# Where the money flows? Colonial health institutions and hospital contemporary outcomes in the D.R.Congo

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**Abstract**

This paper studies whether historical infrastructure distorts public resource allocation in a low-capacity state. Using newly digitised archival records from the Belgian Congo (1929–1959) matched to administrative data on modern hospitals in the Democratic Republic of Congo, we show that facilities established during the colonial period continue to receive substantially higher central government transfers and attract greater donor support decades after independence. While differences in infrastructure partly reflect inherited capital stocks, funding disparities persist even after accounting for staffing and capacity and do not translate into higher observable service provision. These patterns point to dynamic misallocation driven by institutional embeddedness and fixed costs of engagement, leading governments and donors to rely disproportionately on colonial origin facilities. These findings highlight how limited state capacity can impede reallocation over time, with implications beyond colonial settings for public finance and aid.

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# 1 Introduction

How public resources adjust over time is central to understanding state capacity and economic development. In adaptive public systems, budget allocations should gradually reallocate toward facilities that expand capacity, respond to evolving demand, or deliver higher marginal returns. Yet in many low-income countries, large and persistent disparities in the allocation of health resources suggest limited reallocation, even as needs and constraints evolve. These concerns are particularly acute in the hospital sector, which absorbs a substantial share of scarce public health resources (WHO, 2024).

What explains the persistence of these disparities? Persistence in allocation can arise when reallocation is costly, even as underlying needs evolve, generating durable spatial distortions. In low-capacity states, reallocating funds across providers entails significant administrative and political costs, reflecting constraints in fiscal and bureaucratic capacity (Besley and Persson, 2011). Facilities with established bureaucratic ties reduce the marginal cost of engagement for governments and donors (Finan et al., 2017), creating durable advantages for historically embedded providers. When these engagement costs are large relative to productivity differences, funding may remain concentrated on legacy facilities, even if newer hospitals better match contemporary demand. This mechanism predicts persistent fiscal advantages for inherited infrastructure and misalignment between current allocations and service demand.

This paper studies how large historical investments can generate path dependent patterns of public resource allocation in low capacity states. We leverage the colonial health system of the Democratic Republic of Congo (DRC) as an empirical laboratory to examine how inherited hospital infrastructure continues to shape contemporary government and donor financing. The colonial state undertook extensive and spatially uneven investments in hospitals, beds, and medical personnel during the first half of the twentieth century (Lyons, 2002). These investments created a dense network of facilities embedded in centralized administrative structures. By the eve of independence in 1960, the Congo possessed one of the most extensive medical infrastructures on the African continent (Pepin, 2011). While independence brought fiscal collapse and significant institutional restructuring (Frankema and Buelens, 2013), much of the inherited infrastructure remained in place. This setting allows us to study whether historical capital continues to influence modern fiscal flows under limited state capacity.

Using a newly assembled geocoded dataset that links archival records from the Belgian Congo to contemporary administrative data on the universe of hospitals in the DRC, we trace the evolution of health facilities from their colonial origins to their present-day financing and service delivery. We document large and persistent disparities in the allocation of public resources across hospitals that are not aligned with contemporaneous service provision. Facilities established during the colonial period receive substantially higher government transfers today and maintain significantly larger physical infrastructure. The magnitudes are large: colonial era hospitals receive over 40 percent more central-government funding and have roughly twice the bed capacity of post-independence facilities. While these hospitals inherit larger capital stocks that support higher staffing levels, they continue to receive excess public transfers even after accounting for staffing and infrastructure. Yet these input advantages do not translate into higher observable service provision: total and disease-specific outpatient volumes are remarkably similar across hospital origins once staffing is taken into account.

We show that these results are robust to alternative specifications, matching estimators, and reweighting methods. To address concerns that colonial hospital placement may be endogenous (Jedwab et al., 2022), we implement an instrumental-variable (IV) strategy that exploits historical variation in exposure to sleeping sickness control campaigns, drawing on newly digitised epidemiological maps from the colonial period.[1] Sleeping sickness prevalence was driven primarily by ecological interactions between the parasite, tsetse flies, and human and animal hosts, rather than by colonial economic or administrative priorities (Ford, 1971), and we show that it is orthogonal to pre-existing political and economic characteristics. Moreover, historical disease prevalence does not predict the location of post-independence hospitals or other modern investments. These patterns, together with a battery of robustness checks, support a causal interpretation of the relationship between colonial health investments and contemporary hospital financing.

One could be concerned with the risk of 'compression' of history that would overlook critical periods associated with major structural changes in the political and economic landscapes

[1]We consider sleeping sickness distribution to be the preferred measure for colonial presence over alternative measures. Following Lowes and Montero (2021b), an alternative instrument could use the suitability of the soil for cassava relative to another traditional crop in the Belgian Congo such as maize. While the instrument can predict sleeping sickness, it has a low predicting power for colonial health settlements. Alsan (2015) created a tsetse fly suitability index in Africa, but colonial health authorities in Congo already provided fine grained data on the geographic distribution of tsetse flies, and reported little variations across the country.

(Austin, 2008). To address this concern, we build the first long run series of public financing and health-sector budgets for the DRC and show a sharp and sustained collapse in state financing of health after independence, in contrast to relatively high and stable colonial-era investments. This discontinuity implies that colonial hospitals entered the post-independence period with substantially larger capital endowments than later-built facilities, providing a plausible channel for the persistence of their infrastructural advantage. Our analysis on the channels of persistence rules out any mediating role of economic development, ethnicity, contemporary disease burdens, modern conflict, or local elite capture. We further show that quality of care does not systematically differ across hospitals, and thereby exclude the possibility that the central government strategically targets better working hospitals. Instead, the evidence is consistent with a political economy mechanism whereby colonial investments created hospitals with substantial capital endowments and administrative visibility. We formalise this mechanism in a simple model in which governments allocate resources under administrative frictions, showing that historically embedded facilities receive persistently higher transfers when engagement costs are high. In a context of limited fiscal and bureaucratic capacity, governments and donors continue to direct resources toward these historical nodes, for which the fixed costs of engagement are lowest, even when current marginal returns or needs would justify reallocation. This dynamic reinforced historical advantages: contemporary public spending aligns more with inherited infrastructure than with observable productivity, generating persistent spatial disparities in resource allocation. Thus, the legacy of colonial health investments lies not only in the survival of historical facilities but in the reproduction of an inherited geography of public financing.

From a welfare perspective, persistence matters because it weakens the link between public spending and contemporaneous service provision. Even when formal budgeting rules tie transfers to staffing, historically advantaged facilities embedded within bureaucratic networks may face lower transaction and monitoring costs and continue to absorb a disproportionate share of public resources, potentially crowding out investment in newer hospitals. While colonial hospitals were initially larger and more capital-intensive, the collapse of public financing after independence and subsequent political change could have reshaped allocation patterns. In particular, post-independence governments may have preferred to invest in more recent facilities symbolising the new national identity. The continued funding advantage of colonial-origin facilities therefore reflects not only inherited scale, but institutional embeddedness that sustains path-dependent allocation decisions, with implications for efficiency and spatial equity.

This paper makes three contributions. First, we contribute to the literature on the long run effects of historical shocks and institutional persistence by documenting a form of dynamic misallocation in public service provision. A large number of studies single out the extractive nature of colonial powers in durably affecting health behaviour and mistrust in medicine. In the Belgian Congo, labour coercion and violence disrupted local communities and social structures (Kivilu, 1984; Lyons, 2002). Subsequent work shows persistent negative effects of colonial brutality on anthropometric outcomes (Lowes and Montero, 2021a), trust in modern medicine and disease prevalence (Lowes and Montero, 2021b), and modern HIV burden (Anderson, 2018; Cagé and Rueda, 2020; Denton-Schneider, 2024). Additional studies document positive long run effects of proximity to religious medical missions on health outcomes and practices (Calvi and Mantovanelli, 2018; Fors et al., 2024). While this literature focuses primarily on demand-side behavior and health outcomes, we complement it by studying the supply side of healthcare, showing that colonial investments generated persistent differences in infrastructure and public financing across hospitals. Our results indicate that historical advantages continue to shape resource allocation even when they no longer translate into higher observable service provision.

Second, our findings speak directly to the literature on state capacity and the persistence of historical investments in infrastructure. Prior work documents long lasting effects of large scale infrastructure investments on economic activity and service provision (Bleakley and Lin, 2012; Chung et al., 2017; Donaldson, 2018; Huillery, 2009; Jedwab et al., 2017; Mitrunen, 2024). In the health sector, Chung et al. (2017) show that postwar hospital construction in the United States led to sustained increases in capacity and utilisation, while Hollingsworth et al. (2024) demonstrate that hospital expansion generated enduring mortality reductions through the diffusion of modern medicine. We extend this literature by showing that in low-income, capacity-constrained settings, large initial investments in hospitals can generate even longer lived effects, not only on physical infrastructure but also on public financing. We argue that limited fiscal and administrative capacity in the postcolonial period constrained the development of newer facilities, while fixed costs of engagement led both governments and donors to rely disproportionately on historically embedded institutions. Donor behaviour reinforces this pattern, suggesting that legacy hospitals lower the fixed costs of implementing, monitoring, and coordinating aid projects.

Third, while colonial history provides our empirical setting, the mechanism we identify extends beyond colonialism. A broad literature shows that initial conditions and factor endowments play a central role in shaping long run institutional and economic development (Acemoglu et al., 2001; Dell, 2010; Jedwab et al., 2022; Nunn, 2014; Sokoloff and Engerman, 2000).[2] Colonial investments in public goods have been shown to generate both negative and positive long run effects, depending on context (Dell and Olken, 2019; Huillery, 2009; Iyer, 2010; Wantchekon et al., 2015). Our results suggest that coordination around existing investments, rather than their original extractive purpose, can be a key channel of persistence. More broadly, we document a dynamic misallocation that may arise whenever large sunk investments interact with limited state capacity, a mechanism that is relevant well beyond colonial settings.

The focus on the Belgian Congo provides an opportunity to examine the effect of a colonial regime covering a vast spatial territory, beyond the comparatively more studied French and British colonial rules. Furthermore, no studies have, to our knowledge, explored the effects of colonialism on modern hospital outcomes. Our novel dataset allows us to estimate directly the persistence of colonial effects at the granular level and avoid losing information through data aggregation.

The roadmap of the paper is as follows. Section 2 provides historical background on the DRC and its health system. Section 3 posits explanations to understand the long run effects of colonial settlements. Section 4 describes the data and the geographical analysis. Section 5 presents the long run effects of colonial legacy. Section 6 explores multiple alternative channels for the results, and Section 7 concludes.

## 2 Background

### 2.1 Colonial health investments

Belgian colonial rule established both the administrative structure and the physical footprint of Congo's modern health system. Although the Congo Free State (1885–1908) invested almost nothing in public health, the Belgian state gradually built a more formal medical apparatus once it assumed control in 1908.[3] Large-scale interventions began only in the 1920s, with the outbreak of sleeping sickness, or Human African Trypanosomiasis (HAT), a disease transmitted through the bite of the tsetse fly. To address the disastrous effect of the disease on local populations, colonial authorities, working with Catholic and Protestant missions and with medical services financed by large firms, created mobile treatment teams, expanded disease

[2] For a thorough review of this literature, see Michalopoulos and Papaioannou (2020).
[3] There were 2 doctors in 1896 in the Congo Free State, and 30 by 1908 (Lyons, 2002).

surveillance, and opened the first facilities dedicated to Indigenous populations (Lyons, 2002). These initiatives were not motivated by broad welfare concerns but by the need to preserve a productive workforce, and health provision remained highly unequal across racial lines. Although all medical care was free of charge, the distribution of health services was highly uneven, with the best and most expensive care restricted to Europeans (Figures A1 and A2 in Online Appendix). On the other hand, the provision of health care for the native Congolese population was rudimentary and primarily geared towards a healthy and productive labour force required for both colonial health and economic concerns (Hunt, 1999). Nevertheless, the campaigns laid the initial geographic foundation of the public health network.

The more transformative phase of expansion occurred after World War II. Supported by strong economic growth and Belgian-backed fiscal surpluses, the colonial administration launched the Van Hoof-Duren Plan (1949–1959), an ambitious public investment program covering infrastructure, education, and health. Its health component sought to build a coordinated, tiered system: rural medico-surgical centres supported by surrounding dispensaries, and major hospitals in urban areas offering higher-level services (Duren, 1953). Implementation progressed rapidly. By the end of the colonial period the territory hosted nearly 3,000 facilities, including close to 300 general referral hospitals, more than 50,000 beds, and a large network of dispensaries (Ministry of Colonies, 1958). Relative to the rest of SSA, Congo emerged with one of the most extensive medical infrastructures on the continent (Pepin, 2011). This infrastructure continues to form the backbone of the present hospital network, and its spatial distribution generates significant variation in historical exposure to health investments.

### 2.2 Post-independence evolution of the health system

Independence in 1960 disrupted this system abruptly. The rapid departure of foreign administrators and medical personnel, combined with political fragmentation and secessionist conflicts, immediately weakened state capacity. During the 1970s and 1980s, macroeconomic instability, driven by declining copper prices, debt accumulation, and the effects of nationalisation, further constrained government budgets (IBRD, 1973). Health expenditures fell, maintenance of the colonial-era network was deferred, and several previously controlled endemic diseases resurged. Service delivery became increasingly fragmented across public facilities, mission providers, firm-run clinics, and private dispensaries operating with little coordination (World Bank, 1987).

The prolonged conflicts of the 1990s and early 2000s deepened the deterioration (Nest et al., 2006). Many hospitals suffered damage or abandonment; supply chains for drugs and equipment collapsed; and skilled health workers faced irregular and declining remuneration (MSP, 2011). Although the political settlement after 2003 restored territorial control and some administrative coherence, public investment remained limited. Even today, many facilities operate with severely degraded infrastructure (Figure A3 in Online Appendix), relying on intermittent donor support and local coping strategies (MSP, 2011). Further historical details appear in the Online Appendix Section A.

### 2.3 Contemporary system organisation

Donor programs partially compensate for the lack of domestic resources, but coordination is limited, and support varies substantially across regions and providers. This contributes to wide disparities in drug supply, equipment availability, and staffing conditions across hospitals (Brunner et al., 2019). Health workers in hospitals are normally paid by the government, and their wage comprises a salary and occupational risk allowance (*prime de risque*). However, only workers with a matriculation number can be enrolled in government payroll and thus receive a government salary. The risk allowance, by contrast, is distributed outside formal payroll systems and is therefore extended to a broader set of health personnel. Low and delayed salary payments, along with frequent non-payment of the risk allowance are frequent in the DRC (Fox et al., 2014; Bertone et al., 2016). Consequently, many health workers rely heavily on a local allowance collected from consultation fees. The contemporary system is organised around 26 provincial health departments and 516 health zones, but the effective responsibilities of each tier are shaped by financial constraints and the uneven distribution of external support. Additional institutional details are provided in the Online Appendix A.3.

## 3 Evolution of public finances and health care provision

### 3.1 Persistence of colonial health infrastructure

Colonial health infrastructure may matter today through two related channels. First, independence was followed by a sustained reduction in the state's fiscal and administrative capacity. The loss of Belgian personnel, coupled with political instability, corruption, and fragmentation of donor support, sharply limited the ability of the postcolonial government to maintain or expand the inherited hospital network (Vanthemsche, 2012). These shocks reduced its capacity to sustain public investment, decreasing both the quantity and quality of hospital infrastructure.[4]

Second, maintaining a colonial-era network of relatively effective hospitals — built through large sunk investments — may have become less costly at the margin after independence. While colonial governments financed health through substantial public spending and customs-based taxation (Gardner, 2013), the postcolonial state faced fiscal collapse and recurring crises that severely constrained healthcare funding (Frankema and Buelens, 2013).

The rise in Development Assistance for Health (DAH) in the DRC since 2008 (Figure A4 in Online Appendix) could challenge these assumptions if external funding had been primarily directed toward health infrastructure development. However, available evidence indicates that DAH has largely focused on supporting operational aspects of hospitals, particularly in the area of infectious disease control, while contributing only marginally to the upgrading of existing health facilities (World Bank, 2021). Consistent with this pattern, only four hospitals in our dataset were constructed after 2008, when DAH rose substantially. These observations motivate our examination of how historical investments continue to shape contemporary hospital infrastructure and financing.

### 3.2 Historical patterns of public finances

Extensive historical evidence indicates that the colonial administration operated under substantially stronger fiscal capacity than the post-independence state (Vanthemsche, 2012). Given the major political and economic disruptions that followed independence, it is essential to document how the state's revenue base and spending priorities evolved over time, as these shifts likely shaped the ability to maintain or replace inherited health infrastructure. We therefore assemble long run series on public revenues, expenditures, and health-sector allocations to characterise the trajectory of fiscal capacity in the DRC. Details on data construction are provided in Online Appendix C.

The Great Depression and World War II led to temporary contractions in health spending, which resumed an upward trajectory during the late colonial period. A similar pattern of colonial medical expenditures has been found in the French and British colonial administration (Vrooman, 2023). During the 1940s and 1950s, health expenditures represented a stable share of the budget, supported by relatively effective revenue collection and access to external borrowing.

[4]Similar investment patterns occurred across Africa following the fall of colonial regimes (Barnum, Kutzin, et al., 1993).

Figure 1 shows that domestic health spending fluctuated between 8 and 13 percent of the budget in the final decades of colonial rule.

Independence in 1960 produced an immediate and sharp fiscal contraction. Public revenues collapsed, health workers reportedly went unpaid, and the share of health spending fell close to zero (EEC, 1963). Although revenues temporarily recovered in the late 1960s, mainly through mineral exports, this improvement proved short-lived. The decline in copper prices in the 1970s durably reduced the state's revenue base, and high inflation further eroded real fiscal capacity (Bension et al., 1980). As shown in Figure A6 in Online Appendix, the revenue-to-GDP ratio deteriorated steadily, mirroring patterns documented in other resource-dependent African economies (Cogneau et al., 2021).

Importantly, periods of rising national income did not translate into increased funding for the health sector (Figure A5 in Online Appendix). Throughout the post-independence period, government expenditures were reallocated toward political and military priorities rather than health (World Bank, 1987). Even during periods of improved fiscal capacity, the share of resources directed to health remained flat. This pattern suggests that the long run underinvestment in health reflects not only fiscal scarcity but also a persistent de-prioritisation of the sector. The combination of declining revenues and shifting spending priorities produced a prolonged shortfall in public investment in health infrastructure, leaving much of the colonial-era network without substantial replacement or upgrading.

### 3.3 Composition of health financing

Public financing of health care in the DRC is extremely limited: government health spending has remained below 5 percent of the national budget since independence (Figure 1). As a result, the health system relies heavily on development assistance and user fees, while government salary payments to health workers are often irregular and incomplete. This financing structure amplifies the importance of central government transfers and external aid in shaping hospital resources and incentives.

### 3.4 Evolution of hospital resources

After independence, a sudden exodus of European health personnel (Figure A7 in Online Appendix) temporarily reduced the number of health workers in the country. However, the share of medical personnel in the total population recovered in the early 1970s and has continued to grow with a similar trend as the one observed during the colonial period. On the other hand, the number of beds per 1,000 has sharply decreased since independence, indicating that only limited capital investment was made in building new hospitals or health centers to address population growth (World Bank, 2021). This evidence further supports the view that much of donor-driven investment has been targeting operational costs, supply chains, and vertical programmes, rather than the expansion of infrastructure.

# 4 Data

We construct a novel dataset linking modern administrative records on hospitals in the DRC with historical information on colonial health facilities. Below we briefly summarise the main sources; details on data construction are provided in Online Appendix Section B.1.

## 4.1 Sources

**Colonial status.** The treatment variable indicates whether a modern hospital traces its origin to a health facility operating during the colonial period. We compile a complete inventory of colonial hospitals and dispensaries using a series of geocoded maps produced by the Belgian Ministry of Colonies between 1929 and 1959. These maps report the location, type of facility, population served, and ownership (state, missions, or private companies). Additional archival materials, including maps from the *Fondation Reine Elisabeth pour l'Assistance Médicale aux Indigènes*(Foreami) and a 1929 register of Christian missions, supplement this information. We match these historical facilities to modern hospitals using geographic coordinates and names. Importantly, colonial origin is assigned only when a post-independence hospital can be uniquely and independently verified as matching a documented colonial facility. Hospitals without such verification are conservatively coded as post-independence, even though some may in fact have colonial origins.

**Modern hospital data.** Contemporary hospital outcomes are obtained from the District Health Information System (DHIS2), a routine web platform managed by the Congolese Ministry of Health, that provides monthly financial and epidemiological data for all registered health facilities in the DRC between January 2017 and December 2021. Lordemus (2022) provides an introduction to these data. Following the Ministry of Health classification, we restrict the sample to hospitals, defined as facilities offering at least surgery, paediatrics, general medicine and gynaecology-obstetrics departments. Each modern hospital is then assigned a colonial or postcolonial origin based on the geographic matching described above.

### 4.2 Outcome variables

We examine three categories of outcomes. First, to measure hospital infrastructure, we use a facility's total bed capacity. Second, we capture public financing using the annual amount of government transfers received by each hospital. These transfers cover personnel-related expenditures, including salaries and occupational risk allowances, and are recorded for public, faith-based, and private facilities.[5] The data report the annual amount received by each hospital. The number of health workers employed in a hospital should then strongly predict government transfers. Finally, to assess service provision, we use hospital-level counts of outpatient and inpatient admissions, emergency department visits, and the number of patients treated for severe malaria and severe diarrhea. These indicators reflect the main categories of hospital-based service delivery in the DRC (Ouma et al., 2018). Like most administrative health data in low-income settings, DHIS2 outputs may be subject to classical measurement error. Our multiple measures of service provision ensure that our conclusions do not hinge on any single noisy outcome measure.[6]

All outcomes are constructed as averages over monthly observations from January 2017 to December 2021, based on administrative data from the DHIS2 system.[7]

### 4.3 Control variables

We control for a rich set of hospital and location-level characteristics that may jointly influence historical placement, contemporary infrastructure, and public financing.

**Geographic characteristics.** Baseline specifications include detailed geographic controls capturing accessibility, ecology, and spatial heterogeneity. These comprise distance to major cities, rivers, and railways; elevation and terrain ruggedness; and indicators for ecological

[5]Salary payments represent the vast majority of government transfers, accounting for roughly 98% of the total (World Bank, 2021). Top-up payments from locally collected fees are not included in these figures (Bertone et al., 2016).

[6]Household survey data such as the Demographic Health Surveys do not allow us to study health outcomes at the level of individual hospitals in the DRC. DHS surveys do not identify the specific facilities used by respondents, cluster locations are spatially displaced for confidentiality, and observed outcomes reflect multiple layers of care rather than hospital-specific inputs or performance. These limitations are particularly severe in urban areas with dense hospital networks and overlapping catchment areas.

[7]Results are robust to using medians and to applying Correlated Random-Effects models to the panel structure of the data.

zones. We further include province fixed effects and geographic coordinates to flexibly absorb unobserved spatial variation and regional differences in administrative capacity and public investment.

**Health staff.** Staffing is measured by the total number of health workers employed at each hospital. The dataset distinguishes three categories of nurses (by qualification level) and two categories of physicians (general and specialist). Because job responsibilities and specialisation boundaries vary across facilities, and since individual physicians often divide their time across multiple workplaces, we aggregate all categories into a single measure of total health workers.[8]

**Population and ownership.** Population in each hospital's catchment area is proxied by the population of its health zone. Historical population density is obtained from colonial maps. We classify modern hospitals as public, faith-based, or private using administrative data, and identify the corresponding ownership of colonial facilities (state, missions, or private companies) from archival records.

### 4.4 Final sample

The final sample comprises 1,393 modern hospitals of which 302 can be linked to a facility operating during the colonial period. We exclude from the data sample the largest hospital in the country, Kinshasa General Referral Hospital, whose financial and structural capacities largely outperform the rest of the data sample.[9] Figure 2 displays the locations of all colonial and post-colonial hospitals that could be geo-localised. Approximately 20 percent of modern facilities could not be geo-referenced; these are small, recently constructed structures located mainly in rural areas.[10] Colonial and post-colonial hospitals differ along several observable dimensions. Online Table A1 reports summary statistics for both groups. Post-colonial hospitals are more likely to be privately owned, located closer to urban centres, and operate with smaller infrastructure. By contrast, about two-thirds of colonial hospitals are publicly owned and nearly one-third are faith-based. These imbalances motivate the matching and permutation procedures presented in the following section.

Table A2 in Online Appendix compares ownership in 1959 and today. While the share of faith-based hospitals has remained relatively stable, the share of hospitals owned by private

[8] Results are robust to distinguishing nurses and physicians as separate aggregates.
[9] The results remain qualitatively robust to the inclusion of Kinshasa General Hospital.
[10] The province and health zone of these facilities can be identified. As shown in the next section, our main results remain robust to including these facilities in the analysis.

firms shrinks from almost 20% in 1959 to 5% in present days, mostly through a reconversion to public ownership. We also examine the extent to which colonial hospitals recorded in 1959 can be matched to modern facilities. Approximately 15% cannot be matched by either name or location and are classified as lost; an additional 11% cannot be verified with certainty due to missing or inconsistent historical coordinates, leaving some uncertainty regarding their colonial status (Online Appendix Table A3). Unmatched colonial hospitals are equally likely to be located in resource-rich areas but tend to be more remote and more frequently privately owned than matched colonial hospitals (Online Appendix Table A4). We discuss below how these cases are handled in the IV and robustness analyses. Importantly, unmatched facilities arise exclusively from colonial hospitals; postcolonial hospitals are never misclassified as colonial. As a result, any misclassification is one-sided and mechanically biases estimated effects toward zero. These matching losses reflect post-independence closures or institutional transformations rather than uncertainty about colonial origin. Finally, Online Appendix Table A5 show that, at the intensive margin, investments measured by bed capacity were strongly associated with population density during the last decade of the colonial era, consistent with patterns documented for mission settlement (Jedwab et al., 2022).

## 5 Long Run effects of colonial health settlements

We begin by estimating whether hospitals with a colonial origin differ systematically in contemporary government transfers and bed capacity. A key concern is that historical and geographic factors that shaped the location of the colonial enterprise, may also influence modern hospital performance, generating spurious correlations (Good, 1991; Jedwab et al., 2022). To address this, we control for a rich set of historical and geographic covariates, allowing comparisons between facilities operating in similar environments. Under this specification, any remaining association between colonial origin and modern outcomes is unlikely to be driven solely by locational advantages. Second, we demonstrate the strength of our results with propensity score matching. Third, we assess the plausibly causal effect of colonial settlement with the instrumental variable approach that relies on the geographic distribution of sleeping sickness during the colonial period.

### 5.1 Relationship between colonial legacy and facility performance

We start by estimating the reduced-form relationship between colonial health investments and contemporary health facility performance using Ordinary Least Square (OLS) regressions. The cross-sectional equation is

$$\mathbf{Y}_{ij} = \alpha_j + \beta Colonial_{ij} + \mathbf{X}^{'}_{ij}\gamma + \epsilon_{ij} \tag{1}$$

where $\mathbf{Y}_{ij}$ denotes the outcome of interest for hospital $i$ in province $j$, $Colonial_{ij}$ is an indicator equal to one if the facility originated during the colonial period. Provincial fixed effects $\alpha_j$ absorb all province-level factors affecting hospital performance. The coefficient of interest $\beta$ captures the conditional association between colonial origin and contemporary outcomes. The vector $\mathbf{X}^{'}_{ij}$ includes hospital characteristics and geographic controls.

We account for historical geographic controls including elevation, distance to the provincial capital, distance to historical transportation networks (railway, road or navigable river), hospital latitude and longitude, population density in 1951,[11] soil suitability for cassava,[12] and an indicator for colonial-era resource exploitation. The last three variables are measured at the health-zone level and assigned to all hospitals located within the same zone, reflecting characteristics of the local environment rather than hospital-specific attributes. We further control for modern geographic factors with distances to the nearest pharmaceutical distribution center, the nearest hospital, and recent armed conflict. We also control for local malaria transmission intensity using the median *Plasmodium falciparum* parasite rate (PfPR) from 2017–2018, obtained from the Malaria Atlas Project.[13] All continuous variables are entered in logarithms.[14] To account for the heterogeneity across the 26 provinces in the country and the correlation of hospital performance within provinces, standard errors are clustered at this administrative level.

In our baseline specification, we exclude current staffing, bed capacity, and catchment population, which are themselves outcomes of colonial investments and contemporary political

[11] Although the estimates are well documented at the subnational level in the colonial reports, we acknowledge the caveat that population density during the colonial time was likely underestimated (Frankema and Jerven, 2014). We establish the robustness of our results to using population density in 1800 from the History Database of the Global Environment (HYDE).

[12] Cassava was the leading crop production in Belgian Congo.

[13] PfPR measures the share of children aged 2–10 carrying the parasite. Annual rasters at 5 km resolution are provided by the Malaria Atlas Project.

[14] Results are similar using the inverse hyperbolic sine transformation.

processes. The coefficient on colonial origin thus captures the total effect of historical health investments on modern transfers. Because government transfers are formally tied to the wage bill, our policy-relevant object is whether colonial-origin hospitals receive higher transfers net of staffing differences. In subsequent specifications and mechanism analyses, we introduce staffing and infrastructure to study allocation after accounting for these margins. Whenever staffing or bed capacity is included, the resulting coefficients should be interpreted as mechanical decompositions of the total effect rather than causal estimates conditioning on predetermined inputs.

### 5.1.1 Main Results

Table 1 reports the baseline estimates for six outcomes: bed capacity, government transfers, total admissions, severe malaria cases treated, severe diarrhea cases treated, and emergency department visits. All specifications include the full set of geographic controls and provincial fixed effects. For each outcome, we first report OLS specifications that omit potentially endogenous hospital characteristics such as staffing, ownership, and current catchment population, and then introduce these variables selectively to study allocation net of input differences (except for bed capacity). Full coefficients on all covariates are reported in Online Appendix Table A6. To better compare the magnitudes across the specifications, we report the standardised beta coefficients. Colonial origin is strongly associated with all hospital outcomes. The largest associations are found for bed capacity and government transfers: a one standard deviation (SD) predicts 0.43 more beds and 0.38 SD more transfers. Associations for health service outputs are smaller, ranging from 0.16 and 0.25 SD. Adding catchment population and ownership slightly attenuates the colonial effect for transfers and health services.[15]

We then add staffing and interpret the remaining coefficient on colonial origin as an estimate of the residual or excess funding associated with colonial origin. The coefficient on colonial origin falls by almost 70%, indicating that much of the legacy effect operates through higher staffing, but it remains positive and statistically significant. Colonial-origin hospitals still receive 51% more in transfers, indicating that colonial status is associated with budgetary advantages beyond those justified by staffing.[16] By contrast, once staffing and geographic factors are included,

[15] Estimates for health services when controlling for local population and ownership do not significantly change the results and are omitted to save space.

[16] The dependent variable is log-transformed and $Colonial_{ij}$ is a dummy variable. Hence, a one unit change

colonial origin has little or no association with contemporary health production, except for severe malaria treatments (in the following subsection, we show that this last result is not robust to alternative empirical strategies). In particular, emergency visits and diarrhea treatments are statistically similar across colonial and post-independence hospitals after controlling for staff. This similarity indicates comparable technical efficiency in the use of given inputs, but does not justify the substantially higher funding levels allocated to colonial-origin facilities. The asymmetry between large differences in financing and limited changes in service provision after holding observed inputs fixed points to persistent allocative misalignment in the public hospital network rather than differences in hospital productivity.

### 5.1.2 Robustness

We assess the robustness of the baseline OLS estimates along several dimensions.

**Alternative estimators.** Since outcomes may be jointly determined, we estimate a Seemingly Unrelated Regressions (SUR) system using Generalised Least Squares (GLS). As shown in Online Appendix Table A7, the coefficients on colonial origin are slightly lower but remain positive and significant for all outcomes.

**Inference.** Next, we examine a range of corrections for potential misspecification of the error structure. Standard errors clustered at the provincial level are complemented with wild cluster bootstrap procedures suitable for few clusters (Cameron et al., 2008). To further account for spatial distortions causing low standard errors (Conley and Kelly, 2025), we apply the Moran test for spatial autocorrelation in residuals. The related $p$-values in Online Appendix Table A8 suggest that the colonial effect is unlikely driven by spatial noise. Next, we test for spatial autocorrelation in residuals and implement Conley (1999) standard errors using distance cutoffs from 100 to 1,000 km (Colella et al., 2018). Across all approaches (Online Appendix Tables A8 and A9), estimates on colonial origin remain stable.

**Geolocation uncertainty.** Some hospitals could not be geocoded, raising concerns about selection into the analytical sample. Online Appendix Table A10 shows that results are unchanged when (i) excluding all geographic controls in the main sample (Panel A) or (ii) including hospitals without coordinates (Panel B).

**Omitted variables.** Next, we assess the sensitivity of the baseline estimates for bed capacity and government transfers to selection on observables using the methods of Oster (2019) and

in $Colonial_{ij}$ leads to $(exp(\beta - 1)) \times 100$ percent on the dependent variable.

Diegert et al. (2024). Online Appendix Tables A11 and A12 show that coefficients on colonial origin remain stable as progressively richer sets of geographic controls are added (distance to coast, electrical infrastructure, slope, and the suitability indexes of cotton and rubber). The breakdown point estimates suggest that selection on unobservables would need to be of comparable magnitude to selection on observed covariates to overturn the baseline effects for both outcomes (see Online Appendix subsection D.1 for more details). Given the wealth of our geographical and historical level data, such a degree of unobserved selection appears unlikely. We nevertheless explore additional identification strategies in the following sections.

**Functional forms and missing observations.** Government transfers are either reported with a non-negative value or recorded as missing in our data.[17] To distinguish between the true zeros and the missing values, we assign zeros to hospitals with perfect reporting completeness (the extent to which a minimum set of indicators, defined by the Ministry of Health, is reported). The assumption is that the true zero values for government transfers are most likely to be attributable to hospitals with a perfect completeness score. Columns 4 and 5 in Online Appendix Table A11 shows that the estimated effect of colonial origin on government transfers remains positive and statistically significant when using Poisson regressions, which accommodate a large mass of zeros. By contrast, linear probability models indicate no effect on the extensive margin, suggesting that colonial origin affects the level of transfers received rather than the probability of receiving transfers. These results confirm that the baseline findings are not driven by functional-form assumptions or the handling of missing observations.

**Panel structure.** As an additional robustness check, we exploit the panel structure of the data and estimate Correlated Random Effect (CRE) models following Mundlak (1978), augmenting the random-effects specification with hospital-level averages of time-varying inputs (Online Appendix Table A11, panel C). This approach allows unobserved hospital characteristics to be correlated with observed covariates (Wooldridge, 2010). Because staffing lies on the causal pathway from colonial investments to contemporary outcomes, the estimate does not recover the total effect of colonial origin, but assesses whether the residual association between colonial origin and government transfers persists once long run staffing patterns are flexibly controlled for. The magnitude is smaller than the baseline OLS but remains positive and statistically significant, indicating that colonial-origin hospitals receive higher transfers even after accounting for both contemporaneous staffing and persistent differences in staffing levels.

[17] For most of the variables, zero values are not stored in the DHIS2.

**Subsamples.** We further demonstrate that results are not driven by Kinshasa or by provinces affected by Ebola outbreaks or armed conflict. Sequentially excluding each of these regions leaves the estimated effects largely unchanged (Online Appendix Table A13).

**Permutation tests.** Online Appendix Figure A8 performs permutation tests for government transfers and bed capacity, where we randomly reassign the colonial status of hospitals and re-estimate equation (1), with 1,000 replications. The intuition behind the test is that treatment effects of similar magnitudes should not be estimated in cases where hospitals do not have a colonial origin. The results rule out spuriously correlated effects: for both government transfers and bed capacity outcomes, the graphs show that the distributions of these estimated placebo effects are well outside the effect size of the actual treatment.

**Data quality.** A potential concern is that colonial-origin hospitals may report administrative data more accurately or completely, which could mechanically generate higher measured transfers or infrastructure. To address this, we test whether colonial-origin facilities systematically report higher-quality administrative data (see Online Appendix Section D.2). Multiple indicators (i.e., completeness, internal consistency, and reporting of transfers) show that the colonial status of hospitals does not a meaningful impact on these quality outcomes (Online Appendix Tables A14, A15, and A16). We further interpolate missing values with different simulation exercises, and show that the colonial effect on government transfers remains sizeable, which reinforces our confidence that underreporting does not drive our results (Online Appendix Table A17). A remaining concern is that some hospitals classified as postcolonial may in fact originate from colonial facilities that cannot be linked to archival records. We address this by conservatively reclassifying a corresponding share of postcolonial hospitals as colonial under worst-case assignments that minimise the colonial–postcolonial gap. The estimated colonial effect is attenuated but remains qualitatively similar ((Online Appendix Table A17).

## 5.2 Matching estimation

While the OLS derives a functional relationship between the outcome and observed facility characteristics, our second approach uses propensity score matching, comparing colonial and post-colonial hospitals, to allow for complex interactions. Online Appendix E provides supportive evidence for the validity of the matching estimation.

Table 2 reports the Average Treatment effects on the Treated (ATT), comparing colonial-origin hospitals to observationally similar post-independence facilities. The first two raws of

Panel A reports matching estimates using the biased-corrected method proposed by Abadie and Imbens (2011) with one and three nearest-neighbour respectively. The third row presents results obtained using entropy balancing Hainmueller (2012), implemented as in Hainmueller and Xu (2013), where the weights of the post-independence hospitals are adjusted to match the mean and the variance of the covariates of colonial hospitals. Across methods, the estimated effect sizes associated with colonial origin remain comparable to the baseline OLS estimates. Panel B reports conditional matching estimates that explicitly account for contemporary inputs. The first row imposes exact matching on quintiles health worker size, and identifies nearest neighbours within each quintile using baseline covariates and geographic coordinates. The second raw imposes exact matching on hospital type (referral vs. non-referral), and the third raw adds staffing into the entropy balancing algorithm. For government transfers, the conditional matching estimates consistently indicate that colonial-origin hospitals receive higher funding even when compared to post-independence hospitals with similar staffing levels and hospital types. For service provision, by contrast, the conditional estimates show no systematic differences across hospital origins, suggesting that colonial hospitals do not deliver more services per worker. Taken together, the matching results reinforce the interpretation that persistent differences in financing are not driven by observable differences in inputs or scale, while differences in service provision largely vanish once inputs are held constant.

### 5.3 Instrumenting the colonial origin

We further gauge causality by addressing the potential endogeneity of the colonial presence through an instrumental variable approach to estimate equation (1). We instrument colonial settlements with the historical geographic distribution of the burden of sleeping sickness. Sleeping sickness attracted substantial medical attention from colonial authorities and strongly influenced the location of early medical campaigns and health facilities (Duren, 1953). At the same time, the geographic spread of the disease, driven by ecological interactions between humans, tsetse flies, and wildlife, was highly irregular and not anticipated by colonial administrators (Franco et al., 2014; Lyons, 2002). This generates plausibly exogenous variation in the intensity of colonial medical activity across space.

To operationalise this idea, we exploit the reporting from public health archival data of the geographic distribution of sleeping sickness during the colonial period, where the infection rate is at least equal to 1%.[18] Aggregating information across years serves two purposes. First, early reporting was incomplete in parts of the western Congo, making single-year measures unreliable. Second, colonial health campaigns altered local disease dynamics over time (Lyons, 2002), so combining maps provides a more comprehensive measure of underlying exposure. The resulting indicator captures geographic areas that experienced a substantial disease burden and were therefore more likely to attract medical interventions and the establishment of colonial health facilities. Online Appendix Figures A9 and A10 illustrate the distribution of sleeping sickness and its strong spatial correlation with colonial health settlements. A full historical discussion of the disease, reporting systems, and public health responses is provided in Online Appendix Section A.1.

We estimate the following first-stage equation:

$$Colonial_{ij} = \delta Sleeping_{ij} + \theta X^{'}_{ij} + \nu_{ij} \tag{2}$$

where $Sleeping_{ij}$ is a dummy variable defined at hospital location and equal to 1 if hospital $i$ is located in an area where the infection rate was reported greater than 1% at least once during the last three decades of the colonial period - which coincides with the expansion of public services. The fitted values are then used as explanatory variables for the indicator of colonial origin in equation (1).

Table 3 reports the instrumental-variable estimates. Panel A presents the first-stage results, Panel B the reduced-form estimates, and Panel C the 2SLS specifications. Historical sleeping sickness exposure is a strong predictor of colonial medical settlement: hospitals located in historically affected areas are more than 60 percent more likely to have been established during the colonial period. The Kleibergen–Paap F-statistics exceed 200 across specifications, indicating a strong first stage. The reduced-form estimates reveal a clear pattern. Historical sleeping sickness exposure strongly predicts modern hospital inputs (bed capacity and government transfers) but has a weaker relationship with service provision. Moreover, the reduced-form association with service volumes disappears once we condition on staffing, indicating that any effect of the instrument on service provision operates primarily through increased health-worker inputs rather than higher productivity per worker.

[18]This arbitrary threshold aims to consider only geographic areas where the burden of sleeping sickness became significant. The archival maps also report the areas where the infection rate is less than 1%, but without further information about the number of identified cases, we cannot claim that they significantly impacted the location of colonial settlements.

The 2SLS estimates reinforce this interpretation. Colonial origin has large and statistically significant effects on hospital inputs: a one standard-deviation increase in colonial medical settlement exposure raises bed capacity by 0.52 SD and government transfers by 0.46 SD. These magnitudes are comparable to, and in some cases larger than, those documented in related studies on the long run effects of colonial health interventions (e.g., Calvi and Mantovanelli, 2018; Lowes and Montero, 2021b). By contrast, estimates for service provision are smaller and not consistently statistically significant.

The 2SLS estimates are systematically larger than their OLS counterparts, though Wu–Hausman tests provide only limited evidence of differences between the two. A plausible explanation is attenuation bias in OLS due to misclassification of hospital origin: while colonial records list 408 health facilities in 1959, we identify only 301 colonial-origin facilities in our data, reflecting name changes and the disappearance or repurposing of some hospitals after independence. In addition, the 2SLS coefficients identify Local Average Treatment Effects for hospitals whose establishment was induced by sleeping sickness exposure. If these "complier" hospitals benefited from particularly large initial investments or differ systematically in geography, IV estimates may exceed average effects. We examine this heterogeneity in the next subsection.

Finally, in separate 2SLS regressions, we show that colonial origin has large and significant effects on both bed capacity and staffing. However, once bed capacity is included, the IV effect of colonial origin on staffing becomes statistically insignificant (Online Appendix Table A18), indicating that higher staffing levels are largely mediated by inherited infrastructure rather than by direct contemporaneous allocation of personnel. Combined with the OLS decompositions that account for staffing, this pattern implies that colonial hospitals inherited larger endowments of physical capital, which supported higher staffing, while still receiving excess government transfers holding observed inputs fixed.

#### 5.3.1 Identifying assumptions and robustness

Our identification relies on the exclusion restriction that historical sleeping sickness exposure affects contemporary hospital outcomes only through its impact on colonial origin facilities. A key threat to our identification is that historical sleeping sickness maps may reflect differential surveillance intensity and colonial administrative capacity, which is itself likely to be persistent and directly related to modern transfers. We address this concern through a sequence of complementary falsification and validation exercises designed to rule out these alternative channels.

**Persistent location advantages.** First, we examine whether historical sleeping sickness exposure predicts the placement of post-independence hospitals. If exposure simply captures time-invariant locational advantages, it should predict hospital placement both before and after independence. We rule out any statistically significant relationship, confirming that the instrument does not capture persistent location advantages (Online Appendix Table A19).

**Placebo outcomes: non-health administrative investments.** A central threat to the exclusion restriction is that sleeping sickness exposure may reflect persistent administrative salience or surveillance capacity rather than underlying epidemic conditions. This hypothesis has a clear testable implication: if exposure captures broader state presence, it should predict non-health administrative investments both during and after the colonial period. We therefore examine its relationship with multiple proxies for non-health state presence, including settlement density, transport infrastructure, night-time lights, proximity to colonial *Force Publique* posts, and distance to post-independence hospitals. Across all proxies, we find precisely estimated zeros, ruling out the interpretation that the instrument proxies for generic administrative reach (Online Appendix Section F.1). Taken together, the one-sided classification error of historical facilities (with unlikely false positives) and the failure of the instrument to predict any non-health administrative investments imply that our estimates, if anything, understate the true effect of colonial medical investments on contemporary resource allocation.

**Selective colonial response.** While the preceding tests suggest that sleeping sickness exposure does not proxy for broad administrative presence, a remaining concern is that colonial medical investments may have responded selectively to disease outbreaks in locations where intervention was logistically feasible. To address this possibility, we construct a shift–share instrument that interacts sleeping sickness exposure with pre-1920 transport routes. Reassuringly, IV estimates using this alternative instrument are quantitatively similar to our baseline results (Online Appendix Table A20), indicating that the findings are not driven by selective colonial response related to transport access or logistical feasibility.

**Direct effects on postcolonial hospitals**. We further conduct placebo tests that examine hospitals built after independence and located in areas historically exposed to the disease ("the never-takers"). If the effects of the sleeping sickness instrument are working through the colonial origin of hospitals, then simply being located in areas exposed to the disease during the colonial era should not predict higher government transfers and bed capacity for hospitals built after independence. Figure 3 plots reduced-form estimates of sleeping sickness exposure on our baseline hospital outcomes, for colonial and postcolonial hospitals. We find no effect for post-independence hospitals, whereas sizeable and statistically significant effects appear only for colonial facilities. This pattern supports the interpretation that the instrument affects modern hospital outcomes through colonial hospital establishment rather than through a direct persistent effect of disease exposure.

**Pre-1920 economic and geographic characteristics.** Next, we test whether sleeping sickness exposure is correlated with a wide set of pre-1920 characteristics that could independently shape long run development, including early population density, access to rivers and railways, ethnic institutions, and the location of early concession companies (Gennaioli and Rainer, 2007; Michalopoulos and Papaioannou, 2013). Figure 4 shows no systematic relationship with these predetermined factors. Predictive power emerges only for sleeping sickness exposure after 1920, coinciding with the expansion of colonial medical interventions.

**Measurement and surveillance expansion.** We further mitigate concerns that recorded exposure reflects the gradual expansion of colonial surveillance by exploiting sleeping sickness maps drawn at multiple points during the colonial period. Using disease distributions from different periods reduces the likelihood that the instrument captures administrative expansion rather than epidemic dynamics. For measurement error to drive our results, areas with high exposure would need to be systematically underreported across all map waves, which is unlikely given the documented spatial progression and eventual decline of the epidemic. Any remaining measurement error would therefore bias estimates toward zero.

**Alternative biological and ecological channels.** A further concern is that sleeping sickness exposure may proxy for underlying ecological suitability for the tsetse vector rather than localised epidemic dynamics. However, both modern FAO land-cover–based habitat measures and historical colonial tsetse maps indicate that ecological suitability is nearly ubiquitous across the DRC, generating little cross-territory variation. Broad ecological conditions therefore cannot account for the highly localised pattern of reported sleeping sickness outbreaks or the spatial concentration of colonial medical investments. Remaining concerns related to administrative reach or surveillance capacity are addressed directly through the falsification tests with state presence discussed above.

**Residual robustness.** Finally, we rule out additional alternative channels through which historical disease exposure could affect modern hospital outcomes. Sleeping sickness has a negligible contemporary disease burden relative to malaria and HIV (Fèvre et al., 2008; WHO, 2017), and its ecological determinants differ markedly from those of malaria (Online Appendix Figure A11). Colonial records indicate that tsetse flies were widespread across much of the territory (Online Appendix Figure A12), suggesting that broad ecological suitability varied little at large spatial scales. Although uniform ecological suitability does not rule out local variation in reporting driven by surveillance or administrative capacity, our combined falsification tests support the interpretation that recorded sleeping sickness exposure primarily reflects localised epidemic dynamics relevant for colonial medical expansion. To further guard against residual confounding, we reweight hospitals outside sleeping sickness zones to match observable geographic characteristics using entropy balancing and obtain nearly identical IV estimates (Online Appendix Table A21). We also test for local violations of the exclusion restriction using causal forests following Farbmacher et al. (2022) and allow for partial violations of exogeneity using the approach of Conley et al. (2012) (Online Appendix Subsections F.2 and F.3). These exercises provide further confidence that historical sleeping sickness exposure is not correlated with unobserved determinants of modern hospital outcomes.

Taken together, these exercises address the main channels through which historical sleeping sickness exposure could plausibly affect contemporary hospital outcomes outside colonial medical investment. We find no evidence that exposure proxies for persistent location advantages, non-health administrative capacity, or broader state presence; nor does it predict contemporary service provision or observable proxies for quality, nor outcomes that would be expected to increase under persistently higher underlying health needs (examined in the following Section). To the extent that disease control campaigns coincided with colonial administrative expansion, mission activity, or surveillance, these processes contributed to the establishment and persistence of colonial medical institutions rather than creating independent direct effects. The next Section examines these institutional channels directly.

## 6 Channels

Our results document strong persistence in both hospital infrastructure and government transfers among colonial origin facilities, but these patterns arise through distinct processes. Persistence in bed capacity largely reflects differences in initial endowments: colonial hospitals benefited from substantially higher public investments in physical infrastructure than facilities built after independence, and these large sunk investments plausibly continue to shape hospital capital today.

Persistence in government transfers is more puzzling. Even after accounting for staffing levels, the primary determinant of salary-based transfers, colonial origin hospitals continue to receive significantly higher public funding. This pattern cannot be explained mechanically by differences in size or workforce alone. We hypothesise and provide suggestive evidence that colonial hospitals became institutionally embedded platforms with lower fixed costs of engagement for both the state and external donors. Such fixed costs generate persistence by biasing public and donor resource allocation toward legacy facilities, even when marginal productivity is similar. We contrast this mechanism with alternative explanatory channels, and demonstrate that none of them are predicted by colonial health settlements.

In the remainder of this section, we condition on staffing levels when examining government transfers. Because staffing captures the main rule-based component of transfer allocation, these specifications isolate variation in funding that is not mechanically explained by workforce size. They are not intended to recover the total effect of colonial origin, but rather to shed light on the mechanisms sustaining the persistent funding advantage of colonial origin hospitals beyond what staffing alone would justify.

## 6.1 Conceptual Framework

The results above suggest that colonial origin hospitals receive higher government transfers despite similar observable service provision and quality. This pattern raises the question of whether public funding decisions differ primarily i) in how much hospitals receive once funded (intensive margin), or ii) in whether they are funded at all (extensive margin). In settings with low fiscal and administrative capacity, funding decisions often involve substantial administrative and coordination costs, suggesting that persistence may operate primarily through the extensive margin. To guide the analysis of this mechanism, we present a simple allocation framework emphasising fixed engagement costs in an environment with external donors. Government transfers $T_i \geq 0$ finance hospital activity, producing output

$$y_i = A_i g(T_i)$$

where $g(.)$ is increasing and concave. Funding a hospital entails not only the transfer itself, but also a fixed engagement cost $F_i$ reflecting administrative integration, and coordination with external donors. The government chooses transfers subject to $\sum_i T_i \leq Budget$ to maximise

$$\sum_i \theta_i A_i g(T_i) - \sum_i (T_i + \mathbb{1}\{T_i > 0\} F_i)$$

where $\theta_i$ captures distributional (or political) weights. The fixed cost generates an extensive margin: a hospital receives any transfer only if the net surplus from funding exceeds $F_i$. Differences in $F_i$ therefore affect the extensive margin, i.e. the probability that a hospital receives any transfer, even when marginal returns to funding are similar across hospitals. We model $F_i$ as depending on both colonial origin and donor engagement:

$$F_i = \bar{F} - \tau c_i - \lambda D_i$$

where $c_i$ indicates colonial origin and $D_i$ captures donor support. Colonial origin and donor engagement both reduce the fixed costs of sustained public funding by improving durable administrative capacity and visibility. In this environment, central government transfers optimally target facilities already engaged by donors, while facilities without donor support face higher effective funding costs and are less likely to receive any transfers.

## 6.2 Colonial origin and selection into government transfers

Guided by this framework, we first examine whether colonial origin predicts inclusion in the set of hospitals receiving any central government transfer. Table 4 shows that colonial origin hospitals are more likely to receive transfers in the baseline specification. When conditioning on a rich set of predetermined characteristics, including bed capacity, ownership, and baseline geographic controls, the estimate declines and becomes less precisely estimated but remains positive, suggesting that the extensive margin difference is not mechanically driven by differences in observable facility size, ownership, or location alone. Conditioning on general referral hospital status and contemporaneous staffing substantially attenuates the colonial coefficient, consistent with colonial origin operating through persistent institutional classification and payroll integration rather than performance-based allocation. Poisson pseudo–maximum likelihood estimates yield similar quantitative and qualitative results.

### 6.3 Foreign aid, engagement costs, and institutional embeddedness

We next examine institutional channels that may underlie the extensive-margin differences documented above, focusing on general referral hospital status and donor engagement. Table 5 documents patterns consistent with the fixed engagement cost framework. Colonial origin hospitals are substantially more likely to be classified as general referral hospitals, even after conditioning on ownership and bed capacity. Moreover, general referral hospitals are more likely to host donor-supported projects, and while the referral status absorbs part of the colonial effect, colonial origin remains a significant predictor of donor presence. Together, these patterns suggest that donor engagement reflects both formal institutional classification and historical embeddedness; associations attenuate when conditioning on capacity and ownership, consistent with donor selection being shaped by logistical and institutional constraints.

Because donors rarely disclose hospital-level funding, we proxy donor engagement using three complementary measures: (i) the availability of Tuberculosis and HIV drugs in hospital pharmacies, which are almost entirely donor-financed in the DRC (MSP, 2019); (ii) hospital-level indicators of direct donor support compiled from major donor and NGO sources; and (iii) spatial proximity to geocoded aid projects. Table 6 reports estimates of colonial settlement across multiple regressions with differing aid-related dependent variables. To assess whether donor engagement with colonial hospitals simply reflects differences in facility size or staff capacity, we re-estimate each specification controlling separately for bed capacity and staffing. Columns (1)–(3) measure exposure to general (non–health-specific) Western aid using the logarithm of the distance from a hospital to the nearest geocoded aid project between 1998 and 2014.[19] Columns (4)–(6) consider the log-distance to Chinese-funded aid projects, which tend to be more discretionary and, relative to Western donors, tend to rely less on local administrative and institutional capacity (Isaksson and Kotsadam, 2018; Dreher et al., 2019). Columns (7)–(9) define a binary indicator equal to one if a hospital reports the support of United States health aid, the largest bilateral donor in the DRC. Columns (10)-(12) extend this outcome to receipt of health aid from any donor at least once during the sample period. Colonial origin hospitals are 13 percentage points more likely to receive health aid support, relative to a mean of 78%. The effect is significant at the one percent level. Standardised $\beta$ coefficients indicate comparable magnitudes for U.S. health aid, albeit with lower precision. For general Western aid, colonial hospitals are located significantly *closer* to aid projects, by about 21.5% (equiv-

[19] Western aid data are unavailable for the sample period.

alent to $0.215 \times 9.4 = 2$ km), as indicated by the *negative* coefficient. While staffing and bed capacity predict donor presence, colonial origin remains a significant predictor, suggesting that donors preferentially engage with historically established facilities beyond observable inputs.

To assess whether this pattern reflects differences in donors' engagement models and fixed costs rather than simple location advantages or administrative salience, Column (13) interacts colonial origin with donor type. Colonial origin significantly predicts Western donor engagement but has no predictive power for Chinese aid receipt, and the difference between these effects is statistically significant. This asymmetry provides a falsification test that is difficult to reconcile with explanations based on generic state presence or hospital visibility and instead supports a mechanism in which fixed costs of engagement lead Western donors to rely disproportionately on historically embedded facilities.

This interpretation is consistent with historical accounts of post-independence aid delivery in Africa. Following independence, chronic underfunding of public health systems increased donor influence over service delivery, with Western donors frequently relying on non governmental organisations (NGOs) and mission linked providers with long standing local presence and administrative capacity (Hearn, 1998; Walker, 2022). In the DRC, recurrent conflict and epidemic outbreaks further increased the value of rapid deployment through existing infrastructure, giving colonial-era hospitals a comparative advantage to achieve rapid improvements in population health (Lorgen, 1998). Donor-supported projects were often integrated into the public health system, with governments required to assume recurrent costs, particularly salary payments (Hearn, 1998). Moreover, the success of local health projects supported by donors constituted clear incentives for recipient governments to integrate them into the state apparatus (Gary, 1996).

As a further diagnostic check on selection, Online Appendix Table A23 examines whether donor engagement reflects selection on reporting quality. Using measures of reporting completeness and timeliness, we find no evidence of a Western-specific reporting advantage among colonial hospitals, nor any differential pattern for Chinese aid. This suggests that donor engagement is not driven by selection on observable differences in administrative performance.

### 6.4 Ruling out early colonial privilege and targeting

We next examine whether the persistence of colonial-origin hospitals reflects specific features of early colonial investments rather than broader institutional embeddedness.

**Early settlements and European hospitals.** We first assess whether persistence differs by the timing and intended population of colonial hospitals. Early facilities were often established to serve European populations within a racially segmented health system (Figure A1 in Online Appendix), raising the possibility that lower postcolonial spending simply reflects continuity in the marginalisation of African healthcare. However, neither the timing of establishment nor racial orientation of colonial hospitals predicts contemporary government transfers or bed capacity (Online Appendix Tables A24 and A25). These results rule out explanations based on early investments or colonial racial segmentation.

**Religious missions.** We next assess whether early religious missions exerted lasting influence through informal authority or preferential relationships with the colonial state. Although missions played an important role in colonial health provision, we find no evidence that early religious presence prior to 1929 predicts contemporary hospital outcomes (Table A24), suggesting that mission-linked privilege is not a primary driver of persistence.

**Past and modern ownership.** Finally, we examine whether differences in colonial funding source or post-independence ownership explain observed persistence. Colonial funding source (state, mission, or private) does not generate significant heterogeneity in modern transfers or infrastructure (Table A26), consistent with historical accounts emphasizing broad geographic dispersion of colonial facilities rather than intensive investment at specific sites (Duren, 1953). By contrast, modern ownership matters: private hospitals receive fewer government transfers, while colonial-origin hospitals that remain privately owned tend to be larger. Faith-based hospitals, by contrast, are smaller on average. These findings indicate a historical divergence in health facility ownership and structural capacity. While hospitals were relatively similar in size across private and religious ownership during the colonial period, private investors were more likely to retain or select larger facilities after independence, whereas faith-based providers increasingly operated smaller hospitals. These patterns point to post-independence selection favouring larger, more capital-intensive facilities, which were more likely to survive institutional collapse and to be retained within the public health system. Colonial archives indicate that nearly 78 percent of private facilities disappeared or transitioned to public ownership after independence, leaving hospitals with substantial sunk investments more likely to persist. This evidence is consistent with a mechanism in which fixed costs and capital intensity generate institutional embeddedness over time (Giancotti et al., 2017).

While statistical power limits precision for some interaction effects, the overall pattern is difficult to reconcile with explanations based on early colonial privilege, religious influence, or funding source, and instead supports an interpretation centered on capital intensity and institutional embeddedness.[20]

### 6.5 Ruling out performance-based explanations

**Cost-intensive medical care.** A natural interpretation of the higher transfers received by colonial-origin hospitals is that the central government optimally directs resources toward facilities that provide higher-quality or more cost-intensive care. Transfers could reward better-performing hospitals or incentivise health workers in facilities with superior infrastructure and outcomes. While we lack direct measures of clinical quality, we assess this hypothesis using several indirect tests.

First, we examine whether colonial origin hospitals are better equipped or operate with more costly medical inputs. Online Appendix Table A27 shows no systematic relationship between colonial origin and the availability or utilisation of key medical equipment, and results are similar when summarising equipment using a principal component. We further show that colonial origin does not predict higher investment spending, medicine stocks, operating expenditures, user-fee revenues, local wage supplements, or length of hospital stay once baseline covariates and infrastructure size are accounted for (Online Appendix Table A28). Together, these results provide little evidence that colonial hospitals deliver more cost-intensive care.

Second, we assess whether colonial origin differentially affects hospitals operating at higher levels of the care hierarchy. General referral hospitals provide more complex services and incur higher operating costs than district hospitals and are subject to similar formal eligibility criteria for public funding. If the colonial funding advantage reflected greater clinical complexity or higher operating costs, conditioning on general referral hospital status should therefore eliminate the difference. Online Appendix Table A29 shows that colonial hospitals continue to receive higher transfers even within this group, suggesting that the funding gap reflects differences in the ease of administrative engagement rather than differences in the level of care provided.

**Infrastructure size.** We next clarify the role of hospital size in transfer allocation. Table 7 shows that government transfers increase with both staffing and bed capacity, reflecting the role of workforce and facility size in allocation decisions. However, conditioning jointly on

[20] The interaction between colonial origin and private ownership yields a minimum detectable effect of approximately 70%, limiting statistical precision. Each other heterogeneity test has 80% power to detect effects at least as large as its minimum detectable effect on the coefficient scale with $\alpha = 0.05$.

staffing and bed capacity only modestly attenuates the colonial origin coefficient, which remains statistically significant. Moreover, among colonial era hospitals, bed capacity does not predict transfers once staffing is accounted for. Together, these results indicate that while infrastructure size matters for allocation, it does not fully explain the systematically higher transfers received by colonial origin hospitals.

### 6.6 Additional channels

In Online Appendix Section G, we examine a set of alternative channels that could potentially account for the persistence of colonial origin hospitals in public financing. First, we show that colonial health settlements do not predict contemporary local economic development or population levels, ruling out the possibility that colonial hospitals are simply located in areas with greater long run growth or demographic pressure (Table A30). Second, we confirm that our results are not driven by differences in contemporary disease environments, including malaria risk. Third, we assess whether colonial settlements disproportionately served ethnic groups that continue to hold greater economic or political power today, and find no evidence that ethnic power mediates our results. Fourth, we show that our findings are robust to controlling for the historical presence of concession companies during the Congo Free State period, alleviating concerns that early extractive activities confound the estimates. Finally, we rule out differential exposure to local government embezzlement by showing no association between colonial settlement and subsequent prosecutions of provincial governors for corruption.

Taken together, these falsification exercises indicate that the persistence of colonial hospitals in public financing is unlikely to be driven by local development, disease burden, ethnic power, extractive history, or differential corruption risk. Instead, they reinforce the interpretation that the observed patterns reflect institutional persistence rooted in colonial-era investments and their interaction with postcolonial allocation mechanisms.

## 7 Discussion and conclusion

In this article, we conducted a novel investigation about the heritage of colonial health activities on modern hospital outcomes. By linking newly digitised archival data on colonial medical settlements to modern administrative records, we document a striking pattern of persistence. Hospitals established during the colonial period continue to receive substantially higher government transfers and maintain significantly larger physical infrastructure than hospitals built after independence. External aid reinforces rather than corrects historical institutional advantages that continue to shape resource allocation. These effects are robust across specifications and empirical strategies, underscoring the durability of colonial investments despite decades of political instability, fiscal collapse, and health-system deterioration.

A key finding is that these persistent financial and infrastructural advantages do not translate into systematically higher observed service provision once staffing is accounted for. Why should persistent transfer disparities matter if outputs appear similar across hospital origins? The absence of differences in observed service volumes does not imply that the allocation of resources is efficient or without distortion. If colonial origin hospitals deliver better health outcomes along unobserved margins, higher transfers reinforce unequal access to effective care; on the other hand, under similar outcomes, persistent funding gaps point to low marginal returns and misallocation of scarce public resources. More broadly, these patterns reveal a form of path dependence in public spending, whereby inherited infrastructure continues to shape resource allocation even when outputs are equalised through staffing adjustments or constrained by system-wide bottlenecks (e.g., shortages of skilled personnel).

The welfare implications are substantial. Persistent transfer disparities raise concerns about efficiency, by directing scarce public resources toward historically embedded facilities for which engagement is administratively cheapest, even when marginal returns are low; and equity, as the uneven spatial distribution of colonial hospitals reinforces regional disparities in health system capacity. Even if colonial hospitals were once efficient investment targets, persistence may now hinder adaptation to changing population needs. The results point to a political economy mechanism whereby inherited infrastructure became institutionally embedded within public and donor systems through administrative visibility, reducing the fixed costs of engagement and conferring durable bargaining advantages in low-capacity settings.

An important open question is the extent to which these results generalise beyond the Belgian Congo. Colonial administrations differed markedly across Africa in their modes of governance, investment priorities, and reliance on missionary or private providers, with potentially divergent implications for postcolonial state capacity and public finance (Ali et al., 2019). Nonetheless, several features emphasised in this paper - the early establishment of hospital networks under colonial rule, the concentration of capital-intensive investments before independence, and the persistence of low domestic health spending thereafter - are common across many former colonies. These shared features suggest that path dependence in health system financing may be a broader phenomenon, motivating comparative analysis across colonial contexts.

More broadly, the findings suggest that improving allocative efficiency in health systems may require policies that explicitly account for institutional embeddedness and fixed engagement costs, rather than relying solely on performance-based allocation rules. Understanding how different colonial systems shaped the long run evolution of health financing is therefore a promising avenue for future research. Recognising the persistence of historically embedded institutions may inform the design of public budgets and external aid in ways that reduce disparities in health labour markets and infrastructure, and ultimately improve access to care.

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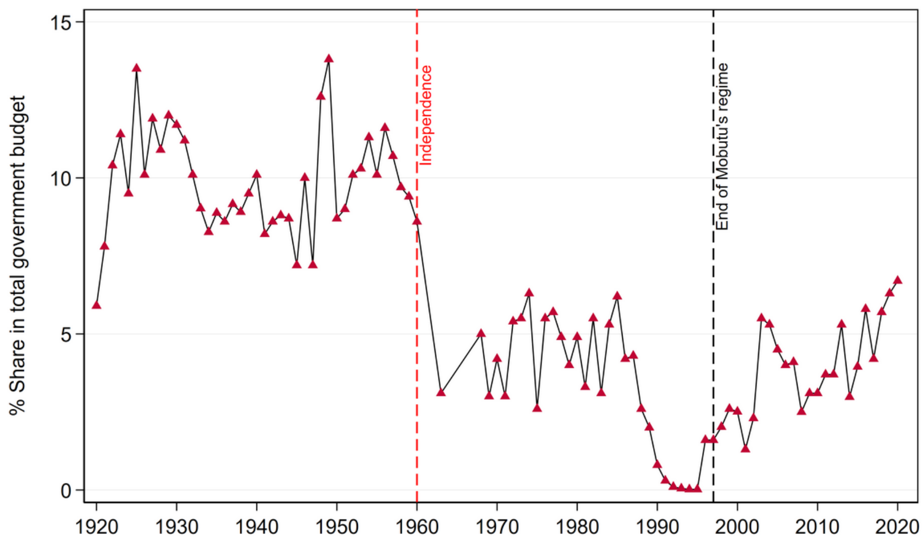
Table 1: Colonial settlement and hospital outcomes: main results

| | Bed capacity | Government transfers | | | Total | | Malaria | | Diarrhea | | Emergency | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Colonial settlement | 0.708*** | 1.204*** | 1.114*** | 0.338*** | 0.431*** | -0.084* | 0.621*** | 0.157*** | 0.291*** | 0.055 | 0.579*** | 0.047 |
| | (0.069) | (0.108) | (0.119) | (0.083) | (0.068) | (0.042) | (0.078) | (0.049) | (0.065) | (0.064) | (0.129) | (0.095) |
| Standardised $\beta$ coeff. | 0.433 | 0.386 | 0.357 | 0.108 | 0.221 | -0.043 | 0.253 | 0.064 | 0.162 | 0.030 | 0.227 | 0.018 |
| $R^2$ | 0.30 | 0.26 | 0.29 | 0.56 | 0.18 | 0.49 | 0.32 | 0.46 | 0.25 | 0.32 | 0.20 | 0.39 |
| Observations | 991 | 755 | 755 | 755 | 1040 | 1040 | 1050 | 1050 | 1051 | 1051 | 915 | 915 |
| Mean dep. var | 3.94 | 14.25 | 14.25 | 14.25 | 5.64 | 5.64 | 3.32 | 3.32 | 1.32 | 1.32 | 3.44 | 3.44 |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Geographic controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Pop + Ownership | | | ✓ | ✓ | | ✓ | | ✓ | | ✓ | | ✓ |
| Health staff | | | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ |

*Notes:* The presents the OLS estimates of equation (1). The unit of observation is a hospital. Nondummy variables are all in natural logarithms. Geographic controls include distance to provincial capital, distance to pharmaceutical distribution centres, distance to nearest transport, population density in 1951, malaria risk rate, elevation, longitude and latitude, distance to conflict events, distance to the nearest hospital, cassava suitability index, and a dummy variable equal to one for the exploitation of natural resources during the colonial period. Pop + Ownership includes current population catchment area and modern hospital ownership. Health staff comprises the size of nurses and physicians. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Figure 1: Share of domestic health spending in total budget, 1920-2020




**Notes:** The graph plots the share of domestic health expenditure as a percentage of total government budget between 1920 and 2020. Counterparts funds received from donor grants, which are not voted budgets but managed by the government, are included in its budget. No information could be found for the immediate period following independence in 1960 (1961, 1962, and 1964 to 1967). *Source:* author's computations using *Annuaire statistique de la Belgique et du Congo Belge* and *Rapport annuel, Direction Générale des services médicaux du Congo Belge 1929-58* for the colonial period; World Bank and IMF data for the 1970-2000 period and Global Health Observatory data from WHO after 2000 (https://www.who.int/gho/health_financing/public_exp_health/en/). See Appendix B.1 for details on the data sources.

Table 2: Colonial settlement and hospital outcomes: Matching estimates

| Dep. Variable | Bed capacity (1) | Government transfers (2) | Health services: admissions Total (3) | Malaria (4) | Diarrhea (5) | Emergency (6) |
|---|---|---|---|---|---|---|
| **Panel A. Matching estimation with baseline controls** | | | | | | |
| Nearest-neighbor(1) | | | | | | |
| Colonial settlement | 0.646*** | 1.048*** | 0.339*** | 0.545*** | 0.199*** | 0.475*** |
| | (0.068) | (0.128) | (0.073) | (0.092) | (0.071) | (0.108) |
| Nearest-neighbor(3) | | | | | | |
| Colonial settlement | 0.639*** | 1.077*** | 0.384*** | 0.543*** | 0.216*** | 0.483*** |
| | (0.053) | (0.106) | (0.063) | (0.075) | (0.063) | (0.094) |
| Entropy reweighting | | | | | | |
| Colonial settlement | 0.612*** | 1.016*** | 0.333*** | 0.524*** | 0.224*** | 0.401*** |
| | (0.056) | (0.113) | (0.064) | (0.080) | (0.068) | (0.104) |
| **Panel B. Matching estimation with staffing and hospital type** | | | | | | |
| Exact matching: HW quintiles | | | | | | |
| Colonial settlement | 0.283*** | 0.475*** | -0.037 | 0.166** | 0.088 | 0.069 |
| | (0.046) | (0.091) | (0.053) | (0.072) | (0.071) | (0.097) |
| Exact matching: Hospital type | | | | | | |
| Colonial settlement | 0.375*** | 0.427*** | 0.154** | 0.150** | 0.047 | 0.110 |
| | (0.049) | (0.092) | (0.062) | (0.071) | (0.066) | (0.100) |
| Entropy reweighting (including HW) | | | | | | |
| Colonial settlement | 0.287*** | 0.380*** | -0.149 | 0.115 | -0.044 | -0.051 |
| | (0.087) | (0.137) | (0.096) | (0.108) | (0.092) | (0.149) |
| Observations | 981 | 755 | 1040 | 1050 | 1051 | 915 |

*Notes:* The unit of observation is a hospital. Nondummy variables are all in natural logarithms. The table reports Average Treatment Effects on the Treated (ATT) from alternative matching estimators. Panel A uses the controls presented in Table 1, except for province fixed effects. The first two matching methods use respectively one nearest-neighbour, and three nearest-neighbours. The third matching approach reports estimates using the entropy balancing algorithm (Hainmueller, 2012) which reweights post-independence hospitals to match the mean and variance of the covariates of colonial hospitals. In addition to using the matching variables in Panel A, Panel B imposes exact matching on health workers (HW) size quintiles (fourth row), hospital type (fifth row), and includes health workers in the entropy balancing (sixth row). *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table 3: Colonial settlement and hospital outcomes: IV

| Dep. Variable | Colonial settlement | | | | | |
|---|---|---|---|---|---|---|
| **Panel A. 1st stage** | | | | | | |
| Sleeping sickness | 0.491*** | 0.504*** | 0.484*** | 0.486*** | 0.477*** | 0.518*** |
| | (0.032) | (0.035) | (0.031) | (0.031) | (0.031) | (0.033) |
| Kleibergen-Paap $F$-statistic | 234.2 | 207.6 | 237.2 | 245.3 | 230.9 | 251.9 |

| | Bed | Government | Health services: admissions | | | |
|---|---|---|---|---|---|---|
| Dep. Variable | capacity | transfers | Total | Malaria | Diarrhea | Emergency |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Panel B. Reduced-form** | | | | | | |
| Sleeping sickness | 0.413*** | 0.716*** | 0.234*** | 0.298*** | 0.037 | 0.295* |
| | (0.078) | (0.078) | (0.058) | (0.068) | (0.074) | (0.149) |
| Standardised $\beta$ coefficient | 0.271 | 0.239 | 0.129 | 0.130 | 0.022 | 0.122 |
| Observations | 981 | 755 | 1,040 | 1,050 | 1,051 | 915 |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Panel C. 2nd stage** | | | | | | |
| Colonial settlement | 0.841*** | 1.421*** | 0.484*** | 0.613*** | 0.077 | 0.570*** |
| | (0.099) | (0.207) | (0.127) | (0.143) | (0.118) | (0.172) |
| Standardised $\beta$ coefficient | 0.519 | 0.455 | 0.248 | 0.250 | 0.043 | 0.224 |
| Anderson-Rubin $p$-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.510 | 0.001 |
| Hausman $p$-value | 0.090 | 0.181 | 0.583 | 0.968 | 0.040 | 0.981 |
| $R^2$ | 0.19 | 0.15 | 0.07 | 0.18 | 0.04 | 0.07 |
| Observations | 981 | 755 | 1,040 | 1,050 | 1,051 | 915 |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

*Notes:* The unit of observation is a hospital. The sleeping sickness instrument is a dummy variable equal to one if the hospital is located within an area where the infection rate was at least equal to 1% at any time during the 1929-1953 period. Baseline controls are presented in Table 1. Robust standard errors are in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table 4: Colonial settlement and the extensive margin of transfers

| | LPM (Any Govt. transfers) | | | | PPML (Any Govt. transfers) | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Colonial settlement | 0.084** | 0.049* | 0.027 | 0.040 | 0.106** | 0.052* | 0.027 | 0.039 |
| | (0.035) | (0.025) | (0.029) | (0.026) | (0.046) | (0.031) | (0.037) | (0.032) |
| $R^2$ | 0.31 | 0.38 | 0.38 | 0.38 | | | | |
| Observations | 952 | 952 | 952 | 952 | 952 | 952 | 952 | 952 |
| Mean dep. var | 0.77 | 0.77 | 0.77 | 0.77 | 0.77 | 0.77 | 0.77 | 0.77 |
| Province Fixed Effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Geographic controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Bed capacity | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| Hospital ownership | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| General Referral Hospital | | | ✓ | | | | ✓ | |
| Health workers | | | | ✓ | | | | ✓ |

*Notes:* The unit of observation is the hospital. Government transfers is defined as a dummy variable only for hospitals with reporting completeness of at least 50 percent; observations below this threshold are treated as missing. Columns (1)–(4) report estimates from linear probability models (LPM), where the dependent variable is an indicator for receiving any central government transfer. Columns (5)–(8) report Poisson pseudo-maximum likelihood (PPML) estimates. Baseline controls are those reported in Table 1. Ownership includes indicators for private and faith-based hospitals; public hospital constitutes the omitted reference category. Robust standard errors, reported in parentheses, are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table 5: Institutional status and donor presence

| | General Referral Hosp. | | Health aid | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Colonial settlement | 0.454*** | 0.248*** | | 0.071*** |
| | (0.049) | (0.047) | | (0.023) |
| General Referral Hosp. | | | 0.132*** | 0.101*** |
| | | | (0.031) | (0.030) |
| $R^2$ | 0.45 | 0.56 | 0.13 | 0.14 |
| Observations | 990 | 990 | 990 | 990 |
| Mean dep. var | 0.48 | 0.48 | 0.80 | 0.80 |
| Province Fixed Effects | ✓ | ✓ | ✓ | ✓ |
| Geographic controls | ✓ | ✓ | ✓ | ✓ |
| Bed capacity | | ✓ | | |
| Hospital ownership | | ✓ | | |

*Notes:* The unit of observation is the hospital. General referral hospital and health aid are dummy variables, Columns (1)–(4) report estimates from linear probability models (LPM). Baseline controls are those reported in Table 1. Ownership includes indicators for private and faith-based hospitals; public hospital constitutes the omitted reference category. Robust standard errors, reported in parentheses, are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table 6: Colonial settlement and local aid

| | dist(Western aid) | | | dist(Chinese aid) | | | US health aid | | | Health aid | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| Colonial settlement | -0.247*** | -0.189** | -0.198** | 0.145** | 0.146** | 0.098 | 0.053*** | 0.030 | 0.037* | 0.119*** | 0.061** | 0.048** | 0.038 |
| | (0.075) | (0.085) | (0.084) | (0.062) | (0.066) | (0.074) | (0.016) | (0.021) | (0.019) | (0.026) | (0.022) | (0.020) | (0.092) |
| Colonial × Chinese Aid | | | | | | | | | | | | | 0.029 |
| | | | | | | | | | | | | | (0.017) |
| AidChina (distance) | | | | | | | | | | | | | -0.008 |
| | | | | | | | | | | | | | (0.018) |
| Colonial × Western Aid | | | | | | | | | | | | | -0.044*** |
| | | | | | | | | | | | | | (0.013) |
| Western Aid (distance) | | | | | | | | | | | | | 0.039** |
| | | | | | | | | | | | | | (0.018) |
| Standardised $\beta$ coefficient | -0.088 | -0.067 | -0.070 | 0.043 | 0.044 | 0.029 | 0.145 | 0.081 | 0.099 | 0.137 | 0.070 | 0.055 | 0.150 |
| $R^2$ | 0.53 | 0.53 | 0.53 | 0.77 | 0.77 | 0.77 | 0.11 | 0.13 | 0.12 | 0.13 | 0.15 | 0.16 | 0.17 |
| Observations | 981 | 981 | 981 | 981 | 981 | 981 | 981 | 981 | 981 | 981 | 981 | 981 | 981 |
| Mean dep. var | 2.24 | 2.24 | 2.24 | 3.53 | 3.53 | 3.53 | 0.03 | 0.03 | 0.03 | 0.80 | 0.80 | 0.80 | 0.80 |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Health Workers | | ✓ | | | ✓ | | | ✓ | | | ✓ | | ✓ |
| Bed Capacity | | | ✓ | | | ✓ | | | ✓ | | | ✓ | ✓ |

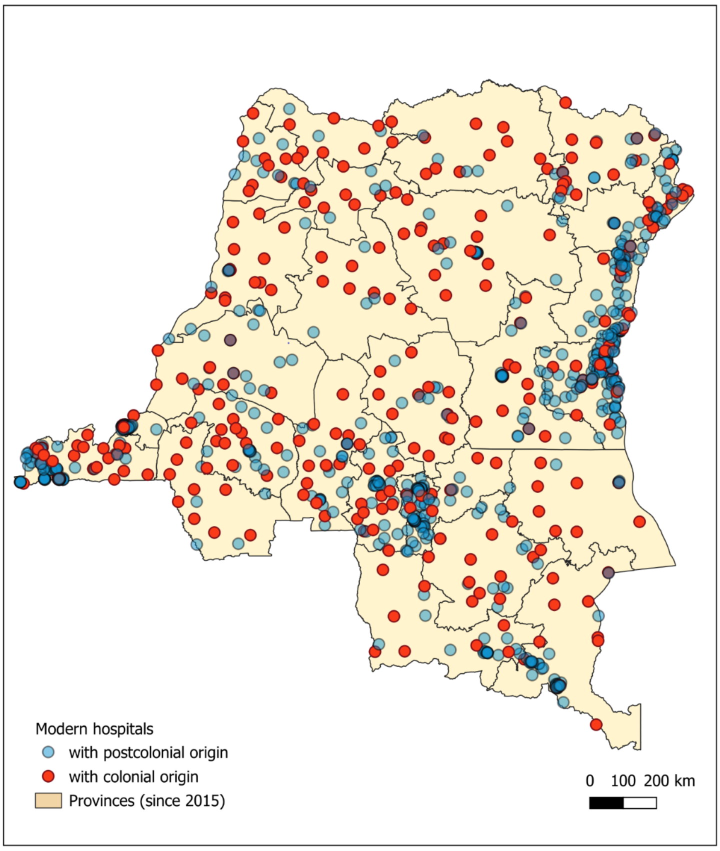
*Notes:* The unit of observation is the hospital. The table presents OLS estimates. Health aid and US health aid are dummy outcome variables respectively equal to one if a hospital receives general health aid from international donors and US health aid specifically, and zero otherwise. Western aid and Chinese local aid are measures of the distance between the hospital and its closest aid project as geocoded from the DRC AIMS Geocoded Research Release. Baseline controls are presented in Table 1. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table 7: Government transfers, health workers and bed capacity

| | Government transfers | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Nurses | 0.549*** | 0.336*** | 0.346*** | 0.348*** |
| | (0.057) | (0.078) | (0.078) | (0.078) |
| Physicians | 0.719*** | 0.652*** | 0.633*** | 0.633*** |
| | (0.089) | (0.070) | (0.075) | (0.075) |
| Bed capacity | | 0.420*** | 0.353*** | 0.360*** |
| | | (0.086) | (0.086) | (0.103) |
| Colonial settlement | | | 0.267*** | 0.286*** |
| | | | (0.084) | (0.090) |
| Colonial settlement × Bed capacity | | | | -0.033 |
| | | | | (0.147) |
| $R^2$ | 0.51 | 0.56 | 0.57 | 0.57 |
| Observations | 731 | 731 | 731 | 731 |
| Mean dep. var | 14.30 | 14.30 | 14.30 | 14.30 |
| Province Fixed Effects | ✓ | ✓ | ✓ | ✓ |
| Geographic controls | ✓ | ✓ | ✓ | ✓ |

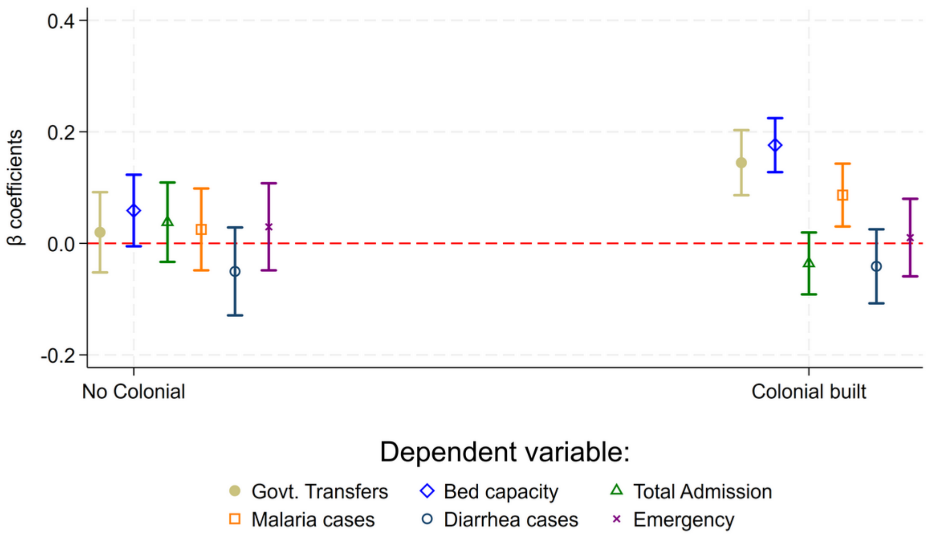
*Notes:* The unit of observation is a hospital. The table presents the OLS estimates of equation (1) with only government transfers as the dependent variable. The Nurses variable includes all categories of nurses, while Physicians includes generalists and specialists. Bed capacity is the total number of beds centered at the mean for postcolonial hospitals. Non-dummy variables are in logarithm transformation. All columns include the baseline controls. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Figure 2: Mapping of the full sample of colonial and post-independence hospitals



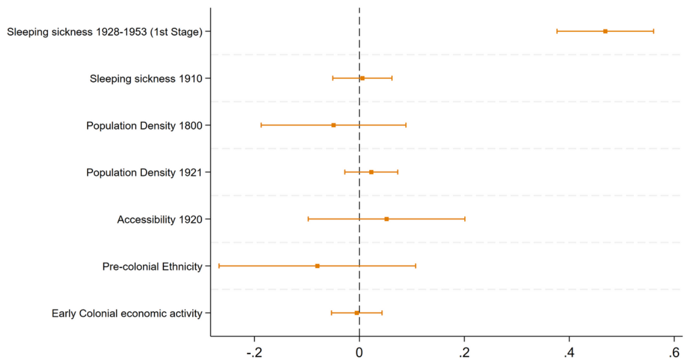

**Notes:** The map depicts the georeferenced locations of hospitals built during the colonial period (red dots) between 1920 and 1956, and after independence in 1960 (blue dots).

Figure 3: Reduced-form estimates of hospital outcomes on sleeping sickness




**Notes:** The graph plots the coefficient estimates and 95% confidence intervals of the effects of the distribution of sleeping sickness during the colonial period on the seven measures of hospital characteristics, in areas with no sleeping sickness (left) and with the disease presence (right).

Figure 4: Falsification tests




**Notes:** The graph plots the standardised coefficient estimates and 95% confidence intervals from OLS estimations of equation (2) with a range of alternative pre-1920 outcomes. Accessibility 1920 corresponds to the (logarithm) distance to the nearest transportation in 1920, pre-colonial ethnicity corresponds to ancestral characteristics of ethnic groups using the Ethnographic Atlas, coded by Murdock (1967) and updated by Nunn and Wantchekon (2011). Early colonial economic activity is a dummy variable equal to 1 if a hospital falls into an area that belongs to a concession granted to private companies under the Congo Free State (1885-1908). All regressions include provincial fixed effects as well as the baseline controls. Standard errors are clustered at the provincial level.

# Appendix for online publication

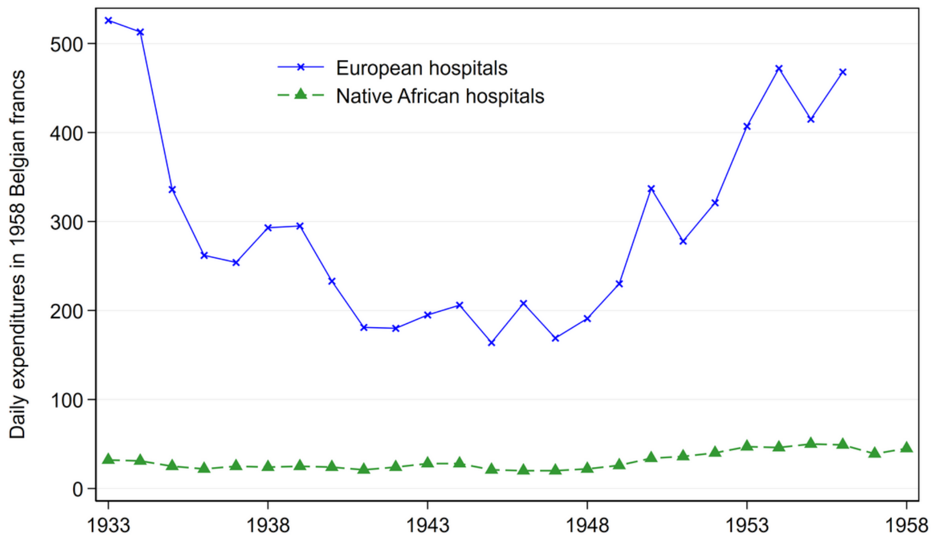
Where the money flows? Colonial health institutions and hospital contemporary outcomes in the D.R.Congo

Samuel Lordemus

- Not For Publication -

## Table of Contents

Figure A1: Daily cost of European and native hospitals




**Notes:** The graph plots the country average daily cost (for the colonial government) of hospitalisation in European and native (dashed line) hospitals between 1933 and 1958. The estimated cost of hospitalisation includes health treatment costs, salary, provision of drugs and health equipment, and general maintenance costs. *Source*: Archival data from annual medical report in Belgian Congo for each year of the covered period.

Table A1: Summary statistics and difference-in-means

| | PostColonial | | | Colonial | | | | |
|---|---|---|---|---|---|---|---|---|
| | Obs. (1) | Mean (2) | s.d. (3) | Obs. (4) | Mean (5) | s.d. (6) | Difference (7) | *t*-stat (8) |
| **Hospital outcomes** | | | | | | | | |
| Bed Capacity | 904 | 3.69 | 0.02 | 296 | 4.41 | 0.03 | 0.73 | -17.69 |
| Government transfers | 533 | 13.73 | 0.07 | 263 | 15.03 | 0.07 | 1.30 | -13.30 |
| Total admissions | 1,042 | 5.44 | 0.03 | 297 | 5.86 | 0.04 | 0.42 | -8.25 |
| Malaria cases | 1,039 | 2.93 | 0.04 | 301 | 3.93 | 0.04 | 1.01 | -17.45 |
| Diarrhea cases | 1,040 | 1.15 | 0.03 | 300 | 1.58 | 0.04 | 0.43 | -8.35 |
| Emergency cases | 812 | 3.14 | 0.04 | 289 | 3.81 | 0.06 | 0.68 | -8.77 |
| **Baseline variables** | | | | | | | | |
| Nurses | 1,060 | 2.27 | 0.03 | 301 | 3.10 | 0.05 | 0.83 | -14.56 |
| Physicians | 1,035 | 0.94 | 0.03 | 301 | 1.53 | 0.06 | 0.59 | -9.52 |
| Population | 1,088 | 12.43 | 0.01 | 301 | 12.17 | 0.03 | -0.26 | 8.36 |
| *Hospital ownership* | | | | | | | | |
| Public | 1,092 | 0.28 | 0.01 | 301 | 0.66 | 0.03 | 0.39 | -12.68 |
| Faith-based | 1,092 | 0.36 | 0.01 | 301 | 0.32 | 0.03 | -0.04 | 1.40 |
| Private | 1,092 | 0.45 | 0.01 | 301 | 0.06 | 0.01 | -0.39 | 19.38 |
| **Geographic controls** | | | | | | | | |
| Distance Provincial capital | 795 | 4.53 | 0.06 | 300 | 5.24 | 0.07 | 0.71 | -7.85 |
| Distance Distributional Centre | 795 | 3.90 | 0.04 | 300 | 4.62 | 0.06 | 0.72 | -9.54 |
| Distance to transport | 795 | 2.63 | 0.05 | 300 | 2.86 | 0.08 | 0.23 | -2.44 |
| Distance conflict | 795 | 1.99 | 0.04 | 300 | 2.85 | 0.09 | 0.86 | -8.67 |
| Distance nearest hospital | 797 | 7.78 | 0.07 | 300 | 9.41 | 0.10 | 1.63 | -12.93 |
| Distance to Electricity network | 795 | 2.21 | 0.05 | 300 | 2.83 | 0.10 | 0.62 | -5.54 |
| Distance to coast | 795 | 6.92 | 0.01 | 300 | 6.80 | 0.03 | -0.13 | 4.01 |
| Population density 1951 | 793 | 2.71 | 0.04 | 299 | 2.27 | 0.06 | -0.43 | 6.72 |
| Natural resources (before 1960) | 798 | 0.54 | 0.02 | 300 | 0.38 | 0.03 | -0.16 | 4.75 |
| Malaria risk rate | 796 | 0.20 | 0.01 | 300 | 0.26 | 0.01 | 0.06 | -6.03 |
| Soil suitability (cassava) | 797 | 5,821.50 | 116.44 | 300 | 6,625.12 | 173.70 | 803.63 | -3.84 |
| Elevation | 796 | 789.72 | 18.71 | 300 | 685.38 | 23.00 | -104.34 | 3.52 |
| Slope | 796 | 1.18 | 0.02 | 300 | 1.15 | 0.04 | -0.04 | 0.83 |
| Longitude | 798 | 22.77 | 0.21 | 300 | 22.88 | 0.28 | 0.11 | -0.32 |
| Latitude | 798 | -4.09 | 0.13 | 300 | -2.88 | 0.24 | 1.22 | -4.52 |

**Notes:** The unit of observation is hospital. All variables are taken in logarithm, except elevation, slope, longitude and latitude. The first six columns show the number of observations, sample mean and standard deviation for post-independence and colonial hospitals respectively. The last two columns indicate the difference in means between post-independence and colonial hospitals, the *t*-stat of the test of whether the mean coefficients in the two samples are equal.

Table A2: Change in hospital ownership: past and present numbers

| | 1959 | | Actual | |
|---|---|---|---|---|
| Period: | No. | Share (%) | No. | Share (%) |
| Colonial hospitals | | | | |
| Public | 145 | 48.0 | 189 | 62.5 |
| Faith-based | 99 | 32.8 | 96 | 31.8 |
| Private | 58 | 19.2 | 17 | 5.6 |
| Total | 302 | | 302 | |

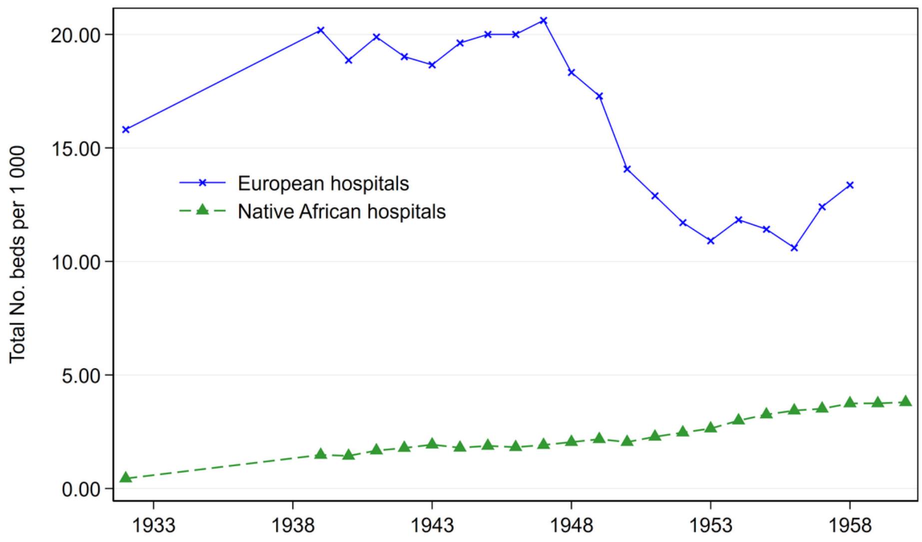
*Notes:* The table shows the number of colonial hospitals in the data sample that changed ownership after independence. The table reports the number and share of hospitals by ownership right before independence (1959) and with actual data as reported from the DHIS2. Public, faith-based and private present-day ownerships correspond respectively to government, religious missions and private firms during the colonial period.

Table A3: Lost colonial hospitals

| | 1959 No. | Actual No. | Share in total 1959 (%) |
|---|---|---|---|
| **Panel A.** Total recorded hospitals | 408 | 302 | 73.8 |
| **Panel B**. Hospitals lost after Independence | | | |
| Public | | 20 | 4.9 |
| Faith-based | | 19 | 4.7 |
| Private | | 22 | 5.4 |
| **Panel C.** Lost hospitals | | | |
| Total recorded | | 62 | 15.2 |
| Total unrecorded | | 46 | 11.3 |

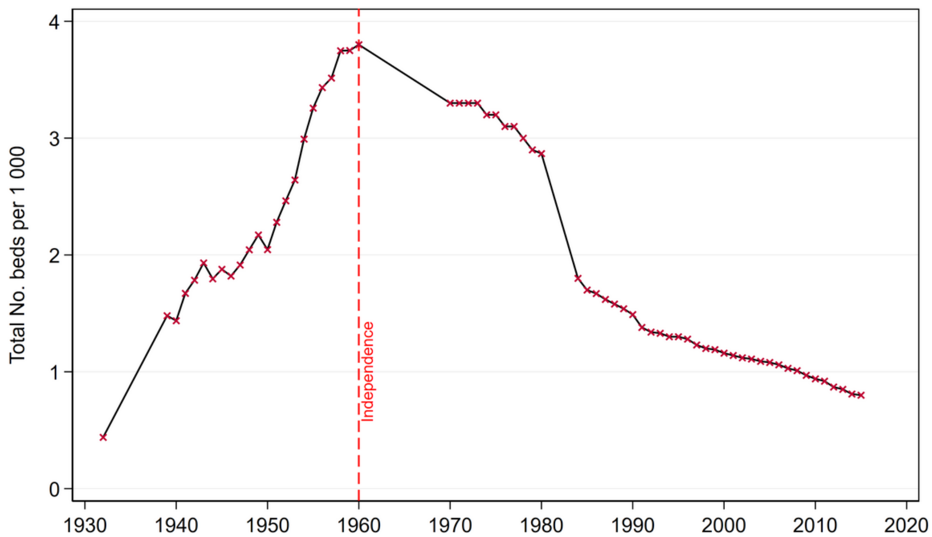
*Notes:* The table presents the number and share of colonial hospitals recorded in the archives and in the modern list of hospitals in panel A, and in panel B the hospital lost during the postcolonial period by ownership (government, religious missions and private firms). Panel C lists the number of colonial hospitals with a recorded georeferenced location in the archives and that could not be found in the modern list of hospitals. Panel C further reports the number of colonial hospitals whose georeferenced locations were not recorded in the archives (total unreported). This number is derived using the difference between the reported number of hospitals aggregated at the national level in the latest colonial archives (1959), and the latest georeferenced locations of colonial hospitals. Public, faith-based and private present-day ownerships correspond respectively to government, religious missions and private firms during the colonial period.

Figure A2: Bed per capita between European and Congolese populations



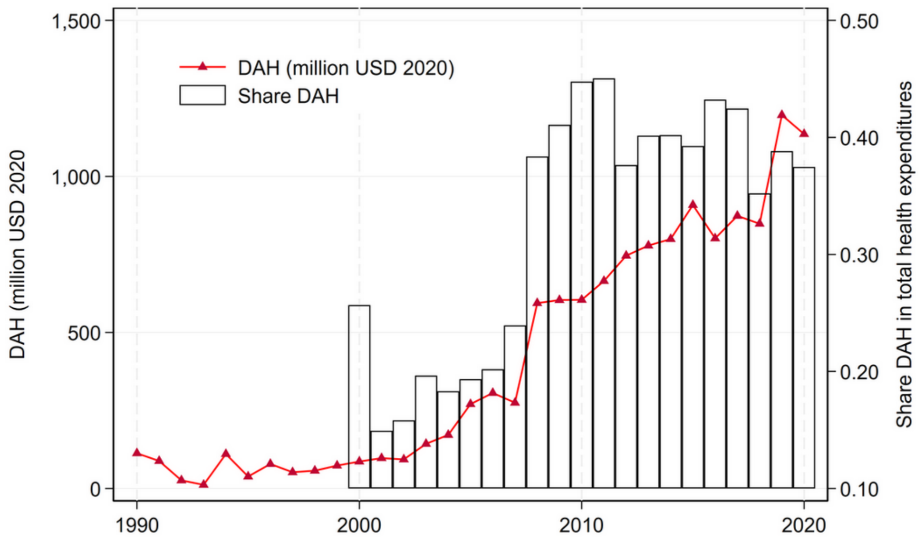

**Notes:** The graph plots the shared of bed per capita for European (blue) and Congolese (dashed green line) hospitals between 1933 and 1958. *Source*: Archival data from annual medical report in Belgian Congo for each year of the covered period.

Figure A3: Evolution of bed capacity, 1930-2020



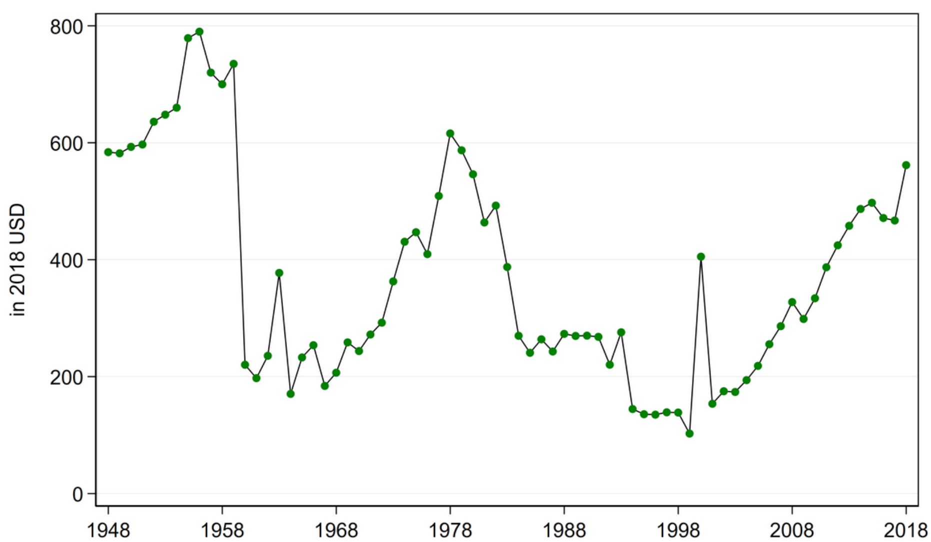

**Notes:** The graph plots the evolution of the total number of beds per 1,000 among the Congolese population during the 1930-2020 period. *Source:* author's computations using data on the Annual Medical reports of the Colony and population estimates from *Annuaire statistique de la Belgique et du Congo Belge* and *Rapport annuel, Direction Générale des services médicaux du Congo Belge* for the colonial period; World Bank estimates in the post-colonial period (`Source:https://data.worldbank.org/indicator/SP.DYN.CDRT.IN?locations=CD`). See Appendix B.1 for details on the data sources.

Figure A4: Development Assistance for Health in the DRC, 1990-2020



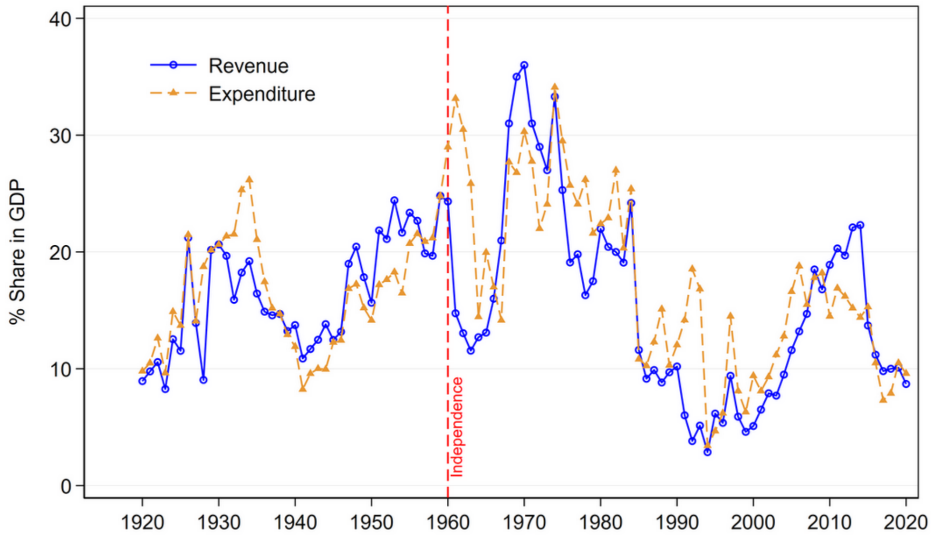

**Notes:** The graph plots the total Development Assistance for Health (DAH) between 1990 and 2020 in millions of 2020 USD in the DRC and its share in total health expenditure starting from 2004.
*Source:* author's computations using the Development Assistance for Health Database 1990-2020 from IHME Global Health Data Exchange (http://ghdx.healthdata.org/) and Global Health Observatory data from WHO (http://apps.who.int/gho/data/node.home).

Figure A5: DRC Gross National Income per capita in 2018 USD, 1948-2018



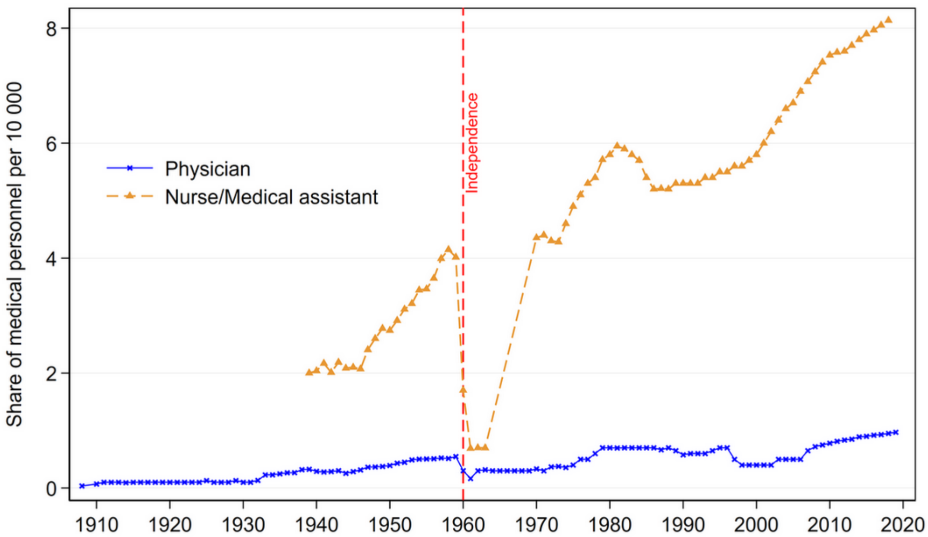

**Notes:** The graph plots the Gross National Income per capita of the DRC in 2018 USD between 1948 and 2018.
*Source:* World Bank national account data (https://data.worldbank.org/indicator/NY.GNP.PCAP.CD).

Figure A6: Total government revenue and expenditure to GDP, 1920-2020



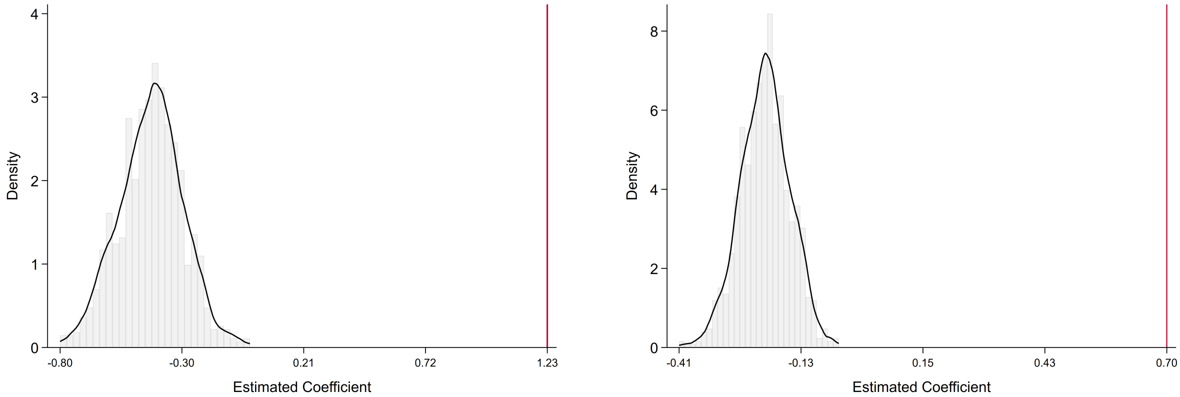

**Notes:** The graph plots the evolution of total government revenue and expenditure to GDP between 1920 and 2020. *Source:* author's computations using *Annuaire statistique de la Belgique et du Congo Belge* and *Rapport annuel, Direction Générale des services médicaux du Congo Belge 1929-58* for the colonial period; World Bank and IMF data for the post-independence period (see Appendix B.1 for details on the data sources).

Figure A7: Evolution of the share of medical personnel, 1908-2020




**Notes:** The graph plots the share of medical personnel (blue for physicians, orange for nurses) per 10,000 between 1908 and 2020. All numbers of medical personnel and population estimates were collected from the annual reports of public health in Belgian Congo during the colonial period, and from a combination of IMF, IBRD and World Bank reports in the post-colonial period. *Source:* author's computations using data on medical personnel and population estimates from *Annuaire statistique de la Belgique et du Congo Belge* and *Rapport annuel, Direction Générale des services médicaux du Congo Belge* for the colonial period; IMF, IBRD and World Bank reports in the post-colonial period (see Appendix B.1 for details on the data sources).

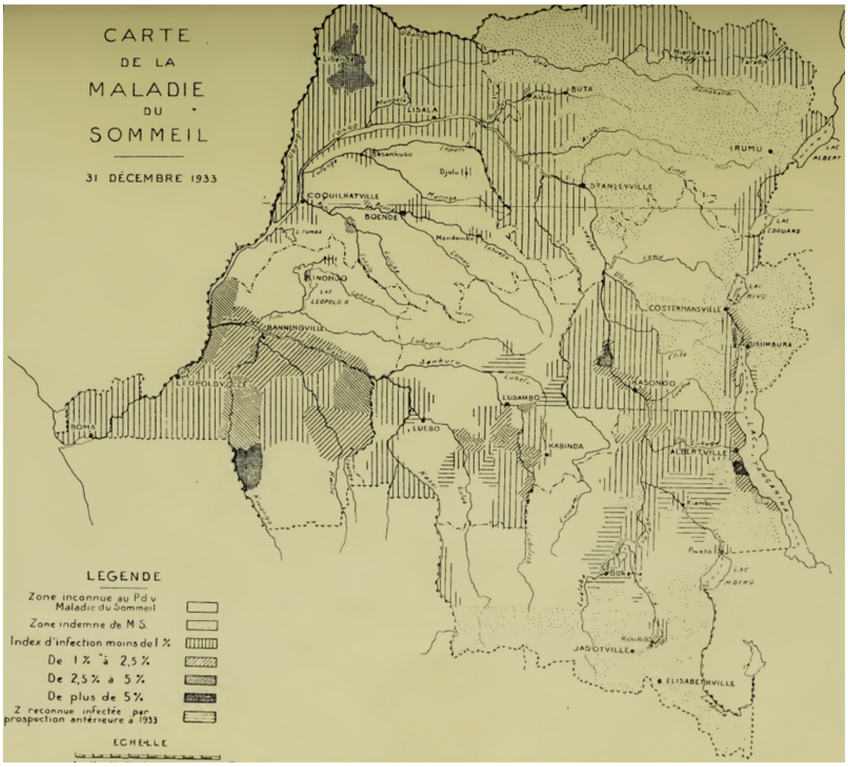
Figure A8: Permutation tests at hospital level




(A) Government funding (B) Bed Capacity

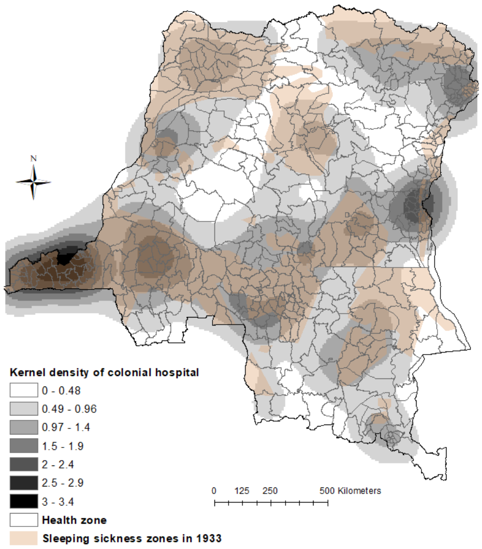
**Notes:** The graphs plot the histograms with the distribution of coefficients obtained from permutation tests based on 1,000 replications, for government funding and bed capacity respectively at the left and right panel. The permutation inference is obtained by reassigning the colonial status of hospitals with an equal number of randomly drawn hospitals in the DRC. The vertical line indicates the estimated coefficient from the real assignment in the baseline sample (Table 1).

Figure A9: Map of sleeping sickness in 1933




**Notes:** The figure shows the geographic distribution of the sleeping sickness in Belgian Congo in December 1933. *Source:* Bureau of Hygiene and Tropic Disease.

Figure A10: Kernel density of colonial settlements and the presence of sleeping sickness in 1933



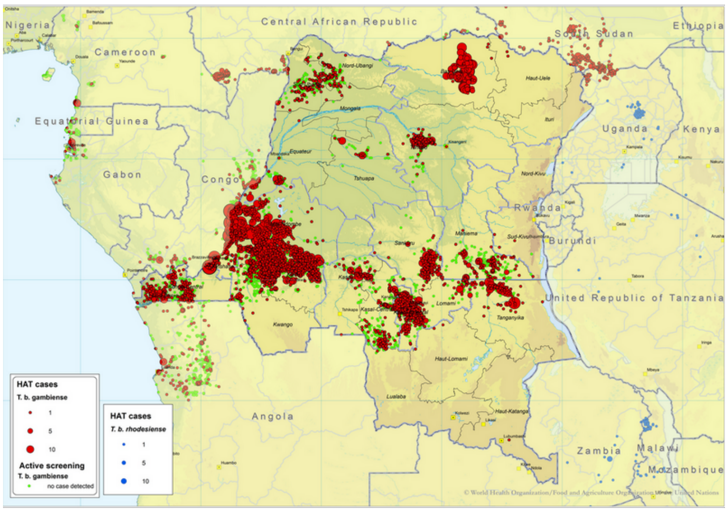

**Notes:** The map depicts the kernel density of colonial health settlements and the geographic distribution of the sleeping sickness (in brown) by health zones (district level) as reported in the public health data of the Ministry of Colonies between 1928 and 1933 (Lyons, 2002). A health zone is reported with sleeping sickness when the prevalence of the disease is at least equal to 1%.

Table A4: Summary statistics: Lost vs. matched colonial hospitals

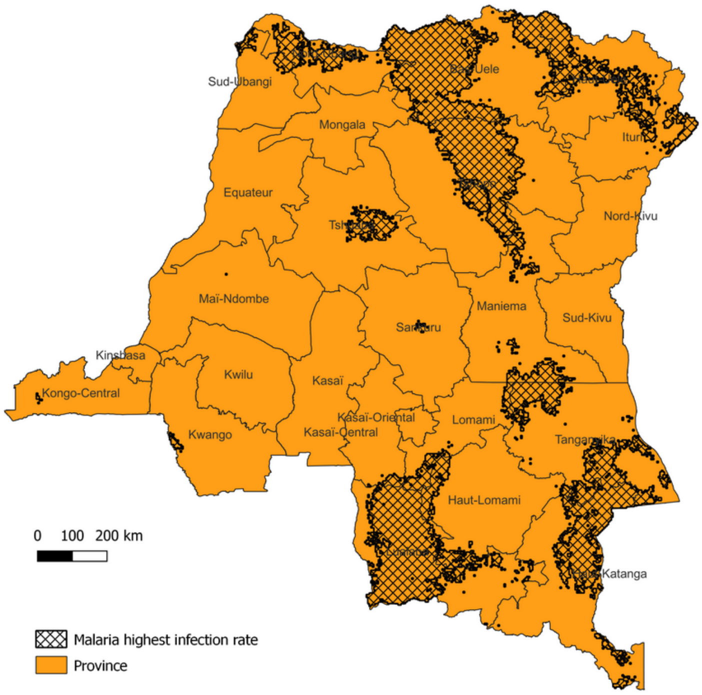
| | Matched colonial hospitals | | | Lost colonial hospitals | | | | |
|---|---|---|---|---|---|---|---|---|
| | Obs. (1) | Mean (2) | s.d. (3) | Obs. (4) | Mean (5) | s.d. (6) | Difference (7) | $t$-stat (8) |
| Pop. density (1951) | 299 | 14.06 | 0.85 | 62 | 5.55 | 0.62 | -8.51 | 8.08 |
| Mineral resources | 300 | 0.38 | 0.03 | 62 | 0.39 | 0.06 | 0.01 | -0.10 |
| Distance Provincial city | 300 | 2.42 | 0.08 | 62 | 3.12 | 0.12 | 0.70 | -4.82 |
| Distance Transport | 300 | 36.98 | 2.47 | 62 | 50.20 | 5.36 | 13.22 | -2.24 |
| Distance hospital | 300 | 46.02 | 1.82 | 62 | 64.88 | 5.94 | 18.86 | -3.03 |

**Notes:** The unit of observation is hospital. Mineral resources is a dummy variable equal to one if the hospital is located within an area with mineral resources as reported in the colonial maps. All distances are expressed in km. Matched colonial hospitals are hospitals listed in the colonial maps that could be matched with a modern hospital. Lost colonial hospitals are those with a recorded georeferenced location in the archives and that could not be matched with any modern hospitals. The first six columns show the number of observations, sample mean and standard deviation for post-independence and colonial hospitals respectively. The last two columns indicate the difference in means between post-independence and colonial hospitals, the $t$-stat of the test of whether the mean coefficients in the two samples are equal.

Figure A11: Geographic distribution of historical sleeping sickness and modern malaria



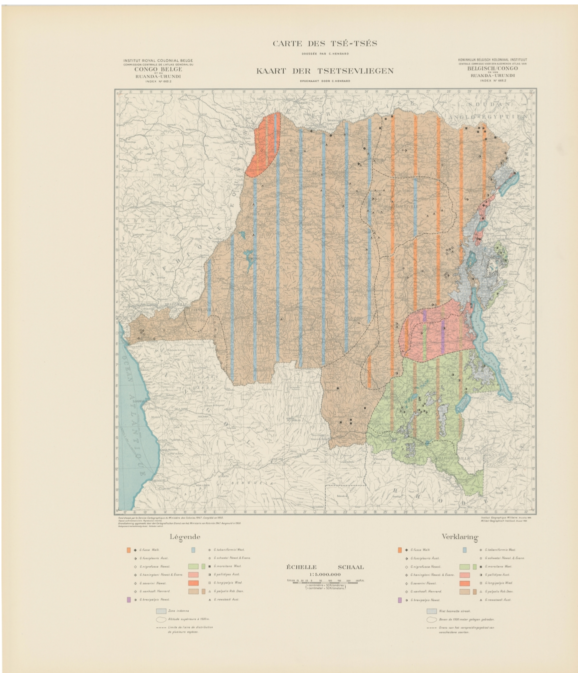

(A) Distribution of sleeping sickness (2012-2016)




(B) Distribution of PfPR rate (2017)

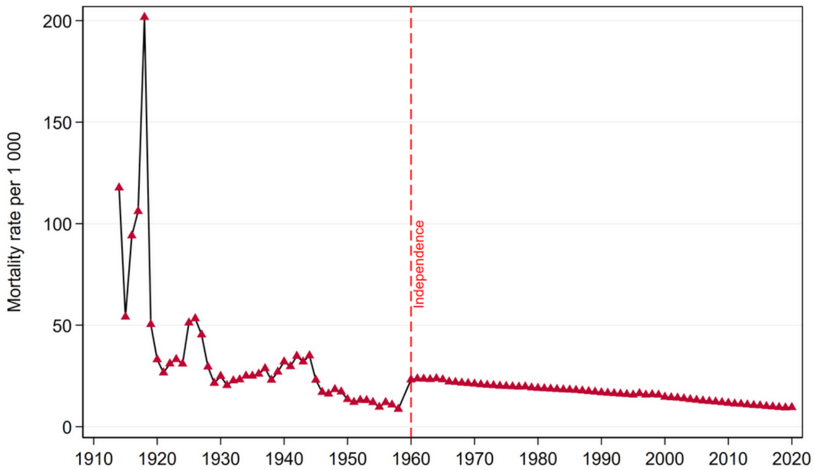
**Notes:** The map in Panel A depicts the geographical distribution of sleeping sickness (Human African Trypanosomiasis) through the reported number of new cases between 2012 and 2016. Panel B shows the geographic distribution of the highest (above median) Plasmodium falciparum parasite rate (PfPR) using median values for 2017 from the Malaria Atlas Project (MAP). *Source:* Panel A is produced by Franco et al. (2020) and accessed from the WHO website (https://www.who.int/trypanosomiasis_african/country/foci_AFRO/en/). Panel B was obtained from author's computation using the MAP data on PfPR in the DRC in 2017.

Figure A12: Geographic distribution of the tsetse fly in 1950



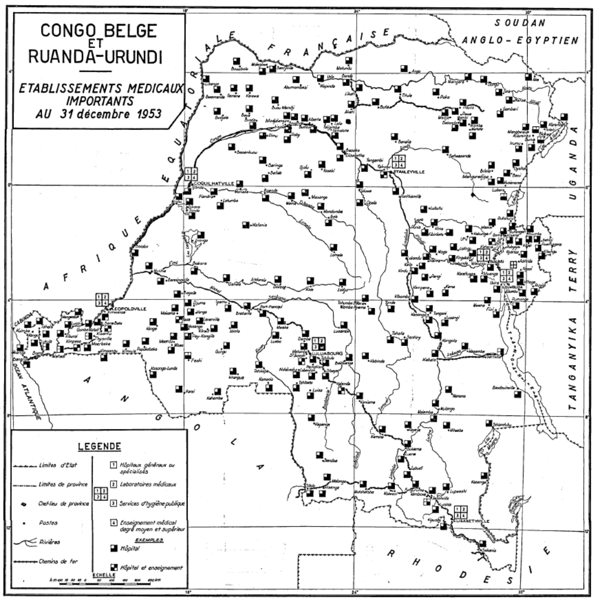

**Notes:** The figure shows the geographic distribution of the tsetse fly by species in 1950. The only free zones of tsetse fly (*zone indemne*, in light blue dots) are located in the Kivus (Eastern region) and the Katanga province (South East). *Source:* Service Cartographique du Ministere des Colonies.

Figure A13: Evolution of mortality rate, 1910-2020



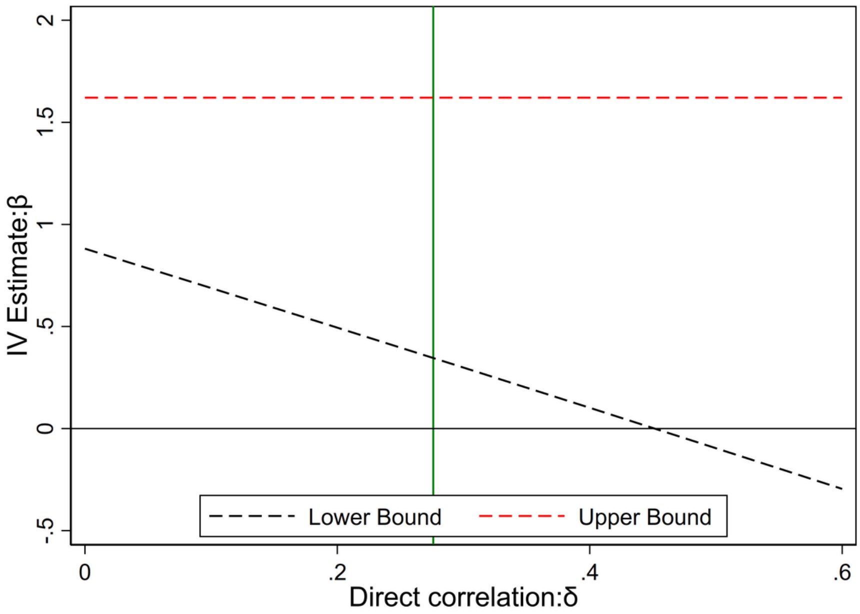

**Notes:** The graph plots the evolution of the mortality rate per 1,000 among the Congolese population during the colonial period (1910-1960) and in the country in the post-colonial period (1960-2020). Data on mortality rate were collected from the annual reports of public health in Belgian Congo during the colonial period, and from a combination of IMF, IBRD and World Bank reports in the post-colonial period. *Source:* author's computations using data on medical personnel and population estimates from *Annuaire statistique de la Belgique et du Congo Belge* and *Rapport annuel, Direction Générale des services médicaux du Congo Belge* for the colonial period; World Bank estimates in the post-colonial period (Source:https://data.worldbank.org/indicator/SP.DYN.CDRT.IN?locations=CD). See Appendix B.1 for details on the data sources.

Figure A14: Mapping of colonial medical structures in 1953

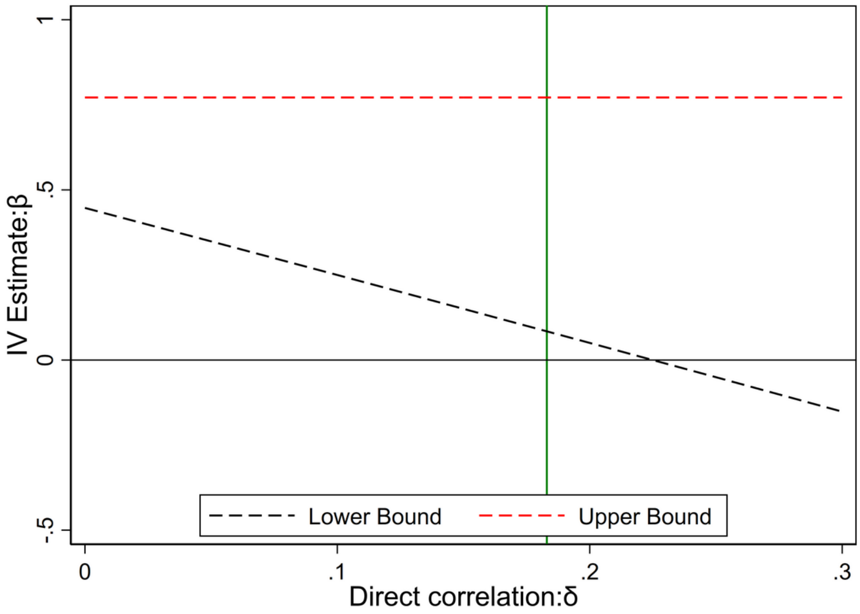



**Notes:** The map depicts the location of all major health infrastructures in 1953. *Source:* Ministry of Colonies.

Figure A15: Confidence intervals of IV Estimates under plausible exogeneity




(A) Government transfers




(B) Bed capacity

**Notes:** The graphs plot the upper and lower bounds of the union of 95% confidence intervals of the IV estimates for government transfers and bed capacity using Conley et al. (2012)'s methodology on Union of Confidence Intervals approach. The algorithm was implemented by Clarke and Matta (2018). In each graph, the vertical green line indicates the value of the reduced-form coefficient. The maximum $\delta$ for which the lower bound is nonnegative is 0.451 in graph (A) and 0.225 in graph (B).

Table A5: Characteristics of colonial health investments

| | Bed capacity | |
|---|---|---|
| | (1) | (2) |
| Population density 1951 | 0.092** | 0.079* |
| | (0.043) | (0.043) |
| Distance Provincial capital | -0.085 | -0.067 |
| | (0.052) | (0.045) |
| Distance to transport | -0.035 | -0.035 |
| | (0.035) | (0.036) |
| Distance to coast | -0.066 | -0.063 |
| | (0.334) | (0.305) |
| Natural resources (before 1960) | 0.125 | 0.121 |
| | (0.091) | (0.093) |
| Longitude | -0.013 | -0.012 |
| | (0.039) | (0.041) |
| Latitude | 0.031 | 0.032 |
| | (0.053) | (0.047) |
| Cassava suitability | 0.000 | 0.000 |
| | (0.000) | (0.000) |
| Ruggedness | -0.004 | -0.004 |
| | (0.003) | (0.003) |
| White European population | 0.113 | 0.105 |
| | (0.072) | (0.081) |
| Sleeing sickness | 0.011 | 0.014 |
| | (0.112) | (0.111) |
| Population density in 1921 | | -0.057 |
| | | (0.194) |
| Population density in 1800 | | 0.079 |
| | | (0.054) |
| Sleeping sickness in 1910 | | 0.004 |
| | | (0.076) |
| Concessions in CFS | | 0.034 |
| | | (0.118) |
| $R^2$ | 0.35 | 0.36 |
| Observations | 296 | 296 |
| Mean dep. var | 4.41 | 4.41 |
| Province Fixed Effect | ✓ | ✓ |

*Notes:* The unit of observation is a hospital. The table presents OLS estimates. The dependent variable is bed capacity (in logarithm), a proxy for the amount of colonial health investment. The data sample is restricted to hospitals with a colonial origin. Natural resources is a dummy variable equal to one for the exploitation of natural resources during the colonial period. White European population is an indicator equal to one if the colonial health settlement had at least one unit providing health services to Europeans only. Colonial Congolese is an indicator equal to one if the colonial health settlement had at least one unit providing health services to Congolese. Concessions in CFS is a dummy variably equal to one if a hospital is located in an area historically belonging to a private concession during the Congo Free State (CFS). Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

# Table A6: Extended results of Table 1

| | Bed capacity | Government transfers | | | Total | | Malaria | | Diarrhea | | Emergency | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Colonial settlement | 0.708*** | 1.204*** | 1.114*** | 0.338*** | 0.431*** | -0.084* | 0.621*** | 0.157*** | 0.291*** | 0.055 | 0.579*** | 0.047 |
| | (0.069) | (0.108) | (0.119) | (0.083) | (0.068) | (0.042) | (0.078) | (0.049) | (0.065) | (0.064) | (0.129) | (0.095) |
| ln Nurses | | | | 0.583*** | | 0.640*** | | 0.542*** | | 0.280*** | | 0.683*** |
| | | | | (0.070) | | (0.040) | | (0.044) | | (0.036) | | (0.074) |
| ln Physicians | | | | 0.621*** | | -0.005 | | -0.014 | | 0.000 | | 0.014 |
| | | | | (0.077) | | (0.045) | | (0.064) | | (0.054) | | (0.100) |
| Hospital ownership | | | -0.355*** | -0.116* | | 0.043** | | -0.030 | | -0.002 | | 0.006 |
| | | | (0.086) | (0.061) | | (0.021) | | (0.028) | | (0.014) | | (0.045) |
| ln Population | | | 0.116 | -0.198** | | 0.058 | | 0.022 | | 0.037 | | 0.041 |
| | | | (0.115) | (0.085) | | (0.045) | | (0.130) | | (0.045) | | (0.132) |
| ln Distance Provincial capital | 0.001 | -0.100 | -0.107 | 0.017 | -0.028 | 0.001 | 0.118 | 0.137 | -0.009 | 0.002 | 0.009 | 0.042 |
| | (0.040) | (0.083) | (0.082) | (0.064) | (0.039) | (0.031) | (0.094) | (0.093) | (0.038) | (0.036) | (0.093) | (0.077) |
| ln Distance Distributional Centre | 0.048 | 0.099 | 0.113 | 0.139* | 0.016 | 0.034 | 0.094 | 0.111** | 0.043 | 0.053 | 0.058 | 0.093 |
| | (0.037) | (0.075) | (0.073) | (0.072) | (0.031) | (0.022) | (0.059) | (0.046) | (0.035) | (0.032) | (0.079) | (0.061) |
| ln Distance Transport | 0.012 | 0.038 | 0.026 | -0.010 | 0.012 | 0.007 | 0.001 | -0.010 | 0.027 | 0.023 | 0.008 | -0.001 |
| | (0.023) | (0.031) | (0.033) | (0.029) | (0.026) | (0.020) | (0.038) | (0.035) | (0.022) | (0.020) | (0.041) | (0.040) |
| Population density 1951 | 0.050** | 0.125** | 0.125** | 0.052 | 0.049 | 0.025 | 0.028 | 0.009 | 0.015 | 0.003 | 0.077* | 0.039 |
| | (0.024) | (0.048) | (0.055) | (0.053) | (0.037) | (0.034) | (0.065) | (0.064) | (0.034) | (0.028) | (0.039) | (0.043) |
| Natural resources (before 1960) | -0.132 | 0.272 | 0.291 | 0.081 | 0.116 | 0.040 | 0.045 | 0.001 | 0.044 | 0.015 | 0.137 | 0.044 |
| | (0.161) | (0.179) | (0.172) | (0.109) | (0.170) | (0.114) | (0.177) | (0.113) | (0.156) | (0.123) | (0.201) | (0.132) |
| Malaria risk rate | -0.023 | 0.020 | -0.094 | 0.491 | -0.395** | -0.148 | 0.209 | 0.383 | 0.192 | 0.285 | -0.028 | 0.264 |
| | (0.215) | (0.397) | (0.385) | (0.413) | (0.182) | (0.168) | (0.426) | (0.417) | (0.286) | (0.290) | (0.491) | (0.462) |
| Elevation | 0.000 | -0.000* | -0.000 | -0.000 | -0.000** | -0.000 | -0.001*** | -0.001*** | -0.000 | -0.000 | -0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Longitude | 0.001 | 0.005 | -0.010 | 0.043 | 0.006 | 0.022 | 0.074** | 0.085** | 0.032 | 0.040* | -0.006 | 0.014 |
| | (0.016) | (0.052) | (0.050) | (0.037) | (0.028) | (0.024) | (0.034) | (0.034) | (0.021) | (0.020) | (0.032) | (0.031) |
| Latitude | -0.008 | 0.062 | 0.078 | 0.079* | -0.001 | 0.007 | 0.003 | 0.013 | -0.039 | -0.035 | -0.053 | -0.039 |
| | (0.025) | (0.065) | (0.062) | (0.044) | (0.042) | (0.030) | (0.033) | (0.024) | (0.030) | (0.032) | (0.048) | (0.042) |
| ln Distance conflict | -0.063*** | -0.143*** | -0.137** | -0.030 | -0.084*** | -0.030 | -0.065*** | -0.023 | -0.051* | -0.027 | -0.097** | -0.024 |
| | (0.020) | (0.050) | (0.051) | (0.042) | (0.025) | (0.027) | (0.022) | (0.021) | (0.030) | (0.026) | (0.042) | (0.033) |
| ln Distance nearest hospital | 0.005 | -0.002 | -0.015 | 0.016 | -0.030* | -0.006 | 0.068** | 0.085*** | 0.008 | 0.018 | 0.049 | 0.077** |
| | (0.012) | (0.041) | (0.045) | (0.044) | (0.015) | (0.012) | (0.026) | (0.022) | (0.021) | (0.018) | (0.042) | (0.032) |
| cassava | 0.000 | 0.000 | 0.000 | -0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000*** | 0.000*** | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Standardised $\beta$ coefficient | 0.433 | 0.386 | 0.357 | 0.108 | 0.221 | -0.043 | 0.253 | 0.064 | 0.162 | 0.030 | 0.227 | 0.018 |
| $R^2$ | 0.30 | 0.26 | 0.29 | 0.56 | 0.18 | 0.49 | 0.32 | 0.46 | 0.25 | 0.32 | 0.20 | 0.39 |
| Observations | 991 | 755 | 755 | 755 | 1,040 | 1,040 | 1,050 | 1,050 | 1,051 | 1,051 | 915 | 915 |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

*Notes:* The unit of observation is a hospital. The table reports the estimated coefficients on the control variables of Table 1. Non-dummy variables are all in natural logarithms. Robust standard errors are in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A7: Colonial settlement and hospital outcomes: SUR model

| Dep. Variable | Bed capacity (1) | Government transfers (2) | Health services: admissions Total (3) | Malaria (4) | Diarrhea (5) | Emergency (6) |
|---|---|---|---|---|---|---|
| Colonial settlement | 0.573 | 1.077 | 0.324 | 0.469 | 0.240 | 0.449 |
| s.e. | 0.050 | 0.111 | 0.057 | 0.072 | 0.060 | 0.088 |
| $p$-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Standardised $\beta$ coefficient | 0.408 | 0.357 | 0.210 | 0.239 | 0.151 | 0.196 |
| Observations | 672 | 672 | 672 | 672 | 672 | 672 |

*Notes:* The unit of observation is a hospital. Generalised Least Squares (GLS) estimation of equation equation (1) using the Seemingly Unrelated Regressions (SUR) technique (Zellner and Huang, 1962). All baseline controls and provincial fixed effects are included. Robust standard errors are in parentheses.

Table A8: Robustness to alternative standard errors

| | Bed capacity | Government transfers | Total | Malaria | Diarrhea | Emergency |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Colonial settlement | 0.708*** | 1.204*** | 0.431*** | 0.621*** | 0.291*** | 0.579*** |
| | (0.070) | (0.110) | (0.068) | (0.079) | (0.066) | (0.131) |
| Inference Robustness ($\beta$) | | | | | | |
| $p$-value: Robust S.E. | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| $p$-value: Wild Bootstrap | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| $p$-value: Moran I Test | 0.253 | 0.337 | 0.119 | 0.257 | 0.319 | 0.234 |
| Standardized $\beta$ coefficient | 0.433 | 0.386 | 0.221 | 0.253 | 0.162 | 0.227 |
| Province Fixed Effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.301 | 0.259 | 0.182 | 0.321 | 0.250 | 0.201 |
| Observations | 991 | 755 | 1,040 | 1,050 | 1,051 | 915 |

*Notes:* The unit of observation is a hospital. The table presents the OLS estimates of equation (1). Robust standard errors are in parentheses. The table reports $p$-value with robust standard errors clustered at the province level, wild bootstrap with 9,999 replications clustered at the province level $p$-value, and the $p$-value of Moran's I statistics for spatial autocorrelation. All baseline controls and provincial fixed effects are included. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

## Table A9: Robustness to different cutoff radii for spatial clustering

| Dep. Variable | Bed capacity (1) | Government transfers (2) | Health services: admissions Total (3) | Malaria (4) | Diarrhea (5) | Emergency (6) |
|---|---|---|---|---|---|---|
| **Baseline: cluster by province** | | | | | | |
| Colonial settlement | 0.708*** | 1.204*** | 0.431*** | 0.621*** | 0.291*** | 0.579*** |
| | (0.069) | (0.108) | (0.068) | (0.078) | (0.065) | (0.129) |
| Observations | 991 | 755 | 1,040 | 1,050 | 1,051 | 915 |
| **Standard errors: Spatial correction using correction thresholds** | | | | | | |
| 100 km | (0.064)*** | (0.105)*** | (0.067)*** | (0.074)*** | (0.057)*** | (0.111)*** |
| 150 km | (0.064)*** | (0.099)*** | (0.065)*** | (0.060)*** | (0.061)*** | (0.115)*** |
| 200 km | (0.072)*** | (0.105)*** | (0.065)*** | (0.071)*** | (0.071)*** | (0.126)*** |
| 250 km | (0.074)*** | (0.108)*** | (0.065)*** | (0.071)*** | (0.066)*** | (0.129)*** |
| 500 km | (0.082)*** | (0.119)*** | (0.067)*** | (0.080)*** | (0.050)*** | (0.132)*** |
| 750 km | (0.079)*** | (0.100)*** | (0.076)*** | (0.078)*** | (0.071)*** | (0.144)*** |

**Notes:** The unit of observation is a hospital. The table presents OLS estimates. Following Conley (1999) and using the approach developed by Colella et al. (2018), standard errors are adjusted for spatial dependence by clustering observations within circles of varying distances. The first panel reports the coefficient of the colonial settlement from equation 1 and the second panel reports the standard errors when changing the variance-covariance matrix through varying the distance thresholds of the spatial clusters. All regressions include baseline the baseline controls and province fixed effects. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

## Table A10: Colonial settlement effects: adding hospitals without locations

| Dep. Variable | Bed capacity (1) | Government transfers (2) | Health services: admissions Total (3) | Malaria (4) | Diarrhea (5) | Emergency (6) |
|---|---|---|---|---|---|---|
| **Panel A. Baseline sample** | | | | | | |
| Colonial settlement | 0.713*** | 1.182*** | 0.348*** | 0.752*** | 0.293*** | 0.589*** |
| | (0.090) | (0.105) | (0.076) | (0.090) | (0.064) | (0.136) |
| Standardised $\beta$ coefficient | 0.436 | 0.374 | 0.177 | 0.302 | 0.163 | 0.230 |
| $R^2$ | 0.29 | 0.23 | 0.14 | 0.24 | 0.23 | 0.19 |
| Observations | 991 | 765 | 1,057 | 1,068 | 1,068 | 922 |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Panel B. Adding hospitals with no recorded locations** | | | | | | |
| Colonial settlement | 0.764*** | 1.285*** | 0.453*** | 0.858*** | 0.334*** | 0.685*** |
| | (0.090) | (0.112) | (0.085) | (0.090) | (0.065) | (0.136) |
| Standardised $\beta$ coefficient | 0.438 | 0.393 | 0.196 | 0.311 | 0.172 | 0.248 |
| $R^2$ | 0.29 | 0.23 | 0.15 | 0.23 | 0.23 | 0.20 |
| Observations | 1,200 | 796 | 1,339 | 1,340 | 1,340 | 1,101 |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

*Notes:* The unit of observation is a hospital. The table presents OLS estimates. Panel A reports the estimates using the main data sample, and without controlling for the geographic factors. Panel B adds hospitals with unknown geo-coordinates. Robust standard errors are in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A11: Colonial settlement and government transfers (extended)

| | (ln) Government transfers OLS | | Government transfers Poisson | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **Panel A. Estimates** | | | | |
| Colonial settlement | 1.189*** | 1.234*** | 1.310*** | 1.287*** |
| | (0.106) | (0.101) | (0.158) | (0.153) |
| $R^2$ | 0.23 | 0.26 | | |
| Observations | 765 | 765 | 874 | 874 |
| Mean dep. var | | 14.230 | 3.74e+06 | 3.74e+06 |
| Standardised $\beta$ coefficient | | 0.391 | | |
| Province Fixed Effects | | ✓ | ✓ | ✓ |
| Baseline controls | | ✓ | ✓ | ✓ |
| Additional controls | | ✓ | | ✓ |
| **Panel B. Omitted variable - breakdown points** | | | | |
| Oster $\delta$: $R^2_{long} = 1.3 \times \hat{R}^2_{med}$ | | 3.45 | | |
| DMP: $\bar{r}_X^{\mathsf{bp}}$ | | 0.98 | | |
| **Panel C. Panel data - Correlated Random Effects** | | | | |
| Colonial settlement | 0.252*** | | | |
| | (0.081) | | | |
| Observations | 17298 | | | |
| Hospitals | 735 | | | |
| Mean dep. var | 14.29 | | | |
| Province Fixed Effect | ✓ | | | |
| Baseline controls | ✓ | | | |
| Wald test $\chi^2$ | 11.52 | | | |
| Wald test $p$-value | 0.00 | | | |

*Notes:* The unit of observation is a hospital. The table presents OLS estimates for log government transfers in the first two columns, and the Poisson pseudo-maximum likelihood (PPML) estimates in the following two columns. Additional controls include distance to electrical infrastructure, slope, distance to coast, suitability index for rubber, and for cotton. Oster $\delta$ refers to the test of the relative importance of observed and unobserved variables in selection bias, as suggested in Oster (2019), with the rule of thumb choice of $R^2_{long} = 1.3 \times \hat{R}^2_{med}$. The parameter $\bar{r}_X^{\mathsf{bp}}$ refers to the method proposed by Diegert et al. (2024) (DMP) that captures the proportion of selection on unobservables relative to observables where the coefficient on colonial settlement would still be non-negative, while allowing correlation between omitted variables and the controls. All additional controls are used as comparison variables. Panel C reports estimates from the Random Effect Mundlak model using the panel structure of the data, with time fixed effects and within-hospital averages of the number of health workers and physicians. The Wald test assesses the join significance of all hospital averages (i.e. Mundlak variables) included in the model. Non-dummy variables are all in natural logarithms. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A12: Colonial settlement and bed capacity (extended)

| | (ln) Bed capacity (OLS) | | Bed capacity (Poisson) | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **Panel A. Estimates** | | | | |
| Colonial settlement | 0.708*** | 0.706*** | 0.694*** | 0.691*** |
| | (0.069) | (0.070) | (0.078) | (0.078) |
| $R^2$ | 0.30 | 0.30 | | |
| Observations | 991 | 991 | 991 | 991 |
| Mean dep. var | | 3.940 | 66.946 | 66.946 |
| Standardised $\beta$ coefficient | | 0.432 | | |
| Province Fixed Effects | | ✓ | ✓ | ✓ |
| Baseline controls | | ✓ | ✓ | ✓ |
| Additional controls | | ✓ | | ✓ |
| **Panel B. Omitted variable - breakdown points** | | | | |
| Oster $\delta$: $R^2_{long} = 1.3 \times \hat{R}^2_{med}$ | | 2.76 | | |
| DMP: $\bar{r}_X^{\mathsf{bp}}$ | | 0.99 | | |

*Notes:* The unit of observation is a hospital. Columns (1)–(2) report OLS estimates for log bed capacity; Columns (3)–(4) report Poisson pseudo-maximum likelihood (PPML) estimates. Additional controls include distance to electrical infrastructure and the coast, slope, and suitability indices for rubber and cotton. Oster $\delta$ measures the relative importance of selection on unobservables versus observables following Oster (2019), using $R^2_{long} = 1.3 \times \hat{R}^2_{med}$. The parameter $\bar{r}_X^{\mathsf{bp}}$ is the breakdown point proposed by Diegert et al. (2024) (DMP) allowing for correlation between omitted variables and controls. Robust standard errors in parentheses clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A13: Colonial settlement and hospital outcomes: subsample robustness

| Dep. Variable | Bed capacity (1) | Government transfers (2) | Health services: admissions Total (3) | Malaria (4) | Diarrhea (5) | Emergency (6) |
|---|---|---|---|---|---|---|
| Panel A. | | | subsample: **Excluding Kinshasa** | | | |
| Colonial settlement | 0.690*** | 1.228*** | 0.437*** | 0.660*** | 0.281*** | 0.551*** |
| | (0.071) | (0.105) | (0.073) | (0.080) | (0.067) | (0.132) |
| Standardised $\beta$ coefficient | 0.432 | 0.399 | 0.235 | 0.275 | 0.161 | 0.222 |
| $R^2$ | 0.32 | 0.26 | 0.20 | 0.34 | 0.27 | 0.23 |
| Observations | 920 | 744 | 953 | 963 | 962 | 857 |
| Panel B. | | | subsample: **Excluding North & South Kivu** | | | |
| Colonial settlement | 0.689*** | 1.168*** | 0.414*** | 0.641*** | 0.329*** | 0.568*** |
| | (0.077) | (0.116) | (0.075) | (0.079) | (0.060) | (0.131) |
| Standardised $\beta$ coefficient | 0.430 | 0.388 | 0.216 | 0.272 | 0.190 | 0.236 |
| $R^2$ | 0.31 | 0.25 | 0.20 | 0.32 | 0.26 | 0.24 |
| Observations | 786 | 613 | 859 | 865 | 863 | 735 |
| Panel C. | | | subsample: **Excluding Ituri** | | | |
| Colonial settlement | 0.719*** | 1.238*** | 0.454*** | 0.673*** | 0.301*** | 0.594*** |
| | (0.071) | (0.110) | (0.073) | (0.080) | (0.069) | (0.136) |
| Standardised $\beta$ coefficient | 0.436 | 0.397 | 0.230 | 0.272 | 0.166 | 0.231 |
| $R^2$ | 0.30 | 0.27 | 0.19 | 0.33 | 0.26 | 0.21 |
| Observations | 944 | 728 | 1010 | 1021 | 1021 | 877 |
| Panel D. | | | subsample: **Excluding Kasaï Oriental & Kasaï Central** | | | |
| Colonial settlement | 0.734*** | 1.271*** | 0.450*** | 0.656*** | 0.279*** | 0.620*** |
| | (0.062) | (0.102) | (0.070) | (0.078) | (0.066) | (0.129) |
| Standardised $\beta$ coefficient | 0.452 | 0.408 | 0.229 | 0.268 | 0.156 | 0.241 |
| $R^2$ | 0.32 | 0.27 | 0.19 | 0.33 | 0.26 | 0.22 |
| Observations | 903 | 677 | 965 | 973 | 976 | 835 |

*Notes:* The unit of observation is a hospital. The table reports the OLS estimates of equation (1), with alternative samples. Panel A removes hospitals from Kinshasa province, panel B excludes hospitals from North and South Kivu provinces, panel C from Ituri province, and panel D from the Kasaï region. Non-dummy variables are all in natural logarithms. All baseline controls listed in Table 1 and province fixed effects are included. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A14: Completeness and timeliness scores

| | Completeness | | Promptness | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Colonial settlement | 0.038** | -0.001 | -0.052*** | -0.012 |
| | (0.017) | (0.018) | (0.009) | (0.008) |
| Standardised $\beta$ coefficient | 0.063 | -0.002 | -0.142 | -0.034 |
| $R^2$ | 0.12 | 0.14 | 0.20 | 0.23 |
| Observations | 1,092 | 1,092 | 1,092 | 1,092 |
| Mean dep. var | 0.88 | 0.88 | 0.06 | 0.06 |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ |
| Baseline controls | ✓ | ✓ | ✓ | ✓ |
| Referral Hospital | | ✓ | | ✓ |

*Notes:* The unit of observation is a hospital. The table presents the OLS estimates of equation (1) where the dependent variable is completeness rate (the extent to which expected data is reported) in Columns (1) and (2), and timeliness score (whether data is submitted on time) in Columns (3) and (4). Columns (1) and (3) include all hospitals, and columns (2) and (4) control for the referral general hospital (HGR) status as a dummy variable. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A15: Government transfers and missing values

| | Government transfers | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Colonial settlement | 1.235*** | 1.307*** | 1.533*** | 1.582*** |
| | (0.105) | (0.119) | (0.146) | (0.153) |
| Quality threshold | | | | |
| Completeness score ≥ | | 80% | 80% | 80% |
| Timeliness score ≥ | | 80% | 65% | 50% |
| Standardized $\beta$ coefficient | 0.391 | 0.357 | 0.296 | 0.254 |
| Province Fixed Effects | ✓ | ✓ | ✓ | ✓ |
| Baseline controls | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0.261 | 0.207 | 0.177 | 0.218 |
| Observations | 765 | 768 | 780 | 791 |

*Notes:* The unit of observation is a hospital. The table presents the OLS estimates of equation (1), replacing the missing values in the dependent variable (government transfers) according to various assumptions about the data quality. When the reporting data from a hospital reaches a minimum quality threshold, missing values are replaced with zero. The quality of data reporting is defined as reaching minimum threshold for completeness (how much of the expected data has been reported) and timeliness (whether a hospital has submitted the data within a certain period), two scores used to assess data quality by the central health system in the DRC. The minimum set objective by the central health authorities is 80% for both completeness and timeliness scores. Column (1) corresponds to the baseline results. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

## Table A16: Summary statistics for unreported govt. transfers

| | Non-missing values | | | Missing values | | | Difference-in-means | |
|---|---|---|---|---|---|---|---|---|
| | Obs. | Sample mean | s.d. | Obs. | Sample mean | s.d. | Diff-in-means | p-value |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Colonial hospital | 796 | 0.32 | 0.02 | 597 | 0.06 | 0.01 | -0.26 | 0.00 |
| Nurses | 795 | 2.56 | 0.03 | 566 | 2.31 | 0.04 | -0.25 | 0.00 |
| Physicians | 783 | 1.10 | 0.03 | 553 | 1.03 | 0.04 | -0.07 | 0.18 |
| Public hospital | 796 | 0.50 | 0.02 | 597 | 0.17 | 0.02 | -0.33 | 0.00 |
| Faith-based hospital | 796 | 0.43 | 0.02 | 597 | 0.25 | 0.02 | -0.18 | 0.00 |
| Private hospital | 796 | 0.16 | 0.01 | 597 | 0.63 | 0.02 | 0.47 | 0.00 |
| Distance to provincial city | 767 | 5.11 | 0.04 | 328 | 3.84 | 0.11 | -1.27 | 0.00 |
| Distance to distribution centres | 767 | 4.37 | 0.04 | 328 | 3.47 | 0.07 | -0.89 | 0.00 |
| Access | 767 | 2.96 | 0.05 | 328 | 2.09 | 0.07 | -0.87 | 0.00 |
| Population density 1951 | 765 | 2.44 | 0.03 | 327 | 2.95 | 0.06 | 0.51 | 0.00 |
| Presence natural resouces | 768 | 0.47 | 0.02 | 329 | 0.57 | 0.03 | 0.10 | 0.00 |
| Malaria risk rate | 768 | 0.23 | 0.01 | 328 | 0.17 | 0.01 | -0.06 | 0.00 |
| Elevation | 768 | 773.13 | 17.24 | 328 | 733.12 | 29.89 | -40.02 | 0.25 |
| Population | 796 | 12.27 | 0.02 | 593 | 12.50 | 0.02 | 0.23 | 0.00 |
| Longitude | 768 | 23.49 | 0.18 | 329 | 21.21 | 0.36 | -2.27 | 0.00 |
| Latitude | 768 | -3.23 | 0.14 | 329 | -5.00 | 0.20 | -1.76 | 0.00 |
| Distance to conflict | 767 | 2.52 | 0.05 | 328 | 1.54 | 0.06 | -0.97 | 0.00 |
| Distance to electrical infrastructure | 767 | 2.52 | 0.06 | 328 | 2.06 | 0.08 | -0.45 | 0.00 |
| Slope | 768 | 1.17 | 0.02 | 328 | 1.17 | 0.04 | -0.01 | 0.88 |
| Distance to coast | 767 | 6.88 | 0.02 | 328 | 6.92 | 0.02 | 0.04 | 0.13 |

**Notes:** The unit of observation is a hospital. The first six columns report the number of observations, sample mean and standard deviation for hospitals with and without missing values for government transfers. The last two columns indicate the difference in means between the two hospital groups, and the *p*-value of the test of whether the mean coefficients in the two samples are equal.

## Table A17: Government transfers and underreporting

| | Government transfers | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Colonial settlement | 1.235*** | 0.338** | 1.266*** | 1.685*** | 1.606*** | 0.811*** |
| | (0.105) | (0.133) | (0.128) | (0.127) | (0.131) | (0.141) |
| Interpolated data | | | | | | |
| Postcolonial | | bottom 5% | | | | |
| Public hospitals | | | bottom 1% | | top 1% | bottom 1% |
| Private hospitals | | | | bottom 1% | bottom 1% | top 1% |
| Standardized $\beta$ coefficient | 0.391 | 0.110 | 0.338 | 0.354 | 0.325 | 0.184 |
| Province Fixed Effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| $R^2$ | 0 | 0 | 0 | 0 | 0 | 0 |
| Observations | 765 | 765 | 813 | 945 | 987 | 987 |

*Notes:* The table presents the OLS estimates of equation (1), replacing values in the dependent variable (government transfers) according to various simulations. Since about 46 colonial hospitals could not be verified with certainty due to missing or inconsistent coordinates (Table A3), Column (1) reclassifies the 46 lowest-transfer of hospitals currently coded as postcolonial as colonial. Column (2) reports the baseline results. Columns (3) and (4) replace the missing values for respectively public and private hospitals with the bottom 1% of the transfers distribution. Columns (5) and (6) alternatively replace the missing values with the top 1% and bottom 1% of the distribution. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A18: Effects on Transfers, beds, and staff: IV

| | Government transfers | Bed capacity | Health workers | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Colonial settlement | 1.525*** | 0.864*** | 0.823*** | 0.129 |
| | (0.208) | (0.101) | (0.120) | (0.108) |
| Standardised $\beta$ coefficient | 0.483 | 0.529 | 0.412 | 0.065 |
| $R^2$ | 0.16 | 0.19 | 0.20 | 0.52 |
| Observations | 765 | 991 | 987 | 987 |
| Mean dep. var | 14.23 | 3.94 | 2.62 | 2.62 |
| Province Fixed Effects | ✓ | ✓ | ✓ | ✓ |
| Geographic controls | ✓ | ✓ | ✓ | ✓ |
| Bed Capacity | | | | ✓ |

*Notes:* The unit of observation is a hospital. The table presents 2SLS estimates. The sleeping sickness instrument is a dummy variable equal to one if the hospital is located within an area where the infection rate was least equal to 1% at any time during the 1929-1953 period. Baseline controls are presented in panel A of Table 1. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

## Table A19: Falsification and Placebo Tests for the Instrument

| | Distance postcolonial | | Locality | | Road length | | Nightlight | | Distance Public Force | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Sleeping area | 0.151 | 0.112 | 0.336 | 0.292 | 0.830 | 0.787 | -0.021 | -0.024 | -0.424 | -0.398 |
| | [-0.275,0.577] | [-0.321,0.546] | [-0.129,0.800] | [-0.152,0.737] | [0.086,1.573] | [-0.043,1.616] | [-0.138,0.095] | [-0.137,0.089] | [-1.061,0.213] | [-0.974,0.179] |
| Standardised $\beta$ coefficient | 0.041 | 0.031 | 0.105 | 0.092 | 0.148 | 0.141 | -0.022 | -0.025 | -0.133 | -0.125 |
| $R^2$ | 0.46 | 0.48 | 0.47 | 0.52 | 0.68 | 0.68 | 0.33 | 0.35 | 0.27 | 0.32 |
| Observations | 239 | 237 | 137 | 136 | 239 | 237 | 239 | 237 | 237 | 237 |
| Mean dep. var | 3.04 | 3.03 | 6.17 | 6.18 | 3.51 | 3.50 | 0.47 | 0.47 | 3.89 | 3.89 |
| Province Fixed Effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Geo. controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Additional controls | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ |

*Notes:* The unit of observation is a territory (main administrative unit below provinces). The table reports reduced-form regressions of historical sleeping sickness exposure on proxies for non-health state presence. Outcomes include distance to hospitals constructed after independence, number of localities, total road area, night-time lights, and proximity to *Force Publique* posts. All outcomes are taken in logarithm ($ln(1+x)$). Sleeping area is an indicator that a territory was exposed to sleeping sickness during the colonial period. Geographic controls include early colonial population density (1921), ruggedness, and territory surface area. Additional controls include geological resource endowments, distance to coast, distance to major rivers, and the presence of early concessions during the Congo Free State. Confidence intervals reported in brackets. Robust standard errors are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A20: Colonial settlement and hospital outcomes: IV shift-share

| Dep. Variable | Colonial settlement | | | | | |
|---|---|---|---|---|---|---|
| **Panel A. 1st stage** | | | | | | |
| Sleeping sickness | 0.481*** | 0.502*** | 0.476*** | 0.480*** | 0.472*** | 0.509*** |
| | (0.032) | (0.035) | (0.031) | (0.031) | (0.031) | (0.033) |
| Kleibergen-Paap $F$-statistic | 225.2 | 209.4 | 233.3 | 244.5 | 231.3 | 241.8 |

| | Bed | Government | Health services: admissions | | | |
|---|---|---|---|---|---|---|
| Dep. Variable | capacity | transfers | Total | Malaria | Diarrhea | Emergency |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Panel B. 2nd stage** | | | | | | |
| Colonial settlement | 0.860*** | 1.507*** | 0.463*** | 0.685*** | 0.054 | 0.580*** |
| | (0.101) | (0.207) | (0.127) | (0.145) | (0.117) | (0.173) |
| Standardised $\beta$ coefficient | 0.526 | 0.478 | 0.236 | 0.276 | 0.030 | 0.227 |
| Anderson-Rubin $p$-value | 0.00 | 0.00 | 0.00 | 0.00 | 0.64 | 0.00 |
| $R^2$ | 0.19 | 0.16 | 0.08 | 0.19 | 0.04 | 0.07 |
| Observations | 991 | 765 | 1,057 | 1,068 | 1,068 | 922 |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

*Notes:* The unit of observation is a hospital. The table presents 2SLS estimates. The sleeping sickness instrument is interacted with distance to pre-1920 transport routes. Baseline controls are presented in Table 1. Robust standard errors are in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A21: Colonial settlement and hospital outcomes: IV and Entropy balancing

| Dep. Variable | Colonial settlement | | | | | |
|---|---|---|---|---|---|---|
| **Panel A. 1st stage** | | | | | | |
| Sleeping sickness | 0.483*** | 0.493*** | 0.473*** | 0.479*** | 0.470*** | 0.513*** |
| | (0.033) | (0.036) | (0.032) | (0.032) | (0.032) | (0.034) |
| Kleibergen-Paap $F$-statistic | 218.4 | 184.4 | 217.3 | 227.6 | 212.8 | 231.9 |

| Dep. Variable | Bed capacity (1) | Government transfers (2) | Health services: admissions Total (3) | Malaria (4) | Diarrhea (5) | Emergency (6) |
|---|---|---|---|---|---|---|
| **Panel B. Reduced-form** | | | | | | |
| Sleeping sickness | 0.432*** | 0.717*** | 0.248*** | 0.294*** | 0.123 | 0.351** |
| | (0.078) | (0.096) | (0.054) | (0.076) | (0.086) | (0.144) |
| Standardised $\beta$ coefficient | 0.293 | 0.259 | 0.152 | 0.148 | 0.077 | 0.159 |
| $R^2$ | 0.28 | 0.18 | 0.21 | 0.22 | 0.26 | 0.23 |
| Observations | 981 | 755 | 1,040 | 1,050 | 1,051 | 915 |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Panel C. 2nd stage** | | | | | | |
| Colonial settlement | 0.893*** | 1.454*** | 0.525*** | 0.615*** | 0.261** | 0.685*** |
| | (0.111) | (0.224) | (0.134) | (0.151) | (0.130) | (0.176) |
| Standardised $\beta$ coefficient | 0.586 | 0.515 | 0.309 | 0.298 | 0.157 | 0.302 |
| Anderson-Rubin $p$-value | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 |
| $R^2$ | 0.22 | 0.20 | 0.09 | 0.14 | 0.07 | 0.07 |
| Observations | 981 | 755 | 1,040 | 1,050 | 1,051 | 915 |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

*Notes:* The unit of observation is a hospital. The table presents 2SLS estimates of equation (1) after using entropy weights from the balancing algorithm Hainmueller (2012) that imposes the control group (areas without sleeping sickness) to have the same mean and the same variance as the treatment group (areas with sleeping sickness) for all geographic variables. The sleeping sickness instrument is a dummy variable equal to one if the hospital is located within an area where the infection rate was least equal to 1% at any time during the 1929 - 1953 period. Baseline controls are presented in panel A of Table 1. Robust standard errors are in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A22: Test results of the validity of Sleeping sickness

| Dep. Variable | Bed capacity (1) | Government transfers (2) | Health services: admissions<br>Total (3) | Malaria (4) | Diarrhea (5) | Emergency (6) |
|---|---|---|---|---|---|---|
| $t$-stat | 0.920 | 0.000 | 0.000 | 0.939 | 0.080 | -2.287 |
| critical value $c(\alpha)$ | 2.241 | 1.960 | 2.394 | 2.128 | 2.241 | 1.959 |
| $p$-value | 0.715 | 0.999 | 0.999 | 0.522 | 0.999 | 0.999 |

**Notes:** The unit of observation is a hospital. The table presents the results of the procedure developed by Farbmacher et al. (2022) that employs causal forests to detect and test local violations of the exclusion restriction. The instrument tested is sleeping sickness. The set of covariates includes all baseline and geographic controls presented in Table 1. Rejecting the null hypothesis indicates that the exclusion assumption is violated at least in one subpopulation. The software package `LATEtest` in R was used to implement the tests.

Table A23: Foreign aid and reporting quality

| | Completeness (1) | Completeness (2) | Promptness (3) | Promptness (4) |
|---|---|---|---|---|
| Colonial × Chinese Aid | -0.003 | 0.001 | -0.000 | -0.000 |
| | (0.012) | (0.012) | (0.006) | (0.006) |
| AidChina (distance) | 0.004 | 0.001 | 0.004 | 0.004 |
| | (0.010) | (0.011) | (0.005) | (0.005) |
| Colonial × Western Aid | -0.016 | -0.016 | 0.001 | -0.003 |
| | (0.011) | (0.011) | (0.006) | (0.006) |
| Western Aid (distance) | 0.009 | 0.011 | 0.003 | 0.005 |
| | (0.009) | (0.009) | (0.006) | (0.006) |
| Colonial settlement | 0.064 | 0.032 | -0.042 | -0.017 |
| | (0.057) | (0.059) | (0.027) | (0.030) |
| $R^2$ | 0.16 | 0.17 | 0.19 | 0.20 |
| Observations | 981 | 981 | 981 | 981 |
| Mean dep. var | 0.90 | 0.90 | 0.05 | 0.05 |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ |
| Baseline controls | ✓ | ✓ | ✓ | ✓ |
| Health Workers | | ✓ | | ✓ |
| Bed Capacity | | ✓ | | ✓ |

*Notes:* The unit of observation is a hospital. The table presents the OLS estimates of equation (1) where the dependent variable is completeness rate (the extent to which expected data is reported) in Columns (1) and (2), and timeliness score (whether data is submitted on time) in Columns (3) and (4). Western aid and Chinese local aid are measures of the distance between the hospital and its closest aid project as geocoded from the DRC AIMS Geocoded Research Release. Baseline controls are presented in Table 1. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A24: Early and late colonial settlement

| Dependent variable: | Government transfers | | | | Bed capacity | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Colonial settlement | 0.334*** | 0.426*** | 0.293*** | 0.416*** | 0.276*** | 0.275*** | 0.282*** | 0.267*** |
| | (0.081) | (0.079) | (0.094) | (0.090) | (0.046) | (0.064) | (0.045) | (0.054) |
| × Early settlement | | -0.147* | | | | 0.002 | | |
| | | (0.081) | | | | (0.053) | | |
| × Late settlement | | | 0.132 | | | | -0.020 | |
| | | | (0.081) | | | | (0.058) | |
| × Early religious mission | | | | -0.131 | | | | 0.014 |
| | | | | (0.088) | | | | (0.049) |
| $R^2$ | 0.558 | 0.558 | 0.558 | 0.558 | 0.592 | 0.592 | 0.592 | 0.592 |
| Observations | 755 | 755 | 755 | 755 | 981 | 981 | 981 | 981 |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Health workers | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

*Notes:* The unit of observation is a hospital. The table presents the OLS estimates. The dependent variables are government transfers and bed capacity, both taken in logarithm. Early settlement is a dummy variably equal to one if the colonial settlement was constructed before 1936 and 0 otherwise. Late settlement is a dummy variable equal to one if the settlement was built after 1945. Early religious mission is a dummy variable equal to one if the settlement was a religious mission prior to 1929 (without necessarily providing health services) and is reported as providing health services before 1936. Baseline controls are presented in Table 1. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A25: Historical targeted population

| Dependent variable: | Government transfers | | | Bed capacity | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Colonial settlement | 0.334*** | 0.373*** | 0.428*** | 0.276*** | 0.270*** | 0.282*** |
| | (0.081) | (0.071) | (0.087) | (0.046) | (0.045) | (0.074) |
| × Colonial Europeans | | -0.155 | | | 0.024 | |
| | | (0.137) | | | (0.050) | |
| × Colonial Congolese | | | -0.135 | | | -0.008 |
| | | | (0.102) | | | (0.062) |
| $R^2$ | 0.558 | 0.558 | 0.558 | 0.592 | 0.592 | 0.592 |
| Observations | 755 | 755 | 755 | 981 | 981 | 981 |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Health workers | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

*Notes:* The unit of observation is a hospital. The table presents the OLS estimates. The dependent variables are government transfers and bed capacity, both taken in logarithm. Colonial Europeans is an indicator equal to one if the colonial health settlement had at least one unit providing health services to Europeans only. Colonial Congolese is an indicator equal to one if the colonial health settlement had at least one unit providing health services to Congolese. Baseline controls are presented in Table 1. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A26: Historical and modern hospital ownership

| Dependent variable: | Government transfers | | | | Bed capacity | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Panel A. Historical ownership** | | | | | | | | |
| Colonial settlement | 0.338*** | 0.435*** | 0.309*** | 0.306*** | 0.277*** | 0.329*** | 0.256*** | 0.252*** |
| | (0.083) | (0.090) | (0.092) | (0.081) | (0.046) | (0.048) | (0.043) | (0.050) |
| × Colonial state | | -0.208** | | | | -0.108** | | |
| | | (0.086) | | | | (0.051) | | |
| × Colonial mission | | | 0.083 | | | | 0.062 | |
| | | | (0.111) | | | | (0.051) | |
| × Colonial private | | | | 0.127 | | | | 0.110 |
| | | | | (0.119) | | | | (0.071) |
| **Panel B. Modern ownership** | | | | | | | | |
| Colonial settlement | 0.338*** | 0.414*** | 0.445*** | 0.311*** | 0.277*** | 0.277*** | 0.342*** | 0.240*** |
| | (0.083) | (0.109) | (0.118) | (0.087) | (0.046) | (0.078) | (0.048) | (0.040) |
| × Public hospital | | -0.124 | | | | 0.020 | | |
| | | (0.146) | | | | (0.079) | | |
| × Faith-based hospital | | | -0.213 | | | | -0.140* | |
| | | | (0.147) | | | | (0.069) | |
| × Private hospital | | | | 0.382 | | | | 0.412** |
| | | | | (0.288) | | | | (0.166) |
| Public hospital | | 0.139 | | | | -0.222*** | | |
| | | (0.119) | | | | (0.042) | | |
| Faith-based hospital | | | 0.272*** | | | | 0.298*** | |
| | | | (0.096) | | | | (0.033) | |
| Private hospital | | | | -0.541*** | | | | -0.038 |
| | | | | (0.183) | | | | (0.042) |
| F-test joint significance | | 0.01 | 0.04 | 0.02 | | 0.00 | 0.00 | 0.00 |
| $R^2$ | 0.56 | 0.56 | 0.56 | 0.57 | 0.59 | 0.60 | 0.61 | 0.59 |
| Observations | 755 | 755 | 755 | 755 | 981 | 981 | 981 | 981 |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Health workers | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

*Notes:* The unit of observation is a hospital. Colonial state, mission and private refer to the source of funding of the health settlement during the colonial period. Public, faith-based and private hospital refer to modern hospital ownership. Baseline controls are presented in Table 1. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A27: Hospital equipments

| | Glucometer | Microscope | Spectrophotometer | Anesthesia | Equipment utilisation | Prob(Equipment) |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Colonial settlement | -0.328 | -1.208 | -0.519 | 1.380** | -0.012 | 0.003 |
| | (1.037) | (1.402) | (0.676) | (0.636) | (0.102) | (0.029) |
| Standardised $\beta$ coefficient | -0.013 | -0.041 | -0.034 | 0.064 | -0.005 | 0.003 |
| $R^2$ | 0.26 | 0.16 | 0.16 | 0.39 | 0.25 | 0.18 |
| Observations | 732 | 613 | 865 | 858 | 876 | 1,064 |
| Mean dep. var | 21.71 | 15.33 | 28.34 | 13.88 | 0.15 | 0.48 |
| Province Fixed Effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Notes:** The unit of analysis is a hospital. The table presents the OLS estimates of equation (1) with four hospital equipments as dependent variables: Glucometer, Microscope, Spectrophotometer, Ketamine for medically-delegated analgesia. All are included in WHO's List of Priority Medical Devices and Essential Diagnostics List for primary and emergency care: glucometers are used for estimation of blood glucose levels (e.g. patients with diabetes); ketamine is a general anesthetic used for the management of acute pain; spectrophotometer provides quantitative analysis of biochemical substances through measuring the absorbance of light (e.g. blood analysis), but is not prioritised for primary care due to its high cost and maintenance complexity; microscopes are critical tools for diagnosis of diseases like malaria, tuberculosis, and intestinal parasites. Column (5) defines equipment utilisation by extracting the first principal component of Columns (1-4). Column (6) corresponds to the probability of having all the four equipments. All regressions add to the baseline controls the total number of hospital admissions. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A28: Additional hospital outcomes

| | Investment | Value of ward stock | Expenditure | | Revenue | | Local allowance | | Length of stay | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Colonial settlement | 0.066 | 0.181 | 0.354*** | 0.230* | 0.284** | 0.207 | 0.184** | 0.073 | 0.189*** | 0.045 |
| | (0.123) | (0.167) | (0.115) | (0.129) | (0.127) | (0.126) | (0.087) | (0.083) | (0.058) | (0.062) |
| Standardised $\beta$ coefficient | 0.019 | 0.032 | 0.093 | 0.061 | 0.064 | 0.047 | 0.054 | 0.022 | 0.075 | 0.018 |
| $R^2$ | 0.47 | 0.24 | 0.49 | 0.51 | 0.47 | 0.48 | 0.53 | 0.55 | 0.62 | 0.68 |
| Observations | 716 | 846 | 776 | 776 | 814 | 814 | 816 | 816 | 937 | 937 |
| Mean dep. var | 12.84 | 14.30 | 14.59 | 14.59 | 14.80 | 14.80 | 14.68 | 14.68 | 6.21 | 6.21 |
| Province Fixed Effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Total outpatients | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| No. Beds | | | | ✓ | | ✓ | | ✓ | | ✓ |

**Notes:** The unit of analysis is a hospital. The table presents the OLS estimates of equation (1) with additional hospital characteristics as dependent variables. Value of ward stock corresponds to the value of the medicine in the stock. Expenditure includes social charges, purchase of furniture and medicines. Local allowance corresponds to another source of revenue coming from user fees collected by hospitals to cover the salary of health workers. Length of stay corresponds to the total number of days that patients spend in hospital. All outcomes are taken in logarithm. All regressions add to the baseline controls the total number of hospital admissions, and Columns (4), (6), (8) and (10) further control for the number of beds. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A29: Colonial settlement and hospital outcomes: Referral hospitals

| Dep. Variable | Bed capacity (1) | Government transfers (2) | Health services: admissions<br>Total (3) | Malaria (4) | Diarrhea (5) | Emergency (6) |
|---|---|---|---|---|---|---|
| **Panel A. OLS** | | | | | | |
| Colonial settlement | 0.325*** | 0.436*** | 0.161*** | 0.248*** | 0.064 | 0.186* |
| | (0.039) | (0.068) | (0.046) | (0.059) | (0.074) | (0.097) |
| Standardised $\beta$ coefficient | 0.279 | 0.201 | 0.117 | 0.148 | 0.043 | 0.090 |
| $R^2$ | 0.35 | 0.30 | 0.32 | 0.32 | 0.30 | 0.25 |
| Observations | 478 | 423 | 474 | 478 | 478 | 472 |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Panel B. 2SLS estimation** | | | | | | |
| Colonial settlement | 0.373*** | 0.382** | 0.132 | 0.220* | -0.077 | 0.090 |
| | (0.091) | (0.177) | (0.110) | (0.131) | (0.127) | (0.176) |
| Standardised $\beta$ coefficient | 0.321 | 0.176 | 0.096 | 0.131 | -0.052 | 0.044 |
| Anderson-Rubin $p$-value | 0.00 | 0.03 | 0.22 | 0.09 | 0.52 | 0.59 |
| $R^2$ | 0.20 | 0.18 | 0.19 | 0.20 | 0.07 | 0.07 |
| Observations | 478 | 423 | 474 | 478 | 478 | 472 |
| Province Fixed Effect | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Baseline controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

*Notes:* The unit of observation is a hospital. The Table presents a replication of the baseline results, restricted to general referral hospitals. Panel A presents the OLS estimates of equation (1). Non-dummy variables are all in natural logarithms. Baseline controls are presented in panel A of Table 1. Robust standard errors in parentheses are clustered at the provincial level. Panel B presents the 2SLS estimates with the sleeping sickness instrument introduced in Section 5. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

Table A30: Colonial settlement: exploring additional channels

| | ln(0.01 + Light) | | Malaria risk | | Ethnic power | | Concessions in CFS | | Local gov. |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Colonial settlement | -0.096 | -0.081 | 0.004 | 0.004 | -0.019 | -0.013 | -0.014 | -0.004 | 0.089 |
| | (0.099) | (0.061) | (0.010) | (0.007) | (0.021) | (0.011) | (0.030) | (0.019) | (0.057) |
| Standardised $\beta$ coefficient | -0.025 | -0.021 | 0.015 | 0.013 | -0.020 | -0.014 | -0.013 | -0.004 | 0.015 |
| $R^2$ | 0.61 | 0.77 | 0.30 | 0.61 | 0.61 | 0.88 | 0.59 | 0.79 | 0.94 |
| Observations | 1,092 | 1,092 | 1,092 | 1,092 | 1,086 | 1,086 | 1,086 | 1,086 | 1,086 |
| Mean dep. var | 0.32 | 0.32 | 0.21 | 0.21 | 0.23 | 0.23 | 0.64 | 0.64 | 3.28 |
| Province Fixed Effect | | ✓ | | ✓ | | ✓ | | ✓ | ✓ |
| Geographic controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

*Notes:* The unit of observation is a hospital. The table presents the OLS estimates of equation (1). The dependent variables are $\ln(0.01+Light)$ to capture economic activity through night-time light, contemporary malaria risk, ethnic power, a dummy variably equal to one if a hospital is located in an area historically belonging to a private concession during the Congo Free State (CFS). In the last column, the dependent variable is defined as an indicator equal to one if the province governor was prosecuted for corruption (before 2017) interacted with the distance to the capital of the province to capture the influence of potential elite capture of government transfers. Robust standard errors in parentheses are clustered at the provincial level. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively.

# A Additional background information

## A.1 Sleeping sickness and colonial medical expansion

Human African Trypanosomiasis (sleeping sickness) is a parasitic disease transmitted by tsetse flies and was endemic in large parts of Central Africa prior to European colonisation. Historical evidence indicates that African populations were aware of the ecological determinants of the disease and adapted settlement and economic activity accordingly (Janssens and Burke, 1992; Koerner et al., 1995).

In the early twentieth century, sleeping sickness outbreaks escalated into large-scale epidemics across equatorial Africa, including the Belgian Congo. While the precise drivers of epidemic intensity remained poorly understood at the time, subsequent research shows that spatial variation in disease exposure was primarily driven by localised ecological interactions between parasites, vectors, humans, and animal hosts, rather than by colonial economic or administrative priorities (Ford, 1971; Franco et al., 2014). The disease spread along river systems and trade routes but remained geographically uneven. Colonial authorities responded to these epidemics by expanding medical surveillance and treatment capacity. Initial containment strategies relying on population isolation were gradually replaced by decentralised medical interventions, including mobile health teams operating in rural areas. These teams were tasked with population screening, treatment, and disease monitoring and frequently led to the establishment of permanent clinics and hospitals dedicated to sleeping sickness and other infectious diseases (Lyons, 2002). By the late 1930s, the burden of sleeping sickness had declined substantially, and by the end of the colonial period the disease was largely controlled (Ekwanzala et al., 1996).

Two features are critical for identification. First, tsetse fly habitat suitability was widespread across much of the territory, implying that observed variation in sleeping sickness exposure reflects localised epidemic intensity rather than coarse ecological gradients alone. Second, colonial medical expansion followed disease exposure rather than preceding it, making historical sleeping sickness prevalence a strong predictor of colonial hospital placement while remaining orthogonal to pre-existing economic or political conditions.

## A.2 Colonial health investments and persistence.

Prior to World War I, public health spending in the Belgian Congo was limited and largely confined to military and missionary medicine. During the interwar period, and especially after World War II, colonial authorities substantially expanded health investments in response to epidemic risks and economic exploitation needs (Dubois and Duren, 1947). The creation of the Department of Health in 1909 formalised a centralised system, and subsequent medical campaigns, combined with the Ten-Year Plan (1949–1959), generated large capital investments in hospitals, laboratories, and medical personnel.

These investments were sizeable by historical standards and resulted in a dense network of hospitals with comparatively high structural capacity by the eve of independence. This period represents the peak of public investment in health infrastructure. Following independence in 1960, state capacity deteriorated sharply: European medical personnel exited, public health budgets collapsed, and capital investment in hospitals stagnated (Mock et al., 1990). Kornfield (1986) examines how the quality of healthcare provision varies with hospital ownership. Using Lubumbashi, the second largest city in the country, as a case study, the author notes: "*There were three hospitals in the city. The most fully staffed and adequately equipped was the private hospital run by the large mining company. It was run very much like an American hospital with strict visiting hours. Parents were not hospitalized with their children as the staff was sufficient* *to give the complete attention to sick infants. It served the employees of the company and Zairian elite and Europeans. The least well-equipped and most inadequately staffed hospital which served the general population of the city was the public hospital run by the Zairian government. In this overcrowded hospital, families stayed with the patients, often slept on the floors of the hospital rooms, cooked their food, washed their laundry, and visited on the grounds within the inner court yard of the hospital buildings. The third hospital [...] was originally established by Catholic missionaries for the colonial community of the city. At the time of the study it served the university employees, including those professors and administrative staff who could not afford to use the mining company hospital, and those members of the population who could afford to pay for better care than was offered at the public hospital. It was better equipped than the public hospital but not as well as the mining hospital. The adequacy of its facilities and staff fell far below the minimum standards required of American and European hospitals*". Government health spending thereafter largely covered salaries, often irregularly, with little funding for new infrastructure or modernization.

This sharp discontinuity implies that hospitals established during the colonial period entered the post-independence era with substantially larger capital endowments than facilities built later. In a context of persistently low domestic health spending, these initial differences were never offset, providing a plausible mechanism for long run persistence in hospital infrastructure and financing.

### A.3 Modern-day health sector

The health system in DR Congo is made up of three levels: central, intermediate and peripheral. At the central level, the Ministry of Health is responsible for the national health strategies for each province of the country, and directly manages all general referral hospitals. In 2015, the DRC underwent a significant administrative reform that increased the number of provinces from 11 to 26. The intermediate level comprises provincial health divisions that coordinate between the central and local levels. In the decentralised Congolese economy, each of the 26 provinces of the DRC is ruled by a local government with a small autonomous budget. However, central government transfers account for the bulk of public health spending, while provincial governments contribute little (MSP, 2019).

The peripheral or operational level is the health zone. Each health zone integrates a network of health centres (first line of care, e.g. providing only ambulatory care) around a general referral hospital (serving as the main referral centre for health zones). Some rural health zones with limited access to a hospital also include referral health centres, which provide medical and surgical emergencies. The majority of non-hospital care is provided by the private sector, run mainly by health care professionals (Chenge et al., 2010).

The contemporary health system in the DRC is characterised by low domestic public financing and heavy reliance on external resources. Central government transfers account for the bulk of public health spending, while provincial governments contribute little. Development Assistance for Health represents roughly 40 percent of total health expenditures, and out-of-pocket payments account for nearly half (MSP, 2019).

Hospitals rely heavily on user fees to fund operating costs, including medicines, equipment, administrative staff, and wage supplements. Government salary payments are often irregular and incomplete. In this setting, historically established hospitals with larger infrastructure and administrative visibility face lower fixed costs of engagement for both the state and external donors.

Overall, the long run evolution of the mortality rate suggests a steady improvement in population health (Figure A13 in Online Appendix) compared to the colonial era.

# B Data Sources and variables definitions

## B.1 Archival data

**Georeferenced locations of colonial health settlements and modern hospitals.** To construct a novel dataset of all geocoded colonial health settlements during the colonial period, we digitise and geocode colonial maps on health settlements between 1929 and 1959, 7 in total. These maps, produced by the Belgian Ministry of Colonies, provide information on the location of all hospitals and dispensaries that reported health activities to the colonial government.

We obtain the georeferenced locations of modern hospitals in the DRC primarily using DHIS2. Since the database provides incomplete information about the geographic coordinates of health facilities, we triangulated the geographic information of facilities from additional sources: ReliefWeb maps with detailed locations of health facilities in each of the 26 provinces in the DRC; the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) database, OpenStreetMap files and the International Committee of the Red Cross health maps.[21] ReliefWeb provides a list of geocoded health facilities in the DRC related to OCHA's humanitarian activities and OpenStreetMap is an open database routinely enriched by field observations, satellite images and integrated datasets. We supplement these maps with the location of health facilities supported by the International Committee of the Red Cross in 2018.

We then matched contemporary hospitals with colonial settlements based on the name of the facility and its geographic coordinates. As all hospital names with Belgian references changed after independence, we tracked all hospital names with a former Belgian name from multiple post-colonial sources to match the colonial names with modern hospitals.[22]

## B.2 DHIS2 data

The DHIS2 (District Health Information System Version 2), is a health information system management developed, and supported by the University of Oslo (www.dhis2.org). The widespread implementation of the platform (more than 110 countries) is supported by global health partners such as the Global Fund, World Health Organization (WHO), UNICEF, USAID and GAVI, with the objective to strengthen Health Information System (HIS), and thereby inform evidence-based decision-making and strengthen health services delivery (Okonjo-Iweala and Osafo-Kwaako, 2007).

DHIS2 was first implemented in the DRC in 2013 at the national level. Routine data on key components such as health care programs, disease surveillance, stock management, finance, human resources, and infrastructure are collected at the health facility level. Additional information on a facility's catchment area is collected data on paper forms and transmitted to the facility by community health workers. At the end of each month, facilities send their routine data on key epidemiological, social, and financial indicators to the coordinating health zone office (*Bureau Central de la Zone de santé, BCZ*), and the paper forms are subsequently entered into the DHIS2 platform, managed and owned by the *Système National d'Information*

[21] These maps are obtained from the following websites: (ReliefWeb) https://reliefweb.int/; (OCHA) https://data.humdata.org/organization/ocha-dr-congo); (Red Cross) https://www.croixrouge-rdc.org/organisations/ and OpenStreet map (https://www.openstreetmap.org/).

[22] Using geographic location alone is insufficient as colonial maps only provide approximate geo-locations and new hospitals may have been built within a closed distance to colonial hospitals after independence.

Table A31: Maps of the colonial period

| Document & Author | Year | Information |
|---|---|---|
| Administrative map, Goossens | 1926 | Administrative map |
| Institut cartographique militaire | 1928 | Communication channels |
| Religious missions map, Mission scientifique belge | 1929 | Religious missions |
| Annual Public Health report Belgian Congo | 1933 | map of sleeping sickness |
| Annual Public Health report Belgian Congo | 1934 | map of sleeping sickness |
| Annual Public Health report Belgian Congo | 1934 | Medical infrastructure |
| Annuaire des missions catholiques au Congo | 1935 | Colonial settlements |
| Annual Public Health report Belgian Congo | 1935 | Medical infrastructure (FOREAMI) |
| Annual Public Health report Belgian Congo | 1936 | Medical infrastructure |
| Annual Public Health report Belgian Congo | 1936 | map of sleeping sickness |
| Annual Public Health report Belgian Congo | 1937 | map of sleeping sickness |
| Annual Public Health report Belgian Congo | 1938 | map of sleeping sickness |
| Annual Public Health report Belgian Congo | 1938 | Medical infrastructure |
| Annual Public Health report Belgian Congo | 1939 | Medical infrastructure |
| Institut cartographique militaire | 1939 | Communication channels |
| Institut cartographique militaire | 1940 | Communication channels |
| Institut Géographique du Congo Belge | 1946 | Protestant missions |
| Annual Public Health report Belgian Congo | 1947 | map of sleeping sickness |
| Annual Public Health report Belgian Congo | 1948 | map of sleeping sickness |
| Annual Public Health report Belgian Congo | 1948 | Medical infrastructure |
| Institut Royal Colonial Belge, Index 624 | 1951 | Population density |
| Annual Public Health report Belgian Congo | 1952 | map of sleeping sickness |
| Institut Royal Colonial Belge, Index 661.1 | 1953 | Medical infrastructure |
| Institut Royal Colonial Belge, Index 663.2 | 1953 | Map of Tse-tses |
| Institut Royal Colonial Belge, Index 622 | 1953 | Mining concessions map |
| Institut Royal Colonial Belge, Index 67 | 1953 | Public Force |

**Notes:** Medical infrastructure refers to the geographic location of hospitals and health centres in Belgian Congo, along with their ownership (public, private, religious missions). Maps from Institut Royal Colonial Belge were collected from the Royal Academy for Overseas Sciences (https://www.kaowarsom.be).

*Sanitaire* (SNIS), of the Ministry of Health. The facility data are collected and analysed at the provincial level, and transmitted to the Ministry of Health to monitor the evolution of national programme outcomes, stock management, and disease surveillance. We cross-validate the self-reported data in the DHIS2 with estimates from external sources (IMF, World Bank, WHO) on the number of health workers, doctors, beds, and health aid. The matching of these estimates with the reported data in the DHIS2 at the national level gives further confidence in the accuracy of the database.

The following variables are extracted from the DRC DHIS2 (https://snisrdc.com/):

**Population**: Log of population in the catchment area of a hospital (approximately equal to district population) as reported in the DHIS2.

**Government transfers**: Funding allocated from the central government to a hospital, that is essentially used for payments of health worker salaries and occupational risk allowances. The amount is expressed in 2017 US Dollars.

**Bed capacity**: Total number of beds in a hospital as reported in the DHIS2.

Table A32: Sources for Public health in Belgian Congo

| Document | Year | Information |
|---|---|---|
| Annual Public Health report Belgian Congo | 1932 | Healthcare organisation & public health spending |
| Annual Public Health report Belgian Congo | 1933 | Healthcare organisation & public health spending |
| Annual Public Health report Belgian Congo | 1934 | Colonial settlements & public health spending |
| Annual Public Health report Belgian Congo | 1935 | Colonial settlements & public health spending |
| Annual Public Health report Belgian Congo | 1936 | Healthcare organisation & public health spending |
| Annual Public Health report Belgian Congo | 1937 | Healthcare organisation & public health spending |
| Annual Public Health report Belgian Congo | 1938 | Healthcare organisation & public health spending |
| Annual Public Health report Belgian Congoo | 1939 | Colonial settlements & public health spending |
| Annuaire des missions catholiques au Congo | 1935 | Colonial settlements & Healthcare organisation |
| Annual FOREAMI report | 1935 | Colonial settlements & Healthcare organisation |
| Annual Public Health report Belgian Congo | 1940 - 1944 | Colonial settlements & public health spending |
| Annual Public Health report Belgian Congo | 1946 | Healthcare organisation & public health spending |
| Annual Public Health report Belgian Congo | 1947 | Healthcare organisation & public health spending |
| Annual Public Health report Belgian Congo | 1949 | Healthcare organisation & public health spending |
| Annual Public Health report Belgian Congo | 1950 | Healthcare organisation & public health spending |
| Annual Public Health report Belgian Congo | 1951 | Colonial settlements & public health spending |
| Annual Public Health report Belgian Congo | 1953 | Healthcare organisation & public health spending |
| Annual Public Health report Belgian Congo | 1954 | Healthcare organisation & public health spending |
| Annual Public Health report Belgian Congo | 1955 | Healthcare organisation & public health spending |
| Annual Public Health report Belgian Congo | 1956 | Healthcare organisation & public health spending |
| Annual Public Health report Belgian Congo | 1957 | Healthcare organisation & public health spending |
| Annual Public Health report Belgian Congo | 1958 | Healthcare organisation & public health spending |
| Annual Public Health report Belgian Congo | 1959 | Healthcare organisation & public health spending |
| Annual statistics: Medical missions | 1938 | Healthcare organisation & public health spending |
| Annual statistics: Medical missions | 1946 | Healthcare organisation & public health spending |
| Annual statistics: Medical missions | 1947 | Healthcare organisation & public health spending |
| Annual statistics: Medical missions | 1948 | Healthcare organisation & public health spending |
| Annual statistics: Medical missions | 1949 | Colonial settlements & public health spending |
| Annual statistics: Medical missions | 1950 | Healthcare organisation & public health spending |
| Annual statistics: Medical missions | 1951 | Healthcare organisation & public health spending |
| Annual statistics: Medical missions | 1950 | Healthcare organisation & public health spending |
| Annual statistics: Medical missions | 1952 | Healthcare organisation & public health spending |
| Annual statistics: Medical missions | 1953 | Colonial settlements & public health spending |
| Annual statistics: Medical missions | 1954 | Healthcare organisation & public health spending |
| Annual statistics: Medical missions | 1955 | Healthcare organisation & public health spending |
| Annual statistics: Medical missions | 1956 | Healthcare organisation & public health spending |
| Annual statistics: Medical missions | 1957 | Healthcare organisation & public health spending |
| Annual statistics: Medical missions | 1959 | Colonial settlements & public health spending |

**Health workers**: Total number of nurses working in a hospital, including A1 (nursing colleges with undergraduate degree), A2 (secondary level of nursing school (diploma)) and L2 (graduated with a 5 year university degree)levels.

**Physicians**: Total number of general and speciality physicians in a hospital as reported in the DHIS2.

**Total patients**: Monthly average of total inpatients and outpatients.

**Malaria**: Monthly average of severe malaria cases treated between January 2017 and December 2021. Severe malaria treatment relies on artesunate injection and differs from uncomplicated malaria treatment (artemisinin-based combination therapies).

**Diarrhea**: Monthly average of patients treated for diarrhea.

**Emergency**: Monthly average of patients treated in the emergency department.

**Investment**: Monthly average of investment in a hospital as reported in the DHIS2. The

Table A33: Documents collected on Public financing

| Document | Year | Author | Publisher |
|---|---|---|---|
| Annuaire Statistique Congo Belge 1924-25 | 1927 | | Ministere Interieur et Hygiene |
| Le probleme economique au Congo Belge | 1932 | O. Louwers | Institut Royal Colonial Belge |
| Budget bill Congo Belge | 1932 | | |
| Budget bill Congo Belge | 1934 | | |
| Budget bill Congo Belge | 1935 | | |
| Budget bill Congo Belge | 1936 | | |
| Indices conjoncture économique du Congo Belge | 1933 | G. Eyskens | Bulletin de l'Institut de Recherches Économiques et Sociales |
| Le Congo économique | 1938 | J. Onckelinx | Bulletin de l'Institut de Recherches Économiques et Sociales |
| Le Congo Belge et la politique de conjoncture economique | 1946 | Van de Putte | Institut Royal Colonial Belge |
| La situation économique du Congo belge 1940-46 | 1948 | M. Masoin | Bulletin de l'Institut de Recherches Économiques et Sociales |
| Bulletin de l'Institut de Recherches Économiques et Sociales | 1949 | | |
| Situation économique du congo belge | 1950 | | Etudes et conjoncture - Economie mondiale |
| Situation économique du congo belge | 1953 | | Ministere des Colonies |
| Bulletin d'information et de documentation Congo Belge | 1952 | | Banque Nationale de Belgique |
| Essai sur la zone monétaire belge | 1954 | C. Lefort | Revue économique |
| Budget bill Congo Belge | 1954 | | |
| Economic planning and development in Belgian Congo | 1955 | J. Huge | Annals of the American Academy of Political and Social Science |
| Annuaire Statistique Congo Belge 1956 | 1957 | | Institut National de la Statistique |
| Rapport EA-77A Economy of Belgian Congo | 1957 | | IBRD |
| Economie du Congo | 1958 | | Bulletin de la Banque centrale du Congo belge et du Ruanda-Urundi |
| The economy of the Belgian Congo | 1959 | R. Bertieaux | Institut de Sociologie de l'Université de Bruxelles |
| La situation économique du Congo | 1961 | R. Bertieaux | Louvain Economic Review |
| La situation économique du Congo | 1963 | J. Lacroix | Louvain Economic Review |
| Sante Congo | 1963 | | Mission assistance technique CEE Congo |
| L'Économie Congolaise 1960-65 | 1968 | M. Norro | Institut de Recherches Economiques et Sociales |
| Rapport AF-23A Economie de la Republique du Congo | 1964 | | IBRD |
| Blocage de la croissance economique en RDC | 1967 | H. Vander Eycken | Revue Tiers Monde |
| African Public Finances | 1968 | G. Martner | Latin American Institute for Economic and Social Planning |
| Situation Economique et Sociale Congo | 1971 | F. Bezy | IBRD |
| Rapport 821-ZR Economie du Zaire | 1975 | | IBRD |
| Rapport 1407-ZR Economie du Zaire | 1977 | | World Bank Archives |
| Rapport 2518-ZR Economie du Zaire | 1979 | | World Bank Archives |
| Rapport 4077-ZR Economie du Zaire | 1982 | | World Bank Archives |
| Rapport 5417-ZR Economie du Zaire | 1985 | | World Bank Archives |
| Zaire population, Health, Nutrition | 1989 | | World Bank Archives |
| Rapport 8995-ZR Zaire examen Depenses de l'Etat | 1991 | | World Bank Archives |
| Zaire: Background information and Statistical data | 1996 | | IMF country report |
| Zaire's hyperinflation 1990-96 | 1997 | P. Beaugrand | IMF country report |
| DRC: : Poverty Reduction Strategy Paper | 2003 | | IMF country report |
| DRC: : Poverty Reduction Strategy Paper | 2004 | | IMF country report |
| DRC: : Poverty Reduction Strategy Paper | 2007 | | IMF country report |
| DRC: : Poverty Reduction Strategy Paper | 2010 | | IMF country report |
| DRC: : Poverty Reduction Strategy Paper | 2011 | | IMF country report |
| DRC: : Poverty Reduction Strategy Paper | 2013 | | IMF country report |
| DRC: : Poverty Reduction Strategy Paper | 2015 | | IMF country report |
| Rapport 96172-ZR Revue de la gestion des depenses publiques | 2015 | | World Bank |
| DRC Country report | 2018 | | IMF country report |
| DRC Country report | 2021 | | IMF country report |

**Notes:** IBRD: International Bank for Reconstruction and Development; IMF: International Monetary Fund.

amount is expressed in 2017 US Dollars.

**Value of ward stock**: Monthly average of the value of ward stock pharmacies in a hospital as reported in the DHIS2. The amount is expressed in 2017 US Dollars.

**Expenditure**: Monthly average of expenditure in a hospital as reported in the DHIS2. The amount is expressed in 2017 US Dollars, as a monthly average between January 2017 and December 2021.

**Revenue**: Monthly average of revenue in a hospital as reported in the DHIS2. The amount is expressed in 2017 US Dollars.

**Local allowance**: Local allowance corresponds to the share of user fees collected by a hospital that is distributed to health workers. The amount is expressed in 2017 US Dollars.

**Length of stay**: Number of days stayed by all inpatients in a hospital.

**US Health aid**: dummy variable that indicates whether a hospital receives medical or financial support from the U.S. Agency for International Development (USAID), as reported in DHIS2.

**Health aid**: dummy variable that indicates whether a hospital receives medical or financial support from external sources. This information was collected from the DRC websites of

Médecins Sans Frontières (MSF), the International Committee of the Red Cross, U.S. Agency for International Development (USAID), the Global Fund, World Health Organization (WHO), World Bank, and the United Kingdom Department for International Development (DFID).

### B.3 Additional data

**Distance to coast**: The geodesic distance from each hospital to the nearest coastline measured in km. Colonial hospital locations are obtained from multiple maps from colonial archival data between 1929 and 1956. Figure A14 presents such a map.

**Distance to transport**: The geodesic distance from each hospital to the nearest transportation mode, which comprises railways, paved road and main rivers as navigation mode measured in km. The communication channels during the colonial period are obtained from a 1928 map on public services in Belgian Congo from the *Institut Cartographique militaire Service Cartographique du Ministère des Colonies*. Additional information on transport connections from the International Bank for Reconstruction and Development (IBRD, 1957) supplements the mapping before independence in 1960. Euclidean distances are calculated with ArcGIS.

**Natural resources**: A dummy variable equal to one if a hospital is located within a health zone that contains natural resources (gold, diamond, copper, tin, bauxite, coal, cobalt, iron, manganese, and uranium), as reported by the colonial administration (using the 1953 mining concessions map from the *Institut Royal Colonial Belge*, and after independence (with the 1969 map of mines and industries from *Institut géographique du Congo*).

**Distance to electrical infrastructure**: data on electricity infrastructure in the DRC obtained from a model developed in collaboration between the Energy Sector Management Assistance Program (ESMAP) at the World Bank, KTH Royal Institute of Technology, World Resources Institute (WRI), the University of Massachusetts Amherst and Facebook. The model combines night lights imagery collected from the Visible Infrared Imaging Radiometer Suite (VIIRS) band sensor on board the NASA Suomi satellite with GIS data on roads from OpenStreetMap and global land cover Moderate Resolution Imaging Spectroradiometer (MODIS).

**Distance to the provincial city**: The geodesic distance from each hospital to the main provincial city during the colonial period measured in km (Leopoldville, Costermansville, Albertville, Elisabethville, Stanleyville).

**Distance to armed conflicts**: The geodesic distance from each hospital to a civilian conflict (defined as political violence and protest). The data is obtained from the Armed Conflict Location and Event Data Project (ACLED) which reports georeferenced information on political violence and protests between January 2017 and December 2021.

**Distance to Regional Distribution Centre**: The geodesic distance from each hospital to the nearest Regional Distribution Centre (*Centrale de Distribution Régionale*, CDR). The 19 CDRs across the DRC supply public, private and faith-based health facilities with essential medicines and other pharmaceutical products. The list of CDRs in 2017 was obtained from the Department of Pharmaceuticals and Medicines (*Direction de la Pharmacie et du Médicament)*, Ministry of Health (`https://http://dpmrdc.org/BASE-DES-DONNEES`).

**Malaria risk rate**: indicator of the malaria parasite transmission intensity in 2017 obtained from the Malaria Atlas Project to account for the spatial heterogeneity of malaria transmission in the DRC. The *Plasmodium falciparum* parasite rate (PfPR) is an index of malaria transmission intensity which estimates the proportion of children aged 2 to 10 who carries the parasite (Hay and Snow, 2006). Annual median of PfPR in 2017 was obtained at approximately 5 km resolution from the Malaria Atlas Project (`https://map.ox.ac.uk`).

**Ethnic Political Power**: a dummy variable to indicate whether the ethnic group in the health zone where a hospital belongs is politically active, with access to executive government power. Data was collected from the GROWup platform on settlement patterns of politically active ethnic groups developed by Bormann et al. (2015). We code as dominant an ethnic group that has been dominant either during the Mobutu regime or at anytime since 1999, corresponding to the modern DRC period.

**Light**: night-time light data obtained from the NASA/NOAA Visible Infrared Imaging Radiometer Suite (VIIRS) sensor between 2018 and 2020.

**Elevation**: Data collected using satellite images obtained from the Shuttle Radar Topography Mission (SRTM). The data provide elevation information at the 30 arc-second resolution, corresponding to approximately to a cell of one square kilometer near the equator.

**Slope**: Calculated in degrees using information from the Shuttle Radar Topography Mission (SRTM).

**Historical population density**: Population density during the colonial period using a digitised map on population density in 1921 from Trewartha and Zelinsky (1954), and a 1951 map from the Institut Royal Colonial Belge. we further collect data on population density in 1800 from the History Database of the Global Environment (HYDE) version 3.3

**Ruggedness index**: Terrain Ruggedness index using the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model (GDEM) version 3 (https://lpdaac.usgs.gov/products/astgtmv003/).

**Soil suitability**: Suitability of index for cassava, maize, cotton and rubber collected from the Food and Agriculture Organization's Global Agro-Ecological Zones v4 model (FAO-GAEZ v4): https://gaez.fao.org/.

**Development Aid**: Geocoded aid projects reported by the government of the DRC Aid Information Management System (AIMS) between 1998 and 2014. The donors are the Department for International Development (UK), European Commission, KfW Bankengruppe, Embassy of Sweden, Embassy of Canada, Embassy of Japan, Embassy of Sweden, Embassy of Belgium, Embassy of Netherlands, Embassy of Germany, Korea International Cooperation Agency, USAID, World Bank, UNDP, Deutsche Gesellschaft Technische Zusammenarbeit, African Development Fund. Data collected from DRC AIMS Geocoded Research release, version 1.3.1, 2016.

**Chinese Aid**: Geocoded Chinese aid projects in the DRC, which correspond to loans and grants from official sector institutions in China. Data collected from AidData's Global Chinese Development Finance Dataset, Version 3.0 (Custer et al., 2023).

**Local government corruption**: a dummy variable equal to one if the province governor between 2017 and 2021 was prosecuted for corruption before 2017, and interacted with the distance to the provincial capital to capture the influence of potential elite capture of government transfers. Data on the existence of a motion of no confidence initiated against a provincial governor was collected from local media websites for each of the 26 provinces (e.g. Radio Okapi : https://www.radiookapi.net/; Actualite CD: https://actualite.cd/; 7sur7 CD: https://7sur7.cd/; Congo Quotidien: https://www.congoquotidien.com/).

# C Long run series of public finances

We build long run series of the share of domestic health expenditures in the total budget, public revenue, and expenditure by drawing on numerous data sources for different sub-periods: during the colonial period, the series primarily relies on national reports of the Belgian Congo from Ministry of Economic and Financial Affairs, statistical yearbooks and bills containing the ordinary budget. In the post-independence period, data was mostly obtained from the International Monetary Fund (IMF), the World Bank, and the International Bank for Reconstruction and Development (IBRD) reports. Additional reports from the Central Bank of the Congo (Zaire) supplemented the data collection. A full description of these data sources is presented in Online Appendix Section B.1. We further cross-validate the data from the Colonial reports of the Belgian Congo with IMF, World Bank and IBRD reports to ensure that observed differences between the colonial and postcolonial periods are not driven by differing reported measures between the Belgian colonial administration and the international institutions. The novel data covers the period from 1920 to 2020, which allows to examine public finances from the inception of the health system in the colony to the end of the colonial period, the transition to independence, and the evolution until the modern period. For data from 1950 onward, we cross-validate aggregate population and revenue figures with Maddison (2001), in addition to using national sources.

We further construct a series of Gross Domestic Product (GDP) using existing estimates for the 1920 - 1960 period from Eycken and Vorst (1967) and Lacroix et al. (1967), national accounts (Zaire and modern DRC), and IMF reports for the post-colonisation period.

# D OLS Results

## D.1 Omitted variables

Online Appendix Tables A11 and A12 report in Panel B estimates of the breakdown point (the proportional degree of selection of unobservables relative to observables needed to overturn the baseline results) $\delta$ at which the colonial effect $\beta = 0$ remain above the minimum recommended threshold of one (Altonji et al., 2005; Oster, 2019). We follow the recommendations of Diegert et al. (2024) to calculate the correct $\delta$ with the choice $R^2_{long} = 1.3 \times \hat{R}^2_{med}$, where $R^2_{med}$ and $R^2_{long}$ correspond respectively to the $R^2$ in the regression with a minimum set of covariates, and the long regression with additional controls. The estimates suggest a limited scope for omitted variable bias. The methodology developed by Oster (2019) relies on the assumption that the omitted variables are uncorrelated with all observed covariates. Diegert et al. (2024) (DMP) propose an alternative approach that relaxes the exogeneity assumption. We report estimates of the breakdown point $\bar{r}_X^{\mathsf{bp}}$ proposed by Diegert et al. (2024) in the second row of Panel B. The set of calibration covariates includes the baseline geographic controls and province fixed effects. The breakdown point estimates indicate that omitted variables would have to be as strong as all observed geographic controls to overturn the colonial effect, both for government transfers and bed capacity.[23] Given the wealth of our geographical and historical level data, it seems rather implausible that the strength of the correlation between between colonial settlement and unobservables is greater than the correlation with observables. Nonetheless, we investigate alternative strategies in the following sections to address the concern of potential omitted variable bias.

## D.2 Missing values and data quality

Hospital outcomes are drawn from administrative data reported through the DHIS2 platform. A potential concern is that colonial-origin hospitals may exhibit systematically higher

[23] Diegert et al. (2024) show that we can no longer compare the estimates to the benchmark of one with equal selection when controls are endogenous.

reporting quality, mechanically generating higher measured government transfers or infrastructure. To assess this possibility, Online Appendix Table A14 examines the relationship between colonial origin and two data-quality indicators used by the Ministry of Health: completeness (the share of required indicators reported) and timeliness (whether reports are submitted within the prescribed period). Colonial origin is associated with a statistically significant but quantitatively small increase in completeness and a reduction in timeliness. Both effects disappear once we control for whether a facility is classified as a general referral hospital. This pattern suggests that the raw differences primarily reflect the over-representation of larger referral hospitals among colonial facilities, which face more complex reporting requirements and therefore tend to report with greater delay.

A second concern relates to missing values in government transfer data. The DHIS2 system does not allow hospitals to report zero values, raising the possibility that some missing observations correspond to true zeros. This concern is mitigated by the long observation window (48 months), which makes persistent non-receipt of transfers unlikely for most facilities. To further assess sensitivity, we interpolate missing values using information on reporting completeness and timeliness, following the Ministry of Health's benchmark of 80 percent for each indicator.[24] As shown in Online Appendix Table A15, the estimated effect of colonial origin on government transfers remains positive and statistically significant, though less precisely estimated as the share of interpolated observations increases.

We further characterise hospitals that never report government transfers (Table A16). These facilities are smaller, more urban, less exposed to malaria risk and conflict, and substantially less likely to have a colonial origin. Approximately two-thirds are private hospitals, for which transfers are typically smaller (MSP, 2019). Consistent with this pattern, the share of private hospitals falls below 20% among facilities reporting transfers.

Finally, Table A17 reports simulation-based imputations in which missing transfer values are replaced with extreme values from the distribution (e.g., bottom or top 1 percent, by ownership type). Across all scenarios, the estimated effect of colonial origin on government transfers remains sizeable, reinforcing the conclusion that differential reporting or underreporting does not drive the main results.

## E Matching procedure

The matching procedure imputes counterfactual observations by pairing colonial hospitals with their nearest post-independence neighbours from a predefined set of matching covariates, and exploits the large size of the control group (post-independence) relative to the treatment group (colonial hospitals). To reduce heterogeneity, we impose exact matching on the type of hospital (referral vs non-referral).

Spatial matching should ensure that matched hospitals share similar geographic characteristics and, consequently, address the concern that colonial settlements are located in areas with better geographical access or better climatological and epidemiological conditions (or conversely, some hospitals could operate under more adverse environmental factors).

The identification and consistency of the estimate rely on two assumptions: i) unconfoundedness or random assignment of the treatment (*i.e.* the exposure to the treatment is independent of the outcome variable conditional on all relevant characteristics to the probability of treatment being observed) and ii) common support assumption, whereby the probability of being a colonial or a post-independence hospital given a set of observable covariates should be positive.

[24] https://dhis2.org/drc-data-use/.

We argue that both assumptions should be valid in this exercise. Although the location of colonial settlements might be motivated by several factors that include geographic characteristics, the exact location of a medical mission at a sufficiently small geographic level should also bear a randomised component. The favourable conditions that could motivate a settlement decision such as the proximity to a transportation mode, the economic activity of the area or the burden of disease among the local population locally form a continuum of location points with pre-defined characteristics of interest. The optimal location site of a hospital is then unlikely to be unique and should bear a random component. The colonial settlement should not preclude the construction of hospitals in its vicinity if the geographical area of optimal conditions is sufficiently large, or the population density is high enough.[25] The existing public infrastructures during the colonial period might also have opened up additional possibilities of locations for new hospitals and increased, thereby, the area of potential construction sites. Our assumption is further supported by the absence of spatial context in which hospital plans were designed and sketched. According to De Nys-Ketels et al. (2019), hospital plans were "[...] drawn in an empty, blank environment. Although these hospitals would be constructed at numerous, different locations, their varying surroundings were deemed irrelevant and reduced to a virtually homogeneous emptiness. Rural Congo was assumed a climatically and socio-culturally isotropic territory."

# F IV: sleeping sickness

We collect data on the geographic distribution of the sleeping sickness from the public health reports of the Ministry of Colonies (maps in 1910, 1928, and 1933 to 1938). The maps were produced as a result of surveys of sleeping sickness conducted across regions of the Congo by the colonial medical services in the corresponding years. After digitising the maps, we constructed the sleeping instrument as the geographic area where the reported prevalence of the disease is at least equal to 1% (i.e. a threshold set by the colonial authorities).

## F.1 Historical sleeping sickness exposure and falsification tests

Does historical sleeping sickness exposure proxy for persistent location advantages, such as administrative reach, accessibility, or development, that would also attract hospitals after independence? We examine this question by assessing whether territories (the main administrative unit below provinces) historically affected by sleeping sickness are systematically closer to hospitals constructed after independence. Columns (1)–(2) of Table A19 report estimates from OLS regressions of the log distance from a territory centroid to the nearest post-independence hospital on an indicator for historical sleeping sickness exposure. Shorter distances would indicate greater postcolonial hospital density in areas historically exposed to the disease. We find no such relationship, suggesting that sleeping sickness exposure does not proxy for time-invariant locational advantages that mechanically attract hospitals across periods.

Yet, sleeping sickness exposure may proxy for persistent administrative salience and state presence, beyond colonial medical investments. We address this concern by assessing the relationship between sleeping sickness exposure and several complementary proxies for non-health state presence. First, settlement density is measured using the count of officially recorded *localités* and the presence of administrative centres (*chef-lieux*). Second, transport infrastructure

[25] The geographical distribution of hospitals in the DRC is often characterised by a concentration in urban centres (Chenge et al., 2010).

is proxied by the total length of primary and secondary roads within a territory. Third, night-time lights are used to proxy for local economic activity. Lastly, we exploit a 1953 map of the colonial public security force, *Force Publique*, that depicts the locations of military and administrative facilities during the colonial period. If sleeping sickness exposure were capturing persistent administrative salience or general location advantages, it should predict these non-health proxies of state presence.

Although these falsification tests are not designed to yield causal estimates, the resulting confidence intervals are informative about economic magnitudes. In particular, for proximity to post-independence hospitals, locality density, night-time lights, and *Force Publique* presence, the 95% confidence intervals rule out economically meaningful effects of sleeping sickness exposure in the direction implied by the state presence hypothesis. For example, for distance to postcolonial hospitals and night-time lights, the upper bound of the confidence interval corresponds to less than 20% of the mean outcome, while for distance to *Force Publique* it is less than 5% of the mean. Estimates for road infrastructure are less precise, reflecting the noisier measurement of transport networks at this level of aggregation, but are not systematically different from zero.

### F.2 Testing LATE assumptions

We follow the test procedure developed by Farbmacher et al. (2022) that employs random forests and classification and regression trees to find violations of exclusion assumption. The test first consists of splitting the data sample along the covariate space using pruned regression trees to find relevant subgroups where potential violations are more likely to be found. The full data sample is partitioned with the classification and regression trees (CART) algorithm along the observable covariates in a way that maximises effect heterogeneity across the newly formed partitions. Causal forests are then used to estimate the magnitude of the potential violations in these subgroups by combining results from a large number of trees built on random subsamples of the data. Positive values of the causal forest estimates indicate local violations. Finally, the null hypothesis of no local violation of the exclusion assumption is tested using Bonferroni-corrected critical values for multiple hypothesis testing. Any violation in at least one subpopulation would challenge the validity of the instrument. The results in Table A22 rule out local violations and provide further confidence that the historical distribution of sleeping sickness should not be correlated with modern hospital characteristics.

### F.3 Relaxing instrument exogeneity

In this section, we relax the strict exogeneity assumption by following the plausibly exogenous methodology in Conley et al. (2012) that allows for a direct effect of sleeping sickness on government transfers and bed capacity respectively. Consider the following structural equation:

$$\mathbf{Y}_{ij} = \beta Colonial_{ij} + \delta Sleeping_{ij} + \epsilon_{ij}$$

with $Colonial_{ij}$ the endogenous variable, and $Sleeping_{ij}$ the instrumental variable. Under strict exogeneity assumption, the instrument $Sleeping_{ij}$ has no direct effect on the outcome $\mathbf{Y}_{ij}$ and $\delta$ is equal to zero. Conley et al. (2012)'s methodology departs from this latter assumption by allowing to flexibly specify a range of non-zero values that $\delta$ can take, in the above structural equation. Conley et al. (2012) show that their approach is particularly well suited to empirical applications with strong instruments, which is the case with the sleeping sickness instrument. The graphs in Figure A15 display all estimated 95% confidence intervals for $\beta$ that vary with $\delta \in [0, g_{max}]$ using the "Union of Confidence Interval" approach ($g_{max}$ denotes the maximum value of $\delta$, set at 0.6 for government transfers and 0.3 for bed capacity). To contextualise the magnitude of $\delta$, note that the overall reduced-form estimate of the effect of the sleeping sickness instrument on the outcome of interest is 0.276 for government transfers and 0.183 for bed capacity (indicated by vertical green lines in the graphs). The figure illustrates that to overturn our IV results, the direct effect of sleeping sickness on the outcome would have to exceed two-thirds of the reduced-form effect for government transfers (with an estimated $\hat{\delta}$=0.451), and over 85% of the reduced-form for bed capacity (with an estimated $\hat{\delta}$=0.225). Given the weak association established through the multiple falsification tests, such conditions appear highly implausible.

## G Additional channels

We explore in this section additional channels that could drive our results.

**Economic development.** We first explore whether the colonial effect could operate through higher levels of local economic development across the country, using night-time light luminosity data. Early colonial exposure could have favoured state-making and higher public investments with positive long term effects on contemporary development. The colonial effect on government transfers would then be mediated by the government's promotion of areas with higher economic development through greater provision of public goods (Besley and Persson, 2011). Columns (1-2) of Table A30 report the effect with and without province fixed effect and document a negative relationship with economic outcome.

**Malaria risk.** The enormous modern health burden of malaria could find its origin in colonial development. Although we control for the risk of malaria burden in our baseline results, the statistically significant effect of colonial origin found with OLS estimation on patients treated with malaria suggests that the disease may have an important role. However, Columns (3-4) of Table A30 do not show any statistical significance of colonial settlement on malaria risk.

**Ethnic favouritism.** Colonial activities could have favoured the establishment of an educated and politically-oriented group that evolved into a powerful, corrupted elite after independence. This political elite could subsequently have favoured their home regions/towns for the allocation of public (including health) resources (Burgess et al., 2015). To test the relevance of ethnic representation at the national level, we retrieve information on politically relevant ethnic groups from the Ethnic Power Relations (EPR) dataset (Vogt et al., 2015), where a group is defined as politically relevant if at least one political organization claims to represent it in national politics or its members are subjected to state-led political discrimination. We construct an indicator variable equal to one if the geographical ethnic area to which a hospital belongs is politically relevant during the 2017-2021 period, or if it was historically relevant during the 1965-1997 Mobutu era, and zero otherwise.[26] Because of the small number of persons who ruled the country in the postcolonial period, we are likely to identify the presence of ethnic favouritism with the central government if it exists in the government transfers to hospitals.[27]

[26] A concern about the validity of this coding could be that ethnic identity of the government forces and the executive power may differ in some settings (Harkness, 2022). Using information from the Ethnic Stacking in Africa Dataset (ESAD) confirms that this concern does not apply to the DRC, where the ethnicity of both political leaders and the military has historically been aligned.

[27] Joseph Mobutu ruled the Congo from 1965 to 1997. Laurent Kabila became the new President of the DRC until his assassination in 2001. He was succeeded by his son, Joseph Kabila, who remained President until 2019. A member of the Ngbandi ethnic group, Mobutu was born in the Mongala province but grew up in the village of Gbadolie, in the province of Nord-Ubangi, where he later established his infamous presidential palace; Laurent Kabila was from the Tanganyika province with both Luba and Lunda ethnic origins; Joseph Kabila is from the South Kivu province.

Our results in Columns (5-6) rule out this possibility.

**Congo Free State and mining concessions.** We next consider mining concessions which may have indirect persistent effects. During the Congo Free State (before 1908), the state partitioned the territory into economic and social areas, to ensure the preponderance of Belgian capital through granted concessions to private enterprises. Although the largest companies were dissolved after 1908, the interdependence between the state and private enterprises continued to affect the development of institutions and political control during the latter period of the colonisation of the Belgian Congo (Vellut, 1981). It is then possible that colonial health investments were higher in these areas. Historical exposure to the concessions also has a negative long run effect on local development and health outcomes (Lowes and Montero, 2021), which could motivate differential allocations of public resources. We do not find supportive evidence for this channel in Columns (7-8).

**Institutional quality.** Another possibility is that colonial settlements contributed to establishing relatively higher-performing local institutions. To circumvent the lack of information on local governance quality, we investigate whether colonial settlements are associated with the current level of corruption. Whilst misuse of public funds could prevent health facilities from reaching their full share of government funding, the local institutions established by colonial settlements may participate in deterring the embezzlement of public funds (for example, dedicated departments of inspection of local resources, or transparency indicators). To explore this assumption, we collect data on motion of no confidence initiated against a provincial governor before 2017 as a proxy for the embezzlement of public funds. We construct a dummy variable equal to one if the province governor was prosecuted for corruption, interacted with the distance to the provincial capital to capture the influence of potential elite capture of government transfers. Column (9) of Table A30 shows that the colonial effect is not statistically significant at the conventional level.

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