Supernatural Beliefs about Illness and the Use of Modern Medicine: Evidence from the DR Congo*

Clara Sievert†

August 11, 2025

Abstract

In many societies around the world, individuals attribute illness to supernatural forces such as spirits, curses, or divine punishment. Despite rich qualitative documentation, systematic empirical evidence on the prevalence, behavioral consequences, and adaptability of supernatural illness beliefs remains scarce. In a first step, I use publicly available survey data from sub-Saharan Africa and newly collected survey data from the Democratic Republic of Congo (DRC) to document that supernatural illness beliefs are widespread: 94% of respondents in the DRC attribute at least one illness to supernatural causes, with large variation across illnesses. These beliefs matter: they are associated with lower perceived efficacy of modern medicine, lower use of modern medicine, and higher stigma toward those with certain illnesses. In a second step, I conduct a field experiment in the DRC to test whether such beliefs can shift. I randomize exposure to an informational video about the biomedical causes and treatment of epilepsy, a prevalent condition most commonly attributed to supernatural causes. The intervention shifts respondents' beliefs away from supernatural explanations and toward modern medicine's effectiveness, not only for epilepsy but also for other illnesses. It increases take-up of free hospital consultations for epilepsy by 50% and reduces stigma toward those with the condition. Taken together, I give causal evidence that supernatural illness beliefs form an internally coherent, yet adaptable explanatory framework that links perceived cause to treatment and social response, and connects beliefs across illnesses.

*I am especially grateful to my advisors Nathan Nunn, Marcella Alsan, Emily Breza, and David Yang for their invaluable support and guidance. I am grateful to Alberto Alesina for the initial spark and encouragement. I thank Lydia Assouad, Michal Bauer, Matthew Basilico, Augustin Bergeron, David Cutler, Eliana La Ferrara, Edward Glaeser, Rema Hanna, Joseph Henrich, Gabriel Kreindler, Sara Lowes, Elisa Macchi, Edward Miguel, Eduardo Montero, Raul Sanchez de la Sierra, Dev Patel, Max Posch, Gautam Rao, Felipe Valencia Caicedo, Jonathan Weigel, the Harvard Economics graduate student community, and participants at the Harvard workshops and the Berkeley–Stanford Development and Political Economics PhD Student Conference for their invaluable feedback and support. I thank the ODEKA survey team for their excellent work, Dr. John M. Tshibangu and Dr. Pacifique L. Badibangu from the Kasai Ministry of Health for their invaluable input and collaboration, Dr. Serge M. Kazadi and Kastin K. Ntumba at the Institut Médical Chrétien du Kasai for the collaboration, as well as Dr. Richard N. Tshibaka at the Centre Neuro-Psychiatrique de Katuambi for the collaboration. This research is funded by The Weiss Fund for Research in Development Economics at the University of Chicago, the Harvard Lab for Economic Applications and Policy (LEAP), and the Harvard Warburg Fund. Harvard IRB approval: 21-1422. AEA RCT Registry ID: AEARCTR-0009417.

†CERGE-EI, Charles University and Czech Academy of Sciences. clara.sievert@cerge-ei.cz

1 Introduction

Humans need an explanation for their suffering—an answer to the question, "Why? Why me?" (Kleinman, 1988). To fulfill this need, societies have attributed illness to supernatural forces throughout history—forces that defy known natural law, such as divine intervention, evil spirits, or "witchcraft" (Legare et al., 2012, Murdock, 1980). Indeed, 185 out of 186 independent preindustrial societies predominantly used supernatural explanations for illness (Murdock and White, 1969). Although biomedical explanations are often assumed to be universal today, ethnographic and qualitative research suggests that supernatural attributions of illness remain common across diverse societies.

Medical anthropologists have long emphasized that illness is not merely a biological condition but a culturally and socially mediated experience, studied under the constructs of "illness narratives" and "theories of illness" (Kleinman, 1988, Foster, 1976, Murdock, 1980). They argue that beliefs about disease causation are central to health behavior, particularly in non-Western societies (Foster, 1976; Olupona, 2014). Supernal attributions of illness could impact take-up of modern medicine if they cast doubt on modern medicine's ability to treat diseases believed to be caused by spirits or curses. In addition, they may affect the perception of those with disease, spurring negative attitudes and discrimination toward those with illness, i.e. stigma. Understanding how beliefs about illness affect health behavior is particularly relevant for low- and middle-income countries with a high burden of disease, low use of modern medicine, and high prevalence of traditional supernatural beliefs. Yet, we have relatively little empirical evidence on the prevalence of supernatural beliefs about illness and their consequences for medical decision-making.

In this paper, I provide empirical and causal evidence for the prevalence of supernatural beliefs about the cause of illness and their consequences for medical decision-making, with a focus on sub-Saharan Africa and the Democratic Republic of Congo (DRC). I ask three questions: (1) How common are supernatural beliefs about illness, and do they vary by illnesses and individuals? (2) Are these beliefs relevant for health behavior by shaping perceptions of treatment and social response? (3) Is it possible to shift these beliefs from supernatural toward medical and to increase the take-up of modern medicine by appealing to their internal logic? The results shed light on whether supernatural beliefs about illness form an internally coherent explanatory framework: a system of beliefs that links cause, treatment, and social response.[1]

In the first part of the paper, I start by documenting motivational patterns in sub-Saharan

[1] I use the term "explanatory framework" or "mental model" to refer to a collection of internally coherent and interconnected beliefs, in contrast to idiosyncratic superstitions—such as carrying a rabbit's foot or wearing a specific color—that lack systematic causal logic.

Africa using publicly available survey data. The region exhibits a rich landscape of supernatural beliefs, including spirits, curses, and "witchcraft"—concepts that predate Abrahamic religions and often coexist with Christianity and Islam. Throughout this paper, I refer to such beliefs as "traditional supernatural beliefs". Indeed, in the Pew Research Center surveys, an average of 46% of the population across 19 sub-Saharan countries hold such beliefs. Using within-country variation, I find that people with traditional supernatural beliefs are 16 percentage points more likely to have used traditional healers in the Pew data, and that people who have traditional supernatural beliefs about HIV/AIDS are 7 percentage points more likely to agree that people with HIV/AIDS should feel "ashamed of themselves" in the Demographic and Health Surveys data. Together, these patterns point to the existence of a medical system—predating both Abrahamic religions and modern biomedicine—comprising both explanatory beliefs and treatment practices, which continues to shape health behavior and health outcomes today.

Motivated by these patterns, in the second part of the paper I zoom in on a single setting: Kananga, in the Democratic Republic of Congo (DRC). The DRC is one of the five poorest countries in the world, with high poverty, high mortality, and limited access to modern medicine. Kananga is an urban agglomeration of 1.5 million inhabitants. While nearly all residents identify as Christian, traditional supernatural beliefs remain widespread. I designed a large-scale survey of a representative sample of 800 respondents, eliciting beliefs about 13 common adulthood illnesses.

Drawing on my original survey data, I document five stylized facts that form a first core empirical contribution of the paper and the empirical foundation for the experimental design. First, supernatural beliefs about the cause of illness—such as "witchcraft", evil spirits, curses, or divine punishment—are widespread: 94% of respondents attribute at least one illness to supernatural forces.

Second, supernatural attribution varies sharply by illness: 93% of respondents cite supernatural causes for epilepsy, but only 6% do so for malaria. Even illnesses with observable causes, such as snakebites (67%) and fractures (38%), can have supernatural causes. These patterns echo classic anthropological insights: individuals may accept proximate biological causes but invoke supernatural explanations to answer "why now, why me?" (Evans et al., 1995). Moreover, supernatural attributions even vary across cases of the same illness. These variations suggest that supernatural beliefs are not rigid worldviews, but context-dependent frameworks that may be open to change.

Third, individuals differ in the extent to which they attribute illnesses to supernatural causes. This variation is not explained by education, age, wealth, or prior illness experience, suggesting that such beliefs are not reducible to socioeconomic status. This pattern offers an initial indication that changes in education or income are unlikely to be the primary drivers of belief change.

Fourth, beliefs about illness causation and treatment are systematically linked. I focus on beliefs about the efficacy of modern medicine, which are central to treatment decisions and unaffected by prior illness episodes or access constraints. Local medical professionals report that patients often avoid hospitals for conditions believed to have supernatural origins, reasoning that modern medicine cannot treat a curse or a spirit. Consistent with this logic, I find a strong negative correlation between supernatural causal beliefs and the perceived effectiveness of modern medicine, even within individuals across illnesses. The same logic also appears to operate in reverse: nearly half of the respondents agree that if modern medicine can treat a condition, it cannot be caused by supernatural forces. In line with this pattern, individuals who attribute an illness to supernatural forces are also less likely to have used modern medicine for it.

Fifth, I find evidence that supernatural illness beliefs can generate stigma, reflected in discriminatory attitudes and social avoidance toward the afflicted. The belief that people with epilepsy are witches predicts stigma toward those with epilepsy—a noncommunicable condition affecting all ages and genders. Such stigma can discourage treatment-seeking and lead to serious consequences, including increased risk of complications during seizures (such as burning or drowning) and the neglect of afflicted individuals, including children (Jilek-Aall, 1999; Molina, 2006; Cimpric, 2010). Since stigma directly reflects supernatural beliefs—independent of care-seeking behavior—I include it as a separate outcome in the experiment.

Together, the patterns suggest a bundled belief system in which beliefs about cause, treatment, and social response are linked—both within and across illnesses. Demonstrating the effectiveness of modern medicine for one condition may shift causal beliefs more broadly, motivating the experimental design that follows.

In the third part of the paper, I examine whether targeted information can shift illness beliefs away from supernatural explanations toward biomedical ones, increase the take-up of modern medicine, and reduce stigma. To provide causal evidence, I implemented a randomized controlled trial in Kananga, DRC. Rather than randomizing biomedical treatment—limited by slow, experiential learning—I partnered with local medical professionals from the Ministry of Health to design a video conveying the informational content of a typical modern medical consultation. I opted for a locally familiar storytelling format rather than a presentation of abstract facts. The video focused on epilepsy and explained (1) its occurrence in the brain, (2) the availability and effectiveness of biomedical treatment, (3) the ineffectiveness of traditional remedies, and (4) the lack of association with supernatural forces. The physicians delivered the message in the local language Tshiluba and chose to explicitly refer to supernatural causes, drawing on their experience with previous epilepsy campaigns. The video also included a testimonial from a local woman describing her daughter's

treatment journey, using narrative formats common in churches and on local radio.

The intervention focused on epilepsy because it is prevalent and the illness most frequently attributed to supernatural causes in Kananga.[2] In my baseline survey, 96% of respondents report having seen a seizure, and 10.5% have a close family member with epilepsy. Yet only 10% believe that treatment exists in Kananga, and 63.3% believe that modern medicine could never treat it, creating a clear opportunity for an information intervention.

I randomized the representative sample of 800 respondents to watch either the treatment video or a placebo control video, in which the same medical professionals—without identifying themselves as such—discussed children's games. Local surveyors showed the video on a tablet during a first visit, followed by an immediate midline survey and an endline survey (N = 782) one week later.

I find that the intervention shifted beliefs about epilepsy from supernatural toward medical: treated respondents were 20.8 percentage points less likely to attribute epilepsy to supernatural causes, 47.4 percentage points more likely to believe that modern medicine is effective, and 30.2 percentage points less likely to believe in the effectiveness of traditional medicine in the endline survey. Effects were strongest among respondents unaware of modern medical treatment availability, consistent with learning about the existence and efficacy of modern medicine as a mechanism for belief updating.

Moreover, the intervention spilled over to beliefs about other illnesses. Excluding epilepsy and considering the variation across individuals for a given illness, I find that treated respondents were 9.0 percentage points less likely to believe that an illness could be of supernatural origin and 6.0 percentage points more likely to believe that modern medicine is effective in treating an illness. These cross-illness spillovers provide causal evidence that beliefs are not held in isolation but form a system that can be updated through information about a single condition.

Importantly, the intervention significantly increased the take-up of free hospital consultations for seizures, which helps address concerns about experimenter demand effects. At the end of the second visit, all respondents received a voucher for a free consultation at the neuropsychiatric division of Kananga's General Hospital. In the treatment group, 10.9% of vouchers were redeemed, a 3.8 percentage point increase relative to the control group mean of 7.1%, and a nearly 50% increase in take-up. Notably, 95% of redeemed vouchers were used by someone other than the respondent, indicating that the information propagated through social networks.

Heterogeneity analyses, including both structured and machine learning approaches, reveal that

[2]Developing countries face a higher prevalence of epilepsy because of a higher risk of infectious diseases and birth- and pregnancy-related complications, which can injure the brain of the infant. Sub-Saharan Africa has an average epilepsy prevalence of 9.39 per 1,000, in contrast to the U.S. rate of 0.45 per 1,000. Individuals with epilepsy in sub-Saharan Africa face a mortality rate up to ten times higher than the population average, with deaths often stemming from loss of consciousness in unfortunate circumstances (Ba-Diop et al., 2014).

standard development indicators—such as education, gender, income, or wealth—do not meaningfully predict take-up. Instead, beliefs about illness causation and treatment are the strongest predictors of responsiveness. The intervention appears to have worked by both reinforcing existing biomedical views and shifting prior beliefs from supernatural toward natural. In both cases, it is illness beliefs, not demographic or economic traits, that best explain heterogeneity in responsiveness to the intervention.

Finally, the intervention significantly reduced stigma toward people living with epilepsy. In the endline survey, treated respondents were 7.2 percentage points less likely to agree that children should not play with children who have epilepsy, and 12.6 percentage points less likely to agree that one should avoid people with epilepsy during a seizure, relative to control group means of 28.9% and 54%, respectively. To capture behavioral willingness to engage with epileptics, I implemented an incentivized measure: respondents could opt into a list for a job interview for an NGO project working with people with epilepsy, a high-stakes decision incurring real costs in an environment with high unemployment. Treated respondents were 4.6 percentage points more likely to choose the epilepsy project.

In summary, I show that supernatural attributions of illness are common, relevant, and malleable. Supernatural beliefs about illness causation are not arbitrary or isolated; they are interconnected across illnesses and systematically linked to treatment beliefs and social responses, forming an internally coherent, yet adaptable explanatory framework—or mental model. These beliefs matter: they shape health outcomes indirectly, by influencing perceptions of biomedical efficacy and the decision to seek care, and directly, by fueling stigma and social exclusion. The experiment, which holds costs constant, demonstrates that even when modern care is available and free, beliefs can still act as barriers to its use.[3]

While I focus on epilepsy, the prototypical supernatural illness, the findings likely generalize to other diseases and settings. Differential exposure to modern medicine may help explain variation in supernatural attributions across illnesses and societies today, and the results may shed light on how other societies may have historically transitioned toward biomedical belief systems. The light-touch intervention may have worked by accelerating learning about disease and modern medicine—an inherently slow and complex process, especially in contexts with a high disease burden and limited access to high-quality care. Overall, the findings underscore the importance of understanding

[3]The cost channel may include motivated beliefs. If modern care is unavailable or unaffordable, individuals may adopt a motivated belief that an illness is supernatural and thus untreatable—preserving internal consistency between cause and cure. My design isolates the belief channel by holding costs constant: the video made no mention of price, and a free consultation voucher was given to all respondents in both treatment and control groups. Moreover, since most respondents were not personally affected by epilepsy, belief updating cannot be attributed to need or self-rationalization.

culturally-rooted beliefs about illness for the design of health policy.

This paper contributes to three main literatures. First, it extends the literature on the economics of culture and religion, particularly work on persistence, change, and policy relevance.[4] The economics of religion literature has primarily focused on causes and consequences of religious participation, religious practices, and affiliation with institutionalized religions.[5] I instead extend research on the "believing component" of religion (e.g., belief in heaven or hell; Barro and McCleary, 2003, 2006) by studying supernatural beliefs—foundational to all religious traditions—and focusing on causal explanations for misfortune that, according to cognitive and anthropological theories, may have driven the evolution of religion itself.[6] My data allow me to draw people's perceived boundary between the supernatural and natural worlds. I show that natural and supernatural beliefs often coexist—even for the same illness event—and provide causal evidence that beliefs about different illnesses are interconnected. By doing so, I contribute to the psychology literature on the cognition of religion and introduce this concept into economics (e.g., Legare et al., 2012). Moreover, I give causal evidence that these beliefs impact behavior and can be shifted through targeted information. Together, the findings shed light on the evolution of belief systems and, ultimately, the secularization hypothesis.[7] More broadly, I address key limitations in prior work in psychology and anthropology, which typically rely on small, non-representative samples, do not systematically measure beliefs across multiple illnesses, and lack causal evidence. By doing so in the context of sub-Saharan Africa, I also contribute to the emerging literature in economics on traditional religion and its consequences for trust, violence, and investment (Gershman, 2020, 2022; Le Rossignol et al., 2023; Nunn and Sanchez de la Sierra, 2017; Miguel, 2005; Butinda et al., 2023).[8]

Second, the paper contributes to the health economics literature by examining a new determinant of health behavior and health outcomes. Existing work has extensively examined demand-side determinants of underutilization of modern medicine, particularly in low-income countries—costs, credit constraints, information, trust, and behavioral biases—as well as supply-side factors such as provider quality and drug availability (Dupas, 2011b; Dupas and Miguel, 2017; Dupas, 2009; Dupas and Robinson, 2013; Banerjee et al., 2010; Thornton, 2008; Tarozzi et al., 2014; Banerjee et

[4]For example, see Spolaore and Wacziarg (2013), Becker and Woessmann (2009), Nunn and Wantchekon (2011), Nunn (2008), Moscona et al. (2020), Alesina et al. (2013), Lowes (2022), Bazzi et al. (2020), Bau (2021), Lowes and Montero (2021), Moscona and Seck (2024), and Ashraf et al. (2020).
[5]For example, see Bryan et al., 2018, Auriol et al., 2020, Valencia Caicedo (2019), Alesina et al. (2023b), Chaney (2013), Chen (2010), Clingingsmith et al. (2009), Laeven et al. (2024), Becker et al. (2024), Bentzen (2019), and Alfonsi et al. (2024). See Iannaccone (1998), Iyer (2016), Barro and McCleary (2019), and Seabright (2024) for an overview of the literature on the economics of religion.
[6]For example, see Boyer (2001); Atran (2002); Norenzayan (2013).
[7]For example, see Berkes et al. (2023); Inglehart and Norris (2004).
[8]Oster, 2004 documents related patterns in early modern Europe.

al., 2015; Chandra et al., 2019; Alsan and Wanamaker, 2017; Alsan et al., 2019, 2024; Lowes and Montero, 2021; Oster, 2012; Christensen et al., 2021; Nyqvist et al., 2019; Banerjee et al., 2004; Das et al., 2008; Das and Hammer, 2014; Okeke, 2023; Björkman Nyqvist et al., 2022; Dupas, 2011a; Kremer and Miguel, 2007; de Walque, 2007). While much of this work focuses on later stages of care (reaching, paying, engaging), I examine upstream constraints on healthcare access: the perception of a condition as natural and biomedically treatable and the choice to seek biomedical care. Illness beliefs have long been a very important subject in medical anthropology (e.g., Kleinman, 1988), and public health has engaged with these ideas to understand epidemics (e.g., Snowden, 2019), but in economics, supernatural illness beliefs are often treated only anecdotally (e.g., Banerjee and Duflo, 2011). Lowes and Montero (2019),Ashraf et al. (2017), and Bennett et al. (2018) are recent exceptions, examining health behavior through the lens of local beliefs and practices.[9] I build on this work by documenting that beliefs about etiology and treatment are bundled into internally coherent systems that govern both medical and social responses to disease. I thereby also contribute to the literature on social exclusion and health-related discrimination (Ramos-Toro, 2023; Ridley et al., 2020).

Finally, the paper contributes to the literature in behavioral economics by providing causal evidence on how individuals use simplified causal frameworks—mental models—to guide decision-making.[10] I show that individuals may rely on general explanatory frameworks—frequently supernatural in nature—that are internally coherent, culturally transmitted, and shape high-stakes decisions in a relevant setting. I give evidence that these incorrect causal beliefs can lead to inefficiencies and externalities, which may extend beyond health and apply to other domains as well. Moreover, I expand an emerging literature on how individuals view the world—primarily in the domains of public finance and macroeconomics (e.g., Stantcheva, 2021)—by applying this lens to illness, an inherently complex, evolutionarily foundational, and universally human domain. Unlike tax policy or inflation, life, death, and illness confront every person on Earth. Finally, I build on a broader literature on survey experiments (e.g., Alesina et al., 2023a) and information provision experiments (see Haaland et al. (2023) for a recent overview).

[9] Lowes and Montero (2019) examine predictors of traditional medicine use in former French Central Africa and find that a belief in supernatural causes of HIV/AIDS positively correlates with traditional medicine use. Ashraf et al. (2017) demonstrate that traditional beliefs about the cause of childbirth complications attenuate learning about childbirth risks in Zambia. Furthermore, Bennett et al. (2018) find that displaying bacteria under a microscope enhances the credibility of hygiene information and promotes better hygienic practices in Pakistan, where illness is attributed to an imbalance between bodily humors.

[10] See, for example, Mullainathan et al., 2008, Hanna et al., 2014, Schwartzstein and Sunderam, 2021, Bordalo et al., 2022, Bursztyn and Yang, 2022, Barron and Fries, 2023, Alsan et al., 2024.

2 Background and Motivational Patterns from Sub-Saharan Africa

This section documents motivational patterns in supernatural illness beliefs across sub-Saharan Africa. Drawing on data from the Gallup World Poll (Gallup), the Pew Religion and Public Life Survey (Pew), and the Demographic and Health Surveys (DHS), I quantify the prevalence of such beliefs, examine their relationship with care-seeking and stigma, and explore their correlation with prior biomedical exposure.

I. How common are supernatural illness beliefs?

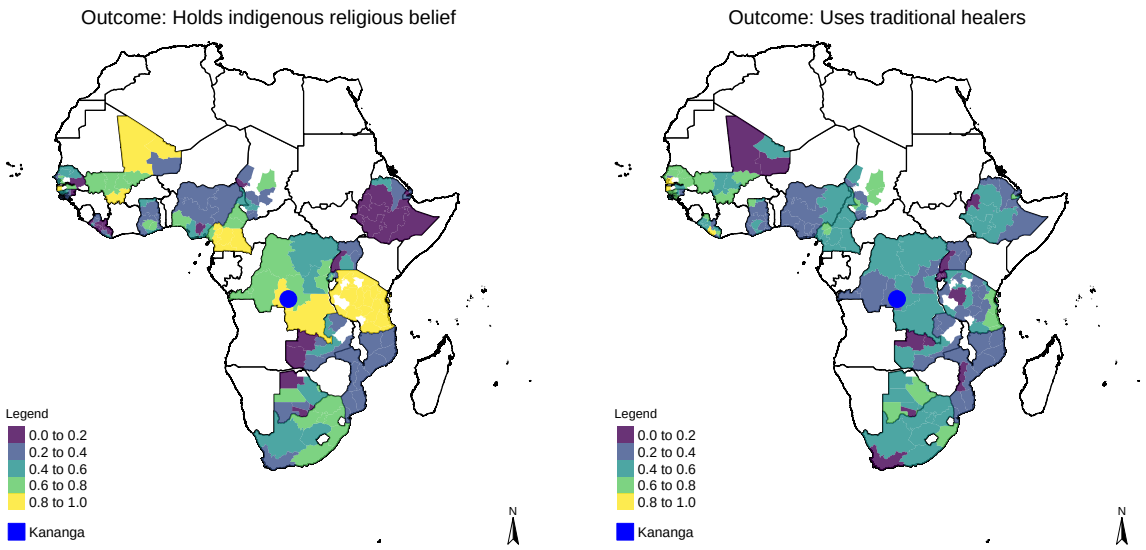
Historical patterns. Across history and cultures, illness has often been understood through supernatural frameworks. For example, the Bible frames healing as the casting out of demons; in early modern Europe, surges in witchcraft accusations frequently followed unexplained illness or death (Oster, 2004); and epilepsy was known even in Socrates' time as the "sacred disease" because of its presumed supernatural causes (*On the Sacred Disease*, Hippocrates [ca. 400 BCE]).

To quantify these patterns, I draw on the Standard Cross-Cultural Sample (SCCS), which covers 186 pre-industrial societies. In 117 of these, illness was most commonly attributed to supernatural forces—such as spirits, curses, or witchcraft. Even the notion of "natural death" from aging or physical deterioration was absent in 157 societies. Proto-natural theories of disease were exceptionally rare: only premodern Japan recorded explanations resembling infection (Murdock, 1980). Even in the Western medical tradition, naturalistic models emerged only gradually—Hippocrates' humoral theory, while scientifically incorrect, marked an early departure from supernatural causality (Hippocrates, 1983a).

Why were these beliefs so widespread? Anthropologists and cognitive psychologists suggest that supernatural illness beliefs serve both psychological and social functions. The theory of "compensatory control" holds that supernatural causal beliefs emerge as adaptive responses to uncertainty, helping individuals regain a sense of agency when confronted with illness or death (Kay et al., 2010; Boyer, 2001). Cultural evolutionary and anthropological theories emphasize their social role: frameworks involving spirits, curses, or divine punishment provide communities with shared epistemologies for assigning moral causality and locating blame (Evans-Pritchard, 1976; Henrich, 2021; Purzycki et al., 2016).

Contemporary patterns. Ethnographic studies document the existence of supernatural illness beliefs in regions such as South Asia and sub-Saharan Africa, with particular emphasis on the frequent use of "witchcraft" beliefs (e.g., Banerjee and Duflo, 2011; Ashforth, 2002; Wood and Lam-

Figure 1: Prevalence of Traditional Supernatural Beliefs and Traditional Healer Use in Sub-Saharan Africa



(a) Prevalence of traditional religious beliefs

(b) Prevalence of traditional healer use

Note: Panel 1a: The figure plots the share of respondents answering "yes" to the question "Do you believe in witchcraft? (yes/no)" by region in each country. Panel 1b: The figure plots the share of respondents answering "yes" to the question "Do you or your family ever use traditional healers when someone is sick?" by region in each country. The data come from the Pew Forum on Religion and Public Life survey from 2009 for both maps. Kananga is the site of the field experiment.

bert, 2008; Rödlach, 2006; Preston-Whyte, 2008). The existence of such beliefs is not surprising given their deep historical roots and the well-documented persistence of cultural traits across generations (e.g., Bisin and Verdier, 2001; Giuliano and Nunn, 2021). Nor is the invocation of witchcraft anomalous: beliefs in supernatural harm remain widespread today. In the 2009 Pew survey, 45.6% of respondents in sub-Saharan Africa report belief in witchcraft (Figure 1a), and globally, 43% of respondents across 95 countries endorse belief in the evil eye or harmful spells (Gershman, 2022). Such beliefs often coexist with formal religious affiliation, reflecting widespread syncretism—the integration of local supernatural logics into institutional religion.[11]

II. Are supernatural beliefs about illness relevant for health behavior?

The use of traditional healers is widespread in sub-Saharan Africa. In the Pew survey, 42% of respondents report using traditional healers when someone is ill (Figure 1b), with country-level rates ranging from 12% in Rwanda to 75% in Senegal, and 42% in the DRC.

Do supernatural beliefs help explain this variation? Ethnographic accounts suggest they do: if

[11] Catholicism historically incorporated folk practices such as saint veneration and protective rituals (Thomas, 1971), which Protestant reformers later rejected. In sub-Saharan Africa, syncretism remains common across both Christian and Muslim populations (Ashforth, 2002; Wood and Lambert, 2008).

illness is attributed to spirits or curses, biomedical care is viewed as ineffective (Appendix C.2). I test this relationship using individual-level Pew data. Using within-country variation, I find that individuals who believe in witchcraft are 16 percentage points more likely to use traditional healers (Appendix Figure A.4).

Supernatural illness beliefs may also shape social responses to illness. Anthropological work highlights how supernatural explanations of disease—e.g., attributing HIV/AIDS to witchcraft or punishment by God—can lead to stigma, ostracism, or withdrawal of care (Jilek-Aall et al., 1997; Farmer, 2006). I examine this relationship using DHS data from 16 countries in sub-Saharan Africa (2004–2013). I find that individuals who believe HIV can be contracted supernaturally are 7 percentage points more likely to agree that "people with AIDS should be ashamed," controlling for country fixed effects. These results suggest that beliefs shape not only treatment behavior but also the social experience of illness.

III. Can supernatural beliefs about illness change?

While supernatural explanations for illness have been historically ubiquitous across societies, not all societies appear to rely on them today as their primary explanatory framework, raising the question of what mechanisms might drive such change. One candidate is exposure to effective biomedical treatment. Ethnographic accounts suggest that visible biomedical treatment success can displace supernatural explanations according ot the logic, "if modern medicine can treat a condition, it cannot be supernatural" (Jilek-Aall et al., 1997; Cox and Phillips, 2015).

I explore this idea by linking individual-level DHS data from sub-Saharan Africa to country-year availability of HIV treatment (antiretroviral therapy, ART) from the World Health Organization (WHO). I find that a one-standard-deviation increase in lagged ART coverage predicts a 0.17 standard-deviation decrease in supernatural beliefs about HIV/AIDS, controlling for country and year fixed effects (Appendix Table A.1). While not causal, the pattern suggests that biomedical exposure may shift supernatural illness beliefs.

These findings suggest that supernatural illness beliefs are widespread across sub-Saharan Africa and may meaningfully shape health behavior and stigma. Evidence from the HIV treatment rollout indicates that such beliefs may adapt in response to modern medicine, which motivates the original data collection and field experiment that follow.

3 Setting in Kananga and Survey Design

In Section 2, I document that supernatural beliefs about illness are common across sub-Saharan Africa, and that such beliefs correlate with health behavior. However, existing survey data do not

allow analysis of beliefs across a broader set of conditions, nor can they illuminate the mechanisms linking supernatural beliefs to take-up of modern medicine. To address these limitations, I conducted a large-scale, representative survey in Kananga, DRC. This section describes the setting, sampling strategy, and survey instrument.

Setting. Kananga is an urban agglomeration of roughly 1.5 million residents and the capital of Kasai Province in the Democratic Republic of Congo (DRC). The DRC is the fourth most populous country in Africa and among the five poorest globally, with a high disease burden and recurring disease outbreaks, including Ebola. Kananga exhibits high levels of poverty: based on my data, the unemployment rate is 37%, median household income is 60 USD per month, 53% of respondents lack any form of electricity, and 60% live in homes made of clay or stick walls.

Modern medicine exists but focuses on primary and maternal care, often provided through NGOs such as UNICEF, Doctors Without Borders, and the WHO. This is not a setting unfamiliar with biomedicine: only 12% of respondents report never having consulted a medical professional. At the same time, traditional medicine, including herbal remedies and ancestral spiritual healing, is widely used: 50% of the respondents have consulted a traditional practitioner.

Nearly all respondents identify as Christian, but their Christian beliefs often integrate traditional supernatural elements including "witchcraft".

Sampling. I conducted a baseline survey with 800 adults, sampled using two-stage clustered sampling. First, I divided Kananga into 443 polygons based on 2016 Google Earth imagery and estimated polygon populations via housing counts. I then selected 50 polygons with probability proportional to size, stratifying by median distance to the city center, where collaborating hospitals are located.[12] Within each polygon, surveyors selected 16 households using a household skip pattern to ensure geographic representativeness.

Surveyors prioritized surveying the household head. If the household head was not present, the surveyor interviewed another adult in the household. Eligibility required basic understanding of Tshiluba and prior awareness of epilepsy; only one respondent was excluded. Surveys were conducted in Tshiluba by trained local surveyors between March and June 2022.

Survey design. The baseline survey elicited beliefs about 13 common adulthood illnesses and conditions: malaria, typhoid, tuberculosis, fractures, snakebite, sterility, hypertension, diabetes, COVID-19, swollen limbs, HIV/AIDS, anemia, and epilepsy.[13] At least 90% of respondents were

[12] Appendix Figure A.7 shows the selected polygons.

[13] This list is not comprehensive or representative of all illnesses in Kananga, but was derived from piloting, interviews, and focus groups as a subset of conditions that frequently arose in discussions about health. It includes common and severe conditions (e.g., malaria, typhoid), conditions often perceived as supernatural (e.g., epilepsy,

familiar with each condition (Appendix Table A.2), suggesting biomedical illness categories were generally well understood. Reported exposure varied: over 90% of respondents knew someone who had experienced malaria, typhoid, or epilepsy, while HIV/AIDS and COVID-19 had the lowest exposure rates (36% and 19%, respectively).

Main measures of beliefs about illness. Throughout the paper, I distinguish between natural and supernatural illness explanations, reflecting local etiological frameworks. Drawing on focus groups and interviews, I classify causes such as witchcraft, evil spirits, curses, and ancestral punishment as "supernatural". In contrast, biological processes, accidents, and environmental factors are considered "natural". The following three measures were elicited for each of the 13 illnesses, including epilepsy:

Supernatural illness. For each illness, respondents were asked: "According to you, can illness [...] be caused only by witchcraft, evil spirits, bad spell/curse, or fetishism, can [...] be caused only by something natural, or can [...] be caused by both?"[14] Surveyors selected one of three response options—"only supernatural," "only natural," or "both"—without reading them aloud.[15] I construct a binary variable, "illness can be supernatural," equal to one if the respondent selected "only supernatural" or "both," and zero otherwise.

In addition, to capture beliefs more granularly on the intensive margin, respondents were asked: "Out of ten people who have [...], how many do you think have [...] caused by witchcraft, evil spirits, or curses, that is, not by natural causes?" [16] I define the variable "share of illness supernatural" by dividing the respondent's answer by 10.

Efficacy of modern medicine. Respondents were asked: "For each of the following diseases or conditions, please tell me how good modern medicine or a doctor of modern medicine is at treating and diagnosing it: very good, good, neither good nor bad, not so good, not good at all." Surveyors proceeded through the list of illnesses including epilepsy. I construct the dummy variable "modern medicine effective" for each illness, equal to one if the respondent selected "very good" or "good"

sterility, snakebite), more novel conditions (e.g., COVID-19 and HIV/AIDS) or more benign conditions (e.g., anemia, hypertension).

[14]The words used in local French are *sorcellerie*, *mauvais esprits*, *mauvais sort*, *fétichisme*.

[15]These categories reflect local etiological frameworks and were derived from focus groups and interviews in Kananga, where respondents readily distinguished between natural and supernatural causes in precisely these terms.

[16]Before answering, respondents were told: *"Then, for each of the following disease or conditions, please imagine 10 people who have the disease or condition. It doesn't mean that these 10 people have to be your family members or that you have to know 10 people with that disease. Imagine that you take 10 people who have the disease by chance from the population. Then, you tell me how many of these 10 people you think have the disease caused by witchcraft, evil spirits, or curses. This means that these people do not have the disease from a natural cause. If you think a disease can have only supernatural causes, you say '10'. If you think a disease can have only natural causes, you say '0'. You can also think of percentages if it is easier for you. For example, if you think that 30% of all people who have diarrhea have diarrhea caused by evil spirits or witchcraft, you'd say '3'."* If needed, surveyors used a board with ten figures that respondents could allocate between "supernatural" and "natural" fields.

and zero otherwise.

Efficacy of traditional medicine. Respondents were asked: "For each of the following diseases or conditions, please tell me how good traditional medicine either at the basis of herbs or at the basis of ancestral powers is at treating and diagnosing it: very good, good, neither good nor bad, not so good, not good at all."[17] I construct the dummy variable "traditional medicine effective" for each illness, equal to one if the respondent selected "very good" or "good" and zero otherwise.

Incentivized beliefs about treatment efficacy. I also elicited incentivized estimates of the effectiveness of modern and traditional medicine for epilepsy in the midline survey. Respondents guessed how many patients recovered after each treatment, based on local hospital records, and received a small cash reward for accurate answers. These measures are described in detail in Section 6.

Additional survey measures are explained throughout the text. Appendix Section A details the construction of different indices.

4 Descriptive Evidence on Beliefs about the Cause of Illnesses in the DRC

Motivated by the evidence from sub-Saharan Africa, I use my original data from the DRC to examine the prevalence and structure of supernatural beliefs about illness, and their relationship with medical efficacy beliefs and stigmatizing attitudes toward those with illness. The descriptive evidence constitutes a core contribution of this paper and informs the design of the later experiment.

I. Are supernatural beliefs about illness common?

Based on focus groups and interviews, people in Kananga generally classify illness causes as either "natural" (e.g., biological processes or accidents) or "supernatural". Supernatural causes include evil spirits, curses, ancestral punishment, and "witchcraft", understood locally as harm inflicted through supernatural powers by a malicious human. These explanations draw on both traditional and Christian beliefs. For example, when asked in an open-ended survey question about the causes of epilepsy, respondents often mentioned "witchcraft", "spirits", and "curse", but, notably, not "God" (Appendix Figure A.8).

Supernatural beliefs about illness are widespread but vary across individuals. Using original survey data from 800 adults in Kananga, I find that 94% endorse a supernatural cause for at least one illness. However, individuals markedly vary in how often they use supernatural explanations (Figure 2a): the average respondent attributes 4.8 of 13 illnesses to supernatural

[17] "Traditional medicine at the basis of ancestral powers" is the local phrasing for healing practices that do not involve herbal medicine.

forces; only 0.9% attribute all illnesses to such causes, and 5.6% attribute none.

Individuals apply supernatural explanations selectively, even within the same illness. Focus group discussions and interviews in Kananga suggested that respondents do not only use supernatural explanations for some illnesses, but also for only some cases of a given illness, taking into account the characteristics or behavior of the afflicted person.[18] For empirical evidence, respondents were asked for each illness: "Out of ten people with illness x, how many have it due to supernatural causes?" For example for epilepsy, while 21.4% answered "0" and 10% said "10," the majority chose intermediate values (Appendix Figure A.10). This distribution implies that supernatural beliefs and natural beliefs can co-exist, a major contribution to the understanding of the cognition of religion (e.g., Legare et al., 2012).

Education and wealth do not predict supernatural illness beliefs. In light of the variation in beliefs, it is natural to ask who holds supernatural illness beliefs—and what this can teach us about the mechanisms of belief change. A natural prior is that supernatural illness beliefs are a symptom of poverty: education and wealth. I test this hypothesis empirically, regressing a standardized index of supernatural attribution across illnesses on demographic characteristics (Figure A.12). I find no robust association with age, education, or wealth. The only significant correlates are gender—women are more likely to endorse supernatural causes—and religious affiliation, with higher beliefs among Pentecostal or Protestant respondents.[19]

Could supernatural beliefs reflect a lack of knowledge about the affected person's health history? At the example of epilepsy, I find no evidence for this hypothesis: There is no difference in supernatural attribution between those who have a first-degree family member with epilepsy—including oneself or one's child—and those who do not.[20]

Supernatural attribution varies strongly by illness. Moreover, some illnesses are attributed to supernatural forces more frequently than others in the population (Figure 2b). Epilepsy is most commonly attributed to supernatural forces (93%), followed by sterility (70.3%) and snakebites (65.3%). In contrast, malaria (5.76%) and typhoid (10.8%) are less frequently attributed to such causes.

[18] Similar patterns are documented in South Africa with respect to HIV/AIDS; see Legare and Gelman (2008); Legare et al. (2012); Lynch and Medin (2006).

[19] Some Pentecostal churches in Kananga integrate traditional supernatural belief systems more than Catholic churches, potentially increasing endorsement of supernatural illness causes.

[20] Appendix Figure A.14 shows that respondents with first-degree relatives who have epilepsy are as likely to endorse supernatural causes as those without. However, more granular analysis suggests that relationship closeness may shape how supernatural beliefs are expressed. Respondents are less likely to endorse the more stigmatizing belief that people with epilepsy are witches, and more likely to endorse the empathy-inducing belief that they are bewitched, when the person with epilepsy is their child (Appendix Figures A.15a and A.15b). I return to the role of supernatural beliefs in shaping stigma below.

The fact that 38% of respondents attribute fractures and 65% attribute snakebites to supernatural causes illustrates a key insight: even observable mechanical triggers do not preclude supernatural causes. Supernatural beliefs do not imply denial of biological mechanisms; rather, they reflect the view that such mechanisms are ultimately governed—and can be manipulated—by supernatural forces. As Evans-Pritchard (1976) famously noted in his study of the Azande, people may understand the mechanical cause of an event, such as termites that hollow out a granary, but still invoke witchcraft to explain why the structure collapsed at that particular moment, injuring a particular person. As another example, Gottlieb (2004) describes how villagers dismissed advice to boil drinking water during a Guinea worm outbreak in Côte d'Ivoire because boiling water would not stop the witches from putting the worms into the water (see Section C.1).

In Kananga, this reasoning is particularly salient in the case of epilepsy. Over 90% of respondents agree that epilepsy originates in the brain, while simultaneously endorsing supernatural causes. This insight also foreshadows how the intervention may operate: not by explaining biological mechanisms, but by engaging with deeper causal models and the logic of illness attribution.[21]

Moreover, the variation across illnesses cannot be explained by novelty or rarity alone. For example, beliefs about COVID-19 and HIV/AIDS are relatively low despite their novelty and thus potentially lack of understanding. Nor does exposure explain the pattern: over 90% of respondents report knowing someone with epilepsy, yet supernatural attribution remains high (see Appendix Table A.2).

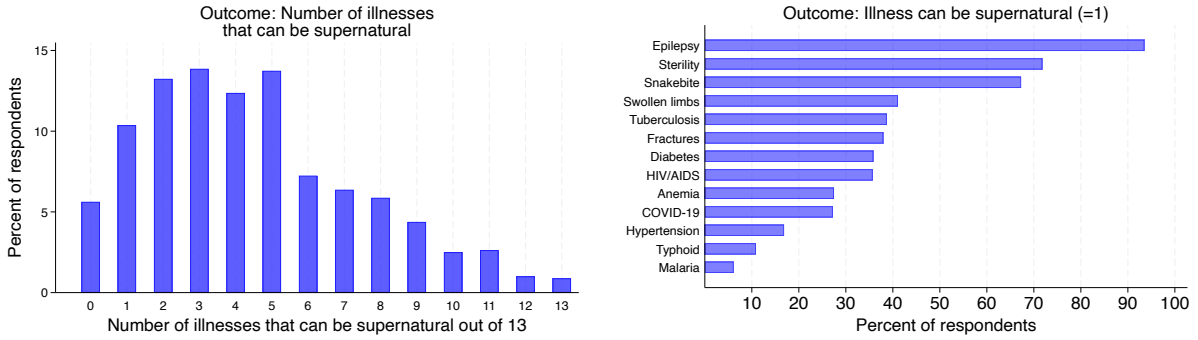
II. Are supernatural beliefs about illness relevant for health behavior?

Supernatural beliefs about illness are strongly negatively correlated with past use of modern medicine and beliefs about its efficacy. I examine whether supernatural beliefs about illness are empirically relevant for medical decision-making. I begin by asking whether such beliefs predict past use of modern medicine. Using data at the individual–illness level and individual fixed effects, I find that believing an illness may have supernatural causes is associated with a 25.6 percentage point lower likelihood of having used modern medicine for that illness (Appendix Table A.3, Panel B, column (2)). This association remains negative and statistically significant when I include illness fixed effects instead (–4.8 percentage points; column (3)) and both illness and individual fixed effects (column (4)).

While these patterns in treatment use are suggestive, they are shaped by multiple factors beyond beliefs—most notably, whether the illness occurred and whether biomedical care was available at the time. Instead, the primary object of interest in this paper is not past modern medicine use,

[21] See also Evans et al. (1995) for a classic example in which villagers understand termites cause huts to collapse, but attribute the event to witchcraft when it harms a particular individual.

Figure 2: Variation in Supernatural Beliefs Across Individuals and Illnesses



(a) Variation in illness beliefs across individuals (b) Variation in supernatural beliefs across illnesses

Notes: Panel 2a: The histogram shows the distribution of the variable on the number of illnesses that an individual believes can be supernatural in origin (out of 13). The variable is based on the question of whether an illness j has only supernatural causes, only natural causes, or both. See Section 3 for the variable description. Panel 2b: The figure shows the percent of respondents believing an illness can have supernatural causes by illness, constructed in the same way. The data come from the baseline survey (N=800).

but beliefs about its effectiveness. Every individual who experiences symptoms must form a belief about whether biomedical treatment could be effective even before incurring the cost of seeking information at a modern medical practice.

Next, I examine the relationship between supernatural beliefs and beliefs about the efficacy of modern medicine across illnesses. Focus group discussions and interviews revealed a logic connecting the two beliefs, summarized by a survey respondent as, "If the disease is natural, modern medicine can treat it. But if it is supernatural, it is in the realm of traditional medicine." First, I investigate the relationship by comparing population means of supernatural beliefs and beliefs about modern medicine's efficacy for every illness. Figure 3a shows the share of respondents who believe that modern medicine is effective in treating the illness on the y-axis and the share of respondents who believe an illness can be supernatural on the x-axis. I find that beliefs that an illness can be of supernatural origin negatively correlate with beliefs that modern medicine is effective at the population level. For example, malaria, typhoid, hypertension, and anemia exhibit low supernatural beliefs and high beliefs about the efficacy of modern medicine. In contrast, snakebites, sterility, and epilepsy show high supernatural attributions and low beliefs in the efficacy of modern medicine. The results for the new and less prevalent disease of COVID-19 follow this pattern, providing evidence of the link between beliefs even when respondents have little experience with the illness. The results for HIV/AIDS deviate, possibly due to extensive information campaigns about the transmission mechanisms.

Next, I demonstrate that this negative relationship even holds across beliefs about different

illnesses for a given individual by introducing individual fixed effects. Figure 3b shows a binned scatter plot of the belief that modern medicine is effective for an illness on the y-axis and the belief that the illness can have supernatural causes on the x-axis, including individual fixed effects. Appendix Table A.3 shows the corresponding regression results in Panel A column (6). Panel A columns (7) and (8) and Panels B and C show that the negative relationship holds when I use illness fixed effects, illness and individual fixed effects, when I control for the individual's experience with modern medicine for a particular illness, and when I control for the individual knowing somebody who has had the illness capturing exposure and prevalence. In conclusion, the relationship is robust and not driven by particular illnesses or individual-level factors such as age, education, wealth, or general trust in medicine.

The evidence points to an explanatory framework: individuals appear to hold interdependent beliefs about disease causataion and treatment domain. Survey evidence supports this hypothesis: only 12% of respondents believe that modern medicine can treat supernatural illnesses well, compared to 86% who believe that traditional medicine can. For example, nearly half (47.4%) of respondents agree that "If modern medicine can treat a patient such that the person does not have epilepsy anymore, the person cannot have had epilepsy caused by evil spirits, witchcraft or the mauvais sort." A third of respondents (32%) agree that "If a person who has epilepsy takes modern medicine but the person keeps having attacks, the person must be a witch or bewitched." The interdependence of beliefs suggests that if individuals come to believe that modern medicine can treat a given condition, they may update away from supernatural explanations, which motivates the experimental design below.

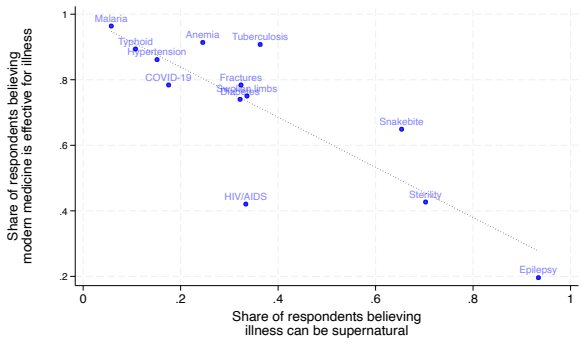
Supernatural beliefs regarding epilepsy predict stigma toward those with epilepsy. In Section 2, I documented a positive association between supernatural beliefs and stigmatizing attitudes in the case of HIV/AIDS. Focus group discussions in Kananga reinforced this pattern, highlighting that beliefs about the supernatural origin of illness shape perceptions of the afflicted, affecting their well-being and acting as an additional barrier to treatment.[22]

Since stigma toward people with HIV/AIDS may be shaped by concerns about transmission and the demographic profile of affected individuals, I test whether supernatural causal beliefs can predict stigmatizing attitudes at the example of epilepsy, a non-transmissible condition affecting all demographic groups.

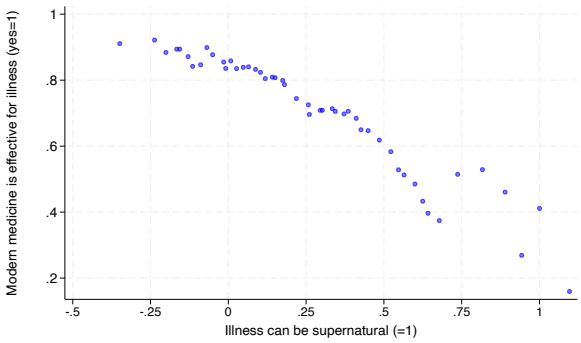
I measure stigma using a dummy variable equal to one if the respondent agrees that one's children should not play with a child who has epilepsy. I examine three dimensions of beliefs as predictors

[22] Jilek-Aall (1999) identified a high prevalence of epilepsy in Tanzania not through epilepsy consultations but through treatment of burn injuries, often sustained during seizures.

Figure 3: Relationship Between Supernatural Beliefs and Beliefs about Modern Medicine



(a) Relationship of beliefs that modern medicine is effective and that illness is supernatural, by illness



(b) Relationship of beliefs that modern medicine is effective and that illness is supernatural, at illness–individual level with individual fixed effects

Notes: Panel 3a: The figure shows the mean of the dummy variable for whether an illness can have supernatural causes by illness on the y-axis and the mean of the dummy variable for whether modern medicine is effective for an illness on the x-axis. See Section 3 for the construction of the variables. The data come from the baseline survey (N=800). Panel 3b: The figure shows the binned scatter plot of the dummy variable for whether an illness can have supernatural causes for an illness on the x-axis and the dummy variable for whether modern medicine is effective for an illness on the y-axis. The regression includes individual fixed effects with observations at the illness–individual level in the baseline survey (N=800). See Section 3 for the construction of the variables.

in addition to demographic covariates: First, whether the respondent believes that people living with epilepsy (PLWE) are witches[23]; second, whether PLWE are believed to be bewitched—that is, under a curse or spell and not personally responsible[24]; and third, whether the respondent believes epilepsy is transmissible from human to human as an incorrect transmission belief could rationalize social distancing.[25]

Figure A.13 plots the regression coefficients. Belief in transmission is the strongest predictor of stigma, with a coefficient of 0.45, which may reflect both incorrect biomedical beliefs and ideas of supernatural contagion. Respondents who believe that PLWE are witches are 11.7 percentage points more likely to express stigmatizing attitudes, significant at the 1% level. In contrast, the belief that PLWE are bewitched—i.e., passive victims of misfortune—does not predict stigma.[26]

Summary and interpretation. Supernatural illness beliefs are widespread in Kananga and vary systematically across both individuals and illnesses. They are not ad hoc, but structured: respondents distinguish between natural and supernatural causes of disease, and the frequency of invoking

[23] Agreement with the statement "Somebody with epilepsy is a witch," measured on a 5-point scale; coded as 1 if "agree" or "strongly agree" and 0 otherwise

[24] Agreement with the statement "Somebody with epilepsy is bewitched" (*ensorcelé*); coded as 1 if "agree" or "strongly agree" and 0 otherwise

[25] This includes beliefs in supernatural contagion, such as transmission via spirits.

[26] This raises the question of whether observable characteristics of affected individuals shape which supernatural explanation is adopted; see Appendix A.15.

supernatural explanations is not explained by education, wealth, or disease familiarity. Such beliefs frequently coexist with biomedical knowledge, suggesting they do not reflect ignorance or rejection of science. Instead, they appear to form part of a coherent explanatory framework that individuals use to reason about illness.

Within this framework, beliefs are bundled: individuals who attribute illness to supernatural causes are simultaneously more likely to believe that modern medicine is ineffective, and vice versa. I use the term *bundled beliefs*, *explanatory frameworks*, or *mental model* to describe this internally consistent reasoning about causality, efficacy, and social meaning. While I do not attempt to recover its full cognitive structure, the observed regularities suggest that beliefs are internally consistent.

I show that these beliefs matter for behavior. Individuals are substantially less likely to use or believe in modern medicine for illnesses they view as potentially supernatural. They also matter in themselves: beliefs about spiritual causality predict stigma, especially when illness is seen as involving witchcraft. Such beliefs shape how others respond to the sick and may lead to neglect or harm.

Among all illnesses, epilepsy emerges as a particularly salient case. It is the condition most frequently attributed to supernatural forces, yet one that most respondents recognize as occurring in the brain and that they have personally witnessed. The experiment that follows tests whether providing credible information about the biomedical causes and treatment of epilepsy can shift not only beliefs about epilepsy, but also causal beliefs for other illnesses.

5 Experiment Description

I now test whether supernatural beliefs about illness can be shifted, take-up of modern medicine increased, and stigma toward those with epilepsy reduced through a randomized controlled trial (RCT) in Kananga, DRC. The descriptive sections have shown that natural and supernatural explanations often co-exist indicating potential malleability (Section 4), that these beliefs are not tightly predicted by wealth or education (Section 2), and that instead exposure to modern medicine may serve as a mechanism for belief change. Building on this logic, the experiment implements a narrative-based informational intervention on the biomedical causes and treatment of epilepsy.

5.1 Design of Intervention

Motivation. One approach involves delivering modern medical treatment and studying subsequent belief updates. Yet in practice, belief change through lived experience is slow: biomedical effects are rarely immediate or directly observable, causal inference is difficult in health contexts, and stigma may limit disclosure and open discussion. To accelerate this process, I instead provided the kind of

information typically conveyed in a biomedical consultation on the condition's causes, the efficacy and availability of modern treatment, and the limitations of traditional medicine.

Background on epilepsy.[27] Epilepsy is a chronic neurological disorder with disproportionate prevalence in low-income countries due to infections, birth complications, and trauma (Ba-Diop et al., 2014).[28] Though effective treatment exists—antiseizure drugs can control 70–80% of cases (World Health Organization, 2004)—an estimated 80% of people living with epilepsy (PLWE) in Africa remain untreated.

Epilepsy is a highly salient and misunderstood condition in Kananga. Exposure is widespread: 91% of respondents in the baseline survey know someone with the condition, 96% have witnessed a seizure, and 10.5% have a first-degree relative with epilepsy. Modern drugs are available locally, though costly ($30/month). Only 9.9% of respondents believe modern treatment exists in Kananga, and 63.3% believe epilepsy cannot be treated with modern medicine. These patterns suggest scope for belief updating through credible information.

Treatment group. I collaborated with two medical professionals from the local Ministry of Health in Kananga, who are experts on epilepsy in this setting and who have ample experience with epilepsy information campaigns, motivated by the large misperceptions in the population. We designed a short informational video, opting for a "narrative approach", providing information through story-telling rather than abstract fact delivery—particularly important in settings with low literacy and numeracy.

The video conveyed five key pieces of information on epilepsy:[29] (1) the efficacy of modern medicine and availability of treatment in Kananga, (2) the neurological origin of epilepsy, (3) biomedical causes such as meningitis or birth complications, (4) the ineffectiveness of traditional medicine, and (5) the nonassociation of epilepsy with curses, spirits, or "witchcraft". This last point was included by the medical professionals, who consistently address supernatural explanations in their public health campaigns.

The medical professionals delivered the content in Tshiluba using unscripted, accessible language and locally relevant examples.[30] The video also featured a testimonial by a woman recounting her daughter's successful treatment, a format commonly used in churches and on the radio. Respondents received an illustrated leaflet summarizing the key points in French and Tshiluba. Given limited internet access, videos were shown individually on tablets rather than distributed via social media.

[27] See Appendix Section A for more details on epilepsy.
[28] In parts of Central and West Africa with high prevalence of onchocerciasis (river blindness), epilepsy prevalence has been found to exceed 4% in some affected communities (Fodjo et al., 2019).
[29] Full treatment script in Appendix B.
[30] Content was jointly developed, but final delivery was in free speech to ensure natural communication.

To enhance processing and engagement, surveyors asked respondents immediately after the video what they had learned and whether the content might also apply to other illnesses as a pedagogical nudge.

Control group. Control respondents watched a placebo video to ensure comparable exposure to audiovisual technology. The video featured the same two medical professionals (who did not identify themselves as such) discussing different children's games in low-resource settings.[31] Respondents also received a leaflet with illustrated instructions for one of the games.

5.2 Survey and Experimental Flow

The experiment was embedded in the data collection of 800 respondents described in Section 3. Each respondent was visited twice. The first visit included the baseline survey, followed by the video and an immediate midline survey. The endline survey occurred about one week later.[32]

Randomization. Treatment was randomly assigned at the point of video delivery via survey software (413 treated, 387 control). The treatment and placebo videos lasted 15 and 10 minutes, respectively. To ensure attention, respondents received 500 FC (USD 0.25) for correctly answering a basic comprehension question about the video. Accuracy was high and similar across groups (97.5% in treatment, 93.5% in control).

Both videos were well received. At endline, 77% of treated respondents and 69% of controls reported having discussed the video with others; 72% and 65%, respectively, had shared the leaflet with somebody else.

Midline and endline surveys. The midline survey captured belief measures and incentivized outcomes, including perceived treatment efficacy (modern vs. traditional), willingness to pay for health services, valuation of care for third parties, and an incentivized stigma measure. Respondents also received vouchers for free HIV and hypertension testing.

The endline survey served to assess persistence of belief changes and to reduce experimenter demand (Haaland et al., 2023). It retained 97.8% of the baseline sample and re-elicited belief modules. At the end of the visit, respondents received a voucher redeemable by any adult for a free epilepsy consultation at the General Hospital.

5.3 Estimating Equation

I estimate treatment effects using ordinary least squares (OLS):

[31] Examples include drawing in the sand, jumping rope with bamboo cords, making paper airplanes, and playing with homemade balls.

[32] Appendix Figure A.16 illustrates the survey flow.

$$y_i = \alpha + \beta_1 T_i + \beta_2 y_i^0 + \mathbf{X}_i \mathbf{\Gamma} + \varepsilon_i. \quad (1)$$

where y_i is the outcome of interest for individual i, T_i is a dummy variable equal to one if the individual watched the treatment video and zero otherwise, and y_i^0 is the baseline value (or proxy) of the outcome. The coefficient β_1 captures the average causal effect of the treatment. The vector $\mathbf{X}_i$ includes controls for gender, age, age squared, and two baseline imbalances: whether the respondent knew modern epilepsy treatment exists in Kananga and whether the respondent is a widow (see Section 5.4). I use robust standard errors throughout.

I also report p-values based on randomization inference and bootstrapped standard errors with 1,000 iterations. These methods are less sensitive to distributional assumptions and finite-sample bias, and help ensure robustness in settings with possible non-normality or weak identification.

5.4 Balance

I assess randomization by estimating equation 1 without covariates, using as outcomes: (i) past use of traditional and modern medicine, (ii) familiarity with epilepsy, (iii) demographic and economic characteristics, and (iv) survey-related variables such as attrition and trust in the surveyor (Appendix Table A.4).

Two variables are imbalanced at the 5% level: whether the respondent believes modern epilepsy treatment exists in Kananga, and whether the respondent is a widow. I include both in $\mathbf{X}_i$. While monthly income differs at the 10% level, there is no significant difference in $\log(1 + \text{income})$.

6 Experimental Results

In this section, I report the experimental results. I begin with the effects of the intervention on belief updating for epilepsy and other illnesses, then examine behavioral impacts on the take-up of modern medicine, and finally analyze effects on stigma toward those with epilepsy. Details on survey design and construction of the main variables are provided in Section 3.

6.1 Experimental Results on Beliefs

6.1.1 Treatment Effects on Beliefs about the Cause and Treatment of Epilepsy

Before analyzing belief outcomes, I verify that treated respondents retained the video's factual content as a zero stage. Appendix Table A.5 shows that in the midline survey, treated respondents were 65.7 percentage points more likely to report that medication for epilepsy exists in Kananga (control mean: 0.256), 64.5 percentage points more likely to report that doctors to treat epilepsy exist in Kananga (control mean: 0.289), and 7.2 percentage points more likely to report that

epilepsy occurs in the brain, with a control mean of 0.91. The latter is noteworthy, pointing to a high baseline knowledge about proximate causes. Treated respondents were also 30.5 percentage points more likely to disagree with a statement that epilepsy always occurs in the heart (control mean: 0.527) in the midline survey, ruling out that answers are driven by respondents agreeing with any statement they are presented with. All effects are statistically significant at the 1-percent level.

Moreover, although the video did not explicitly address transmissibility, treated respondents were 8.5 percentage points less likely to believe epilepsy is transmissible immediately after viewing the video (control mean: 0.305). However, the effect does not persist at endline.

Main results. Turning to primary belief outcomes, I find that the treatment shifted both causal and treatment beliefs about epilepsy in the endline survey. Panel A of Table 1 shows that treated respondents were 20.6 percentage points less likely to endorse any supernatural cause (control mean: 0.892). The outcome is a binary indicator equal to one if the respondent reported that epilepsy could exclusively have supernatural causes or both supernatural and natural causes. Treated respondents also attributed 29.3 percentage points fewer cases of epilepsy to supernatural causes (control mean: 0.582), measured as the reported share of ten hypothetical epilepsy cases believed to be due to supernatural causes, visualized in Appendix Figure A.17. Moreover, treated respondents were 31.5 percentage points less likely to report that people living with epilepsy (PLWE) are witches (control mean: 0.632) and 36.9 percentage points less likely to report that PLWE are bewitched (control mean: 0.749). These outcomes are binary indicators equal to one if the respondent agreed or strongly agreed with the corresponding statements on a five-point Likert scale. All effects are statistically significant at the 1-percent level.

Panel B reports corresponding shifts in beliefs about treatment efficacy. Treated respondents were 47.4 percentage points more likely to report that modern medicine is effective for epilepsy (control mean: 0.328), defined as rating modern medicine as "good" or "very good" at treating epilepsy. They were also 30.2 percentage points less likely to report that traditional medicine is effective (control mean: 0.674), using the same binary construction. All effects are statistically significant at the 1-percent level.

Taken together, these findings suggest that individuals updated a bundled set of beliefs—moving away from a supernatural framework of illness and toward a biomedical one.

Heterogeneous treatment effects. I examine heterogeneity in belief updating to shed light on the mechanisms of belief change. The outcome is the "epilepsy supernatural index," a Kling et al. (2007) index of three indicators (see Appendix Section A for the construction): whether the respondent believes epilepsy can have supernatural causes, whether the respondent agrees that people with

epilepsy (PLWE) are witches, and whether the respondent agrees that PLWE are bewitched. I estimate the following interaction specification, expanding equation 1:

$$y_i = \alpha + \beta_1 T_i + \beta_2 T_i \times H_i + \beta_3 H_i + \beta_4 y_i^0 + \mathbf{X}i\mathbf{\Gamma} + \varepsilon_i, \tag{2}$$

where H_i denotes a moderator (e.g., belief or knowledge at baseline), and β_2 captures heterogeneous treatment effects. Appendix Table A.8 reports the regression results.

Three main patterns emerge. First, respondents who scored high on the epilepsy supernatural index at baseline updated more strongly (column (1)), consistent with a higher potential for change when priors were strongly supernatural. This pattern is reflected in respondents' categorical updating as well: a substantial share switched from endorsing only supernatural causes at baseline to endorsing only natural causes at endline (Figure A.19). In contrast, general supernatural beliefs—such as a general belief in witchcraft or the idea that other illnesses can be supernatural—do not predict differential updating (columns (2) and (3)).

Second, I find that treatment effects are significantly attenuated for respondents who already knew that epilepsy medication was available in Kananga (column (4)), and among those who already believed that modern medicine is effective for epilepsy (column (5)). Moreover, belief updating was 17.1 percentage points larger among respondents who agreed that "if modern medicine can treat epilepsy, it cannot be supernatural" (column (6)). These results are consistent with the intervention's intended logic and support the hypothesis that respondents reasoned using internally consistent mental models linking cause and treatment. In contrast, knowledge of proximate mechanisms—e.g., knowing that epilepsy occurs in the brain—did not moderate effects (column (7)), in line with anthropological findings that proximate biological mechanisms and ultimate supernatural causality can coexist (Evans-Pritchard, 1976).

Third, I find no evidence of heterogeneity by whether the respondents had a close family member with epilepsy (column (8)) and demographics (Appendix Table A.9). Taken together, the results indicate that the intervention worked by engaging respondents' internal causal framework for illness and treatment, rather than through instruction in biological mechanisms.

Incentivized estimates of modern medicine's and traditional medicine's treatment efficacy. To mitigate concerns about social desirability bias and experimenter demand effects in belief elicitation, I included incentivized measures of respondents' beliefs about the effectiveness of modern and traditional medicine for epilepsy. These measures were based on real patient data and designed to reward accurate beliefs.

I obtained data on modern medicine's treatment efficacy for epilepsy in Kananga from the

Table 1: Experimental Evidence on Beliefs about Epilepsy

Panel A: Beliefs about supernatural cause of epilepsy				
	(1) Epilepsy can be supernatural	(2) Share epilepsy supernatural	(3) Epileptic is a witch	(4) Epileptic is bewitched
Treatment	-0.208***	-0.293***	-0.318***	-0.369***
	(0.028)	(0.021)	(0.033)	(0.033)
p-value OLS	0.000	0.000	0.000	0.000
p-value randomisation inference	0.000	0.000	0.000	0.000
p-value bootstrap	0.000	0.000	0.000	0.000
Control mean	0.892	0.582	0.632	0.749
R^2	0.114	0.252	0.199	0.205
Observations	782	776	782	782
Panel B: Beliefs about modern medicine's and traditional medicine's efficacy and incentivized estimation				
	(1) Modern medicine effective	(2) Traditional medicine effective	(3) Modern medicine estimation	(4) Traditional medicine estimation
Treatment	0.474***	-0.302***	0.154***	-0.195***
	(0.032)	(0.034)	(0.025)	(0.022)
p-value OLS	0.000	0.000	0.000	0.000
p-value randomization inference	0.000	0.000	0.000	0.000
p-value bootstrap	0.000	0.000	0.000	0.000
Control mean	0.328	0.674	0.334	0.467
R^2	0.243	0.093	0.080	0.114
Observations	782	782	766	781

Notes: This table reports estimates from Equation 1. "Epilepsy can be supernatural" is a dummy variable equal to one if the respondent answered "only supernatural" or "both supernatural and natural" to the question "Can epilepsy be caused only by witchcraft, evil spirits, curses, or fetishism, can it be caused only by something natural, or can it be caused by both?" The variable "Share epilepsy supernatural" is the answer to the question "Out of ten people who have epilepsy, how many have epilepsy caused by witchcraft, evil spirits, or curses, that is, not by natural causes?", divided by 10. The variables "Epileptic is a witch" and "Epileptic is bewitched" are dummy variables equal to one if the respondent agrees or strongly agrees with the statements "People with epilepsy are witches" and "People with epilepsy are bewitched", respectively, with answer options on a 5-point scale from "strongly disagree" to "strongly agree". "Modern medicine effective" and "traditional medicine effective" are dummy variables equal to one if the respondent answers "very good" or "good" to the questions "How good is modern medicine at diagnosing and treating epilepsy?" and "How good is traditional medicine at diagnosing and treating epilepsy?", respectively, with answer options on a 5-point scale from "strongly disagree" to "strongly agree". "Modern medicine estimate" is the respondent's answer to the incentivized question of how many out of 40 patients who took modern treatment for epilepsy had no seizures in the month after starting treatment, divided by 40. "Traditional medicine estimate" is the respondent's answer to the incentivized question of how many out of 10 patients who took traditional treatment for epilepsy had no seizures in the month after starting treatment, divided by 10. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors in parentheses.

neuropsychiatry division of the General Hospital in Kananga. Hospital staff identified a sample of 40 patients who had experienced at least one seizure per month before initiating modern treatment, who had documented seizure histories, and who adhered to treatment protocols. Among these, 13 patients had no seizures in the month following treatment initiation. While these figures do not provide an unbiased estimate of the true treatment efficacy in Kananga, the survey instrument did not describe the data as such.

Respondents were told: "I have data on 40 patients who have or had epilepsy and started to take modern medicine for treatment as prescribed by a doctor here in Kananga. Before taking modern medicine, they had at least one seizure per month. How many of the 40 do you think had no seizures in the month after starting the treatment? Please guess." The outcome variable, "modern medicine estimate", is defined as the respondent's answer divided by 40.

Since equivalent clinical data could not be obtained from traditional practitioners, I used hospital-collected information about past use of traditional medicine from patient interviews. The hospital recorded retrospective reports from 10 patients who had tried traditional medicine, met the same seizure-frequency criteria prior to treatment, and recalled whether they had remained seizure-free for one month. None of the 10 patients reported full seizure cessation.

The corresponding prompt read: "I also have data on 10 patients who have or had epilepsy and that at some point in their life consulted a traditional practitioner and took the suggested remedy here in Kananga. Before they started the treatment, all of them had at least one seizure per month. How many of the 10 do you think had no seizure at all in the month after they started the treatment? Please guess." The outcome variable, "traditional medicine estimate", is defined as the respondent's answer divided by 10.

Both measures were incentivized. Respondents received 500 FC (0.25 USD) for each correct guess. No respondent answered both questions correctly.

Treatment effects are shown in Table 1, Panel B, columns (3) and (4). Treated respondents estimated modern medicine efficacy to be 15.4 percentage points higher than the control group (control mean of 0.334), and traditional medicine efficacy to be 19.5 percentage points lower (control mean of 0.467). It is noteworthy that respondents in the control group—when incentivized to be accurate—estimated traditional medicine to be more effective than modern medicine for treating epilepsy. Appendix Figure A.18 shows a shift in the full distribution of responses.

As an additional incentivized measure of modern medicine efficacy, I implemented a third-party valuation task, modeled after the Becker–DeGroot–Marschak (BDM) method, in which respondents decided whether an anonymous patient with seizures should receive a hospital consultation or a cash transfer. Appendix Section B details the task and presents the results. Although the treatment

group assigned slightly higher value to the consultation, the result is not statistically significant. This null result likely reflects the cognitive and contextual limitations of the task, consistent with difficulties in the BDM exercises for other illnesses discussed below.

In conclusion, the treatment reduced supernatural causal beliefs and increased beliefs in modern medicine's efficacy for epilepsy. Heterogeneity analyses suggest that this shift was driven by credible new information and activated inference logics, rather than general education or biological understanding. The intervention appears to have shifted respondents' mental models of illness causality—from frameworks rooted in spiritual explanations to those grounded in biomedical reasoning.

6.1.2 Spillover Effects: Treatment Effects on Beliefs about the Cause and Treatment of Other Conditions

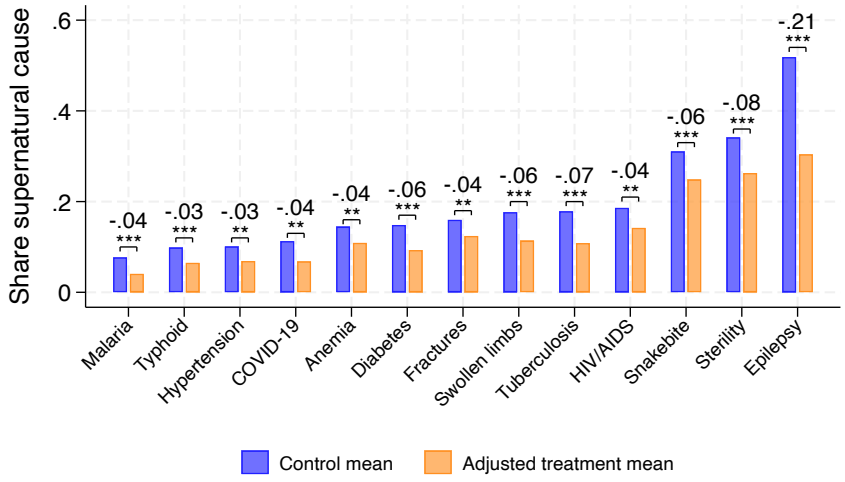
I next test whether belief updating generalizes beyond the illness discussed in the video. If illness beliefs are bundled as the descriptive evidence suggests, information about one condition could affect beliefs about other conditions as well. I test this idea by examining whether treated respondents revised their beliefs not only about epilepsy, but about a set of other illnesses that were not mentioned in the intervention.

Figure 4 shows that the treatment induced significant reductions in supernatural attributions across the twelve other illnesses. For a more continuous measure, the outcome is the perceived share of ten hypothetical cases attributed to supernatural causes. The share fell by 4 to 8 percentage points across conditions (Panel A), relative to a –21 percentage point effect for epilepsy.

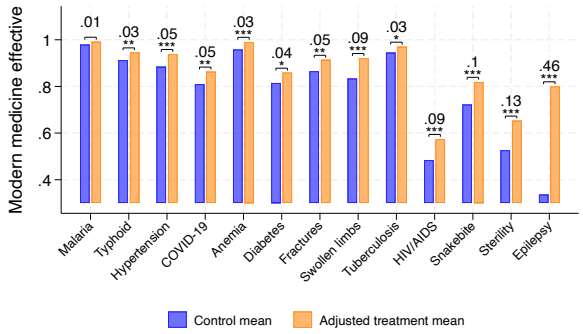
Beliefs about modern medicine shifted similarly. Panel B of Figure 4 shows that the treatment increased beliefs in modern medicine's efficacy across all illnesses—except malaria because of high baseline modern medical beliefs—, with effects ranging from 1 to 13 percentage points. Belief in modern medicine's efficacy is measured as a dummy variable equal to one if the respondent rated modern medicine as "good" or "very good" for a given illness. Panel C shows a consistent decline in belief in traditional medicine's efficacy, with effects between –4 and –12 percentage points. The more irregular pattern could be due to the fact that traditional medicine encompasses both herbal and spiritual medicine—a topic for future research.

Interpretation and mechanisms for spillover effects. Are the spillover effects related to baseline beliefs about supernatural causes? I examine treatment effect heterogeneity at the individual–illness level, excluding epilepsy. The outcome is the respondent's estimated share of cases of illness

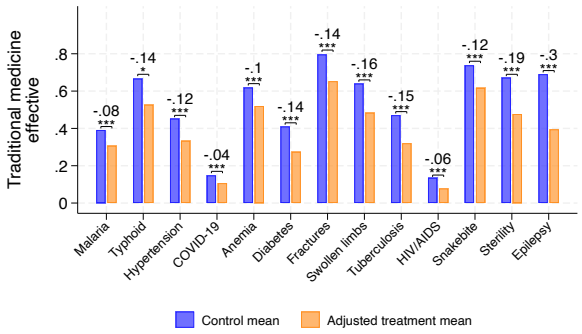
Figure 4: Spillover Effects: Treatment Effects on Beliefs Across Illnesses



(a) Treatment effect on share of people with illness of supernatural cause



(b) Treatment effect on belief that modern medicine is effective



(c) Treatment effect on belief that traditional medicine is effective

Note: The figure shows the control mean, adjusted treatment mean, and treatment effect for three different outcome variables by illness from separate regressions using equation 1. The outcome in Figure 4a is the answer to the question "Out of ten people who have [...], how many have [...] caused by witchcraft, evil spirits, or curses, that is, not by natural causes?" for every illness divided by 10. The outcomes in Figures 4b and 4c are dummy variables equal to one if the respondent answered "very good" or "good" to the questions "How good is modern medicine at diagnosing and treating [...]?" and "How good is traditional medicine at diagnosing and treating [...]?", respectively, for every illness, with answer options on a 5-point scale from "strongly disagree" to "strongly agree". The figures show the treatment effect coefficient and significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ based on OLS robust standard errors.

j caused by supernatural forces. The regression includes illness fixed effects.[33]

Appendix Table A.10 reports the results. Respondents who believed illness j could be of supernatural origin at baseline exhibit a 162.5% larger treatment effect than those who did not (column (1)). Those who believed epilepsy itself could be supernatural at baseline show a 250% larger effect (column (2)). Treatment effects are also larger among those with higher values on a Kling et al. (2007) index of supernatural beliefs across the 13 illnesses (column (3)), and among those who attributed a greater average share of illnesses to supernatural causes (column (4)). While these results partly reflect mechanical ceiling effects—only those with supernatural priors have scope to update—they also suggest that updating occurs systematically across illnesses associated with similar causal beliefs.

Although the data do not allow a direct test of mechanism, the pattern of heterogeneity sheds light on how individuals organize illness beliefs. A first possibility is that individuals may treat "supernatural causality" as a cognitive category over which generalization occurs. This is consistent with category-based induction: disconfirming the supernatural origin of one illness may trigger reevaluation of others within the same causal category.[34] The fact that belief updating is concentrated among illnesses seen as having a supernatural component—not those with similar symptoms or biomedical profiles—suggests that individuals categorize illness in causal rather than clinical terms. For example, information about epilepsy triggered belief updating for sterility and fractures, even though both are markedly different from epilepsy in their symptoms.

A second possibility is that individuals hold a global prior over the likelihood of supernatural causality across illnesses. In this interpretation, the intervention shifts that prior, generating spillovers through an updating process not tied to illness-specific inference.

In either case, the findings highlight that explanations are central to learning: they enable individuals to generalize across categories by extracting underlying causal structure (Williams and Lombrozo, 2010).[35] Both mechanisms suggest that individuals interpret new information through

[33] I estimate the following equation using OLS:

$$\text{Share supernatural}_{ij} = \mu_j + \beta\, T_i + \gamma\, T_i \times H^0_{ij} + \delta H^0_{ij} + \lambda \text{illness supernatural}^0_{ij} + \mathbf{X}_i\mathbf{\Gamma} + \varepsilon_{ij} \tag{3}$$

where i indexes individuals and j indexes illnesses. The outcome variable measures the respondent's estimated share of individuals with an illness j of supernatural causes. I use a continuous outcome variable to mitigate ceiling effects. The outcome variable spans all illnesses with the exception of epilepsy. I consider different variables H_{ij} that I interact with the treatment variable indicator. I control for whether the respondent thought illness j could be supernatural in the baseline survey, variable illness supernatural$^0_{ij}$. μ_j is illness fixed effects. $\mathbf{X}_i$ includes gender, age, age squared, being a widow, and knowing that medication to treat epilepsy exists at baseline.

[34] See López et al. (1992), Osherson et al. (1990), Tversky (1977), Peski (2011), Fryer and Jackson (2008), Mullainathan (2002), Mullainathan et al. (2008), and Alsan et al. (2024).

[35] For example, Lombrozo (2006) shows that when novices learn that herring and tuna are infected, they infer that wolffish (a perceptually similar fish) might also be infected. Experts, by contrast, form a causal explanation—e.g., tuna contracted the disease from herring—and extend that property to dolphins, who share the causal exposure (eating herring) despite lacking superficial similarity. See also Williams and Lombrozo (2010).

structured explanatory frameworks, updating not just illness-specific beliefs but broader causal systems. The observed spillovers provide causal evidence that beliefs are linked across illnesses via shared explanatory logic.

Spillover effects on other illnesses: Incentivized measures. While stated beliefs shifted across multiple illnesses, the natural next question is whether these updates translated into behavior. To test this idea, I elicited respondents' willingness to pay for a voucher for a consultation and testing for a subset of illnesses: HIV/AIDS, hypertension, tuberculosis, diabetes, malaria, typhoid, and anemia. I used a Becker–DeGroot–Marschak (BDM) mechanism, presenting respondents with a list of prices and informing them that one disease–price combination would be selected and implemented. Due to Harvard IRB concerns about equal distribution of benefits, the draw was constrained to always offer either an HIV and hypertension voucher at a price of zero.[36] Section 6.2.3 discusses the treatments effects on the redemption of these vouchers.

I find a significant increase in acceptance of the vouchers when offered for free (Appendix Table A.7). Among respondents who passed comprehension checks, treatment raised the probability of accepting the free offer by 3.1 percentage points for tuberculosis, 4.3 percentage points for HIV/AIDS, and 4.1 percentage points for diabetes. An index of free-voucher acceptance is 0.67 standard deviations higher in the treated group compared to the control group ($p<0.05$). These effects are notable given already high baseline take-up rates (93–98%) and the fact that these conditions were not mentioned in the video. While full willingness-to-pay values were also elicited through the BDM, these were highly noisy likely due to the difficulty of this task in this context and show no significant treatment effects (Appendix Table A.6).[37] Taken together, the results indicate that respondents did not only revise beliefs across illnesses, but also acted on those revisions in a concrete, health-relevant domain.

Taken together, I show that belief updating extended beyond epilepsy. These spillovers provide the first causal evidence that illness beliefs are not isolated propositions but components of an interconnected explanatory system.

[36]The tablet randomized whether the respondent received the HIV or hypertension testing voucher for free as a result of the BDM. Then, the respondent was given whichever voucher the tablet did not select for free in addition.

[37]The BDM mechanism was challenging to implement in this context. Many respondents lacked cash-on-hand or failed to understand the logic of the task. As a result, valuation responses were noisy and treatment effects on stated willingness to pay are close to zero (Appendix Table A.6). I focus instead on whether respondents accepted the voucher when offered for free—a simpler, behaviorally meaningful threshold decision.

6.2 Experimental Evidence on Take-up of Modern Medicine

I now turn from beliefs to behavior. Having shown that the intervention shifted both causal and treatment-related beliefs about epilepsy and other conditions, I test whether the intervention spurred action. Specifically, I examine whether treated respondents were more likely to redeem a voucher for free modern epilepsy care. This analysis addresses a key concern in informational interventions: whether observed belief updating reflects genuine inference or experimenter demand.

6.2.1 Experimental Evidence on the Take-up of an Epilepsy Consultation

To measure take-up of modern medicine, I offered all respondents a voucher for a free consultation for seizures at the neuropsychiatric division of the General Hospital, Kananga's largest hospital.[38] The voucher was transferable and could be redeemed by any adult. The hospital is centrally located and thus reachable by all respondents, with an average distance of 3.4 km.

I implemented a two-step approach. First, respondents were offered the voucher, but accepting the voucher would incur a small time cost, as explained by the survey script: "If you accept this voucher, I will need a few minutes to fill out the voucher." I deliberately offered the voucher at the end of the second visit to prevent any contamination of earlier survey responses.[39] Second, I tracked voucher redemption through voucher identifiers recorded by the hospital.[40]

I construct two binary outcomes: (1) whether the respondent accepted the voucher, and (2) whether the voucher was ultimately redemeed. Table 2 reports the regression results.

Column (1) shows that treated respondents were 3.4 percentage points more likely to accept the voucher than control respondents (control group: 71.2%). However, this difference is not statistically significant. Despite the small time cost, most respondents were willing to accept the voucher, suggesting high baseline interest.

Column (2) reports the main outcome: actual voucher use. Voucher redemption is 3.8 percentage points higher in the treated group compared to the control group, a statistically significant effect at the 10-percent level. Given a baseline redemption rate of 7.7% in the control group, this treatment effect represents an approximate 50% increase in voucher use.

Column (3) includes controls selected by LASSO methods from a large set of demographic and

[38]The neuropsychiatric division is operated by the Centre Neuro-Psychiatrique de Katuambi, a major institution for neurological and psychiatric illnesses in the region. While the main hospital is located 18 km outside Kananga, it operates a branch at the General Hospital in the city center.

[39]While the survey text did not explicitly state that effective treatment for epilepsy exists in Kananga, I cannot rule out the possibility that the voucher implicitly signaled such treatment. However, the same script was used for both treatment and control groups. Monitoring systems were implemented to ensure surveyors did not deviate from the survey script.

[40]Voucher redemption information collected from the hospital included only the voucher ID and whether the voucher was used by the original respondent or another individual. There is no additional information available on the person redeeming the voucher.

belief-related covariates (Belloni et al., 2014a,b).[41] The estimated treatment effect remains virtually unchanged, reinforcing the robustness of the result.

Column (4) restricts the sample to respondents who accepted the voucher. Among this subsample, the treatment effect on redemption is 5 percentage points (control mean: 10.8%), again significant at the 10-percent level.

In 70 out of 74 redemption cases (95%), the voucher was used by someone other than the original respondent. Successful third-party redemption required several steps: respondents needed to convey the voucher and associated information to another person, who in turn had to trust the information, travel to the hospital, and navigate the process to access the consultation. In light of these challenges, the treatment effect is noteworthy. Moreover, vouchers were typically redeemed within a few days of issuance despite a one-month validity period, suggesting substantial latent demand for treatment.

Overall, these findings indicate that a simple, low-cost informational intervention can meaningfully increase the take-up of modern healthcare services and that social networks play a critical role in health-seeking behavior in this context.

Table 2: Experimental Evidence on Take-Up of Medical Treatment for Epilepsy

	Voucher accept	Voucher accept + use		Voucher use
	(1)	(2)	(3)	(4)
Treatment	0.034	0.038*	0.035*	0.050*
	(0.032)	(0.021)	(0.021)	(0.027)
Control mean	0.712	0.077	0.077	0.108
R^2	0.033	0.016		0.032
Observations	782	782	782	574
p-value OLS	0.283	0.063		0.067
p-value randomisation inference	0.271	0.069		0.087
p-value bootstrap	0.279	0.061		0.059
Regular controls	yes	yes	no	yes
LASSO-selected controls	no	no	yes	no
Sample	Endline	Endline	Endline	Voucher accepted

Notes: This table reports estimates from Equation 1. "Voucher accept" is a dummy variable equal to one if the respondent accepted the voucher. "Voucher accept + use" and "voucher use" are dummy variables equal to one if the respondent's voucher was redeemed. Regressions in columns (1), (2), and (4) include the standard set of control variables. Column (3) includes controls selected based on the LASSO methods of Belloni et al. (2014a) from the full set of variables used for balance exercises and variables reflecting beliefs about epilepsy in the baseline survey. The LASSO-selected controls are: not being able to identify epilepsy from its symptoms and being in a polygamous marriage. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors in parentheses.

Who uses the voucher in the control group? To understand barriers to the take-up of free modern care, I examine predictors of voucher redemption in the control group. Although not exposed to the information intervention, these respondents faced the same offer, making their

[41] The selected controls are: (i) inability to recognize epilepsy symptoms and (ii) being in a polygamous marriage.

behavior informative about baseline constraints on care-seeking. I focus on two sets of predictors: (i) epilepsy-related beliefs and experiences, and (ii) standard demographic characteristics. In particular, as someone other than the respondent used the voucher in 95% of cases, I examine variables related to social proximity and stigma toward those with epilepsy.

Appendix Table A.11 shows the regression results. Column (1) regresses voucher use on epilepsy-specific variables: beliefs about epilepsy's transmissibility, awareness of treatment availability in Kananga, beliefs about "witchcraft" as a cause of epilepsy (distinguishing between "witches" and "bewitchment"), the number of known individuals with epilepsy, number of seizures witnessed (as a proxy for perceived exposure risk), stigmatizing attitudes, and prior experience with modern medicine across illnesses.

Three predictors stand out. First, believing epilepsy is transmissible—including supernatural contamination fears—is associated with a 7.8 percentage point lower voucher use ($p < 0.01$). Second, having a close family member with epilepsy increases voucher redemption by 14 percentage points ($p < 0.10$). Third, greater prior experience with modern medicine is positively associated with use, although only marginally significant ($p < 0.10$).

Column (2) adds demographic controls to test whether these patterns are simply proxies for wealth or location. The main results are robust: transmission beliefs and family ties remain strong predictors. Column (3), which includes only demographic variables, shows that no coefficient is statistically significant; distance to the hospital has the largest estimated effect, but remains imprecise.

Overall, two main predictors robustly explain voucher use absent the intervention: transmission beliefs and having a close family member with epilepsy. These patterns point to informational and social costs as a barrier to transferring and using the voucher.

6.2.2 Heterogeneous Treatment Effects on the Take-up of Modern Medicine

To examine mechanisms for the intervention's effect on the take-up of hospital consultations for epilepsy, I turn to heterogeneity analyses. I examine three key channels: (1) learning that modern medicine exists, (2) learning that it is effective for epilepsy, and (3) rejecting supernatural explanations—potentially through channels (1) and (2).

This exercise presents conceptual and empirical challenges. Beliefs about illness are tightly bundled: respondents with high supernatural beliefs about illness tend to know less about modern medicine, have less experience with it, and have lower beliefs about its effectiveness. Thus, isolating whether the treatment effect operates by correcting misinformation, reinforcing existing priors, or some combination of both proves difficult. For instance, a respondent who believes modern medicine is effective but is unaware of its existence may use the voucher in response to the intervention simply

by learning that treatment is available. Conversely, a respondent with high supernatural beliefs and low beliefs in the efficacy of modern medicine may revise their views on cause and treatment, leading to a higher treatment effect on the voucher redemption. In one case, uptake is higher among those with low supernatural beliefs; in the other, among those with high supernatural beliefs.

To preview results, across both structured and machine learning-based analyses, I find that treatment effects are consistently larger among respondents with weaker supernatural beliefs and lower beliefs in the efficacy of traditional medicine. Observable demographic traits—such as age, gender, education, income, or religious affiliation—explain little variation. Instead, belief bundles dominate responsiveness, underscoring the limits of standard development economics predictors in capturing heterogeneity in health behavior in this setting.

Demographics. Before turning to the three mechanisms discussed above, I first examine standard demographic characteristics to rule out that they are the true drivers of treatment effect heterogeneity (Appendix Table A.12). I find no significant differences by gender, age, education, or being from rural areas, suggesting these traits do not meaningfully predict responsiveness. Wealthier respondents show significantly smaller treatment effects (column (5)), consistent with lower marginal benefit from subsidized care or higher opportunity costs of acting.

Column (6) shows that treatment effects are concentrated among respondents without a close family member with epilepsy. In contrast, those with a close family member with epilepsy show no treatment effect and exhibit higher baseline redemption rates, consistent with the results on the predictors of voucher redemption in the control group discussed above. Thus, they are the "always takers." For them, perceived benefits may already be high due to emotional or moral obligations, and logistical costs of transferring the voucher are lower. By contrast, respondents without a close family member show stronger treatment effects, consistent with the need for new information to overcome higher behavioral thresholds, lower baseline utility from voucher redemption, and higher social or logistical costs of transferring the voucher.

Treatment effects are larger among respondents residing farther from the hospital or those who own a shop (columns (8)–(9)). More generally, effects are concentrated among individuals for whom baseline costs were sufficiently high to deter action, but belief updating shifted expected net benefits of care from below to above zero.

Medical knowledge and modern medicine beliefs. I begin by examining heterogeneity using categorical baseline beliefs about modern medicine (Appendix Table A.13). Respondents who did not know that epilepsy treatment exists in Kananga exhibit a 3.9 percentage point larger treatment effect (column (1)), consistent with the intervention filling a factual knowledge gap. Respondents

who believed in the efficacy of modern medicine at baseline also display somewhat larger effects (column (2)), though the difference is not statistically significant.

Column (3) explores the interaction between these two belief dimensions by including the triple interaction term "treat × modern medicine exists × modern medicine effective". The coefficient for "treat" in this column captures the effect for respondents who neither knew about the existence of modern treatment nor believed in its efficacy. The estimate is 4.2 percentage points ($p < 0.1$), indicating that the intervention induced meaningful behavioral change among those with minimal baseline knowledge. The interaction term "treat × modern medicine exists" in column (3) identifies respondents who knew treatment existed but doubted its efficacy; the positive (though imprecise) coefficient suggests that belief updating about effectiveness can still induce behavioral change. Conversely, the coefficient on "treat × modern medicine effective" in column (3) is larger, consistent with the idea that among respondents who already believed in the efficacy of modern medicine, learning that treatment is available locally was sufficient to unlock latent demand. The triple interaction term is negative and insignificant (–0.102), in line with the interpretation that respondents who already held both beliefs had limited scope for further updating and thus behavioral change.

Column (4) provides complementary evidence: Those who thought modern medicine could never treat epilepsy exhibit 3.3 percentage point higher treatment effect. Column (5) shows that respondents who believe that effective modern medical treatment is evidence against a supernatural cause exhibit a 4.8 percentage point higher treatment effect, which supports the mechanism that demonstrating the effectiveness of modern medicine may have shifted causal beliefs, thereby influencing behavior.

To further explore these patterns, I examine treatment effect heterogeneity by quartiles of continuous indices capturing additional dimensions of belief and experience with modern and traditional care. Figure A.20 panels A–C visualize these patterns. Panel A considers belief in the effectiveness of modern medicine, using a Kling et al. (2007) index constructed from responses across 13 illnesses.[42] Panel B presents results for an analogous index of beliefs in the effectiveness of traditional medicine, and panel C uses an index measuring personal experience with modern medicine, based on reported past use across the same set of conditions.

Respondents in the upper quartiles of the modern medicine index exhibit somewhat larger effects, consistent with the idea that the intervention reinforces favorable priors. For the traditional medicine index, there is no clear monotonic pattern, though treatment effects appear weaker among those most committed to traditional systems. No systematic variation is observed across quartiles of the experience index, suggesting that personal exposure, absent belief, is not predictive of

[42]Index construction details are provided in Appendix A.

responsiveness.[43]

Supernatural beliefs. Beliefs about illness causation and treatment are closely bundled. Having examined heterogeneity by beliefs about modern medicine, I now turn to supernatural illness beliefs.

I begin by categorizing respondents based on baseline beliefs about epilepsy causation: exclusively natural, exclusively supernatural, or both (Table A.14). Respondents attributing epilepsy solely to natural causes exhibit the largest treatment effect (15.2 percentage points), followed by those attributing it exclusively to supernatural causes (6.0 percentage points). No significant effect is observed among those holding "both" beliefs. One plausible interpretation is that internal ambiguity dilutes the salience and coherence of the intervention's message, limiting belief updating and behavioral response. However, the "only supernatural" category likely masks substantial heterogeneity in belief strength. Some respondents who select "only supernatural" may hold relatively moderate beliefs—that is, they endorse a supernatural explanation but do not adhere to a fully rigid explanatory model. Others, by contrast, exhibit strongly bundled and entrenched supernatural priors that resist updating.

To better capture such differences in belief intensity, I examine treatment effect heterogeneity by quartiles of a continuous "epilepsy supernatural index".[44] I find a striking pattern: effects are concentrated in the lower three quartiles, with no detectable response in the top quartile (Figure A.20d; Appendix Table A.17).

Panels E and F provide further support using broader measures of supernatural beliefs. Panel E considers a Kling et al. (2007) supernatural belief index constructed across 13 illnesses, aggregating whether each illness can be supernatural. Panel F plots treatment effects by quartile of the share of illnesses the respondent believes can have supernatural causes. Both measures reveal the same pattern: treatment effects decline monotonically with supernatural belief intensity and vanish in the top quartile. These results reinforce the interpretation that individuals with the strongest bundled priors—those most committed to a supernatural explanatory logic—are least responsive to biomedical information.

Stigma, transmission, and fear. I next examine heterogeneity along social dimensions of illness perception. Since most vouchers were redeemed by someone other than the respondent, uptake

[43] Appendix Table A.16 reports median-split results for these indices. Patterns are directionally consistent but less informative than the quartile splits presented here.

[44] The Kling et al. (2007) index includes three components specific to epilepsy: (i) whether the respondent attributes epilepsy to only supernatural, only natural, or both causes (coded ordinally); (ii) agreement with the statement "epileptics are witches" (5-point scale); and (iii) agreement with the statement "epileptics are bewitched" (5-point scale). All components are normalized and combined with equal weight. Higher values correspond to stronger supernatural beliefs. See Section A for index construction.

often required a deliberate act of social transfer. For individuals without a close family member with epilepsy, such transfers may involve greater social or psychological frictions. Beliefs related to stigma, contagion, or fear may thus constrain behavior.

Appendix Table A.15 column (1) shows that respondents who reject the norm of avoiding epileptics during seizures exhibit a 2.8 percentage-point treatment effect, compared to 4.0 percentage points among those who endorse avoidance. The strongest response—6.9 percentage points—is among those who are neutral, suggesting that uncertainty may signal belief malleability. Examining norms that one's children should not play with epileptic children, I find the highest treatment effect among those who do not endorse such a norm in column (2): treated respondents are 5.3 percentage points more likely to redeem the voucher in this sub-group, significant at the 10-percent level. Thus, stigmatizing attitudes seem to be a relevant barrier to voucher redemption, which the intervention can overcome. In terms of transmission beliefs in column (3), those who are neutral show the largest treatment effect (10.5 percentage points), followed by those who reject transmission for epilepsy (4.4 percentage points).

Finally, I examine whether fear from witnessing seizures—distinct from stigma or supernatural beliefs—shapes responsiveness. Greater past exposure may raise the perceived probability that someone will seize during interaction, potentially deterring engagement if seizures are seen as distressing. Yet the data suggest the opposite: respondents who witnessed more than the median number of seizures exhibit treatment effect of 4.9 percentage points, 2.5 percentage points higher than those who witnessed less than the median number of seizures. This result cannot be explained by kinship ties—treatment effects are flat among those with close family members with epilepsy —and instead likely reflects heightened perceived severity or salience, increasing the urgency to act.

Machine learning methods. To complement the structured heterogeneity analysis, I use causal machine learning methods to flexibly explore variation in treatment effects without imposing functional form assumptions or relying on pre-defined subgroups. I closely follow Chernozhukov et al. (2025) and Okunogbe and Pouliquen, 2022. Based on model performance tests, I use random forest and neural nets in the following analyses (Appendix Table A.18).

First, to test for the presence of meaningful heterogeneity, I estimate a best linear predictor (BLP) of individual-level treatment effects. As shown in Appendix Table A.19, the heterogeneity parameter is imprecisely estimated, suggesting limited power to detect heterogeneity in this sample.

Second, I examine which baseline covariates are most predictive of treatment effect heterogeneity using a variable importance procedure based on random forests. Variables are ranked by how frequently they are used in splits, adjusted for depth in the tree structure. As shown in Figure A.21, the most important predictors of treatment effect heterogeneity are belief-related variables: indices

of beliefs about supernatural causes and the efficacy of traditional and modern medicine. Geographic access (e.g., distance to hospital) also ranks highly. In contrast, standard demographic and economic variables—such as income, education, and employment—contribute relatively less explanatory power.

It is noteworthy that belief-related variables dominate the top of the variable importance ranking: only two standard demographic measures (age and education) appear in the top ten, and income and salaried employment are ranked 11th and 14th, respectively. These results suggest that conventional poverty-related metrics, often the default in targeting frameworks, may fail to capture key drivers of heterogeneity in response to this type of information-based intervention—and that such variation would likely go unnoticed without explicitly measuring locally relevant beliefs.

Third, I implement the Group Average Treatment Effects (GATES) procedure to estimate average effects among individuals sorted by predicted responsiveness. Appendix Table A.20 and Figure A.22 show that individuals in the top half of the predicted treatment effect distribution experience effects of 3.2–4.1 percentage points, while the bottom half shows no effect. These differences are not statistically significant likely due to the small sample size but are directionally consistent with the structured analysis.

Finally, I conduct a Classification Analysis (CLAN) to characterize the most and least treatment-responsive subgroups identified via machine learning. Appendix Tables A.21 and A.22 show that the most affected differ little from the least affected in terms of standard demographics, but diverge sharply in beliefs. The largest differences are observed for the "illnesses supernatural index" and "traditional medicine effective index", consistent with the variable importance results.

Taken together, across both structured and machine learning-based analyses, supernatural illness beliefs and beliefs in the efficacy of traditional medicine consistently emerge as important predictors of treatment effect heterogeneity. Observable demographic traits—such as age, gender, education, income, or religious affiliation—explain little variation. While some individuals may have responded to the intervention by updating their supernatural illness beliefs, others may have responded because the intervention reinforced existing biomedical views. This dual pathway highlights the interpretive challenge posed by bundled beliefs: similar behavioral responses can result from either reinforcement of prior beliefs or belief revision. Nonetheless, the results underscore that beliefs—not standard development indicators—are key to understanding variation in health behavior in this setting.

6.2.3 Experimental Evidence on Take-up of HIV and Hypertension Testing

To test whether belief spillovers translated into behavioral engagement with biomedical care for other conditions, I examine the take-up of free consultations and diagnostic tests for HIV and hy-

pertension. I chose these two conditions because testing is sensible without experiencing symptoms and because they vary in levels of stigma and the invasiveness of the test.

Each respondent was given a voucher for a free consultation and test for each condition in the first survey visit, redeemable within two weeks at PAX Medical Clinic, a well-known private hospital in Kananga affiliated with the Institut Chrétien Médical du Kasaï (IMCK). Redemption was restricted to the respondent, verified via government-issued ID (81% of the sample had one).[45]

I examine two outcomes: (1) refusal—defined as the respondent declining the voucher when it was physically handed to them by the surveyor (no verbal prompt was given); and (2) actual use—measured via hospital redemption logs. I estimate equation 1, controlling for prior testing history and baseline beliefs about modern medicine's efficacy for the respective condition.

Table A.23 shows that treated respondents were 1.3 percentage points less likely to refuse the hypertension voucher and 1.1 percentage points less likely to refuse the HIV voucher (columns (1)–(2)). Baseline refusal rates were low—2.9% for hypertension and 2.3% for HIV. Treatment effects on actual voucher use are close to zero and not statistically significant (columns (3)–(4)). In the control group, only 27.7% of respondents used the hypertension voucher and 24.8% used the HIV voucher. Since take-up was similar for HIV and hypertension, the patterns suggest that differences in stigma, invasiveness, or urgency are unlikely to explain the results. Follow-up calls with a subset of the sample indicate that some respondents attempted to redeem vouchers but were turned away due to hospital capacity constraints.

Overall, the intervention reduced refusal of modern medical services for other conditions, consistent with the observed belief spillovers, but it did not increase actual take-up. These null results are theoretically informative. While the intervention shifted beliefs about multiple illnesses, it may not have shifted them strongly enough to overcome inertia in behavior, particularly for conditions with low salience or personal relevance. As emphasized in prior work—especially on HIV testing—belief change alone may be insufficient when uptake involves no symptoms, no immediate benefit, and potential psychological or social costs (e.g., Dupas, 2011b; Thornton, 2008).

6.3 Experimental Evidence on Stigma Toward Those with Illness

I now examine whether the intervention reduced stigma toward people living with epilepsy (PLWE). Stigmatizing attitudes are a direct expression of supernatural causal beliefs: as shown in Section 4, attribution to "witchcraft" strongly predicts endorsement of social exclusion norms. Assessing stigma matters independently of treatment-seeking behavior, as stigma affects the life and health of PLWE

[45]The reason for this restriction was that passing or selling the vouchers to others might have diluted the treatment effect.

directly—including increased risk of injury or death during seizures due to withholding of assistance.

I use two survey measures and one incentivized measure of stigma. The first outcome is a dummy variable equal to one if the respondent agrees that one's children should not play with children who have epilepsy. The second is a dummy variable equal to one if the respondent agrees that one should avoid touching or approaching a person during an epileptic seizure.[46] This measure was motivated by discussions with my local medical collaborators, who noted the great danger that the fear of spirits poses for the risk of injury and death during seizures.

To capture a behavioral measure of stigma, I elicited willingness to engage with PLWE in a real-world employment context. In the midline survey, respondents were informed: "An NGO we work with is thinking about launching a project, in which the NGO provides support and activities to epileptic people. They might need to hire people. They might also hire people for a project providing support and activities to people who are disabled because of road accidents. Shall I put your phone number on a list of people that the NGO could call if the NGO needed to hire more people? Would you like to be put on the list for the project with epileptic people, disabled people, or both?"

Respondents could choose to be listed for either project or both. Being listed for the epilepsy project would involve engaging directly with PLWE. The disability project option was included to distinguish genuine willingness to work with PLWE from agreement driven purely by self-image concerns. The main outcome is a dummy equal to one if the respondent chose to be listed only for the epilepsy project.

The measure is incentivized: in a setting with high unemployment, job interview lists—typically accessed through personal referrals—are the primary gateway to employment. Declining to be listed, therefore, imposes a real cost. I recruited my own surveyor team through such lists, and during fieldwork, surveyors themselves asked whether they could refer people for this NGO job.

Table 3 reports the regression results. Treated respondents were 7.2 percentage points less likely to agree that children should not play with epileptic children (column (1); $p < 0.01$) and 12.6 percentage points less likely to agree that one should avoid PLWE during seizures (column (2); $p < 0.001$), relative to control group means of 28.9% and 54%, respectively. They were also 4.6 percentage points more likely to express willingness to work on a project with PLWE (column (3); $p < 0.1$) relative to a control mean of 13.2%.

One alternative explanation is that stigma reductions are driven by changes in beliefs about transmissibility rather than supernatural causality. As discussed in Section 6.1, I find a negative

[46] Both outcomes are coded as one if the respondent agrees or strongly agrees with the statements on a five-point Likert scale. See Section 4 for full survey wording.

treatment effect on transmission beliefs in the midline survey, but not in the endline survey. Moreover, Appendix Table A.24 shows no differential treatment effect on stigma outcomes among those that knew that epilepsy was non-transmissible at baseline and those that did not. While transmission beliefs and supernatural beliefs may overlap in local understandings, the evidence suggests that changes in supernatural causal attributions drove the stigma reductions.

Taken together, I show that the intervention significantly reduced stigma toward people living with epilepsy. Since stigma is a direct manifestation of supernatural illness beliefs, these changes provide further evidence that such beliefs were meaningfully updated. Moreover, the stigma results demonstrate that understanding causal illness beliefs matters independently of their effect on treatment take-up: beliefs shape not only care-seeking but also the social experience of illness and the well-being of those affected.

Table 3: Experimental Evidence on Stigma toward Those with Epilepsy

	(1) Children shouldn't play with epileptic children (=1)	(2) Should avoid epileptic during attack (=1)	(3) Chooses NGO project with epileptic people (=1)
Treatment	-0.072**	-0.126***	0.046*
	(0.028)	(0.033)	(0.026)
p-value OLS	0.009	0.000	0.073
p-value randomisation inference	0.005	0.000	0.076
p-value bootstrap	0.011	0.000	0.063
Control mean	0.289	0.540	0.132
R^2	0.209	0.181	0.017
Observations	782	782	800

Notes: This table reports estimates from equation 1. "Children shouldn't play with epileptic children" and "Should avoid epileptic during attack" are dummy variables equal to one if the respondent strongly agrees or agrees with the statements "One's children shouldn't play with epileptic children" and "One shouldn't touch or be close to people when they have an epileptic attack", respectively, with answer options on a 5-point scale from "strongly disagree" to "strongly agree". "NGO project with epileptic children" is a dummy variable equal to one if the respondent chooses to be put on a list for job interviews for an NGO project targeting epileptic people. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors in parentheses.

7 Conclusion

Drawing on existing survey data from sub-Saharan Africa, original survey data, and a randomized controlled trial in the DRC, I show three main findings. First, beliefs in supernatural causes of illness are common: 94% of respondents in Kananga, DRC, endorse such causes for at least one illness, with systematic variation across conditions. Second, these beliefs are relevant for health behavior and health outcomes: supernatural attributions are strongly negatively correlated with beliefs in the effectiveness of modern medicine, prior use of it, and higher stigma toward those with certain conditions. Third, a low-cost information intervention, developed in partnership with local health professionals, shifted beliefs away from supernatural toward medical for epilepsy and other

conditions, increased take-up of modern care for epilepsy by 50%, and reduced stigma toward those with epilepsy. These findings show that supernatural illness beliefs are not arbitrary, isolated superstitions but part of a structured, yet adaptable explanatory framework, linking cause, treatment, and social response.

The intervention appears to have disrupted a locally stable equilibrium characterized by supernatural attributions, limited experimentation with modern medicine, and low exposure to it. The intervention's information may have accelerated a difficult causal learning process that might otherwise unfold only gradually through lived experience. The evidence suggests that individuals are open to adopting biomedical explanations for illness and exploring modern medical treatments. While the study focuses on a single illness in one setting, the results may generalize to other conditions and contexts with similar beliefs —and offer insight into how societies historically transitioned toward a biomedical understanding of disease.

These findings underscore the importance of understanding local belief systems for effective health policy. On the positive side, demonstration effects—using credible cases to challenge causal misconceptions—can be a powerful tool, especially for conditions with ambiguous or poorly understood biomedical markers. On the negative side, interventions that ignore local beliefs risk unintended consequences. When treatments fail—whether due to weak health systems or the inherent limitations of modern medicine, as in the case of epilepsy—patients may interpret this as evidence of supernatural causality rather than medical constraint, potentially undermining future treatment-seeking and reinforcing stigma (Cox and Phillips, 2015).

This paper also has implications for the study of religion and supernatural belief systems more broadly. Some might think that religious worldviews are dichotomous and all-encompassing—an all-powerful, omnipresent, omniscient God must be the cause of all events for believers—or that holding both supernatural and natural beliefs for the same event would create cognitive dissonance and costs. Yet, I show that supernatural and natural explanations can coexist for the same type of event. Supernatural beliefs—by definition—do not follow natural laws, but they are not adopted arbitrarily and instead follow a coherent internal logic.

These findings contribute to our understanding of how supernatural beliefs and religion evolve alongside scientific progress, shedding light on the secularization hypothesis (Berkes et al., 2023; Inglehart and Norris, 2004). In Kananga, where illness is often attributed to localized supernatural forces—spirits, ancestors, or "witches"—rather than to an all-powerful God, they suggest that greater exposure to scientific advances may shift beliefs toward more encompassing "moralizing big-God" systems that can better accommodate both natural and supernatural explanations. This idea is consistent with arguments that religion has evolved from localized, "small god" supernatural beliefs

to encompass broader, overarching "big-God" beliefs (Norenzayan, 2013).

Finally, the results open several directions for future research. First, medical providers in low-income settings—often trained informally (Das et al., 2008)—may themselves hold supernatural illness beliefs, shaping diagnostic decisions, patient communication, and care quality. Anticipating discrimination based on perceived causes of illness, patients may conceal symptoms or avoid care altogether. Second, beliefs may influence not only treatment-seeking behavior but also treatment outcomes, through mechanisms such as placebo effects or psychosomatic symptoms. Third, traditional medicine—blending spiritual and herbal elements—intersects with psychiatry and behavioral therapy, areas increasingly central in development economics (e.g., Ridley et al., 2020). Existing medical infrastructures can be leveraged to improve healthcare provision in resource-constrained settings. While alternative approaches should not serve as first-line treatment for all conditions such as infectious diseases, they may complement care for illnesses where pharmaceutical options are limited or less effective, such as mental health conditions or chronic pain. More broadly, the findings underscore the importance of culturally grounded health intervention design and highlight that understanding how people explain illness is central to improving health outcomes in low-resource contexts.

References

Alesina, Alberto, Armando Miano, and Stefanie Stantcheva, "Immigration and Redistribution," *The Review of Economic Studies*, 2023, *90* (1), 1–39.

_ , Paola Giuliano, and Nathan Nunn, "On the Origins of Gender Roles: Women and the Plough," *The Quarterly Journal of Economics*, 2013, *128* (2), 469–530.

_ , Sebastian Hohmann, Stelios Michalopoulos, and Elias Papaioannou, "Religion and educational mobility in Africa," *Nature*, June 2023, *618* (7963), 134–143. Publisher: Nature Publishing Group.

Alfonsi, Livia, Michal Bauer, Julie Chytilová, and Edward Miguel, "Human capital affects religious identity: Causal evidence from Kenya," *Journal of Development Economics*, March 2024, *167*, 103215.

Alsan, Marcella and Marianne Wanamaker, "Tuskegee and the Health of Black Men," *The Quarterly Journal of Economics*, 2017, *133* (1), 407–455.

_ , Maya Durvasula, Harsh Gupta, Joshua Schwartzstein, and Heidi Williams, "Representation and Extrapolation: Evidence from Clinical Trials," *The Quarterly Journal of Economics*, 2024, *139* (1), 575–635.

_ , Owen Garrick, and Grant Graziani, "Does Diversity Matter for Health? Experimental Evidence from Oakland," *American Economic Review*, 2019, *109* (12), 4071–4111.

Ashforth, Adam, "An Epidemic of Witchcraft? The Implications of AIDS for the Post-Apartheid State," *African Studies*, 2002, *61* (1), 121–143.

Ashraf, Nava, Erica Field, Giuditta Rusconi, Alessandra Voena, and Roberta Ziparo, "Traditional Beliefs and Learning about Maternal Risk in Zambia," *American Economic Review*, 2017, *107* (5), 511–515.

_ , Natalie Bau, Nathan Nunn, and Alessandra Voena, "Bride Price and Female Education," *The Journal of Political Economy*, 2020, *128* (2), 591–641.

Atran, Scott, *In Gods We Trust: The Evolutionary Landscape of Religion* Evolution and Cognition, Oxford, New York: Oxford University Press, 2002.

Auriol, Emmanuelle, Julie Lassébie, Amma Panin, Eva Raiber, and Paul Seabright, "God Insures those Who Pay? Formal Insurance and Religious Offerings in Ghana," *The Quarterly Journal of Economics*, November 2020, *135* (4), 1799–1848.

Ba-Diop, Awa, Benoît Marin, Michel Druet-Cabanac, Edgard B Ngoungou, Charles R Newton, and Pierre-Marie Preux, "Epidemiology, causes, and treatment of epilepsy in sub-Saharan Africa," *The Lancet Neurology*, October 2014, *13* (10), 1029–1044.

Banerjee, Abhijit, Angus Deaton, and Esther Duflo, "Health Care Delivery in Rural Rajasthan," *Economic and Political Weekly*, 2004, *39* (9), 944–949.

_ , Esther Duflo, Rachel Glennerster, and Cynthia Kinnan, "The Miracle of Microfinance? Evidence from a Randomized Evaluation," *American Economic Journal. Applied Economics*, January 2015, *7* (1), 22–53. tex.copyright: Copyright American Economic Association Jan 2015.

Banerjee, Abhijit V. and Duflo, *Poor economics: A radical rethinking of the way to fight global poverty*, New York: PublicAffairs, 2011.

Banerjee, Abhijit Vinayak, Esther Duffo, Rachel Glennerster, and Dhruva Kothari, "Improving Immunization Coverage in Rural India: Clustered Randomized Controlled Evaluation of Immunization Campaigns with and without Incentives," *British Medical Journal*, 2010, *340* (7759), 1291.

Barro, R. J. and R. M. McCleary, "Religion and Political Economy in an International Panel," *Journal for the Scientific Study of Religion*, 2006, *45* (2), 149–176.

Barro, Robert J. and Rachel M. McCleary, "Religion and Economic Growth across Countries," *American Sociological Review*, 2003, *68* (5), 760–781.

_ **and** _ , *The Wealth of Religions: The Political Economy of Believing and Belonging*, Princeton, NJ: Princeton University Press, 2019.

Barron, Kai and Tilman Fries, "Narrative Persuasion," 2023.

Bau, Natalie, "Can Policy Change Culture? Government Pension Plans and Traditional Kinship Practices," *American Economic Review*, June 2021, *111* (6), 1880–1917.

Bazzi, Samuel, Martin Fiszbein, and Mesay Gebresilasse, "Frontier Culture: The Roots and Persistence of "Rugged Individualism" in the United States," *Econometrica : journal of the Econometric Society*, 2020, *88* (6), 2329–2368.

Becker, Sascha O. and Ludger Woessmann, "Was Weber Wrong? A Human Capital Theory of Protestant Economic History," *The Quarterly Journal of Economics*, 2009, *124* (2), 531–596.

_ **, Jared Rubin, and Ludger Woessmann**, "Religion and Growth," *Journal of Economic Literature*, September 2024, *62* (3), 1094–1142.

Belloni, Alexandre, Victor Chernozhukov, and Christian Hansen, "High-Dimensional Methods and Inference on Structural and Treatment Effects," *The Journal of Economic Perspectives*, 2014, *28* (2), 29–50.

_ **,** _ **, and** _ , "Inference on Treatment Effects after Selection among High-Dimensional Controls," *The Review of Economic Studies*, 2014, *81* (2 (287)), 608–650.

Bennett, Daniel, Asjad Naqvi, and Wolf-Peter Schmidt, "Learning, Hygiene and Traditional Medicine," *Economic Journal*, 2018, *128* (612), 545–574.

Bentzen, Jeanet Sinding, "Acts of God? Religiosity and Natural Disasters Across Subnational World Districts," *The Economic Journal*, 2019, *129* (622), 2295–2321. Place: Oxford Publisher: University Press.

Berkes, Enrico, Davide M. Coluccia, Gaia Dossi, and Mara P. Squicciarini, "Dealing With Adversity: Religiosity or Science? Evidence from the Great Influenza Pandemic," 2023.

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan, "How Much Should We Trust Differences-In-Differences Estimates?," *The Quarterly Journal of Economics*, February 2004, *119* (1), 249–275.

Bisin, Alberto and Thierry Verdier, "The Economics of Cultural Transmission and the Dynamics of Preferences," *Journal of Economic Theory*, 2001, *97* (2), 298–319.

Bordalo, Pedro, Giovanni Burro, Katherine B. Coffman, Nicola Gennaioli, and Andrei Shleifer, "Imagining the Future: Memory, Simulation and Beliefs about Covid," August 2022. Series: Working Paper Series Type: Working Paper.

Boyer, Pascal, *Religion explained: the evolutionary origins of religious thought*, New York: Basic Books, 2001.

Bruno, Elisa, Karamoko Nimaga, Ibrahima Foba, Philippe Vignoles, Pierre Genton, Ogobara Doumbo, Daniel Gérard, Pierre-Marie Preux, and Guy Farnarier, "Results of an action-research on epilepsy in rural Mali," *PloS One*, 2012, *7* (8), e44469. tex.pmcid: PMC3435093.

Bryan, Gharad, James J Choi, and Dean Karlan, "Randomizing Religion: The Impact of Protestant Evangelism on Economic Outcomes," 2018.

Bursztyn, Leonardo and David Y. Yang, "Misperceptions About Others," *Annual review of economics*, 2022, *14* (1), 425–452.

Butinda, Lewis Dunia, Aimable Amani Lameke, Nathan Nunn, Max Posch, and Sanchez de la Sierra, "On the Importance of African Traditional Religion for Economic Behavior," 2023.

Caicedo, Felipe Valencia, "The Mission: Human Capital Transmission, Economic Persistence, and Culture in South America," *The Quarterly Journal of Economics*, February 2019, *134* (1), 507–556.

Carter, Michael R., Emilia Tjernström, and Patricia Toledo, "Heterogeneous impact dynamics of a rural business development program in Nicaragua," *Journal of Development Economics*, May 2019, *138*, 77–98.

Chandra, Amitabh, Benjamin Handel, and Joshua Schwartzstein, "Behavioral economics and health-care markets," in "in" Handbooks in Economics, Amsterdam: Elsevier, 2019, pp. 459–502. ISSN: 0169-7218.

Chaney, Eric, "Revolt on the Nile: Economic Shocks, Religion, and Political Power," *Econometrica : journal of the Econometric Society*, 2013, *81* (5), 2033–2053.

Chen, Daniel L., "Club Goods and Group Identity: Evidence from Islamic Resurgence during the Indonesian Financial Crisis," *Journal of Political Economy*, 2010, *118* (2), 300–354.

Chernozhukov, Victor, Mert Demirer, Esther Duflo, and Iván Fernández-Val, "Fisher-Schultz Lecture: Generic Machine Learning Inference on Heterogeneous Treatment Effects in Randomized Experiments, with an Application to Immunizations in India," *Econometrica*, 2025, *93* (4), 1121–1164.

Christensen, Darin, Oeindrila Dube, Johannes Haushofer, Bilal Siddiqi, and Maarten Voors, "Building Resilient Health Systems: Experimental Evidence from Sierra Leone and The 2014 Ebola Outbreak," *The Quarterly Journal of Economics*, May 2021, *136* (2), 1145–1198.

Cimpric, Aleksandra, "Chidlren Accused of Witchcraft - An anthropological study of contemporary practices in Africa," 2010.

Clingingsmith, David, Asim Ijaz Khwaja, and Michael Kremer, "Estimating the impact of the Hajj: religion and tolerance in Islam's global gathering," *The Quarterly Journal of Economics*, 2009, *124* (3), 1133–1170.

Cox, John and Georgina Phillips, "Sorcery, Christianity and the Decline of Medical Services," in Miranda Forsyth and Richard Eves, eds., *Talking it Through*, Responses to Sorcery and Witchcraft Beliefs and Practices in Melanesia, ANU Press, 2015, pp. 37–54.

Das, Jishnu and Jeffrey Hammer, "Quality of Primary Care in Low-Income Countries: Facts and Economics," *Annual Review of Economics*, 2014, *6* (1), 525–553.

_ , _ , **and Kenneth Leonard**, "The Quality of Medical Advice in Low-Income Countries," *Journal of Economic Perspectives*, 2008, *22* (2), 93–114.

de Walque, Damien, "How Does the Impact of an HIV/AIDS Information Campaign Vary with Educational Attainment? Evidence from Rural Uganda," *Journal of Development Economics*, 2007, *84* (2), 686–714.

Dupas, P. and E. Miguel, "Impacts and Determinants of Health Levels in Low-Income Countries," in Abhijit Vinayak Banerjee and Esther Duflo, eds., *Handbook of Economic Field Experiments*, Vol. 2, North-Holland, January 2017, pp. 3–93.

Dupas, Pascaline, "What Matters (and What Does Not) in Households' Decision to Invest in Malaria Prevention?," *American Economic Review*, 2009, *99* (2), 224–230.

_ , "Do Teenagers Respond to HIV Risk Information Evidence from a Field Experiment in Kenya," *American Economic Journal: Applied Economics*, 2011, *3* (1), 1–34.

_ , "Health Behavior in Developing Countries," *Annual Review of Economics*, 2011, *31* (1), 425–449.

_ **and Jonathan Robinson**, "Why Don't the Poor Save More Evidence from Health Savings Experiments," *American Economic Review*, 2013, *103* (4), 1138–1171.

Evans-Pritchard, Edward Evan, *Witchcraft, oracles, and magic among the Azande*, Oxford University Press, 1976.

Evans, T. D., F. T. Cullen, R. G. Dunaway, and V. S. Burton, "Religion and Crime Reexamined: The Impact of Religion, Secular Controls, and Social Ecology on Adult Criminality," *Criminology : an interdisciplinary journal*, 1995, *33* (2), 195–224.

Farmer, Paul, *AIDS and Accusation: Haiti and the Geography of Blame*, University Of California Press, 2006.

Fodjo, Joseph Nelson Siewe, Michel Mandro, Deogratias Wonya'rossi, Yasemine Inaç, Francoise Ngave, Richard Lokonda, Aimé Anyolito, Frederik Verelst, and Robert Colebunders, "Economic Burden of Epilepsy in Rural Ituri, Democratic Republic of Congo," *EClinicalMedicine*, March 2019, *9*, 60–66.

Foster, George M., "Disease Etiologies in Non-Western Medical Systems," *American Anthropologist*, 1976, *78* (4), 773–782.

Fryer, Roland and Matthew O. Jackson, "A Categorical Model of Cognition and Biased Decision Making," *The B.E. Journal of Theoretical Economics*, February 2008, *8* (1).

Gershman, Boris, "Witchcraft beliefs as a cultural legacy of the Atlantic slave trade: Evidence from two continents," *European Economic Review*, 2020, *122*.

_ , "Witchcraft beliefs around the world: An exploratory analysis," *PloS one*, 2022, *17* (11).

Giuliano, Paola and Nathan Nunn, "Understanding Cultural Persistence and Change," *The Review of Economic Studies*, July 2021, *88* (4), 1541–1581.

Gottlieb, Alma, *The afterlife is where we come from: the culture of infancy in West Africa*, Chicago: University of Chicago Press, 2004.

Haaland, Ingar, Christopher Roth, and Johannes Wohlfart, "Designing information provision experiments," *Journal of Economic Literature*, 2023, *61* (1), 3–40.

Hanna, Rema, Sendhil Mullainathan, and Joshua Schwartzstein, "Learning Through Noticing: Theory and Evidence from a Field Experiment," *Quarterly Journal of Economics*, 2014, *129* (3), 1311–1311.

Henrich, Joseph Patrick, *The WEIRDest people in the world: how the West became psychologically peculiar and particularly prosperous*, 1 ed., New York: Picador: Farrar, Straus and Giroux, 2021.

Hippocrates, "On the Nature of Man," in G. E. R. Lloyd, ed., *Hippocratic Writings*, London: Penguin Classics, 1983.

_ , "On the Sacred Disease," in G. E. R. LLoyd, ed., *Hippocratic Writings*, London: Penguin Classics, 1983. Originally written ca. 400 BCE.

Iannaccone, Laurence R., "Introduction to the Economics of Religion," *Journal of Economic Literature*, 1998, *36* (3), 1465–1495.

Inglehart, R. and P. Norris, *Sacred and Secular: Religion and Politics Worldwide*, Cambridge: Cambridge University Press, 2004.

Iyer, Sriya, "The New Economics of Religion," *Journal of Economic Literature*, 2016, *54* (2), 395–441.

Jilek-Aall, Louise, Martica Jilek, John Kaaya, Lilian Mkombachepa, and Kalister Hillary, "Psychosocial study of epilepsy in Africa," *Social science & medicine (1982)*, 1997, *45* (5), 783–795.

Jilek-Aall, Louise, "Morbus Sacer in Africa: Some Religious Aspects of Epilepsy in Traditional Cultures," *Epilepsia (Copenhagen)*, 1999, *40* (3), 382–386.

Kay, Aaron C., Danielle Gaucher, Ian McGregor, and Kyle Nash, "Religious Belief as Compensatory Control," *Personality and Social Psychology Review*, February 2010, *14* (1), 37–48. Publisher: SAGE Publications Inc.

Kleinman, Arthur, *The Illness Narratives: Suffering, Healing, and the Human Condition*, New York: Basic Books, 1988.

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

Kremer, Michael and Edward Miguel, "The Illusion of Sustainability," *Quarterly Journal of Economics*, 2007, *122* (3), 1007–1066.

Laeven, Luc, Alexander Popov, and Clara Sievert, "Is religion an inferior good? Evidence from fluctuations in housing wealth," *Journal of Economic Behavior & Organization*, 2024, *217*, 705–725. Publisher: Elsevier B.V.

Legare, Cristine H. and Susan A. Gelman, "Bewitchment, Biology, or Both: The Co-Existence of Natural and Supernatural Explanatory Frameworks Across Development," *Cognitive Science*, 2008, *32* (4), 607–642.

_ **, E. Margaret Evans, Karl S. Rosengren, and Paul L. Harris**, "The Coexistence of Natural and Supernatural Explanations Across Cultures and Development," *Child Development*, 2012, *83* (3), 779–793.

Lombrozo, Tania, "The structure and function of explanations," *Trends in Cognitive Sciences*, 2006, *10* (10), 464–470.

Lowes, Sara, "Kinship Structure and the Family: Evidence from the Matrilineal Belt," *NBER Working Paper Series*, 2022.

_ **and Eduardo Montero**, "Traditional Medicine in Central Africa," *AEA Papers and Proceedings*, 2019, *109*, 516–520.

_ **and** _ , "The Legacy of Colonial Medicine in Central Africa," *The American Economic Review*, 2021, *111* (4), 1284–1314.

Luschinsky, Mildred, "Problems of Culture Change in the Indian Village," *Human Organization*, 1963, *22* (1), 66–74.

Lynch, Elizabeth and Douglas Medin, "Explanatory Models of Illness: A Study of Within-Culture Variation," *Cognitive Psychology*, 2006, *53* (4), 285–309.

López, A., S. A. Gelman, G. Gutheil, and E. E. Smith, "The development of category-based induction," *Child Development*, October 1992, *63* (5), 1070–1090.

Miguel, Edward, "Poverty and Witch Killing," *The Review of Economic Studies*, October 2005, *72* (4), 1153–1172.

Molina, Carlos Javier Aguilar., "The Invention of Child Witches in the Democratic Republic of Congo: Social cleansing, religious commerce and the difficulties of being a parent in an urban culture," 2006.

Moscona, Jacob and Awa Ambra Seck, "Age Set versus Kin: Culture and Financial Ties in East Africa," *American Economic Review*, September 2024, *114* (9), 2748–2791.

_ **, Nathan Nunn, and James A. Robinson**, "Segmentary Lineage Organization and Conflict in Sub-Saharan Africa," *Econometrica : journal of the Econometric Society*, 2020, *88* (5), 1999–2036.

Mullainathan, Sendhil, "Thinking through categories," 2002.

_ **, Joshua Schwartzstein, and Andrei Shleifer**, "Coarse Thinking and Persuasion," *The Quarterly Journal of Economics*, May 2008, *123* (2), 577–619.

Murdock, George P. and Douglas R. White, "Standard Cross-Cultural Sample," *Ethnology*, 1969, *8* (4), 329–369.

Murdock, George Peter, *Theories of Illness: A World Survey*, Pittsburgh: University of Pittsburgh Press, 1980.

Norenzayan, Ara, *Big Gods: How Religion Transformed Cooperation and Conflict*, Princeton University Press, 2013.

Nunn, Nathan, "The Long-term Effects of Africa's Slave Trades," *The Quarterly Journal of Economics*, 2008, *123* (1), 139–176.

_ **and Leonard Wantchekon**, "The Slave Trade and the Origins of Mistrust in Africa," *The American Economic Review*, 2011, *101* (7), 3221–3252.

_ **and Raul Sanchez de la Sierra**, "Why Being Wrong Can Be Right: Magical Warfare Technologies and the Persistence of False Beliefs," *American Economic Review*, May 2017, *107* (5), 582–587.

Nyqvist, Martina Björkman, Andrea Guariso, Jakob Svensson, and David Yanagizawa-Drott, "Reducing Child Mortality in the Last Mile: Experimental Evidence on Community Health Promoters in Uganda," *American Economic Journal. Applied Economics*, 2019, *11* (3), 155–192.

Nyqvist, Martina Björkman, Jakob Svensson, and David Yanagizawa-Drott, "Can Good Products Drive Out Bad? A Randomized Intervention in the Antimalarial Medicine Market in Uganda," *Journal of the European Economic Association*, 2022, *20* (3), 957–1000.

Okeke, Edward N., "When a Doctor Falls from the Sky: The Impact of Easing Doctor Supply Constraints on Mortality," *American Economic Review*, March 2023, *113* (3), 585–627.

Okunogbe, Oyebola and Victor Pouliquen, "Technology, Taxation, and Corruption: Evidence from the Introduction of Electronic Tax Filing," *American Economic Journal: Economic Policy*, February 2022, *14* (1), 341–372.

Olupona, Jacob K., *African religions: a very short introduction*, Oxford]: Oxford University Press, 2014.

Osherson, Daniel N., Edward E. Smith, Ormond Wilkie, Alejandro López, and Eldar Shafir, "Category-Based Induction," *Psychological review*, 1990, *97* (2), 185–200.

Oster, Emily, "Witchcraft, Weather and Economic Growth in Renaissance Europe," *Journal of Economic Perspectives*, 2004, *18* (1), 215–228.

_ , "HIV and sexual behavior change: Why not Africa?," *Journal of Health Economics*, 2012, *31* (1), 35–49.

Peski, Marcin, "Prior symmetry, categorization and similarity-based reasoning," *Journal of Economic Theory*, 2011, *146* (1), 111–140.

Preston-Whyte, Eleanor, "Culture in Action: Reactions to Social Responses to HIV/AIDS in Africa," 2008.

Purzycki, Benjamin Grant, Coren Apicella, Quentin D Atkinson, Emma Cohen, Rita Anne McNamara, Aiyana K Willard, Dimitris Xygalatas, Ara Norenzayan, and Joseph Henrich, "Moralistic gods, supernatural punishment and the expansion of human sociality," *Nature*, 2016, *530* (7590), 327.

Ramos-Toro, Diego, "Social Exclusion and Social Preferences: Evidence from Colombia's Leper Colony," *The American Economic Review*, 2023, *113* (5), 1294–1333.

Ridley, Matthew, Gautam Rao, Frank Schilbach, and Vikram Patel, "Poverty, depression, and anxiety: Causal evidence and mechanisms," *Science*, December 2020, *370* (6522).

Rossignol, Etienne Le, Sara Lowes, and Nathan Nunn, "The Social Consequences of Traditional Religion in Contemporary Africa," 2023.

Rödlach, Alexander, *Witches, Westerners, and HIV: AIDS and Cultures of Blame in Africa*, Routledge, 2006.

Schwartzstein, Joshua and Adi Sunderam, "Using Models to Persuade," *American Economic Review*, January 2021, *111* (1), 276–323.

Seabright, Paul, *The Divine Economy: How Religions Compete for Wealth, Power, and People*, Princeton: University Press, 2024.

Snowden, Frank M., *Epidemics and Society: From the Black Death to the Present*, Yale University Press, 2019.

Spolaore, Enrico and Romain Wacziarg, "How Deep Are the Roots of Economic Development?," *Journal of Economic Literature*, 2013, *51* (2), 325–369.

Stantcheva, Stefanie, "Understanding Tax Policy: How do People Reason?," *The Quarterly Journal of Economics*, 2021, *136* (4), 2309–2369.

Tarozzi, Alessandro, Aprajit Mahajan, Brian Blackburn, Daniel J. Kopf, and Joanne Yoong, "Micro-loans, insecticide treated bednets and malaria: evidence from a randomized controlled trial in Orissa, India," 2014, *104* (7), 1909–1941.

Thomas, Keith, *Religion and the decline of magic: studies in popular beliefs in sixteenth and seventeenth century England*, London: Weidenfeld and Nicolson, 1971.

Thornton, Rebecca L., "The Demand for, and Impact of, Learning HIV Status," *American Economic Review*, December 2008, *98* (5), 1829–1863.

Tversky, Amos, "Features of similarity," *Psychological Review*, 1977, *84*, 327–352.

Williams, Joseph J. and Tania Lombrozo, "The Role of Explanation in Discovery and Generalization: Evidence From Category Learning," *Cognitive Science*, 2010, *34* (5), 776–806. Place: Oxford, UK Publisher: Blackwell Publishing Ltd.

Wood, Kate and Helen Lambert, "Coded Talk, Scripted Omissions," *Medical Anthropology Quarterly*, 2008, *22* (3), 213–233.

World Health Organization, "Epilepsy in the WHO African Region: Bridging the Gap," 2004.

_ , "Atlas: Epilepsy Care in the World," 2005.

A Online Appendix: Variable Description

A Construction of Indices

To capture belief intensity and structure across illnesses, I construct several indices following the Kling et al., 2007. The indices used in the main analysis are defined as follows:

- *Epilepsy supernatural index*: An index combining three variables specific to epilepsy: (i) whether the illness is considered only supernatural, only natural, or both, (ii) whether the respondent agrees with a statement that epileptics are witches, measured on a 5-point scale from "strongly disagree" to "strongly agree", iii) whether the respondent agrees with a statement that epileptics are bewtiched, measured on a 5-point scale from "strongly disagree" to "strongly agree".

- *Illnesses supernatural index*: An index combining the 13 dummy variables "illness can be supernatural" for all 13 conditions.

- *Modern medicine effectiveness index*: An index combining the 13 dummy variables "modern medicine effective" for all 13 conditions.

- *Traditional medicine effectiveness index*: An index combining the 13 dummy variables "traditional medicine effective" for all 13 conditions.

- *Modern medicine experience index*: An index combining the 13 dummy variables "used modern medicine" for all 13 conditions.

- *Heard of illness index*: An index combining the 13 dummy variables "Heard of illness" for all 13 conditions. For each illness, the dummy variable "heard of illness" is equal to one if the respondent has heard about the illness or condition before.

- *Know somebody with illness index*: An index combining the 13 dummy variables "knows somebody with illness" for all 13 conditions. For each illness, the dummy variable "knows somebody with illness" is equal to one if the respondent knows somebody (including themselves) who has had the condition.

In addition, I use the following:

- *Share illnesses supernatural*: The share (out of 13) of illnesses that the respondent believes can be supernatural.

B Online Appendix: Background

A Background on Epilepsy

Epilepsy is a chronic noncommunicable disease of the brain and one of the most common neurological diseases worldwide (World Health Organization, 2004). Epilepsy is defined as a condition characterized by recurrent seizures, at least two of which are unprovoked, occurring in a period of more than 24 hours. Recurrent seizures are brief episodes of involuntary movement that may involve a part of the body (partial epilepsy) or the entire body (generalized epilepsy). Sometimes seizures are accompanied by loss of consciousness and control of bowel or bladder function (World Health Organization, 2004).

Seizures are the result of excessive electrical discharges in a group of brain cells that can occur in different parts of the brain. Seizures can vary in their manifestation, which could range from very short lapses of attention or muscle jerks to severe and prolonged convulsions, and in their frequency, which can range from less than one per year to several per day (World Health Organization, 2004). While the incidence of epilepsy in more developed countries is highest in the 30–50 age group, in less developed countries, particularly in sub-Saharan Africa, more than 90% of people with epilepsy are younger than 20 years.

There are four types of epilepsy: (1) idiopathic epilepsies, which are thought to be genetically determined, (2) symptomatic epilepsies, which are acquired conditions and are usually associated with a structural abnormality of the brain, (3) cryptogenic epilepsies, when no clear abnormality or putative risk factor can be identified for what is thought to be a symptomatic or acquired epilepsy, and (4) progressive epilepsies, which are associated with an evolving neurological condition (World Health Organization, 2005). Developed countries frequently report idiopathic epilepsies, while symptomatic epilepsies, commonly caused by factors such as family seizure history, birth trauma, and central nervous system infections, are more prevalent in Africa due to a high burden of disease (World Health Organization, 2004, Ba-Diop et al., 2014).

The primary risk factors for epilepsy in sub-Saharan Africa are family history of seizures, previous febrile seizures, perinatal trauma, head injury, and central nervous system (CNS) infections

such as neurocysticercosis.[47] Perinatal causes account for between 2% and 65% of cases of epilepsy in sub-Saharan Africa. Difficult pregnancies or childbirth can lead to birth injuries (Ba-Diop et al., 2014). Most neurological infections that cause seizures are of parasitic origin, including malaria, cysticercosis, onchocerciasis, and toxocariasis (Ba-Diop et al., 2014). Onchocerciasis (river blindness) has also been associated with seizure disorders (Ba-Diop et al., 2014). It is estimated that 30% of epilepsy in endemic regions results from neurocysticercosis (Ba-Diop et al., 2014). Traumatic brain injuries resulting from road accidents, assaults, injuries in war, or violent sports are also a common cause of epilepsy in sub-Saharan Africa (Ba-Diop et al., 2014).

Modern pharmaceutical treatment of epilepsy began with bomides (1856), phenobarbital (1912) and phenytoin (1938) (World Health Organization (2005)). To treat epilepsy, its cause has to be identified, antiepileptic drugs have to be given to control seizures, and comorbidities have to be prevented and treated. Epilepsy surgery can be performed but is rarely available in sub-Saharan Africa. The World Health Organization (WHO) claims that it is possible to diagnose and treat most people with epilepsy at primary healthcare facilities without the use of sophisticated equipment (Ba-Diop et al., 2014, World Health Organization, 2005). Bruno et al. (2012) find that, in rural areas in Mali with an epilepsy prevalence rate of 1,335 per 100,000 people, 59.6% of patients were seizure-free after 12 months of taking phenobarbital and receiving treatment from primary healthcare providers.

B Treatment Video Text

Because using a script or a teleprompter was considered unnatural, the medical professionals and I discussed the treatment video content in advance, which they then delivered in free speech. This gave the professionals degrees of freedom with regard to the content but rendered the treatment video very natural and the campaign as close as possible to a campaign conducted by local professionals. The following presents the treatment text translated from Tshiluba into French and then into English.

Dr. Tshibangu:

Hello dear all, I am Dr. John Musenga Tshibangu, I am the Leader of an institution that deals with diseases of the brain or cranial diseases here in our province of Central Kasai.

Dr. Badibanga:

As for me, I am Dr. Pacifique Lushiku Badibanga. I am a specialist in brain diseases. I work in the health division of the province of Central Kasai, especially in the coordination of brain diseases here in Kananga.

[47] Neurocysticercosis is a preventable parasitic infection caused by larval cysts of the pork tapeworm.

Dr. Tshibangu:

Today we will talk to you about the disease of seizures or epilepsy. Brothers and sisters, epilepsy is a disease that affects the brain. The brain is located in the skull and in it are also the neurons. There are many nerves that are connected, and these nerves are called neurons. Whenever someone thinks, these neurons send a current. It is by giving this current that you have the possibility to walk, to talk, and to make any movement, and that you study or do calculations.

Dear friends, as we have talked about how a person can have an epileptic seizure, we affirm that these neurons in the brain are connected. During a seizure, the neurons send a strong current like during a thunderstorm; this is what causes the person to fall, and when they fall, they start to agitate, having convulsions because the current is very strong. A person may not withstand this current, so they may fall, start to agitate, make movements and also have convulsions.

Because it is the brain that helps you walk, this brain is like a computer, which has many parts inside it, and these parts help it so that everything that enters inside the computer can reach the memory of the computer. The brain helps the person to think, and every time there is no communication between the neurons, there is no way the brain can work. So, we have shown that the brain is located in the skull, it's like the radio that transmits when there are batteries and doesn't transmit when there are no batteries.

It's comparable to the television: if you see images on the television, that means the television is in good condition, and when the images become dark, that means there is a problem with the television. And if we think about the brain like the television, when it doesn't work, a person cannot think well, they may fall, have an epileptic seizure.

Dr. Tshibangu:

Now we will talk about the causes of epilepsy.

Epilepsy or seizure is not a disease of sorcery. It's not a disease that occurs when you have used charms or when someone has cast spells on you. And here's how this disease affects someone.

Firstly, all the diseases that affect the brain can cause epilepsy. These diseases, meningitis for example, can cause the victim to develop epilepsy. Head trauma that affects the brain can also cause the victim to develop epilepsy.

Secondly, malaria can affect someone and affect the brain and develop epilepsy.

Brothers and sisters, let's remember that a child can develop epilepsy if they were resuscitated at birth and/or if they came through a birth with complications. Their brain can be injured at birth

and make them develop epilepsy. Let's also remember that every child or adult who has received a blow to the head and whose brain is injured, can develop this disease.

We also inform you that a mother or a father who has had epilepsy seizures can have a child who will have epilepsy, which means that this disease can be hereditary.

We explain well that this disease does not come from witchcraft.

Dr. Badibanga:

We want to talk to you now about the treatment of epileptic seizures or convulsions. The treatment for this disease is a treatment of many days. The medications with which to treat such a patient are numerous in our city of Kananga.

For this, we can prescribe a product to such a patient. They can take one tablet in the morning and another in the evening; twice for the whole day.

This patient has time to stay at home to take the products and when the month is over, they are asked to come back to the doctor so that he can know if it's working and continue in this way. These medications, when they are prescribed, they decrease the epileptic seizures and these so that this patient can get better. In short, I mean this: The products are there to be taken for many days and can also stop the seizures. And these products can stop any movement when the patient falls.

Mrs. Nagalula:

My name is Josefine Ngalula.

Regarding the disease of epilepsy that my daughter suffered from, I took the traditional treatment, which did not serve me any solution.

But in the modern treatment followed with her, I saw a total change in my daughter. This is why I am here to testify to you about this treatment. Modern treatment has an effective solution compared to the traditional treatment.

Let's take modern treatment, because it is indeed this treatment that has been brought to us for the healing of our children. This treatment that will address all head diseases.

In the course of seeking traditional treatment for the child, we suffered a lot. People who told us "my product is effective" and asked us not to eat from other people's pots and not to eat pork, and said 'let's see at the end of this month if it will continue". We walked everywhere and they were only lying to us. All the doctors always asked us to give pots and money – we did everything, but with no favorable outcome. We walked a lot for this treatment; we were asked to give chickens, clothes, etc. Everyone said their product was effective, we did everything because we wanted us all

to be well because if you are well and the other is sick, you will not have an appetite. And in all this, we did not have a solution. The solution we had is in God and in modern medicine. We must put God and modern medicine first because the first person that God sent to heal and give life was the modern doctor.

When I went to traditional medicine, I did not find an effective treatment. I went through all the hospitals, and everywhere I went, they told me the child suffered from malaria, meningitis, and in all this, I did not have a solution or treatment, and so I went to see Dr. Richard. When I arrived, he examined the child, scanned her head, administered a product and still there is a change because before the child had epileptic seizures all the time (she would fall, fall, fall). Since Dr. Richard treated her, currently the child no longer has seizures like before. Since then, she no longer falls like before, she can already go two months without seizures because she could fall every month, she could injure herself very badly. And when she fell, she could wake up as if from sleep. That's how I speak of modern treatment for you who have children with sick heads or even adults. Stop agitating/bothering people by talking to them about traditional treatment. Because in this treatment, there is no solution.

Someone can give you traditional treatment, and the child goes two months or one month without having seizures, and after that, they relapse, whereas in modern treatment, we continue to take this product because it is in this modern treatment that there is a solution. So go to the modern doctors for good treatment, because with the modern treatment that I took, today I have a solution in my family.

C Anthropological Accounts

C.1 Account 1: Beng Farmers in West Africa

In Gottlieb (2004), anthropologist Alma Gottlieb describes her fieldwork among the Beng farmers of West Africa, recounting her failed efforts to persuade them to boil their drinking water.

"During our stays in Beng villages, Philip and I have always either boiled or filtered our own drinking water. To our dismay, our neighbors often derided our laborious efforts. One day we thought to explain our mysterious actions. The village had been experiencing an especially crippling outbreak of Guinea worm. After reading about the disease, Philip and I were convinced that polluted drinking water was the cause of our neighbors' misery. We urged our friends to boil their water as protection against future infestation. But even our closest and most open-minded friends dismissed

our suggestion with casual laughter. 'Can you see the worms in our water?' our friend Yacouba challenged us. We admitted we couldn't. 'There's nothing wrong with the water,' he insisted. 'Anyway, even if the Guinea worms come to us through the water, they're put there by witches.' Yacouba added emphatically, 'Boiling the water wouldn't stop the witches."' (Gottlieb, 2004, p. 189).

C.2 Account 2: India

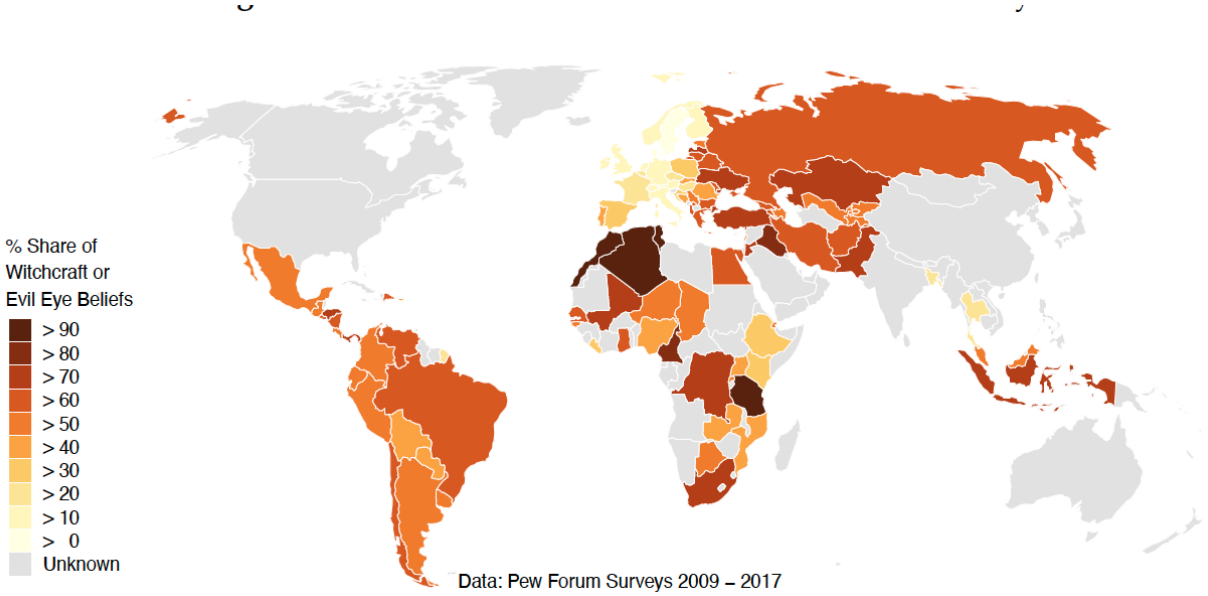
Luschinsky (1963) recounts a village woman's reasoning about an aching tooth.

"A village woman of Noniya caste squatted near the door rubbing her jaw. She said that she knew why her teeth were aching. An evil spirit was troubling her. The village shaman had told her so and she was performing ceremonies to placate the spirit under the shaman's direction. An American research worker had tried to persuade her to go to a dentist in Banaras, but she had refused, asking, What would such a man know about evil spirits?" (Luschinsky, 1963, p.66)

C Online Appendix: Supplementary Figures and Tables

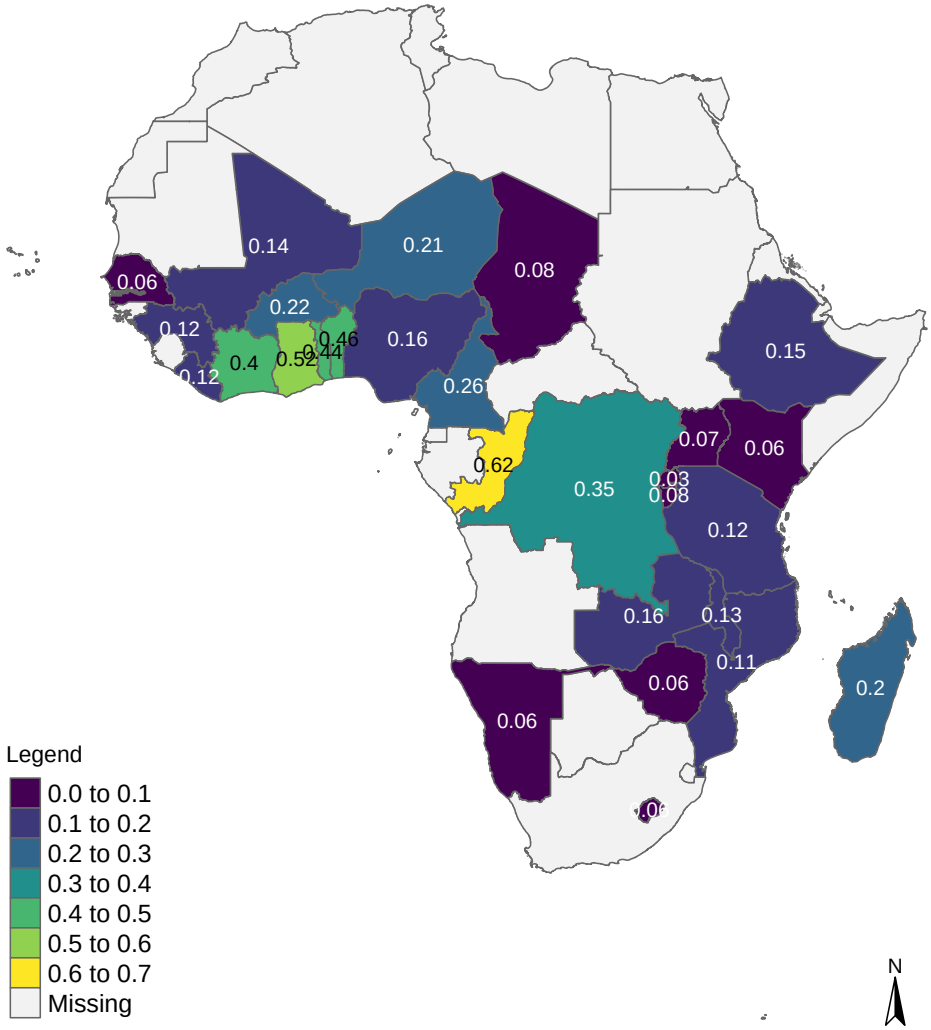
A Appendix Figures

Figure A.1: Global Prevalence of Beliefs in Witchcraft or Evil Eye



Source: Butinda et al. (2023). *Notes:* The map illustrates data gathered by the Pew Forum in various nationally representative survey waves spanning from 2009 to 2017. Participants were surveyed on their beliefs, specifically regarding (i) belief in witchcraft and (ii) belief in the evil eye or that certain people can cast curses or spells that cause bad things to happen to someone. In western European countries, the survey included the evil eye question but omitted the witchcraft question. Butinda et al. (2023) calculate the country-level shares of individuals who believe in witchcraft or the evil eye (or both) using the sampling weights of the survey data.

Figure A.2: Share of Respondents with Supernatural Belief Regarding HIV/AIDS Across Countries in Sub-Saharan Africa



Note: The figures show the share of respondents who agree with the statement "One can get HIV/AIDS from witchcraft or other supernatural means". The data come from the Demographic and Health Surveys and the Gallup World Poll 2009.

Figure A.3: Association of Supernatural Beliefs with Healer Use in Sub-Saharan Africa

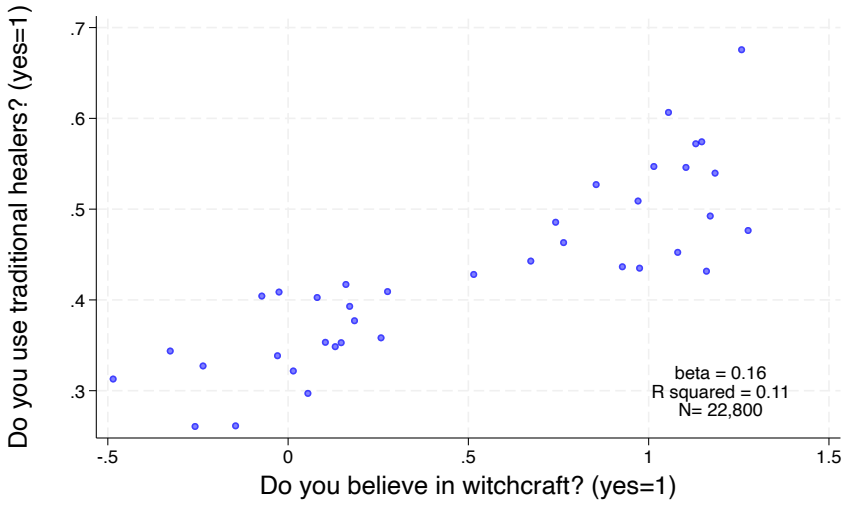


Figure A.4: Association of Supernatural Beliefs with Healer Use

Note: The figure shows a binned scatter plot of the use of traditional healers on beliefs in witchcraft including country fixed effects. The data come from the Pew Forum on Religion and Public Life survey.

Figure A.5: Association of Supernatural Beliefs with Stigma in Sub-Saharan Africa

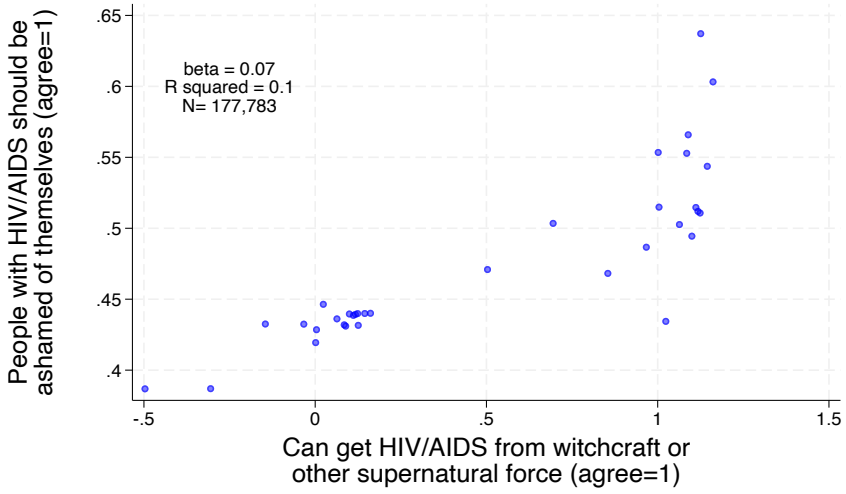
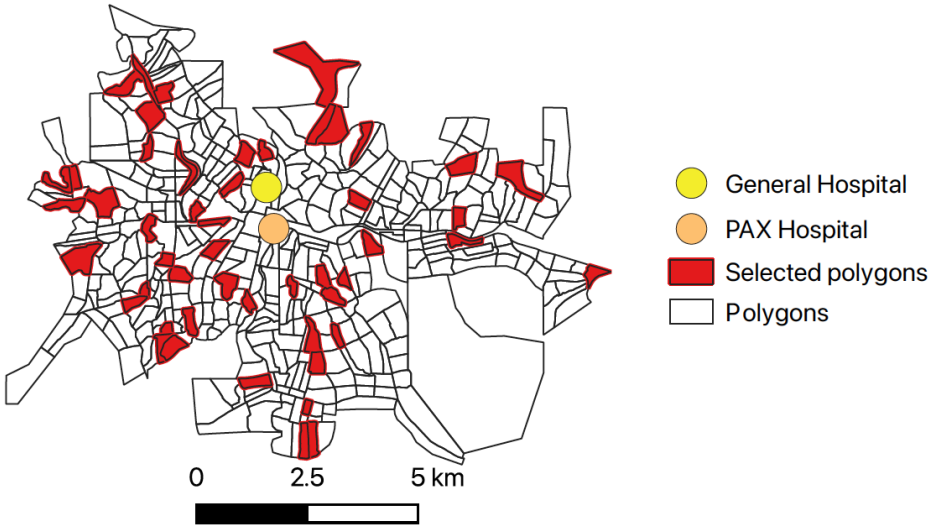


Figure A.6: Association of Supernatural Beliefs with Stigmatizing Attitudes

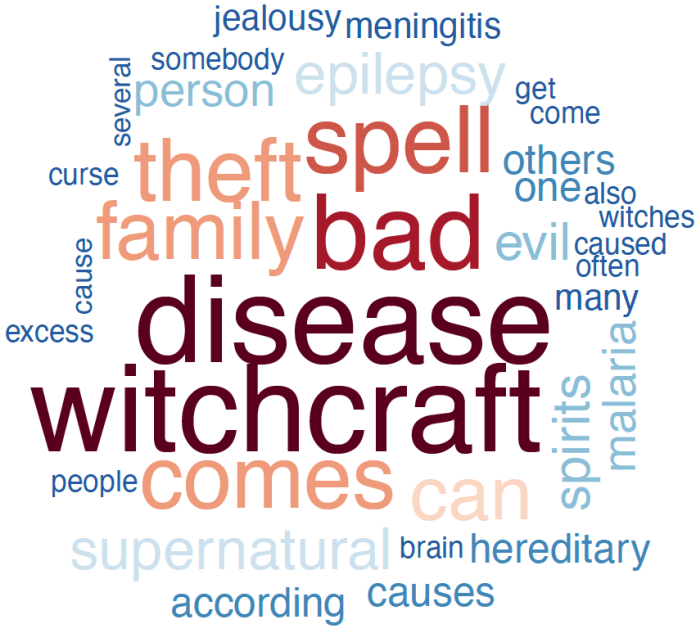
Note: Panel A.6: The figure shows a binned scatter plot of the variable "People with HIV/AIDS should be ashamed of themselves" (yes=1) on the variable "One can get HIV/AIDS from witchcraft or other supernatural means" (yes=1) including country fixed effects. The sample is restricted to the years before the introduction of HIV treatment. The data come from all Demographic and Health Surveys covering the variables and time periods in sub-Saharan Africa.

Figure A.7: Sampling in Kananga



Note: The map depicts the selected neighborhoods (polygons) for the sample using two-stage clustered sampling. The selection of polygons was stratified by median distance to the city center. General Hospital is the hospital where the voucher for an epilepsy consultation could be used (see Section 6.2.1). PAX Hospital is the hospital where the hypertension and HIV testing vouchers could be used (see Section 6.2.3).

Figure A.8: Word Cloud on Causes of Epilepsy in Kananga



Note: Word cloud of the answers to the open question "Now I'd like to talk about the causes of epilepsy here in Kananga. Can you explain the causes of epilepsy to me in your own words?" Data from subsample in baseline survey. N=90.

Figure A.9: Case-Based Supernatural Attributions for Epilepsy

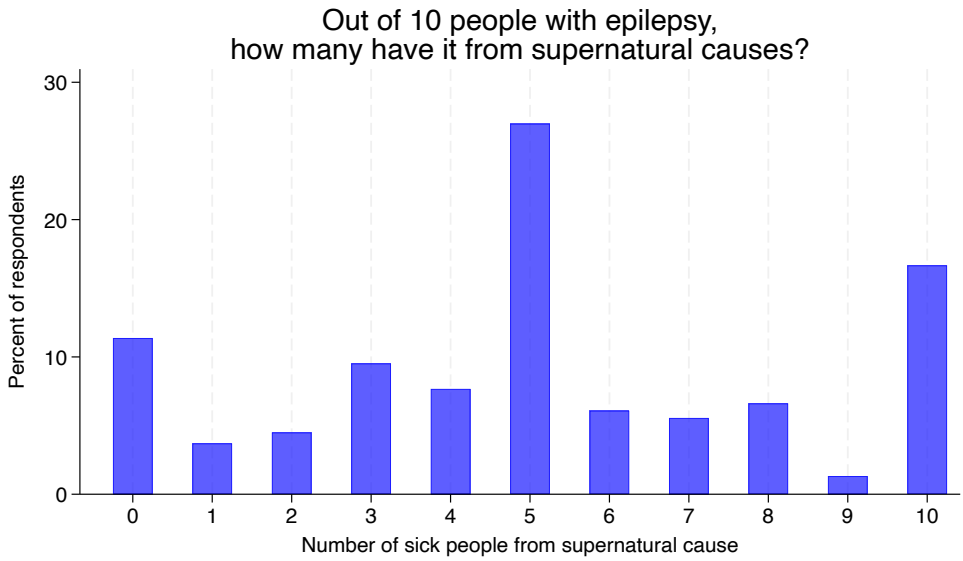


Figure A.10: Case-based supernatural attributions for epilepsy

Notes: The histogram shows the distribution of responses to the question "Out of 10 people with epilepsy, how many have it from supernatural causes?" The data come from the control group in the midline survey (N= 378).

Figure A.11: Correlates of Supernatural Beliefs about Illness

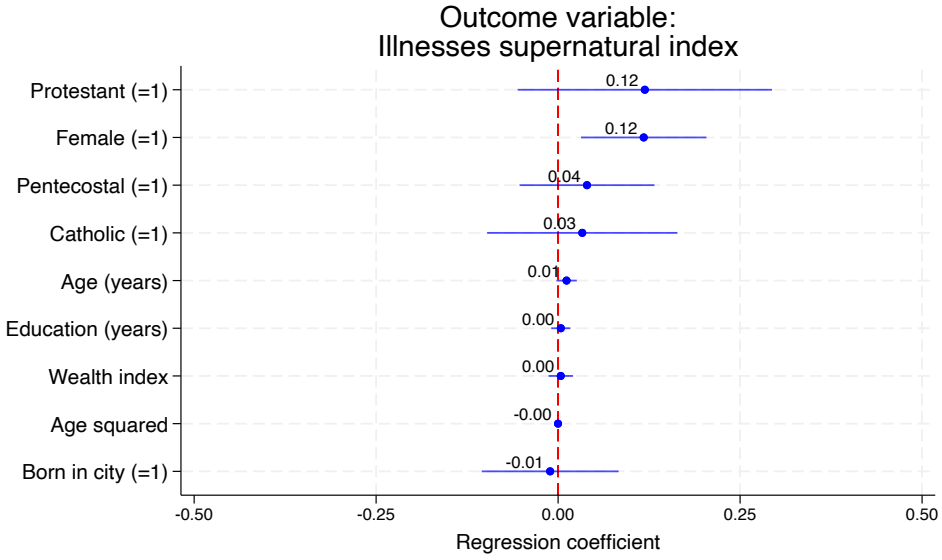
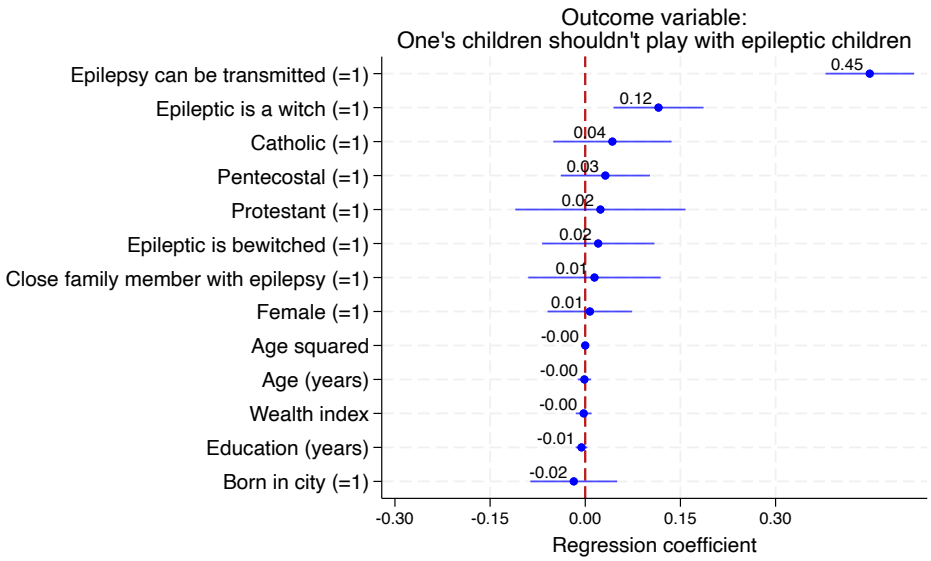


Figure A.12: Outcome variable: Illnesses supernatural index

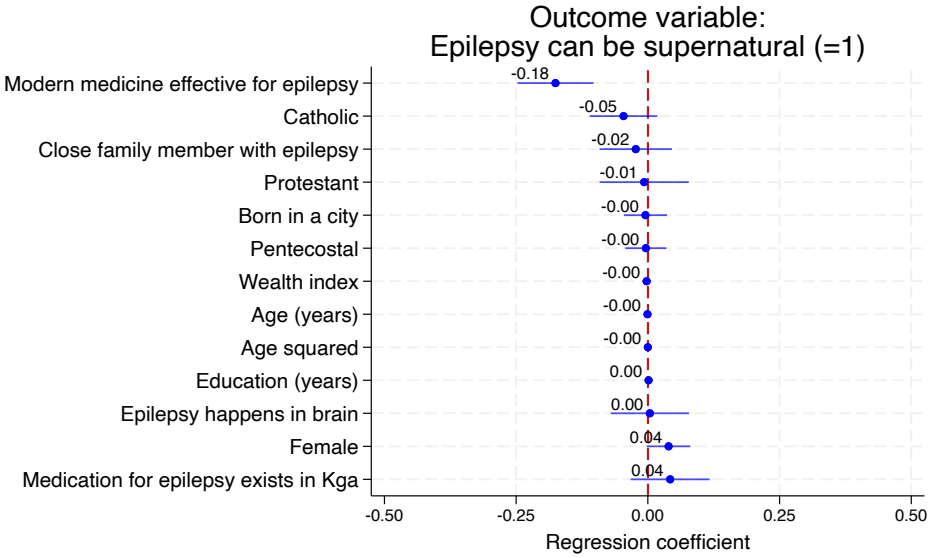
Note: The figure plots the regression coefficient of the *illnesses supernatural index* for different individual-level variables from the same regression. The *illnesses supernatural index* is a Kling et al. (2007) index of the variables for whether the respondent believes an illness can have supernatural causes across 13 illnesses. See Appendix Section A for the description of the variables.

Figure A.13: Predictors of Stigma toward Those with Epilepsy



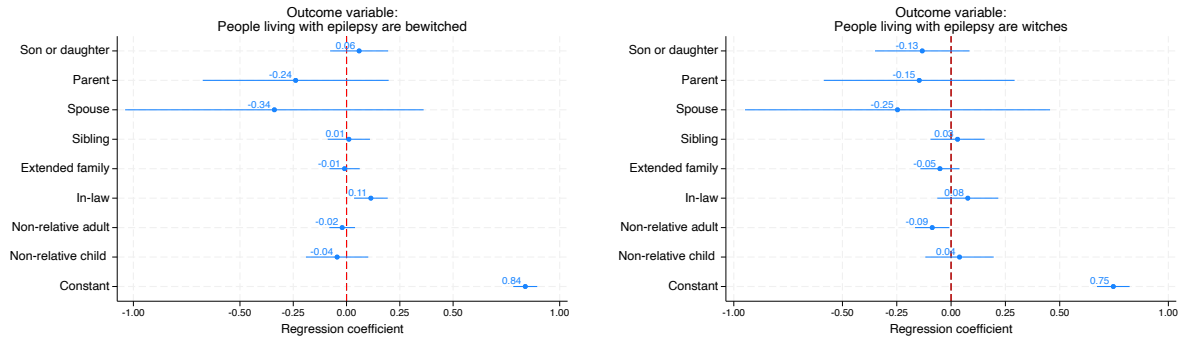
Note: Panel A.13: The outcome variable is a dummy variable equal to one if the respondent agrees or strongly agrees with the statement "One's children shouldn't play with epileptic children". The figure plots the regression coefficients of different individual-level variables. Dependent variable mean of 0.359. The data come from the baseline survey (N=800).

Figure A.14: Correlates of Supernatural Beliefs about Epilepsy



Notes: The figure shows the regression coefficients of the regression of "epilepsy can be supernatural" (see Section 3 for variable construction) on demographics and beliefs about epilepsy. All variables elicited in baseline survey. The dependent variable mean is 0.923. 95% confidence intervals.

Figure A.15: Variation in Supernatural Beliefs about Epilepsy by Relationship to Closest Person with Epilepsy

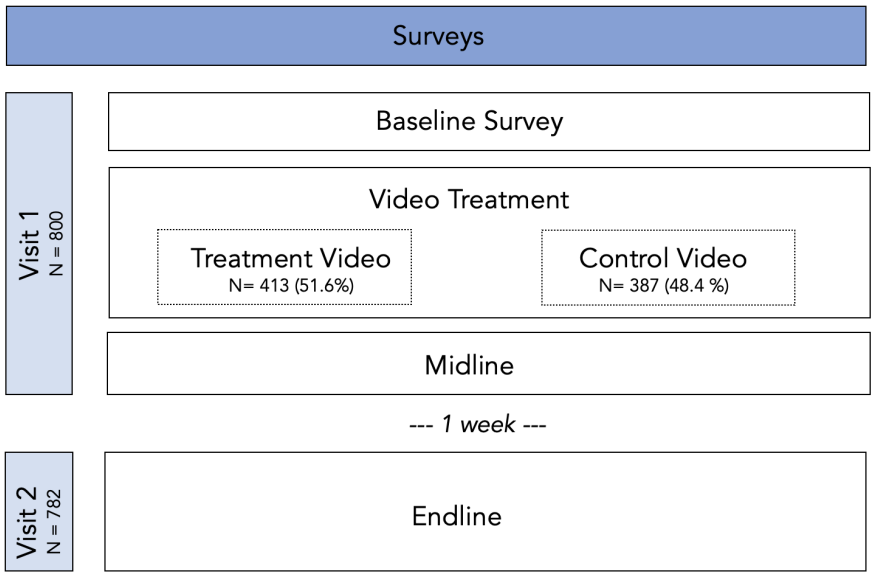


(a) Outcome variable: People living with epilepsy are bewitched

(b) Outcome variable: People living with epilepsy are witches

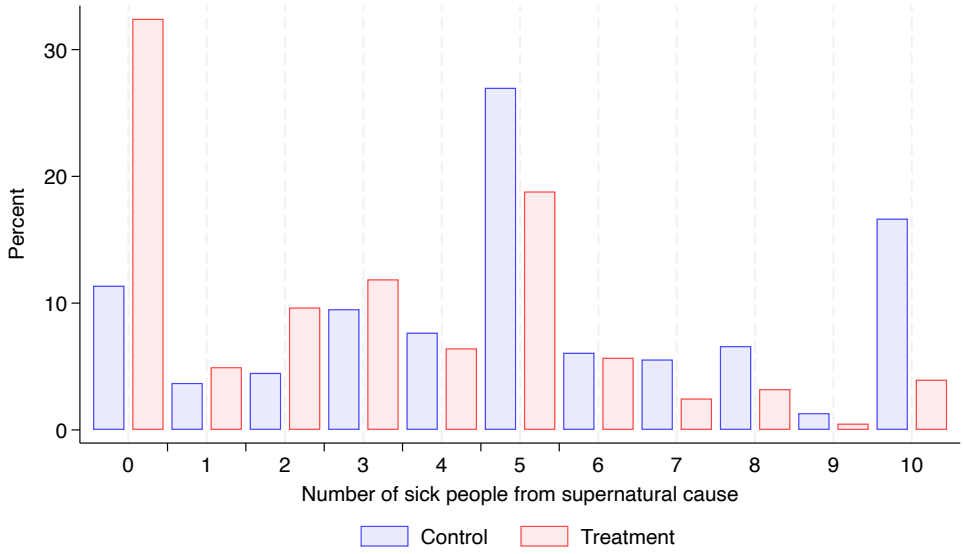
Note: Panels A.15a and A.15b plot regression coefficients from models where the outcome is a dummy equal to one if the respondent agrees that people with epilepsy are bewitched (Panel A.15a) or witches (Panel A.15b), respectively. The main regressors are dummy variables for the respondent's relationship to the socially closest person with epilepsy they know. The omitted category ("Constant") includes respondents who either do not know anyone with epilepsy or did not answer the question. All variables were elicited in the baseline survey. 95% confidence intervals shown.

Figure A.16: Survey Flow



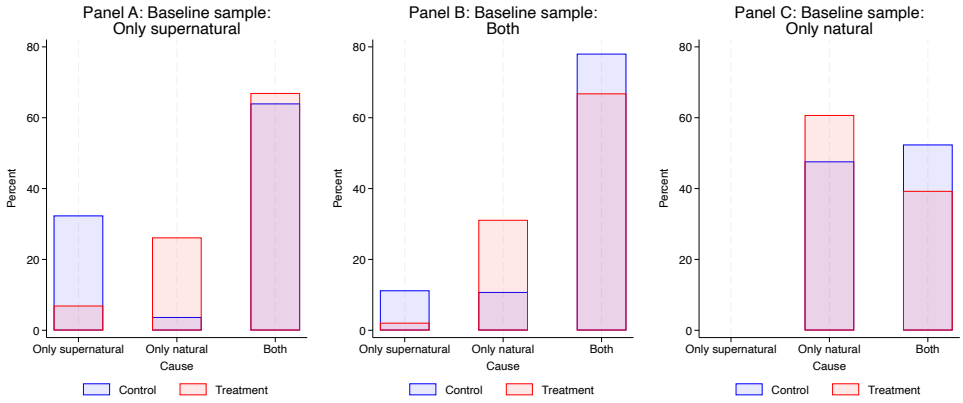
Notes: The figure shows the survey flow.

Figure A.17: Distribution: Share of Epilepsy Cases Caused Supernaturally by Treatment Group



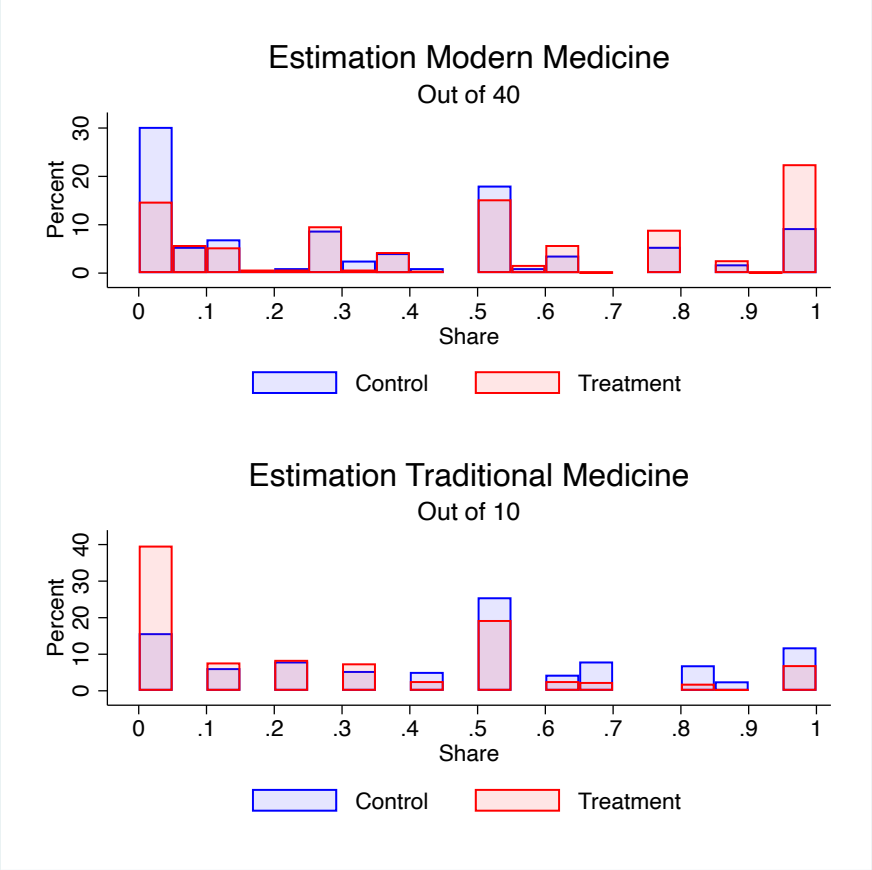
Note: The figure shows the distribution of the answer to the question "Out of 10 people with epilepsy, how many have it from supernatural causes?" by treatment group elicited in the endline survey in the second visit. See Section 3 for the definition of the variable.

Figure A.19: Heterogeneous Treatment Effects on Explanations of Epilepsy by Baseline Beliefs



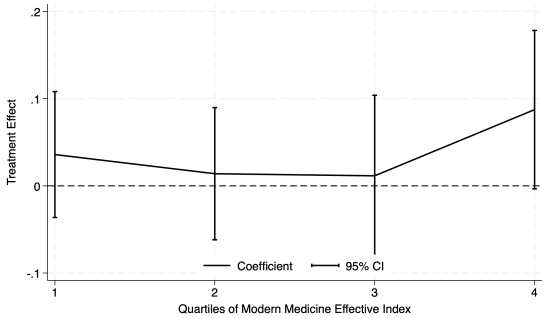
Note: The figure shows the frequency of beliefs that epilepsy can only be supernatural, can only be natural, or can be both in the endline survey by treatment group and subsample of baseline beliefs. Each panel shows a different subsample: The subsample of respondents thinking epilepsy can only be supernatural in Panel A, the subsample of respondents thinking epilepsy can be both supernatural and natural in Panel B, and the subsample of respondents thinking epilepsy can only be natural in Panel C.

Figure A.18: Distribution of Estimations of Efficacy for Modern and Traditional Medicine by Treatment Group

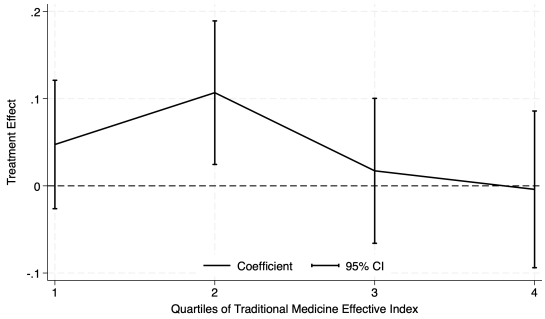


Note: The figure shows the distribution of respondents' estimates of the treatment efficacy of modern medicine and traditional medicine in Kananga by treatment status. The estimated efficacy for modern medicine is calculated as the estimated number of patients with epilepsy out of 40 who received modern medical treatment and had no seizures in the month after starting treatment. The estimated efficacy for traditional medicine is calculated as the estimated number of patients with epilepsy out of 10 who took traditional medicine and had no seizure in the month after starting traditional treatment. The estimates were incentivized based on numbers provided by the hospital. See Section 6.1.1 for the description of these variables.

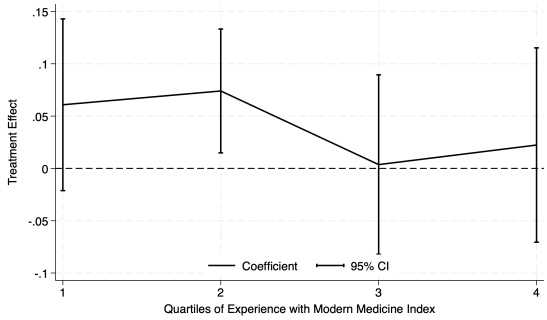
Figure A.20: Heterogeneity in Voucher Redemption by Supernatural Epilepsy Beliefs



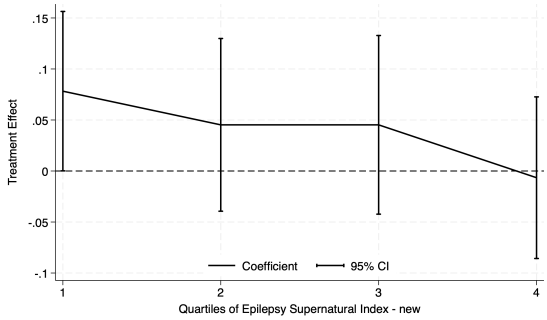
(a) Modern medicine effective index



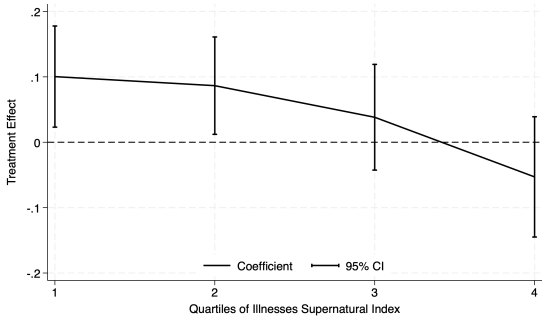
(b) Traditional medicine effective index



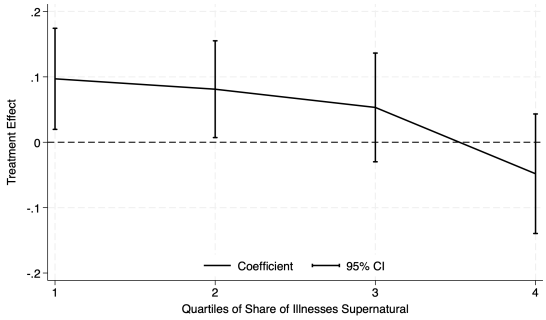
(c) Experience with modern medicine index



(d) Epilepsy supernatural index



(e) Illnesses supernatural index



(f) Share of illnesses that can be supernatural

Note: Each panel shows heterogeneity in voucher redemption by quartiles of belief-related indices. The outcome is a binary indicator for whether the hospital voucher for epilepsy was redemeed. The indices are constructed as described in Appendix A.

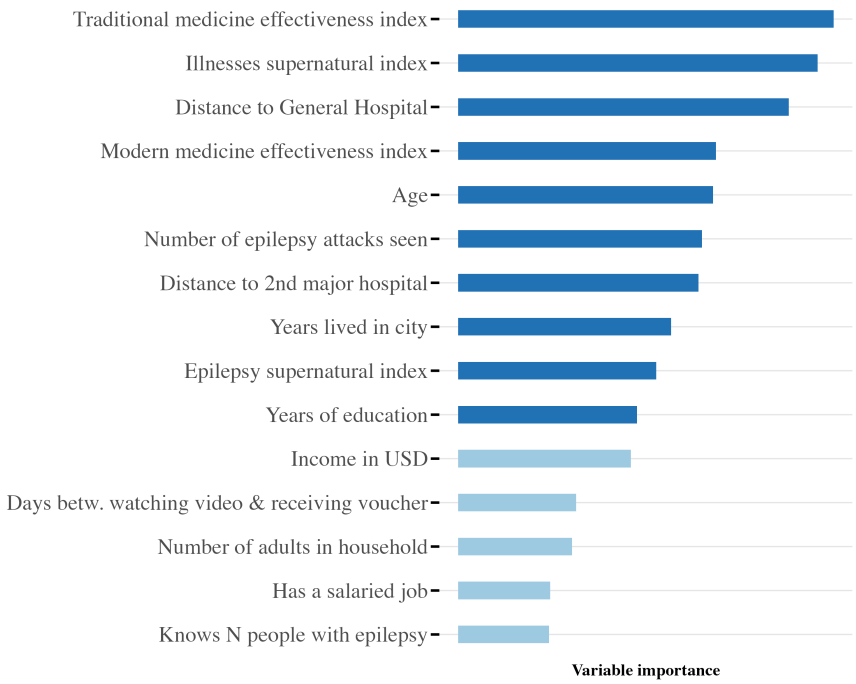


Figure A.21: Variable Importance in Epilepsy Voucher Treatment Effect Heterogeneity

Note: Variable importance scores from the causal forest model estimating heterogeneous treatment effects on voucher redemption. Importance reflects the frequency with which each covariate is used as a splitting variable in the forest, weighted by the depth of the split, following the approach in Carter et al., 2019 and Okunogbe and Pouliquen, 2022. Bars in dark blue indicate the ten most important predictors; lighter blue bars rank 11–15. Indices of belief intensity—covering traditional medicine, modern medicine, and supernatural illness beliefs—are constructed using Kling et al., 2007 indices across 13 illnesses; see Appendix Section A for details.

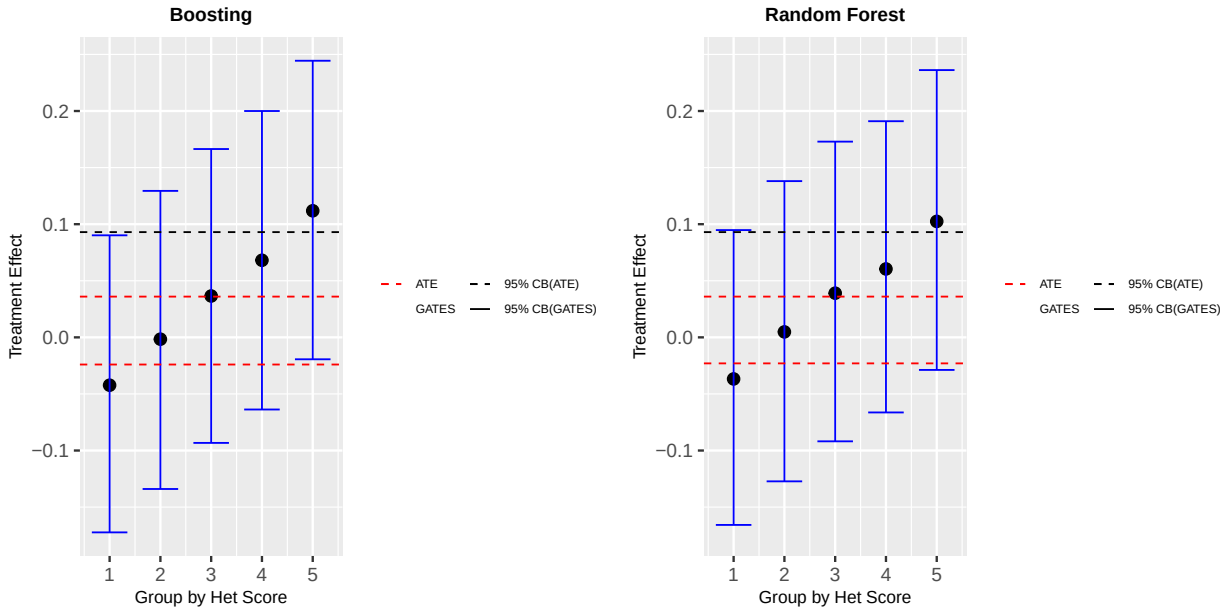


Figure A.22: Treatment Effect Heterogeneity in Epilepsy Voucher Redemption: GATES

Note: GATES estimates of heterogeneity in voucher redemption, following the methodology of Chernozhukov et al. (2025). Point estimates and 95% uniform confidence intervals are based on 100 random sample splits. The outcome is voucher redemption; groups are defined based on predicted individual treatment effects from causal machine learning.

B Appendix Tables

Table A.1: Supernatural Beliefs about AIDS and Their Relationship with Stigmatizing Attitudes and HIV testing, and Impact of Availability of HIV Treatment on These Beliefs

	(1) HIV/AIDS supernatural	(2) HIV test	(3) HIV/AIDS stigma
HIV treatment prevalence$_{t-1}$	-0.018**	0.170***	-4.629***
	(0.008)	(0.020)	(0.635)
R^2	0.150	0.064	0.146
Observations	761,982	545,279	202,351
Country FE	yes	yes	yes
Year FE	yes	yes	yes
Controls	yes	yes	yes

Notes: Coefficients are standardized and represent the change in the dependent variable (in standard deviation units) with a one-standard-deviation change in the independent variable. Regressions include the control variables sex, age, age squared, education in years, indicator variables for marital status, and a wealth index. *HIV/AIDS supernatural* is a dummy variable equal to one if the respondent agrees that one can contract AIDS/HIV from witchcraft or by other supernatural means. *AIDS stigma* is a dummy variable equal to one if the respondent agrees that people living with HIV/AIDS should be ashamed of themselves. *HIV test* is a dummy variable equal to one if the respondent consents to the HIV test. *HIV treatment prevalence* measures the share of the population receiving antiretroviral therapy (ART) in the previous year at the country level. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS standard errors clustered at country level in parentheses. *Source:* Demographic and Health Surveys data. The sample includes all countries in sub-Saharan Africa and all associated years for which the variables of interest are available and downloadable from IPUMS. Column (1) sample: Benin 2006, 2011, 2017; Burkina Faso 2010; Burundi 2010, 2016; Cameroon 2004, 2018; Chad 2004, 2014; Congo 2005, 2011; Cote d'Ivoire 2011; DRC 2007, 2013; Eswatini 2006; Ethiopia 2005, 2011, 2016; Ghana 2003, 2008, 2014; Guinea 2005, 2012, 2018; Kenya 2008, 2014; Lesotho 2004, 2009, 2014; Liberia 2007, 2013; Madagascar 2008; Malawi 2004, 2010, 2016; Mali 2006, 2012, 2018; Mozambique 2011; Namibia 2006, 2013; Niger 2006, 2012; Nigeria 2003, 2008, 2013, 2018; Rwanda 2010, 2014; Senegal 2005, 2010, 2014, 2015, 2016, 2017; Tanzania 2004, 2010; Togo 2013; Zambia 2007, 2013, 2018; Zimbabwe 2005, 2010, 2015. Column (2) sample: Benin 2006; Congo 2005; DRC 2007; Eswatini 2006; Ethiopia 2005; Guinea 2005; Lesotho 2009; Mali 2006; Namibia 2006; Niger 2006; Nigeria 2008, 2013; Rwanda 2005; Senegal 2005; Tanzania 2004; Zambia 2007, 2013; Zimbabwe 2005. Column (3) sample: Angola 2015; Burkina Faso 2010; Burundi 2016; Cameroon 2011, 2018; Chad 2014; Cote d'Ivoire 2011; DRC 2007, 2013; Eswatini 2006; Ethiopia 2011, 2016; Ghana 2014; Guinea 2012, 2018; Kenya 2008; Lesotho 2009, 2014; Liberia 2007, 2013; Malawi 2010, 2016; Mali 2006, 2012; Namibia 2013; Niger 2006, 2012; Rwanda 2010, 2014; Senegal 2010, 2017; South Africa 2016; Togo 2013; Zambia 2007, 2013, 2018; Zimbabwe 2005, 2010, 2015. Estimates on antiretroviral therapy and population numbers from World Health Organization.

Table A.2: Exposure to Illnesses in Sample and Prior Use of Traditional Medicine or Modern Medicine

	For illness			
Illness	Heard about (%) (1)	Know somebody (incl. self) (%) (2)	Used modern medicine for consultation or testing (%) (3)	Used traditional medicine (%) (4)
Malaria	99.87	99.09	82.85	44.57
Typhoid	100	91.82	64.13	56.99
Tuberculosis	98.37	55.96	16.16	7.78
Fractures	93.37	51.49	9.66	18.07
Snakebite	94.75	56.31	6.08	15.73
Diabetes	96.63	62.5	12.18	4.6
Anemia	96.74	74.77	24.77	21.59
Swollen limbs	90.1	67.01	15.74	20.48
HIV	98.62	36.11	15.82	2.25
Sterility	97.37	64.49	5.81	9.09
Hypertension	99.5	67.27	26.39	11.11
Covid	96.86	19.05	16.6	1.16
Epilepsy	99.88	90.89	1.88	4.4

Notes: The table shows the percentage of respondents who have heard about the illness before, who know somebody who has had the illness including the respondent herself, who have used modern medicine for testing or consultation before, and who have used traditional medicine before by illness. The variables were elicited in the baseline survey. Variables of columns (1) and (3) collected from all baseline survey respondents; variables in columns (2) and (4) collected from a subset of around 100 control respondents in the baseline survey.

Table A.3: Regression Results of Beliefs about Modern Medicine's Efficacy on Supernatural Origin of Illness

Panel A								
Dep. var.:	Illness can be supernatural (=1)				Modern medicine effective for illness (=1)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.362***	0.917***	0.058***	0.611***	0.845***	1.295***	0.972***	1.281***
	(0.008)	(0.000)	(0.000)	(0.010)	(0.006)	(0.010)	(0.001)	(0.011)
Illness can be					-0.284***	-0.322***	-0.106**	-0.082***
supernatural (=1)					(0.012)	(0.011)	(0.025)	(0.012)
Dep var mean	0.362	0.362	0.362	0.362	0.715	0.715	0.715	0.715
R^2	0.000	0.235	0.266	0.499	0.097	0.277	0.291	0.466
Observations	9,913	9,913	9,913	9,913	9,913	9,913	9,913	9,913
Individual FE	no	yes	no	yes	no	yes	no	yes
Disease FE	no	no	yes	yes	no	no	yes	yes
Panel B								
Dep. var.:	Has used modern medicine for illness (=1)				Modern medicine effective for illness (=1)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Illness can be	-0.209***	-0.256***	-0.048**	-0.046***	-0.260***	-0.289***	-0.105**	-0.082***
supernatural (=1)	(0.009)	(0.009)	(0.012)	(0.010)	(0.012)	(0.012)	(0.025)	(0.012)
Has used modern					0.119***	0.126***	0.032*	0.029**
medicine for illness (=1)					(0.010)	(0.010)	(0.015)	(0.011)
Dep. var. mean	0.232	0.232	0.232	0.232	0.715	0.715	0.715	0.715
R^2	0.056	0.232	0.302	0.467	0.110	0.288	0.291	0.466
Observations	9,896	9,896	9,896	9,896	9,896	9,896	9,896	9,896
Individual FE	no	yes	no	yes	no	yes	no	yes
Disease FE	no	no	yes	yes	no	no	yes	yes
Panel C								
Dep. var.:	Knows somebody with illness (=1)				Modern medicine effective for illness (=1)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Illness can be	0.150***	0.003	0.040	0.016	-0.489***	-0.355***	-0.213**	-0.139***
supernatural (=1)	(0.031)	(0.034)	(0.028)	(0.041)	(0.028)	(0.034)	(0.058)	(0.040)
Knows s.b.					-0.075**	0.036	-0.017*	0.034
w. illness (=1)					(0.034)	(0.037)	(0.009)	(0.037)
Dep var mean	0.734	0.734	0.734	0.734	0.715	0.715	0.715	0.715
R^2	0.028	0.453	0.239	0.607	0.250	0.649	0.394	0.730
Observations	2036	2036	2036	2036	2036	2036	2036	2036
Individual FE	No	Yes	No	Yes	No	Yes	No	Yes
Disease FE	No	No	Yes	Yes	No	No	Yes	Yes

Notes: I use OLS and estimate versions of the following equation:

$$\text{y}_{ij} = \alpha + \beta x_{ij} + \mu_i + \delta_j + \varepsilon_{ij}, \tag{4}$$

where i indexes individuals and j indexes diseases. y_{ij} is the outcome of interest and x_{ij} is a predictor of interest. μ_i is individual fixed effects and δ is illness fixed effects. ε_{ij} is the error term clustered at the individual level. I introduce illness and individual fixed effects as indicated in the table. The variables are a dummy variable equal to one if the respondent thinks an illness can have supernatural causes, a dummy variable equal to one if the respondent thinks modern medicine is effective for an illness (see Section 4 for the variable construction), a dummy variable equal to one if the respondent has ever used modern medicine in the form of an examination or testing for the illness, and a dummy variable equal to one if the respondent knows somebody who has had the condition. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors clustered at individual and illness level in parentheses.

Table A.4: Summary Statistics and Balance Checks

	Summary Statistics					Balance test	
	Mean	Std. dev.	Min	Max	N	β_1	Std. err.
Age (years)	38.14	16.13	18	83	800	-1.714	1.141
Female (dummy)	0.49	0.50	0	1	800	-0.044	0.035
Monthly household earnings (USD)	88.02	103.06	0	1100	755	12.726*	7.500
Log(1+income)	3.98	1.13	0	7	755	0.126	0.082
No schooling (dummy)	0.01	0.12	0	1	782	-0.014	0.009
Education (years)	12.90	4.03	0	21	800	0.252	0.286
Single, never married (dummy)	0.19	0.39	0	1	800	0.018	0.028
Married monogamous (dummy)	0.68	0.47	0	1	800	0.013	0.033
Married polygamous (dummy)	0.04	0.19	0	1	800	0.005	0.013
Divorced, separated (dummy)	0.01	0.11	0	1	800	0.009	0.008
Widowed (dummy)	0.06	0.24	0	1	800	-0.044***	0.017
Born in a city (dummy)	0.68	0.47	0	1	782	-0.017	0.033
Pentecostal (dummy)	0.49	0.50	0	1	779	0.012	0.036
Catholic (dummy)	0.16	0.37	0	1	779	0.008	0.026
Protestant (dummy)	0.06	0.25	0	1	779	-0.014	0.018
No religion (dummy)	0.06	0.25	0	1	779	-0.014	0.018
Unemployed (dummy)	0.37	0.48	0	1	689	-0.010	0.037
Medical profession (dummy)	0.02	0.13	0	1	689	-0.000	0.010
Family member with salary (dummy)	0.33	0.47	0	1	782	0.037	0.034
Nuclear family has shop or enterprise (dummy)	0.18	0.38	0	1	782	0.034	0.027
Owns motorbike (dummy)	0.13	0.33	0	1	782	-0.003	0.024
Any source of electricity (dummy)	0.47	0.50	0	1	781	-0.009	0.036
House with brick or cement walls (dummy)	0.40	0.49	0	1	779	0.021	0.035
Distance to General Hospital (km)	3436.30	1521.65	765	11027	801	77.083	107.503
Distance to Pax hospital (km)	3269.70	1466.74	455	10081	801	47.534	103.571
Knows Pax hospital (dummy)	0.93	0.26	0	1	800	-0.003	0.018
Treated at Pax hospital before (dummy)	0.24	0.43	0	1	743	0.017	0.032
Traditional medicine - never	0.55	0.50	0	1	787	0.034	0.036
Traditional medicine - 2 weeks	0.06	0.23	0	1	787	-0.014	0.016
Traditional medicine - 30 days	0.05	0.22	0	1	787	0.022	0.016
Traditional medicine - 30 to 60 days	0.06	0.24	0	1	787	-0.017	0.017
Traditional medicine - 60 days or more	0.28	0.45	0	1	787	-0.025	0.032
Modern medicine - never	0.14	0.35	0	1	791	0.010	0.025
Modern medicine - 2 weeks	0.12	0.32	0	1	791	0.002	0.023
Modern medicine - 30 days	0.10	0.30	0	1	791	0.011	0.021
Modern medicine - 30 to 60 days	0.13	0.33	0	1	791	0.019	0.024
Modern medicine - 60 days or more	0.51	0.50	0	1	791	-0.043	0.036
Identifies epilepsy from symptoms (dummy)	0.87	0.33	0	1	776	0.003	0.024
Knows N alive with epilepsy	4.49	35.85	0	1000	800	1.965	2.460
Close family member with epilepsy (dummy)	0.10	0.31	0	1	800	0.033	0.022
Seen epileptic attack (dummy)	0.96	0.20	0	1	800	-0.002	0.014
N attacks seen	8.56	10.60	0	90	768	-0.755	0.768
Distrust in researcher (dummy)	1.50	0.53	1	4	800	-0.008	0.037
Has identity card (dummy)	0.81	0.39	0	1	800	0.008	0.028
Attrition	0.02	0.15	0	1	800	-0.001	0.011
Days between visits	6.80	3.29	2	24	782	0.116	0.235
Medication for epilepsy exists (dummy)	0.10	0.30	0	1	800	0.046**	0.021
Doctors for epilepsy exist (dummy)	0.13	0.34	0	1	800	0.029	0.024

Notes: The first five columns provide summary statistics about the variables indicated (whose unit/type is indicated in parentheses). Some variables have a lower N because of nonresponse to certain survey questions. The last two columns summarize results from OLS estimations of equation 1 (without covariates) with each variable as the outcome.

Table A.5: Zero Stage: What Respondents Retrieve about Epilepsy from the Video

	Dependent variables all referring to epilepsy							
	Medication exists in Kananga (=1)	Doctors exist in Kananga (=1)	Occurs in brain (=1)		Disagree: Occurs in heart (=1)		Transmissible (=1)	
Survey	Midline	Midline	Midline	Endline	Midline	Endline	Midline	Endline
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	0.657***	0.645***	0.072***	0.039***	0.305***	0.228***	-0.085***	0.005
	(0.026)	(0.025)	(0.015)	(0.013)	(0.029)	(0.031)	(0.025)	(0.028)
Control mean	0.256	0.289	0.910	0.943	0.527	0.568	0.305	0.258
R^2	0.493	0.493	0.169	0.062	0.254	0.153	0.354	0.215
Observations	800	800	800	782	800	782	800	782
p-value OLS	0.000	0.000	0.000	0.004	0.000	0.000	0.001	0.853
p-value RI	0.000	0.000	0.000	0.001	0.000	0.000	0.002	0.884
p-value bootstrap	0.000	0.000	0.000	0.005	0.000	0.000	0.001	0.854

Notes: This table reports estimates from Equation 1. The outcome in column (1) is a dummy variable equal to one if the respondent answers "yes" to the survey question "Is there medication to treat epilepsy in Kananga?" The outcome in column (2) is a dummy variable equal to one if the respondent answers "yes" to the question "Are there medical doctors who treat epilepsy in Kananga?" The outcomes in columns (3) and (5) are dummy variables equal to one if the respondent agrees or strongly agrees with the statement "Epilepsy always happens in the brain" and "Epilepsy can be transmitted from human to human", respectively, with answer choices on a 5-point scale from "strongly disagree" to "strongly agree". The outcomes in columns (3)–(4) and (7)–(8) are dummy variables equal to one if the respondent agrees or strongly agrees with the statement "Epilepsy always happens in the brain" and "Epilepsy can be transmitted from human to human", respectively, with answer choices on a 5-point scale from "strongly disagree" to "strongly agree". The outcome in columns (5)–(6) is a dummy variable equal to one if the respondent disagrees or strongly disagrees with the statement "Epilepsy always occurs in the heart", with answer choices on a 5-point scale from "strongly disagree" to "strongly agree". The outcome in columns (7)–(8) is a dummy variable equal to one if the respondent agrees or strongly agrees with the statement "Epilepsy can be transmitted from one person to another", with answer choices on a 5-point scale from "strongly disagree" to "strongly agree". Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors in parentheses.

Table A.6: Treatment Effect on Willingness to Pay for Vouchers for Consultations in Restricted Sample

	Dependent var: Willingness to pay (USD)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Tuberculosis	Hypert.	HIV	Diabetes	Anemia	Malaria	Typhoid	Index
Treatment	0.028	-0.020	0.092	0.085	-0.053	-0.165	0.006	-0.050
	(0.141)	(0.120)	(0.237)	(0.206)	(0.171)	(0.173)	(0.267)	(0.465)
p-value OLS	0.844	0.867	0.697	0.679	0.757	0.341	0.982	0.914
p-value rand. inf.	0.838	0.881	0.685	0.659	0.770	0.322	0.984	0.896
p-value bootstrap	0.832	0.871	0.691	0.677	0.747	0.362	0.982	0.916
Control mean	1.422	1.365	1.629	1.961	1.802	1.943	2.595	-0.206
R^2	0.032	0.034	0.019	0.027	0.055	0.047	0.043	0.050
Observations	572	583	575	564	562	585	586	586

Notes: This table reports estimates from equation 1. The outcome variables measure the respondent's willingness to pay in USD for a voucher for consultations and testing for the respective disease elicited through the Becker–DeGroot–Marschak method. The index is a Kling, Liebman, and Katz (2007) index of columns (1)–(7). Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors in parentheses. The sample is restricted to those who understood the exercise and passed the test questions.

Table A.7: Treatment Effect on Willingness to Accept Vouchers for Free Consultations in Restricted Sample

	Dependent var: Accepting voucher for free (=1)							
	(1) Tuberculosis	(2) Hypert.	(3) HIV	(4) Diabetes	(5) Anemia	(6) Malaria	(7) Typhoid	(8) Index
Treatment	0.031**	0.016	0.043**	0.041**	0.025*	0.005	0.012	0.669**
	(0.012)	(0.010)	(0.016)	(0.016)	(0.015)	(0.009)	(0.013)	(0.297)
p-value OLS	0.013	0.101	0.007	0.009	0.087	0.555	0.372	0.025
p-value rand. inf.	0.011	0.141	0.007	0.005	0.091	0.607	0.383	0.024
p-value bootstrap	0.015	0.102	0.006	0.008	0.084	0.565	0.334	0.022
Control mean	0.961	0.975	0.939	0.945	0.952	0.986	0.965	0.561
R^2	0.032	0.019	0.045	0.029	0.030	0.045	0.041	0.043
Observations	576	583	575	564	562	585	586	586

Notes: This table reports estimates from equation 1. The outcome variables measure whether the respondent is willing to accept a voucher for consultations and testing for the respective disease for free, which was offered as part of a Becker–DeGroot–Marschak exercise to elicit willingness to pay for the vouchers. The index is a Kling, Liebman, and Katz (2007) index of columns (1)–(7). Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors in parentheses.

Table A.8: Heterogeneity in Belief Updating on Supernatural Cause of Epilepsy Index: Epilepsy Related Variables

	Dep. var.: Epilepsy supernatural index							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-0.719***	-0.719***	-0.706***	-0.733***	-0.717***	-0.623***	-0.638***	-0.703***
	(0.060)	(0.094)	(0.059)	(0.063)	(0.066)	(0.084)	(0.228)	(0.063)
Treat × Interaction var.	-0.240***	0.019	0.088	0.294	0.097	-0.171	-0.072	-0.037
	(0.072)	(0.119)	(0.105)	(0.190)	(0.153)	(0.117)	(0.235)	(0.194)
Interaction variable	0.479***	0.041	0.124*	-0.249*	-0.308**	0.040	0.055	0.048
	(0.051)	(0.075)	(0.070)	(0.132)	(0.120)	(0.073)	(0.159)	(0.132)
Interaction variable	Epilepsy supernatural index	Witchcraft belief (=1)	Illnesses supernatural index	Medication for epilepsy exists in Kananga (=1)	Modern medicine effective for epilepsy (=1)	Modern medicine disproves witchcraft (=1)	Epilepsy happens in brain (=1)	Close family member with epilepsy (=1)
R^2	0.261	0.252	0.262	0.254	0.261	0.254	0.252	0.252
Observations	782	782	782	782	782	782	782	782

Notes: This table reports estimates from equation 1. All variables interacted with the treatment variable are measured in the baseline survey. "Epilepsy supernatural index" is the outcome variable in all regressions and is a Kling et al. (2007) index of the three dummy variables for believing epilepsy can have supernatural causes, agreeing with the statement that PLWE are witches, and agreeing with the statement that PLWE are bewitched elicited in the second visit. "Witchcraft belief" is a dummy variable equal to one if the respondent knows at least one person affected by witchcraft. "Illnesses supernatural index" is a Kling et al. (2007) index based on the variables for whether an illness can be supernatural across the 13 illnesses in the sample. "Close family member with epilepsy" is a dummy variable equal to one if the respondent has a close family member with epilepsy. "Epilepsy happens in brain" is a dummy variable equal to one if the respondent agrees that epilepsy always occurs in the brain. "Medication for epilepsy exists in Kananga" is a dummy variable equal to one if the respondent think medication to treat epilepsy exists in Kananga. "Modern medicine effective for epilepsy" is a dummy variable equal to one if the respondent thinks modern medicine is good or very good at treating and diagnosing epilepsy. "Modern medicine disproves witchcraft" is a dummy variable equal to one if the respondent agrees that, if modern medicine can treat epilepsy, the disease cannot have supernatural causes. All regressions include the control variables sex, age, age squared, widowed, whether the respondent knew epilepsy treatment existed in Kananga in the baseline survey and the baseline value of the outcome variable. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.9: Heterogeneity in Belief Updating on Supernatural Cause of Epilepsy: Demographics

	Dep. var.: Epilepsy supernatural index				
	(1)	(2)	(3)	(4)	(5)
Treatment	-0.734***	-0.798***	-0.671***	-0.628***	-0.706***
	(0.083)	(0.152)	(0.205)	(0.109)	(0.059)
Treat × Interaction variable	0.057	0.002	-0.003	-0.105	0.014
	(0.118)	(0.004)	(0.015)	(0.129)	(0.025)
Interaction variable	0.108	0.004	-0.015	0.212**	-0.024
	(0.076)	(0.010)	(0.010)	(0.085)	(0.016)
Interaction variable	Female (=1)	Age	Education (years)	City born (=1)	Wealth index
R^2	0.252	0.252	0.255	0.258	0.254
Observations	782	782	782	782	782

Notes: This table reports estimates from equation 1. The outcome variable is always the supernatural belief of epilepsy index, a Kling et al. (2007) index of the three dummy variables for believing epilepsy can have supernatural causes, agreeing with a statement that PLWE are witches, and agreeing with a statement that PLWE are bewitched elicited in the second visit. All regressions include the control variables sex, age, age squared, widowed, whether the respondent thought epilepsy treatment existed in Kananga in the baseline survey and the baseline value of the outcome variable. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.10: Relationship of Supernatural Explanations in Baseline and Treatment Effect on Updating of Beliefs about Supernatural Origin and Modern Medicine's Efficacy for Other Illnesses

	Dep var: Share of illnesses from supernatural cause			
	(1)	(2)	(3)	(4)
Treatment	-0.032***	-0.018	-0.047***	-0.015
	(0.009)	(0.022)	(0.010)	(0.017)
Treat × Interaction var.	-0.053***	-0.045	-0.035*	-0.087*
	(0.017)	(0.033)	(0.021)	(0.050)
Interaction var.	0.168***	0.111***	0.079***	0.187***
	(0.013)	(0.025)	(0.016)	(0.039)
Interaction var.	Illness supernatural$_{ij}$	Epilepsy supernatural$_i$	Illnesses supernatural index$_i$	Share illnesses supernatural$_i$
Control mean	0.197	0.197	0.197	0.197
R^2	0.170	0.185	0.189	0.188
Observations	8900	8796	8900	8900
Illness FE	yes	yes	yes	yes

Notes: This table reports estimates from equation 3 including illness fixed effects. Each observation is at the illness–individual level. The outcome variable is respondent i's estimated share in the endline survey of individuals with an illness j who are believed to have it from supernatural causes. "Interaction variable" indicates which baseline variable the treatment variable is interacted with, where i indexes individuals and j indexes illnesses. "Illness supernatural" is a dummy variable equal to one if the respondent believed the illness can have supernatural causes in the baseline survey (see Section 4). "Epilepsy supernatural" is a dummy variable equal to one if the respondent believed epilepsy can have supernatural causes in the baseline survey. "Illnesses supernatural index" is a Kling, Liebman, and Katz (2007) index of the dummy variables for whether a respondent believed an illness can have supernatural causes for the illnesses malaria, typhoid, tuberculosis, hypertension, HIV/AIDS, fractures, swollen limbs, diabetes, COVID-19, snakebite, anemia, sterility, and epilepsy in the endline survey at the individual level. "Share illnesses supernatural" is the mean of the dummy variables for whether an illness can have supernatural causes across illnesses by individual in the endline survey. The variable measures the share of all illnesses that an individual believes can have supernatural causes. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors clustered at individual level in parentheses. The disease epilepsy is excluded from the analysis.

Table A.11: Who Uses the Voucher? Predictors in the Control Group

	Dep. var.: Accept & use voucher (=1)		
	(1)	(2)	(3)
Epilepsy can be transmitted (=1)	-0.078***		-0.069***
	(0.023)		(0.024)
Medication for epilepsy exists in Kga (=1)	-0.003		0.028
	(0.051)		(0.055)
Epileptic is a witch (=1)	0.039		0.037
	(0.029)		(0.029)
Epileptic is bewitched (=1)	-0.009		-0.010
	(0.038)		(0.038)
Close family w. epilepsy (=1)	0.140*		0.135*
	(0.072)		(0.072)
Modern medicine effective for epilepsy (=1)	-0.008		-0.017
	(0.027)		(0.029)
Avoid epileptic during attack (=1)	-0.024		-0.020
	(0.031)		(0.031)
Log(N attacks seen)	-0.016		-0.018
	(0.015)		(0.016)
Knows N with epilepsy	0.007		0.011
	(0.017)		(0.016)
Modern medicine experience index	0.056*		0.041
	(0.032)		(0.032)
Female (=1)		0.009	0.013
		(0.030)	(0.032)
Wealth index		0.001	0.001
		(0.005)	(0.005)
Education (years)		-0.001	-0.001
		(0.004)	(0.005)
Born in city (=1)		-0.015	-0.009
		(0.030)	(0.031)
Age (years)		0.005	0.007
		(0.005)	(0.005)
Age squared		-0.000	-0.000
		(0.000)	(0.000)
Pentecostal (=1)		0.013	0.014
		(0.031)	(0.031)
Catholic (=1)		0.034	0.044
		(0.046)	(0.047)
Protestant (=1)		-0.028	-0.025
		(0.041)	(0.044)
Log(distance to hospital)		-0.062	-0.049
		(0.039)	(0.039)
Constant	0.105*	0.428	0.332
	(0.055)	(0.343)	(0.335)
Observations	363	377	362
R^2	0.057	0.039	0.081

Notes: This table reports estimates from Equation 1. The outcome is the variable "voucher accept + use", a dummy variable equal to one if the respondent's voucher was redeemed. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors in parentheses.

Table A.12: Heterogeneity in Treatment Effect on Take-Up of Free Hospital Consultations for Epilepsy by Demographics

	Dep. var.: Accept & use voucher (=1)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment	0.031	0.102**	-0.067	0.032	0.039*	0.035*	0.024	-0.091	0.024
	(0.029)	(0.047)	(0.074)	(0.039)	(0.021)	(0.020)	(0.035)	(0.100)	(0.023)
Treat × Female (=1)	0.015								
	(0.041)								
Treat × Age		-0.002							
		(0.001)							
Treat × Education (years)			0.008						
			(0.005)						
Treat × City born (=1)				0.008					
				(0.046)					
Treat × Wealth index					-0.014*				
					(0.008)				
Treat × Ep. in close fam. (=1)						-0.048			
						(0.094)			
Treat × Log(knows N people w. ep.)							0.013		
							(0.026)		
Treat × Log(distance to hospital)								0.091	
								(0.068)	
Treat × Has shop (=1)									0.081
									(0.050)
Education (years)			0.000						
			(0.004)						
Born in a city (=1)				-0.015					
				(0.030)					
Wealth index					0.001				
					(0.005)				
Ep. in close family (=1)						0.145**			
						(0.073)			
Log(knows N people w. ep.)							0.013		
							(0.019)		
Log(distance to hospital)								-0.071	
								(0.051)	
Has shop (=1)									-0.045
									(0.028)
Female	0.006	0.012	0.021	0.013	0.015	0.008	0.015	0.016	0.014
	(0.027)	(0.021)	(0.023)	(0.021)	(0.022)	(0.021)	(0.022)	(0.021)	(0.021)
Age (years)	0.005	0.006*	0.006	0.005	0.005	0.002	0.006	0.005	0.005
	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.001)	(0.004)	(0.004)	(0.004)
R^2	0.016	0.018	0.020	0.016	0.021	0.122	0.018	0.019	0.019
Observations	782	782	782	782	782	782	782	782	782

Notes: This table reports estimates from equation 1. The outcome variable is a dummy variable equal to one if the respondent accepted the voucher and the voucher was used. Regressions include the control variables sex, age, age squared, widowed, whether the respondent knew epilepsy treatment existed in Kananga in the baseline survey and whether the respondent thought modern medicine was good at treating and diagnosing epilepsy in the baseline survey. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors in parentheses.

Table A.13: Heterogeneity in Treatment Effect on Take-Up of Free Hospital Consultations for Epilepsy by Medical Belief Variables

	Dep. var.: Accept & use voucher (=1)				
	(1)	(2)	(3)	(4)	(5)
Treatment	0.039*	0.031	0.033	0.011	0.014
	(0.022)	(0.023)	(0.024)	(0.049)	(0.029)
Treat×Medication exists (=1)	-0.020		0.018		
	(0.065)		(0.050)		
Medication exists (=1)	-0.002	-0.008	-0.082***	-0.017	-0.015
	(0.049)	(0.032)	(0.021)	(0.036)	(0.033)
Treat × Modern medicine effective (=1)		0.037	0.058		
		(0.049)	(0.051)		
Modern medicine effective (=1)		-0.037	-0.073***		
		(0.030)	(0.028)		
Treat× Medication exists × Modern medicine effective (=1)			-0.102		
			(0.129)		
Medication exists × Modern medicine effective (=1)			0.200**		
			(0.089)		
Treat × Modern never treat (=1)				0.033	
				(0.054)	
Modern medicine never treat (=1)				-0.028	
				(0.039)	
Treat × Modern medicine disproves witchcraft (=1)					0.048
					(0.042)
Modern medicine disproves witchcraft (=1)					-0.030
					(0.028)
Constant	-0.066	-0.058	-0.047	-0.042	-0.054
	(0.064)	(0.064)	(0.065)	(0.069)	(0.064)
Control mean	0.077	0.077	0.077	0.077	0.077
R^2	0.016	0.016	0.022	0.016	0.017
Observations	782	782	782	782	782

Notes: This table reports estimates from equation 2. The outcome variable is a dummy variable equal to one if the respondent accepted the voucher and the voucher was used. Regressions include the control variables sex, age, age squared, widowed, whether the respondent knew epilepsy treatment existed in Kananga in the baseline survey and whether the respondent thought modern medicine was good at treating and diagnosing epilepsy in the baseline survey. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors in parentheses.

Table A.14: Heterogeneity in Treatment Effect on Take-Up of Free Hospital Consultations for Epilepsy by Supernatural Belief Variables

	Dep. var.: Accept & use voucher (=1)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment	0.026	0.071**	0.031	0.038*			
	(0.025)	(0.032)	(0.021)	(0.021)			
Treat × Ep. only supernat.	0.034				0.060*		
	(0.045)				(0.036)		
Ep. only supernat.	-0.005				-0.070		
	(0.028)				(0.066)		
Treat × Ep. both		-0.058			0.014		
		(0.042)			(0.027)		
Ep. both		0.030			-0.054		
		(0.026)			(0.065)		
Treat × Ep. only natural			0.121*		0.152**		
			(0.072)		(0.069)		
Ep. only natural			-0.091***		-0.153**		
			(0.019)		(0.066)		
Treat × Ep. dont know				-0.037	0.002		
				(0.034)	(0.026)		
Ep. don't know				-0.089***	-0.155**		
				(0.021)	(0.072)		
Treat × Ep. witch disagree						0.067*	
						(0.035)	
Ep. witch disagree						-0.116*	
						(0.067)	
Treat × Ep. witch neutral						0.034	
						(0.028)	
Ep. witch neutral						-0.114*	
						(0.065)	
Treat × Ep. witch agree						0.011	
						(0.052)	
Ep. witch agree						-0.040	
						(0.071)	
Treat × Ep. bewitched disagree							0.066
							(0.050)
Ep. bewitched disagree							-0.016
							(0.048)
Treat × Ep. bewitched neutral							0.055
							(0.035)
Ep. bewitched neutral							0.004
							(0.042)
Treat × Ep. bewitched agree							0.005
							(0.031)
Ep. bewitched agree							0.004
							(0.040)
Constant	-0.064	-0.085	-0.061	-0.062			
	(0.065)	(0.065)	(0.064)	(0.064)			
Control mean	0.077	0.077	0.077	0.077	0.077	0.077	0.077
R^2	0.017	0.018	0.018	0.017	0.114	0.118	0.111
Observations	782	782	782	782	782	782	782

Notes: This table reports estimates from equation 2. The outcome variable is a dummy variable equal to one if the respondent accepted the voucher and the voucher was used. Regressions include the control variables sex, age, age squared, widowed, whether the respondent knew epilepsy treatment existed in Kananga in the baseline survey and whether the respondent thought modern medicine was good at treating and diagnosing epilepsy in the baseline survey. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors in parentheses.

Table A.15: Heterogeneity in Treatment Effect on Take-Up of Free Hospital Consultations for Epilepsy by Stigma, Transmission Beliefs, and Fear Variables

	Dep. var.: Accept & use voucher (=1)			
	(1)	(2)	(3)	(4)
Treat × Avoid disagree	0.028			
	(0.040)			
Avoid disagree	-0.068			
	(0.082)			
Treat × Avoid neutral	0.069			
	(0.058)			
Avoid neutral	-0.180**			
	(0.070)			
Treat × Avoid agree	0.040			
	(0.025)			
Avoid agree	-0.111			
	(0.073)			
Treat × Avoid don't know	0.000			
	(.)			
Avoid don't know	0.000			
	(.)			
Treat × Stigma children disagree		0.053*		
		(0.028)		
Stigma children disagree		-0.040		
		(0.061)		
Treat × Stigma children neutral		0.001		
		(0.102)		
Stigma children neutral		-0.038		
		(0.101)		
Treat × Stigma children agree		0.015		
		(0.032)		
Stigma children agree		-0.058		
		(0.060)		
Treat × Transmission disagree			0.044	
			(0.030)	
Transmission disagree			0.023	
			(0.038)	
Treat × Transmission neutral			0.105	
			(0.098)	
Transmission neutral			-0.031	
			(0.061)	
Treat × Transmission agree			0.020	
			(0.026)	
Transmission agree			-0.042	
			(0.038)	
Treat × Epilepsy attacks < median				0.024
				(0.028)
Epilepsy attacks < median				-0.072
				(0.065)
Treat × Epilepsy attacks >= median				0.049*
				(0.029)
Epilepsy attacks >= median				-0.047
				(0.064)
Control Mean	0.077	0.077	0.077	0.077
Observations	782	782	782	782
R^2	0.114	0.113	0.121	0.112

Notes: This table reports estimates from equation 2. The outcome variable is a dummy variable equal to one if the respondent accepted the voucher and the voucher was used. Regressions include the control variables sex, age, age squared, widowed, whether the respondent knew epilepsy treatment existed in Kananga in the baseline survey and whether the respondent thought modern medicine was good at treating and diagnosing epilepsy in the baseline survey. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors in parentheses.

Table A.16: Heterogeneity in Treatment Effect on Take-Up of Free Hospital Consultations for Epilepsy by Supernatural Epilepsy Beliefs - Median Split

Panel A: Heterogeneity in Treatment Effect on Take-Up (Medical Belief Indices)						
	Dep. var.: Accept & use voucher (=1)					
	Modern medicine effective index		Traditional medicine effective index		Modern medicine experience index	
	(1)	(2)	(3)	(4)	(5)	(6)
	Below	Above	Below	Above	Below	Above
Treatment	0.026	0.049	0.078***	0.001	0.071***	0.006
	(0.026)	(0.032)	(0.027)	(0.031)	(0.026)	(0.032)
Control Mean	0.056	0.099	0.039	0.111	0.042	0.112
Observations	393	389	390	392	393	389
R^2	0.016	0.020	0.048	0.022	0.046	0.018
Panel B: Heterogeneity in Treatment Effect on Take-Up (Supernatural Belief Indices)						
	Dep. var.: Accept & use voucher (=1)					
	Epilepsy supernatural index		Illnesses supernatural index		Share of illnesses supernatural	
	(1)	(2)	(3)	(4)	(5)	(6)
	Below	Above	Below	Above	Below	Above
Treatment	0.069**	0.016	0.092***	-0.011	0.086***	-0.003
	(0.028)	(0.030)	(0.027)	(0.031)	(0.027)	(0.031)
Control Mean	0.066	0.087	0.037	0.115	0.038	0.115
Observations	388	394	392	390	392	390
R^2	0.026	0.022	0.038	0.022	0.034	0.025

Notes: The dependent variable is a binary indicator equal to one if the respondent accepted the voucher and the voucher was used. Each pair of columns corresponds to a median split of the belief index indicated in the column header; estimates are reported separately for individuals below and above the median. All regressions include controls for sex, age, age squared, widowhood, baseline knowledge of epilepsy treatment availability in Kananga, and baseline belief that modern medicine is effective at diagnosing and treating epilepsy. Robust standard errors are shown in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.17: Heterogeneity in Take-Up of Free Hospital Consultations for Epilepsy by Quartiles of Belief Indices

Panel A: Heterogeneity in Treatment Effect on Beliefs												
	Dep. var.: Accept & use voucher (=1)											
	Epilepsy supernatural index				Illnesses supernatural index				Share of illnesses supernatural			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Treatment	0.087**	0.042	0.044	0.004	0.100**	0.087**	0.038	-0.052	0.098**	0.082**	0.052	-0.048
	(0.041)	(0.039)	(0.039)	(0.044)	(0.039)	(0.038)	(0.042)	(0.047)	(0.040)	(0.038)	(0.042)	(0.047)
Control mean	0.049	0.079	0.057	0.111	0.034	0.041	0.082	0.149	0.033	0.042	0.082	0.147
Observations	195	193	197	197	197	195	197	193	197	195	198	192
R^2	0.026	0.076	0.018	0.055	0.042	0.052	0.024	0.041	0.039	0.041	0.036	0.036
Panel B: Heterogeneity in Treatment Effect on Belief Updating and Experience												
	Dep. var.: Accept & use voucher (=1)											
	Modern medicine effective index				Traditional medicine effective index				Modern medicine experience index			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Treatment	0.036	0.014	0.012	0.087*	0.047	0.107**	0.017	-0.004	0.061	0.074**	0.004	0.022
	(0.037)	(0.039)	(0.047)	(0.046)	(0.038)	(0.042)	(0.042)	(0.046)	(0.042)	(0.030)	(0.044)	(0.047)
Control mean	0.049	0.064	0.124	0.071	0.035	0.042	0.086	0.133	0.061	0.022	0.101	0.121
Observations	197	196	198	191	193	197	198	194	197	196	192	197
R^2	0.032	0.036	0.032	0.025	0.048	0.080	0.014	0.064	0.090	0.038	0.038	0.038

Notes: The outcome variable is a dummy equal to one if the respondent accepted the voucher and the voucher was used. Each column corresponds to a quartile of the belief index indicated in the panel header. Belief indices are constructed as described in Appendix Section A. Regressions include control variables for sex, age, age squared, widowhood, baseline knowledge that epilepsy treatment exists in Kananga, and belief that modern medicine is effective for epilepsy. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses.

Table A.18: Comparing Machine Learning Methods for Treatment Effect Heterogeneity of Epilepsy Voucher Redemption

	Dep var: Accept & use voucher (=1)			
	Elastic Net	Boosting	Nnet	Random Forest
Best BLP	0.004	0.005	0.005	0.004
Best GATES	0.021	0.017	0.022	0.024

Notes: This table reports the medians over 100 splits for the Best Linear Predictor (BLP) and Group Average Treatment Effect (GATES), which I compute using the methodology by Chernozhukov et al. (2025)

Table A.19: Epilepsy Voucher Redemption: Best Linear Predictor (BLP) Estimates

	Dep. var: Accept & use voucher (=1)			
	Neural Net		Random Forest	
	ATE	HET	ATE	HET
Coefficient	0.034	0.102	0.036	0.319
	(-0.024,0.093)	(-0.215,0.338)	(-0.024,0.093)	(-0.865,1.564)
	[0.507]	[1.000]	[0.488]	[1.000]

Notes: This table reports the means of the average treatment effect (ATE) and heterogeneity loading parameter (HET) over 100 splits. The Best Linear Predictors of the average treatment effect is computed with random forest and neural net, following the methodology by Chernozhukov et al. (2025).

Table A.20: Epilepsy Voucher Redemption: GATES of 20% Most and 20% Least Affected Groups

Dep. var.: Accept & use voucher (=1)					
Nnet			Random forest		
Most Affected	Least Affected	Difference	Most Affected	Least Affected	Difference
0.046	-0.001	0.045	0.045	0.009	0.027
(-0.084,0.178)	(-0.133,0.131)	(-0.138,0.231)	(-0.087,0.181)	(-0.119,0.142)	(-0.159,0.212)
[0.978]	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]

Notes: This table reports the medians over 100 splits for Group Average Treatment Effect (GATES) for the 20% most and 20% least affected groups, as well as their difference. I compute GATES using the methodology by Chernozhukov et al. (2025). P-values for the hypothesis that the parameter is equal to zero against the two-sided alternative in brackets.

Table A.21: CLAN Results on Epilepsy Voucher Redemption: Demographic and Economic Covariates

	Most Affected	Least Affected	Difference	Most Affected	Least Affected	Difference
Age	37.56	38.40	-1.128	37.91	38.00	0.054
	(35.26,39.87)	(36.19,40.70)	(-4.235,1.961)	(35.67,40.15)	(35.71,40.25)	(-3.120,3.279)
	-	-	[0.948]	-	-	[1.000]
Female	0.500	0.497	0.005	0.492	0.503	-0.005
	(0.429,0.570)	(0.427,0.568)	(-0.095,0.105)	(0.422,0.563)	(0.432,0.573)	(-0.105,0.095)
	-	-	[1.000]	-	-	[1.000]
Income (USD)	84.10	90.22	-6.451	87.50	87.69	-1.582
	(70.95,98.23)	(76.14,103.5)	(-24.26,13.26)	(73.11,102.1)	(73.50,101.4)	(-21.82,19.56)
	-	-	[0.999]	-	-	[1.000]
Pentecostal	0.492	0.492	-0.001	0.469	0.511	-0.044
	(0.422,0.563)	(0.422,0.563)	(-0.101,0.098)	(0.399,0.540)	(0.441,0.582)	(-0.143,0.056)
	-	-	[1.000]	-	-	[0.780]
Catholic	0.155	0.167	-0.010	0.150	0.165	-0.019
	(0.103,0.207)	(0.115,0.217)	(-0.083,0.062)	(0.098,0.201)	(0.114,0.218)	(-0.093,0.055)
	-	-	[1.000]	-	-	[1.000]
Protestant	0.062	0.062	0.005	0.088	0.041	0.046
	(0.031,0.099)	(0.028,0.095)	(-0.046,0.053)	(0.054,0.122)	(0.006,0.076)	(-0.003,0.097)
	-	-	[1.000]	-	-	[0.129]
No religion	0.062	0.062	0.005	0.088	0.041	0.046
	(0.031,0.099)	(0.028,0.095)	(-0.046,0.053)	(0.054,0.122)	(0.006,0.076)	(-0.003,0.097)
	-	-	[1.000]	-	-	[0.129]
Unemployed	0.390	0.357	0.032	0.390	0.361	0.028
	(0.326,0.454)	(0.293,0.421)	(-0.058,0.122)	(0.325,0.454)	(0.297,0.425)	(-0.062,0.119)
	-	-	[0.982]	-	-	[1.000]
Medical profession	0.017	0.018	-0.001	0.007	0.028	-0.022
	(0.000,0.035)	(0.001,0.035)	(-0.025,0.024)	(-0.010,0.024)	(0.011,0.045)	(-0.046,0.003)
	-	-	[1.000]	-	-	[0.172]
Has salaried job	0.303	0.367	-0.056	0.272	0.410	-0.138
	(0.236,0.370)	(0.300,0.433)	(-0.153,0.039)	(0.206,0.337)	(0.344,0.477)	(-0.232,-0.047)
	-	-	[0.487]	-	-	[0.006]
Has electricity	0.459	0.474	-0.023	0.454	0.487	-0.028
	(0.389,0.529)	(0.404,0.545)	(-0.122,0.076)	(0.383,0.524)	(0.417,0.558)	(-0.128,0.071)
	-	-	[1.000]	-	-	[1.000]
House w. cement or brick walls	0.366	0.431	-0.067	0.348	0.446	-0.100
	(0.297,0.435)	(0.362,0.500)	(-0.165,0.031)	(0.280,0.416)	(0.377,0.514)	(-0.198,-0.003)
	-	-	[0.355]	-	-	[0.085]
Distance General Hospital (km)	3498	3367	128.30	3491	3363	126.40
	(3282,3714)	(3147,3588)	(-169.6,433.6)	(3272,3710)	(3146,3575)	(-184.1,431.6)
	-	-	[0.790]	-	-	[0.837]
Close family member with epilepsy	0.110	0.092	0.021	0.113	0.092	0.015
	(0.069,0.153)	(0.051,0.134)	(-0.041,0.082)	(0.068,0.154)	(0.051,0.136)	(-0.045,0.075)
	-	-	[0.935]	-	-	[1.000]
Recognises epilepsy from symptoms	0.873	0.883	-0.015	0.848	0.903	-0.053
	(0.827,0.918)	(0.838,0.929)	(-0.077,0.050)	(0.804,0.893)	(0.859,0.948)	(-0.117,0.010)
	-	-	[1.000]	-	-	[0.202]
Knows N alive w. Ep.	3.554	3.167	0.490	3.815	2.954	1.118
	(1.949,10.26)	(1.242,9.642)	(-3.297,4.742)	(1.934,10.04)	(1.187,9.664)	(-3.211,4.537)
	-	-	[0.804]	-	-	[0.655]
Days betw. Watching video & receiving voucher	6.813	6.792	0.003	6.885	6.669	0.164
	(6.342,7.297)	(6.314,7.246)	(-0.665,0.665)	(6.422,7.346)	(6.206,7.137)	(-0.495,0.809)
	-	-	[1.000]	-	-	[1.000]
Medication for ep. exists in Kga.	0.097	0.103	0.000	0.103	0.092	0.005
	(0.056,0.140)	(0.059,0.144)	(-0.061,0.058)	(0.060,0.142)	(0.053,0.137)	(-0.052,0.063)
	-	-	[1.000]	-	-	[1.000]
Doctors for ep. exist in Kga.	0.144	0.128	0.015	0.149	0.128	0.028
	(0.094,0.192)	(0.082,0.179)	(-0.053,0.085)	(0.101,0.199)	(0.078,0.174)	(-0.039,0.095)
	-	-	[1.000]	-	-	[0.767]
Education (years)	13.28	13.03	0.272	13.24	13.13	0.133
	(12.78,13.78)	(12.56,13.53)	(-0.446,0.979)	(12.74,13.75)	(12.63,13.63)	(-0.581,0.864)
	-	-	[0.908]	-	-	[1.000]
Single, never married	0.195	0.195	-0.003	0.200	0.185	0.018
	(0.140,0.251)	(0.138,0.249)	(-0.081,0.075)	(0.146,0.256)	(0.128,0.241)	(-0.062,0.096)
	-	-	[1.000]	-	-	[1.000]
Married, monogamous	0.705	0.682	0.021	0.703	0.695	0.013
	(0.641,0.770)	(0.618,0.747)	(-0.072,0.113)	(0.638,0.767)	(0.630,0.759)	(-0.079,0.106)
	-	-	[1.000]	-	-	[1.000]
Married, polygamous	0.026	0.044	-0.015	0.031	0.041	-0.010
	(0.002,0.053)	(0.017,0.071)	(-0.054,0.020)	(0.005,0.058)	(0.014,0.066)	(-0.045,0.029)
	-	-	[0.696]	-	-	[1.000]
Divorced, separated	0.010	0.015	-0.005	0.010	0.015	-0.005
	(-0.005,0.026)	(0.000,0.031)	(-0.028,0.017)	(-0.005,0.026)	(0.000,0.031)	(-0.026,0.017)
	-	-	[1.000]	-	-	[1.000]
Widowed	0.062	0.062	0.005	0.056	0.064	-0.008
	(0.027,0.095)	(0.027,0.096)	(-0.045,0.050)	(0.022,0.090)	(0.031,0.098)	(-0.058,0.040)
	-	-	[1.000]	-	-	[1.000]

Notes: This table reports differences in baseline covariates between individuals predicted to be most versus least responsive to the intervention, based on treatment effect heterogeneity in epilepsy voucher redemption. Estimates are medians across 100 splits from the predictive learner. Mean differences are shown, with 95% median confidence intervals in parentheses and two-sided p-values in brackets. Belief indices are standardized following Kling et al. (2007). Index construction is detailed in Appendix A.

Table A.22: CLAN Results on Epilepsy Voucher Redemption: Belief-Based Covariates

V1	Most Affected	Least Affected	Difference	Most Affected	Least Affected	Difference
Voucher Take-up						
Epilepsy supernatural index	-0.111	-0.032	-0.076	-0.130	-0.010	-0.114
	(-0.217,-0.008)	(-0.134,0.071)	(-0.225,0.072)	(-0.234,-0.025)	(-0.112,0.092)	(-0.260,0.033)
	-	-	[0.628]	-	-	[0.255]
Illnesses supernatural index	-0.102	0.068	-0.159	-0.093	0.068	-0.167
	(-0.177,-0.025)	(-0.007,0.143)	(-0.267,-0.053)	(-0.170,-0.015)	(-0.009,0.145)	(-0.276,-0.058)
	-	-	[0.007]	-	-	[0.006]
Epileptics are bewitched	0.807	0.845	-0.036	0.803	0.851	-0.041
	(0.752,0.859)	(0.792,0.898)	(-0.111,0.039)	(0.749,0.856)	(0.797,0.904)	(-0.117,0.033)
	-	-	[0.706]	-	-	[0.554]
Epileptics are witches	0.669	0.693	-0.020	0.646	0.730	-0.085
	(0.603,0.735)	(0.627,0.758)	(-0.112,0.072)	(0.581,0.711)	(0.665,0.795)	(-0.178,0.007)
	-	-	[1.000]	-	-	[0.143]
Modern medicine could never treat ep.	0.792	0.788	0.001	0.782	0.801	-0.012
	(0.735,0.848)	(0.734,0.843)	(-0.077,0.079)	(0.727,0.837)	(0.747,0.856)	(-0.089,0.067)
	-	-	[1.000]	-	-	[1.000]
Stigma children	0.338	0.375	-0.036	0.341	0.375	-0.038
	(0.271,0.406)	(0.307,0.443)	(-0.131,0.059)	(0.273,0.408)	(0.308,0.443)	(-0.133,0.057)
	-	-	[0.918]	-	-	[0.855]
Stigma avoid seizures	0.654	0.679	-0.016	0.661	0.659	0.005
	(0.587,0.720)	(0.612,0.745)	(-0.110,0.078)	(0.594,0.728)	(0.593,0.725)	(-0.089,0.100)
	-	-	[1.000]	-	-	[1.000]
Ep. occurs in brain	0.970	0.976	-0.006	0.969	0.977	-0.009
	(0.947,0.991)	(0.955,0.998)	(-0.037,0.024)	(0.947,0.990)	(0.956,0.999)	(-0.039,0.020)
	-	-	[1.000]	-	-	[1.000]
Ep. transmissible	0.667	0.625	0.035	0.656	0.646	0.011
	(0.600,0.733)	(0.560,0.691)	(-0.058,0.128)	(0.591,0.722)	(0.581,0.711)	(-0.082,0.104)
	-	-	[0.923]	-	-	[1.000]
Heard of illness index	-0.032	-0.002	-0.033	-0.052	0.032	-0.093
	(-0.106,0.040)	(-0.073,0.077)	(-0.147,0.075)	(-0.125,0.023)	(-0.044,0.112)	(-0.199,0.013)
	-	-	[1.000]	-	-	[0.168]
Know somebody with illness index	-0.005	0.001	-0.013	-0.009	-0.012	-0.002
	(-0.139,0.134)	(-0.133,0.137)	(-0.200,0.176)	(-0.145,0.126)	(-0.143,0.125)	(-0.198,0.192)
	-	-	[1.000]	-	-	[1.000]
Modern medicine effective index	0.048	0.005	0.053	0.088	-0.021	0.105
	(-0.043,0.139)	(-0.086,0.095)	(-0.076,0.182)	(-0.003,0.176)	(-0.113,0.071)	(-0.020,0.232)
	-	-	[0.847]	-	-	[0.197]
Traditional medicine effective index	-0.109	0.066	-0.179	-0.087	0.056	-0.138
	(-0.197,-0.019)	(-0.021,0.154)	(-0.301,-0.054)	(-0.176,0.002)	(-0.033,0.144)	(-0.259,-0.014)
	-	-	[0.011]	-	-	[0.058]
Witchcraft belief	0.631	0.636	-0.008	0.605	0.664	-0.056
	(0.563,0.699)	(0.568,0.703)	(-0.103,0.088)	(0.537,0.673)	(0.596,0.731)	(-0.152,0.039)
	-	-	[1.000]	-	-	[0.492]

Notes: This table reports differences in baseline covariates between individuals predicted to be most versus least responsive to the intervention, based on treatment effect heterogeneity in epilepsy voucher redemption. Estimates are medians across 100 splits from the predictive learner. Mean differences are shown, with 95% median confidence intervals in parentheses and two-sided p-values in brackets. Belief indices are standardized following Kling et al. (2007). Index construction is detailed in Appendix A.

Table A.23: Treatment Effect on Refusing and Using Hypertension and HIV Testing Vouchers

	(1) Hypertension Refuse	(2) HIV Refuse	(3) Hypertension Use	(4) HIV Use
Treatment	-0.013**	-0.011	-0.020	-0.017
	(0.006)	(0.009)	(0.030)	(0.030)
p-value OLS	0.026	0.209	0.502	0.560
p-value rand. inf.	0.024	0.197	0.506	0.574
p-value bootstrap	0.025	0.209	0.507	0.563
Control mean	0.013	0.021	0.258	0.251
R^2	0.016	0.036	0.060	0.052
Observations	800	800	800	800

Notes: The table reports estimates from equation 1. Respondents were given vouchers for free consultations and testing for HIV and hypertension at the local hospital. The outcomes in columns (1)–(2) are dummy variables equal to one if the respondent refused the respective voucher. The outcomes in (3)–(4) are dummy variables equal to one if the respondent redeemed the respective voucher. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors in parentheses.

Table A.24: Heterogeneity in Treatment Effect on Stigma toward People with Epilepsy

	(1) Epileptic children shouldn't play with other children (=1)	(2) Should avoid epileptic during attack (=1)	(3) NGO project with epileptic people (=1)
Treatment	-0.071**	-0.103***	0.037
	(0.030)	(0.039)	(0.031)
Treat × Epilepsy transmissible	-0.017	-0.104	0.031
	(0.065)	(0.069)	(0.056)
Epilepsy transmissible	0.088*	0.195***	-0.018
	(0.050)	(0.051)	(0.040)
Control mean	0.289	0.540	0.132
R^2	0.215	0.198	0.018
Observations	782	782	800

Notes: This table reports estimates from equation 2. Regressions include the control variables sex, age, age squared, widowed, whether the respondent knew epilepsy treatment existed in Kananga in the baseline survey and whether the respondent thought modern medicine was good at treating and diagnosing epilepsy in the baseline survey. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors in parentheses.

D Online Appendix: Additional Analyses

A Antiretroviral Therapy Scale-Up and Supernatural Beliefs Regarding HIV/AIDS in Sub-Saharan Africa

To explore whether exposure to effective biomedical treatment is associated with changes in supernatural illness beliefs, I examine the rollout of antiretroviral therapy (ART) for HIV/AIDS across sub-Saharan Africa. Ethnographic accounts suggest that observable biomedical efficacy can undermine the perceived plausibility of non-natural causes of illness (Jilek-Aall et al., 1997; Cox and Phillips, 2015).

I combine Demographic and Health Survey (DHS) data from 69 surveys across 29 countries (2003–2018) with country-year data on ART coverage from the World Health Organization. The outcome variable is whether the respondent agrees that HIV/AIDS can be contracted through witchcraft or other supernatural means. I measure ART exposure via the lagged country-level share of the population receiving treatment.

I estimate the following specification using OLS:

$$\text{SupernaturalBelief}_{ict} = \alpha + \beta_1 \, \text{ARTPrevalence}_{c,t-1} + \mathbf{X}_{ict}\boldsymbol{\Gamma} + \delta_c + \theta_t + \varepsilon_{ict} \tag{5}$$

where i indexes individuals, c countries, and t survey years. The outcome variable $\text{SupernaturalBelief}_{ict}$ is an indicator equal to 1 if the respondent agrees that HIV/AIDS can be contracted through witchcraft or other supernatural means. The key independent variable, $\text{ARTPrevalence}_{c,t-1}$, is the lagged country-level share of the population receiving antiretroviral therapy, measured using WHO data. The vector $\mathbf{X}_{ict}$ includes individual-level controls: sex, age, age squared, years of education, marital status indicators, and a household wealth index. All specifications include country (δ_c) and year (θ_t) fixed effects. Standard errors are clustered at the country level, following Bertrand et al. (2004).

Appendix Table A.1 presents the results. A one-standard-deviation increase in lagged ART prevalence is associated with a 0.170-standard-deviation decrease in supernatural beliefs about HIV/AIDS (column (1)). Columns (2) and (3) show that ART prevalence is also associated with increased willingness to undergo HIV testing and reduced stigma toward individuals with HIV/AIDS. These patterns, while correlational, provide suggestive evidence that exposure to effective biomedical

care may shift illness beliefs and improve attitudes toward the afflicted.

B Incentivized Valuation of Third-Party Epilepsy Consultation

As an additional incentivized measure of beliefs about the efficacy of modern medicine for epilepsy, I implemented a third-party valuation task, modeled after the Becker–DeGroot–Marschak (BDM) method. Respondents decided whether an anonymous adult with seizures (the next eligible patient at the hospital) should receive a free consultation or a cash amount, with the cash offer varying from USD 0 to USD 10 in USD 0.50 increments. The respondent was told that one of her choices would be selected with a probability and implemented. The respondent's valuation is defined as the highest cash amount at which they still preferred the consultation. This task was administered at midline.[48]

Using regression equation 1, I find that the average valuation in the treatment group is USD 0.19 higher than in the control group, but the difference is not statistically significant likely due to significant noise in the measure (Appendix Table A.25). As with the BDM tasks for HIV and hypertension testing (see Section 4), this null likely reflects the diffculty of understanding such an exercise in this setting.

Table A.25: Treatment Effect on Valuation of Epilepsy Consultation for Third Party

	(1) Valuation of epilepsy consultation of 3rd person (in USD)
Treatment	0.218
	(0.231)
Control mean	8.309
R^2	0.017
Observations	766
p-value OLS	0.343
p-value RI	0.353
p-value bootstrap	0.330

Notes: This table reports estimates from equation 1. The outcome variable measures the respondent's valuation of an epilepsy consultation for a third party elicited through a method similar to the Becker-DeGroot-Marschak method, with the exception that, in this case, a third party receives the item. Significance levels of * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. OLS robust standard errors in parentheses.

[48] Note that the survey text does not inform the respondent about the availability of medicine and doctors to treat epilepsy in Kananga.