only), KLPS-3 and KLPS-4.

TREATMENT VARIABLE

“Deworming treatment”: An indicator variable equal to one for PSDP worm groups 1 and 2, which received an additional 2.4 y of deworming, on average, compared to group 3.

MEASURES OF HUMAN CAPITAL AND LIVING STANDARDS

“Education (years)”: The variable measures the number of respondent’s years of Education by 2011. The variable uses KLPS-3 data.

“Raven’s test score”: The variable measures the score from a standard Raven’s matrix test. The variable uses KLPS-3 data.

“Father’s education (years)”: The variable measures the highest years of schooling attained by the father of the KLPS respondent. Father’s highest educational attainment is first taken from KLPS-1 and then supplemented with KLPS-2, KLPS-3, and finally KLPS-4 when unavailable from a previous round.

“Mother’s education (years)”: The variable measures the highest years of schooling attained by the mother of the KLPS respondent. Mother’s highest educational attainment is first taken from KLPS-1 and then supplemented with KLPS-2, KLPS-3, and finally KLPS-4 when unavailable from a previous round.

“Total earnings (USD)”: Annual individual earnings are calculated as the sum of wage employment across all jobs; non-agricultural self-employment profit across all business; and individual farming profit, defined as net profit generated from non-crop and crop farming activities for which the respondent provided all reported household labor hours and was the main decision maker within the last 12 mo. Wage earnings and self-employment profits were collected in KLPS-2, KLPS-3, and KLPS-4; agricultural profits were collected in KLPS-3 and KLPS-4. All outcomes are converted to constant 2017 USD at PPP rates, and the top 1% of observations are trimmed.

CONTROL VARIABLES

In all regression analyses, we control for the following set of variables: controls for baseline 1998 primary school population, geographic zone of the school, survey wave, month and year of interview, a female indicator variable, baseline 1998 school grade fixed effects, the average school test score on the 1996 Busia District mock examinations, total primary school pupils within 6 km, and a cost-sharing school indicator. Those treated in a separate vocational training intervention (Technical and Vocational Vouchers Program, VocEd) which occurred prior to KLPS-3 are dropped from the KLPS-3 and KLPS-4 samples. Those treated in a separate small grant intervention (Startup Capital for Youth, SCY) which occurred after KLPS-3 are dropped from the KLPS-4 sample. Observations are weighted to be representative of the original PSDP population, and include KLPS population weights, SCY and VocEd control group weights, and KLPS intensive tracking weights.

ADDITIONAL VARIABLES

Religious practices (measured only in KLPS-4)

“Served as pastor”: An indicator variable equal to one if the respondent served as a pastor in last 12 months.

“Given or interpreted prophecy”: An indicator variable equal to one if the respondent has ever given or interpreted a prophecy.

“Experienced divine healing”: An indicator variable equal to one if the respondent has ever experienced or witnessed a divine healing of an illness or injury.

“Experienced devil drive out of a person”: An indicator variable equal to one if the respondent has ever experienced or witnessed the devil or evil spirits being driven out of a person.

“Experienced spiritual power of traditional beliefs”: An indicator variable equal to one if the respondent has ever experienced or witnessed the spiritual power of traditional religious beliefs.

“Prayed in tongues”: An indicator variable equal to one if the respondent has ever spoken or prayed in tongue.

“Religious services include speaking in tongues, prophesying, ...”: An indicator variable equal to one if the respondent has attended religious services that include people speaking in tongues, prophesying, praying for miraculous or divine healings, or displaying physical signs of the spirit such as laughing and shaking.

“Believes is saved”: An indicator variable equal to one if the respondent is saved.

“Believes in afterlife”: An indicator variable equal to one if the respondent believes in afterlife.

“God will grant material prosperity”: An indicator variable equal to one if the respondent completely agrees or mostly agrees that God will grant material prosperity to all believers who have enough faith.

“God will grant health”: An indicator variable equal to one if the respondent completely agrees or mostly agrees that God will grant good health and relief from sickness to believers who have enough faith.

ONLINE APPENDIX D

ESTIMATING CAUSAL IMPACTS: IDENTIFICATION STRATEGY

To estimate causal effects, we estimate the intention-to-treat (ITT) effect of the deworming treatment, i.e., the difference in outcomes for individuals randomly assigned to treatment schools and for individuals randomly assigned to control schools. We focus on ITT estimates because compliance with treatment was relatively high and untreated individuals in treatment schools were shown by previous research (Miguel and Kremer 2004) to experience gains, complicating estimation of treatment effects on the treated (TOT).

We estimate pooled regressions which use data from all four KLPS rounds to estimate the overall long-run effects of the deworming treatment. The estimation strategy builds on (Baird, Hicks, Kremer, and Miguel 2016) and (Hamory, Miguel, Walker, Kremer, and Baird 2021).

The dependent variable Y_{ijt} is an outcome for individual i in school j as measured in KLPS round

$$t: Y_{ijt} = \alpha + \lambda_1 T_j + \lambda_2 C_j + \lambda_3 P_j + X'_{ij,0} \beta + \varepsilon_{ijt}.$$

The outcome is a function of $T_j \in \{0,1\}$, the assigned deworming program treatment status of the individual's school. The main coefficient of interest is λ_1 , which captures gains for individuals in the treatment schools relative to the control schools. Since deworming was assigned by school rather than at the individual level, some of the gains in treatment schools are likely due to within-school externalities. Thus, the coefficient is a lower bound on the overall effect of deworming in the presence of cross-school treatment externalities, as shown in (Baird, Hicks, Kremer, and Miguel 2016). The vector $X_{ij,0}$ of individual and school covariates includes baseline school characteristics (average test score, population, number of students within 6 km, and administrative zone indicators), baseline individual characteristics (gender and grade), indicators for the KLPS survey calendar month, wave and round, and an indicator for the vocational training and cash grant control group. Estimates are weighted to maintain representativeness with the baseline population, taking into account the sampling for KLPS, the two-stage tracking methodology, and inclusion in the vocational training and cash grant program. Finally, ε_{ijt} is the error term clustered at the school level, allowing for correlation in outcomes both across individuals in those schools and across survey rounds. We also control for two secondary sources of exogenous variation in exposure to deworming, namely, the 2001 cost-sharing school indicator, $C_j \in \{0,1\}$, and the proportion of students in neighboring

schools within 6 km that received deworming, $P_j \in [0,1]$. We present the results for the entire sample and separately for older (baseline age greater than 12) and younger respondents.

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Hamory, Joan et al. 2021. “Twenty Year Economic Impacts of Deworming.” *Proceedings of the National Academy of Sciences* 118(14): e2023185118.

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

ONLINE APPENDIX E

EXPERT SURVEY: MORE DETAILS ON DESIGN AND RESULTS

The design of the expert survey study builds on influential recent papers on forecasting of future research results (DellaVigna and Pope 2018; Casey, Glennerster, Miguel, and Voors 2021). We elicited expectations of experts from various fields in the social sciences about the impacts of the deworming intervention on religiosity and choice of religious denomination.

The survey was implemented using an online survey platform (Qualtrics) between July and November 2019. A link to the survey, together with three subsequent reminders, was shared with 750 selected experts via their personal email. In particular, we invited a sample of researchers whose work is referenced in recent review articles published in leading overview journals in respective fields, Annual Reviews of Psychology/Sociology/Political Science and the Journal of Economic Literature (Bloom 2012; Emmons and Paloutzian 2003; Edgell 2012; Sherkat and Ellison 1999; Grzymala-Busse 2012; Gill 2001; Iannaccone 1998; Iyer 2016). In addition, we sought to include scholars from East Africa. In total, 155 experts answered the survey and provided their forecasts. The pool of experts we summoned encompassed international and East African experts on religion, across social sciences. Specifically, the sample of experts is composed of leading scholars and academics in the fields of Sociology (37%), Economics (32%), Political Science (12%), Anthropology and Psychology (12%) whose research interests include religion. Table A14 provides more information about the sample.

The forecasts elicitation was preceded by a brief explanation of the purpose of the study, background information about economic and human capital impacts of the deworming intervention found in previous work (Baird, Hicks, Kremer, and Miguel 2016), and descriptive information about the main religious denominations, importance of religion and religious practices.

The experts were asked to provide their expectations of the long-run effects of the deworming intervention, 15 years after it was implemented. For each outcome, they were asked to select their answer using a slider, on a scale from <-0.50 standard deviation units to >0.50 standard deviation units. We focus on six outcomes: importance of religion in life, prevalence of religious behavior and practices, religious conversions, conversions into Catholic Church, conversions into Protestant Anglican Church and conversions into Pentecostal churches. For the complete survey on the Open Science Framework (OSF), please click [here](#).

Distributions of expert responses are shown in Figure A6. We observe two main patterns. First, most experts expect small negative effects of the intervention on stated importance of religion in life and the prevalence of religious behaviors and practices, in line with the secularization hypothesis. Second, the expert survey does not indicate a clear collective prior belief about how the intervention would affect religious conversions. The experts' predictions vary substantially: approximately one third expected the deworming program not to change conversions from Traditional to Pentecostal churches, one third expected a positive effect and another third expected a negative effect. The expected effects (both positive and negative) are often relatively small in magnitude and, notably, they are broadly similar across scholars from different disciplines.

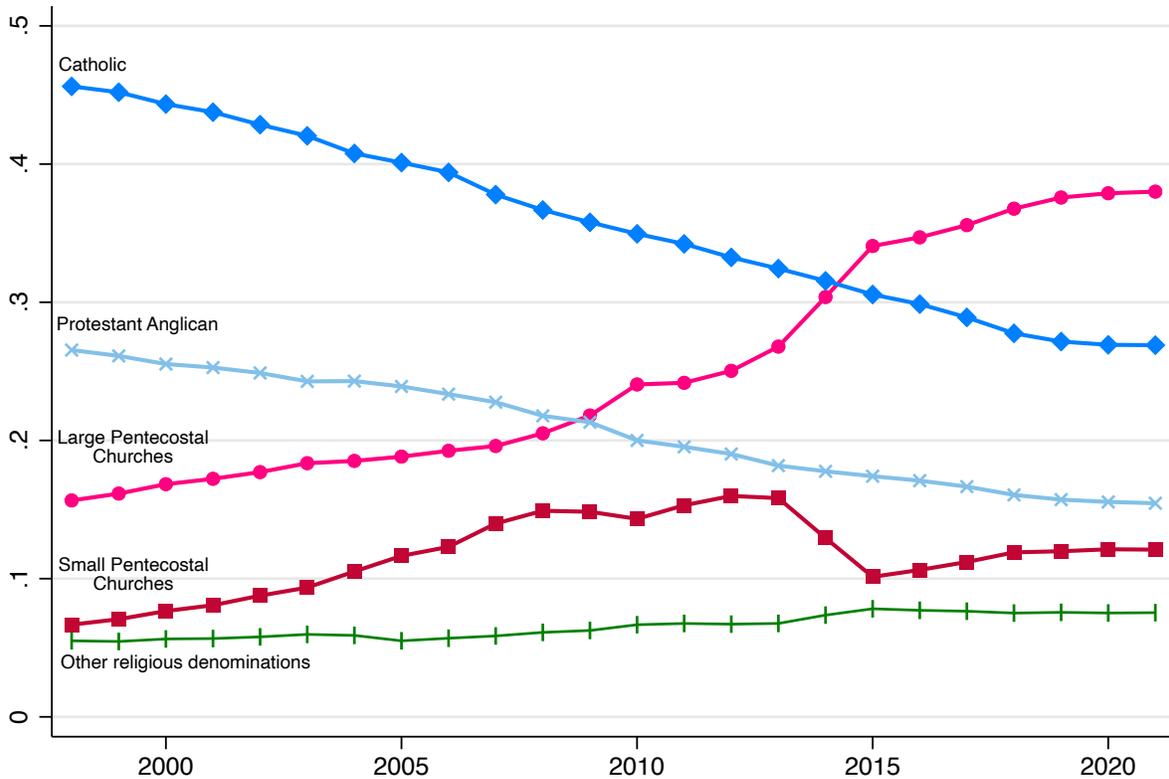
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APPENDIX FIGURES

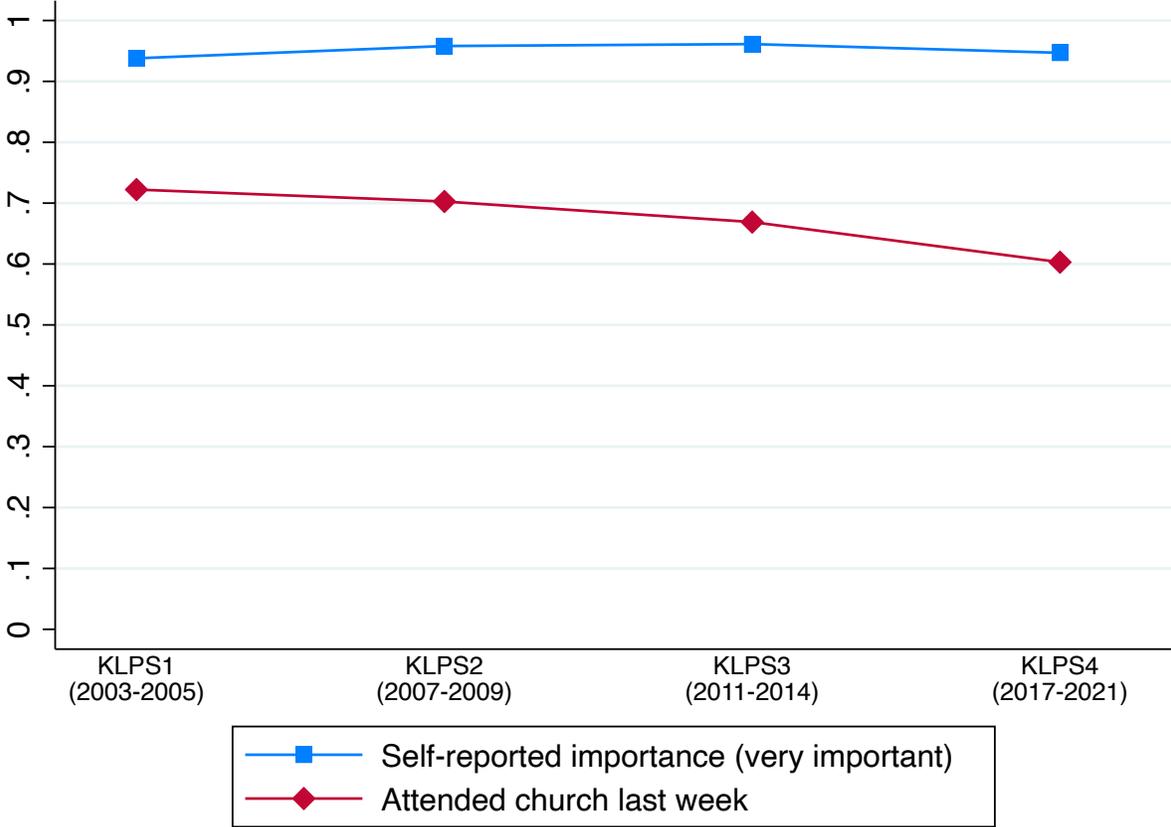
Figure A1: Development of the share of respondents affiliated with different religious denominations - more detailed classification



Notes: This figure plots the share of members of Catholic, Protestant Anglican, Large Pentecostal, Small Pentecostal and Other religious denominations from 1998 to 2021. The category labeled “Large Pentecostal Churches” is our conservative classification of Pentecostal churches and includes churches that belong to one of the historically large Pentecostal denominations (e.g., Church of God, Assembly of God Church, Pentecostal Church) and newer indigenous churches closely resembling Pentecostalism that have at least 140 members (e.g., Roho Church, Legio Maria Church). The category “Small Pentecostal Churches” includes many smaller churches that are more difficult to unambiguously classify and whose name and results of internet searches suggest that they likely belong to the Pentecostal movement (e.g., Voice of Salvation Church, Harvest Church, Miracle Church, among many others). “Other religious denominations” include other Christian churches that are neither traditionally dominant in Kenya nor part of the Pentecostal

movement (e.g., Baptists, Methodists, Jehovah’s Witnesses, Seventh Day Adventists, etc.), as well as followers of Islam and traditional local religions. For a more granular list of religious denominations reported by the respondents and more details about the classification, see Table A4.

Figure A2: Development of importance of religion and church attendance



Notes: This figure plots (i) the share of respondents who reported that religion is very important in their life (rather than answering that it is not very important or somewhat important), and (ii) the share of respondents who reported to attend church in the week prior to the survey.

Figure A3: The effects of the deworming treatment on the likelihood of being a member of Pentecostal churches (conservative classification), across the four survey rounds

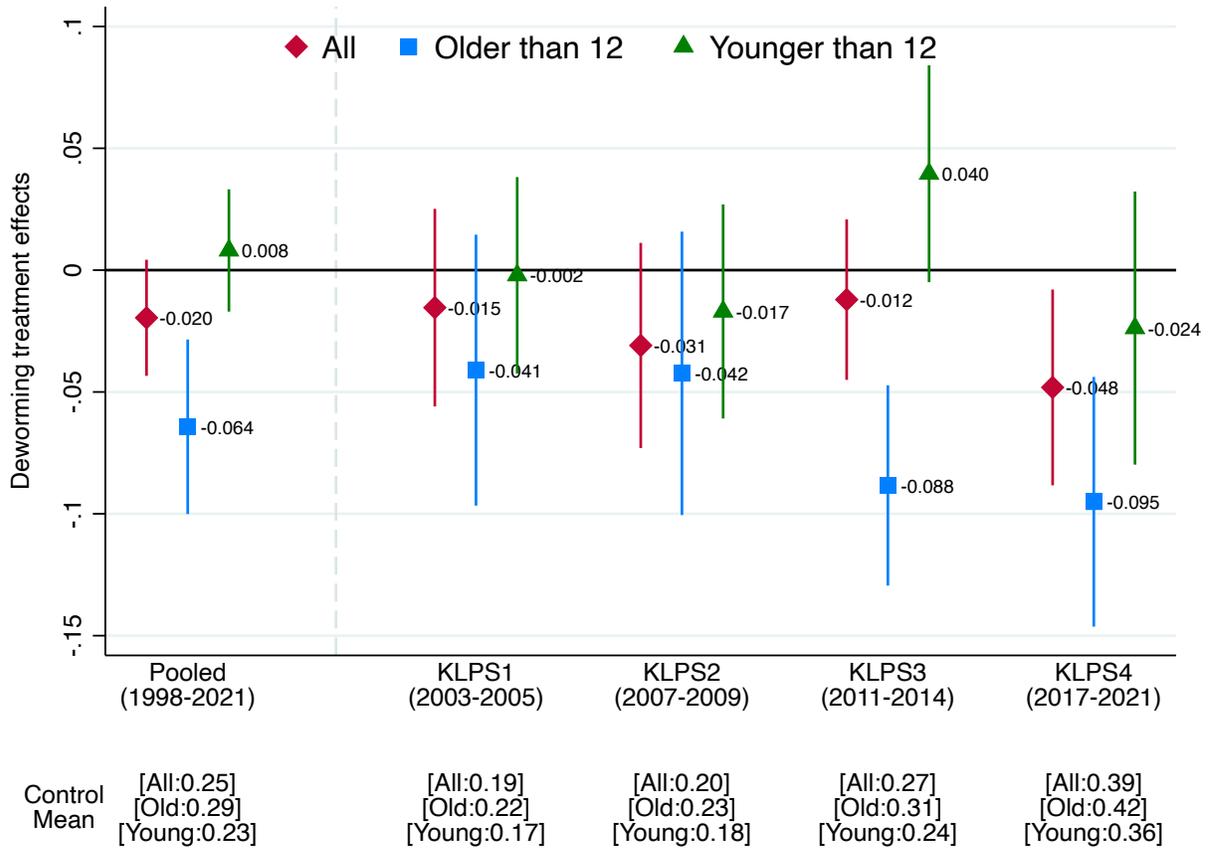


Figure A4: Project timeline of the Primary School Deworming Program (PSDP) and Kenya Life Panel Survey (KLPS)

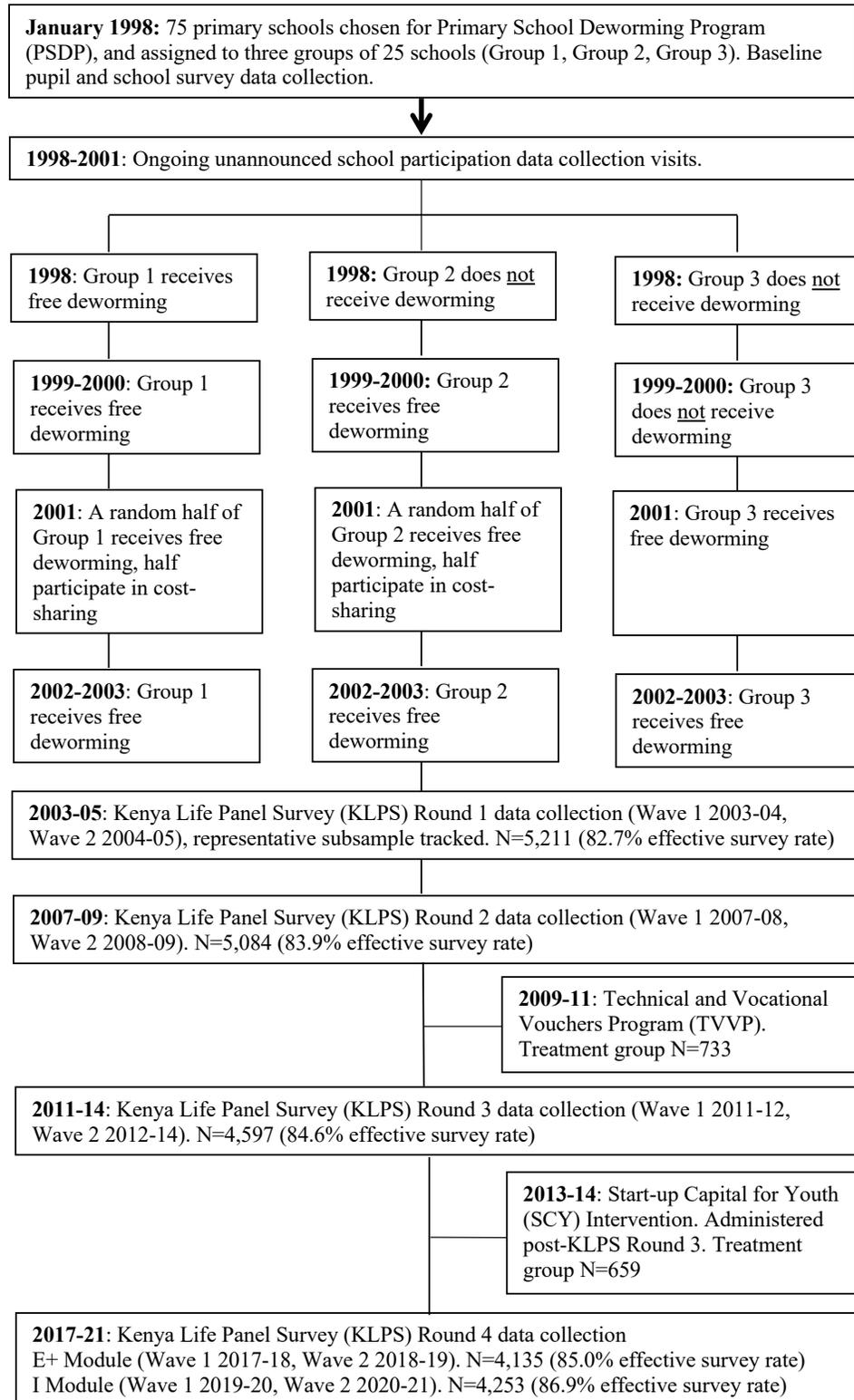
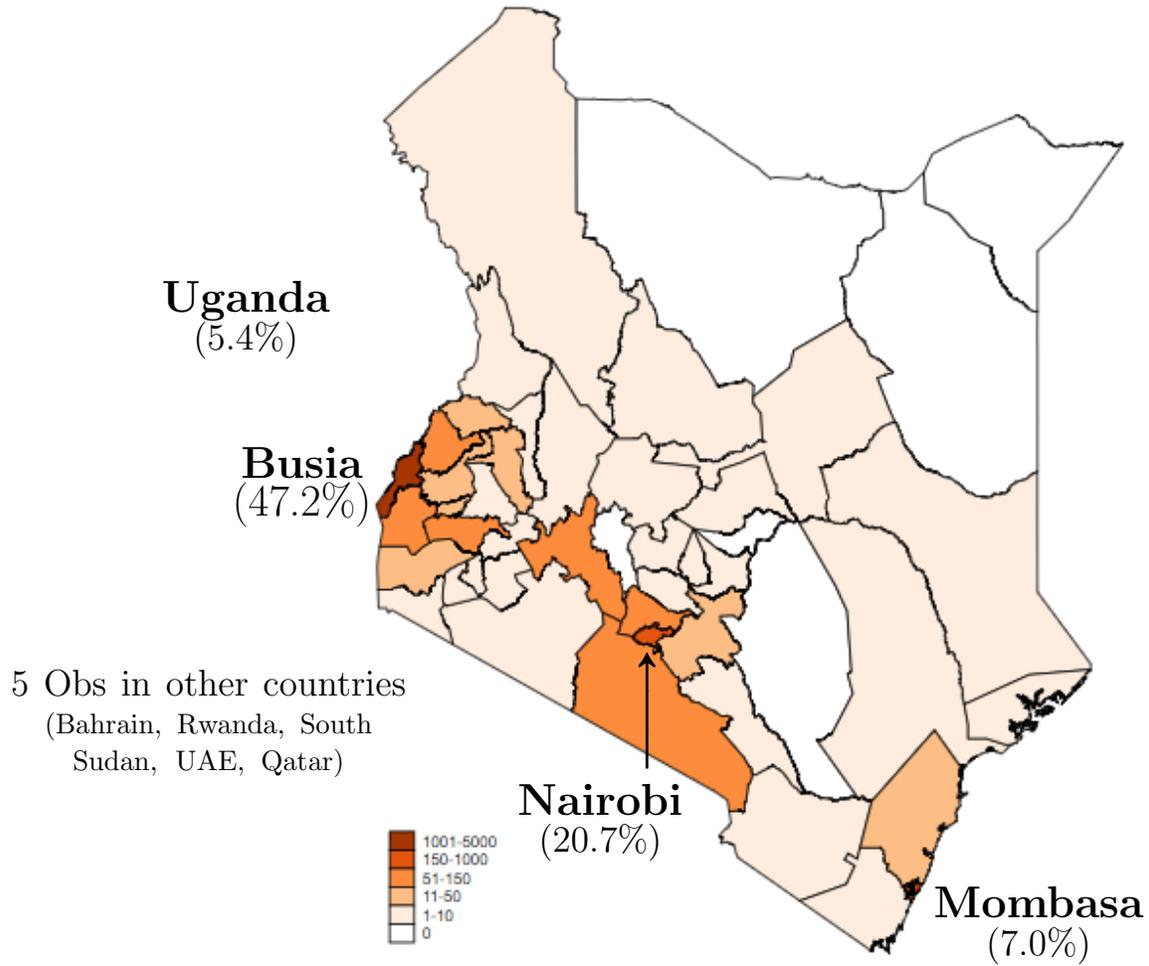
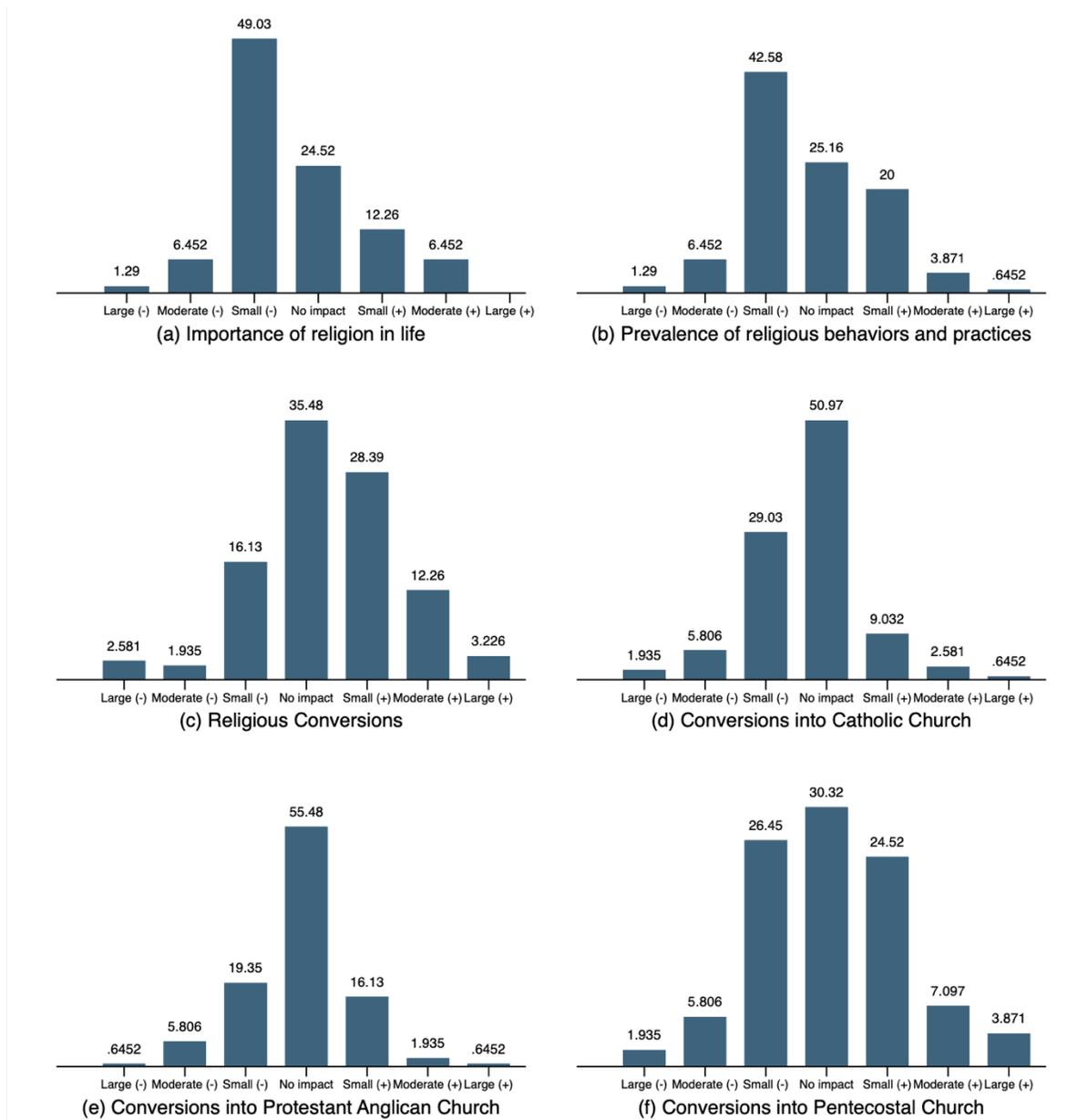


Figure A5: Residential location at the time of KLPS-4 I Module (2020-2021)



Notes: This figure plots the residential location at the time of the KLPS-4 I Module survey, conducted in 2020-21. All respondents attended primary school in Busia County in western Kenya. The figure presents the number of observations by Kenyan county that were surveyed in the KLPS-4 I Module. Observations are weighted to be representative of the original PSDP population, and account for KLPS population weights, SCY and VocEd control group weights, and KLPS-4 intensive tracking weights.

Figure A6: Experts' forecasts of the effects of the deworming treatment on religiosity and choice of religious denomination



Notes: The figure shows the distributions of expert responses when asked to provide their expectations of the long-run effects of the deworming intervention, for six outcomes of interest. Specifically, the experts selected their answer using a slider, on a scale from <-0.50 standard deviation units to >0.50 standard deviation units. We classify their expected effect as large positive (negative) if their selection falls above (below) $(-)0.3$; moderate positive (negative) if their prediction falls between $(-)0.2$ and $(-)0.3$ standard deviation units; small positive (negative) if their expected effect falls between $(-)0.05$ and $(-)0.2$; no impact if their prediction falls between -0.05 and 0.05

APPENDIX TABLES

Table A1: Average pupil and school characteristics (1998, Pre-treatment)

	Group 1 (25 schools)	Group 2 (25 schools)	Group 3 (25 schools)	Group 1 – Group 3	Group 2 – Group 3
<i>Panel A: Pre-school to Grade 8</i>					
Male	0.53	0.51	0.52	0.01 (0.02)	-0.01 (0.02)
Proportion girls < 13 years, and all boys	0.89	0.89	0.88	0.00 (0.01)	0.01 (0.01)
Grade progression (= Grade – (Age – 6))	-2.1	-1.9	-2.1	0.0 (0.1)	0.1 (0.1)
Year of birth	1986.2	1986.5	1985.8	0.4** -0.2	0.8*** -0.2
<i>Panel B: Grades 3 to 8</i>					
Attendance recorded in school registers (during the four weeks prior to the pupil survey)	0.973	0.963	0.969	0.003 (0.004)	-0.006 (0.004)
Access to latrine at home	0.82	0.81	0.82	0.00 (0.03)	-0.01 (0.03)
Have livestock (cows, goats, pigs, sheep) at home	0.66	0.67	0.66	0.00 (0.03)	0.01 (0.03)
Weight-for-age Z-score (low scores denote undernutrition)	-1.39	-1.40	-1.44	0.05 (0.05)	0.04 (0.05)
Blood in stool (self-reported)	0.26	0.22	0.19	0.07** (0.03)	0.03 (0.03)
Sick often (self-reported)	0.10	0.10	0.08	0.02 (0.01)	0.02* (0.01)
Malaria/fever in past week (self-reported)	0.37	0.38	0.40	-0.03 (0.03)	-0.02 (0.03)
Clean (observed by field workers)	0.60	0.66	0.67	-0.07** (0.03)	-0.01 (0.03)
<i>Panel C: School characteristics</i>					
District exam score 1996, grades 5-8	-0.10	0.09	0.01	-0.11 (0.12)	0.08 (0.12)
Distance to Lake Victoria	10.0	9.9	9.5	0.6 (1.9)	0.5 (1.9)
Pupil population	392.7	403.8	375.9	16.8 (57.6)	27.9 (57.6)
School latrines per pupil	0.007	0.006	0.007	0.001 (0.001)	0.000 (0.001)
Proportion moderate-heavy infections in zone	0.37	0.37	0.36	0.01 (0.03)	0.01 (0.03)
Group 1 pupils within 3 km	461.1	408.3	344.5	116.6 (120.3)	63.8 (120.3)
Group 1 pupils within 3-6 km	844.5	652.0	869.7	-25.1 (140.9)	-217.6 (140.9)
Total primary school pupils within 3 km	1229.1	1364.3	1151.9	77.2 (205.5)	212.4 (205.5)
Total primary school pupils within 3-6 km	2370.7	2324.2	2401.7	-31.1 (209.5)	-77.6 (209.5)

Notes: School averages weighted by pupil population. Standard errors in parentheses. Significantly different than zero at 99 (***) , 95 (**), and 90 (*) percent confidence. Data from the 1998 ICS Pupil Namelist, 1998 Pupil Questionnaire and 1998 School Questionnaire. 1996 District exam scores have been normalized to be in units of individual level standard deviations, and so are comparable in units to the 1998 and 1999 ICS test scores (under the assumption that the decomposition of test score variance within and between schools was the same in 1996, 1998, and 1999). "Group 1 pupils within 3 km" includes girls less than 13 years old, and all boys (those eligible for deworming in treatment schools).

Table A2: Religious practices and beliefs

	Served as pastor	Given or interpreted prophecy	Experienced divine healing	Experienced devil drive out of a person	Experienced spiritual power of traditional beliefs	Prayed in tongues	Religious services include speaking in tongues, prophesying, ...	Believes is saved	Believes in afterlife	God will grant material prosperity	God will grant health
Pentecostal	0.21	0.22	0.88	0.75	0.32	0.29	0.76	0.90	0.91	0.81	0.92
Traditional Christian	0.07	0.10	0.69	0.47	0.23	0.14	0.30	0.57	0.86	0.77	0.89
Other	0.16	0.15	0.77	0.56	0.25	0.15	0.36	0.65	0.84	0.74	0.87

Notes: Notes: This table reports the share of members in the Pentecostal, Traditional Christian and Other religious denominations who reported having adopted or experienced the specified religious practices or who hold the specified beliefs about God’s powers, the afterlife etc. Online Appendix C provides wording of the set of questions on religious practices and beliefs.

Table A3: Religious practices and beliefs – more detailed classification of churches

	Served as pastor	Given or interpreted prophecy	Experienced divine healing	Experienced devil drive out of a person	Experienced spiritual power of traditional beliefs	Prayed in tongues	Religious services include speaking in tongues, prophesying, ...	Believes is saved	Believes in afterlife	God will grant material prosperity	God will grant health
Pentecostal churches (conservative classification)	0.21	0.21	0.87	0.74	0.32	0.29	0.77	0.90	0.90	0.82	0.92
Pentecostal churches (broad classification)	0.20	0.23	0.90	0.78	0.31	0.29	0.75	0.93	0.92	0.81	0.92
Catholic	0.06	0.09	0.68	0.46	0.23	0.12	0.24	0.58	0.85	0.75	0.89
Protestant Anglican	0.08	0.13	0.72	0.49	0.22	0.18	0.40	0.53	0.86	0.81	0.89
Other	0.16	0.15	0.77	0.56	0.25	0.15	0.36	0.65	0.84	0.74	0.87

Notes: This table reports the share of members in the Catholic, Protestant Anglican, Large Pentecostal, Small Pentecostal and Other religious denominations who reported having adopted or experienced the specified religious practices or who hold the specified beliefs about God’s powers, the afterlife etc. Table A4 provides the list of religious denomination reported by the respondents and their classification into these categories. Online Appendix C provides wording of the set of questions on religious practices and beliefs.

Table A4: List of religious denomination reported by the respondents and their classification into Traditional Christian, Pentecostal and Other categories

<i>Panel A: Sample - all participants</i>		
	Share	Frequency
Traditional Christian	54.96	10419
Pentecostal Churches (broad classification)	38.78	7352
- Pentecostal (conservative classification)	24.40	4625
- Pentecostal (included in broad classification)	14.38	2727
Other	6.26	1187
<i>Panel B: Traditional Churches</i>		
	Share	Frequency
Anglican	20.37	3861
Catholic	34.59	6558
<i>Panel C: Larger Pentecostal Churches (included in conservative & broad classification)</i>		
	Share	Frequency
Pentecostal Church	9.58	1816
Roho Church	2.96	561
Gospel / New Testament / Injili Church	2.71	513
Apostolic or New Apostolic Church	2.63	498
Assembly of God Church	1.33	252
Church of Christ	1.31	248
Harvest Church / Center / Revival	1.24	235
Voice of Salvation Church	0.93	176
Legio Maria Church	0.86	163
Church of God	0.86	163
<i>Panel D: Smaller Pentecostal Churches (included only in the broad classification)</i>		
	Share	Frequency
Miracle Church / Center / Revival	0.78	147
Deliverance church	0.71	134
Hosana Church	0.60	114
NENO or Local Believers Church	0.49	93
Joe/Joy ministries	0.35	67
Redeemed Church	0.34	64
Glory Church	0.32	61
Jesus Restoration Gospel/Church/Center	0.31	59
PEFA (pentecostal Evangelical Fellowship of Africa)	0.24	45
Repentance and Holyness	0.23	43
Jesus power/Celebration centre	0.19	36
Maranatha	0.18	35
World everngelism fellowship and crusade church	0.18	34
Africa devine church	0.17	32
Peace gospel (PAG)	0.17	32
Kings outreach	0.15	28
AIC (african inland church)	0.13	25
Harvest miracle	0.13	24
Nabii Christian church	0.13	24
Nazerene church	0.13	24
World (wide) evangelism church	0.13	24
Divine church	0.12	22
Church of the lord	0.11	21
Bethel/Ministry/Temple	0.11	21
Rock /Reek Church	0.11	21
United Church	0.11	20
Phillip Ministry	0.10	19
Saints celebration center	0.10	19
River of life / Stream of life	0.09	18
Ushindi Baptict / Ushindi Church	0.09	18

(CONTINUED)

Endtimes church /belivers	0.09	17
Word of faith/fire	0.09	17
Episcopal	0.08	16
Zion/Temple/Zayuni	0.08	16
Musanda Church	0.07	14
Faith Ministry	0.07	13
Living gospel	0.07	13
CRISCO	0.07	13
Bethsaida church/Ministry/Temple	0.07	13
Calvary Church	0.07	13
Great Commission	0.07	13
Good news church	0.06	12
Grace revival	0.06	12
Jesus celebration centre	0.06	11
Holy gost church	0.06	11
Discipleship church	0.05	10
Send me / Nitume	0.05	10
Winners chapel	0.05	9
Toba	0.04	8
Revival miracle	0.04	8
Neema church	0.04	8
Back to the bible	0.04	7
Ufunuo wa manabii	0.04	7
Elimu church	0.04	7
Voice of Victory and peace	0.04	7
New life church	0.04	7
Friends church	0.03	6
Nazareth church	0.03	6
Assembly of christ	0.03	6
Lords ministry	0.03	6
Jesus praise centre	0.03	5
Abundant life church	0.03	5
Grace celebration	0.02	4
Jesus Power Celebration Center	0.02	4
Maximum miracle	0.01	2
Other	5.57	1056
<hr/> <i>Panel E: Other Religions</i>		
	Share	Frequency
Baptist Church	2.06	390
Muslim	1.66	315
Seventh Day Adventists	1.12	212
Jehovah's Witnesses	0.49	93
No religion	0.33	62
Salvation Army Church	0.32	61
(United) Methodists	0.24	46
Traditional / Tribal Religion	0.04	8

Notes: This table reports the full list of religious denomination ever reported by the respondents in each survey round, with their overall frequency and classification into Traditional Christian, Pentecostal (conservative classification), Pentecostal (included in broad classification) and Other religions. The “Other” category in Panel D includes churches like African Church of Holy Spirit, Builders Global Church, Bible Life Ministries , among numerous others.

Table A5: Correlations between measures of human capital and the choice of religious denomination - more detailed classification of churches

	Catholic	Protestant Anglican	Larger Pentecostal Churches	Smaller Pentecostal Churches
Education (years)	.115***	.094***	-.125***	-.069***
Raven's test score	.066***	.037***	-.053***	-.036*
Father's education (years)	.068***	.081***	-.070***	-.054***
Mother's education (years)	.056***	.085***	-.055***	-.070***
Total earnings (USD)	.066***	.037***	-.044***	-.067***

Notes: This table reports pairwise correlation coefficients between relevant measures of human capital and living standards and indicator variables measuring religious denomination, based on a more detailed classification of churches. The analysis uses data pooled across KLPS-3 and KLPS-4. Online Appendix C for additional details on the construction of variables. * denotes significance at 10%, ** denotes significance at 5%, and *** denotes significance at 1%.

Table A6: Correlations between measures of human capital and components of the Religiosity index

	Importance of religion in life	Religious most important identity (after Kenyan)	Became more religious in past year	Attends church regularly	Attended church last week	Work donations to church	Monetary donation to church
Education (years)	.001	-.023**	.125***	-.004	.003	.040***	.143***
Raven's test score	-.020*	-.002	.094***	-.047***	-.023**	.045***	.107***
Father's education (years)	.006	-.017	.017	-.011	.002	.006	.045***
Mother's education (years)	.010	-.028***	.021*	-.012	-.005	-.009	.033***
Tot earnings (USD)	-.022*	-.021*	.011	-.108***	-.103***	-.007	.211***

Notes: This table reports pairwise correlation coefficients between relevant measures of human capital and living standards and each component of the Religiosity index. The analysis uses data pooled across KLPS-3 and KLPS-4. * denotes significance at 10%, ** denotes significance at 5%, and *** denotes significance at 1%.

Table A7: The effect of the deworming treatment on the individual components of the Religiosity index

	Importance of religion in life	Religious most important identity (after Kenyan)	Became more religious in past year	Attends church regularly	Attended church last week	Work donations to church	Monetary donation to church
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Panel A: Sample - all participants</i>							
Deworming treatment	-.006 (.007)	.002 (.013)	.000 (.020)	-.005 (.012)	-.005 (.013)	.024 (.248)	-12.468 (12.780)
Control Mean	2.95	.27	2.12	.76	.68	2.33	294.95
Control SD	.24	.44	.73	.43	.47	7.33	591.62
Treatment Effect (%)	-.20	.76	.00	-.65	-.79	1.03	-4.23
R-squared	.01	.03	.02	.05	.03	.01	.09
Number Individuals	6733	5910	5888	6734	6734	5887	5831
Number Observations	18601	11299	10983	18606	18603	10984	10749
<i>Panel B: Sample - older participants</i>							
Deworming treatment	-.001 (.009)	-.035 (.022)	-.027 (.024)	.006 (.014)	-.006 (.013)	-.102 (.453)	-7.570 (24.424)
Control Mean	2.95	.30	2.10	.74	.66	2.47	284.84
Control SD	.24	.46	.74	.44	.48	8.17	558.23
Treatment Effect (%)	-.04	-11.77	-1.30	.86	-.86	-4.12	-2.66
R-squared	.02	.03	.04	.06	.04	.02	.09
Number Individuals	2914	2531	2520	2915	2915	2520	2500
Number Observations	7746	4849	4693	7749	7747	4693	4608
<i>Panel C: Sample - younger participants</i>							
Deworming treatment	-.009 (.008)	.027* (.014)	.012 (.027)	-.013 (.016)	-.008 (.017)	.124 (.245)	-15.631 (15.624)
Control Mean	2.95	.25	2.13	.77	.70	2.24	301.83
Control SD	.24	.43	.73	.42	.46	6.71	613.30
Treatment Effect (%)	-.31	10.83	.58	-1.71	-1.12	5.54	-5.18
R-squared	.01	.03	.02	.05	.03	.02	.10
Number Individuals	3819	3379	3368	3819	3819	3367	3331
Number Observations	10855	6450	6290	10857	10856	6291	6141

Notes: This table reports treatment effects for each of the seven components of the Religiosity index (Columns 1-7). In Column 8, the dependent variable is an index of intrinsic religiosity constructed as the sum of the standardized values of answers to the three questions on importance of religion in Columns 1-3. In Column 9, the dependent variable is an index of extrinsic religiosity constructed as the sum of the standardized values of answers to the four three questions on religious behavior in Columns 4-7. The analysis uses data pooled across KLPS-1, KLPS-2, KLPS-3, and KLPS-4 for Columns 1, 4 and 5. The outcomes in Columns 2, 3, 6 and 7 use data from KLPS-2 (wave 2), KLPS-3 and KLPS-4, for which they are available. Deworming treatment is an indicator variable equal to one for PSDP worm groups 1 and 2, which received additional 2.4 years of deworming, on average, compared to group 3. Online Appendix C provides additional details on the construction of variables and wording of the questions included in the Religiosity index. Panel A reports the overall treatment effects for the full sample. Panel B reports estimates for the sub-sample of respondents who were older than 12 years at baseline. Panel C reports estimates for the sub-sample of respondents who were 12 years old or younger at baseline. The estimation strategy, including control variables, weighting of observations and clustering is the same as in the Table 2. * denotes significance at 10%, ** denotes significance at 5%, and *** denotes significance at 1%.

Table A8: The effect of the deworming treatment on the choice of religious denomination using multinomial logit regression – more detailed classification of churches

	Catholic (1)	Protestant Anglican (2)	Larger Pentecostal (3)	Smaller Pentecostal (4)
<i>Panel A: Sample - all participants</i>				
Deworming treatment	.117 (.108)	.187 (.148)	-.130 (.080)	-.077 (.087)
Control Mean	1.70	1.70	1.55	1.55
Control SD	.74	.74	.74	.74
Treatment Effect (%)	6.90	10.98	-8.38	-4.95
R-squared	.07	.07	.05	.05
Number Individuals	6740	6740	6740	6740
Number Observations	18958	18958	18958	18958
<i>Panel B: Sample - older participants</i>				
Deworming treatment	286** (.137)	.368* (.188)	-.393*** (.115)	-.116 (.129)
Control Mean	1.63	1.63	1.61	1.61
Control SD	.73	.73	.75	.75
Treatment Effect (%)	17.52	22.51	-24.45	-7.24
R-squared	.07	.07	.05	.05
Number Individuals	2917	2917	2917	2917
Number Observations	7926	7926	7926	7926
<i>Panel C: Sample - younger participants</i>				
Deworming treatment	.006 (.111)	.072 (.163)	.041 (.082)	-.045 (.104)
Control Mean	1.74	1.74	1.51	1.51
Control SD	.75	.75	.73	.73
Treatment Effect (%)	.32	4.15	2.72	-2.98
R-squared	.07	.07	.06	.06
Number Individuals	3823	3823	3823	3823
Number Observations	11032	11032	11032	11032

Notes: This table reports treatment effects on the choice of religious denomination using a more detailed classification of churches (see Table A4). The first two Columns report the coefficients from a multinomial logistic regression model where the dependent variable is a categorical variable that takes value one (base outcome) if the respondent belongs either to Pentecostal or to the ‘Other’ category; two if belonging to the Catholic denomination and three if belonging to the Protestant Anglican denomination. Specifically, Column 1 reports the coefficient on being Catholic and Column 2 on being Protestant Anglican, both from the same specification. Similarly, Columns 3 and 4 report the coefficients from a multinomial logistic regression model where the dependent variable is a categorical variable that takes value one (base outcome) if the respondent belongs either to Traditional Christian denomination (Catholic or Protestant Anglican) or to the ‘Other’ category; two if belonging to a Large Pentecostal denomination and three if belonging to a Small Pentecostal denomination. Specifically, Column 3 reports the coefficient on belonging to a Large Pentecostal denomination and Column 4 on belonging to a Small Pentecostal denomination, both from the same specification. * denotes significance at 10%, ** denotes significance at 5%, and *** denotes significance at 1%.

Table A9: The effect of the deworming treatment on the choice of religious denomination and religiosity, across the four KLPS rounds

	Traditional Christian	Pentecostal (broad classification)	Pentecostal (conservative classification)	Religiosity (index)
	(1)	(2)	(3)	(4)
<i>KLPS 1 Sample</i>				
Deworming treatment	.029 (.031)	-.030 (.025)	-.015 (.020)	- -
Control Mean	.65	.29	.19	-
Control SD	.48	.46	.39	-
Treatment Effect (%)	4.51	-10.26	-8.16	-
R-squared	.03	.03	.03	-
Number Individuals	5159	5159	5159	-
Number Observations	5159	5159	5159	-
<i>KLPS 2 Sample</i>				
Deworming treatment	.048* (.029)	-.036 (.025)	-.031 (.021)	.041 (.059)
Control Mean	.57	.36	.20	-.02
Control SD	.50	.48	.40	1.04
Treatment Effect (%)	8.48	-10.00	15.35	-
R-squared	.04	.04	.03	.06
Number Individuals	4983	4983	4983	2271
Number Observations	4983	4983	4983	2271
<i>KLPS 3 Sample</i>				
Deworming treatment	.044* (.024)	-.026 (.024)	-.012 (.017)	-.040 (.033)
Control Mean	.48	.45	.27	-.01
Control SD	.50	.50	.44	.94
Treatment Effect (%)	9.10	-5.86	-4.52	-
R-squared	.04	.04	.04	.03
Number Individuals	4588	4588	4588	4307
Number Observations	4588	4588	4588	4307
<i>KLPS 4 Sample</i>				
Deworming treatment	.044* (.026)	-.037 (.023)	-.048** (.020)	-.041 (.042)
Control Mean	.40	.52	.39	.03
Control SD	.49	.50	.49	.96
Treatment Effect (%)	10.94	-7.14	-12.45	-
R-squared	.04	.04	.07	.04
Number Individuals	4228	4228	4228	4135
Number Observations	4228	4228	4228	4135

Table A10: The effect of the deworming treatment on the choice of religious denomination and religiosity among the sub-sample of older respondents, across the four KLPS rounds

	Traditional Christian	Pentecostal (broad classification)	Pentecostal (conservative classification)	Religiosity (index)
	(1)	(2)	(3)	(4)
<i>KLPS 1 Sample - older participants</i>				
Deworming treatment	.050 (.036)	-.060** (.029)	-.041 (.028)	- -
Control Mean	.59	.35	.22	-
Control SD	.49	.48	.42	-
Treatment Effect (%)	8.44	-17.25	-18.45	-
R-squared	.05	.04	.03	-
Number Individuals	2067	2067	2067	-
Number Observations	2067	2067	2067	-
<i>KLPS 2: Sample - older participants</i>				
Deworming treatment	.077** (.037)	-.041 (.033)	-.042 (.029)	-.076 (.105)
Control Mean	.52	.40	.24	.03
Control SD	.50	.49	.43	1.15
Treatment Effect (%)	14.74	-10.27	-18.58	-
R-squared	.06	.05	.04	.09
Number Individuals	2081	2081	2081	963
Number Observations	2081	2081	2081	963
<i>KLPS 3: Sample - older participants</i>				
Deworming treatment	.093** (.040)	-.092** (.037)	-.088*** (.021)	-.080 (.050)
Control Mean	.44	.50	.31	-.01
Control SD	.50	.50	.46	.98
Treatment Effect (%)	21.13	-18.41	-28.52	-
R-squared	.07	.08	.06	.04
Number Individuals	1938	1938	1938	1821
Number Observations	1938	1938	1938	1821
<i>KLPS 4: Sample - older participants</i>				
Deworming treatment	.086*** (.031)	-.085*** (.029)	-.095*** (.026)	-.009 (.068)
Control Mean	.37	.55	.42	-.01
Control SD	.48	.50	.49	.92
Treatment Effect (%)	23.45	-15.48	-22.45	-
R-squared	.05	.05	.07	.06
Number Individuals	1840	1840	1840	1804
Number Observations	1840	1840	1840	1804

Notes: This table reports treatment effects of deworming on the choice of religious denomination and religiosity among the sub-sample of older respondents, round by round. The variables and regression specification are the same as those reported in Table 2, Panel B, Columns 3, 4, 5 and 8. * denotes significance at 10%, ** denotes significance at 5%, and *** denotes significance at 1%.

Table A11: The effect of the deworming treatment on the choice of religious denomination and religiosity among the sub-sample of younger respondents, across the four KLPS rounds

	Traditional Christian	Pentecostal (broad classification)	Pentecostal (conservative classification)	Religiosity (index)
	(1)	(2)	(3)	(4)
<i>KLPS 1: Sample - younger participants</i>				
Deworming treatment	.017 (.034)	-.012 (.028)	-.002 (.020)	- -
Control Mean	.68	.26	.17	-
Control SD	.47	.44	.38	-
Treatment Effect (%)	2.47	-4.50	-1.24	-
R-squared	.03	.04	.04	-
Number Individuals	3092	3092	3092	-
Number Observations	3092	3092	3092	-
<i>KLPS 2: Sample - younger participants</i>				
Deworming treatment	.021 (.032)	-.024 (.028)	-.017 (.022)	.132 (.082)
Control Mean	.60	.34	.18	-.06
Control SD	.49	.47	.39	.97
Treatment Effect (%)	3.47	-7.05	-9.21	-
R-squared	.04	.04	.03	.07
Number Individuals	2902	2902	2902	1308
Number Observations	2902	2902	2902	1308
<i>KLPS 3: Sample - younger participants</i>				
Deworming treatment	.006 (.025)	.021 (.026)	.040* (.022)	-.026 (.047)
Control Mean	.51	.41	.24	-.02
Control SD	.50	.49	.43	.91
Treatment Effect (%)	1.13	5.15	16.60	-
R-squared	.05	.05	.04	.03
Number Individuals	2650	2650	2650	2486
Number Observations	2650	2650	2650	2486
<i>KLPS 4: Sample - younger participants</i>				
Deworming treatment	.024 (.029)	-.014 (.030)	-.024 (.028)	-.059 (.051)
Control Mean	.42	.50	.36	.06
Control SD	.49	.50	.48	.98
Treatment Effect (%)	5.75	-2.79	-6.55	-
R-squared	.06	.06	.08	.03
Number Individuals	2388	2388	2388	2331
Number Observations	2388	2388	2388	2331

Notes: This table reports treatment effects of deworming on the choice of religious denomination and religiosity among the sub-sample of younger respondents, round by round. The variables and regression specification are the same as those reported in Table 2, Panel C, Columns 3, 4, 5 and 8. * denotes significance at 10%, ** denotes significance at 5%, and *** denotes significance at 1%.

Table A12: The effect of the deworming treatment on the choice of religious denomination and religiosity by gender

	Traditional Christian	Pentecostal (broad classification)	Pentecostal (conservative classification)	Share of time in Pentecostal (broad classification)	Share of time in Pentecostal (conservative classification)	Religiosity (index)
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A: Sample - all participants</i>						
Deworming treatment	.034 (.020)	-.025 (.017)	-.020 (.012)	-.028 (.017)	-.022* (.012)	-.011 (.025)
Control Mean	.53	.40	.25	.38	.25	-.00
Control SD	.50	.49	.44	.46	.40	.97
Treatment Effect (%)	6.39	-6.12	-7.71	-7.24	-8.85	-
R-squared	.06	.05	.06	.06	.06	.03
Number Individuals	6740	6740	6740	6740	6740	5823
Number Observations	18958	18958	18958	18958	18958	10713
<i>Panel B: Sample - female participants</i>						
Deworming treatment	.033 (.023)	-.024 (.018)	-.019 (.013)	-.037* (.019)	-.023* (.013)	-.029 (.030)
Control Mean	.47	.45	.28	.43	.27	.09
Control SD	.50	.50	.45	.46	.41	.87
Treatment Effect (%)	6.90	-5.20	-6.78	-8.67	-8.25	-
R-squared	.07	.06	.07	.07	.07	.03
Number Individuals	3372	3372	3372	3372	3372	2927
Number Observations	9376	9376	9376	9376	9376	5408
<i>Panel C: Sample - male participants</i>						
Deworming treatment	.035 (.028)	-.026 (.023)	-.021 (.016)	-.021 (.023)	-.023 (.015)	.000 (.040)
Control Mean	.58	.35	.23	.34	.23	-.09
Control SD	.49	.48	.42	.45	.39	1.05
Treatment Effect (%)	6.03	-7.39	-9.43	-6.17	-10.40	-
R-squared	.03	.04	.05	.04	.06	.03
Number Individuals	3368	3368	3368	3368	3368	2896
Number Observations	9582	9582	9582	9582	9582	5305

Notes: This table reports treatment effects on the choice of religious denomination and religiosity by gender. Panel A reports the overall treatment effects for the full sample (and thus replicates Table 2, Panel A), while Panels B and C report estimates for female and male respondents, respectively. The variables and estimations strategy are the same as in Table 2.

Table A13: Effective tracking and survey rates, Kenya Life Panel Survey (KLPS) rounds 2, 3 and 4

	Control Mean			Treatment - Control (se)		
	(1) All	(2) Female	(3) Male	(4) All	(5) Female	(6) Male
<i>Panel A.1: KLPS-4 1 Module (2019-2021)</i>						
Found	.902	.913	.891	.007 (.024)	-.026 (.029)	.039 (.029)
Deceased	.052	.049	.054	.004 (.009)	.004 (.014)	.004 (.011)
Surveyed, among non-deceased	.872	.892	.853	-.005 (.028)	-.049 (.031)	.038 (.035)
Number Surveyed	4253	2195	2058			
<i>Panel A.2: KLPS-4 E+ Module (2017-19)</i>						
Found	.872	.886	.858	.013 (.026)	-.009 (.027)	.034 (.035)
Deceased	.035	.034	.036	.009 (.006)	.004 (.009)	.015* (.008)
Surveyed, among non-deceased	.839	.866	.814	.003 (.027)	-.042 (.028)	.046 (.038)
Number Surveyed	4135	2112	2023			
<i>Panel B.1: KLPS-3 1 Module (2011-14)</i>						
Found	.875	.863	.886	-.005 (.021)	-.018 (.027)	.009 (.021)
Deceased	.022	.022	.022	.005 (.004)	.001 (.006)	.008 (.006)
Surveyed, among non-deceased	.861	.846	.875	-.013 (.022)	-.023 (.028)	-.002 (.022)
Number Surveyed	4596	2260	2336			
<i>Panel B.2: KLPS-3 E+ Module (2011-14)</i>						
Found	.853	.816	.886	.030 (.044)	.032 (.066)	.030 (.049)
Deceased	.028	.034	.023	-.003 (.011)	-.023 (.018)	.016 (.016)
Surveyed, among non-deceased	.760	.731	.787	.007 (.046)	.003 (.066)	.015 (.048)
Number Surveyed	726	371	355			
<i>Panel C: KLPS-2 (2007-09)</i>						
Found	.866	.853	.878	-.006 (.017)	-.020 (.025)	.007 (.022)
Deceased	.014	.012	.016	.004 (.004)	.006 (.005)	.003 (.005)
Surveyed, among non-deceased	.839	.829	.848	.001 (.018)	-.018 (.025)	.019 (.023)
Number Surveyed	5081	2489	2592			

Notes: Column (1) presents control means for indicator variables for respondent found, deceased, or surveyed, across survey rounds. Column (2) presents regression results of these indicator variables regressed on an indicator for PSDP treatment. The sample includes all PSDP individuals found in initial tracking or placed under intensive tracking (known as the attrition sample), and only includes individuals in the PSDP sample. Those treated in a separate vocational training intervention (VocEd) which occurred prior to KLPS-3 are dropped from the KLPS-3 and KLPS-4 attrition samples. Those treated in a separate small grant intervention (SCY) which occurred during KLPS-3 are dropped from the KLPS attrition sample. Observations are weighted to be representative of the original KLPS population, and include KLPS population weights, SCY and VocEd control group weights, and KLPS intensive tracking weights. Standard errors are clustered at the 1998 school level. * denotes significance at 10%, ** denotes significance at 5%, and *** denotes significance at 1%.

Table A14: Expert survey - information about the sample

Sample characteristics	Mean
Panel A: Academic Discipline	
Economics	0.316
Sociology	0.374
Political Science	0.123
Psychology	0.123
Other	0.064
Panel B: Professional Seniority	
Assistant Professor	0.019
Associate Professor	0.168
Professor	0.697
Other	0.116
Panel C: Researcher who has... (indicators)	
Worked on religion	0.748
Worked on evaluating impacts of education or health intervention	0.097
Worked on testing secularization and modernization hypotheses	0.110
Not worked directly on any of the topics described above	0.045
Panel D: Professional experience in Kenya	
No	0.948
Yes	0.052
Number of observations	155

Table A15: Treatment effect on confidence in modern science and medicine

	First child sleeps under a bed net (1)	First child received any vaccine (2)
<i>KLPS 4: Sample - all participants</i>		
Deworming treatment	.015 (.016)	-.001 (.006)
Control Mean	.89	.99
Control SD	.31	.10
Treatment Effect (%)	1.71	-.07
R-squared	.03	.02
Number Individuals	2944	3031
Number Observations	2944	3031

Table A16: School level intraclass correlation in Pentecostal church conversion and affiliation

	ICC	95% C.I.
Ever converted from Trad. to Pent.	0.00244	(0 - .00651)
Ever converted to Pent.	0.00148	(0 - .00551)
Currently Pent. Church	0.01965	(.00989 - .02942)

Table A17: Effect of Peer Pastors on the Conversion of Non-Pastor School Mates, KLPS 4 Sample Only

	Ever converted from Trad. to Pent.	Ever converted to Pent.	Pent. Christain	Trad. Christain
	(1)	(2)	(3)	(4)
<i>Panel A: Sample - all participants</i>				
Number of Pastor Cohorts	-0.00209 (0.00138)	-0.00278 (0.00157)	-0.00128 (0.00309)	-0.00344 (0.00279)
Observations	3555	3555	3541	3541
<i>Panel B: Sample - older participants</i>				
Number of Pastor Cohorts	-0.00174 (0.00131)	-0.00223 (0.00149)	-0.00424 (0.00446)	-0.00372 (0.00365)
Observations	1786	1786	1775	1775
<i>Panel C: Sample - younger participants</i>				
Number of Pastor Cohorts	-0.00241 (0.00274)	-0.00333 (0.00301)	0.00189 (0.00522)	-0.00242 (0.00464)
Observations	1769	1769	1766	1766

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: This table reports the linear relationship between the number of pastors from the school the student attended and church conversion / affiliation. We limit the sample to KLPS4 only because only in KLPS4 were the respondents explicitly asked whether they have served as pastor. In previous rounds, the respondents were asked about their job. However, the number of respondents who identified as pastors is very small, indicating that most of the pastors in KLPS4 are volunteer or parttime. We further limit the sample to those who are not a pastor themselves. The regression uses the same controls and weight as the main regression, with error clustered at school level. Column (1) reports the linear relationship between converting from Traditional churches to Pentecostal churches and the number of pastors from the school attended the student attended. Column (2) reports that between converting from any religion/denomination to Pentecostal churches and the number of pastors from the school attended the student attended. Column (3) reports that between being a member of a Pentecostal church at the time of KLPS4 survey and the number of pastors from the school attended the student attended. Lastly, column (4) reports that between being a member of a Traditional church and the number of pastors from the school attended the student attended.

Table A18: The effect of the deworming treatment on the choice of religious denomination and religiosity, alternative age variable

	Human Capital		Religious Identity				Religiosity Index	
	Educational Attainment	Annual individual earnings	Traditional Christian	Pentecostal (broad classification)	Pentecostal (conservative classification)	Share of time in Pentecostal (broad classification)	Share of time in Pentecostal (conservative classification)	Religiosity (index)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Panel A: Sample - all participants</i>								
Deworming treatment	.258 (.173)	124.114** (57.570)	.034 (.020)	-.025 (.017)	-.020 (.012)	-.028 (.017)	-.022* (.012)	-.011 (.025)
Control Mean	9.30	1026.66	.53	.40	.25	.38	.25	-.00
Control SD	2.90	-	.50	.49	.44	.46	.4	.97
Treatment Effect (%)	2.77	12.09	6.39	-6.12	-7.71	-7.24	-8.85	-
R-squared	.09	-	.06	.05	.06	.06	.06	.03
Number Individuals	4588	-	6740	6740	6740	6740	6740	5823
Number Observations	4588	12929	18958	18958	18958	18958	18958	10713
<i>Panel B: Sample - older participants</i>								
Deworming treatment	.372** (.153)	189.561** (78.802)	.047* (.026)	-.044** (.022)	-.042*** (.015)	-.052** (.023)	-.048*** (.016)	-.029 (.037)
Control Mean	8.68	1087.30	.50	.43	.28	.42	.27	-.01
Control SD	2.75	-	.50	.50	.45	.47	.42	1.00
Treatment Effect (%)	4.29	17.43	9.40	-10.05	-15.19	-12.53	-17.46	-
R-squared	.22	-	.06	.06	.06	.07	.07	.05
Number Individuals	2293	-	3439	3439	3439	3439	3439	2962
Number Observations	2293	6496	9411	9411	9411	9411	9411	5396
<i>Panel C: Sample - younger participants</i>								
Deworming treatment	.004 (.219)	77.821 (66.869)	.018 (.024)	-.005 (.021)	.001 (.014)	-.003 (.021)	.002 (.014)	.000 (.032)
Control Mean	9.88	971.53	.56	.37	.23	.35	.22	.01
Control SD	2.92	-	.50	.48	.42	.45	.38	.94
Treatment Effect (%)	.04	8.01	3.26	-1.25	.45	-.96	.69	-
R-squared	.16	-	.07	.06	.07	.07	.07	.04
Number Individuals	2295	-	3301	3301	3301	3301	3301	2861
Number Observations	2295	6433	9547	9547	9547	9547	9547	5317

Notes: This table reports treatment effects for numerous outcomes, using data pooled across KLPS-1, KLPS-2, KLPS-3, and KLPS-4 unless otherwise indicated. In Column 1, the dependent variable is educational attainment, measured in years of schooling at KLPS-3. In Column 2, the dependent variable is annual individual earnings (measured at KLPS-2, KLPS-3, KLPS-4), calculated as the sum of wage employment across all jobs, nonagricultural self-employment profit across all business, and individual farming profit. Columns 3-7 report treatment effects on religious identity. Pentecostal (broad and conservative) and Traditional Christian are survey-round varying indicator variables constructed using data pooled across KLPS-1, KLPS-2, KLPS-3 and KLPS-4. Each indicator variable is equal to one if the last reported religious denomination fell into the corresponding categorization. For a more granular list of religious denominations reported by respondents and more details on classification, see Table A4. The share of time in Pentecostal (broad and conservative classification) is computed as the share of the five years preceding each survey date in which the respondent belonged to a Pentecostal denomination. Both variables are built from information collected in KLPS-1, KLPS-2, KLPS-3 and KLPS-4. In Column 8, the dependent variable is a religiosity index constructed as the sum of the standardized values of answers to a set of seven

questions (importance of religion in life, importance of religious identity, changes in religiosity in the past year, regular church attendance, recent church attendance, monetary and labor donations to church). Since four questions from this set were added to the survey in the middle of KLPS-2, Column 8 uses data from KLPS-2 (wave 2), KLPS-3 and KLPS-4. Deworming treatment is an indicator variable equal to one for PSDP worm groups 1 and 2, which received additional 2.4 years of deworming, on average, compared to group 3. Online Appendix C provides additional details on variable construction and question wording. Panel A reports the overall treatment effects for the full sample. Panel B reports estimates for the subsample of respondents who were older than 12 years at baseline. Panel C reports estimates for the subsample of respondents who were 12 years old or younger at baseline. In this table we use each respondent's earliest response to question about age possible. Covariates follow (Hamory et al. 2021) and include controls for baseline 1998 primary school population, geographic zone of the school, survey wave, month and year of interview, a female indicator variable, baseline 1998 school grade fixed effects, the average school test score on the 1996 Busia District mock examinations, total number of primary school pupils within 6 km, and a cost-sharing school indicator. Those treated in a separate vocational training intervention (Technical and Vocational Vouchers Program, VocEd) which occurred prior to KLPS-3 are dropped from the KLPS-3 and KLPS-4 samples. Those treated in a separate small grant intervention (Startup Capital for Youth, SCY) which occurred after KLPS-3 are dropped from the KLPS-4 sample. Observations are weighted to be representative of the original PSDP population, and include KLPS population weights, SCY and VocEd control group weights, and KLPS intensive tracking weights. Standard errors are clustered at the 1998 school level. * denotes significance at 10%, ** denotes significance at 5%, and *** denotes significance at 1%