The enduring influence of institutions on universal health coverage: an empirical investigation of 62 former colonies

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The enduring influence of institutions on universal health coverage: An empirical investigation of 62 former colonies*

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Abstract:
In this paper, we argue that particular institutional arrangements partly explain the large and persistent differences in health systems and health outcomes observed former colonies countries. Drawing on data from the World Health Organization for 62 countries, covering the period 2000-2014, we explore whether economic (risk of expropriation) and health (complete cause of death registries) institutions explain mortality rates and access to healthcare. To identify this relationship, we use settler mortality and the distance of the capital from the nearest major port – factors associated with institutional arrangements – to explain cross-national variation in health outcomes and the universality of health systems. We find that inclusive institutions arrangements – that protect and acknowledge the rights of citizens – are associated with better health outcomes (e.g. lower infant mortality and lower maternal mortality) as well as with better health systems (e.g. more skilled birth attendance and greater immunization). Inclusive institutions not only foster economic growth but improves health and well-being too (JEL: I10, P16, P51).

Introduction

On 20 July 2014, after ravaging the West African countries of Liberia, Sierra Leone, and Guinea, the Ebola virus reached Lagos, Nigeria, one of Africa's largest and most densely populated cities (Tilley-Gyado 2015; WHO 2014). Panic regarding the epidemic intensified instantly. If the virus was not immediately contained, it risked escalating into an irreversible global crisis.

*Replication materials are available here: https://github.com/asreeves/origins-health

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Public health officials worried Ebola would expose persistent governance challenges and coordination problems in the Nigerian health system; but these fears did not materialize. The Nigerian government successfully prevented the mass transmission of Ebola, documenting only 19 infections and 7 fatalities (WHO 2016). By contrast, the virus reached epidemic proportions in Liberia, Sierra Leone, and Guinea; with more than 28,600 cases and 11,300 deaths (WHO 2014). The Ebola epidemic illuminates the profound disparities in health systems across West Africa, but these disparities are not only apparent in those few countries directly affected by this localized epidemic. Immunization, infant mortality, and access to healthcare all exhibit jarring levels of inequality between countries, even those with comparable geographies and similar disease burdens (World Bank 2015). What, then, explains these massive disparities in health coverage and health outcomes brought into stark visibility by the Ebola epidemic (Robinson, Acemoglu, and Johnson 2003)?

In this paper we argue that institutional differences – the formal and informal constraints on human interaction (North 1994) – inherited from the colonial period partly explain the large and persistent differences in health systems and the improvements in health they deliver today. Institutions are the rules and regulations of society (Beckfield et al. 2015; Kalleberg 2009) and these rules can be, to differing degrees, extractive or inclusive. The former exist when rules do not protect people from exploitation. Extractive institutions, then, may offer little protection for private property, few safeguards against government expropriation, and often fail to recognize the rights of citizens. Extractive institutions, in fact, may be the source of exploitation (Scheidel 2017). Inclusive institutions, by contrast, are characterized by pluralism, where many people are included in the processes of political and economic governance. They are marked by stricter adherence to law and order, more stringent protection of private property, some constraints on executive power, and more robust recognition of citizenship, hence exploitation is often attenuated (Acemoglu, Johnson, and Robinson 2001).

For many countries, the creation of more extractive (or more inclusive) institutions is rooted in the colonial period, and the influence of these critical junctures on society continues to be felt today (Banerjee and Iyer 2005; Besley 1995; Lange, Mahoney, and vom Hau 2006; Mahoney 2010). For example, the establishment of extractive institutions by colonial powers constrained economic development in former colonies after independence, affecting whether contemporary societies are richer or poorer (Acemoglu et al. 2001). Colonial institutional legacies may affect health too but here the evidence is far less certain (Lange et al. 2006). Mahoney (2010) has examined this question using data from former Spanish colonies and documents persistent differences in social development over time according to the type of institutions established under colonial rule. While almost all countries improve, their relative position with respect to other former colonies remains relatively stable: that is, those Latin American countries with better life expectancy and infant mortality in 1975 still have better outcomes 30 years later. One important gap in this earlier work, however, is whether these colonial institutions affect health only through their impact on economic growth; for 'wealthier is healthier' (Deaton 2015; Pritchett and Summers 1996). Of course, as the Ebola example illustrates, institutional arrangements may directly influence health, independent of their effect on development (Kentikelenis et al. 2015). And so, whether – independent of development – the inheritance of extractive institutions affects health system coverage and/or health outcomes in the present

remains an open question.

Like economic development, institutions may affect health because they stipulate the formal structures and rules governing relations between actors within societies, shaping social interactions and guiding what is fair and reasonable under certain circumstances (Kalleberg 2011). For example, one set of institutions that may influence health is the creation of rules determining property rights. These institutional rules stipulate who can own land and other assets while also providing protections against the risk of expropriation (Soto 2000). Guaranteeing property rights is a form of inclusive institutional arrangements that has been closely linked with economic development (through encouraging investment in physical and human capital), but also with improved health and education among children in specific settings (Besley 1995; Galiani and Schargrodsky 2004, 2010).

Another set of inclusive institutions that may directly impact health is the establishment of a national registration system of deaths (Acemoglu, Gallego, and Robinson 2014; Mathers et al. 2005; Szreter 2007). These institutions are inclusive because they establish a legal identity that is foundational to property rights, voting rights, and other entitlements from the state (Szreter 2007). Registering deaths (and births) was integral to the development of citizenship and the creation of robust healthcare systems (Szreter 2007). Death registration systems are not new – England established their system in 1538 – but many less developed countries still do not possess routinized procedures for recording deaths (and births), while in other contexts registration systems are only partial at best (Mathers et al. 2005). Inclusive institutions which create formal legal identities are also central to demographic analysis; for, if countries are to take seriously their responsibility to protect and enhance the life expectancy of their citizens, they must have access to accurate data on births and deaths (Szreter 2007). In focusing on national registration systems, we follow Lange et al. (2006), who stressed the importance of 'state institutions' in fostering social development because they promoted the 'rule of law' and the creation of state bureaucracies, which are essential to the establishment of effective healthcare systems (Lange 2004; Lange et al. 2006). Carefully recording deaths, not only ensures that rights are protected, but it also reveals where greater resources are required, allowing healthcare providers of various kinds to target their efforts to those areas where improvement is both needed and possible. As Jha has argued, establishing public registration systems is 'one of the world's best investments to reduce premature mortality' (Jha 2012).

Clearly, it is possible to a draw a plausible causal connection between the types of institutional arrangements installed in a country and whether a country can ensure healthy lives for all of their citizens (Marmot et al. 2008). The establishment of inclusive or exclusive institutions will shape the structure of societies and this, in turn, may affect the health of populations (Kalleberg 2011; Reeves et al. 2014).

Although institutions may affect health, simply adopting inclusive institutions does not immediately guarantee everyone can attain a healthy life. Even when particular institutions have been formally changed, pre-existing institutional arrangements continue to cast a long-shadow over social outcomes (Banerjee and Duflo 2014). One reason for the durability of these effects is that institutions are path dependent (Pierson 2000; Thelen 2003) and so the current insti-

tutional arrangements seen in former colonies will have roots in decisions made by European powers during the nineteenth century (Banerjee and Iyer 2005). Slavery was formally abolished in the U.S. in the 1860s but the political effects of these previous institutional arrangements continue to persist today (Acharya, Blackwell, and Sen 2016b). In fact, the lingering effect of colonial institutions on health may be particularly acute. Jim Crow laws, for example, were repealed in 1965 but the health effects of these segregating institutions persisted for many decades afterward (Krieger et al. 2014, 2013). The same is likely true of other colonial institutions too. Institutional arrangements concerning law and order and private property established during the colonial period often became the basis for post-independence institutional systems in former colonies (Acemoglu, Johnson and Robinson 2001), and while such arrangements have no doubt been altered, the inherited framework persists. Thus, while many of the 'institutions from the colonial period… have been superseded' by less explicitly extractive arrangements (Mahoney 2010), the type of institutions installed by colonizers may continue to influence the health of populations today.

The institutional arrangements established by colonial powers were contingent on both the colonizer's identity and the initial conditions faced by the invading power. While colonization was uniformly brutal to the indigenous population, some patterns of colonization were more common among some colonizers than others. Britain, for example, tended to create more 'liberal' institutions, which encouraged development, rather than 'mercantilist' institutions, which did not (Lange et al. 2006). But, these decisions were not standardized within particular colonizers; 'many forms of colonial domination existed… within each colonial empire' (Lange et al. 2006). Within Britain's general tendency to create 'liberal', inclusive institutions, it still installed both inclusive and extractive institutions in different places (Lange 2004) . Moreover, even when colonial powers installed extractive institutions, they managed those institutions quite differently. Spanish extractive institutions required a substantial colonial presence while British extractive institutions did not (Mahoney 2010). Alongside the colonizer's identity, decisions to establish more extractive institutions within a colony were partly determined by the initial conditions faced by settlers to these regions, such as population density and the presence of certain natural resources (Lange et al. 2006). Establishing inclusive institutions was not without costs and so colonizers sometimes regarded these additional costs as excessive; in these circumstances, colonizers seem to have focused on extracting wealth from these regions (Curtin 1998). Thus, extractive institutions were far more common in contexts where, for example, the rates of settler mortality were high since the settlers themselves were less likely to benefit from installing costly inclusive institutions (Acemoglu et al. 2001).

Settler mortality, of course, is not the only driver of the type of colonial institutions installed in particular contexts (Lange 2004; Lange et al. 2006; Mahoney 2010). We argue that establishing inclusive institutions would also have been more costly in contexts where the major economic centers of the colonized regions were more isolated (e.g., further from the closest major port). European powers invariably relied on shipping and ports to establish trade links and to extract wealth, and so if the main economic centers were further away from these ports then establishing such links would be more difficult and more costly (Stasavage 2010). The connections between economic centers and ports partly explains why isolated cities tend to have weaker political institutions (Campante and Do 2014; Stasavage 2010). However, this

measure is different from the 'centrality' of the colony, which is concerned with whether the colonies themselves were central or peripheral to the colonizer (Lange et al. 2006). Rather, by calculating the distance between the major economic centre and the closest major port, this measure is attempting to identify one of the initial conditions that may have influenced the decision of colonizers to install extractive or inclusive institutions.

If these hypotheses are correct then we would expect to see more extractive institutions in contexts where settler mortality was high – as documented by Acemoglu, Johnson, and Robinson (2001) – and where transaction costs with the colony were higher too, namely where the main economic centers were further from the closest port (Stasavage 2010). We deploy these hypotheses to argue that extractive institutions established during the colonial era may have affected the development of universal health coverage and health outcomes, independent of their effect on economic development. We test this theory using a 2SLS model with data on mortality rates and health systems performance for 62 former colonies. Our model relies on two sources of exogenous variation in the colonial origins of institutional formation. As suggested above, these include the settler mortality rate in colonies between the 17th and 19th centuries (Acemoglu et al. 2001) and the distance from the capital city to the main port in the 19th century. Aside from adding this new instrument, we also make two methodological contributions. First, we explore two kinds of inclusive institutions. Following Acemoglu, Johnson and Robinson (2001), we measure inclusive economic institutions as protection against expropriation. But we also introduce a novel measure of inclusive health-related institutions, particularly those centered on the state (Lange et al. 2006), namely the completeness of cause of death registration (Szreter 2007). Second, we specifically address the endogeneity between institutional formations and economic development without directly controlling for GDP, so as to avoid the bias created by conditioning on post-treatment variables (Acharya, Blackwell, and Sen 2016a). Below we describe our method in more detail.

The paper is structured as follows. In section 2, we present the data and the methods. In section 3 we outline the main results. We present the robustness checks in section 4 and finally we conclude in section 5.

Data and method

Data

The sample consists of 62 former colonies covering the period 2000-2014, from the World Health Orgaization's (WHO) Global Health Observatory data repository and the World Bank Open database (World Bank 2015). We limit our sample to 62 former colonies since these are the countries for which we could obtain settler mortality data (Acemoglu et al. 2001). This is not a random sample of countries and for comparison we report a full list of former European colonies in web appendix 1.

To capture health coverage, we apply the WHO's three-dimensions of health coverage: (1) health services, (2) health financing, and (3) population coverage. For health services, we use

three of the WHO's suggested indicators: percentage of children obtaining all three doses of the diphtheria, tetanus and pertussis vaccine (DPT3), measles immunization coverage, and percentage of births attended by skilled health personnel. To measure health spending, we include out of pocket expenditure as a percentage of total health expenditure. Lastly, to measure population coverage, we also include a direct measure of Universal Health Coverage (UHC) defined as 'formal health coverage as % of the population,' which measures the proportion of the population covered by state, social, private and mutual health insurance schemes. This is taken from the International Labour Organization (ILO. 2010; ILO 2008) in line with the previous literature (Feigl and Ding 2013; Reeves et al. 2015). More broadly, we follow the literature looking at health coverage by examining causes of mortality that are amenable to intervention, namely maternal mortality, neonatal mortality, infant mortality, and under-five mortality (McKee et al. 2013; Moreno-Serra and Smith 2012; Reeves et al. 2015). Where possible we take the country-specific average over the period 2000-2014 to reduce the influence of outliers from any single year. Importantly, while we try to abide by the WHO's recommended three dimensions of UHC, we recognize that our operationalization captures health access and services more than measures of health insurance coverage. This is partly due to imperfect data, but also grounded in the understanding that most health delivery, and therefore health coverage, in former colonies is not funded through health insurance models.

We use two measures of institutional arrangements in a society, which are proxies for the degree to which institutions are extractive or inclusive. First, we take the average of the protection against expropriation risk index over 1985 – 1995. This comes from Acemoglu, Johnson and Robinson who derive it from the Political Risk Services (Acemoglu et al. 2001). The variable is scaled from 0 to 10 with a higher score representing greater protection against expropriation. This measure of the protection against expropriation risk is averaged across this period because differences between countries will largely persist over time.

Our second measure of institutional arrangements comes from Mathers et al. and is the completeness of death registration measured in 2003, according to whether International Classification of Disease (ICD) codes are used to report mortality (Mathers et al. 2005). Countries are assigned membership to one of four categories from 0 to 3: 0 = Country reports no recent death registration data, 1 = Low quality death registration data (Proportion of deaths recorded is less than 70% or ill-defined ICD codes are used on more than 20% of registrations), 2 = Medium quality death registration data (Proportion of deaths recorded is between 70-90% or ill-defined ICD codes are used on between 10-20% of registrations. Alternatively, countries are also coded as 2 if they are using non-ICD codes, the proportion of deaths recorded is above 90%, and ill-defined codes appear less than 10% of registrations), 3 = Countries with high quality death registration data (Proportion of deaths recorded is over 90% and ill-defined ICD codes are used on less than 10% of registrations) (Mathers et al. 2005).

Our controls include measures of cross-national wealth, as well as country specific controls such as latitude and the infection rate due to malaria. Data on wealth, measured as the average Gross Domestic Product (GDP) per capita between 2000 and 2014, adjusted for purchasing-power, come from the World Bank Open Database (World Bank 2018). Latitude represents the absolute value of the latitude of a country (i.e. a measure of the distance from the equator) and

is scaled from 0 to 1 and taken from La Porta et al. (1999). For malaria, we use WHO country estimates of infection rates and subsequently divide them by population size to capture infection rates per capita. We use the infection rate and not the mortality rate because the former is primarily a measure of the natural disease burden and not the governments' effectiveness at treating it, which would likely be endogenous.

Statistical Methods

Ordinary Least Square (OLS) Approach

To investigate the association between health coverage and institutions we start by applying an OLS model, as follows:

$$log(Health_i) = \mu + \alpha_1 Institutions_i + \beta_1 log(GDP_i) + \gamma X_i + \epsilon_i \quad (1)$$

Here, i indexes the country. $Health$ is a vector representing the various measures of health outcomes and health coverage noted above for country i for the period 2000-2014. μ is a constant, Institutions is also a vector representing our two measures of institutional arrangements, i) the average protection against expropriation risk measure in line with Acemoglu, Johnson and Robinson (2001) and ii) the proportion of deaths recorded in line with Mathers et al (2005). GDP is the average gross domestic product per capita deflated by Price Purchasing Parity (although we calculate GDP using a different approach, described below, because it is a post-treatment variable); X is a vector of other country-specific covariates (i.e. latitude and the infection rate due to malaria), and ϵ is a random error term. α_1 is the coefficient of interest, estimating whether countries with more 'inclusive' institutions have better health outcomes.

Instrumental Variable (IV) Approach

OLS regression models, of course, cannot determine the direction of causality. Institutions may affect health (by granting individual rights that improve access to healthcare and others services) but the reverse is also possible (healthier populations may be more concerned with implementing better institutions). Put differently, inclusive institutions (e.g. those countries that have put the most effort into maintaining or creating an effective death registration system or granting greater protection against expropriation) might also be the places most likely to monitor their individuals' health with the aim of having healthier populations. Further, any observed association between institutions and health may be due to an unobserved factor that causes both institutions and health. We therefore adopt an instrumental variable approach to try to address the potential bias in the OLS estimates.

We have identified two separate instruments. The first uses the same instrument as Acemoglu, Johnson and Robinson (2001), measuring the mortality rates of soldiers, bishops and sailors stationed in the colonies between the 17th and 19th centuries (settlers' mortality). The intuition behind this instrument – as argued above – is that European powers were aware of these mortality rates and they strongly determined whether colonizers tried to replicate European institutions (the so-called "Neo-Europes"), with a strong emphasis on private property and checks against government expropriation. In short, inclusive institutions were more

common in countries where settlers' mortality was low since colonizers were building such institutions for their own well-being. This is in contrast to countries where settler mortality was high, and therefore colonizers were building institutions purely to extract capital from the indigenous population with little regard for their welfare. As we have argued previously, institutions are path dependent and the early establishment of more inclusive institutions partly explains the presence of modern institutional "inclusivity": average protection against expropriation and comprehensive of death registration. Thus, we suggest that settler mortality is associated with modern institutions because these early institutions subsequently affected the post-independence trajectory of former colonies. At the same time, we argue that settler mortality rates in the past are unlikely to be correlated with modern post-colonial health because of both greater indigenous immunity to tropical diseases and better treatment of the specific diseases most likely to kill settlers. We examine this in more detail below.

As an additional instrument, we use the distance between the capital city and the major port (Distance in KM) in the country during the 19th century as calculated by the authors (see Web Appendix 2). We identify capital cities and ports following Campante and Do (2014), who use historical and other online sources, and we then calculate distances between the cities and the ports using online distance calculators. In situations where the country is landlocked we select the nearest major port possessed by the same colonizer. The intuition here is that when the main economic centers of a colony were further away from major ports possessed by the same colonizer there would be higher transaction costs, which may encourage extractive relationships between colonizers and the colonized in order to ensure return on investment. In other words, in colonies where the cost of extraction was greater (i.e. colonies with economic centers further from major ports), colonial powers were less apt to invest in building inclusive institutions since this would only increase the costs even more. Therefore, we expect these colonies to have been characterized by more extractive institutions, which should subsequently be associated with institutional inclusivity in the more recent past. As we have argued above, average protection against expropriation and comprehensive death registration capture modern institutional inclusivity, because they reflect institutional investment in economic rights, commitment to population health, and are intricately tied to notions of citizenship and social contract between state institutions and individuals.

In addition to this theoretical justification, the essential conditions needed to have consistent estimation through an IV strategy are that the instrumental variable is uncorrelated with the error term and correlated with the endogenous variable. While error terms cannot be observed, it is easy to check that both settler mortality (r = -0.51) and the distance between the major economic centre and the major port (r = -0.42) are significantly correlated with expropriation risk. Similarly, both settler mortality (r = -0.60) and the distance between the major economic centre and the major port (r = -0.28) are correlated with the comprehensiveness of death registration. However, our two instruments are not correlated with each other (r = 0.07).

To this end we apply a 2SLS estimation, as follows:

$$Institution_i = \mu_0 + \delta Z_i + \beta_0 log(GDP_i) + \gamma_0 X_i + \eta_i \quad (2)$$

$$log(Health_i) = \mu_1 + \alpha_1 \widehat{Institutions}_i + \beta_1 log(GDP_i) + \gamma_1 X_i + \epsilon_i \quad (3)$$

Where Z_i represents our instrumental variables (i.e., settlers' mortality and distance in KM) and $\widehat{Institutions}$ represents the fitted values of $Institution$ estimated through equation (2).

The exclusion restriction, implied by our instrumental variable, is that: net of all the explanatory variables included in the regression, both mortality rates of European settlers more than 100 years (settlers' mortality) ago and the distance from the capital city to the major port (Distance in KM) in the country during the 19th century do not have a direct effect on the outcomes: health outcomes and health coverage. The major concern of this exclusion restriction is that mortality rates of European settlers could be correlated with diseases that have a direct impact on our outcome. It is possible that settler mortality rates, which were largely determined by malaria and yellow fever, may be correlated with mortality rates in the present and so we condition on the malaria infection rate – a major cause of death for both recent populations and also settlers. Other causes of settler mortality, such as yellow fever, are far less consequential today due to effective vaccination and treatment. However, this possible link between settler mortality and health in the present necessitates our use of an alternative instrument for institutions. We argue that there is no direct effect of distance from the main capital city to the major port in the 19th century on health outcomes or coverage today. While there is reason to suspect landlocked countries fare worse economically because of their trade disadvantage, we posit that any possible correlation with health is in fact mediated through GDP, which we are able to control for in our model. Lastly, we argue that settler mortality is unlikely to be directly caused by the distance of the capital city from the nearest major port and this is, in fact, what we find (r = 0.07).

GDP: CONDITIONING ON A POST-TREATMENT VARIABLE

Another problem still remains. Institutions affect economic development, which may also affect health. Conditioning on a post-treatment variable (in this case, GDP) can produce bias (Acharya et al. 2016a) and so to address this we estimated the following models:

$$Institution_i = \mu_0 + \delta Z_i + \gamma_0 X_i + \eta_i \quad (4)$$

$$log(GDP_i) = \mu_2 + \alpha_2 \widehat{Institutions}_i + \gamma_1 X_i + \xi_i \quad (5)$$

In short, we estimate a two-stage least squares model with GDP as the outcome, institutions as the endogenous variable, and our two instruments along with our control variables. This model approximates Acemoglu, Johnson, and Robinson's model but with the addition of our extra instrument (Distance in KM). We use this approach for both measures of institutions.

We then take the residuals from each of these two versions of model 5 and generate an instrumented measure of GDP (Log($\widehat{GDP}$)) that remains correlated with our raw measure of GDP (r = 0.34) but is, by construction, orthogonal with respect to the instruments (Settlers' mortality r = -0.028; Death registration r = 0.032). This instrumented measure of GDP is then included in our OLS models (see equation 1) and our IV models (see equations 2 and 3). Treating GDP in

this way allows us to still control for the effect of GDP, thereby blocking other possible causal pathways that may affect health through GDP via mechanisms unrelated to these institutions. Crucially, by parsing out its association with institutions we thereby stop GDP acting as a collider variable (Morgan and Winship 2007). As an additional check on this approach, we also re-estimate our models – following Acharya et al. – using a g-estimation procedure (Acharya et al. 2016a). Not only does this model avoid the problems of post-treatment bias but it also tests whether any association between institutions and our health outcomes persists that does not operate through GDP. Finally, we also report our results without controlling for GDP. We find our results are consistent when using all of these approaches.

Results

In table 1 we initially present results from the naïve estimation (OLS) between health and our proxies for institutional arrangements: the average protection against expropriation risk (panel A) and the comprehensiveness of death registration (panel B). Across all models we control for latitude, malaria infection rate, and our instrumented measure of the Average Log GDP Per Capita PPP, as shown in equation 4. Our measures of institutions are correlated with every health outcome. Both expropriation risk and the comprehensiveness of death registration are associated with lower maternal and infant mortality, more skilled birth attendance, greater immunization, higher out-of-pocket expenditure and lower universal coverage. We also find, as expected, that our instrumented measure of GDP is negatively correlated with all of the outcomes, suggesting that our residual inclusion approach has not produced counter-intuitive findings. The measures of malaria and latitude are not consistently correlated with health outcomes, although there is a suggestion that countries with higher malaria rates have lower financial risk protection (UHC).

In table 2 we report the results of the first-stage regression. Here, we find that both the settler mortality rate and the distance from the major economic centre to the nearest port are strongly correlated with institutional arrangements. In countries where settler mortality was higher and where the distance to the port was further, there is, on average, less protection against the risk of expropriation and less comprehensive death registration. Once again, our instrumented measure of GDP is correlated with these same outcomes in the expected direction. Although latitude was not correlated with either institutional proxy, malaria was negatively correlated with both outcomes.

Having demonstrated that our measure of institutions both predicts our outcomes and is partially explained by our instruments, we now estimate our two-stage least squares or instrumental variable model (see table 3). Panel A of table 3 presents the coefficients of interest using the average protection against expropriation as the main explanatory variable while Panel B uses, instead, the comprehensiveness of death registration in each country.

Table 1A: OLS regressions using as main explanatory variable Average Protection against expropriation risk, 1985-1995

Covariates	Maternal Mortality[1]	Neonatal Mortality[2]	Infant Mortality[3]	Under 5 Mortality[4]	Skilled Birth Attended[5]	DPT3 Coverage[6]	Measles (MCV) Immunization[7]	OOP[8]	UHC[9]
Average Protection against	-0.77***	-0.51***	-0.57***	-0.62***	15.56***	6.28***	6.90***	-8.01***	19.37***
expropriation risk, 1985-95	(0.08)	(0.06)	(0.06)	(0.07)	(2.04)	(1.53)	(1.65)	(2.29)	(4.13)
Latitude	-1.88***	0.01	-0.12	-0.11	-27.62	11.02	2.92	-34.98*	30.81
	(0.69)	(0.52)	(0.53)	(0.56)	(17.05)	(12.74)	(13.79)	(19.11)	(31.94)
Malaria	1.24	0.48	0.89	1.36*	-3.12	7.02	6.26	-57.27**	-40.21
	(0.85)	(0.64)	(0.64)	(0.69)	(20.77)	(15.53)	(16.81)	(23.28)	(40.63)
Log($\widehat{GDP}$)	-0.80***	-0.49***	-0.52***	-0.57***	18.33***	7.00***	8.27***	-12.08***	31.79***
	(0.14)	(0.10)	(0.11)	(0.11)	(3.39)	(2.54)	(2.74)	(3.80)	(6.79)
Constant	10.23***	6.10***	7.00***	7.59***	-18.67	39.30***	35.91***	104.68***	-78.50***
	(0.59)	(0.45)	(0.45)	(0.48)	(14.60)	(10.92)	(11.81)	(16.36)	(28.30)
N	62	62	62	62	62	62	62	62	45
R^2	0.804	0.698	0.755	0.778	0.627	0.350	0.337	0.250	0.655

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors are in parenthesis. Source: Data from the World Bank and WHO for 62 former colonies covering the period 2000-2014. All the outcomes are expressed in Logarithms, except those measured as a proportion of the population. Average protection against expropriation risk is on a scale from 0 to 10, where a higher score means more protection against expropriation of private investment by government. Log($\widehat{GDP}$) represents the residual of the regression using the Average Log GDP Per Capita PPP, 2000-2014 as an outcome and our measures of institutions as explanatory variables the average protection against expropriation risk, 1985-1995, both of which have been instrumented through settler mortality in logarithms and distance from capital city during the 19C to a major port in the country (in Km).
1 - Per 100,000 Live Births, Average (2000-2014); 2 - Per 1,000 Live Births, Average (2000-2014); 3 - Per 1,000 Live Births, Average (2000-2014); 4 - Per 1,000 Live Births, Average (2000-2014); 5 - % of births attended by a skilled health personnel (Latest Available Year); 6 - % of Total Population, Average (2000-2014); 7 - % of Total Population (2000-2014); 8 – Out of Pocket expenditure as % of the budget; 9 - formal health coverage as % of the population.

Table 1B: OLS regressions using as main explanatory variable Proportion of deaths recorded

Covariates	Maternal Mortality[1]	Neonatal Mortality[2]	Infant Mortality[3]	Under 5 Mortality[4]	Skilled Birth Attended[5]	DPT3 Coverage[6]	Measles (MCV) Immunization[7]	OOP[8]	UHC[9]
Comprehensiveness of	-0.97***	-0.65***	-0.72***	-0.79***	19.13***	7.76***	8.59***	-9.86***	23.08***
death registration	(0.09)	(0.07)	(0.07)	(0.07)	(2.47)	(1.85)	(1.99)	(2.80)	(5.30)
Latitude	-1.86***	-0.05	-0.25	-0.23	-29.93*	10.70	1.10	-28.32	14.36
	(0.59)	(0.44)	(0.46)	(0.49)	(16.32)	(12.27)	(13.15)	(18.50)	(32.62)
Malaria	1.27*	0.36	0.64	1.11*	-7.55	6.43	2.78	-44.45**	-65.22
	(0.68)	(0.51)	(0.53)	(0.56)	(18.84)	(14.17)	(15.19)	(21.36)	(40.95)
Log($\widehat{GDP}$)	-0.49***	-0.29***	-0.36***	-0.39***	14.78***	5.68**	5.16*	-5.96	20.93***
	(0.12)	(0.09)	(0.09)	(0.10)	(3.39)	(2.55)	(2.73)	(3.84)	(6.74)
Constant	6.15***	3.41***	4.03***	4.33***	64.99***	72.80***	73.21***	59.59***	30.43***
	(0.18)	(0.14)	(0.14)	(0.15)	(5.09)	(3.83)	(4.11)	(5.77)	(9.93)
N	62	62	62	62	62	62	62	62	45
R^2	0.852	0.767	0.804	0.824	0.635	0.356	0.356	0.249	0.618

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors are in parenthesis. Source: Data from the World Bank and WHO for 62 former colonies covering the period 2000-2014. All the outcomes are expressed in Logarithms, except those measured as a proportion of the population. Countries are coded as 1 on our measure of the Comprehensiveness of death registration is measured on a 4-point scale as described in the paper. Log($\widehat{GDP}$) represents the residual of the regression using the Average Log GDP Per Capita PPP, 2000-2014 as an outcome and our measures of institutions as explanatory variables the average protection against expropriation risk, 1985-1995, both of which have been instrumented through settler mortality in logarithms and distance from capital city during the 19C to a major port in the country (in Km).

1 - Per 100,000 Live Births, Average (2000-2014); 2 - Per 1,000 Live Births, Average (2000-2014); 3 - Per 1,000 Live Births, Average (2000-2014); 4 - Per 1,000 Live Births, Average (2000-2014); 5 - % of births attended by a skilled health personnel (Latest Available Year); 6 - % of Total Population, Average (2000-2014); 7 - % of Total Population (2000-2014); 8 – Out of Pocket expenditure as % of the budget; 9 - formal health coverage as % of the population.

Table 2: First stage regression models

	Average Protection against expropriation risk, 1985-1995	Comprehensiveness of death registration
Covariates	(1)	(2)
European settler mortality (log)	-0.47***	-0.39***
	(0.11)	(0.09)
Distance (100km)	-0.13***	-0.099***
	(0.035)	(0.028)
Latitude	0.78	0.45
	(0.91)	(0.73)
Malaria	-2.13*	-2.01**
	(1.12)	(0.82)
Log($\widehat{GDP}$)	-1.00***	-0.79***
	(0.13)	(0.12)
Constant	9.03***	3.10***
	(0.55)	(0.46)
N	62	62
R^2	0.733	0.704

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors are in parenthesis. Source: Data from the World Bank and WHO for 62 former colonies covering the period 2000-2014. Average protection against expropriation risk is on a scale from 0 to 10, where a higher score means more protection against expropriation of private investment by government. Comprehensiveness of death registration is measured on a 4-point scale as described in the paper. Distance refers to the distance from capital city during the 19C to a major port in the country (per 100 Km). Log($\widehat{GDP}$) represents the residual of the regression using the Average Log GDP Per Capita PPP, 2000-2014 as an outcome and our measures of institutions as explanatory variables the average protection against expropriation risk, 1985-1995, both of which have been instrumented through settler mortality in logarithms and distance from capital city during the 19C to a major port in the country (in Km).

Table 3A: IV Regression using as main explanatory variable Average Protection against expropriation risk, 1985-1995

IV Results	Maternal Mortality[1]	Neonatal Mortality[2]	Infant Mortality[3]	Under 5 Mortality[4]	Skilled Birth Attended[5]	DPT3 Coverage[6]	Measles (MCV) Immunization[7]	OOP[8]	UHC[9]
Average protection against	-1.02**	-0.68**	-0.75**	-0.84**	16.16**	9.78**	9.81**	-11.40**	25.28**
expropriation risk, 1985-95	(0.15)	(0.11)	(0.11)	(0.12)	(3.45)	(2.69)	(2.87)	(3.94)	(7.82)
Latitude	-1.52	0.25	0.13	0.20	-28.45	6.12	-1.16	-30.24	17.15
	(0.77)	(0.57)	(0.58)	(0.63)	(17.50)	(13.66)	(14.53)	(19.97)	(36.10)
Malaria	-0.16	-0.46	-0.11	0.17	0.16	26.29	22.28	-75.93*	-8.96
	(1.13)	(0.84)	(0.86)	(0.93)	(25.82)	(20.15)	(21.43)	(29.46)	(54.28)
Log($\widehat{GDP}$)	-1.10**	-0.69**	-0.73**	-0.83**	19.03**	11.14**	11.71**	-16.08**	38.84**
	(0.21)	(0.15)	(0.16)	(0.17)	(4.72)	(3.69)	(3.92)	(5.39)	(10.50)
Constant	11.96**	7.26**	8.24**	9.06**	-22.71	15.53	16.14	127.70**	-117.11*
	(1.05)	(0.78)	(0.79)	(0.86)	(23.88)	(18.64)	(19.82)	(27.25)	(51.88)
R^2	0.772	0.659	0.720	0.739	0.626	0.290	0.301	0.221	0.638
OLS results									
Average Protection against	-0.77***	-0.51***	-0.57***	-0.62***	15.56***	6.28***	6.90***	-8.01***	19.37***
expropriation risk, 1985-95	(0.08)	(0.06)	(0.06)	(0.07)	(2.04)	(1.53)	(1.65)	(2.29)	(4.13)
N	62	62	62	62	62	62	62	62	45

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors are in parenthesis. Source: Data from the World Bank and WHO for 62 former colonies covering the period 2000-2014. All the outcomes are expressed in Logarithms, except those measured as a proportion of the population. Average protection against expropriation risk is on a scale from 0 to 10, where a higher score means more protection against expropriation of private investment by government. Log($\widehat{GDP}$) represents the residual of the regression using the Average Log GDP Per Capita PPP, 2000-2014 as an outcome and our measures of institutions as explanatory variables the average protection against expropriation risk, 1985-1995, both of which have been instrumented through settler mortality in logarithms and distance from capital city during the 19C to a major port in the country (in Km).
1 - Per 100,000 Live Births, Average (2000-2014); 2 - Per 1,000 Live Births, Average (2000-2014); 3 - Per 1,000 Live Births, Average (2000-2014); 4 - Per 1,000 Live Births, Average (2000-2014); 5 - % of births attended by a skilled health personnel (Latest Available Year); 6 - % of Total Population, Average (2000-2014); 7 - % of Total Population (2000-2014); 8 – Out of Pocket expenditure as % of the budget; 9 - formal health coverage as % of the population.

Table 3B: IV Regression using as main explanatory variable Proportion of deaths recorded

Covariates	Maternal Mortality[1]	Neonatal Mortality[2]	Infant Mortality[3]	Under 5 Mortality[4]	Skilled Birth Attended[5]	DPT3 Coverage[6]	Measles (MCV) Immunization[7]	OOP[8]	UHC[9]
Comprehensiveness of	-1.23***	-0.84***	-0.94***	-1.04***	18.94***	11.61***	11.31***	-12.05**	26.65**
death registration	(0.16)	(0.12)	(0.13)	(0.14)	(4.16)	(3.24)	(3.41)	(4.74)	(9.93)
Latitude	-1.54**	0.18	0.01	0.08	-29.68*	5.92	-2.29	-25.59	7.28
	(0.65)	(0.49)	(0.51)	(0.55)	(16.84)	(13.13)	(13.80)	(19.20)	(36.77)
Malaria	0.14	-0.44	-0.28	0.03	-8.39	23.02	14.53	-53.89*	-50.28
	(0.91)	(0.69)	(0.72)	(0.78)	(23.75)	(18.51)	(19.45)	(27.07)	(54.08)
Log($\widehat{GDP}$)	-0.71***	-0.45***	-0.54***	-0.61***	14.62***	8.95**	7.48**	-7.82	24.00**
	(0.17)	(0.13)	(0.13)	(0.14)	(4.42)	(3.45)	(3.62)	(5.04)	(9.88)
Constant	6.45***	3.62***	4.28***	4.62***	65.21***	68.34***	70.05***	62.13***	27.00**
	(0.25)	(0.19)	(0.19)	(0.21)	(6.41)	(5.00)	(5.25)	(7.30)	(12.82)
R^2	0.829	0.736	0.771	0.789	0.635	0.308	0.335	0.241	0.613
OLS Results									
Comprehensiveness of	-0.97***	-0.65***	-0.72***	-0.79***	19.13***	7.76***	8.59***	-9.86***	23.08***
death registration	(0.09)	(0.07)	(0.07)	(0.07)	(2.47)	(1.85)	(1.99)	(2.80)	(5.30)
N	62	62	62	62	62	62	62	62	45

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors are in parenthesis. Source: Data from the World Bank and WHO for 62 former colonies covering the period 2000-2014. All the outcomes are expressed in Logarithms, except those measured as a proportion of the population. Countries are coded as 1 on our measure of the Comprehensiveness of death registration is measured on a 4-point scale as described in the paper. Log($\widehat{GDP}$) represents the residual of the regression using the Average Log GDP Per Capita PPP, 2000-2014 as an outcome and our measures of institutions as explanatory variables the average protection against expropriation risk, 1985-1995, both of which have been instrumented through settler mortality in logarithms and distance from capital city during the 19C to a major port in the country (in Km).

1 - Per 100,000 Live Births, Average (2000-2014); 2 - Per 1,000 Live Births, Average (2000-2014); 3 - Per 1,000 Live Births, Average (2000-2014); 4 - Per 1,000 Live Births, Average (2000-2014); 5 - % of births attended by a skilled health personnel (Latest Available Year); 6 - % of Total Population, Average (2000-2014); 7 - % of Total Population (2000-2014); 8 – Out of Pocket expenditure as % of the budget; 9 - formal health coverage as % of the population.

Our 2SLS estimation shows that an increase of 1 point in the average expropriation rate leads to significant reduction in maternal (1.02 percentage points) and infant mortality (0.68 percentage points with respect to neonatal mortality and 0.75 percentage points with respect to infant mortality and 0.84 percentage points with respect to under 5 mortality rates), increases in skilled birth attendance (16.16 percentage points), greater immunization (9.78 percentage points with respect to DPT3 coverage and 9.81 with respect to measles), lower out-of-pocket expenditure (11.4 percentage points) and higher universal coverage (25.3 percentage points).

Consistent with these findings, when we re-estimate the models using the comprehensiveness of death registration as an alternative proxy for institutional arrangements we find the direction of the results are identical. To be precise, moving up a category on our ordinal scale of the comprehensiveness of death registration is associated with a significant reduction in maternal (1.23 percentage points) and infant mortality (0.84 percentage points with respect neonatal mortality and 0.94 percentage points with respect to infant mortality and 1.04 percentage point with respect to under 5 mortality), increase skilled birth attendance (18.94 percentage points), greater immunization (11.61 percentage points with respect to DPT3 coverage and 11.30 with respect to Measles), lower out-of-pocket expenditure (12.05 percentage points) and higher universal coverage (26.65 percentage points).

Robustness checks

The validity of the 2SLS estimation we deploy here is based on the assumption that none of the instruments have a direct effect on the outcome. However, LaPorta et al. (1999), Mahoney (2010) and Lange (2004) have all argued that the specific colonizer may have been a determinant of institutions; more specifically the authors suggest that British colonies inherit better institutions because Britain colonized places where settlements were possible. To investigate if our results are driven by the difference between British colonizers and others we restrict our analysis to British colonies only. Table 4 presents the estimated results, which are broadly consistent with the main results. There are two exceptions; both out of pocket expenditure and percentage of total population covered by DPT3 vaccine become insignificant when using the comprehensiveness of death registration as an instrument but the sign remains in the same direction.

We also explore whether our results are sensitive to the set of controls we include in our main models. For example, we re-estimate our IV models but without controlling for GDP, finding almost exactly the same results (Table 5). We also re-estimate our models controlling for other possible predictors of our health outcomes: total health spending, both public and private (% of GDP); indicators of the colonizer (British, Spanish, and French, with a catch-all category for other colonies); the degree of democracy between 2000-2014 (Freedom House's measure of political rights and civil liberties); the level of official development assistance (% of government spending); and a measure of economic globalization (KOF). We do not include these variables in our main models in part due to sample size and in part because there is good evidence that, like GDP, these variables sit on the causal pathway between institutions and health, and would potentially bias our results. However, even when we control for these variables, our two measures of institutions remain correlated with our measures of health outcomes in

almost all instances (see Web Appendix 3).

We also re-estimate our main instrumental regression models using a *g*-estimation procedure (see Table 6) (Acharya et al. 2016a). The *g*-estimation procedures 'transforms (or demediates) the dependent variable by removing from it the effect of the mediator and then estimating the effect of the treatment on this demediated outcome' (Acharya et al. 2016a). In other words, these models enable us to address the issue of post-treatment bias that may be introduced by controlling directly for GDP and allow us to test whether the correlation between institutions and health is solely explained by their connection with GDP. The procedure moves through three-steps, which we apply to our specific case:

1. Estimate the main instrumental variable regression models with health outcomes as our dependent variable and controlling for GDP.
2. Create a de-mediated version of the dependent variable where we have subtracted the effect of GDP from each health outcome.
3. Re-estimate the main instrumental variable regression model again but with two differences: i) use the de-mediated version of the dependent variable and ii) do not include the measure of GDP.

We report the results from these models below for both endogenous variables. We find that most of our results are largely unchanged. But there are some exceptions. For example, the association with skilled birth attendance is weaker and in those models using the average risk of expropriation as the endogenous variables, the results are less clear for our measure of UHC and out-of-pocket spending.

If development alone is not the explanation then perhaps health spending explains the connection between institutions and health outcomes. Using the same g-estimation procedure, we now create a de-mediated version of the dependent variable where we have subtracted both the effect of GDP and total health spending from each health outcome. Running our IV models on this new dependent variable (see Web Appendix 4), we still find our results are largely consistent with our original IV models and our OLS estimates, except for skilled birth attendance (which, again, is not significant at standard levels anymore). Taken together our results do not appear to be especially sensitive to our particular model specification nor does it seem that GDP is the only pathway between institutions and health. Other mechanisms appear to be at work.

Table 4A: IV Regression using as main explanatory variable Average Protection against expropriation risk, 1985-1995, British colonies only

IV Results	Maternal Mortality[1]	Neonatal Mortality[2]	Infant Mortality[3]	Under 5 Mortality[4]	Skilled Birth Attended[5]	DPT3 Coverage[6]	Measles (MCV) Immunization[7]	OOP[8]	UHC[9]
Average protection against	-1.25***	-1.00***	-1.04***	-1.12***	25.52***	11.61**	13.11**	-21.29***	31.46*
expropriation risk, 1985-95	(0.24)	(0.18)	(0.20)	(0.21)	(6.16)	(4.97)	(4.87)	(6.67)	(14.88)
Latitude	-1.54	0.63	0.62	0.61	-12.72	-12.44	-16.96	-69.92**	73.61
	(1.17)	(0.85)	(0.93)	(1.00)	(29.43)	(23.71)	(23.27)	(31.84)	(104.11)
Malaria	-1.68	-2.58	-2.16	-2.07	90.52	46.56	61.91	-197.51***	146.73
	(2.24)	(1.64)	(1.79)	(1.91)	(56.52)	(45.54)	(44.68)	(61.14)	(111.70)
Log($\widehat{GDP}$)	-1.47***	-1.12***	-1.13***	-1.23***	29.26***	12.56	14.09*	-31.60***	32.81
	(0.40)	(0.29)	(0.32)	(0.34)	(9.99)	(8.05)	(7.90)	(10.81)	(21.01)
Constant	13.75***	9.62***	10.41***	11.22***	-104.82**	3.11	-9.86	221.00***	-208.23*
	(1.91)	(1.40)	(1.53)	(1.63)	(48.11)	(38.77)	(38.04)	(52.05)	(97.23)
R^2	0.856	0.806	0.801	0.808	0.594	0.0559	0.0675	0.349	0.659
OLS results									
Average Protection against	-0.97***	-0.81***	-0.81***	-0.85***	17.77***	5.08*	6.21**	-12.92***	20.12*
expropriation risk, 1985-95	(0.15)	(0.11)	(0.12)	(0.12)	(3.66)	(2.92)	(2.80)	(3.96)	(10.52)
N	25	25	25	25	25	25	25	25	14

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors are in parenthesis. Source: Data from the World Bank and WHO for 62 former colonies covering the period 2000-2014. All the outcomes are expressed in Logarithms, except those measured as a proportion of the population. Average protection against expropriation risk is on a scale from 0 to 10, where a higher score means more protection against expropriation of private investment by government. Log($\widehat{GDP}$) represents the residual of the regression using the Average Log GDP Per Capita PPP, 2000-2014 as an outcome and our measures of institutions as explanatory variables the average protection against expropriation risk, 1985-1995, both of which have been instrumented through settler mortality in logarithms and distance from capital city during the 19C to a major port in the country (in Km).
1 - Per 100,000 Live Births, Average (2000-2014); 2 - Per 1,000 Live Births, Average (2000-2014); 3 - Per 1,000 Live Births, Average (2000-2014); 4 - Per 1,000 Live Births, Average (2000-2014); 5 - % of births attended by a skilled health personnel (Latest Available Year); 6 - % of Total Population, Average (2000-2014); 7 - % of Total Population (2000-2014); 8 – Out of Pocket expenditure as % of the budget; 9 - formal health coverage as % of the population.

Table 4B: IV Regression using as main explanatory variable Proportion of deaths recorded, British colonies only

Covariates	Maternal Mortality[1]	Neonatal Mortality[2]	Infant Mortality[3]	Under 5 Mortality[4]	Skilled Birth Attended[5]	DPT3 Coverage[6]	Measles (MCV) Immunization[7]	OOP[8]	UHC[9]
Comprehensiveness of	-1.42***	-1.16***	-1.17***	-1.24***	31.77***	11.65	14.71**	-12.60	53.38*
death registration	(0.35)	(0.26)	(0.27)	(0.28)	(9.38)	(6.93)	(7.04)	(8.28)	(24.06)
Latitude	-1.33	0.67	0.62	0.66	-12.38	-14.14	-16.90	-40.36	74.58
	(1.02)	(0.76)	(0.80)	(0.83)	(27.30)	(20.17)	(20.50)	(24.11)	(97.33)
Malaria	-0.79	-2.20	-1.57	-1.25	95.10	29.70	54.76	-77.57	229.29*
	(2.37)	(1.76)	(1.85)	(1.92)	(63.40)	(46.85)	(47.62)	(55.98)	(114.96)
Log($\widehat{GDP}$)	-1.19*	-0.97*	-0.85	-0.86	31.26*	5.60	10.51	4.15	97.27*
	(0.65)	(0.48)	(0.51)	(0.53)	(17.42)	(12.88)	(13.09)	(15.39)	(43.73)
_cons	6.83***	4.17***	4.64***	4.96***	29.78	70.55***	62.61***	72.42***	-67.19*
	(0.76)	(0.56)	(0.59)	(0.62)	(20.33)	(15.02)	(15.27)	(17.95)	(34.73)
R^2	0.868	0.818	0.828	0.842	0.583	0.185	0.136	0.555	0.703
OLS Results									
Comprehensiveness of	-1.08***	-0.92***	-0.89***	-0.92***	20.26***	3.75	5.52	-9.26*	33.34**
death registration	(0.19)	(0.14)	(0.14)	(0.15)	(4.76)	(3.59)	(3.51)	(4.72)	(12.28)
N	25	25	25	25	25	25	25	25	14

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors are in parenthesis. Source: Data from the World Bank and WHO for 62 former colonies covering the period 2000-2014. All the outcomes are expressed in Logarithms, except those measured as a proportion of the population. Countries are coded as 1 on our measure of the Comprehensiveness of death registration is measured on a 4-point scale as described in the paper. Log($\widehat{GDP}$) represents the residual of the regression using the Average Log GDP Per Capita PPP, 2000-2014 as an outcome and our measures of institutions as explanatory variables the average protection against expropriation risk, 1985-1995, both of which have been instrumented through settler mortality in logarithms and distance from capital city during the 19C to a major port in the country (in Km).

1 - Per 100,000 Live Births, Average (2000-2014); 2 - Per 1,000 Live Births, Average (2000-2014); 3 - Per 1,000 Live Births, Average (2000-2014); 4 - Per 1,000 Live Births, Average (2000-2014); 5 - % of births attended by a skilled health personnel (Latest Available Year); 6 - % of Total Population, Average (2000-2014); 7 - % of Total Population (2000-2014); 8 – Out of Pocket expenditure as % of the budget; 9 - formal health coverage as % of the population.

Table 5A: IV Regression using as main explanatory variable Average Protection against expropriation risk, 1985-1995, without adjusting for GDP

IV Results	Maternal Mortality[1]	Neonatal Mortality[2]	Infant Mortality[3]	Under 5 Mortality[4]	Skilled Birth Attended[5]	DPT3 Coverage[6]	Measles (MCV) Immunization[7]	OOP[8]	UHC[9]
Average protection against	-0.71***	-0.49***	-0.55***	-0.61***	10.98***	6.77***	6.59***	-6.97**	13.42*
expropriation risk, 1985-95	(0.14)	(0.10)	(0.10)	(0.11)	(3.06)	(2.08)	(2.23)	(3.08)	(6.90)
Latitude	-0.57	0.84	0.77	0.92	-45.74*	-4.07	-11.65	-15.85	0.58
	(1.06)	(0.73)	(0.75)	(0.83)	(23.19)	(15.72)	(16.86)	(23.33)	(49.06)
Malaria	4.04***	2.18***	2.68***	3.32***	-72.02***	-15.92	-22.19	-14.83	-128.52***
	(0.91)	(0.63)	(0.65)	(0.71)	(20.00)	(13.56)	(14.54)	(20.12)	(45.97)
Constant	9.34***	5.61***	6.51***	7.10***	21.10	41.05***	43.33***	90.31***	-26.72
	(0.87)	(0.60)	(0.62)	(0.68)	(19.13)	(12.97)	(13.91)	(19.25)	(42.15)
R^2	0.607	0.488	0.566	0.586	0.402	0.141	0.141	0.0298	0.396
OLS results									
Average Protection against	-0.77***	-0.51***	-0.57***	-0.62***	15.56***	6.28***	6.90***	-8.01***	19.37***
expropriation risk, 1985-95	(0.08)	(0.06)	(0.06)	(0.07)	(2.04)	(1.53)	(1.65)	(2.29)	(4.13)
N	62	62	62	62	62	62	62	62	45

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors are in parenthesis. Source: Data from the World Bank and WHO for 62 former colonies covering the period 2000-2014. All the outcomes are expressed in Logarithms, except those measured as a proportion of the population. Average protection against expropriation risk is on a scale from 0 to 10, where a higher score means more protection against expropriation of private investment by government.
1 - Per 100,000 Live Births, Average (2000-2014); 2 - Per 1,000 Live Births, Average (2000-2014); 3 - Per 1,000 Live Births, Average (2000-2014); 4 - Per 1,000 Live Births, Average (2000-2014); 5 - % of births attended by a skilled health personnel (Latest Available Year); 6 - % of Total Population, Average (2000-2014); 7 - % of Total Population (2000-2014); 8 – Out of Pocket expenditure as % of the budget; 9 - formal health coverage as % of the population.

Table 5B: IV Regression using as main explanatory variable Proportion of deaths recorded, without adjusting for GDP

Covariates	Maternal Mortality[1]	Neonatal Mortality[2]	Infant Mortality[3]	Under 5 Mortality[4]	Skilled Birth Attended[5]	DPT3 Coverage[6]	Measles (MCV) Immunization[7]	OOP[8]	UHC[9]
Comprehensiveness of	-1.15***	-0.78***	-0.86***	-0.95***	16.36***	9.95***	10.10***	-10.93**	27.63**
death registration	(0.18)	(0.12)	(0.13)	(0.15)	(4.29)	(3.07)	(3.15)	(4.29)	(12.13)
Latitude	-1.47*	0.22	0.04	0.11	-29.86	5.94	-2.53	-25.13	5.94
	(0.82)	(0.58)	(0.62)	(0.68)	(19.85)	(14.21)	(14.59)	(19.85)	(45.77)
Malaria	1.14	0.20	0.53	0.95	-31.89	8.33	2.85	-42.19*	-62.32
	(0.96)	(0.68)	(0.73)	(0.80)	(23.36)	(16.71)	(17.17)	(23.36)	(61.80)
Constant	6.26***	3.50***	4.12***	4.44***	70.03***	71.38***	72.41***	59.82***	27.54*
	(0.27)	(0.19)	(0.21)	(0.23)	(6.64)	(4.75)	(4.88)	(6.64)	(15.43)
R^2	0.725	0.627	0.653	0.671	0.487	0.180	0.248	0.179	0.372
OLS Results									
Comprehensiveness of	-0.97***	-0.65***	-0.72***	-0.79***	19.13***	7.76***	8.59***	-9.86***	23.08***
death registration	(0.09)	(0.07)	(0.07)	(0.07)	(2.47)	(1.85)	(1.99)	(2.80)	(5.30)
N	62	62	62	62	62	62	62	62	45

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors are in parenthesis. Source: Data from the World Bank and WHO for 62 former colonies covering the period 2000-2014. All the outcomes are expressed in Logarithms, except those measured as a proportion of the population. Countries are coded as 1 on our measure of the Comprehensiveness of death registration is measured on a 4-point scale as described in the paper.
1 - Per 100,000 Live Births, Average (2000-2014); 2 - Per 1,000 Live Births, Average (2000-2014); 3 - Per 1,000 Live Births, Average (2000-2014); 4 - Per 1,000 Live Births, Average (2000-2014); 5 - % of births attended by a skilled health personnel (Latest Available Year); 6 - % of Total Population, Average (2000-2014); 7 - % of Total Population (2000-2014); 8 – Out of Pocket expenditure as % of the budget; 9 - formal health coverage as % of the population.

Table 6A: IV Regression using a g-estimation procedure using as main explanatory variable Average Protection against expropriation risk, 1985-1995

IV Results	Maternal Mortality[1]	Neonatal Mortality[2]	Infant Mortality[3]	Under 5 Mortality[4]	Skilled Birth Attended[5]	DPT3 Coverage[6]	Measles (MCV) Immunization[7]	OOP[8]	UHC[9]
Average protection against	-0.55***	-0.41***	-0.48***	-0.56***	0.67	8.40***	6.07***	-4.76	-2.07
expropriation risk, 1985-95	(0.12)	(0.09)	(0.09)	(0.10)	(2.43)	(2.21)	(2.19)	(2.94)	(5.39)
Latitude	-0.81	0.73	0.67	0.85	-30.31	-6.51	-10.87	-19.17	13.92
	(0.93)	(0.68)	(0.71)	(0.79)	(18.36)	(16.70)	(16.58)	(22.22)	(38.32)
Malaria	3.04***	1.69***	2.28***	3.03***	-7.91	-26.06*	-18.95	-28.61	-49.52
	(0.81)	(0.58)	(0.61)	(0.68)	(15.84)	(14.40)	(14.30)	(19.16)	(35.91)
Constant	10.72***	6.28***	7.06***	7.50***	-66.64***	54.92***	38.91***	109.16***	-159.86***
	(0.77)	(0.56)	(0.58)	(0.65)	(15.15)	(13.78)	(13.68)	(18.33)	(32.92)
R^2	0.539	0.406	0.520	0.560	0.0467	0.257	0.105	0.030	0.111
OLS results									
Average Protection against	-0.77***	-0.51***	-0.57***	-0.62***	15.56***	6.28***	6.90***	-8.01***	19.37***
expropriation risk, 1985-95	(0.08)	(0.06)	(0.06)	(0.07)	(2.04)	(1.53)	(1.65)	(2.29)	(4.13)
N	62	62	62	62	62	62	62	62	45

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors are in parenthesis. Source: Data from the World Bank and WHO for 62 former colonies covering the period 2000-2014. All the outcomes are expressed in Logarithms, except those measured as a proportion of the population. Average protection against expropriation risk is on a scale from 0 to 10, where a higher score means more protection against expropriation of private investment by government.
1 - Per 100,000 Live Births, Average (2000-2014); 2 - Per 1,000 Live Births, Average (2000-2014); 3 - Per 1,000 Live Births, Average (2000-2014); 4 - Per 1,000 Live Births, Average (2000-2014); 5 - % of births attended by a skilled health personnel (Latest Available Year); 6 - % of Total Population, Average (2000-2014); 7 - % of Total Population (2000-2014); 8 – Out of Pocket expenditure as % of the budget; 9 - formal health coverage as % of the population.

Table 6B: IV Regression using a g-estimation procedure using as main explanatory variable Proportion of deaths recorded

Covariates	Maternal Mortality[1]	Neonatal Mortality[2]	Infant Mortality[3]	Under 5 Mortality[4]	Skilled Birth Attended[5]	DPT3 Coverage[6]	Measles (MCV) Immunization[7]	OOP[8]	UHC[9]
Comprehensiveness of	-1.51***	-1.05***	-1.05***	-1.17***	2.20	10.54***	10.96***	-11.51**	27.77**
death registration	(0.22)	(0.15)	(0.16)	(0.17)	(3.63)	(3.11)	(3.21)	(4.32)	(12.16)
Latitude	-1.47	0.22	0.05	0.12	-29.58*	5.93	-2.55	-25.12	5.97
	(1.02)	(0.71)	(0.72)	(0.80)	(16.77)	(14.41)	(14.85)	(19.99)	(45.86)
Malaria	1.79	0.67	0.87	1.35	-6.77	7.27	1.31	-41.17*	-62.48
	(1.20)	(0.84)	(0.85)	(0.94)	(19.73)	(16.95)	(17.47)	(23.51)	(61.92)
Constant	3.05***	1.18***	2.44***	2.49***	-54.62***	76.63***	80.05***	54.76***	28.69*
	(0.34)	(0.24)	(0.24)	(0.27)	(5.61)	(4.82)	(4.96)	(6.68)	(15.46)
R^2	0.747	0.688	0.691	0.705	0.0751	0.210	0.286	0.193	0.373
OLS Results									
Comprehensiveness of	-0.97***	-0.65***	-0.72***	-0.79***	19.13***	7.76***	8.59***	-9.86***	23.08***
death registration	(0.09)	(0.07)	(0.07)	(0.07)	(2.47)	(1.85)	(1.99)	(2.80)	(5.30)
N	62	62	62	62	62	62	62	62	45

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors are in parenthesis. Source: Data from the World Bank and WHO for 62 former colonies covering the period 2000-2014. All the outcomes are expressed in Logarithms, except those measured as a proportion of the population. Countries are coded as 1 on our measure of the Comprehensiveness of death registration is measured on a 4-point scale as described in the paper.
1 - Per 100,000 Live Births, Average (2000-2014); 2 - Per 1,000 Live Births, Average (2000-2014); 3 - Per 1,000 Live Births, Average (2000-2014); 4 - Per 1,000 Live Births, Average (2000-2014); 5 - % of births attended by a skilled health personnel (Latest Available Year); 6 - % of Total Population, Average (2000-2014); 7 - % of Total Population (2000-2014); 8 – Out of Pocket expenditure as % of the budget; 9 - formal health coverage as % of the population.

Discussion

Since the turn of the century there has been a proliferation of studies examining the role of institutions in shaping economic development and political systems. (Acemoglu et al. 2014; Banerjee and Duflo 2014). But far less attention has been given to how institutions shape the development of health systems, health outcomes, and, in particular, universal health coverage (Pega et al. 2013). This study moves this debate forward by examining how institutional arrangements inherited from the colonial period (such as extractive and inclusive institutions) are associated with the development of strong health systems capable of delivering universal health coverage today. Moreover, recognizing the challenges with identifying the causal effect of institutions on health, we have used an instrumental variable approach to more precisely identify the link between institutions and population health. We argue that i) European powers adopted very different colonization strategies, which were determined by the costs associated with colonization; ii) that both completeness of registration systems and the risk of expropriation are features of inclusive institutional formation; and, finally, iii) institutions are path dependent, namely that the institutional arrangements established during the colonial era continue to shape the institution arrangements in the present.

Our paper moves these debates forward in four respects. Earlier analyses of the health effects of colonial legacies have examined a narrow range of health outcomes in a limited set of countries (i.e., Spanish America). We expand the range of health outcomes studied, finding largely consistent correlations between institutions and mortality, vaccination coverage, and universal health coverage, and we include a much wider set of countries, suggesting the form of colonialism is correlated with health outcomes many decades later across countries from very different regions. This reinforces Mahoney's (2010) argument that any geographic effects on social development (including health) depend on the arrangement of existing institutions. We also move beyond the focus on contemporary economic institutions alone, and explicitly address health-related institutions too. Specifically, we pay particular attention to death registration, an institutional arrangement that potentially drives health improvements and which has now been incorporated in the SDGs. This innovation expands the range of possible institutions that may have their roots in colonialism.

Fourth, we also seek to address the endogeneity between institutions, GDP, and health through our IV approach and g-estimation. Building on earlier work, we too observe that current institutional arrangements are correlated with the costs of colonization in the past. Extractive institutions today are more common among countries where settler mortality rates were higher and where the distance between the main economic centre and the nearest major port during the nineteenth century was farther. Crucially, when we control for the endogeneity between institutions and health in the present (using settler mortality and distance as instruments) we find that health outcomes are better in countries with more inclusive institutions such as better protection against expropriation and more comprehensive death registration. This relationship holds even when using a variety of methods to control for the endogeneity in the wealth-health association. The relationship between institutions and health is also not explained by environmental diseases (i.e. malaria) or latitude, or by other factors like official development assistance, democracy, economic globalization, colonizer, or total health spending. While we

do not claim to have entirely resolved the thorny entanglement of health and wealth, the consistency of our results across our models gives us greater confidence in our findings.

Interestingly, and similar to earlier studies (Acemoglu et al. 2001), the estimated coefficients using the 2SLS approach are similar to but larger than the OLS estimates reported in Table 2. One possible explanation is that our proxy measures of institutional arrangements contain a great deal of measurement error, which is large enough to counteract the upward bias introduced by reverse causality or omitted variables. But this seems unlikely in this context given that we see an inflated IV coefficient for both of our instruments. It is also possible that negative selection may explain why the OLS estimates are lower than the IV estimates, especially if the effect of institutions on health varies across contexts. For example, if the effect of inclusive institutions on health is actually greater for those countries that are more likely to have inclusive institutions then the OLS estimate would be larger than the IV estimate. However, if the reverse is true – namely that the health effects of inclusive institutions would actually be greater for those countries least likely to have them – then the IV estimates may actually be larger than the OLS estimates. Our results, therefore, suggest that not only have extractive institutions harmed the ability of some countries to develop strong and effective health systems but that these extractive institutions have actually been more harmful in these contexts than they would have been elsewhere.

There are several important limitations to our work. First, our measures of institutions are not perfect proxies for all the institutional arrangements that may influence health. Yet, our work still moves our understanding of institutions forward by identifying a new health-related institutional arrangement – namely the comprehensiveness of death registrations – which is also foundational to the extension of individual rights, including property rights. Second, our measures of universal health coverage and health systems do not capture every important aspect of health. However, our findings have a high degree of consistency across health indicators, including mortality rates, immunization rates, and financial protection against catastrophic costs, suggesting the health effects of institutions are not narrowly relevant to only a few outcomes. Third, we assume the form of colonization that flowed from settler mortality and the distance between a major port and the capital city was largely stable and so overlooks how colonial influence varied over time (Thelen 2003). This is also one of the strengths of our paper because this assumption explicitly acknowledges the path dependence between initial conditions, the colonial institutions installed, and the level of social development that we see today (Mahoney and Rueschemeyer 2003; Pierson 2000). Better data will be required to explore changing institutional forms. Fourth, our measure of distance to the closest major port only partly takes into account the topography and availability of other forms of connection (e.g. availability of rail connections). This choice was mainly driven by the paucity of data in this area and this is clearly an area of future research. In short, although our analyses are not without their limitations, our results are plausible and highly consistent, suggesting that institutions may play an important role in health system development and in reducing mortality.

It is easy to read these results as a form of historical determinism, that the past shapes the present and there is little that can be done to change the future (Banerjee and Duflo 2014). It is important to be clear about what our findings do and do not imply in this respect. First, our

results reveal a correlation between institutions and health along with the presence of some degree of path dependence between institutional formation in the past and the present. Our models do not necessarily imply, however, that such an association must always persist, just that it remains at this point in time. Second, the influence of the past on the present is not fixed and it is likely that the influence of any particular historical moment changes over time. It is not clear whether and how colonial legacies will still matter 100 years from now. Third, instrumental variable models identify only a part of the causal effect; that part of variation in the cause (institutions) that is due to the instrument (i.e., settler mortality and distance) (Dunning 2008). This is not a purely technical issue. Institutions are not just the product of settler mortality and distance to the nearest major port from the economic centre and so changes in these other drivers of institutions may affect health quite differently (Dunning 2008). In part, this is because, despite what is implied by instrumental variable models, institutions are not simply devices that produce better health or more economic development; they are 'power-implicating instruments' (Mahoney 2010) that constrain and enable different capabilities depending on how they are embedded within and interact with other institutional forms.

One highly salient, but largely unexplored example of this issue is the role of international financial institutions. These organizations may bend the trajectories established by colonial legacies and, in some cases, may even create 'critical junctures' that set these countries and their institutions on new paths (Thelen 2003). There is still debate concerning whether, how, and under what circumstances international financial institutions affect health, with some documenting negative effects (Coburn, Restivo, and Shandra 2015; Daoud et al. 2017; Kentikelenis 2017; Stuckler et al. 2008) and others suggesting their influence on health is largely positive or at least benign (Gupta 2015, 2017). More recent work, has illuminated how the impact of these international organizations may be contingent on the institutional forms already established within countries. For example, Noy (2017) finds that the World Bank's influence of health in Latin America is not monolithic but rather responds to national contexts, sometimes in the service of fostering equity and universalism. Similarly, Barlow (2018) documents how trade liberalization – as promoted by the WTO, IMF, and World Bank – may reduce infant mortality in low – and middle-income countries but only in contexts where the existing institutional arrangements can translate the economic benefits of trade into pro-poor growth. More work is needed to understand how national-level institutions (such as death registration, but also female political representation, among many others) (Quamruzzaman and Lange 2016; Szreter 2007) both create the conditions for improvements in health and interact with other institutions and organizations in pursuing these goals (Shandra et al. 2004).

Our results also have important implications for progress toward the SDGs. Institutional arrangements can accelerate or hinder development and our models suggest that inclusive institutions, such as reducing expropriation risks or establishing legal identities, may form an important part of institutional rules that will protect health and facilitate the creation of robust and resilient health systems that are able to respond to health shocks, such as the spread of Ebola. While our analysis does not directly establish that the spread of this specific disease would have been different if inclusive rather than extractive institutions had been established during the nineteenth century in Liberia, Sierra Leone, and Guinea; it does suggest that such countries will remain vulnerable to health shocks if institutions are not established that can

provide a thorough and robust response to as yet unknown diseases.

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Online Supplement

Web Appendix 1: Former European Colonies

Web Appendix 2: Data on distance major economic centre and major port

Web Appendix 3a: IV regression with additional controls using as main explanatory variable Average Protection against expropriation risk, 1985-1995

Web Appendix 3b: IV regression with additional controls using as main explanatory variable Proportion of deaths recorded

Web Appendix 4a: IV Regression using a g-estimation procedure which de-mediates for GDP and total health spending using as main explanatory variable Average Protection against expropriation risk, 1985-1995

Web Appendix 4b: IV Regression using a g-estimation procedure which de-mediates for GDP and total health spending using as main explanatory variable Proportion of deaths recorded

Web Appendix 1: Former European Colonies

Country	Colonizer	Region	Included in sample	Country	Colonizer	Region	Included in sample
Algeria	France	Africa	Yes	Madagascar	France	Africa	Yes
Angola	Portugal	Africa	Yes	Malawi	Britain	Africa	No
Antigua and Barbuda	Britain	Americas	No	Malaysia	Britain	Asia	Yes
Argentina	Spain	Americas	Yes	Maldives	Britain	Asia	No
Australia	Britain	Oceania	Yes	Mali	France	Africa	Yes
Bahamas	Britain	Americas	Yes	Malta	Britain	Europe	Yes
Bahrain	Britain	Asia	No	Marshall Islands	Spain	Oceania	No
Bangladesh	Britain	Asia	Yes	Mauritania	France	Africa	No
Barbados	Britain	Americas	No	Mauritius	Britain	Africa	No
Belize	Britain	Americas	No	Mexico	Spain	Americas	Yes
Benin	France	Africa	No	Micronesia	Spain	Oceania	No
Bolivia	Spain	Americas	Yes	Morocco	France	Africa	Yes
Botswana	Britain	Africa	No	Mozambique	Portugal	Africa	No
Brazil	Portugal	Americas	Yes	Myanmar	Britain	Asia	No
Brunei	Britain	Asia	No	Namibia	Germany	Africa	No
Burkina Faso	France	Africa	Yes	Nauru	Britain	Oceania	No
Burundi	Belgium	Africa	No	Nepal	Britain	Asia	No
Cambodia	France	Asia	No	New Zealand	Britain	Oceania	Yes
Cameroon	France	Africa	Yes	Nicaragua	Spain	Americas	Yes
Canada	Britain	Americas	Yes	Niger	France	Africa	Yes
Cape Verde	Portugal	Africa	No	Nigeria	Britain	Africa	Yes
Central African Republic	France	Africa	No	Pakistan	Britain	Asia	Yes
Chad	France	Africa	No	Palau	Spain	Oceania	No
Chile	Spain	Americas	Yes	Palestine	Britain	Asia	No
Colombia	Spain	Americas	Yes	Panama	Spain	Americas	Yes
Comoros	France	Africa	No	Papua New Guinea	Britain	Oceania	No
Congo, Republic of	France	Africa	Yes	Paraguay	Spain	Americas	Yes
Costa Rica	Spain	Americas	Yes	Peru	Spain	Americas	Yes
Ivory Coast	France	Africa	Yes	Philippones	Spain	Asia	No
Cuba	Spain	Americas	No	Qatar	Britain	Asia	No
Cyprus	Britain	Asia	No	Rwanda	Belgium	Africa	No
Djibouti	France	Africa	No	Saint Kitts and Nevis	Britain	Americas	No
Dominica	Britain	Americas	No	Saint Lucia	Britain	Americas	No
Dominican Republic	Spain	Americas	Yes	Saint Vincent and the Grenadines	Britain	Americas	No
DRC	Belgium	Africa	Yes	Samoa	Britain	Oceania	No
Ecuador	Spain	Americas	Yes	Sao Tome and Principe	Portugal	Africa	No
Egypt	Britain	Africa	Yes	Senegal	France	Africa	Yes

El Salvador	Spain	Americas	Yes	Seychelles	Britain	Africa	No
Equatorial Guinea	Spain	Africa	No	Sierra Leone	Britain	Africa	Yes
Fiji	Britain	Oceania	No	Singapore	Britain	Asia	Yes
Gabon	France	Africa	Yes	Solomon Islands	Britain	Oceania	No
Gambia	Britain	Africa	Yes	Somalia	Britain	Africa	No
Ghana	Britain	Africa	Yes	South Africa	Britain	Africa	Yes
Grenada	Britain	Americas	No	South Sudan	Britain	Africa	No
Guatemala	Spain	Americas	Yes	Sri Lanka	Britain	Asia	Yes
Guinea	France	Africa	Yes	Sudan	Britain	Africa	Yes
Guinea-Bissau	Portugal	Africa	No	Suriname	Netherlands	Americas	No
Guyana	Britain	Americas	Yes	Swaziland	Britain	Africa	No
Haiti	France	Americas	Yes	Tanzania	Britain	Africa	Yes
Honduras	Spain	Americas	Yes	Timor-Leste	Portugal	Asia	No
India	Britain	Asia	Yes	Togo	France	Africa	Yes
Indonesia	Netherlands	Asia	Yes	Tonga	Britain	Oceania	No
Iraq	Britain	Asia	No	Trinidad and Tobago	Britain	Americas	Yes
Jamaica	Britain	Americas	Yes	Tunisia	France	Africa	Yes
Jordan	Britain	Asia	No	Tuvalu	Britain	Oceania	No
Kenya	Britain	Africa	Yes	Uganda	Britain	Africa	Yes
Kiribati	Britain	Oceania	No	United Arab Emirates	Britain	Asia	No
Kuwait	Britain	Asia	No	United States	Britain	Americas	Yes
Laos	France	Asia	No	Uruguay	Spain	Americas	Yes
Lebanon	France	Asia	No	Vanuatu	Britain	Oceania	No
Lesotho	Britain	Africa	No	Venezuela	Spain	Americas	No
Liberia	USA	Africa	No	Vietnam	France	Asia	Yes
Libya	Italy	Africa	No	Zambia	Britain	Africa	Yes
				Zimbabwe	Britain	Africa	No

Web Appendix 2: Data on distance major economic centre and major port

Country	Distance (KM)	Capital	Port	Source
Algeria	4.83	Algiers	Algiers	https://en.wikipedia.org/wiki/Algeria
Angola	8.05	Luanda	Luanda	https://en.wikipedia.org/wiki/Luanda
Argentina	4.83	Buenos Aires	Buenos Aires	https://en.wikipedia.org/wiki/Argentina
Australia	8.05	Melbourne	Melbourne	Campante et al., 2016
Bahamas	3.703	Nassau	Nassau	https://en.wikipedia.org/wiki/The_Bahamas
Bangladesh	216.27	Dhaka	Chittagong	https://en.wikipedia.org/wiki/Bangladesh
Bolivia	537.93	Sucre	Iquique	https://en.wikipedia.org/wiki/Bolivia
Brazil	4.83	Rio de Janeiro	Rio de Janeiro	Campante et al., 2016
Burkina Faso	841.56	Ouagadougou	Abidjan	https://en.wikipedia.org/wiki/Ouagadougou
Cameroon	8.05	Douala	Douala	https://en.wikipedia.org/wiki/Douala
Canada	4.83	Quebec City	Quebec City	https://en.wikipedia.org/wiki/Province_of_Canada
Chile	109.14	Santiago	Valparaiso	Campante et al., 2016
Colombia	700.56	Bogota	Barranquila	https://en.wikipedia.org/wiki/Colombia
Congo	379.44	Brazzaville	Pointe-Noire	https://en.wikipedia.org/wiki/Republic_of_the_Congo
Costa Rica	117.08	San Jose	Limon	https://en.wikipedia.org/wiki/Costa_Rica
Dominican Republic	4.83	Santo Domingo	Santo Domingo	https://en.wikipedia.org/wiki/Dominican_Republic
Democratic Republic of Congo	378.25	Kinshasa	Pointe-Noire	https://en.wikipedia.org/wiki/Democratic_Republic_of_the_Congo
Ecuador	276.92	Quito	Guayaquil	https://en.wikipedia.org/wiki/Ecuador
Egypt	181.82	Cairo	Port Said	https://en.wikipedia.org/wiki/Egypt
El salvador	25.20	San Salvador	Coast	https://en.wikipedia.org/wiki/El_Salvador
Ethiopia	556.48	Addis Abba	Djibouti	https://en.wikipedia.org/wiki/Ethiopia
Gabon	4.83	Libreville	Libreville	https://en.wikipedia.org/wiki/Gabon
Gambia	4.83	Banjul	Banjul	https://en.wikipedia.org/wiki/The_Gambia
Ghana	8.05	Accra	Accra	https://en.wikipedia.org/wiki/Ghana
Guatemala	230.31	Guatemala City	Puerto Barrios	https://en.wikipedia.org/wiki/Guatemala
Guinea	20.93	Conakry	Conakry	https://en.wikipedia.org/wiki/Guinea
Guyana	4.83	Georgetown	Georgetown	https://en.wikipedia.org/wiki/Georgetown,_Guyana
Haiti	4.83	Port-au-Prince	Port-au-Prince	https://en.wikipedia.org/wiki/Haiti
Honduras	208.53	Tegucigalpa	La Ceiba	https://en.wikipedia.org/wiki/Tegucigalpa
Hong Kong	4.83	Hong Kong	Hong Kong	https://en.wikipedia.org/wiki/Hong_Kong
India	107.73	Calcutta	Shore line	https://en.wikipedia.org/wiki/Kolkata
Indonesia	4.83	Jakarta	Jakarta	https://en.wikipedia.org/wiki/Indonesia
Ivory Coast	16.10	Abidjan	Abidjan	Campante et al., 2016
Jamaica	4.83	Kingston	Kingston	https://en.wikipedia.org/wiki/Jamaica
Kenya	448.35	Nairobi	Mombassa	https://en.wikipedia.org/wiki/Kenya
Madagascar	213.57	Antananarivo	Toamasina	https://en.wikipedia.org/wiki/Antananarivo
Malaysia	39.94	Kuala Lumpur	Coast	Campante et al., 2016
Mali	694.81	Bamako	Conakry	https://en.wikipedia.org/wiki/Mali
Malta	4.83	Valletta	Valletta	https://en.wikipedia.org/wiki/Malta

Mexico	317.59	Mexico City	Heroica Vera Cruz	https://en.wikipedia.org/wiki/Mexico
Morocco	154.30	Fez	Rabat	https://en.wikipedia.org/wiki/Fez
New Zealand	4.83	Wellington	Wellington	https://en.wikipedia.org/wiki/New_Zealand
Nicaragua	387.87	Managua	Puerto Cabezas	https://en.wikipedia.org/wiki/Nicaragua
Niger	1135.53	Niamey	Abidjan	https://en.wikipedia.org/wiki/Niger
Nigeria	16.00	Lagos	Lagos	Campante et al., 2016
Pakistan	12.88	Karachi	Karachi	Campante et al., 2016
Panama	64.87	Panama City	Coast	https://en.wikipedia.org/wiki/Panama_City
Paraguay	933.41	Asunción	Porto Alegre	https://en.wikipedia.org/wiki/Paraguay
Peru	4.83	Lima	Lima	https://en.wikipedia.org/wiki/Lima
Senegal	4.83	Dakar	Dakar	https://en.wikipedia.org/wiki/Senegal
Sierra leone	4.83	Freetown	Freetown	https://en.wikipedia.org/wiki/Sierra_Leone
Singapore	4.83	Singapore	Singapore	https://en.wikipedia.org/wiki/Singapore
South Africa	8.05	Cape Town	Cape Town	https://en.wikipedia.org/wiki/South_Africa
Sri Lanka	4.83	Colombo	Colombo	https://en.wikipedia.org/wiki/Colombo
Sudan	670.09	Khartoum	Port Sudan	https://en.wikipedia.org/wiki/Sudan
Tanzania	9.66	Dar-es-Salaam	Dar-es-Salaam	Campante et al., 2016
Togo	4.83	Lome	Lome	https://en.wikipedia.org/wiki/Togo
Trinidad	4.83	Port of Spain	Port of Spain	https://en.wikipedia.org/wiki/Trinidad_and_Tobago
Tunisia	11.27	Tunis	Tunis	https://en.wikipedia.org/wiki/Tunisia
Uganda	942.38	Kampala	Mombassa	https://en.wikipedia.org/wiki/Uganda
Uruguay	4.83	Montevideo	Montevideo	https://en.wikipedia.org/wiki/Uruguay
USA	57.93	Washington	Baltimore	https://en.wikipedia.org/wiki/Washington,_D.C.
Venezuela	15.07	Caracas	Caracas	https://en.wikipedia.org/wiki/Venezuela
Viet Nam	72.20	Hanoi	Hai Phong	https://en.wikipedia.org/wiki/Vietnam

Web Appendix 3A: IV Regression with additional controls using a g-estimation procedure using as main explanatory variable Average Protection against expropriation risk, 1985-1995

IV Results	Maternal Mortality[1]	Neonatal Mortality[2]	Infant Mortality[3]	Under 5 Mortality[4]	Skilled Birth Attended[5]	DPT3 Coverage[6]	Measles (MCV) Immunization[7]	OOP[8]	UHC[9]
Average protection against	-1.50**	-0.84**	-0.96**	-1.16**	25.00**	20.65*	20.78*	-14.55	40.75**
expropriation risk, 1985-95	(0.63)	(0.39)	(0.43)	(0.49)	(11.77)	(11.55)	(11.41)	(12.98)	(19.08)
Latitude	-0.85	0.90	0.58	0.61	-32.43	0.45	-7.61	-8.10	55.92
	(1.18)	(0.73)	(0.80)	(0.91)	(21.93)	(21.52)	(21.25)	(24.17)	(56.16)
Malaria	-0.88	0.20	0.10	0.02	35.26	57.24	56.16	-80.70	100.08
	(2.63)	(1.62)	(1.78)	(2.03)	(48.93)	(48.03)	(47.42)	(53.95)	(89.44)
Log($\widehat{GDP}$)	-1.57**	-0.79*	-0.89*	-1.10*	27.34*	22.44	22.59*	-19.82	51.23**
	(0.74)	(0.46)	(0.50)	(0.57)	(13.81)	(13.55)	(13.38)	(15.22)	(23.05)
Total health spending (%GDP)	-0.22	-0.22*	-0.14	-0.14	-1.98	1.36	2.54	-6.73	3.91
	(0.21)	(0.13)	(0.14)	(0.16)	(3.92)	(3.85)	(3.80)	(4.33)	(9.07)
Colonizer (baseline = other)									
British	-0.18	-0.31	-0.36	-0.39	2.26	10.51	10.82	18.64*	-38.39
	(0.47)	(0.29)	(0.32)	(0.36)	(8.70)	(8.54)	(8.43)	(9.59)	(23.54)
French	-0.24	-0.33	-0.36	-0.36	10.32	10.36	8.95	10.87	-20.64
	(0.51)	(0.31)	(0.34)	(0.39)	(9.41)	(9.24)	(9.12)	(10.38)	(25.24)
Spanish	-0.46	-0.40	-0.52	-0.65	16.53	18.39*	22.61**	16.54	-0.56
	(0.54)	(0.33)	(0.36)	(0.42)	(10.05)	(9.87)	(9.74)	(11.08)	(23.72)
Democracy	-0.09	-0.08	-0.07	-0.09	-1.60	2.42	2.57	2.73	5.15
	(0.11)	(0.07)	(0.08)	(0.09)	(2.14)	(2.10)	(2.07)	(2.36)	(4.64)
Official development assistance	-0.01	-0.01**	-0.01*	-0.01**	0.17	0.12	0.12	-0.04	0.10
(% government spending)	(0.01)	(0.00)	(0.00)	(0.00)	(0.11)	(0.11)	(0.11)	(0.12)	(0.24)
Economic globalization	0.03	0.00	0.01	0.01	-0.39	-0.65	-0.68	0.37	-0.42
	(0.03)	(0.02)	(0.02)	(0.02)	(0.56)	(0.55)	(0.54)	(0.62)	(1.07)
Constant	14.96***	9.15***	10.22***	11.66***	-67.43	-53.71	-56.30	117.85	-225.44**

	(3.54)	(2.19)	(2.39)	(2.73)	(65.95)	(64.74)	(63.92)	(72.71)	(109.50)
R^2	0.701	0.688	0.704	0.694	0.671	0.00986	0.160	0.359	0.592
OLS results									
Average Protection against	-0.77***	-0.51***	-0.57***	-0.62***	15.56***	6.28***	6.90***	-8.01***	19.37***
expropriation risk, 1985-95	(0.08)	(0.06)	(0.06)	(0.07)	(2.04)	(1.53)	(1.65)	(2.29)	(4.13)
N	62	62	62	62	62	62	62	62	45

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors are in parenthesis. Source: Data from the World Bank and WHO for 62 former colonies covering the period 2000-2014. All the outcomes are expressed in Logarithms, except those measured as a proportion of the population. Average protection against expropriation risk is on a scale from 0 to 10, where a higher score means more protection against expropriation of private investment by government.
1 - Per 100,000 Live Births, Average (2000-2014); 2 - Per 1,000 Live Births, Average (2000-2014); 3 - Per 1,000 Live Births, Average (2000-2014); 4 - Per 1,000 Live Births, Average (2000-2014); 5 - % of births attended by a skilled health personnel (Latest Available Year); 6 - % of Total Population, Average (2000-2014); 7 - % of Total Population (2000-2014); 8 – Out of Pocket expenditure as % of the budget; 9 - formal health coverage as % of the population. Total health spending is both public and private spending on health measured as a % of GDP. Colonizer dummies measure who the main colonizing power was during the nineteenth century. Democracy is a measure of political rights and civil liberties from Freedom House, measured between 2000 and 2014. Official development assistance measures the aid received by each country between 2000 and 2014, measured as a proportion of government spending. Economic globalization comes from KOF and measures trade flows as well as financial flows.

Web Appendix 3B: IV Regression with additional controls using a g-estimation procedure using as main explanatory variable Proportion of deaths recorded

Covariates	Maternal Mortality[1]	Neonatal Mortality[2]	Infant Mortality[3]	Under 5 Mortality[4]	Skilled Birth Attended[5]	DPT3 Coverage[6]	Measles (MCV) Immunization[7]	OOP[8]	UHC[9]
Comprehensiveness of	-1.87***	-1.17**	-1.33**	-1.57***	31.82**	24.64*	25.05*	-13.73	45.93*
death registration	(0.67)	(0.45)	(0.50)	(0.57)	(13.61)	(12.94)	(12.85)	(14.45)	(22.98)
Latitude	-1.37	0.43	0.05	0.04	-30.01	4.12	-4.07	-3.50	48.03
	(1.07)	(0.71)	(0.79)	(0.91)	(21.72)	(20.64)	(20.50)	(23.07)	(52.56)
Malaria	-1.09	-0.54	-0.80	-0.89	41.89	57.24	56.99	-57.93	77.35
	(2.18)	(1.45)	(1.62)	(1.85)	(44.32)	(42.12)	(41.83)	(47.06)	(83.44)
Log($\widehat{GDP}$)	-1.20**	-0.70*	-0.82**	-1.01**	27.91**	19.94*	20.41**	-13.51	44.82**
	(0.53)	(0.35)	(0.39)	(0.45)	(10.71)	(10.18)	(10.11)	(11.37)	(18.95)
Total health spending (%GDP)	-0.04	-0.08	0.02	0.03	-2.68	0.37	1.57	-7.35	6.27
	(0.21)	(0.14)	(0.16)	(0.18)	(4.31)	(4.10)	(4.07)	(4.58)	(9.28)
Colonizer (baseline = other)									
British	-0.08	-0.22	-0.25	-0.28	1.79	9.75	10.09	17.66*	-36.05
	(0.43)	(0.29)	(0.32)	(0.36)	(8.73)	(8.30)	(8.24)	(9.27)	(22.31)
French	-0.32	-0.40	-0.42	-0.43	10.72	10.47	9.11	10.99	-20.17
	(0.47)	(0.32)	(0.35)	(0.40)	(9.67)	(9.19)	(9.13)	(10.27)	(24.82)
Spanish	-0.21	-0.19	-0.28	-0.39	15.55	16.47*	20.80**	14.88	3.61
	(0.47)	(0.32)	(0.35)	(0.40)	(9.67)	(9.19)	(9.13)	(10.27)	(21.65)
Democracy	-0.12	-0.10	-0.09	-0.12	-1.44	2.50	2.66	2.88	5.30
	(0.11)	(0.07)	(0.08)	(0.09)	(2.23)	(2.12)	(2.10)	(2.36)	(4.52)
Official development assistance	-0.01	-0.01*	-0.01	-0.01	0.16*	0.10	0.10	-0.04	0.13
(% government spending)	(0.00)	(0.00)	(0.00)	(0.00)	(0.10)	(0.09)	(0.09)	(0.10)	(0.22)
Economic globalization	0.03	0.01	0.01	0.02	-0.44	-0.63	-0.67	0.20	-0.29
	(0.03)	(0.02)	(0.02)	(0.02)	(0.53)	(0.50)	(0.50)	(0.56)	(0.99)
Constant	6.73***	4.45***	4.86***	5.23***	67.07***	58.15***	56.20***	42.20**	-14.96
	(0.78)	(0.52)	(0.58)	(0.66)	(15.86)	(15.07)	(14.97)	(16.84)	(34.24)

R^2	0.742	0.687	0.690	0.681	0.661	0.0457	0.181	0.389	0.624
OLS Results									
Comprehensiveness of	-0.97***	-0.65***	-0.72***	-0.79***	19.13***	7.76***	8.59***	-9.86***	23.08***
death registration	(0.09)	(0.07)	(0.07)	(0.07)	(2.47)	(1.85)	(1.99)	(2.80)	(5.30)
N	62	62	62	62	62	62	62	62	45

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors are in parenthesis. Source: Data from the World Bank and WHO for 62 former colonies covering the period 2000-2014. All the outcomes are expressed in Logarithms, except those measured as a proportion of the population. Average protection against expropriation risk is on a scale from 0 to 10, where a higher score means more protection against expropriation of private investment by government.
1 - Per 100,000 Live Births, Average (2000-2014); 2 - Per 1,000 Live Births, Average (2000-2014); 3 - Per 1,000 Live Births, Average (2000-2014); 4 - Per 1,000 Live Births, Average (2000-2014); 5 - % of births attended by a skilled health personnel (Latest Available Year); 6 - % of Total Population, Average (2000-2014); 7 - % of Total Population (2000-2014); 8 – Out of Pocket expenditure as % of the budget; 9 - formal health coverage as % of the population. Total health spending is both public and private spending on health measured as a % of GDP. Colonizer dummies measure who the main colonizing power was during the nineteenth century. Democracy is a measure of political rights and civil liberties from Freedom House, measured between 2000 and 2014. Official development assistance measures the aid received by each country between 2000 and 2014, measured as a proportion of government spending. Economic globalization comes from KOF and measures trade flows as well as financial flows.

Web Appendix 4A: IV Regression using a g-estimation procedure which de-mediates for GDP and total health spending using as main explanatory variable Average Protection against expropriation risk, 1985-1995

IV Results	Maternal Mortality[1]	Neonatal Mortality[2]	Infant Mortality[3]	Under 5 Mortality[4]	Skilled Birth Attended[5]	DPT3 Coverage[6]	Measles (MCV) Immunization[7]	OOP[8]	UHC[9]
Average protection against	-0.61***	-0.45***	-0.52***	-0.60***	1.02	8.84***	6.70***	-5.71**	14.49**
expropriation risk, 1985-95	(0.12)	(0.09)	(0.09)	(0.10)	(2.39)	(2.18)	(2.12)	(2.77)	(6.36)
Latitude	0.47	1.71**	1.56**	1.86**	-42.68**	-21.34	-30.75*	12.11	-56.41
	(0.91)	(0.65)	(0.69)	(0.78)	(18.09)	(16.51)	(16.03)	(21.00)	(45.26)
Malaria	4.26***	2.61***	3.11***	3.97***	-18.63	-39.01***	-36.54**	-1.09	-146.46***
	(0.79)	(0.56)	(0.60)	(0.67)	(15.60)	(14.24)	(13.82)	(18.11)	(42.41)
Constant	10.05***	5.79***	6.62***	7.01***	-61.93***	60.72***	47.05***	96.61***	-45.15
	(0.75)	(0.54)	(0.57)	(0.64)	(14.92)	(13.62)	(13.22)	(17.32)	(38.88)
R^2	0.610	0.527	0.598	0.632	0.0949	0.316	0.214	-0.0357	0.382
OLS results									
Average Protection against	-0.77***	-0.51***	-0.57***	-0.62***	15.56***	6.28***	6.90***	-8.01***	19.37***
expropriation risk, 1985-95	(0.08)	(0.06)	(0.06)	(0.07)	(2.04)	(1.53)	(1.65)	(2.29)	(4.13)
N	62	62	62	62	62	62	62	62	45

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors are in parenthesis. Source: Data from the World Bank and WHO for 62 former colonies covering the period 2000-2014. All the outcomes are expressed in Logarithms, except those measured as a proportion of the population. Average protection against expropriation risk is on a scale from 0 to 10, where a higher score means more protection against expropriation of private investment by government.
1 - Per 100,000 Live Births, Average (2000-2014); 2 - Per 1,000 Live Births, Average (2000-2014); 3 - Per 1,000 Live Births, Average (2000-2014); 4 - Per 1,000 Live Births, Average (2000-2014); 5 - % of births attended by a skilled health personnel (Latest Available Year); 6 - % of Total Population, Average (2000-2014); 7 - % of Total Population (2000-2014); 8 – Out of Pocket expenditure as % of the budget; 9 - formal health coverage as % of the population.
Each dependent variable has been demediated to remove the effect of GDP and total health spending on the outcome.

Web Appendix 4B: IV Regression using a g-estimation procedure which de-mediates for GDP and total health spending using as main explanatory variable Proportion of deaths recorded

Covariates	Maternal Mortality[1]	Neonatal Mortality[2]	Infant Mortality[3]	Under 5 Mortality[4]	Skilled Birth Attended[5]	DPT3 Coverage[6]	Measles (MCV) Immunization[7]	OOP[8]	UHC[9]
Comprehensiveness of	-1.67***	-1.16***	-1.20***	-1.35***	1.26	12.79***	11.81***	-10.67**	35.21**
death registration	(0.23)	(0.16)	(0.17)	(0.19)	(3.59)	(3.28)	(3.27)	(4.21)	(13.52)
Latitude	-2.70**	-0.55	-0.88	-0.92	-39.15**	11.41	-3.48	-11.83	13.38
	(1.08)	(0.75)	(0.77)	(0.86)	(16.63)	(15.18)	(15.12)	(19.49)	(51.01)
Malaria	1.04	0.22	0.35	0.78	-13.21	7.95	-0.97	-31.44	-65.00
	(1.26)	(0.88)	(0.91)	(1.01)	(19.56)	(17.86)	(17.79)	(22.93)	(68.87)
Constant	2.04***	0.44*	1.42***	1.29***	-59.56***	94.54***	87.82***	57.60***	84.79***
	(0.36)	(0.25)	(0.26)	(0.29)	(5.56)	(5.07)	(5.06)	(6.52)	(17.20)
R^2	0.780	0.731	0.744	0.753	0.0965	0.334	0.319	0.105	0.443
OLS Results									
Comprehensiveness of	-0.97***	-0.65***	-0.72***	-0.79***	19.13***	7.76***	8.59***	-9.86***	23.08***
death registration	(0.09)	(0.07)	(0.07)	(0.07)	(2.47)	(1.85)	(1.99)	(2.80)	(5.30)
N	62	62	62	62	62	62	62	62	45

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors are in parenthesis. Source: Data from the World Bank and WHO for 62 former colonies covering the period 2000-2014. All the outcomes are expressed in Logarithms, except those measured as a proportion of the population. Countries are coded as 1 on our measure of the Comprehensiveness of death registration is measured on a 4-point scale as described in the paper.
1 - Per 100,000 Live Births, Average (2000-2014); 2 - Per 1,000 Live Births, Average (2000-2014); 3 - Per 1,000 Live Births, Average (2000-2014); 4 - Per 1,000 Live Births, Average (2000-2014); 5 - % of births attended by a skilled health personnel (Latest Available Year); 6 - % of Total Population, Average (2000-2014); 7 - % of Total Population (2000-2014); 8 – Out of Pocket expenditure as % of the budget; 9 - formal health coverage as % of the population.
Each dependent variable has been demediated to remove the effect of GDP and total health spending on the outcome.