The Legacy of Colonial Medicine in Central Africa

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Doctors Battling Ebola Are Met With Fear, Mistrust

By LIZ NEPORENT • Jul 28, 2014, 4:46 PM ET

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A patient is drinking to rehydrate himself under the scrutiny of a nurse at the MSF Treatment Centre in Kailahun, Sierra Leone.

Doctors battling Ebola in Sierra Leone, Guinea and Liberia say a mistrust of Western medicine is hampering efforts to contain the outbreak.

At least 1,201 people having contracted the virus and 672 people have died in what health officials are calling the worst Ebola outbreak in history.

The New York Times

The Battle Against One of the Worst Ebola Epidemics Ever Is in Trouble

Distrust, fear and lack of communication from aid groups have alienated communities in the Democratic Republic of Congo, leading some people to spurn treatment and even attack treatment centers.

AFRICA

Cameroon Finds Resistance to Polio Vaccination Campaign

September 27, 2015 1:30 PM Moki Edwin Kindzeka

YAOUNDE — Cameroon is ending a polio vaccination campaign against a backdrop of growing resistance, even though officials say 7 percent of Cameroon's children are still at risk of contracting the crippling disease.

Forty-three-year-old Clarisse Tomta has refused to allow vaccination agents to inoculate two of her children – both under 5 years of age. She described the anti-polio campaign as unnecessary.

2 top French doctors said on live TV that coronavirus vaccines should be tested on poor Africans, leaving viewers horrified

Julian Kossoff Apr 3, 2020, 5:57 AM

Colonial Medical Campaigns

- Between 1920s and 1950s, French colonial governments undertook extensive medical campaigns aimed at managing tropical diseases in Cameroon and French Equatorial Africa (AEF)
  - Treatment for sleeping sickness, leprosy, yaws, syphilis and malaria
  - Sleeping sickness campaigns some of the largest colonial health investments
  - Millions exposed to the campaigns over several decades
- Campaigns characterized by:
  - Forced participation, often at gunpoint
  - Use of ineffective and harmful medications
  - For many, first interaction with modern medicine
- Colonial campaigns may have had unintended effects on:
  - Beliefs about modern medicine
  - Engagement with the health sector

Research Questions & Roadmap

1. How does exposure to colonial medical campaigns affect trust in medicine today?
   - Digitize archival records for Cameroon and former French Equatorial Africa (AEF) from 1921 to 1956
   - Examine vaccination rates and blood test refusals – revealed preference measure for trust in medicine
   - IV strategy and falsification exercise: British vs. French Cameroon;

2. Is the effect on trust in general or specific to medicine?
   - Use Afrobarometer data on trust in institutions and people

3. What are the mechanisms for the transmission of beliefs?
   - Vertical or horizontal transmission

4. Can understanding the detailed processes of how colonial history matters help improve policy?
   - Provide evidence from World Bank health projects

Contributions & Literature

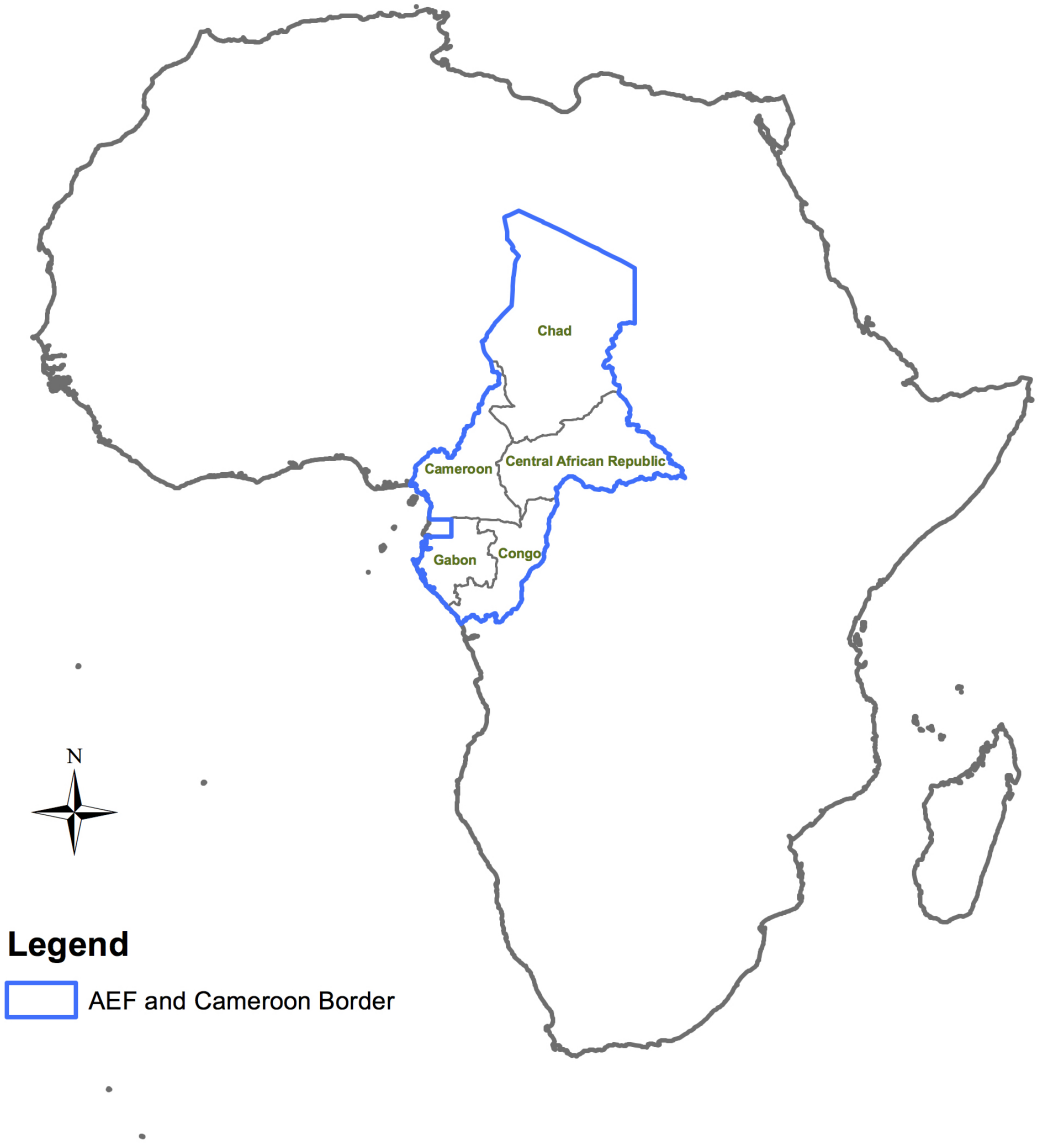
1. Provide evidence on colonial medical campaigns
   - Unintended consequences of foreign aid (e.g. Nunn and Qian, 2014; Dube and Naidu, 2015)
   - Comparative development of sub-Saharan Africa (Nunn, 2009; Michalopoulous and Papaioannou, 2017; Anderson, 2018)

2. Origins of trust in medicine
   - Puzzle of low demand for health care in developing countries (e.g. Dupas and Miguel, 2017)
   - Origins of trust, specifically trust in medicine (Nunn and Wantchekon, 2011; Alsan and Wanamaker, 2017; Martinez-Bravo and Stegmann, 2018)

3. Present evidence on relevance of history for policy
   - Heterogeneity of success based on historical experiences or cultural practices (Ashraf et al. 2017; Bau 2019)
   - Ineffectiveness of foreign aid as a central issue for economists
   - Results may help improve targeting and implementation

History

Cameroon and Former AEF Countries



French Medical Campaigns

- Campaigns were primarily organized through a system of mobile medical teams by the French military
  - Started in Cameroon in 1921 and AEF in 1927 (Service de la prophylaxie de la trypanosomiase)
  - French campaigns motivated by: (i) competition between scientists, (ii) colonial rivalries, (iii) low population density

- Each team consisted of a French military doctor, nurses, two European soldiers and several African soldiers

- In each village, the inhabitants were required, often at gunpoint, to submit to physical examination (Headrick, 2014)

"The villagers had no choice, treatment was mandatory...and followed a familiar ritual: long lines under a merciless sun, blood samples, examinations of each blood sample." - Lachenal, 2016

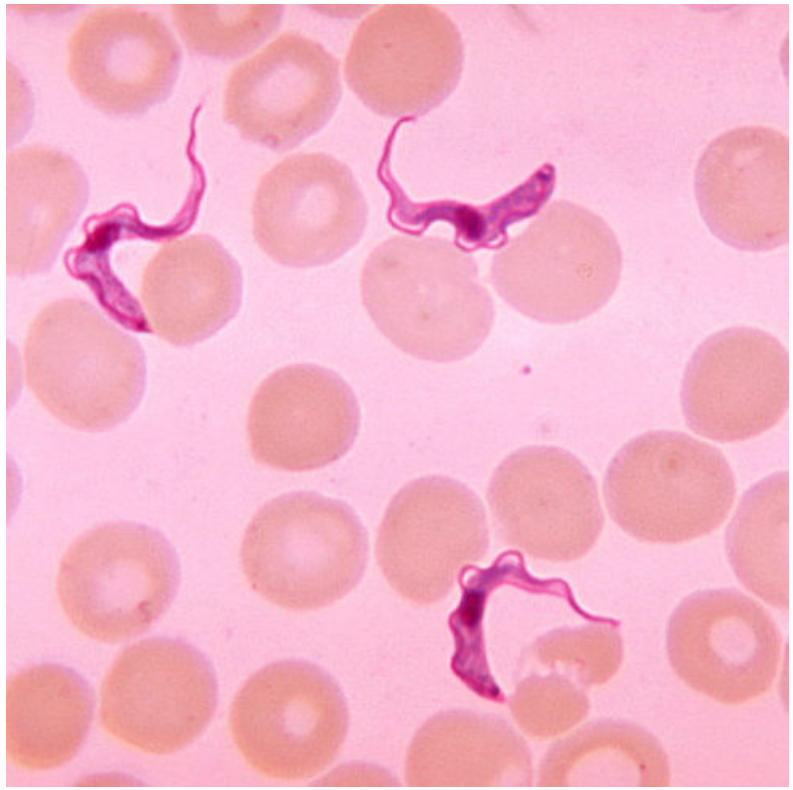
Sleeping sickness

- The most extensive campaigns focused on treating and preventing sleeping sickness (*trypanosomiasis*)
- Sleeping sickness is a lethal parasitic disease transmitted by tsetse flies
  - An infected person experiences severe joint pain and fever, and eventually drowsiness
  - Once pathogen crosses the blood-brain barrier, individuals become lethargic, go into a coma, and eventually die
- A series of human epidemics spread across equatorial Africa in the early 20th century
  - Nagana - animal *trypanosomiasis* - was always present but human sleeping sickness became more pronounced in the late 1890s ▸ Types

Tsetse Fly and Trypanosomes

Tsetse Fly

Trypanosomes in Blood



Sleeping Sickness Treatment

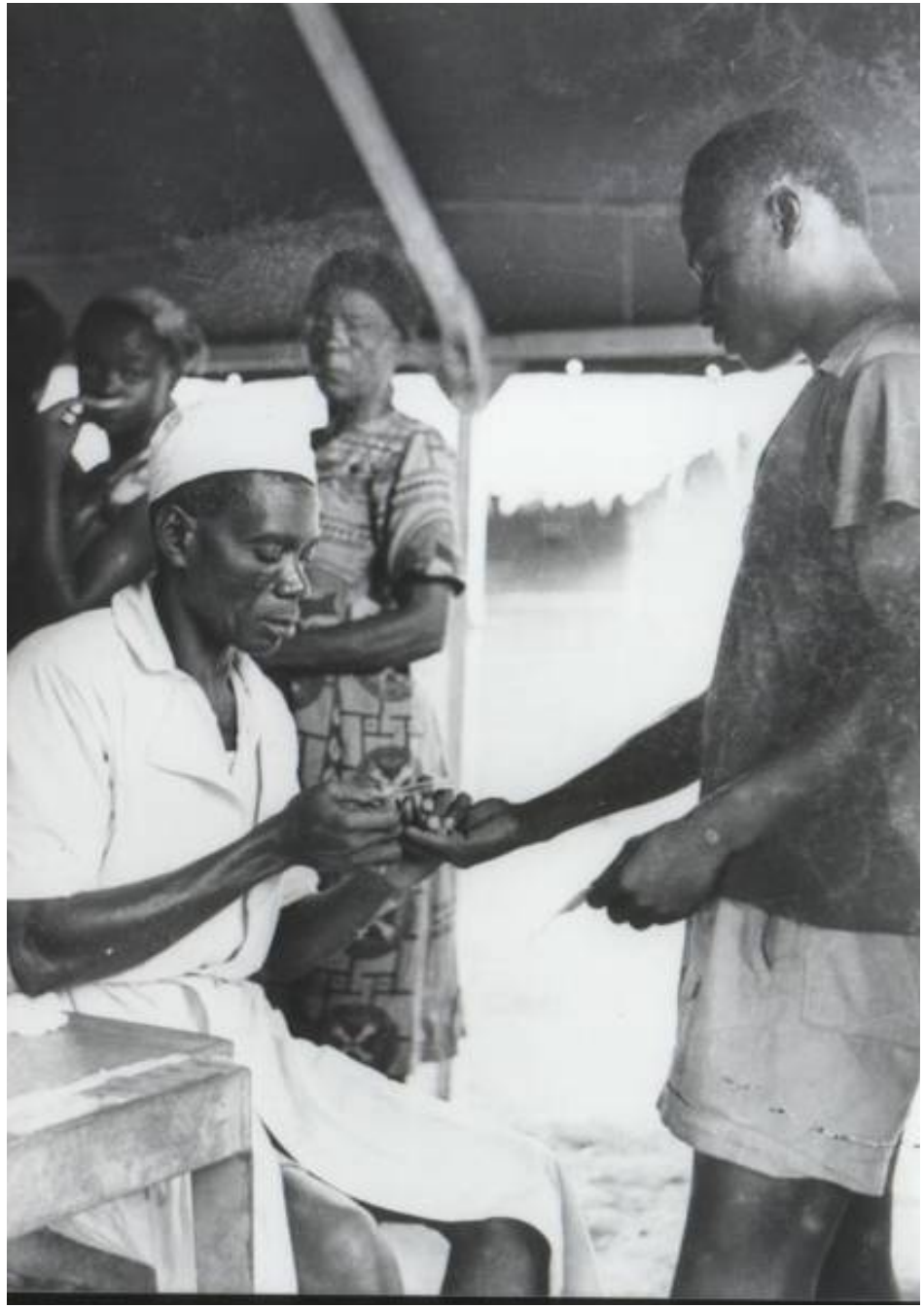
- Early treatments used an arsenic based drug called *atoxyl*:
  - Caused partial or total blindness in 20% of patients
  - Had a chemotherapeutic index close to one
  - However, cheap, stable in the tropics, and easy to inject
- Lomidine was introduced in 1940s
  - Less toxic, but deemed too unsafe for Europeans
  - Had to be injected every six months
  - Injections sites could become infected, leading to gangrene
  - In 1974, a French doctor involved with the colonial medical campaigns wrote that the Lomidine injections were "pointless, dangerous, and therefore pointlessly dangerous"

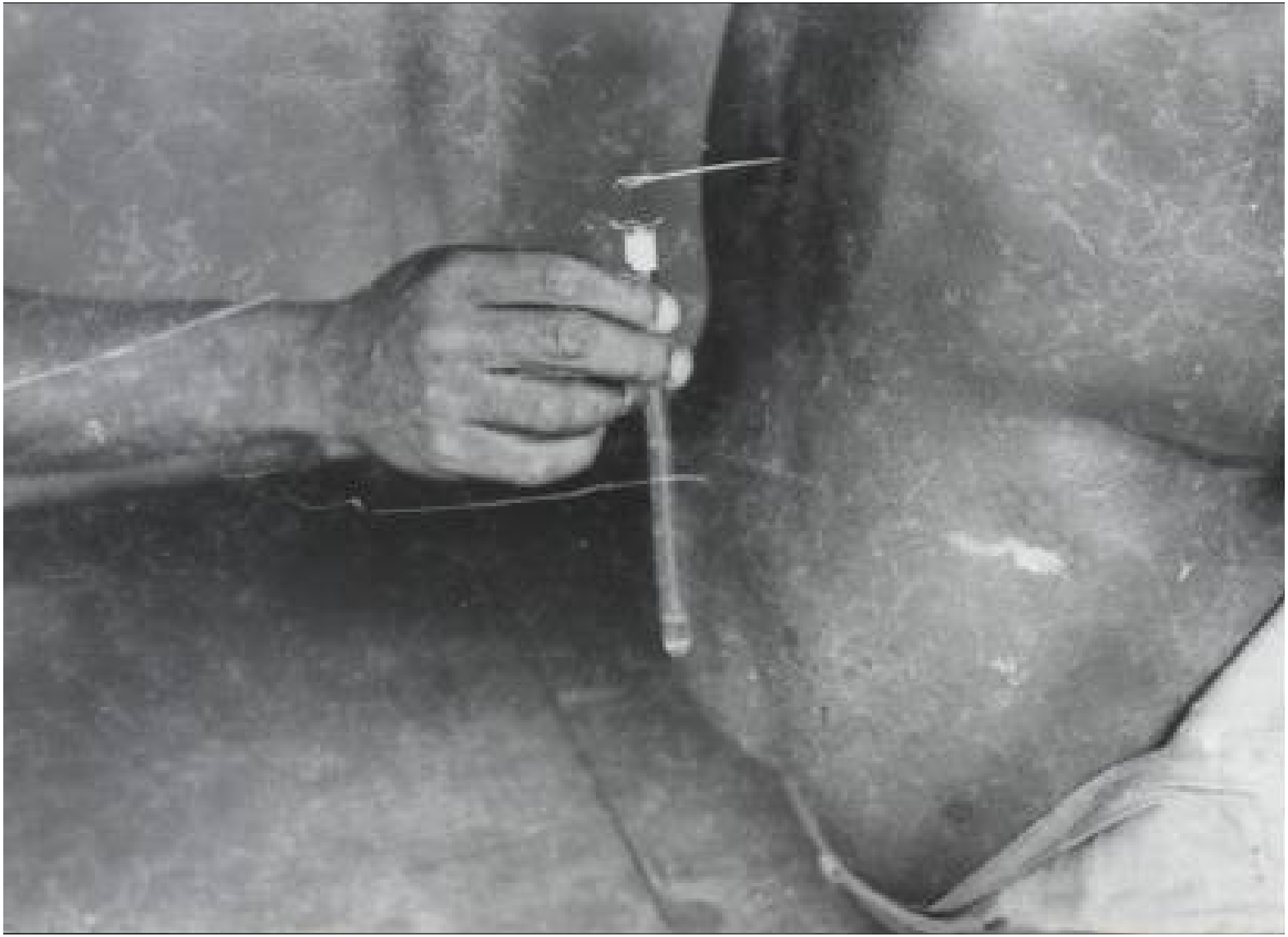
▸ Quotes

Format of Visits

- Doctor and nurses palpated neck glands to check for swelling and examined blood and lymph under a microscope.
- Sometimes performed spinal taps to check for trypanosomes
- Often, the teams administered atoxyl (as treatment) and later on, Lomidine (as a prophylactic) to everyone in a village, regardless of whether sick or not
  - E.g: in 1928 in Cameroon, these teams examined 663,971 people, of whom 115,354 (or 17%) were infected

▸ Quotes





Trust in Medicine

- Campaigns may have affected views of modern medicine
  - Individuals were often forced to participate in the campaigns
  - Treatments had harsh side-effects
  - Anecdotal evidence that many groups became suspicious and resistant
- Anthropologists link resistance to modern health campaigns to the legacy of colonial medicine campaigns
  - In Cameroon, on resistance to tetanus campaigns in 1990: "[The modern campaigns] awakened negative collective memories of French colonial medical efforts to wipe out sleeping sickness" (Feldman-Savage et al., 2000)
  - In CAR, the anthropologist Vernick has written about rumors that still circulated in the late 1980s on injections that brought death

The "Sleeping Sickness Song"

- *Eton* ethnic group, in Central Cameroon, had a song on the campaigns

  The injection against sleeping sickness was too painful
  They gave me an injection in the head
  They gave me an injection in the neck
  They gave me an injection in the back
  ...
  They ask me to go draw water from the well
  If I drag my feet
  The policemen hit me on the head
  The injection against sleeping sickness was too painful
  - Translation from Lachenal (2014)

Spread of Disease

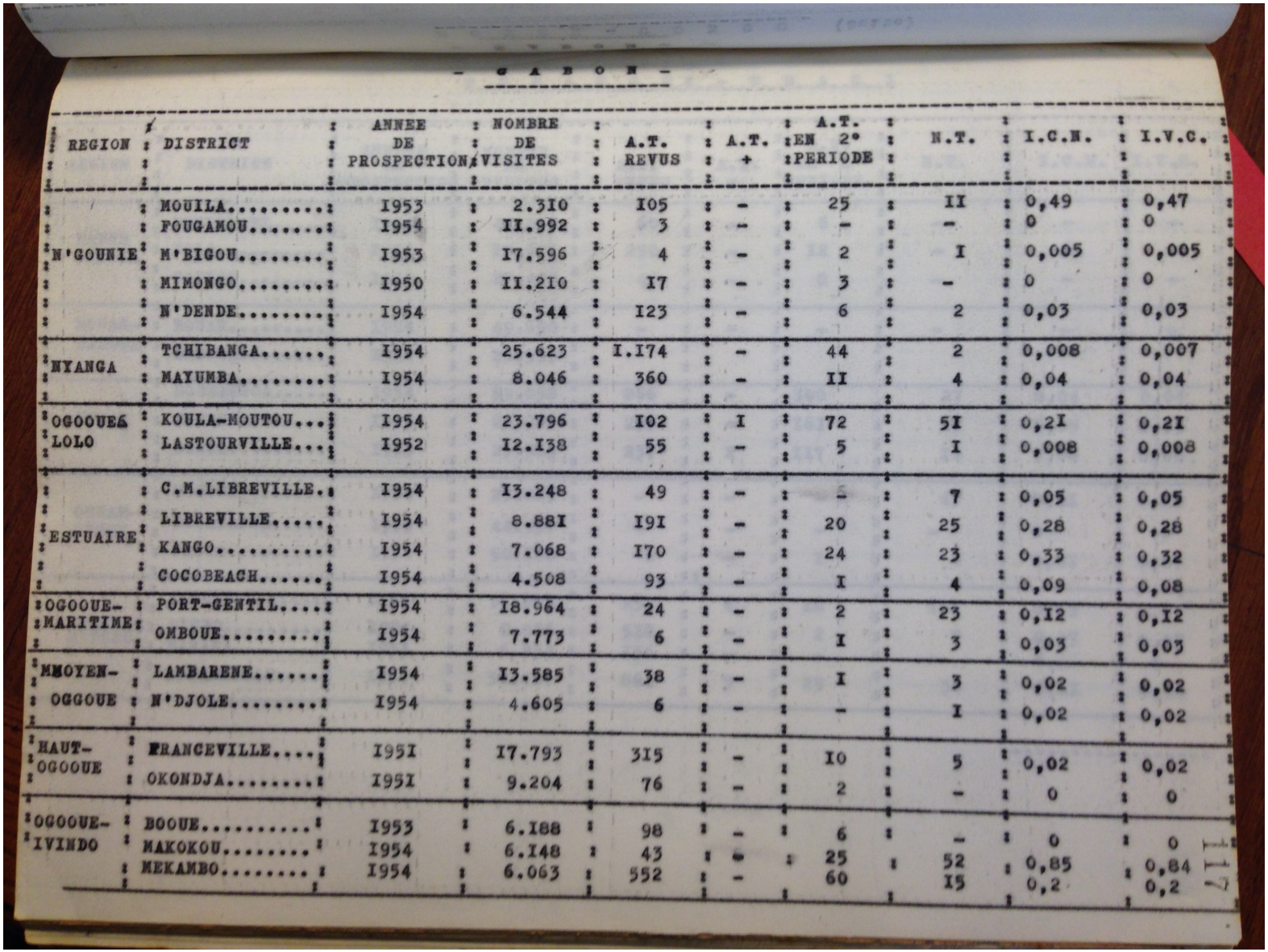
- Epidemiologists have documented the effects of the unsanitary practices during these campaigns on the spread of contagious disease
- Campaigns followed standard contemporaneous medical procedures
- However, spread blood-borne disease due to the reuse of unsanitary needles
  - Linked to Hepatitis C infection rates today (which is non-lethal and difficult to spread sexually)
  - Potentially linked to spread of HIV (Pepin 2011)

Data Sources

Medical Reports for AEF and Cameroon

- We collected archival data from the *Service Historique de la Défense* archives in Toulon, France
- Collected annual medical reports for the AEF countries
  - Countries: Gabon, Republic of Congo, Central African Republic, Chad
  - Time period: 1927 to 1956
  - Level: sub-district
- Collected annual reports for Cameroon
  - Time period: 1921 to 1950
  - Level: ethnicity-district

Archival Data for AEF (1954)



- G A B O N -

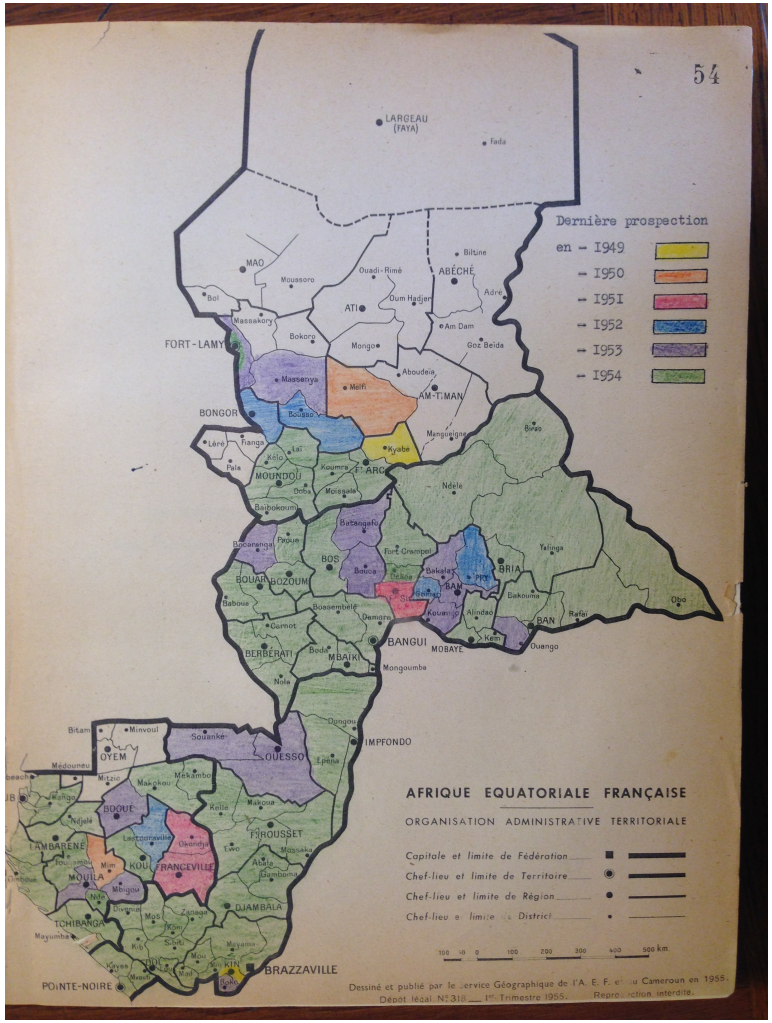
REGION	DISTRICT	ANNEE DE PROSPECTION	NOMBRE DE VISITES	A.T. REVUS	A.T. +	A.T. EN 2e PERIODE	N.T.	I.C.N.	I.V.C.
N'GOUNIE	MOUILA.....	I953	2.3I0	I05	-	25	II	0,49	0,47
	FOUGAMOU.....	I954	II.992	3	-	-	-	0	0
	M'BIGOU.....	I953	I7.596	4	-	2	I	0,005	0,005
	MIMONGO.....	I950	II.2I0	I7	-	3	-	0	0
	N'DENDE.....	I954	6.544	I23	-	6	2	0,03	0,03
NYANGA	TCHIBANGA.....	I954	25.623	I.I74	-	44	2	0,008	0,007
	MAYUMBA.....	I954	8.046	360	-	II	4	0,04	0,04
OGOOUE& LOLO	KOULA-MOUTOU...	I954	23.796	I02	I	72	5I	0,2I	0,2I
	LASTOURVILLE...	I952	I2.I38	55	-	5	I	0,008	0,008
ESTUAIRE	C.M.LIBREVILLE.	I954	I3.248	49	-	-	7	0,05	0,05
	LIBREVILLE.....	I954	8.88I	I9I	-	20	25	0,28	0,28
	KANGO.....	I954	7.068	I70	-	24	23	0,33	0,32
	COCOBEACH.....	I954	4.508	93	-	I	4	0,09	0,08
OGOOUE-MARITIME	PORT-GENTIL....	I954	I8.964	24	-	2	23	0,I2	0,I2
	OMBOUE.....	I954	7.773	6	-	I	3	0,03	0,03
MOYEN-OGOOUE	LAMBARENE.....	I954	I3.585	38	-	I	3	0,02	0,02
	N'DJOLE.....	I954	4.605	6	-	-	I	0,02	0,02
HAUT-OGOOUE	FRANCEVILLE....	I95I	I7.793	3I5	-	I0	5	0,02	0,02
	OKONDJA.....	I95I	9.204	76	-	2	-	0	0
OGOOUE-IVINDO	BOOUE.....	I953	6.I88	98	-	6	-	0	0
	MAKOKOU.....	I954	6.I48	43	-	25	52	0,85	0,84
	MEKAMBO.....	I954	6.063	552	-	60	I5	0,2	0,2

Archival data for Cameroon (1934)

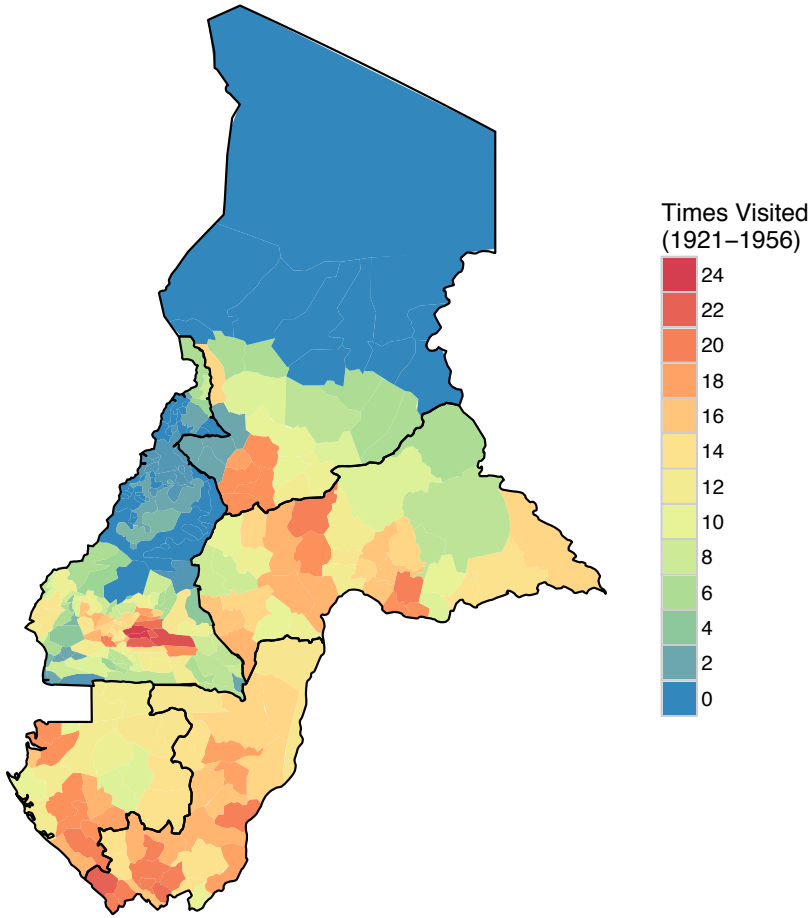
PROSPECTION EN 1934

CIRCONSCRIPTIONS	SUBDIVISIONS	TRIBUS	INDIGÈNES Recensés	INDIGÈNES Visités	Nouveaux malades	Anciens malades positifs	Total des porteurs de germes	Anciens malades contrôlés par ponction lombaire	Anciens malades guéris
Yaoundé	Yaoundé	Mbida-Mbanés	8.367	7.337	17	1	18	231	162
		Tsingas	4.117	3.716	9	2	11	371	290
		Mvélés-Est.	6.040	5.514	20	8	28	1.586	1.412
		Mvélés-Ouest.	19.209	17.737	35	26	61	3.877	2.499
		Étons-Ouest	45.020	40.982	56	5	61	1.388	1.233
		Étons-Est.	81.815	73.490	43	2	45	3.129	2.818
		Banés	35.885	31.839	247	78	325	809	503
		Environs de Yaoundé — Banés	19.490	17.442	208	75	283	701	445
		Environs de Yaoundé — Est	16.357	14.916	121	79	200	2.028	1.599
		Environs de Yaoundé — Ouest	32.067	30.124	152	29	181	334	161
		Environs de Yaoundé — Ville							
	Nanga-Eboko	Yessoums et Yekabas.	11.534	9.019	18	6	24	810	711
	Akonolinga	Yebekolo	21.142	16.339	36	12	48	2.282	1.774
		Omvang.	4.388	3.874	6	11	17	607	507
		Yembama	5.638	4.888	10	12	22	890	720
		Yengono.	3.541	3.085	8	»	8	453	390
		Yedouma	716	619	»	»	»	101	83
		Maka-Nord.	1.220	903	6	3	9	182	151
		Mvogo-Niengué.	7.377	6.578	8	9	17	1.291	909
		Mbida-Mbané.	8.605	6.769	10	13	23	1.179	889
		S'so.	7.090	6.213	16	23	39	868	617
		Yélinda	2.654	2.352	6	9	15	321	220
		Maka-Sud	3.544	3.233	2	12	14	526	366
		Divers.	4.419	4.354	10	9	19	147	129
		Total de la circonscription de Yaoundé.	350.235	311.323	1.044	424	1.468	24.111	18.588
Bafia	Bafia	Bafia	15.777	14.989	88	30	118	563	466
		Yambassa	32.045	29.371	304	108	412	1.950	1.660
		Banens de l'Etoundou.	7.208	6.739	4	1	5	334	283
		Banens de l'Inoubou	4.698	4.315	2	1	3	14	13

Map from AEF Report (1954)



Sleeping Sickness Visits (1921-1956)



Vaccination Rates

- Vaccinations an effective tool to prevent many diseases
- However, many places have low vaccination coverage; 20 million children a year at risk from VPD

Outcome 1: Vaccination Rates

- Examine the share of vaccines reported for children out of the nine possible vaccines reported in the DHS

Measuring Trust in Medicine: Blood Test Refusals

- Existing data for our countries do not include survey questions on trust in medicine.

- The DHS surveys do have an outcome that can be used to infer trust in medicine
  - Random sample of DHS respondents are asked if they are willing to take a blood test
  - DHS then records whether or not people refused the tests
  - Blood tests measure: (i) hemoglobin levels to detect anemia, and/or (ii) HIV

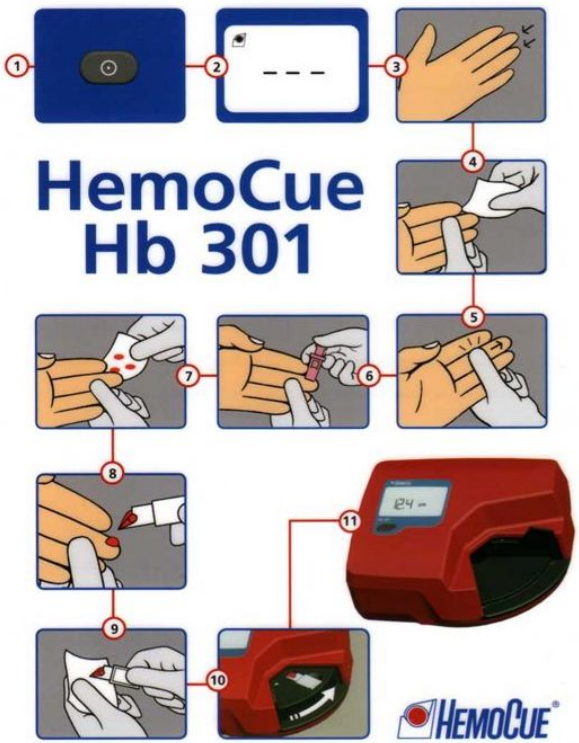
Outcome 2: We take blood test refusal/consent as a proxy for trust in modern medicine

- A revealed preference measure of trust in medicine
- Allows us to control for supply: we know everyone offered the test

▸ DHS Data Sources

Blood Test Examples

Anemia test



HIV test

Estimating Equation: OLS

$$y_{irct} = \gamma ColonialMedicine_r + X'_{irct}B + X'_r\Gamma + \delta_{ct} + \epsilon_{irct} \quad (1)$$

- y_{irct} is the outcome of interest for individual i residing in colonial medical report region r,
  - Cameroon: r is ethnicity-district
  - Gabon, Chad and CAR: r is colonial sub-district
  - Congo: r is district level (due to DHS aggregation level)
- $ColonialMedicine_r$:
  - $ShareYearsVisited_r$ is the share of years a region r was visited between 1921-1956
- X'_i is a vector of individual-level covariates; X'_r is a vector of region-level covariates; All regressions include survey-year fixed effects

Identification Issues

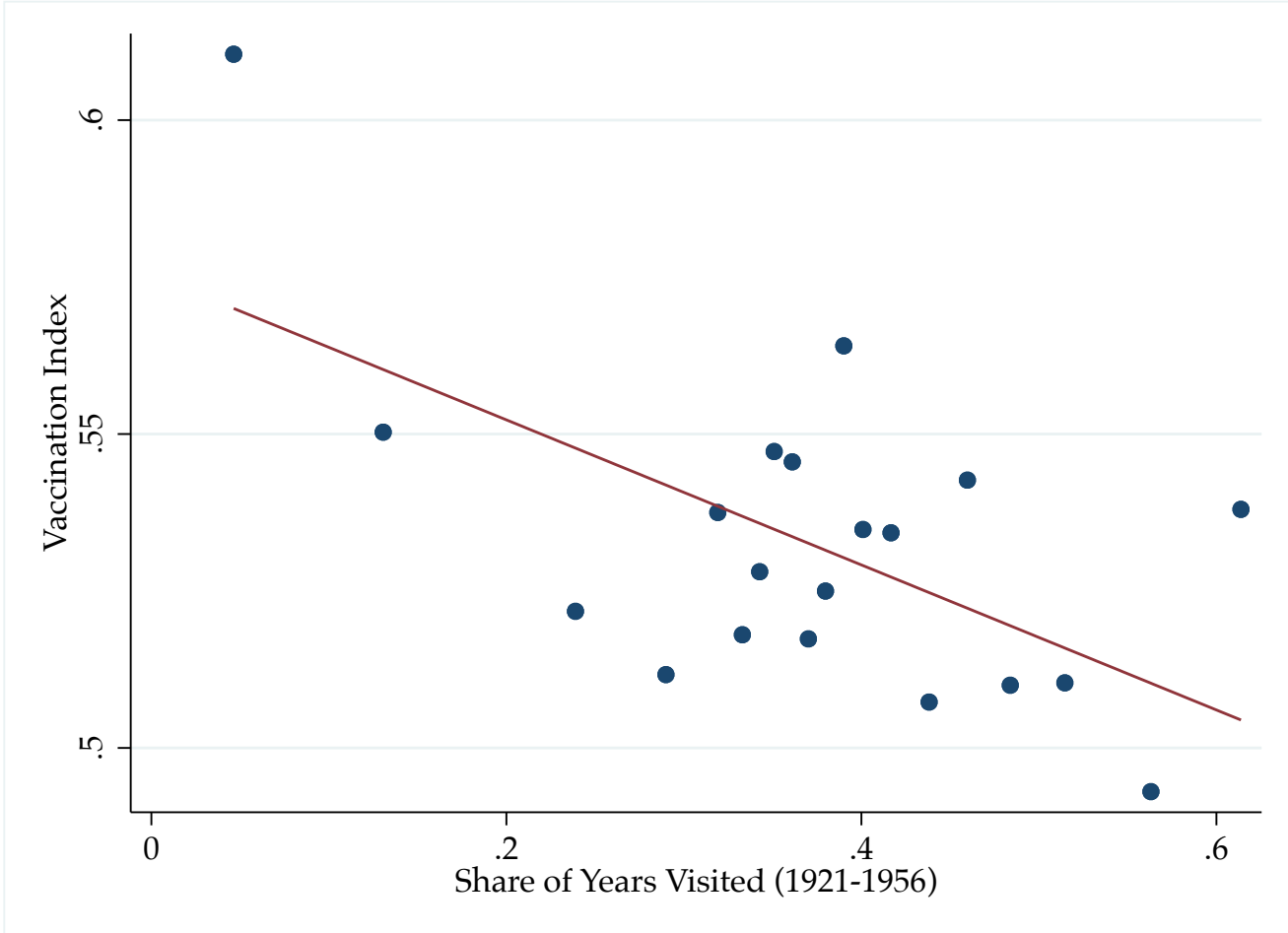
1. Campaigns may have targeted places that were initially less trusting
2. Places that were targeted for medical campaigns differ on other dimensions that may affect present day trust in medicine

Controls

1. **Baseline:** age, age squared, gender, urban-rural status, survey fixed effects
2. **Geography and Climate:** temperature, precipitation, land suitability, area, latitude, longitude, altitude
3. **Disease Suitability:** Tsetse fly suitability, malaria ecology index
4. **Colonial:** Atlantic slave trade, Missionary presence slavery, practice of agriculture
5. **Contemporary:** education fixed effects, wealth index fixed effects

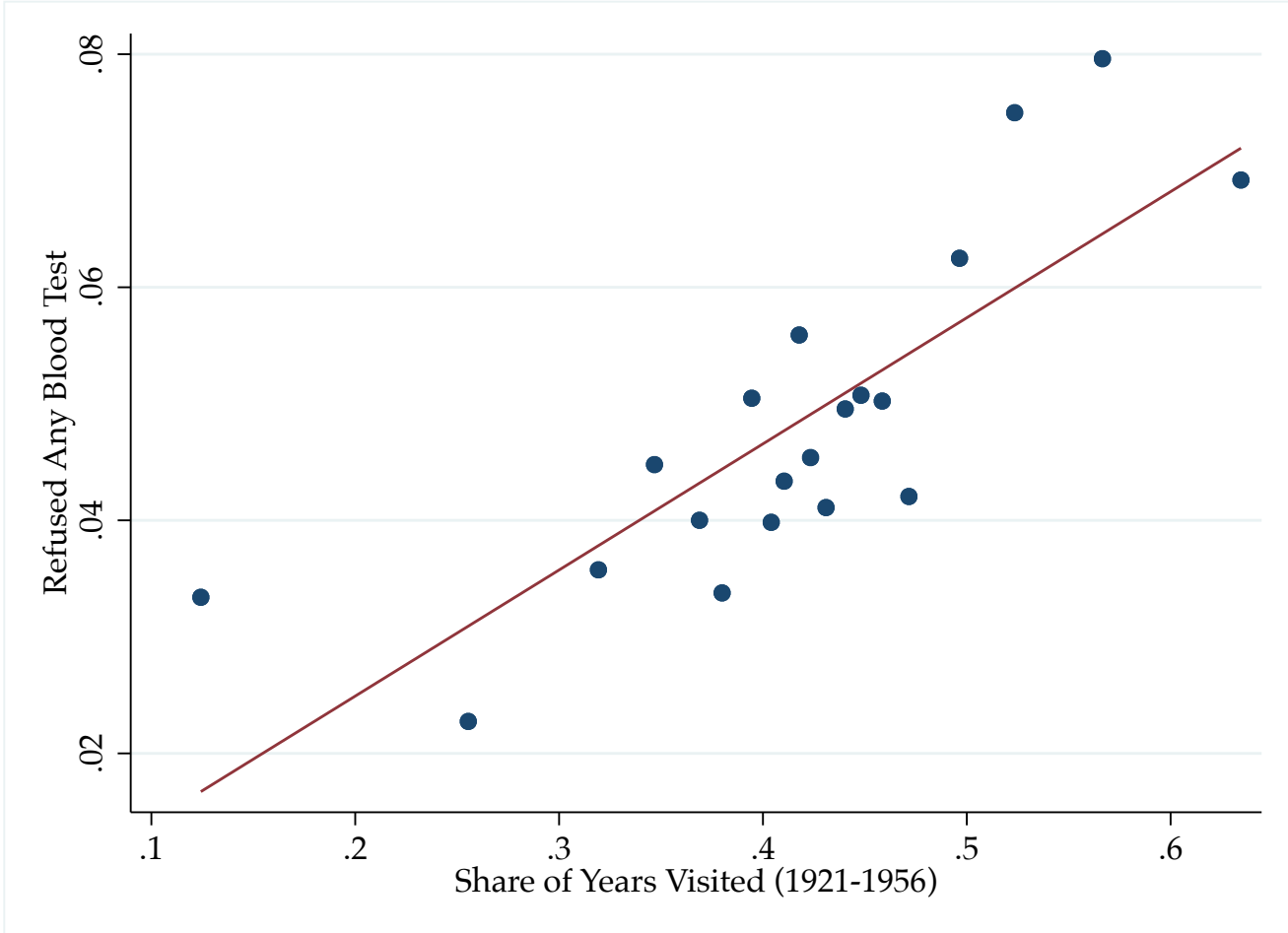
Results

Binscatter: Share of Years Visited and Vaccination Rates



Notes: The figures include survey round fixed effects, control for age, age squared, gender and urban rural status, and include controls for geography, climate, disease environment and colonial experience.

Binscatter: Share of Years Visited and Blood Test Refusal



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Blood Test Refusals and Vaccination Rates (OLS)

	DHS Vaccination Index		*Blood Test Refused*	
	(1)	(2)	(3)	(4)
Share of Years Visited (1921-1956)	-0.0739*	-0.100**	0.122***	0.101***
	(0.0428)	(0.0410)	(0.0303)	(0.0243)
Geography and Climate Controls	Y	Y	Y	Y
Disease Suitability Controls	Y	Y	Y	Y
Colonial Controls	Y	Y	Y	Y
Contemporary Controls	N	Y	N	Y
Observations	50,773	50,720	70,910	70,859
Clusters	207	207	160	160
Mean Dep. Var.	0.532	0.532	0.047	0.047

Notes: Data is from the DHS for Cameroon (2004 and 2011), Gabon (2012), Congo (2011), Central African Republic (1994) and Chad (1996, 2004, 2014). Standard errors are clustered at the ethnic group-district level for Cameroon, at the colonial sub-district level for Gabon and Chad (2014), and at the district level for Congo. *Vaccination Index* is the number of vaccines reported for children in the DHS out of the nine possible vaccines. *Blood Test Refused* is an indicator variable for refusing consent to taking a blood test (for either HIV or anemia) in the DHS data. *Share of Years Visited* measures the share of years the mobile medical teams visited a region for sleeping sickness treatment between 1921 and 1956. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

- A one SD increase in colonial medicine visits is associated with:
  - A 0.08 SD decrease in vaccination rates ▸ More

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- A one SD increase in colonial medicine visits is associated with:
  - A 0.08 SD decrease in vaccination rates ▸ More
  - A 0.10 SD increase in blood test refusals ▸ More

Blood Test Refusals (OLS) - Hemoglobin Test Only

	Dep. Var.: Hemoglobin Blood Test Refused				
	(1)	(2)	(3)	(4)	(5)
Share of Years Visited (1921-1956)	0.0765***	0.126***	0.112***	0.110***	0.0941***
	(0.0241)	(0.0328)	(0.0289)	(0.0258)	(0.0225)
Geography and Climate Controls	N	Y	Y	Y	Y
Disease Suitability Controls	N	N	Y	Y	Y
Colonial Controls	N	N	N	Y	Y
Contemporary Controls	N	N	N	N	Y
Observations	32,652	32,652	32,652	32,652	32,652
Clusters	138	138	138	138	138
Mean Dep. Var.	0.0478	0.0478	0.0478	0.0478	0.0478

Notes: Data is from the DHS for Cameroon (2004 and 2011), Gabon (2012), and Congo (2011). Standard errors are clustered at the ethnic group level for Cameroon, at the colonial Sub-District level for Gabon, and at the district level for Congo. *Hemoglobin Blood Test Refused* is an indicator variable for refusing consent to taking a blood test to test hemoglobin levels. *Share of Years Visited* measures the share of years the mobile medical teams visited a region for sleeping sickness treatment between 1921 and 1956. All regressions control for age, age squared, gender, urban-rural status and include survey round fixed effects. *Geography and Climate Controls* includes mean temperature, mean precipitation, mean land suitability, the mean surface area, centroid latitude, centroid longitude and mean altitude of each region. *Disease Suitability Controls* includes mean malaria ecology index and tse tse fly suitability. *Colonial Controls* includes total number of slaves taken from each main ethnic group in a region during the atlantic slave trade and number of missions in each main ethnic group in a region. *Contemporary Controls* includes educational attainment fixed effects and wealth index fixed effects. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Blood Test Refusals (OLS) - HIV Test Only

	Dep. Var.: HIV Blood Test Refused				
	(1)	(2)	(3)	(4)	(5)
Share of Years Visited (1921-1956)	0.0412	0.128***	0.124***	0.124***	0.102***
	(0.0365)	(0.0381)	(0.0340)	(0.0338)	(0.0279)
Geography and Climate Controls	N	Y	Y	Y	Y
Disease Suitability Controls	N	N	Y	Y	Y
Colonial Controls	N	N	N	Y	Y
Contemporary Controls	N	N	N	N	Y
Observations	58,178	57,902	57,902	57,902	57,827
Clusters	171	170	170	170	170
Mean Dep. Var.	0.0484	0.0485	0.0485	0.0485	0.0484

Notes: Data is from the DHS for Cameroon (2004 and 2011), Gabon (2012), Congo (2009) and Chad (2014). Standard errors are clustered at the ethnic group level for Cameroon, at the colonial Sub-District level for Gabon and Gabon, and at the district level for Congo. *HIV Blood Test Refused* is an indicator variable for refusing consent to taking a blood test to test for HIV. *Share of Years Visited* measures the share of years the mobile medical teams visited a region for sleeping sickness treatment between 1921 and 1956. All regressions control for age, age squared, gender, urban-rural status and include survey round fixed effects. *Geography and Climate Controls* includes mean temperature, mean precipitation, mean land suitability, the mean surface area, centroid latitude, centroid longitude and mean altitude of each region. *Disease Suitability Controls* includes mean malaria ecology index and tse tse fly suitability. *Colonial Controls* includes total number of slaves taken from each main ethnic group in a region during the atlantic slave trade and number of missions in each main ethnic group in a region. *Contemporary Controls* includes educational attainment fixed effects and wealth index fixed effects. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Identification

- Results so far show a correlation between exposure to these campaigns and (i) vaccination completion and (ii) blood test refusal

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- Results so far show a correlation between exposure to these campaigns and (i) vaccination completion and (ii) blood test refusal

- However, French military may have targeted, for example, places that are less trusting or that differed on other important dimensions

- Since effects may be driven by omitted variables, want instrument that:
  1. Affects exposure to campaigns
  2. Does not affect trust through channels other than the campaigns

Instrument

- Proposed instrument:
  1. Log of suitability for cassava ("new" crop) relative to millet ("traditional" crops)

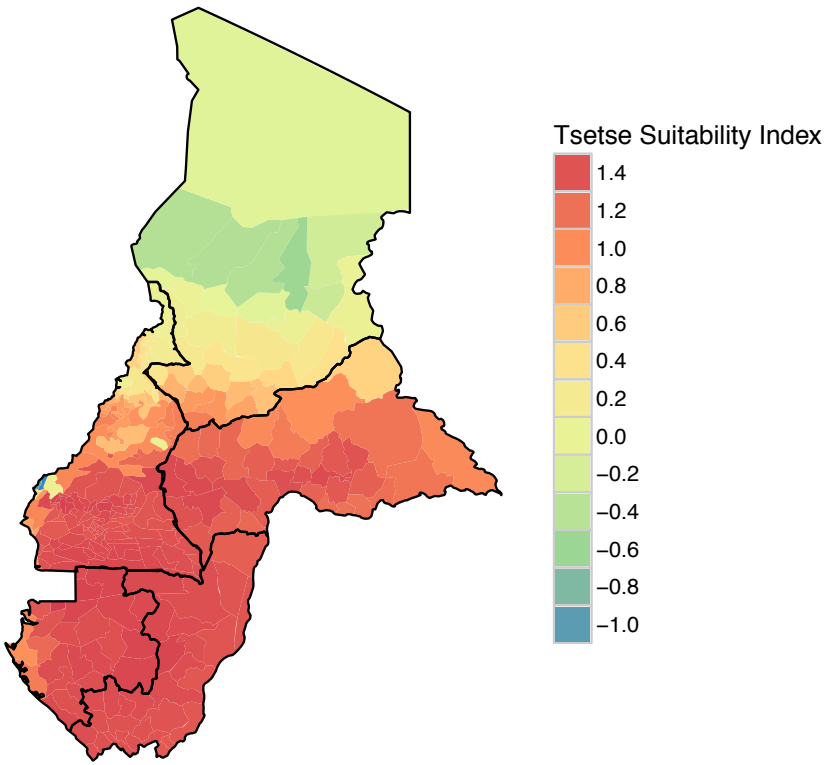
- Historians noted a correlation between growing cassava and sleeping sickness
  - Processing of cassava done near bodies of water (soak to remove cyanide)
  - Cassava yields 4x the number of calories per acre and 13x weight per acre as millet
  - Clear less land to produce a given quantity of calories; leads to more tsetse harboring bush

▸ Cassava/Millet ▸ Distribution

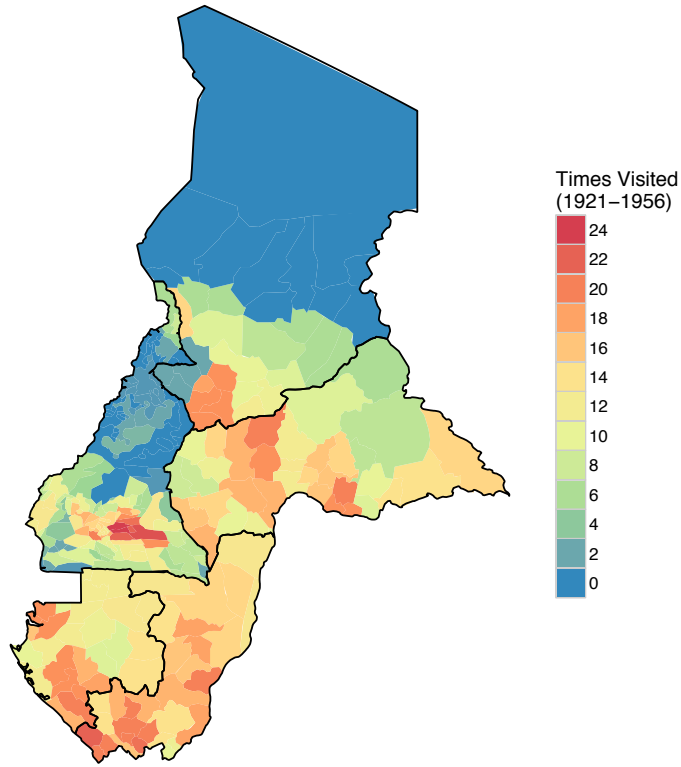
Soaking of Cassava

Tsetse Suitability and Campaign Visits

Tsetse Suitability Index (TSI)

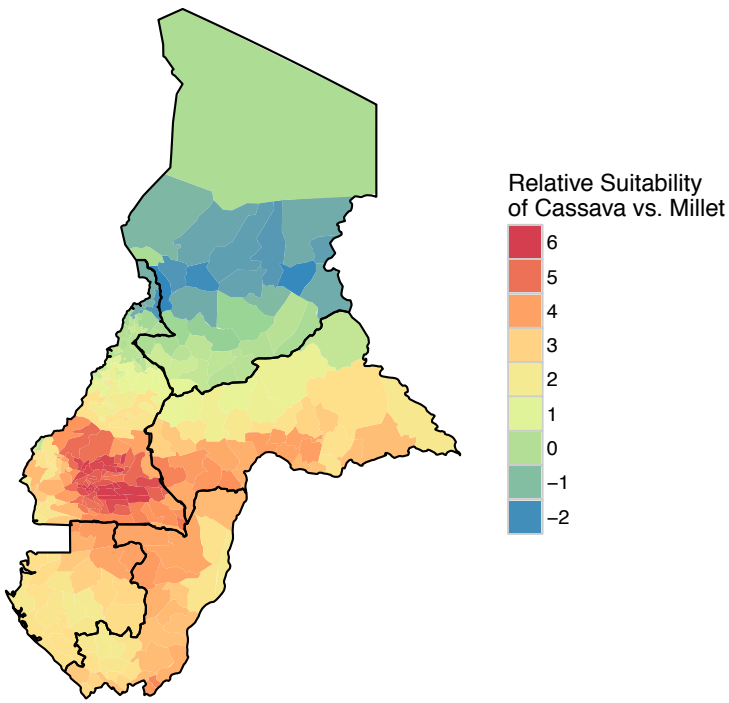


Times Visited

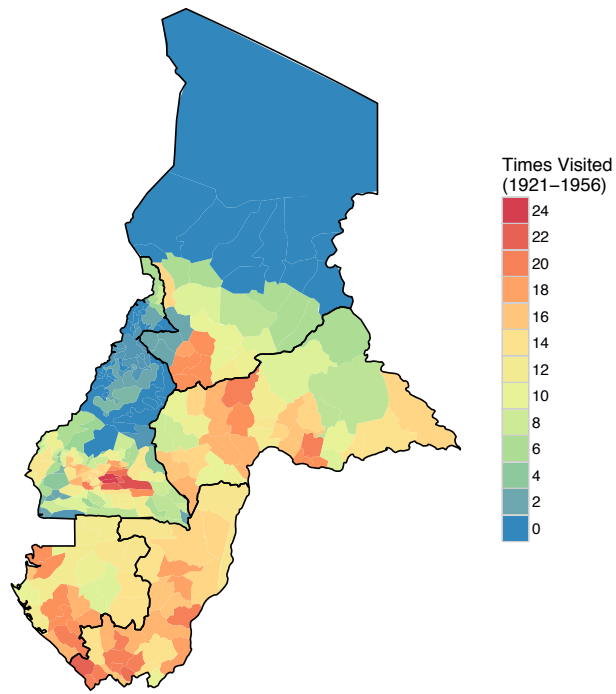


Suitability for Cassava relative to Millet

Cassava vs. Millet



Times Visited



First Stage

	First-Stage Estimates: *Share of Years Visited*			
	(1)	(2)	(3)	(4)
Relative Suitability: Cassava vs. Millet	0.0432***	0.0415***	0.0341***	0.0312***
	(0.0102)	(0.0101)	(0.0111)	(0.0110)
Geography and Climate Controls	Y	Y	Y	Y
Disease Suitability Controls	Y	Y	Y	Y
Colonial Controls	Y	Y	Y	Y
Contemporary Controls	N	Y	N	Y
F-Stat of Excluded Instrument	17.89	17.07	9.40	8.00
Observations	50,773	50,720	70,910	70,859
Clusters	207	207	160	160
Mean Dep. Var.	0.372	0.372	0.416	0.416

Notes: Data is from the DHS for Cameroon (2004 and 2011), Gabon (2012), Congo (2011), Central African Republic (1994) and Chad (1996, 2004, 2014). Standard errors are clustered at the ethnic group-district level for Cameroon, at the colonial sub-district level for Gabon and Chad (2014), and at the district level for Congo. *Vaccination Index* is the number of vaccines reported for children in the DHS out of the nine possible vaccines. *Blood Test Refused* is an indicator variable for refusing consent to taking a blood test (for either HIV or anemia) in the DHS data. *Share of Years Visited* measures the share of years the mobile medical teams visited a region for sleeping sickness treatment between 1921 and 1956. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Blood Test Refusals and DHS Vaccination Index (2SLS)

	Second-Stage Estimates			
	DHS Vaccination Index		*Blood Test Refused*	
	(1)	(2)	(3)	(4)
Share of Years Visited (1921-1956)	-0.370***	-0.468***	0.495***	0.432***
	(0.113)	(0.122)	(0.138)	(0.134)
Geography and Climate Controls	Y	Y	Y	Y
Disease Suitability Controls	Y	Y	Y	Y
Colonial Controls	Y	Y	Y	Y
Contemporary Controls	N	Y	N	Y
Observations	50,773	50,720	70,910	70,859
Clusters	207	207	160	160
Mean Dep. Var.	0.532	0.532	0.047	0.047

Notes: Data is from the DHS for Cameroon (2004 and 2011), Gabon (2012), Congo (2011), Central African Republic (1994) and Chad (1996, 2004, 2014). Standard errors are clustered at the ethnic group-district level for Cameroon, at the colonial sub-district level for Gabon and Chad (2014), and at the district level for Congo. *Vaccination Index* is the number of vaccines reported for children in the DHS out of the nine possible vaccines. *Blood Test Refused* is an indicator variable for refusing consent to taking a blood test (for either HIV or anemia) in the DHS data. *Share of Years Visited* measures the share of years the mobile medical teams visited a region for sleeping sickness treatment between 1921 and 1956. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

- A 1 SD of share of years visited increases refusals by 0.30 SDs and reduces vaccination rates by 0.15 SDs

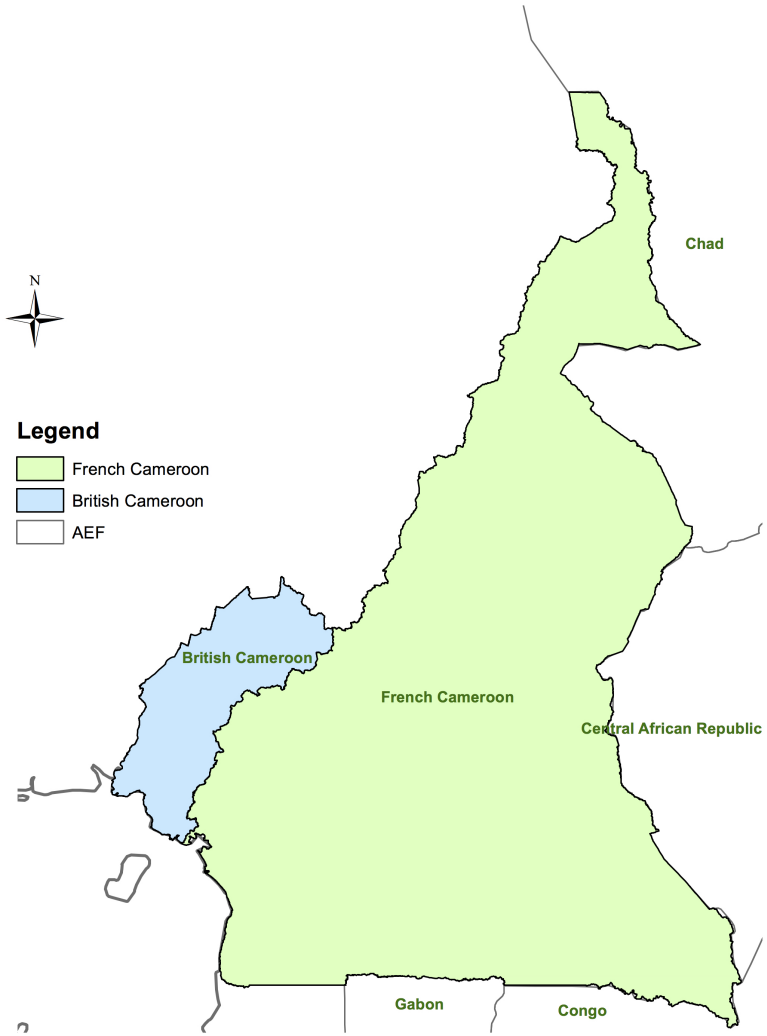
Falsification Exercise

Falsification exercise

- May be concerned that the instrument itself directly affects trust in medicine
- Use the unique history of Cameroon to show that the instrument only predicts refusals in places that had the campaigns
- Find: no effect of the instrument on refusals in places that did not have the campaign

British vs. French Cameroon

- Cameroon initially a German colony
- Divided between Britain and France after WWI
- British generally practiced "indirect rule"
  - British rule of Cameroon characterized as "one of benign neglect" (Gros, 1995)
  - Importantly, no equivalent medical campaigns in British Cameroon



Former British and French Cameroon

British vs. French Cameroon: Reduced Form

	Falsification Test for Relative Suitability of Cassava vs. Millet							
	Dep Var.: *DHS Vaccination Index*				*Dep Var.: Blood Test Refused*			
	Former British Cameroon		Former French Cameroon		Former British Cameroon		Former French Cameroon	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Relative Suitability: Cassava vs. Millet	-0.00438	-0.0110	-0.0536**	-0.0526**	0.00271	0.00204	0.0257**	0.0272**
	(0.0118)	(0.0118)	(0.0218)	(0.0217)	(0.00319)	(0.00293)	(0.0106)	(0.0111)
Geography and Climate Controls	Y	Y	Y	Y	Y	Y	Y	Y
Disease Suitability Controls	Y	Y	Y	Y	Y	Y	Y	Y
Colonial Controls	Y	Y	Y	Y	Y	Y	Y	Y
Contemporary Controls	N	Y	N	Y	N	Y	N	Y
p-value: Former British vs. French Coefficients	–	–	0.047	0.092	–	–	0.040	0.029
Bandwidth	50 km	50 km	50 km	50 km	50 km	50 km	50 km	50 km
Observations	2,067	2,067	3,612	3,612	4,854	4,854	7,866	7,866
Clusters	133	133	219	219	133	133	219	219
Mean Dep. Var.	0.777	0.777	0.740	0.740	0.027	0.027	0.060	0.060

Notes: Data is from the DHS for Cameroon (2004 and 2011). Standard errors are clustered at the ethnic group-district level. *Vaccination Index* is the number of vaccines reported for children in the DHS out of the nine possible vaccines. *Blood Test Refused* is an indicator variable for refusing consent to taking a blood test (for either HIV or anemia) in the DHS data. *Share of Years Visited* measures the share of years the mobile medical teams visited a region for sleeping sickness treatment between 1921 and 1956. *Share of Population Visited* measures the average share of population visited by the sleeping sickness campaigns as a share of the population in that region between 1921 and 1956. *Bandwidth* reports the distance used from the former British and French Cameroon border to restrict the sample. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

- Instrument only predicts blood test refusals in French Cameroon.

British vs. French Cameroon: Reduced Form

	Falsification Test for Relative Suitability of Cassava vs. Millet							
	Dep Var.: *DHS Vaccination Index*				*Dep Var.: Blood Test Refused*			
	Former British Cameroon		Former French Cameroon		Former British Cameroon		Former French Cameroon	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Relative Suitability: Cassava vs. Millet	-0.00438	-0.0110	-0.0536**	-0.0526**	0.00271	0.00204	0.0257**	0.0272**
	(0.0118)	(0.0118)	(0.0218)	(0.0217)	(0.00319)	(0.00293)	(0.0106)	(0.0111)
Geography and Climate Controls	Y	Y	Y	Y	Y	Y	Y	Y
Disease Suitability Controls	Y	Y	Y	Y	Y	Y	Y	Y
Colonial Controls	Y	Y	Y	Y	Y	Y	Y	Y
Contemporary Controls	N	Y	N	Y	N	Y	N	Y
p-value: Former British vs. French Coefficients	–	–	0.047	0.092	–	–	0.040	0.029
Bandwidth	50 km	50 km	50 km	50 km	50 km	50 km	50 km	50 km
Observations	2,067	2,067	3,612	3,612	4,854	4,854	7,866	7,866
Clusters	133	133	219	219	133	133	219	219
Mean Dep. Var.	0.777	0.777	0.740	0.740	0.027	0.027	0.060	0.060

Notes: Data is from the DHS for Cameroon (2004 and 2011). Standard errors are clustered at the ethnic group-district level. *Vaccination Index* is the number of vaccines reported for children in the DHS out of the nine possible vaccines. *Blood Test Refused* is an indicator variable for refusing consent to taking a blood test (for either HIV or anemia) in the DHS data. *Share of Years Visited* measures the share of years the mobile medical teams visited a region for sleeping sickness treatment between 1921 and 1956. *Share of Population Visited* measures the average share of population visited by the sleeping sickness campaigns as a share of the population in that region between 1921 and 1956. *Bandwidth* reports the distance used from the former British and French Cameroon border to restrict the sample. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

- Instrument only predicts blood test refusals in French Cameroon.
  - Can reject coefficients are the same across French and British Cameroon.

▸ AEF vs. British & Portuguese

British vs. French Cameroon: Reduced Form

	Falsification Test for Relative Suitability of Cassava vs. Millet							
	Dep Var.: *DHS Vaccination Index*				*Dep Var.: Blood Test Refused*			
	Former British Cameroon		Former French Cameroon		Former British Cameroon		Former French Cameroon	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Relative Suitability: Cassava vs. Millet	-0.00438	-0.0110	-0.0536**	-0.0526**	0.00271	0.00204	0.0257**	0.0272**
	(0.0118)	(0.0118)	(0.0218)	(0.0217)	(0.00319)	(0.00293)	(0.0106)	(0.0111)
Geography and Climate Controls	Y	Y	Y	Y	Y	Y	Y	Y
Disease Suitability Controls	Y	Y	Y	Y	Y	Y	Y	Y
Colonial Controls	Y	Y	Y	Y	Y	Y	Y	Y
Contemporary Controls	N	Y	N	Y	N	Y	N	Y
p-value: Former British vs. French Coefficients	–	–	0.047	0.092	–	–	0.040	0.029
Bandwidth	50 km	50 km	50 km	50 km	50 km	50 km	50 km	50 km
Observations	2,067	2,067	3,612	3,612	4,854	4,854	7,866	7,866
Clusters	133	133	219	219	133	133	219	219
Mean Dep. Var.	0.777	0.777	0.740	0.740	0.027	0.027	0.060	0.060

Notes: Data is from the DHS for Cameroon (2004 and 2011). Standard errors are clustered at the ethnic group-district level. *Vaccination Index* is the number of vaccines reported for children in the DHS out of the nine possible vaccines. *Blood Test Refused* is an indicator variable for refusing consent to taking a blood test (for either HIV or anemia) in the DHS data. *Share of Years Visited* measures the share of years the mobile medical teams visited a region for sleeping sickness treatment between 1921 and 1956. *Share of Population Visited* measures the average share of population visited by the sleeping sickness campaigns as a share of the population in that region between 1921 and 1956. *Bandwidth* reports the distance used from the former British and French Cameroon border to restrict the sample. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

- Instrument only predicts blood test refusals in French Cameroon.
  - Can reject coefficients are the same across French and British Cameroon.

▸ AEF vs. British & Portuguese

Mechanisms

Afrobarometer Data and Questions

- Research Questions:
  - Do we see the same effect on other measures of trust?
  - Do we see differences in questions related to use of health services?

- Use Afrobarometer Data (w/ Geocodes from AidData):
  - Round 5 data from Cameroon (2013)
  - Round 6 data from Cameroon and Gabon (2015)

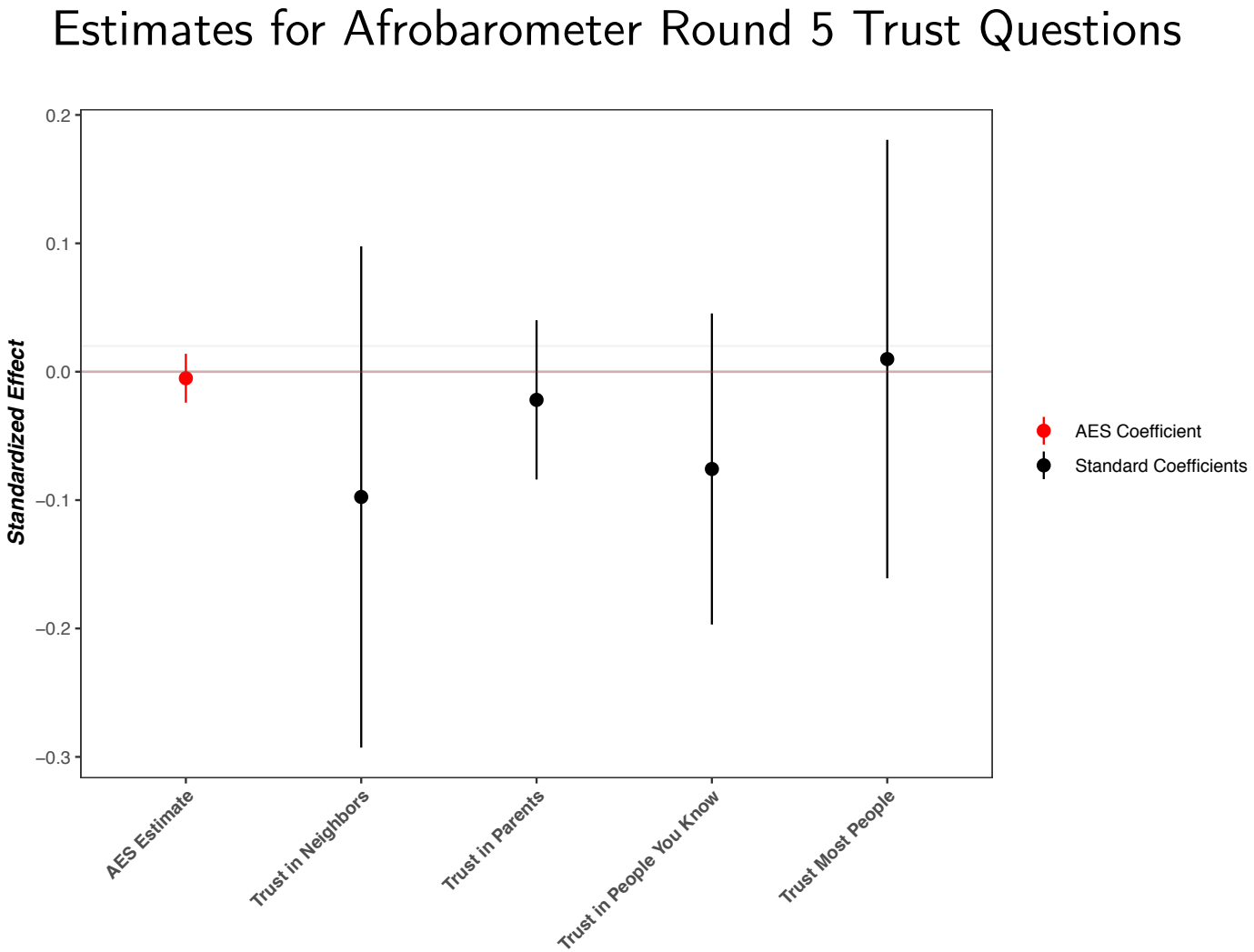
- Trust Questions - "How much to do you trust each of the following?"
  - In Round 5: Neighbors, Parents, People you know, Most people
  - In Round 6: President, Parliament, Electoral commission, Tax department, Local government, Ruling Party, Opposition Party, Police, Army, Courts, Traditional leaders, Religious Leaders

Other Measures of Trust

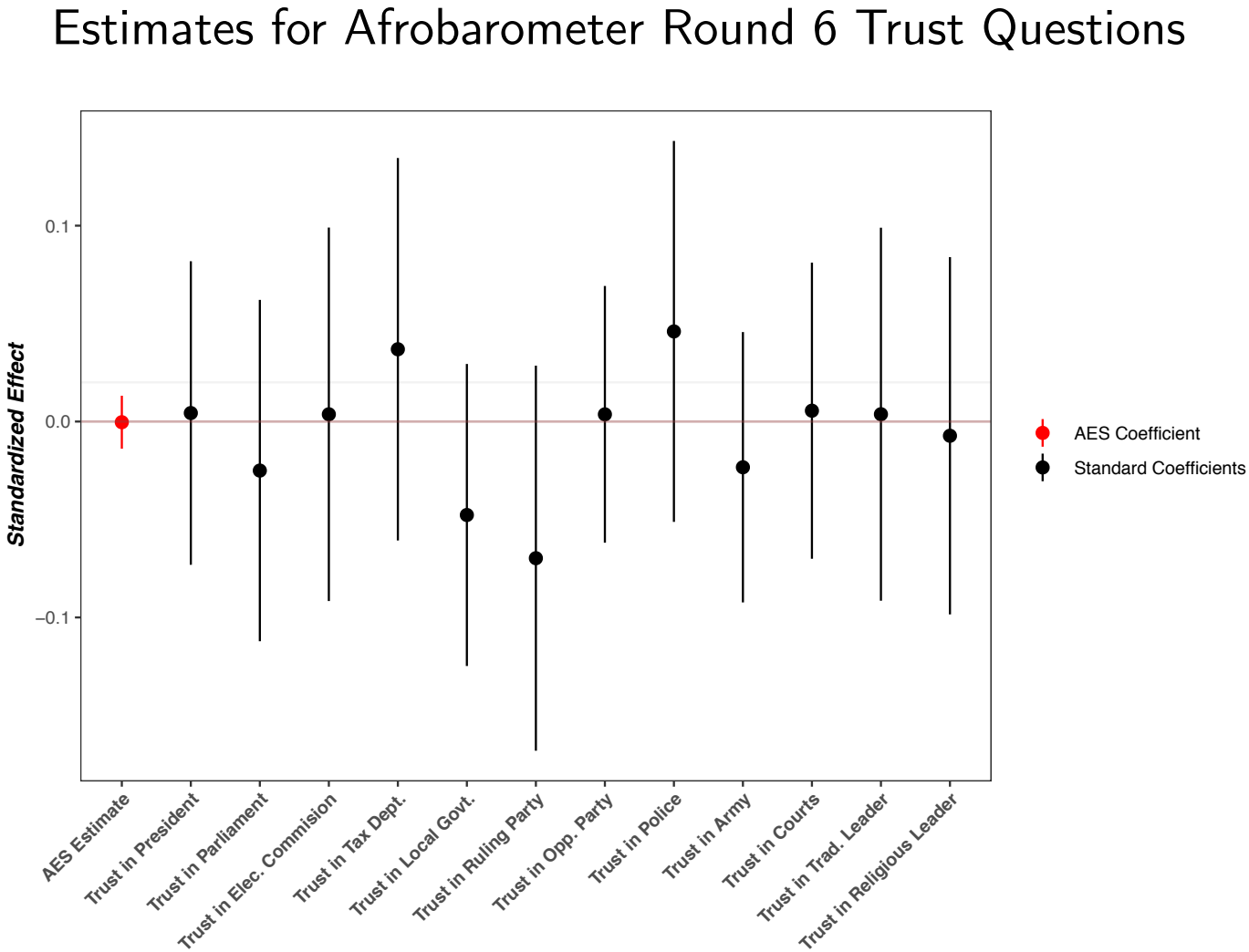
	Trust Questions - AES Coefficients			
	Round 5		*Round 6*	
	(1)	(2)	(3)	(4)
Share of Years Visited (1921-1956)	-0.0061	-0.0051	0.0005	-0.0003
	(0.0093)	(0.0097)	(0.0068)	(0.0069)
Geography and Climate Controls	Y	Y	Y	Y
Disease Suitability Controls	Y	Y	Y	Y
Colonial Controls	Y	Y	Y	Y
Contemporary Controls	N	Y	N	Y
Observations	731	731	1,769	1,769
Clusters	33	33	64	64

Notes: Data is from the Afrobarometer for Cameroon (Round 5 and Round 6) and Gabon (Round 6). Standard errors are clustered at the ethnic group level for Cameroon and at the colonial Sub-District level for Gabon. *Trust Questions* for Round 5 are "How much do you trust each of the following": (1) neighbors, (2) parents, (3) people you know, and (4) most people. *Trust Questions* for Round 5 are "How much do you trust each of the following": (1) president, (2) parliament, (3) electoral commission, (4) tax department, (5) local government, (6) ruling party, (7) opposition party, (8) police, (9) army, (10) courts, (11) traditional leaders, and (12) religious leaders. All trust questions range from 0-3 (0=Not at all, 1=Just a little, 2=Somewhat, 3=A lot) except for *Do you trust most people*, which ranges from 0-1 (0=Do not trust most people, 1=Trust most people).*Share of Years Visited* measures the share of years the mobile medical teams visited a region for sleeping sickness treatment between 1921 and 1956. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Round 5 Trust Questions

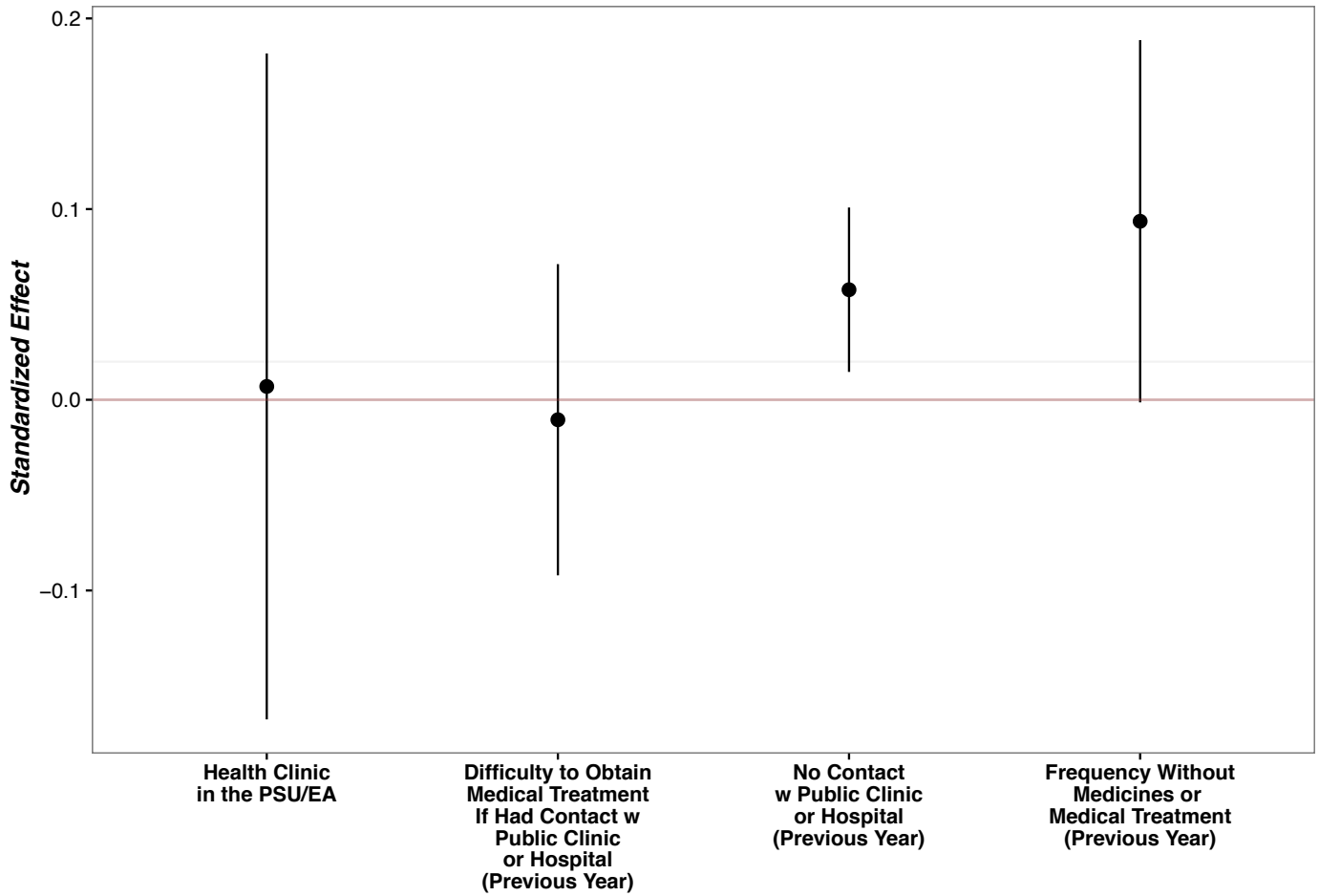


Round 6 Trust Questions



Health Access and Utilization

Estimates for Afrobarometer Health Use and Access Questions



Afrobarometer Results - Summary

Afrobarometer Results suggest that the colonial medical campaigns:

- Do not have the same effect on other (non-medical) trust
- Do affect health care utilization, even when access to health care held constant

Colonial medical campaigns impacted something specific to trust in medicine and not general trust

Transmission

- To what extent does the relationship between campaigns and trust in medicine work through:
  1. Vertical transmission (e.g. exposure of an individual's ethnic group)
  2. Horizontal transmission (e.g. average exposure of those around an individual)

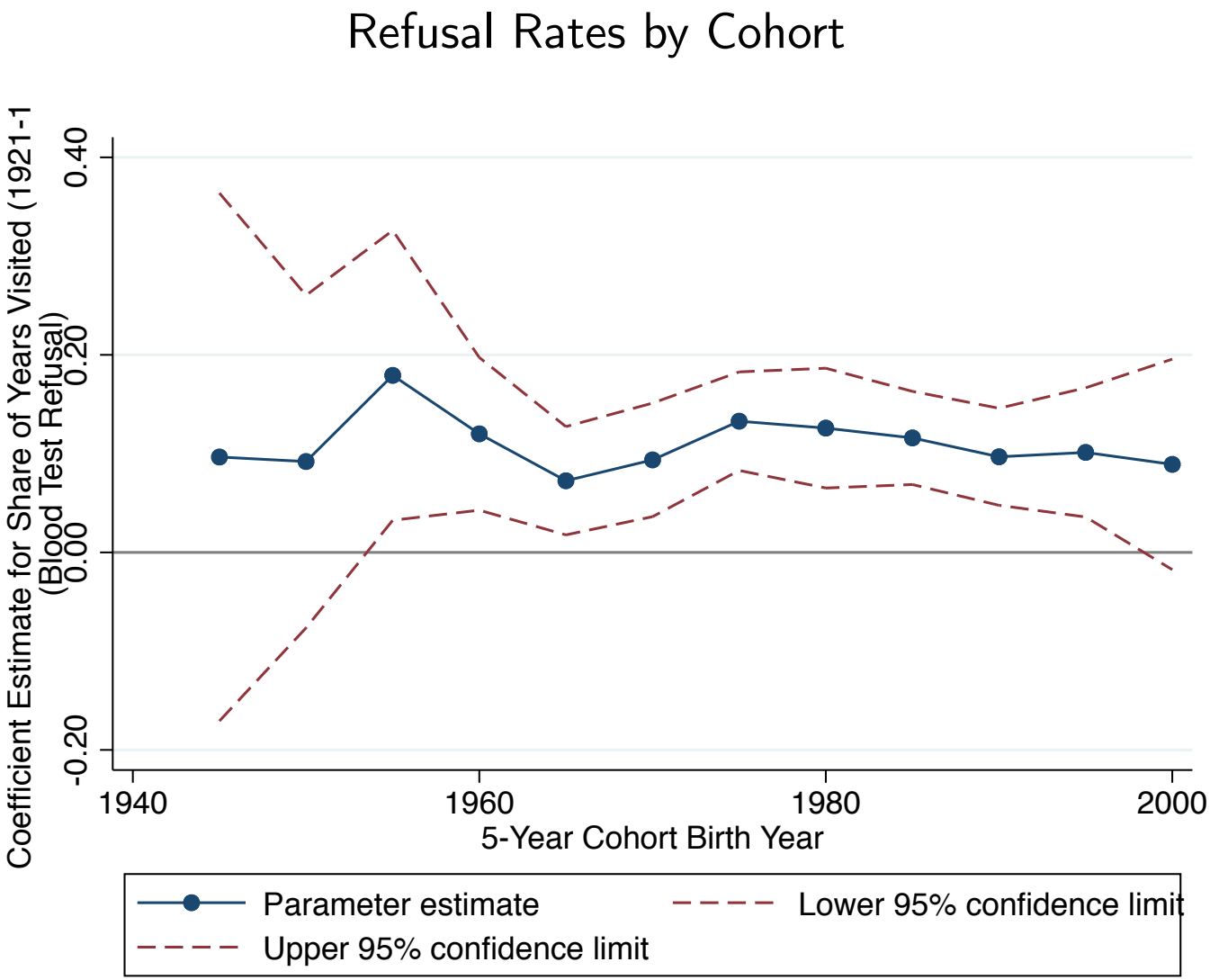
- Use the ethnicity-level data from Cameroon to try to disentangle internal beliefs and external environment (similar to Nunn and Wantchekon (2011))
  - Caveats: Limited to DHS 2004 for Cameroon; DHS ethnicities quite aggregated relative to French reports

Ethnicity vs Location Based Measure

	Blood Test Refused				
	(1)	(2)	(3)	(4)	(5)
Ethnicity-Based Measure of Share of Years Visited (1921-1956)	0.085**	0.082**	0.084**	0.088**	0.071**
	(0.038)	(0.039)	(0.0367)	(0.036)	(0.034)
Average Share of Years Visited (1921-1956) **Among Other Ethnicities in Same Location**	–	0.045	0.046	0.054	0.035
		(0.040)	(0.039)	(0.040)	(0.039)
Geography and Climate Controls	Y	Y	Y	Y	Y
Disease Suitability Controls	Y	Y	Y	Y	Y
Colonial Controls	N	N	Y	Y	Y
Contemporary Controls	N	N	N	N	Y
Observations	8,149	7,103	7,103	7,103	7,103
DHS Ethnicities	26	26	26	26	26
Mean Dep. Var.	0.105	0.110	0.110	0.110	0.110

Note: Data is from the 2004 Cameroon DHS surveys. Standard errors are clustered at the DHS ethnic group level. All regressions control for age, age squared and gender and include survey round fixed effects. *Blood Test Refused* is an indicator variable for refusing consent to taking a blood test (either for HIV testing or hemoglobin levels testing). *Ethnicity-Based Measure of Share of Years Visited* measures the share of years the mobile medical teams visited an individual's reported DHS ethnic group for sleeping sickness treatment between 1921 and 1956. *Average Share of Years Visited Among Other Ethnicities in Same Location* measures the share of years the mobile medical teams visited other individuals' reported DHS ethnic groups within an individual's DHS cluster for sleeping sickness treatment between 1921 and 1956, excluding an individual's own reported DHS ethnic group. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Convergence?



Implications for Policy

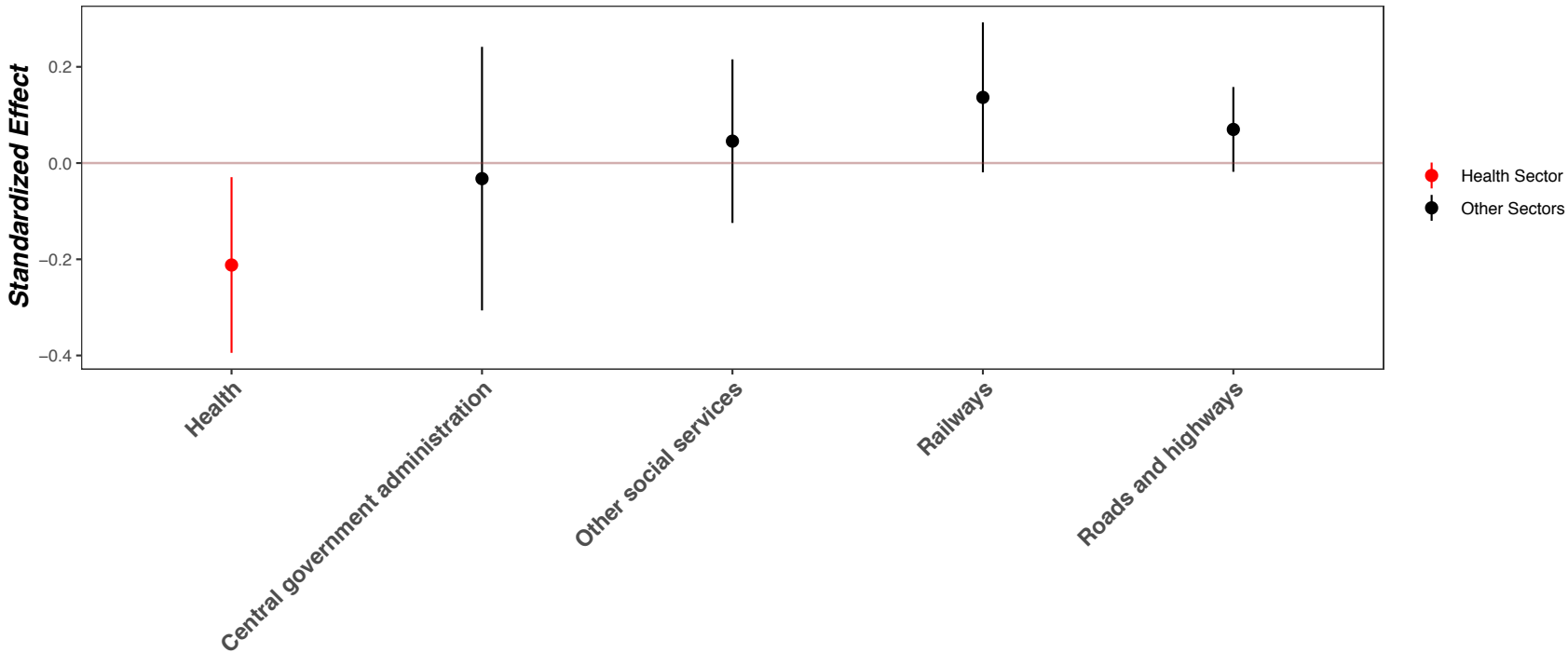
World Bank Project Ratings

- **Research Question:** How does exposure to historical campaigns affect success of World Bank projects in health?
- AidData.org has compiled a data set of geo-located projects funded by the World Bank between 1995 and 2014
- World Bank projects are rated based on "the extent to which the operation's major relevant objectives were achieved, or are expected to be achieved, efficiently"
- Projects rated on a six point scale from highly unsatisfactory to highly satisfactory
- Projects classified by sector: health, administration, other social services, railways, roads

Project Selection

	Panel A: Dep. Var.: Any World Bank Project				
	(1)	(2)	(3)	(4)	
Share of Years Visited	0.00391	0.00479	0.00443	0.00154	
	(0.00592)	(0.00589)	(0.00607)	(0.00825)	
Observations	280	280	280	165	
Clusters	244	244	244	160	
Mean Dep. Var.	0.471	0.471	0.471	0.442	
	Panel B: Dep. Var.: Health Project				
	(1)	(2)	(3)	(4)	(5)
Share of Years Visited	-0.00197	-0.00375	-0.00402	-0.00110	-0.00310
	(0.00586)	(0.00483)	(0.00429)	(0.00945)	(0.00394)
Observations	215	215	215	115	215
Clusters	68	68	68	36	68
Mean Dep. Var.	0.363	0.363	0.363	0.374	0.363
	Panel C: Dep. Var.: Project Received Rating				
	(1)	(2)	(3)	(4)	(5)
Share of Years Visited	0.00173	0.00206	0.00137	-0.00196	0.000347
	(0.00346)	(0.00354)	(0.00368)	(0.00563)	(0.00367)
Geography and Climate Controls	Y	Y	Y	Y	Y
Disease Suitability Controls	N	Y	Y	Y	Y
Colonial Controls	N	N	Y	Y	Y
Pre-Colonial Controls	N	N	N	Y	N
Contemporary Controls	N	N	N	N	Y
Observations	595	595	595	304	595
Clusters	114	114	114	67	114
Mean Dep. Var.	0.361	0.361	0.361	0.378	0.361

Effect by Sector



- 1 SD increase in exposure to medical campaigns decreases project success rating by .2 SD

Health relative to non-health

	Dep. Var.: *World Bank Project Rating*				
	(1)	(2)	(3)	(4)	(5)
	Pooled Regression of Health and Non-health Projects				
Health Project × **Share of Years Visited** (1921-1956)	-2.090***	-2.047***	-2.053***	-2.149*	-2.054***
	(0.509)	(0.579)	(0.590)	(1.251)	(0.589)
Geography and Climate Controls	Y	Y	Y	Y	Y
Disease Suitability Controls	N	Y	Y	Y	Y
Colonial Controls	N	N	Y	Y	Y
Pre-Colonial Controls	N	N	N	Y	N
Contemporary Controls	N	N	N	N	Y
Observations	215	215	215	115	215
Clusters	68	68	68	36	68
Mean Dep. Var.	3.656	3.656	3.656	3.835	3.656

Notes: Data is from AidData for World Bank aid projects. Standard errors are clustered at the ethnic group-district level for Cameroon, at the colonial sub-district level for Gabon, and at the district level for Congo and Chad. *World Bank Project Rating* is variable ranging from 1 to 5, where 1=a project was rated as highly unsatisfactory, 2=unsatisfactory, 3=moderately unsatisfactory, 4=moderately satisfactory, and 5=satisfactory. *Share of Years Visited* measures the share of years the mobile medical teams visited a region for sleeping sickness treatment between 1921 and 1956. *Health Project* is an indicator variable equal to 1 if the project was labeled a "health" sector project by the world bank in the sector designations for a project. All regressions control for country fixed effects and country by health project fixed effects. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

- Being visited average amount decreases health project ratings by 1 point - "moderately satisfactory" to "moderately unsatisfactory"

Conclusion

- We examine geographically granular annual data on colonial medical campaigns in Cameroon and former French Equatorial Africa
- Provide evidence that these campaigns affected trust in modern medicine
  - Measure trust through willingness to consent to a blood test
- Additionally, find that individuals in those areas more exposed to the campaigns have worse health outcomes
  - Children less likely to be vaccinated
- Provide evidence that history important for understanding responses to health policy
  - Open question for future research and policy: how to design health interventions to address mistrust?

Conclusion

- Thank you!
- We appreciate any comments: `slowes@stanford.edu` & `emontero@umich.edu`

The New York Times

GLOBAL HEALTH

Rapid Cure Approved for Sleeping Sickness, a Horrific Illness

Parasites transmitted by tsetse flies travel to the brain, causing paranoia, fury and death. Until now, killing them required hospitalization and harsh drugs.

Types of sleeping sickness

- *Trypanosoma brucei rhodesiense* - acute form of sleeping sickness
  - Most prevalent in Eastern and Central Africa
- *Trypanosoma brucei gambiense* - chronic form of sleeping sickness
  - In West and Central Africa
- *Trypanosoma brucei brucei* - responsible for disease in cattle

Return

- “these considerations about [accidents and cryptic infections] cannot lead us to hesitate to plan chemoprophylaxis campaigns in endemic regions ... because we consciously sacrifice individuals in front of the collective problem which has to be solved” - Neujean, 1958 IBTT report, Archives Africaines.
- “the American trypanocides are more toxic and less stable than the French products..and the accidents are more numerous” (AEF, 1944 Medical Report)

▸ Return

Descriptions from archival records

- "the reason for the lack of visits was because of a lack of means of transport and a missing sanitary agent ... but now there is an agent and we got some trucks so we can go next year" (AEF, 1944 Medical Report)
- "we have had only imprecise information on this endemic, as a result of the failure of the Chief Doctor of this department, who is part of the reserve and hired to serve in a combat unit... and who has manifested his dissatisfaction by abandoning the administrative part of his duties" (AEF, 1944 Medical Report)
- "In a general manner the locals understand the utility of the fight against sleeping sickness. Some individuals who are timid or narrow minded aside, the great majority of people accept in good grace to comply with the multiple formalities" (Congo, 1945 Annual Report)
- "All of the department was prospected here, the work is greatly facilitated by the importance of a road network" (Gabon, 1945, Medical)

▸ Return

Modern Data Sources

- We use data from the Demographic and Health Surveys (DHS) to examine whether historic exposure to colonial medical campaigns is associated with lower trust in medicine today
- We control for potential covariates that affect both exposure to campaigns and trust today:
  - **Geography and climate:** GIS data on soil suitability, precipitation, temperature, and altitude
  - **Disease suitability:** tsetse suitability data from Alsan (2015) and malaria ecology index from Kiszewski et al (2004)
  - **Colonial data:** Nunn and Wantchekon (2011) and medical report maps
  - **Precolonial data:** Alsan (2015)

DHS Data Sets Used

Demographic and Health Survey Data						
Country	**Type**	**Year**	**Survey Data**	**GPS Data**	**HIV/Anemia Data**	**In Sample**
Cameroon	Standard DHS	2011	Yes	Yes	Yes	Yes
Cameroon	Standard DHS	2004	Yes	Yes	Yes	Yes
Cameroon	Standard DHS	1998	Yes	Not Available	No	No
Cameroon	Standard DHS	1991	Yes	Yes	No	No
CAR	MICS	2010	Not Available	Not Available	Not Available	No
CAR	Standard DHS	1994-95	Yes	Yes	No	Child Health
Chad	Standard DHS	2014	Yes	Yes	Yes	Yes
Chad	Standard DHS	2004	Yes	No	No	Child Health
Chad	Standard DHS	1997	Yes	No	No	Child Health
Congo	Standard DHS	2011-12	Yes	No	No	Child Health
Congo	Standard AIS	2009	Yes	No	Yes	Yes
Congo	Standard DHS	2005	Yes	No District	No	No
Gabon	Standard DHS	2012	Yes	Yes	Yes	Yes
Gabon	Standard DHS	2000	Yes	No	No	No

▸ Return

Blood Test Refusals (OLS)

	Share of Years Visited					
	Dep. Var.: *Blood Test Refused*					
	(1)	(2)	(3)	(4)	(5)	(6)
Share of Years Visited (1921-1956)	0.0746***	0.129***	0.123***	0.122***	0.158***	0.102***
	(0.0250)	(0.034)	(0.031)	(0.030)	(0.023)	(0.024)
Geography and Climate Controls	N	Y	Y	Y	Y	Y
Disease Suitability Controls	N	N	Y	Y	Y	Y
Colonial Controls	N	N	N	Y	Y	Y
Pre-Colonial Controls	N	N	N	N	Y	N
Contemporary Controls	N	N	N	N	N	Y
Observations	70,747	70,747	70,747	70,747	33,573	70,696
Clusters	160	160	160	160	94	160
Mean Dep. Var.	0.047	0.047	0.047	0.047	0.066	0.047

Notes: Data is from the DHS for Cameroon (2004 and 2011), Gabon (2012), Congo (2009 and 2011) and Chad (2014). Standard errors are clustered at the ethnic group-district level for Cameroon, at the colonial sub-district level for Gabon and Chad (2014), and at the district level for Congo. *Blood Test Refused* is an indicator variable for refusing consent to taking a blood test (for either HIV or anemia). *Share of Years Visited* measures the share of years the mobile medical teams visited a region for sleeping sickness treatment between 1921 and 1956. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

- Being visited the average share of years (.5 or 15 years) increases blood test refusals 5 percentage points - e.g. doubling of mean refusals

▸ Return

Vaccination Rates (OLS)

	Dep. Var.: DHS Vaccination Index				
	(1)	(2)	(3)	(4)	(5)
Share of Years Visited (1921-1956)	0.0752	-0.0901*	-0.0870*	-0.0739*	-0.100**
	(0.052)	(0.047)	(0.047)	(0.043)	(0.041)
Geography and Climate Controls	Y	Y	Y	Y	Y
Disease Suitability Controls	N	Y	Y	Y	Y
Colonial Controls	N	N	Y	Y	Y
Contemporary Controls	N	N	N	N	Y
Observations	50,773	50,773	50,773	50,773	50,720
Clusters	207	207	207	207	207
Mean Dep. Var.	0.532	0.532	0.532	0.532	0.532

Notes: Data is from the DHS for Cameroon (2004 and 2011), Gabon (2012), Congo (2011), Central African Republic (1994) and Chad (1996, 2004, 2014). Standard errors are clustered at the ethnic group-district level for Cameroon, at the colonial sub-district level for Gabon, CAR, and Chad (2014), and at the district level for Congo and CAR (1996, 2004). *Vaccination Index* is the share of vaccines reported for children in the DHS out of the nine possible vaccines. *Share of Years Visited* measures the share of years the mobile medical teams visited a region for sleeping sickness treatment between 1921 and 1956. All regressions control for age, age squared, gender, urban-rural status, and include survey round fixed effects. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

- Being visited the average share of years decreases the vaccination index by 5 percentage points - e.g. 10% reduction relative to the mean

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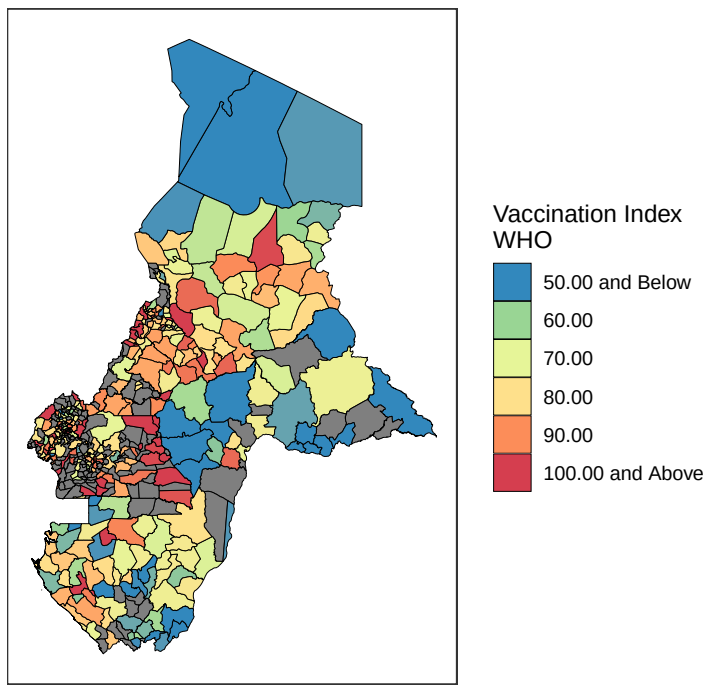
Measuring Trust in Medicine: Vaccination Rates

- One potential issue with the DHS Vaccination data is that they are self-reported and we cannot account for differences in supply

Measuring Trust in Medicine: Vaccination Rates

- One potential issue with the DHS Vaccination data is that they are self-reported and we cannot account for differences in supply
- To address this, we examine WHO data on sub-national immunization coverage data for 2016-2017
  - Data is reported by governments
  - Offers a more accurate sense of vaccination campaign supply



WHO Vaccination Rates (OLS)

	Dep. Var.: *WHO Vaccination Index*				
	(1)	(2)	(3)	(4)	(5)
Share of Years Visited (1921-1956)	-0.00884**	-0.00915**	-0.00925**	-0.0182***	-0.00872**
	(0.00341)	(0.00351)	(0.00354)	(0.00680)	(0.00346)
Geography and Climate Controls	Y	Y	Y	Y	Y
Disease Suitability Controls	N	Y	Y	Y	Y
Colonial Controls	N	N	Y	Y	Y
Pre-Colonial Controls	N	N	N	Y	N
Contemporary Controls	N	N	N	N	Y
Observations	701	701	701	371	701
Clusters	146	146	146	100	146
Mean Dep. Var.	0.779	0.779	0.779	0.764	0.779

Notes: Data is from the WHO sub-national immunization coverage data. The unit of observation is the sub-national unit. Standard errors are clustered at the ethnic group-district level for Cameroon, at the colonial sub-district level for Gabon, CAR, Congo, and Chad. *WHO Vaccination Index* is the average of the vaccination rates for each sub-national unit with reported coverage. *Share of Years Visited* measures the share of years the mobile medical teams visited a region for sleeping sickness treatment between 1921 and 1956. *Share of Population Visited* measures the average share of population visited by the sleeping sickness campaigns as a share of the population in that region between 1921 and 1956. All regressions include country and year (either 2016 or 2017) fixed effects. *Geography and Climate Controls* includes mean temperature, mean precipitation, mean land suitability, the mean surface area, centroid latitude, centroid longitude and mean altitude. *Disease Suitability Controls* includes mean malaria ecology index and tsetse fly suitability. *Colonial Controls* includes total number of slaves taken from each main ethnic group in a region during the Atlantic slave trade and number of missions in each main ethnic group in a region. *Pre-Colonial Controls* includes level of centralization, use of plow, whether indigenous slavery was practiced, and whether agriculture was practiced for each main ethnic group in a region. *Contemporary Controls* includes reported population for each sub-district. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

- A one SD increase in colonial medicine visits is associated with a 0.12 SD decrease in vaccination rates

WHO Vaccination Index (2SLS)

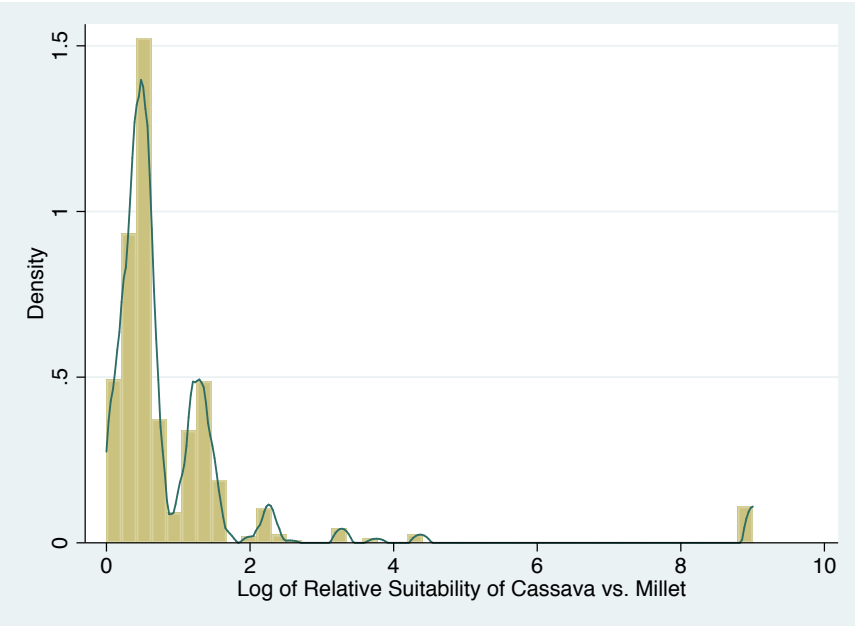
	Second-Stage Estimates			
	Dep. Var.: WHO *Vaccination Index*			
	(1)	(2)	(3)	(4)
Share of Years Visited (1921-1956)	-0.0628	-0.0199*	-0.0174*	-0.0183**
	(0.0456)	(0.0113)	(0.00989)	(0.00930)
Geography and Climate Controls	Y	Y	Y	Y
Disease Suitability Controls	N	Y	Y	Y
Colonial Controls	N	N	Y	Y
Contemporary Controls	N	N	N	Y
F-stat of excluded instrument	3.77	33.81	34.51	28.14
Observations	294	294	294	294
Clusters	101	101	101	101
Mean Dep. Var.	0.665	0.665	0.665	0.665

Notes: Data is from the WHO sub-national immunization coverage data. The unit of observation is the sub-national unit. Standard errors are clustered at the ethnic group-district level for Cameroon, at the colonial sub-district level for Gabon, Congo, CAR, and Chad. *WHO Vaccination Index* is the average of the vaccination rates for each sub-national unit with reported coverage. *Share of Years Visited* measures the share of years the mobile medical teams visited a region for sleeping sickness treatment between 1921 and 1956. *Share of Population Visited* measures the average share of population visited by the sleeping sickness campaigns as a share of the population in that region between 1921 and 1956. All regressions include country and year fixed effects. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

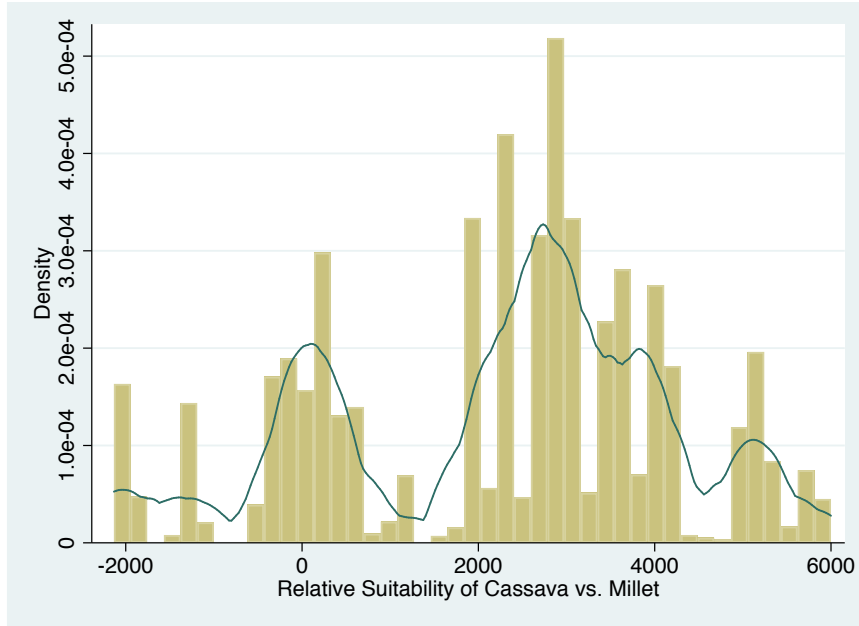
- A 1 SD of share of years visited reduces vaccination rates by 0.25 SDs

Distribution of Log Suitability and Suitability

Log of Relative Suitability



Relative Suitability



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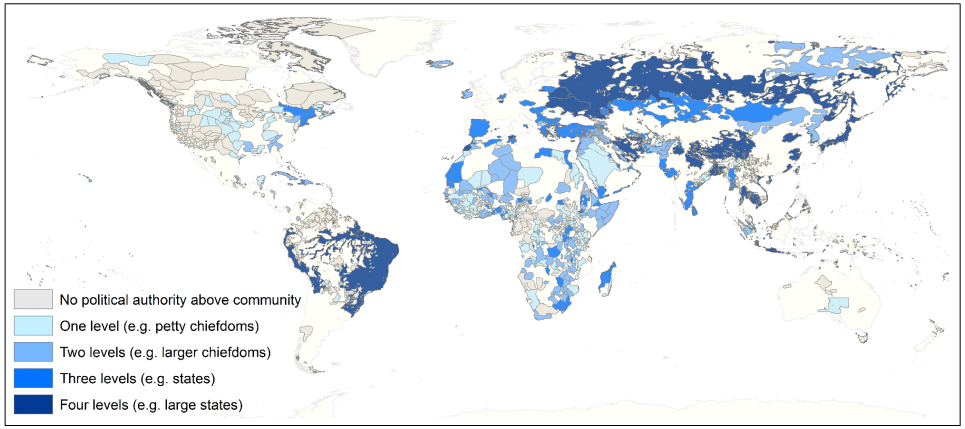
Mayshar et. al, 2018

Figure 2: Jurisdictional hierarchy beyond the local community in pre-colonial societies



- CerAdv: the caloric advantage of cereals - difference between maximum potential caloric yield of cereals and of roots or tubers using data on 11 cereal grains and 4 roots and tubers
- Cereals support state development because are easily taxed. Cereals are cultivated only if their productivity advantage over tubers is sufficiently high to compensate for taxation by the state.

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Falsification: AEF vs British/Portuguese Colonies

	Falsification Test for Relative Suitability of Cassava vs. Millet							
	Dep Var.: *DHS Vaccination Index*				*Dep Var.: Blood Test Refused*			
	Non-French Colonies		Former AEF Colonies		Non-French Colonies		Former AEF Colonies	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Relative Suitability: Cassava vs. Millet	-0.00429***	-0.00223**	-0.0187***	-0.0217***	0.00164	0.000766	0.0121***	0.00889***
	(0.000982)	(0.000875)	(0.00631)	(0.00582)	(0.00189)	(0.00188)	(0.00248)	(0.00235)
Geography and Climate Controls	Y	Y	Y	Y	Y	Y	Y	Y
Disease Suitability Controls	Y	Y	Y	Y	Y	Y	Y	Y
Colonial Controls	Y	Y	Y	Y	Y	Y	Y	Y
Contemporary Controls	N	Y	N	Y	N	Y	N	Y
p-value: Former Non-French vs. AEF Coefficients	–	–	0.0122	0.0011	–	–	0.0004	0.0035
Observations	332,603	322,269	35,583	35,530	102,743	102,743	68,278	68,218
Clusters	19726	19271	108	108	7850	7850	163	163
Mean Dep. Var.	0.300	0.302	0.486	0.486	0.0659	0.0659	0.0497	0.0496

Notes: Data is from the IPUMS-DHS Integrated sample for non-French and non-Belgian colonies with gps coordinates: Ethiopia (2000, 2005, 2010), Ghana (1993, 1998, 2003, 2008), Kenya (2003, 2008), Lesotho (2004, 2009), Malawi (2000, 2004, 2010, 2016), Namibia (2000), Nigeria (1990, 2003), Sudan (1993, 1997, 2005, 2010), Tanzania (1999, 2010), and Uganda (2000 2006, 2011). For former AEF French colonies, the data includes: Cameroon (2004 and 2011), Gabon (2012), Congo (2011), Central African Republic (1994) and Chad (1996, 2004, 2014). Standard errors are clustered at the DHS cluster level. *Vaccination Index* is the share of vaccines reported for children in the DHS out of the reported vaccines. *Blood Test Refused* is an indicator variable for refusing consent to taking a blood test (for either HIV or anemia) in the DHS data. *Relative Suitability: Cassava vs. Millet* is the logarithm of the differences in suitabilities for cassava and millet at the DHS cluster. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

▸ Return

Figure 1: Sleeping sickness by ethnic group in Cameroon - 1934

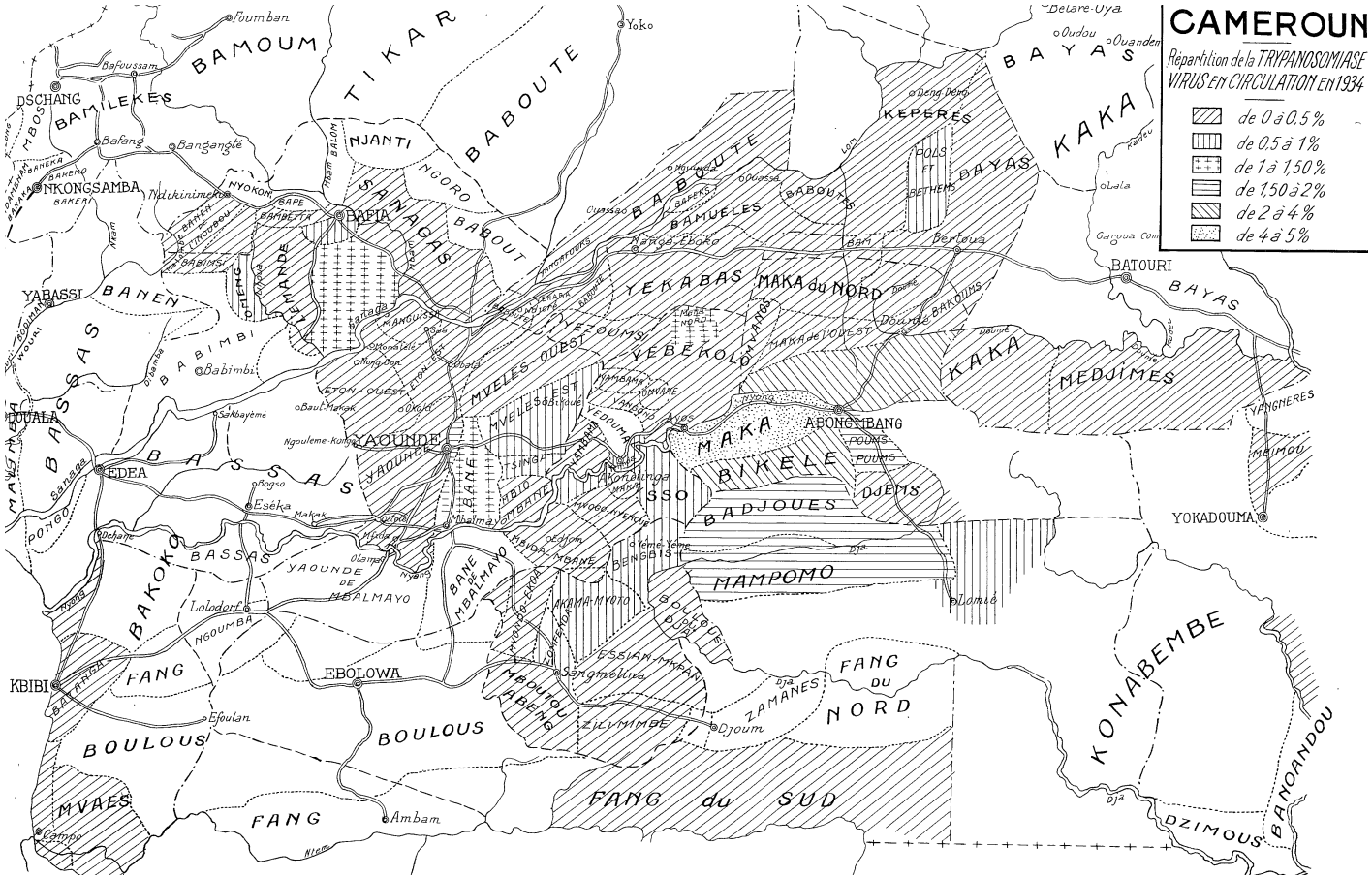

Figure 2: Sleeping sickness campaign map - Areas visited in 1941

Figure 3: Share of Population Visited

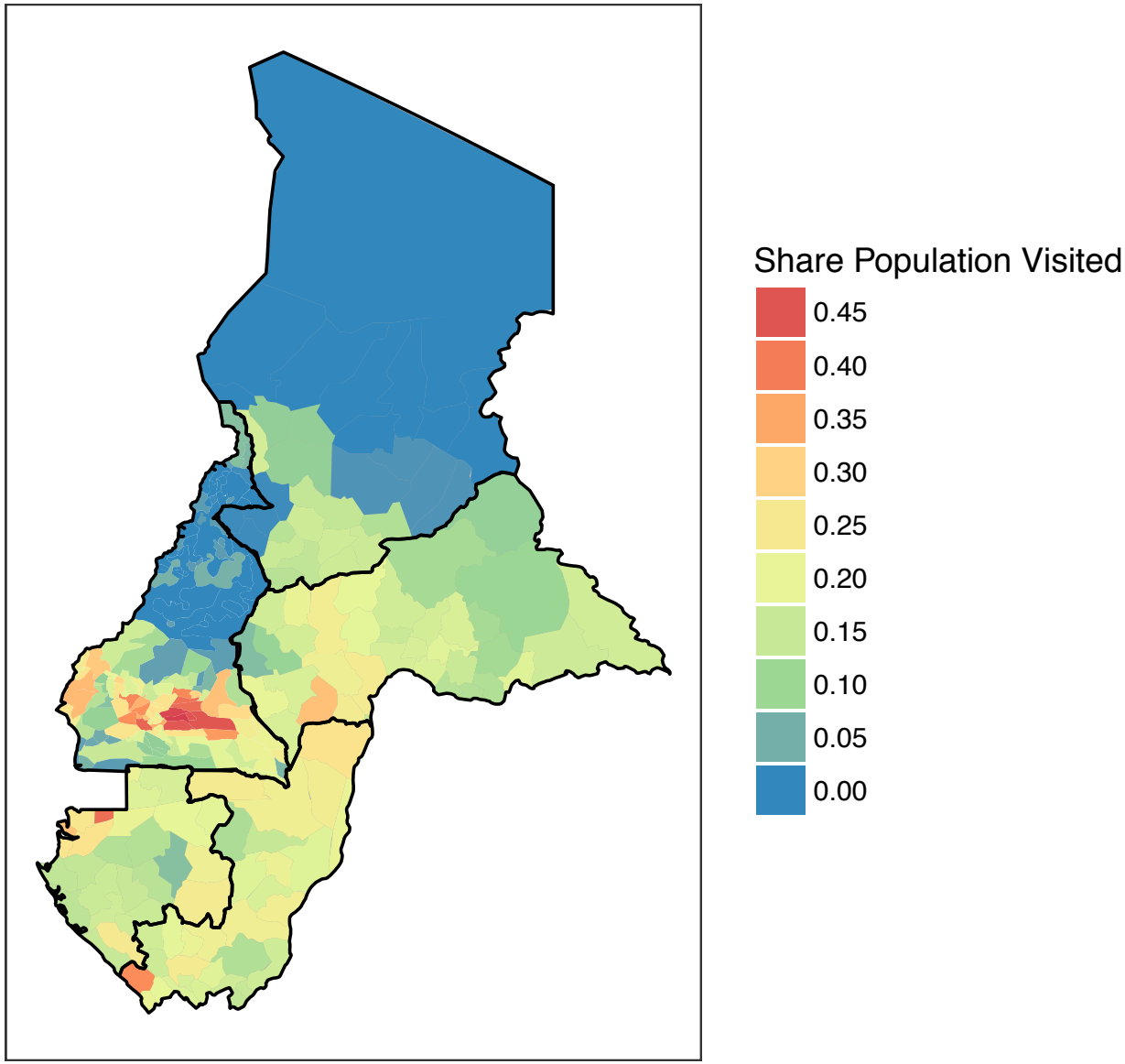

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Figure 4: Average Sleeping Sickness Rates

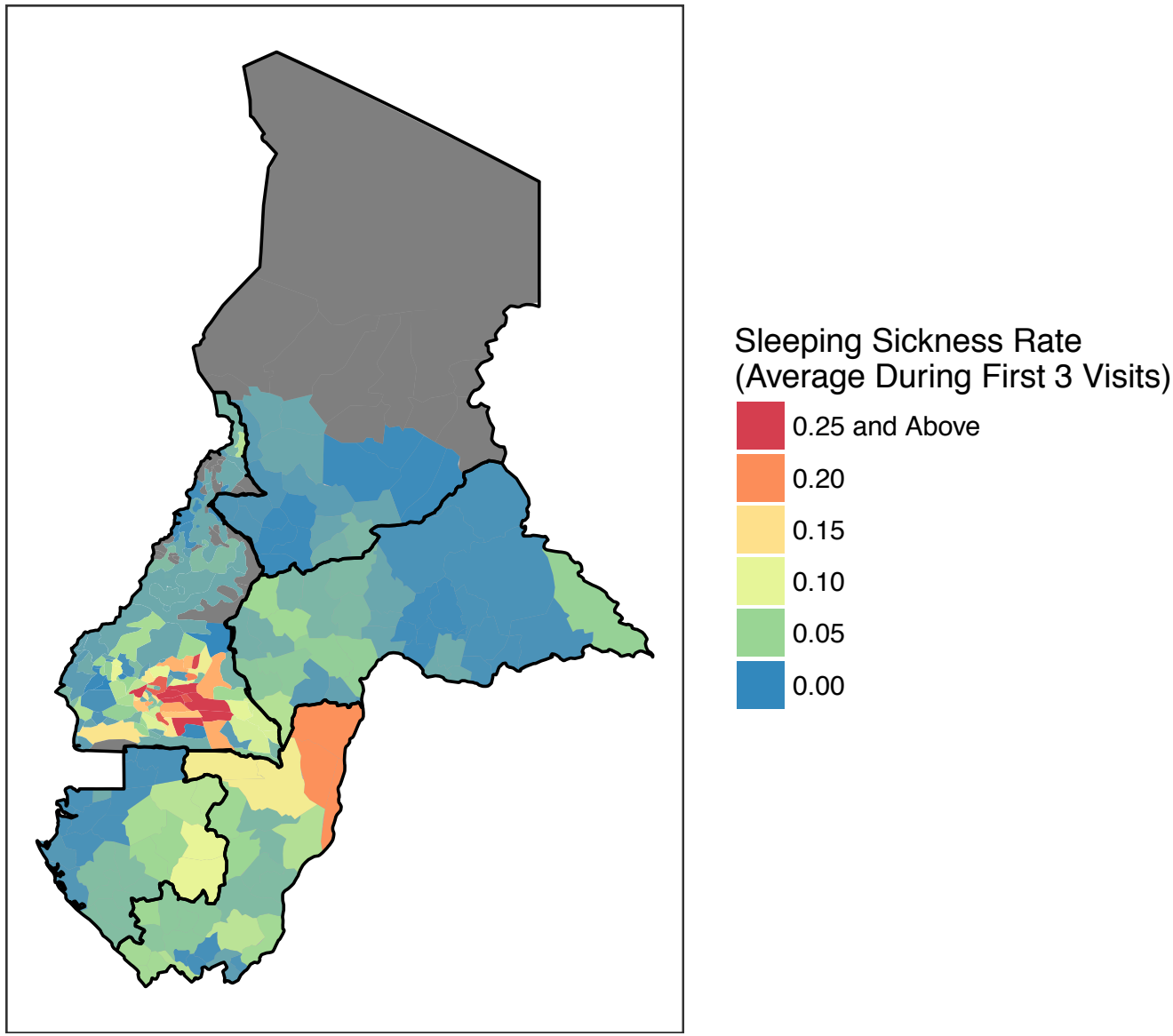

Figure 5: Max Sleeping Sickness Rates

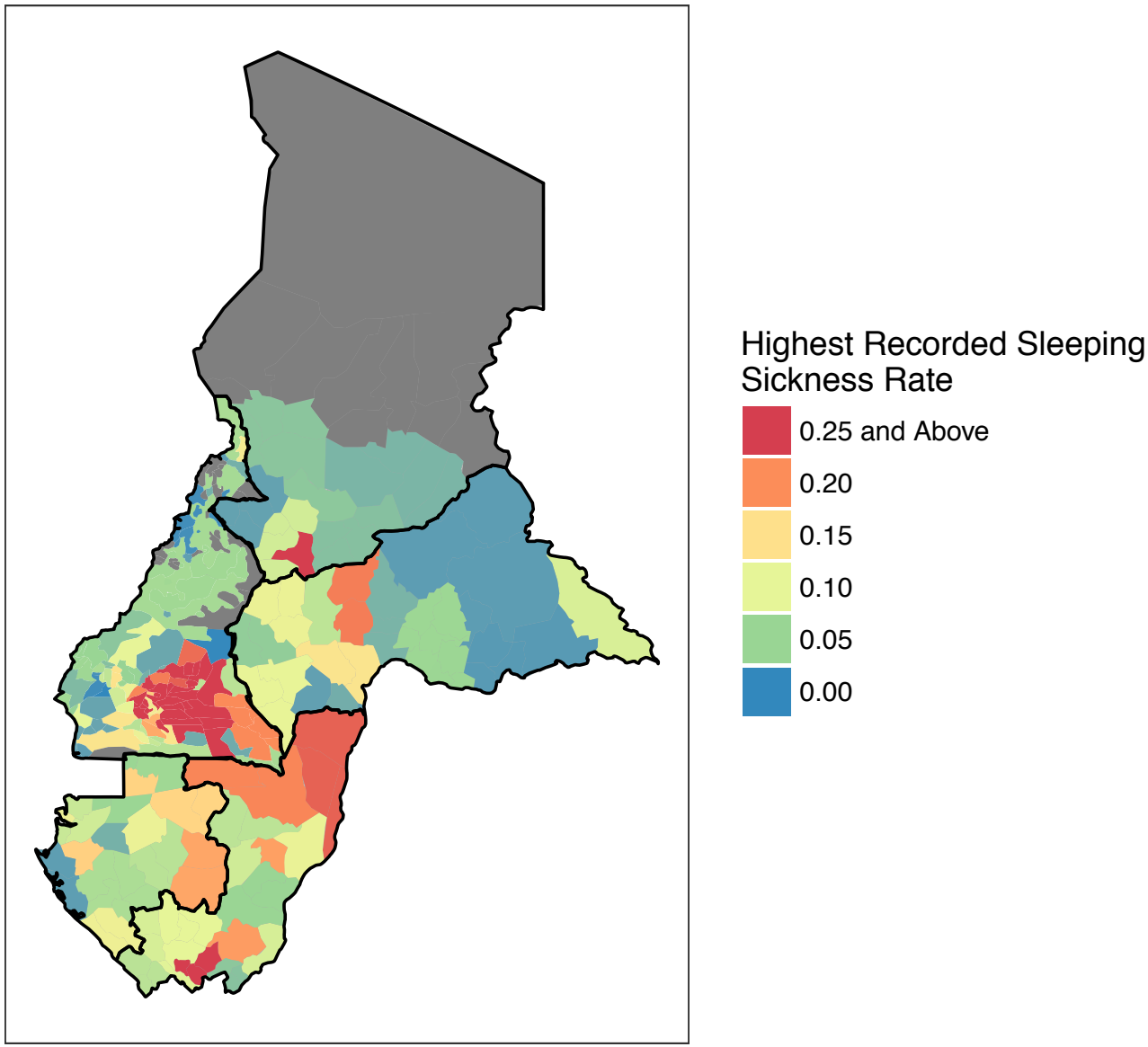

Figure 6: First Year Record Sleeping Sickness Rate