



Responding to COVID-19 in Developing Countries

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Should Low-Income Countries Impose the Same Social Distancing Guidelines as Europe and North America to Halt the Spread of COVID-19?

Zachary Barnett-Howell* Ahmed Mushfiq Mobarak*



EXECUTIVE SUMMARY

Social distancing has become the primary policy prescription for combating the COVID-19 pandemic, and has been widely adopted in Europe and North America. We combine country-specific economic estimates of the benefits of disease avoidance with an epidemiological model that projects the spread of COVID-19 to analyze whether the benefits of social distancing and suppression varies across rich and poor countries. This modeling exercise yields the following key insights:

1. Populations in rich countries tend to skew older, and COVID-19 mortality effects are therefore predicted to be much larger there than in poor countries, even after accounting for differences in health system capacity.
2. Social distancing measures are predicted to save a large number of lives in high-income countries, to the extent that practically any economic cost of distancing is worth bearing. The economic value generated by equally effective social distancing policies is estimated to be 240 times larger for the United States, or 70 times larger for Germany, compared to the value created in Pakistan or Nigeria. The value of benefits estimated for each country translates to a savings of 59% of US GDP, 85% of German GDP, but only 14% of Bangladesh's GDP or 19% of India's.
3. The much lower estimated benefits of social distancing and social suppression in low-income countries are driven by three critical factors:
 - (a) Developing countries have smaller proportions of elderly people to save via social distancing compared to low-fertility rich nations.
 - (b) Social distancing saves lives in rich countries by flattening the curve of infections, to reduce pressure on health systems. Delaying infections is not as useful in countries where the limited number of hospital beds and ventilators are already overwhelmed and not accessible to most.
 - (c) Social distancing lowers disease risk by limiting people's economic opportunities. Poorer people are naturally less willing to make those economic sacrifices. They place relatively greater value on their livelihood concerns compared to concerns about contracting coronavirus.

Not only are the epidemiological and economic benefits of social distancing much smaller in poorer countries, such policies may also exact a heavy toll on the poorest and most vulnerable. Workers in the informal sector

lack the resources and social protections to isolate themselves from others and sacrifice economic opportunities until the virus passes. By limiting their ability to earn a living, social distancing can lead to an increase in hunger, deprivation, and related mortality and morbidity in poor countries. Flattening the epidemiological curve of COVID-19 to buy time until a vaccine can be developed may not be very useful for poor countries if the timeline for vaccine development is too long for social distancing to be maintained.

Poorer countries also have limited capacity to enforce distancing guidelines, and lock-downs may have counterproductive effects if it forces informal sector workers and migrants to reverse-migrate from densely-populated urban areas and spread the disease to remote rural areas of poor countries. It is imperative that the source code for influential epidemiological models (on which the widely-adopted social distancing guidelines are based) are made publicly accessible, so that social scientists can explore the sensitivity of benefit estimates to changes in assumptions about compliance with distancing guidelines or the baseline prevalence of co-morbidities, chronic illnesses or malnutrition that make COVID-19 infections more deadly. Not accounting for co-morbidities, or the greater pollution in poorer countries is an important limitation of these projections. Publicizing code would also allow the research community to quantitatively explore the costs and benefits of alternative harm-reduction measures that better allow poor people to sustain themselves economically while reducing COVID-19 related mortality to the greatest possible extent:

1. Masks and home-made face coverings are comparatively cheap. A universal mask wearing requirement when workers leave their homes is likely feasible for almost all countries to implement.
2. Targeted social isolation of the elderly and other at-risk groups, while permitting productive individuals with lower risk profiles to continue working. Given the prevalence of multi-generational households, this would likely require us to rely on families to make decisions to protect vulnerable members within each household.
3. Improving access to clean water, hand-washing and sanitation, and other policies to decrease the viral load.
4. Widespread social influence and information campaigns to encourage behaviors that slow the spread of disease, but do not undermine economic livelihoods. This could include restrictions on the size of religious and social congregations, or programs to encourage community and religious leaders to endorse safer behaviors and communicate them clearly.

ARGUMENT

Poor Countries Need to Think Twice About Social Distancing

Policies imposed in rich countries to fight the coronavirus could have adverse effects in low-income nations—potentially endangering more lives than they save.

BY AHMED MUSHFIQ MOBARAK, ZACHARY BARNETT-HOWELL | APRIL 10, 2020, 4:23 PM

In response to the coronavirus pandemic, varying levels of social distancing have been implemented around the world, including in China, Europe, and much of the United States. Hundreds of millions of people have accepted dramatic disruptions to their daily lives and substantial economic losses based on the reasoning that slowing the spread of the coronavirus can keep health care systems from becoming overwhelmed.

Epidemiological models make clear that the cost of not intervening in rich countries would be in the hundreds of thousands to millions dead, an outcome far worse than the deepest economic recession imaginable. In other words, social distancing interventions and aggressive suppression, even with their associated economic costs, are overwhelmingly justified in high-income societies.

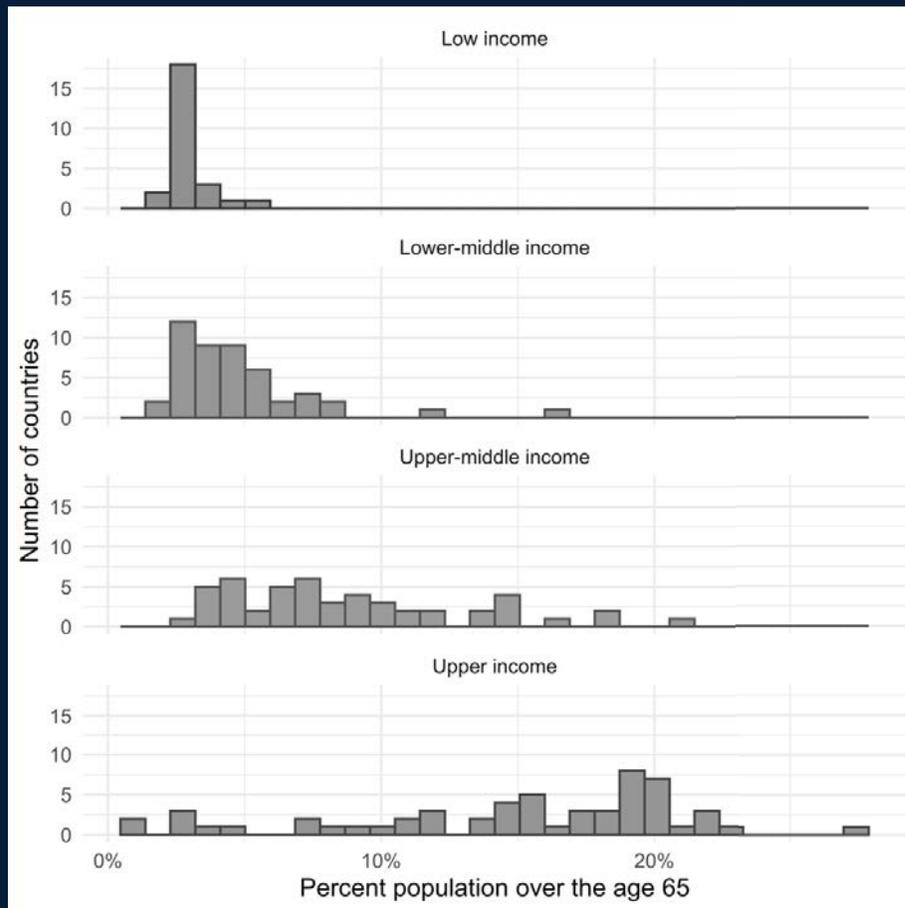
But the logic of this response is built on the characteristics of the industrialized, relatively wealthy societies where the policy has emerged. Low- to middle-income countries, such as Bangladesh and Nigeria, are different and raise different questions, namely: Do the benefits of countrywide lockdowns also outweigh the costs in poor countries?

We see several reasons—including demographic composition, the source of people's livelihoods, and institutional capacity—that suggest that the answer may be different than in the United States or Europe. To put it bluntly, imposing strict lockdowns in poor countries—where people often depend on daily hands-

Developing countries may not be best suited for strict social distancing

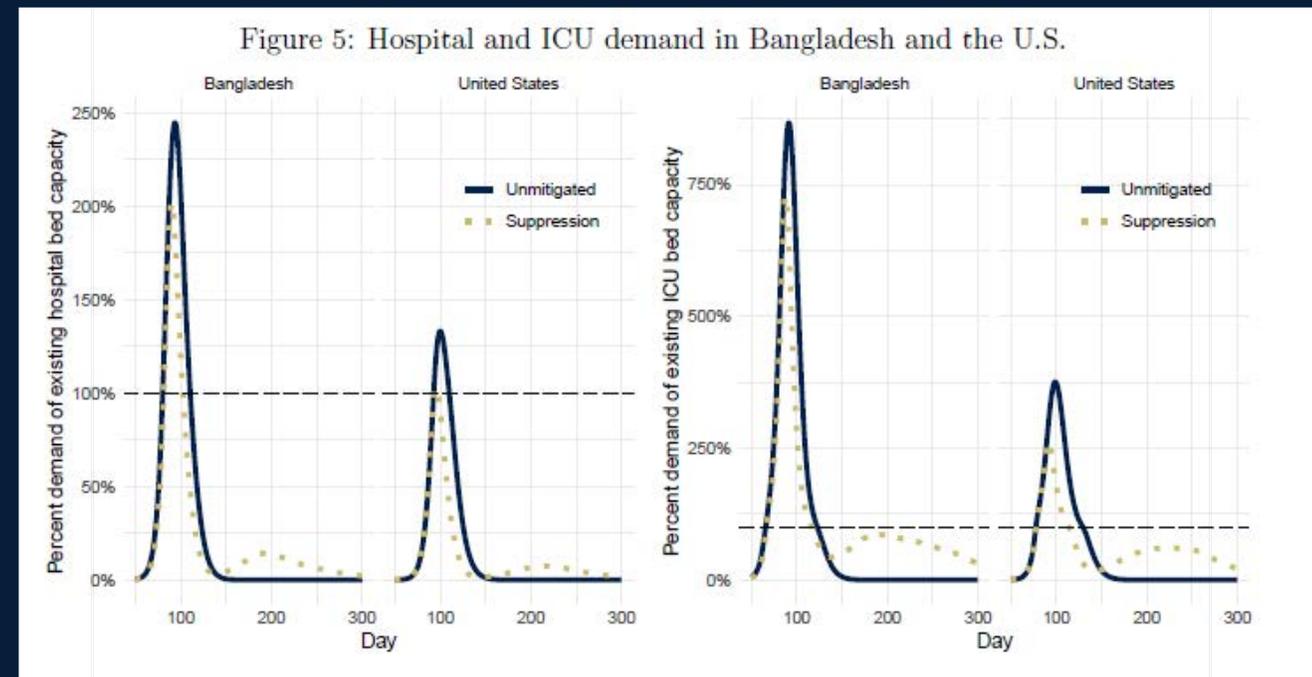
Very Different Population Distributions

17.4% of the population in HIC is elderly vs only 3% in LMICs



Flattening the curve unlikely to release pressure from health systems in LMICs

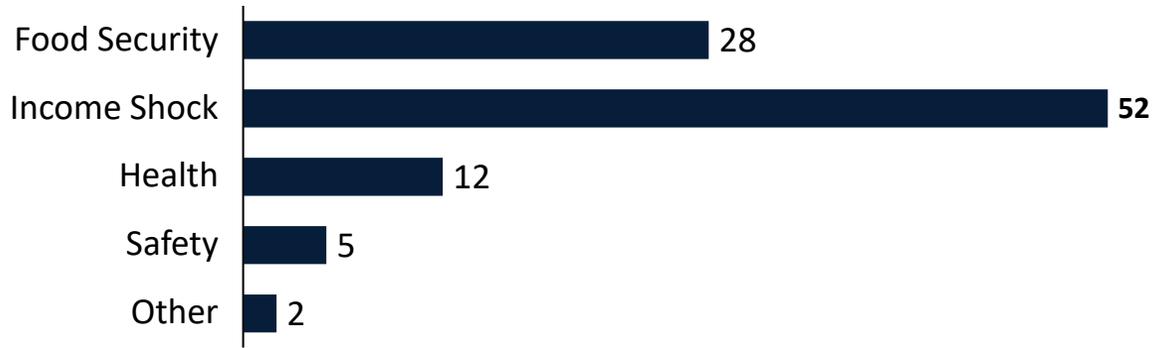
Delaying infections only useful if we can prevent the health system from getting overwhelmed. Not very valuable if health system capacity is extremely low or non-existent



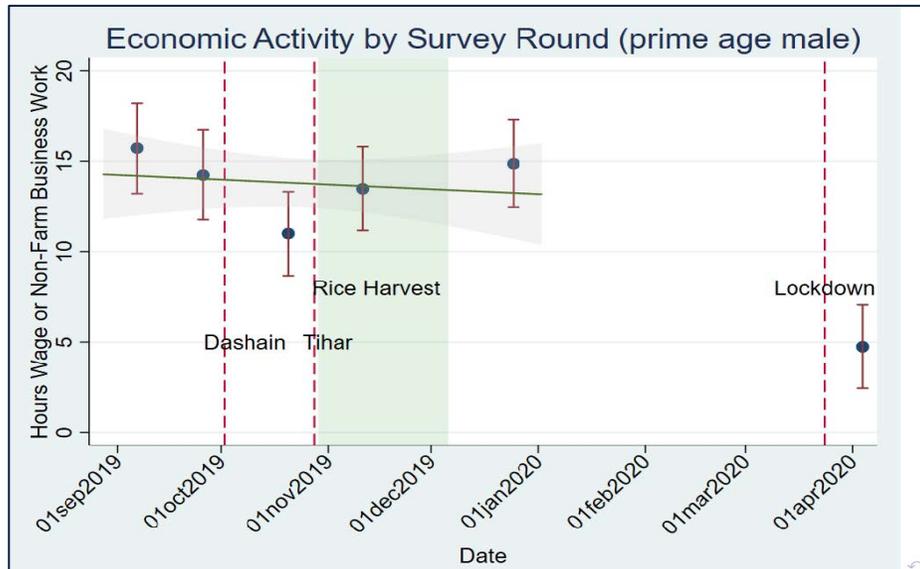
Relative concerns about disease risk vs economic livelihoods very different in LMICs than in HICs

Day-wage laborers, migrants, agricultural workers in South Asia now facing food insecurity

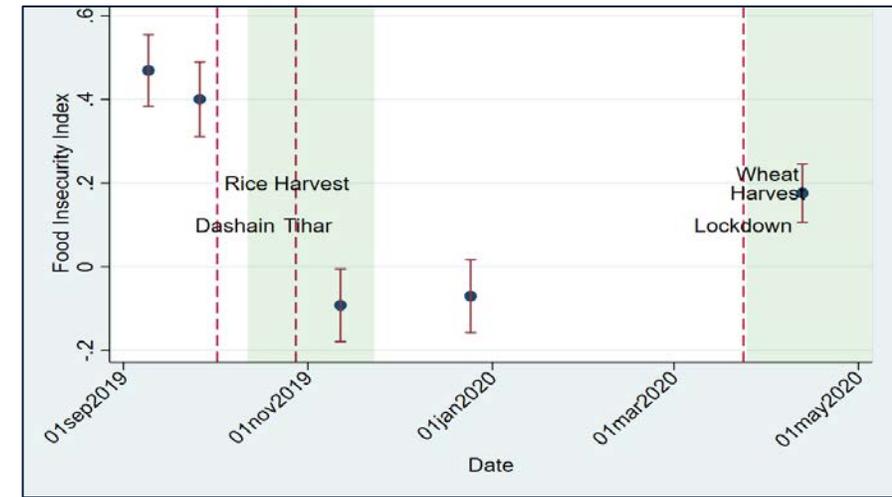
80% of survey respondents concerned about income shocks and food security



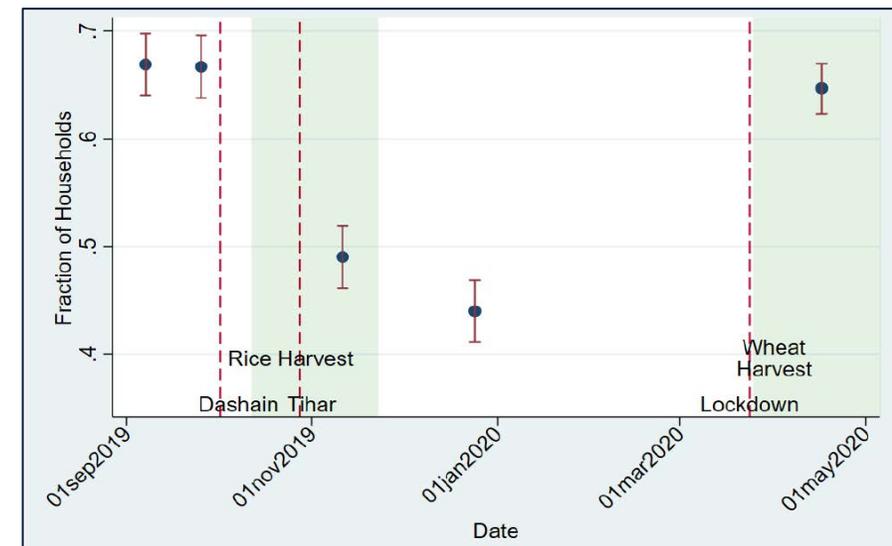
66% decrease in hours worked between Jan and Apr 2020



Food insecurity increased substantially



65% reported that they were worried about enough food



<http://yrise.yale.edu/covid-19>

Social distancing is costly in poor countries

Income shocks



- >80% of workers in LMICs are informally employed
 - No wage/employment guarantees
-

Food Insecurity



- Lockdowns can disrupt internal food supply chains, halt production, and increase prices
-

Health Impact



- Lockdowns lower institutional births, pre-natal visits
 - Vaccination delays for polio, tuberculosis, measles
 - Malaria deaths in SSA could double due to program disruptions
-

Learning Shocks



- Indefinite school closures will lead to adverse learning outcomes

Policy Priorities

Social Protection Policies



Regardless of distancing policies, need to get money to the poor quickly



How do we target the poor and get cash/food to them safely and effectively

Sensibly Target Distancing Policies



Enforce bans on religious and social gatherings



Enforce universal mask wearing norms



People only allowed out for economic livelihood



Enlist families to protect young and vulnerable

Policy Priorities

Behavior Change



Enlist community leaders to endorse and enforce policies



Deploy frugal innovations like Ghanaian Veronica Buckets



Enlist support of mobile services to collect data, deliver messages, deploy social influence strategies

Data Collection



Collect data on symptoms, food security, and prices to spatially target support

Macroeconomic Policies



Need to send payments but these are not “stimulus payments”

- Payments to keep people at home, not stimulate economy
- Can we label transfers as “stay at home” to impose “soft” conditionality?



Target support to SMEs

- Protect SMEs to prevent irreparable damage to economy
- Target sectors the poor depend on, and firms which will have difficulty surviving
- e.g. you can buy an iphone later, but cannot have today’s restaurant meal later

Evidence-Based Policy Support in Bangladesh, Nigeria, Sierra Leone, Nepal



HIGH FREQUENCY DATA COLLECTION

Symptom prevalence
Public health behavior & knowledge
Income shock, food insecurity
Risk Exposure - migrants



INFO CAMPAIGNS & SOCIAL INFLUENCE

Personal appeals - social networks
Community leaders (imams, teachers)
A/B testing - incentives, identity, messaging content.
Scale effective strategies via govt, telcos



SPECIFIC SECTORS & INTERVENTIONS

Produce and distribute masks
Effects of prior cash distribution
Protecting rice harvest & mill workers
RMG Sector - Survey managers



MIGRATION DATA TO IDENTIFY HOTSPOTS

Migrants as Disease Vectors
Identify districts and upazilas at risk
Losses in remittance revenues
International transmission risk



ECON-EPI MODELING

Add economic and behavioral factors to epidemiological models
Discipline with country data
Provide specific policy guidance for LMICs



TARGETING OF SOCIAL PROTECTION

How should we target cash transfers?
How do we identify beneficiaries?
Combine telecom records with detailed survey data
Use machine learning

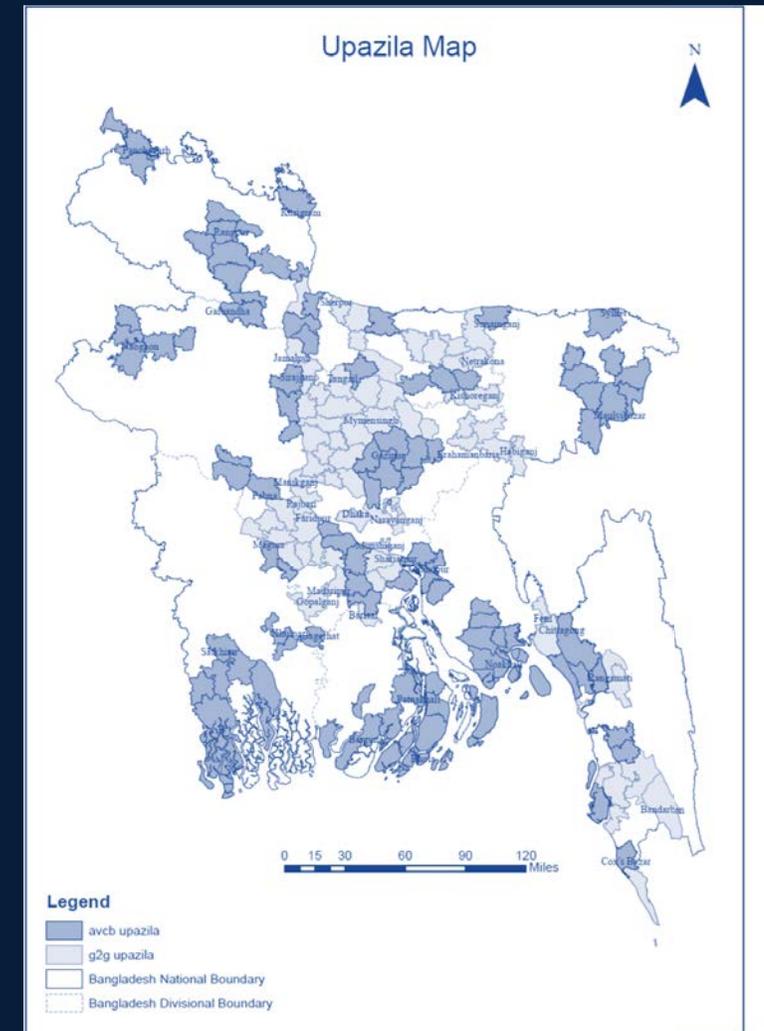


Data Collection to Guide Policy

Collect data on:



- ❑ Use symptoms data to estimate changing prevalence in the country over time and identify clusters where the disease might be growing. This could enable us to recommend more targeted isolation policies instead of a blanket lockdown
- ❑ Understand the level of disease awareness in the community and identify the information gaps that may need to be filled and the behavioural patterns that need to be changed to promote disease prevention
- ❑ Understand the magnitude of income shock and food insecurities faced by households to capture the economic cost of social distancing



Map showing geographical coverage of two of our existing survey populations

Y-RISE Strategy to Promote Behavior Change: Randomize roll out of multiple messaging strategies that raise COVID-19 awareness, test their effectiveness during data collection, and work with A2i to scale up the messaging channels that create highest impact

We will raise awareness by running information treatments both at the household and community level. Evidence suggests that individual messages from acquaintances and community leaders are more effective than impersonalized text messages in changing behavior and at times of crises such as these, information is particularly effective when it comes from influential leaders in the community

Household Level



- We will use a combination of social network, monetary incentives, and varying message content to raise awareness about COVID-19
- Follow up surveys and real time epidemiological modeling will help us identify the most effective messaging strategies that can then be scaled

Community Level



- In collaboration with A2i, BRAC, and Youth Policy Forum, we have mobilized 50+ volunteers to reach out to imams, headmasters, and health workers across 50 unions in Bangladesh
- Over the next 10-14 days we will reach out to leaders in random geographical order
- Ongoing phone surveys will help us capture the impact of reaching out to community leaders

Executive Summary of migration-COVID links evident in the data



❑ Remittances of migrant workers are an important source of income for households in South Asia



❑ Migrant sending households have experienced sharper declines in income



❑ Migrant returnee presence in the community is associated with COVID-19 symptoms



❑ Returning migrants face stigma but the impact cannot (yet) be systematically evaluated

Policy Implication



WB estimates a 22% drop in remittances in South Asia

Bangladesh only collected 1.08 billion USD in April 2020, a 25% drop from last year

Households with return migrants worst hit by the pandemic

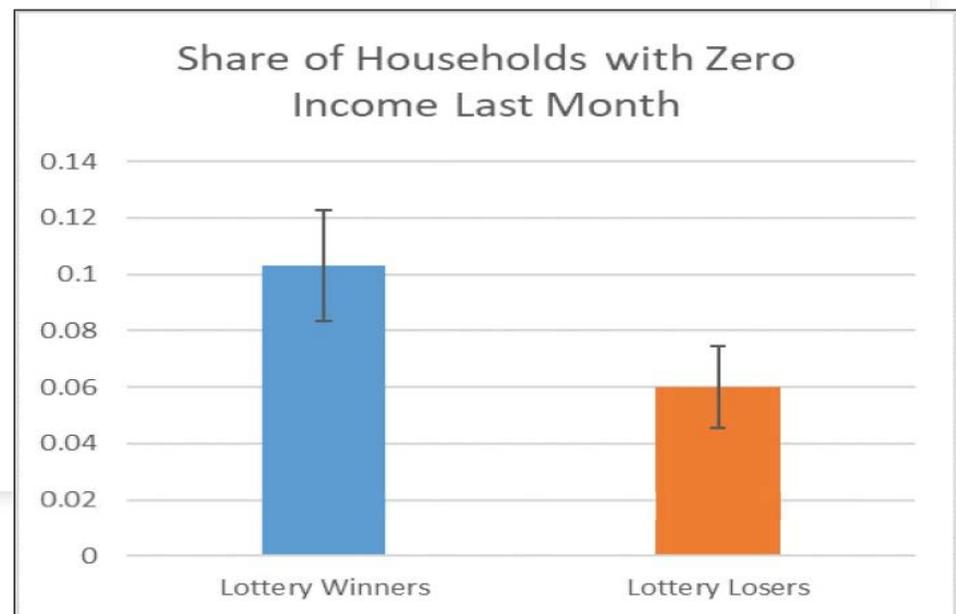
Ensuring that households that rely on remittances meet their basic need should be a priority



Remittance income declined for migrant-sending households in Nepal & Bangladesh

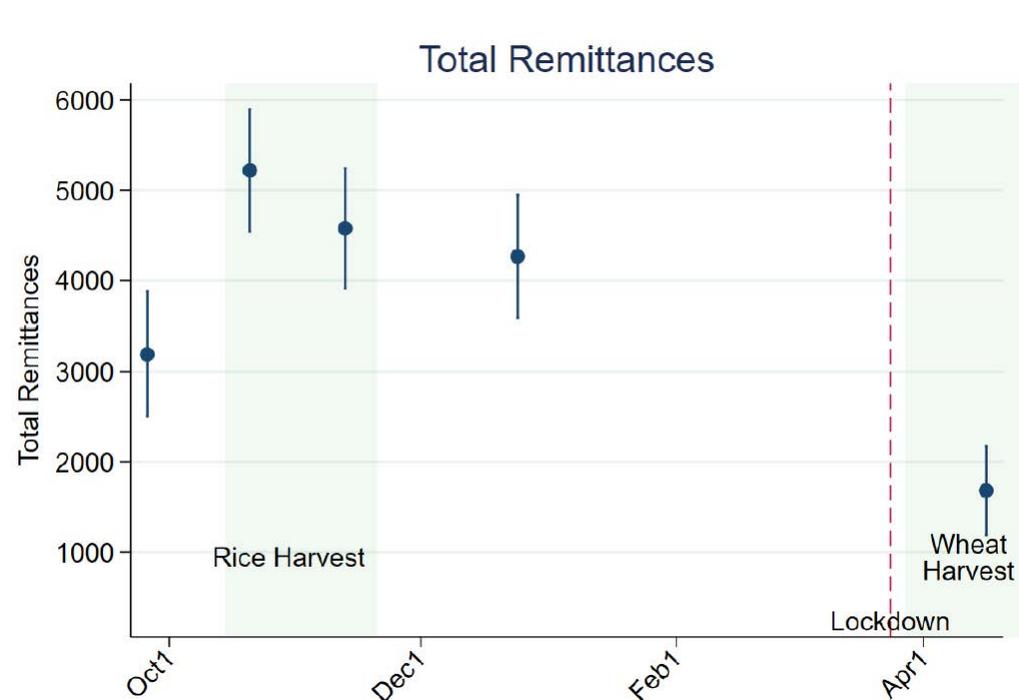
Bangladesh

- ❑ Winners of visa lottery to Malaysia, indicative of high migration, earned **18-100% more 2013-2019**, but **36% less in April, 2020**

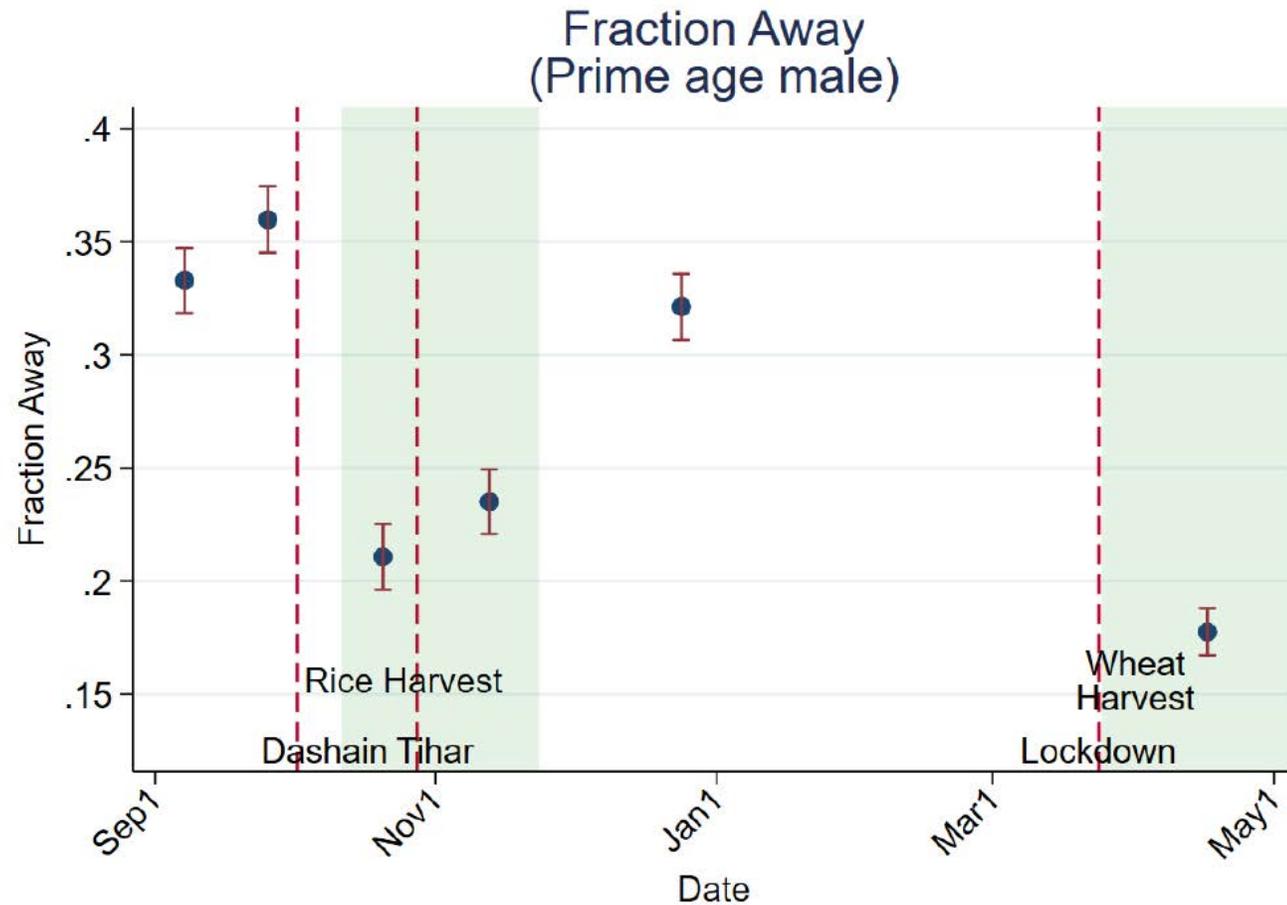


Nepal

- ❑ Households in Western Terai received an average of 4900 NPR in late 2019
- ❑ This fell to 1,700 NPR last month



Both because migrants were forced to return...



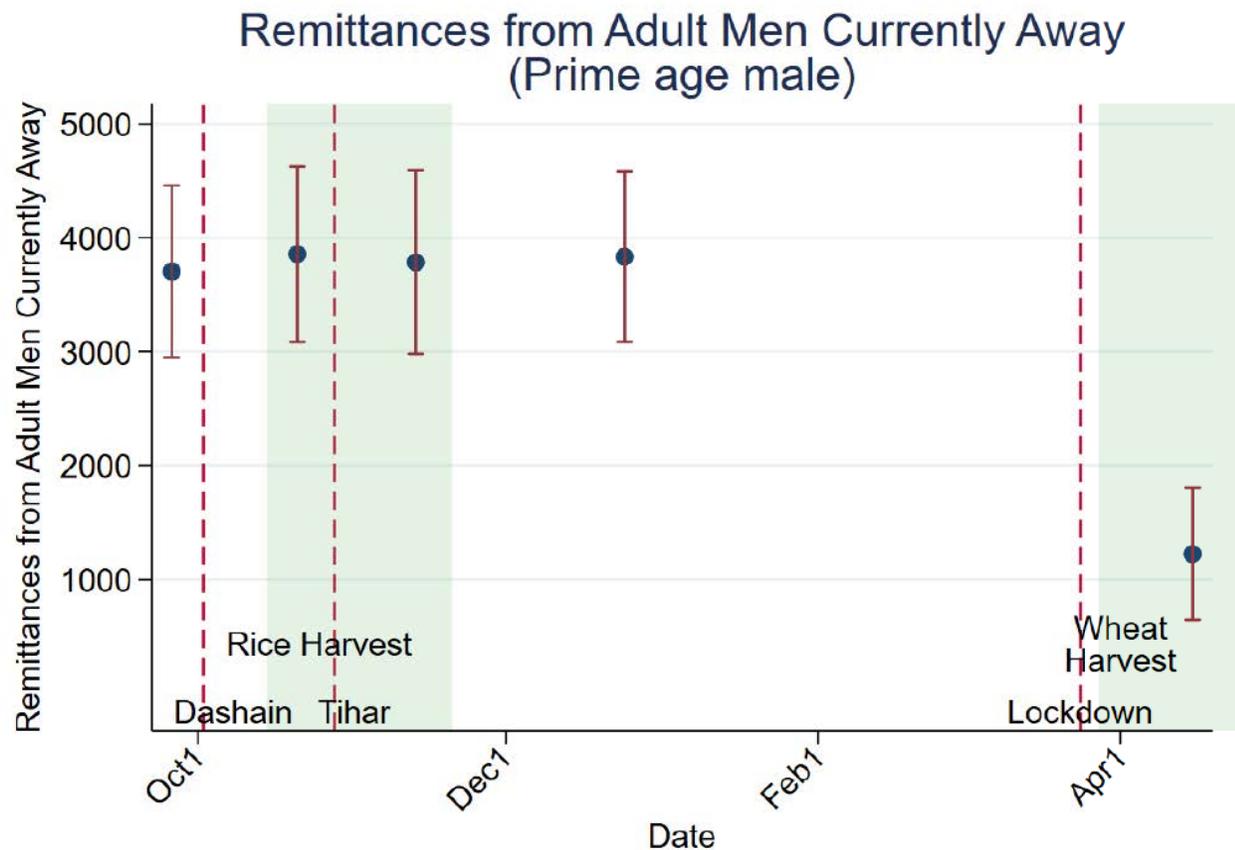
Observed trends:

Returnees

- Because many migrants were forced to return
- Both from India and from cities in Nepal

...and also because those still away are sending less money back

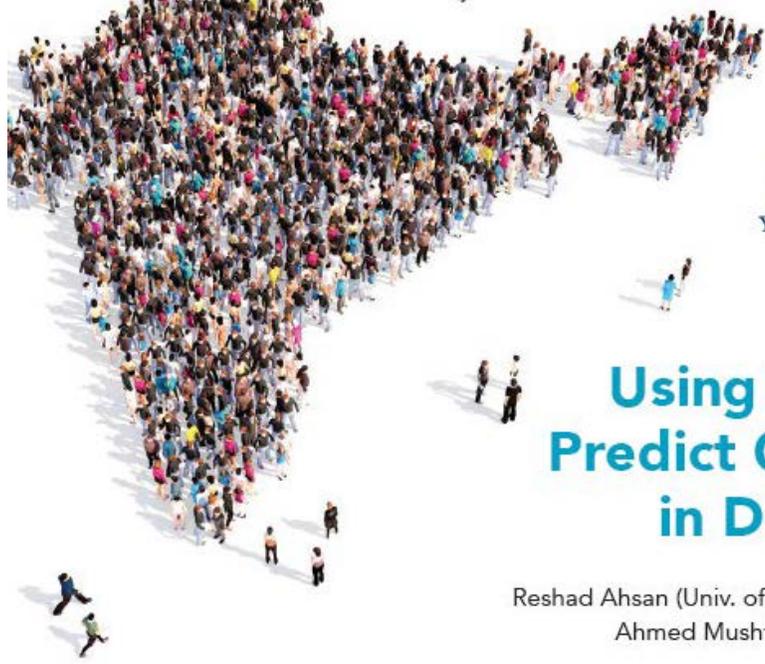
Remittances per Migrant Away



Observed trends:

Remittances also drop

- ❑ Migrants still away are also sending less money back home
- ❑ Drops from ~Rs. 3900 to Rs. 1200



— APRIL 26, 2020 —

Using Migration Patterns to Predict COVID-19 Risk Exposure in Developing Countries

Reshad Ahsan (Univ. of Melbourne), Kazi Iqbal (BIDS), Mahreen Khan (MIT Sloan), Ahmed Mushfiq Mobarak (Yale Univ)¹, and Abu Shonchoy (FIU)



Photo credit: Mehedi Hasan/Dhaka Tribune



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EXECUTIVE SUMMARY

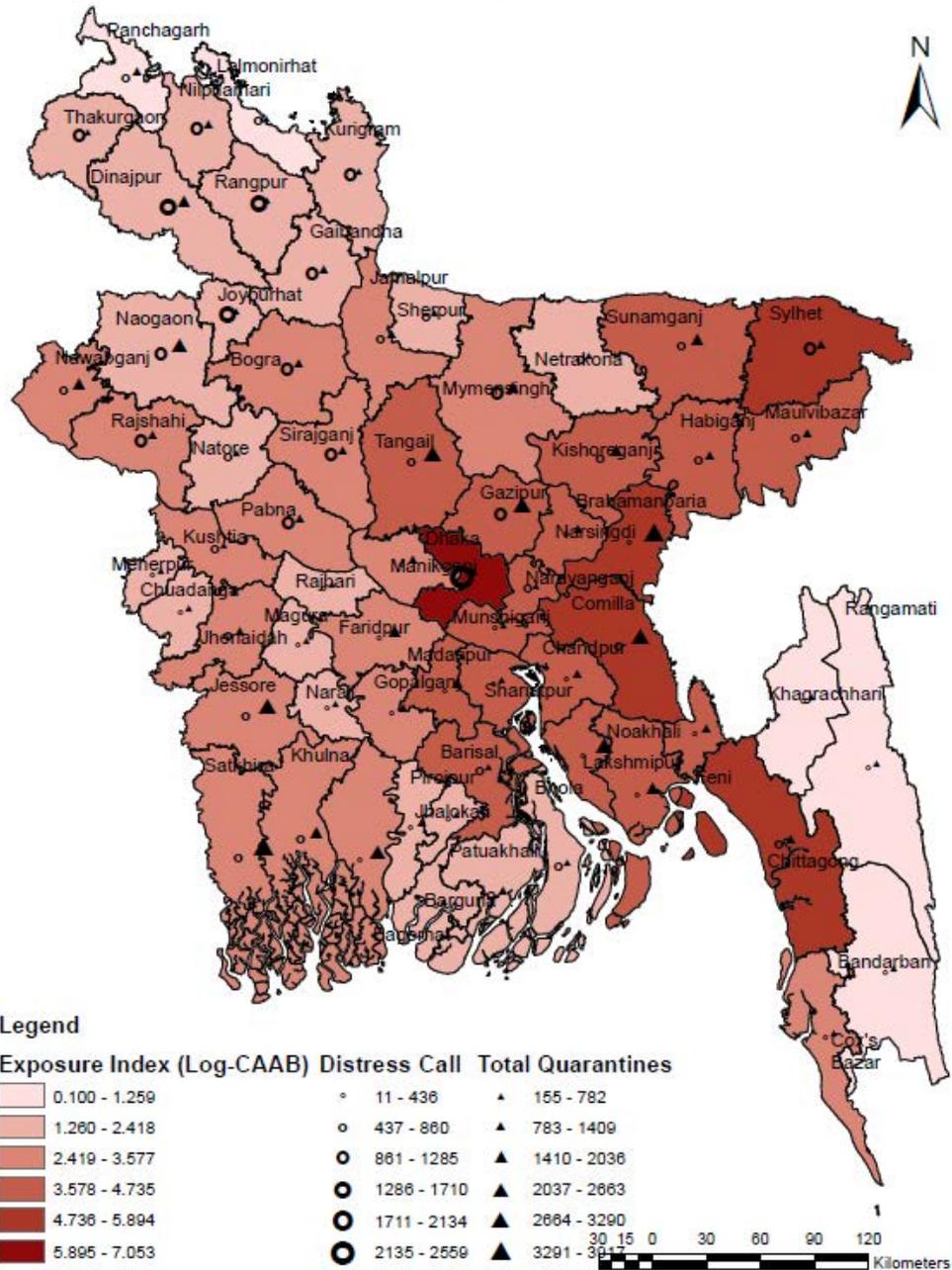
Inadequate COVID-19 testing capabilities is producing testing data that cannot be reliably compared across countries or across jurisdictions within low- and middle-income countries (LMICs). This is hampering the ability of LMICs to devise timely and effective policy responses, such as identifying hotspots and spatially targeting public health responses or economic relief. Data deficiencies also hamper global resource allocation. International bodies such as the World Health Organization need comparative information on disease risk across countries, to be able to direct support to regions at greater risk.

We develop a methodology to make indirect inferences about the spatial distribution of COVID-19 risk using the

migration destination. We construct an index of COVID-19 risk exposure for every country, using the number of emigrants from that country to COVID-affected destinations to infer the likelihood that return migrants are now bringing back the disease to each 'home' country.

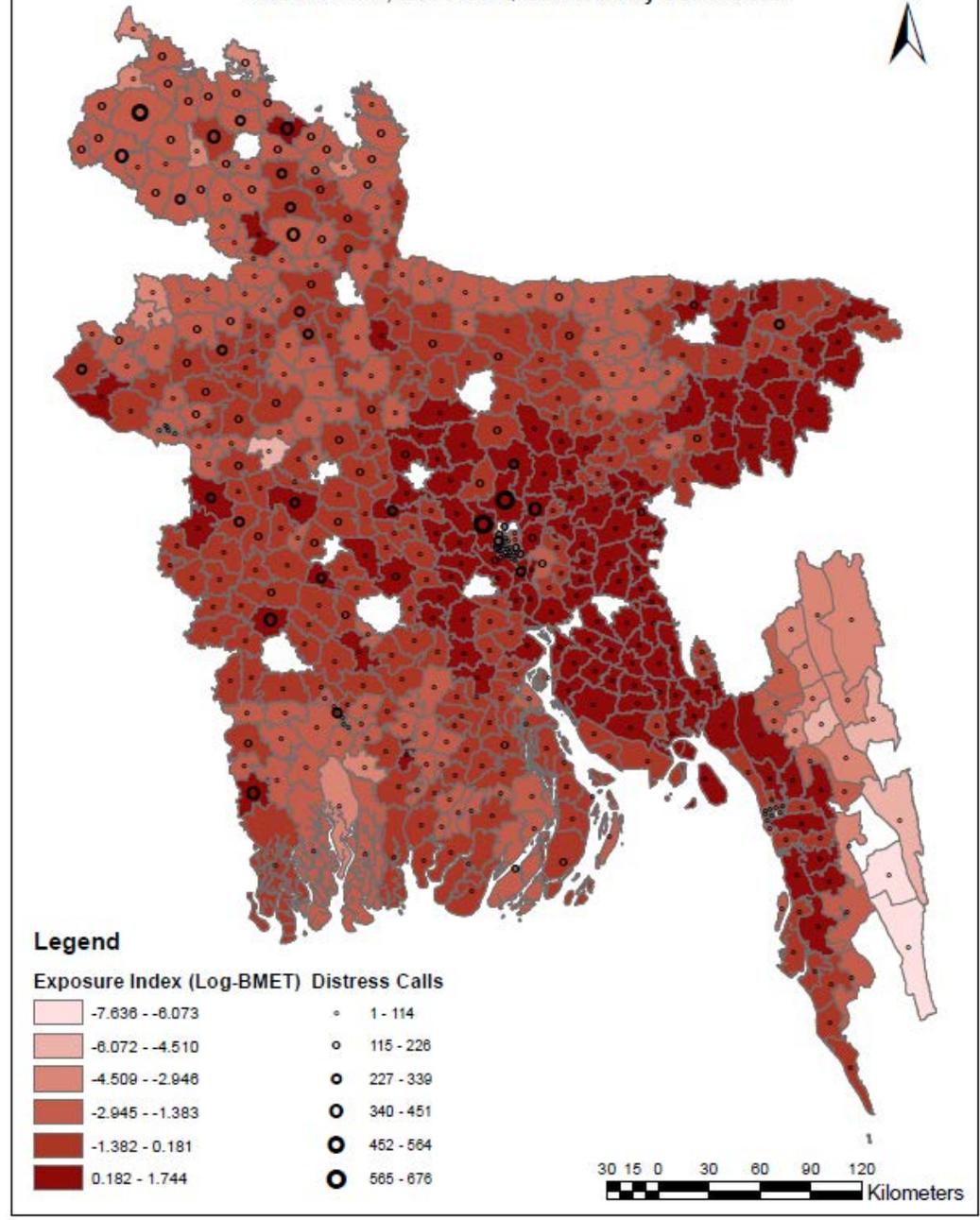
2. We validate this COVID-19 exposure index by comparing it to the number of confirmed COVID-19 cases through testing, as well as to the number of COVID-deaths (given the aforementioned limitation of testing data). There are strong positive correlations between our index and both confirmed cases and deaths, in the order of +0.66 to +0.72. The strong predictive power of our index survives even

**Bangladesh COVID-19 Risk Exposure (by cases),
Distress Calls, and Total Quarantines by District**



N.B. CAAB Data is used for calculating the COVID-19 Risk Exposure Index at the District Level.

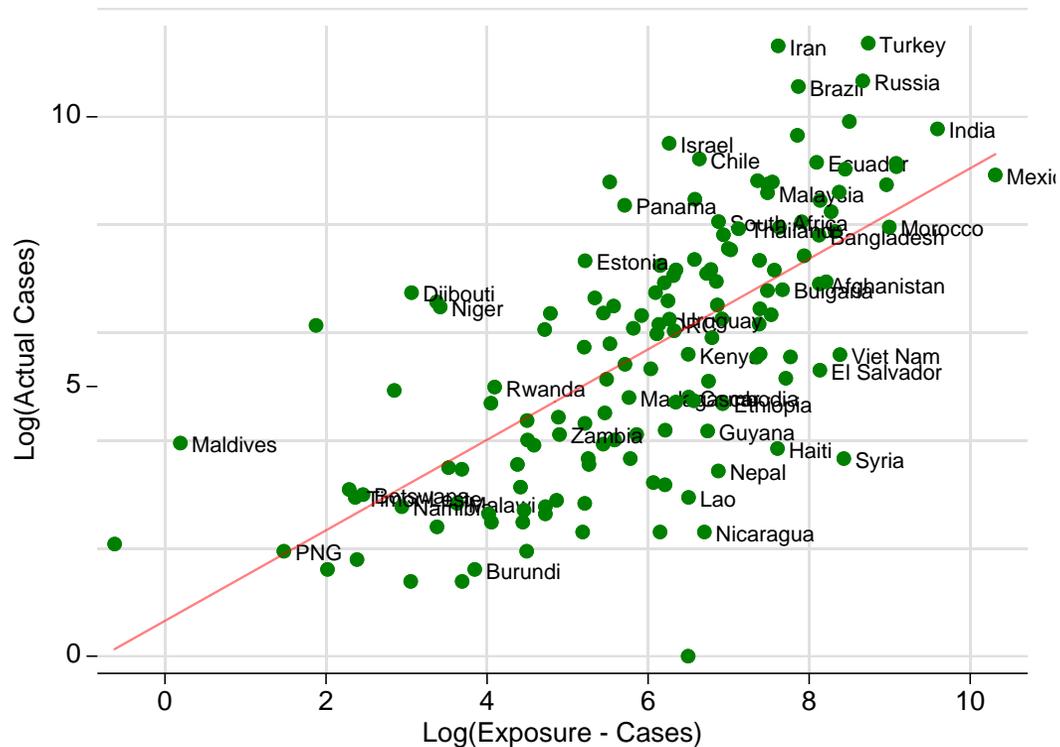
**Bangladesh COVID-19 Risk Exposure (by cases),
Distress Calls, and Total Quarantines by Sub-District**



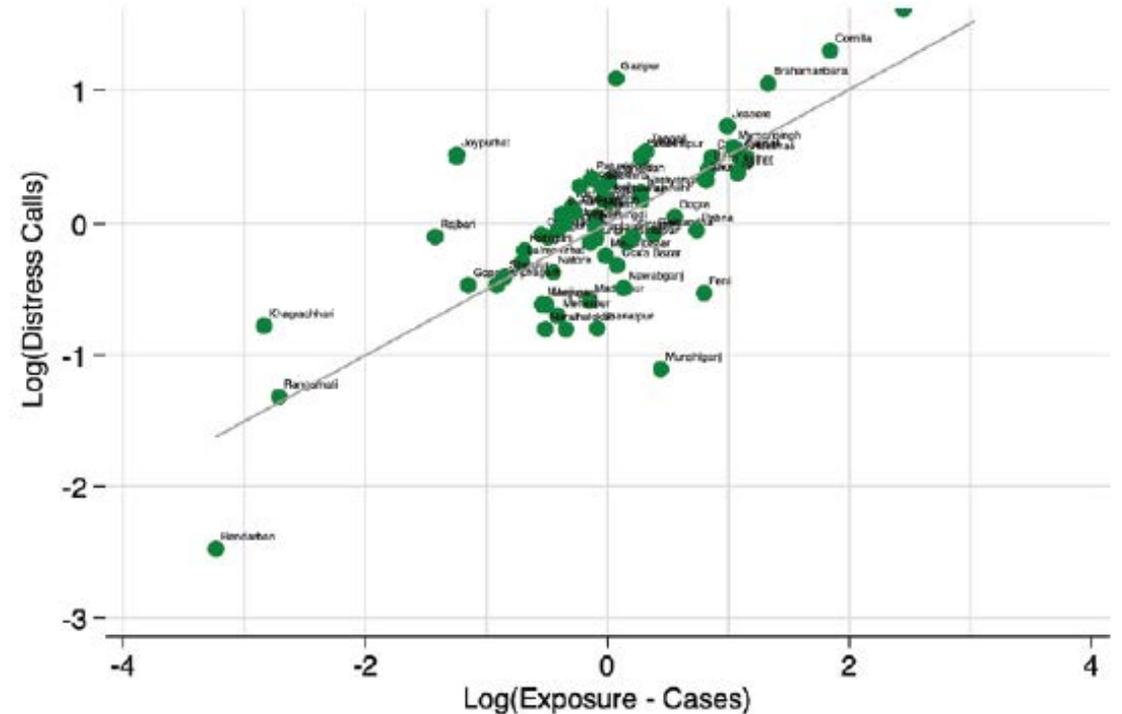
N.B. BMET Data is used for calculating the COVID-19 Risk Exposure Index at the Sub-District Level. No data is available for sub-districts which are white. Sub-district names only provided for hishtest risk category.

Validation with International Case/Fatality Data and with Distress Calls to Government Hotline in Bangladesh

Research Team: Reshad Ahsan (Melbourne) Kazi Iqbal (BIDS), Mahreen Khan (MIT), Mushfiq Mobarak (Yale), Abu Shonchoy (FIU)

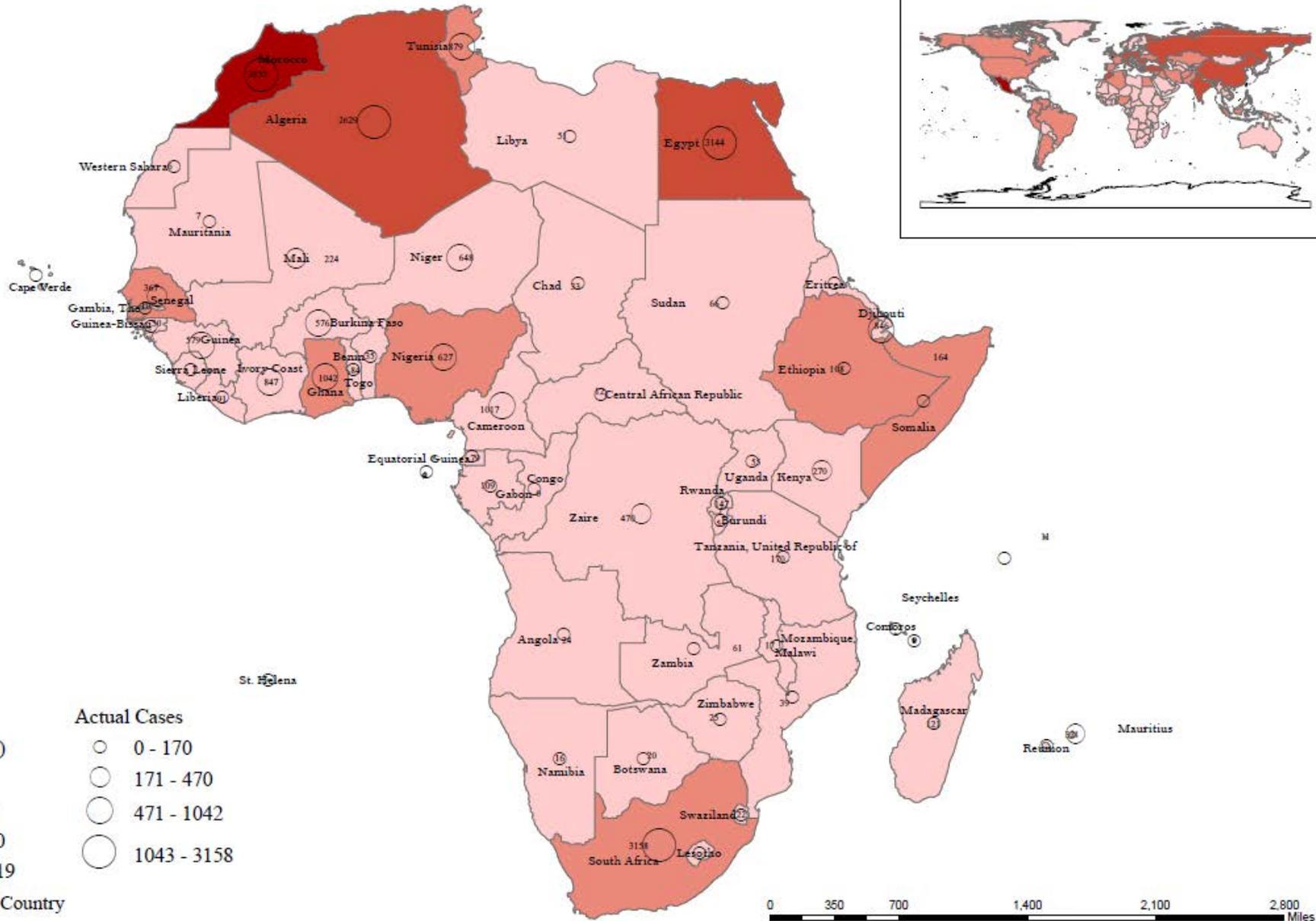


Migration links to COVID-affected destinations match well with recorded cases



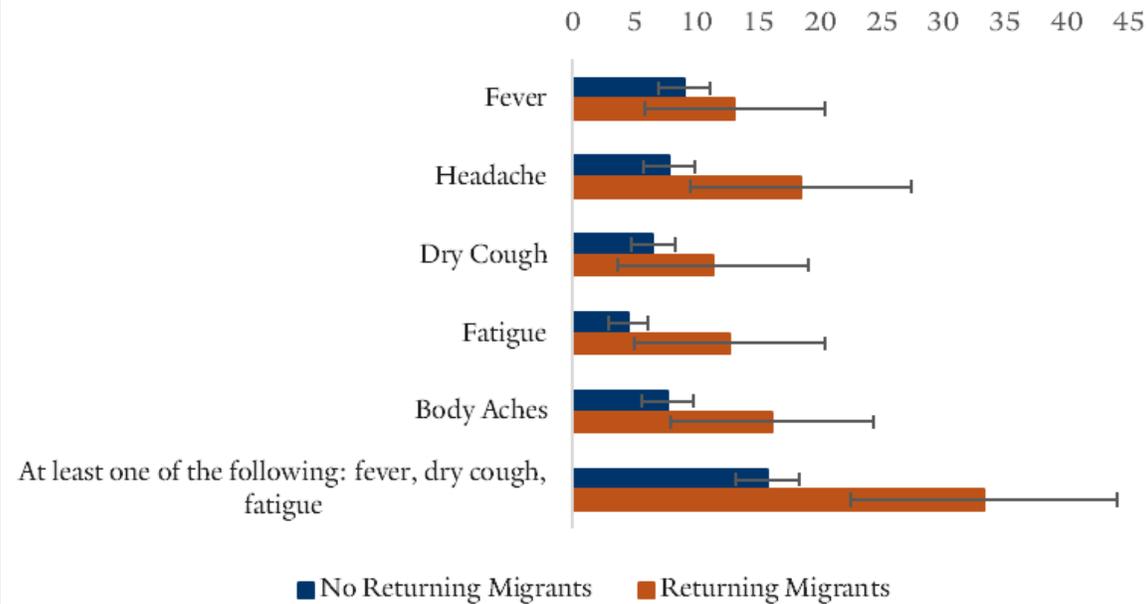
Distress calls coming from various Bangladeshi districts match well with airport returnees Jan-March from COVID-affected destinations

Global COVID-19 Exposure by Region (Africa)

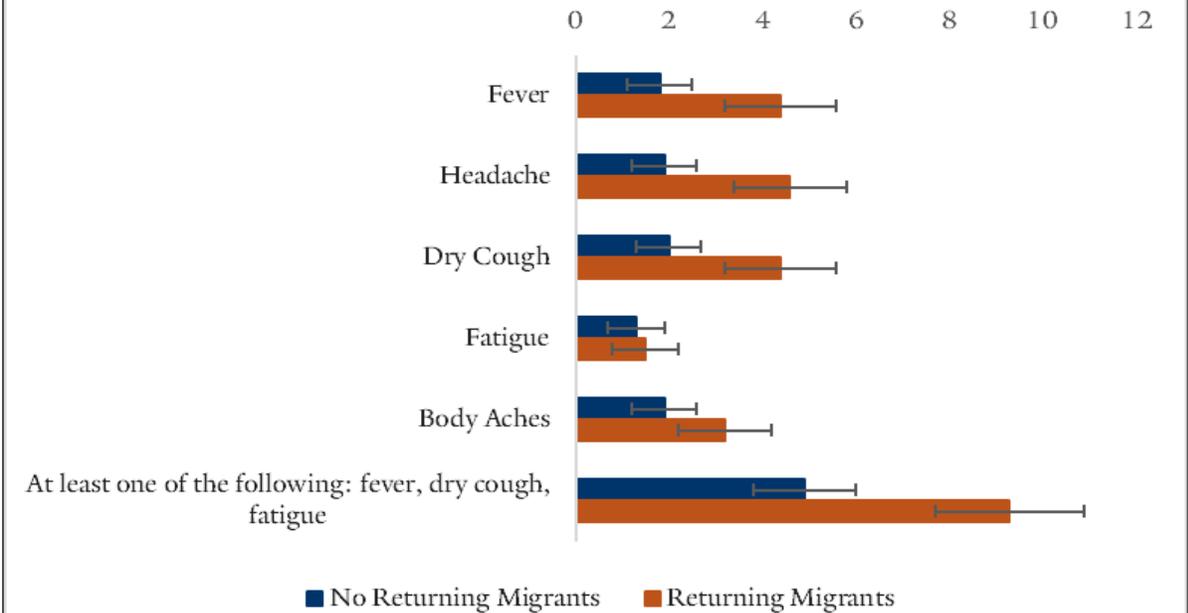


Returnee Presence is associated with COVID-19 symptoms

Symptoms reported by households' migration history (Cox's Bazar sample)



Symptoms reported by households' migration history (visa applicant sample)



- ❑ Strong correlation between returning migrants and self-reported common COVID-19 symptoms
- ❑ In both Cox's Bazar and visa lottery samples, likelihood of reporting symptoms at least doubles for households reporting a returning migrant

Introduction: Targeting Relief Payment

SUMMARY: Combining “big data” (e.g. mobile phone records, satellite images) with pre-existing household survey data can improve targeting of relief payments quickly and at low cost.

The government may wish to target the following populations for benefit transfers:

- Poor and ultra-poor
- Most economically affected (most likely to have lost employment and income during the COVID crisis)
- Those whose livelihoods depend on mobility (such as migrant laborers, who are most likely to transmit disease if not conforming to lockdown)

The procedure we are pursuing in Bangladesh:

1. Collected survey data to identify households that meet some eligibility criteria for relief payment
2. Develop a statistical model that matches those eligible beneficiaries to mobile phone usage patterns (e.g. frequency of top-ups, amounts, mobility).
3. Develop a machine learning algorithm to identify eligible people based on phone usage patterns
4. Deploy this algorithm on the mobile phone records of the entire population
5. Add human elements (e.g. SMS texts, physical verification) to refine method

Need to decide on transfer modalities:

- Add any conditionality?
- Optimal amounts and frequency of transfers?

How do we do it? Overview of Method

Step 0: Create a labeled training set

- For a subset of subscribers, match CDR to survey data
- Goal is to find optimal f : $Wealth_i = f(CDR_i)$

Step 1: “Feature Engineering”

- Convert CDR into feature vectors
- A: Traditional “intuitive” approach (performs poorly)
- B: Deterministic Finite Automata (performs well)
- C: Graph Convolutional Network (performs great)

Step 2: Supervised Learning / Modeling

- Train cross-validated & regularized model on labeled training set

Step 3: Validation

- Validate out-of-sample predictions using independently-collected data

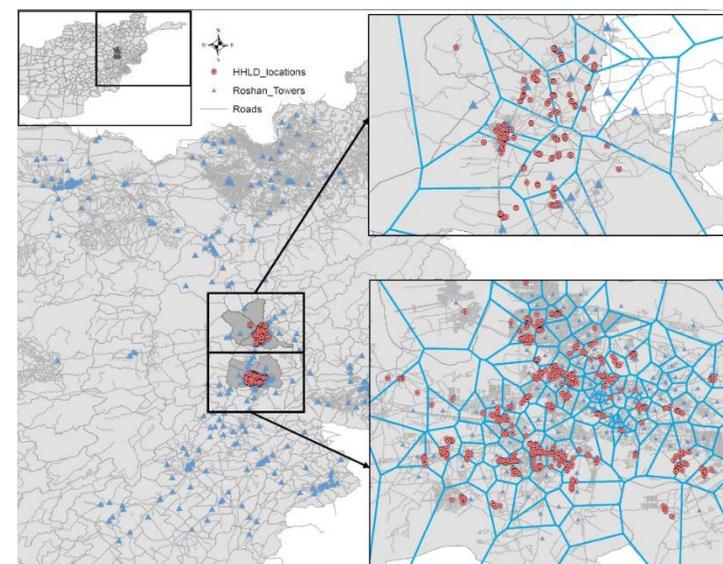
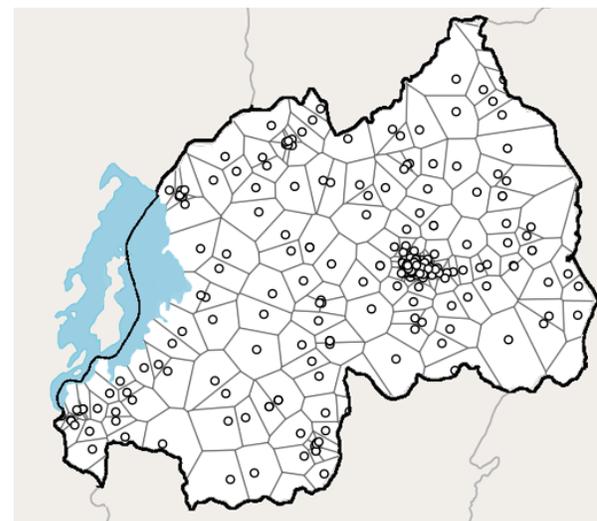
Step 0: Labeled training set

Rwanda

- Geographically stratified random sample of 900 active subscribers
- Single-round survey
- Focus on “wealth index”
 - PCA of 12 different asset questions

Afghanistan

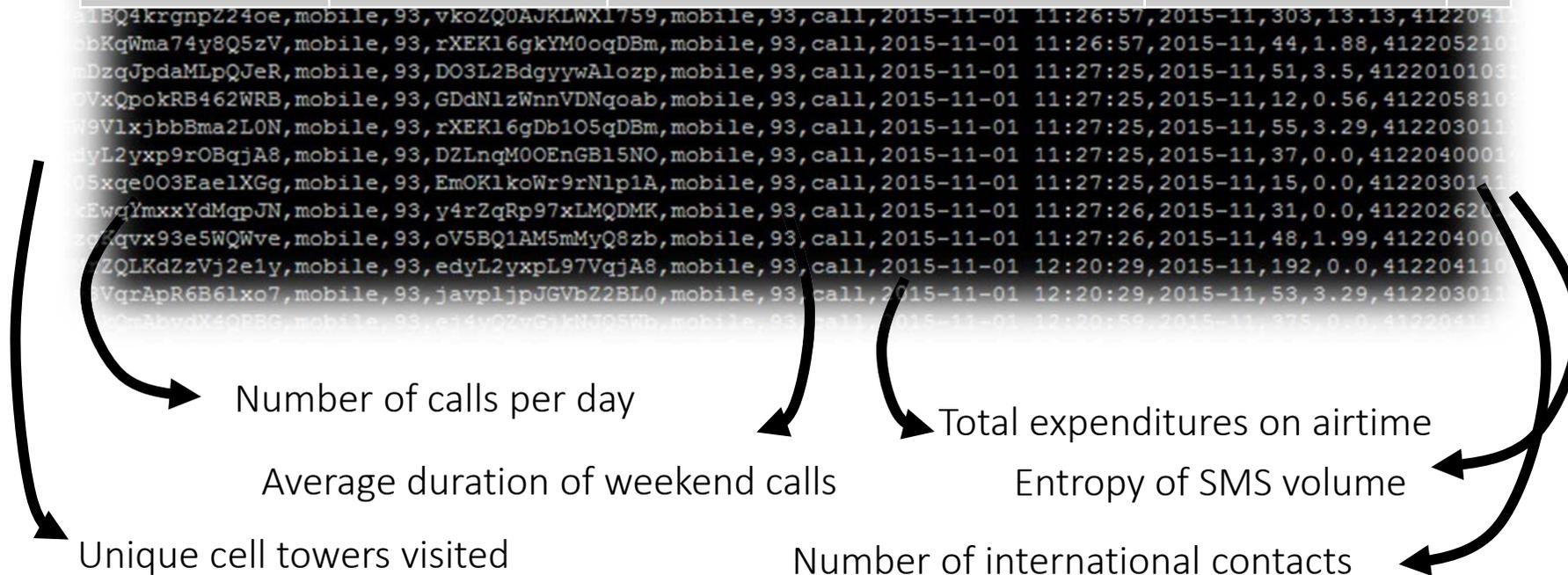
- 1,200 households in two districts
- High-frequency panel survey (13 rounds)
- Many more measures of welfare
 - Wealth index
 - Financial health
 - Vulnerability and shocks
 - Subjective well-being



Step 1: Feature Engineering

How to convert raw data into “features”?

Caller-ID	Receiver-ID	Date-Time	Caller-Tower	...
0mDzqJpd	DO3L2Bdg	2015-11-01 11:27:25	4122010103	...

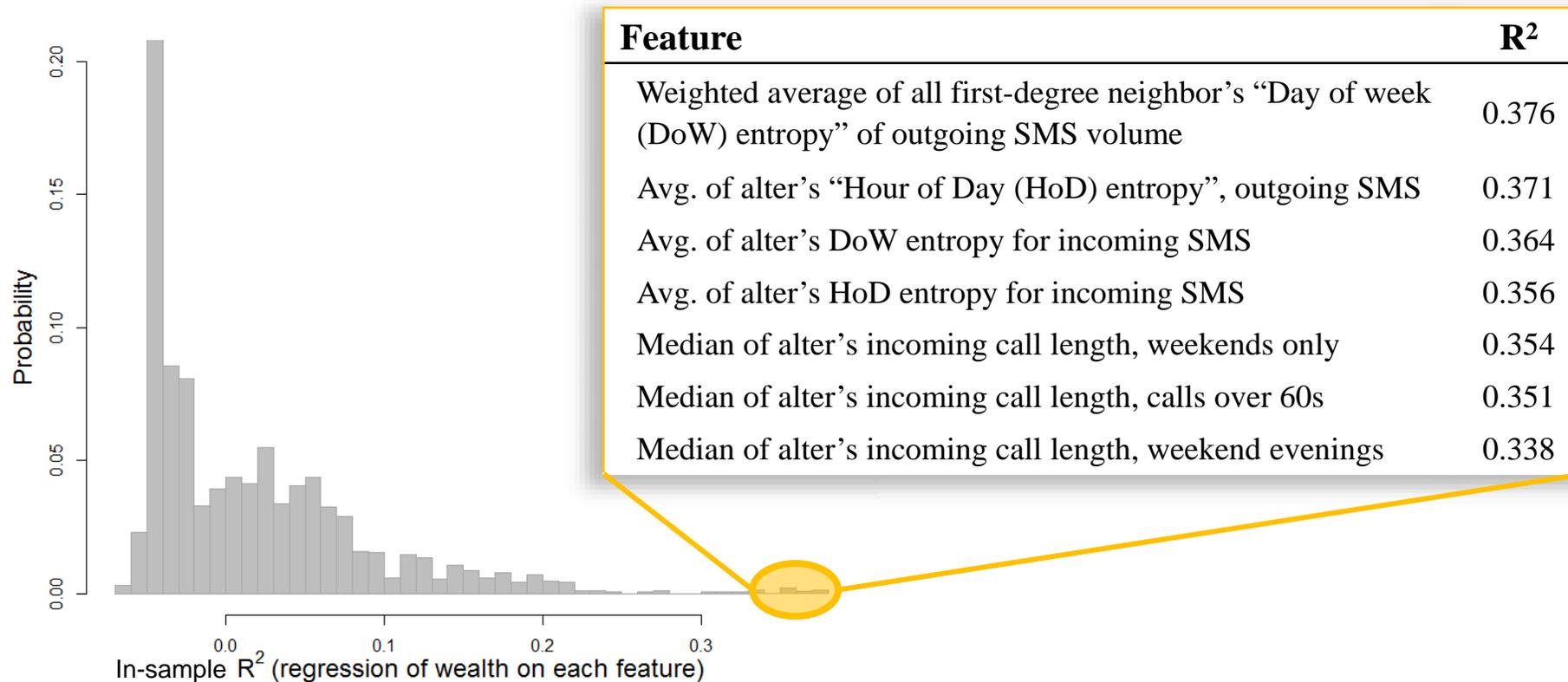


Key point: We need to do this *algorithmically*, not *intuitively*

Step 1: Feature Engineering (DFA)

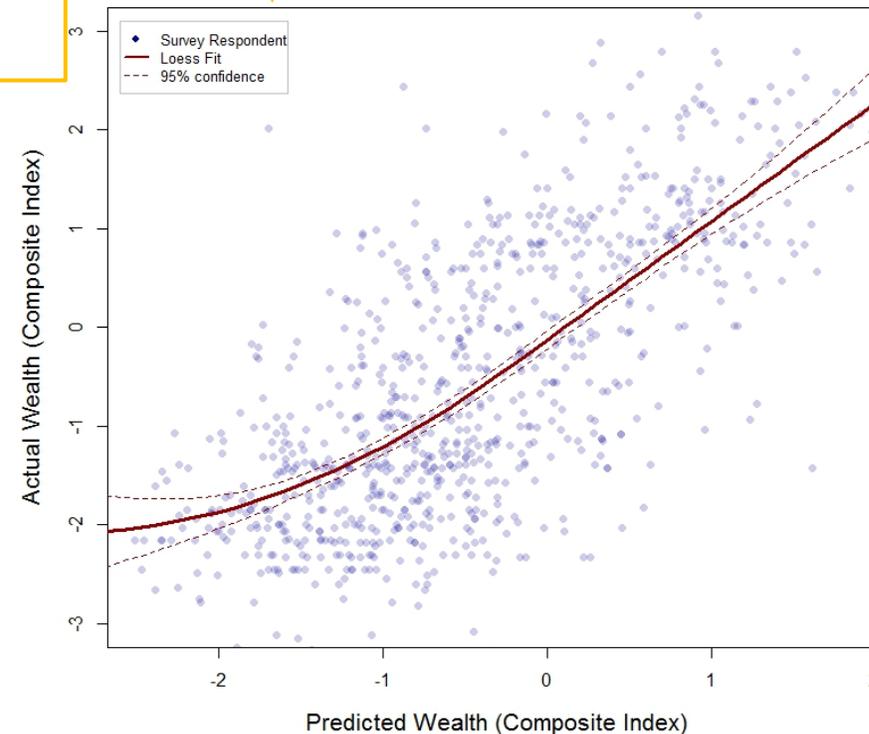
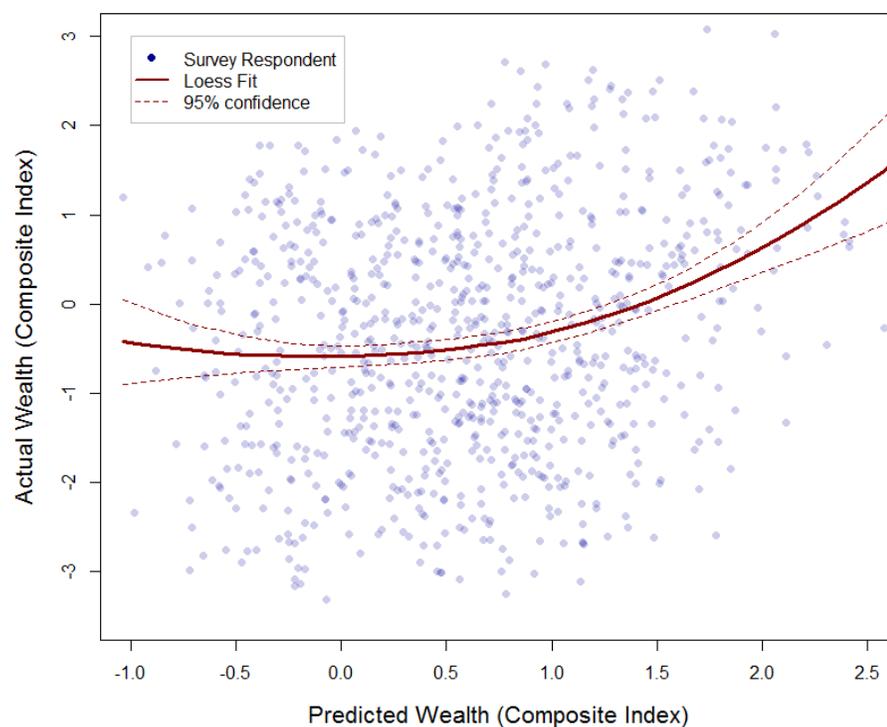
Deterministic Finite Automata (DFA)

- Advantages: Intuitive, creates “interpretable” features



Step 2: Supervised learning

“Features” used in Model	Elastic Net		Random Forest	
	r	R^2	r	R^2
Graph-Convolutional Network	0.72	0.52	0.73	0.54
Deterministic Finite Automata	0.68	0.46	0.63	0.40
“Intuitive” 5-feature model	0.43	0.18	0.37	0.14
Total phone expenditures	0.29	0.08	0.33	0.11

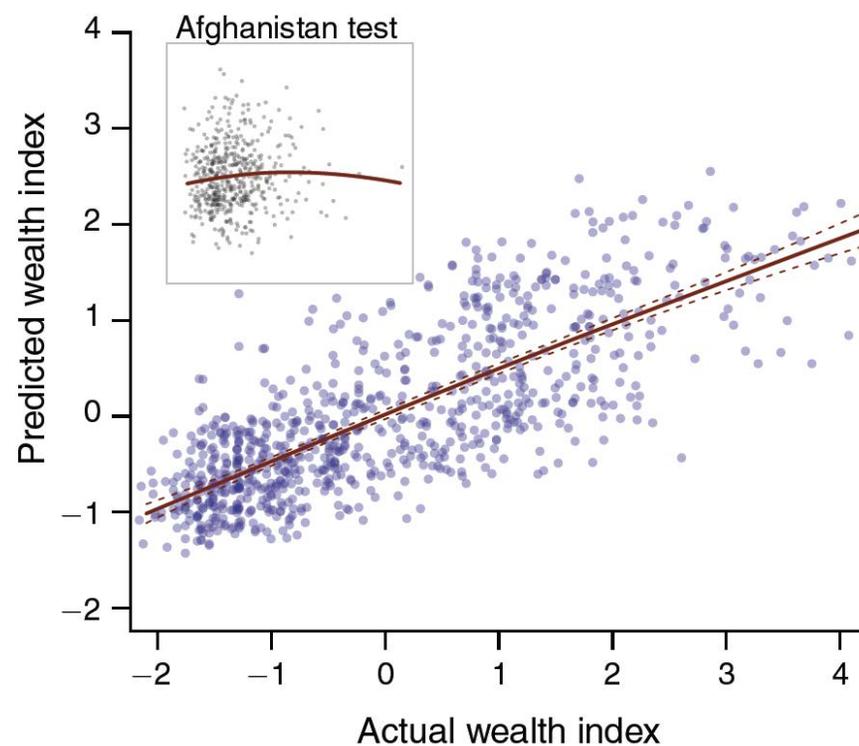


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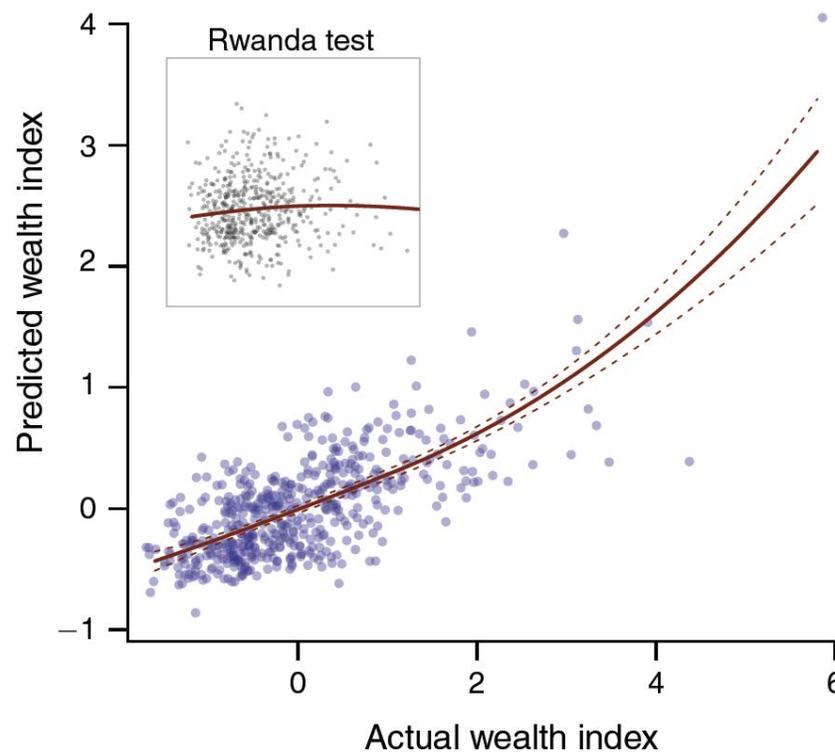
Step 2: Supervised learning

Important Note: A model trained in one country cannot be used in another!

Panel A. Rwanda model



Panel B. Afghan model



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High

Democratic
Republic of the
CONGO

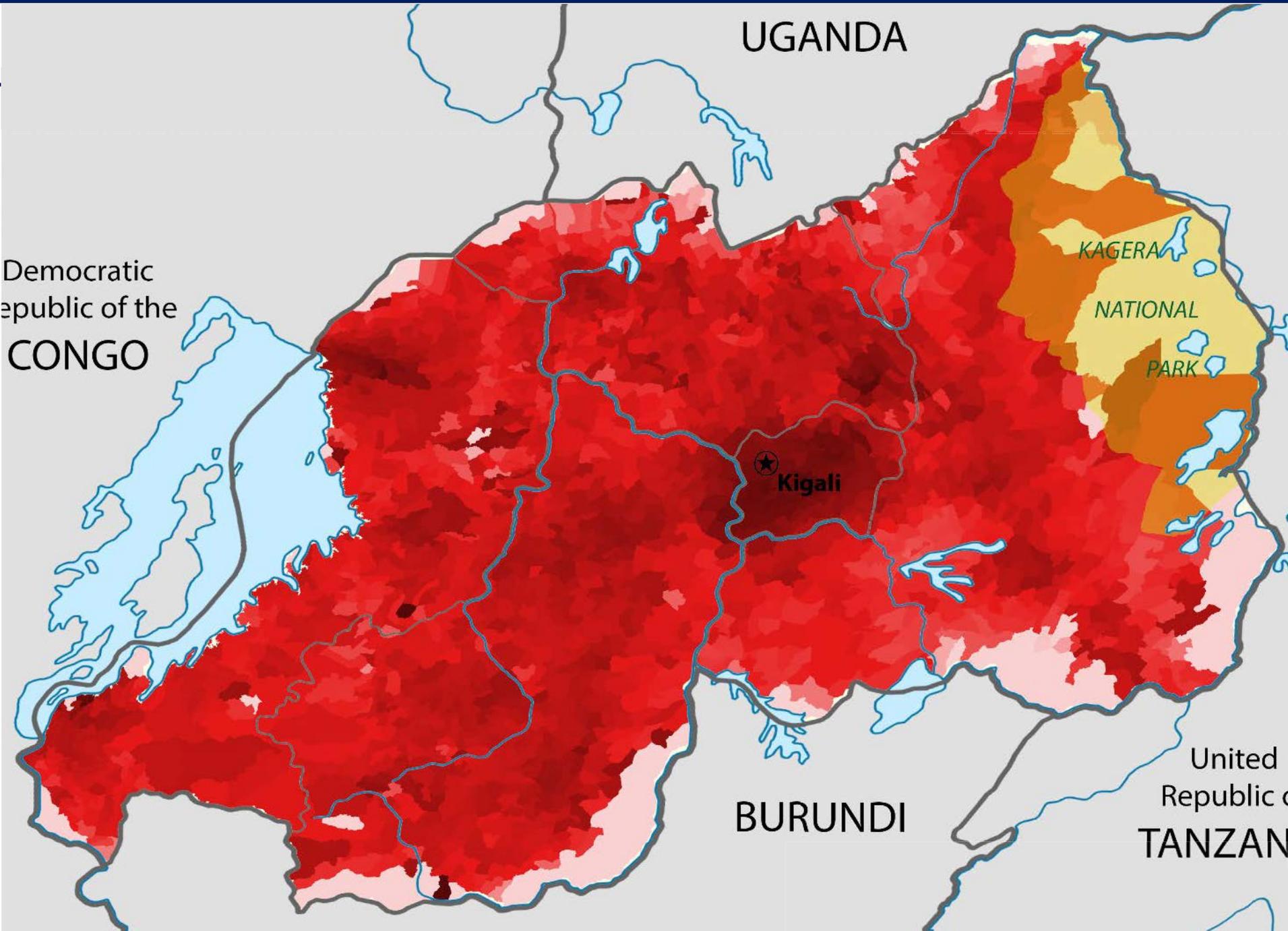
UGANDA

KAGERA
NATIONAL
PARK

Kigali

BURUNDI

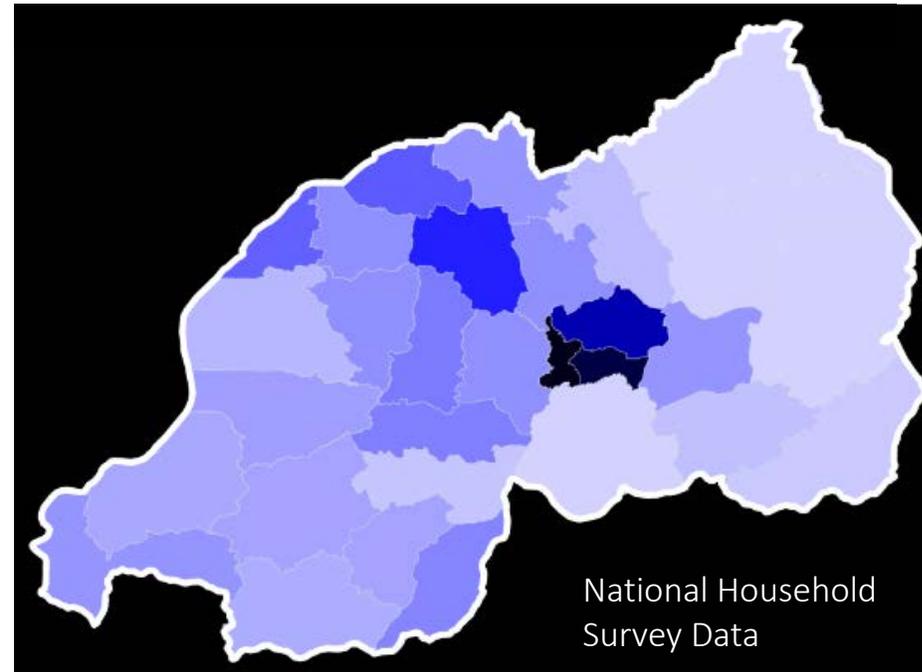
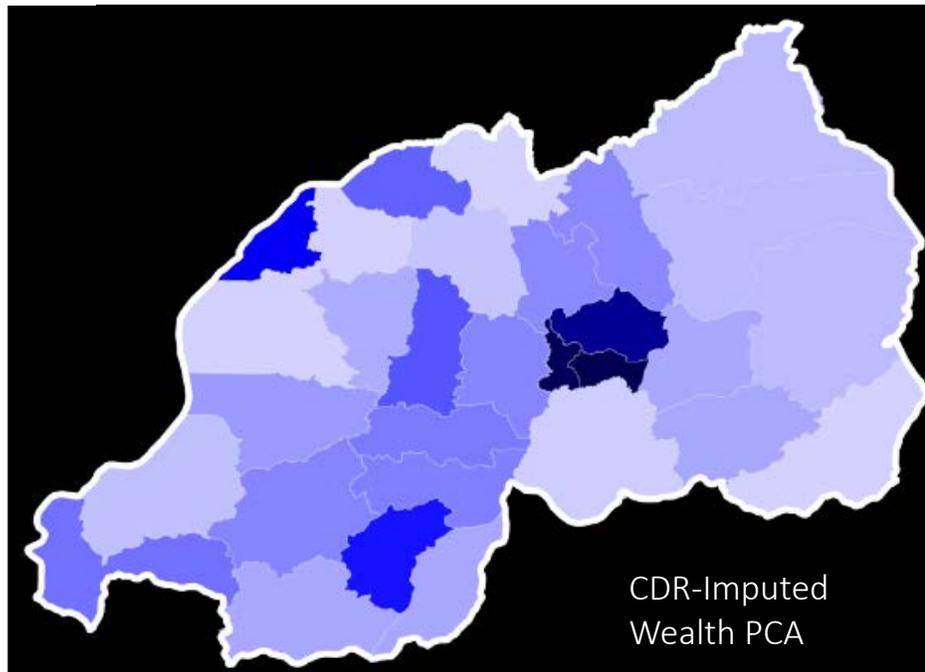
United
Republic of
TANZANIA



Step 3: Validation

How do these phone-based maps compare to maps produced with household survey (DHS) data?

- Note: DHS data only representative at district level (n=30)



The Politics, Economics and Sociology of Implementation

- Key actors:
 - Mobile Network Operators (CDR Data and Implementation)
 - Economists (“Who should be Targeted?” | Design of CCT | Survey Data)
 - Machine Learning & CS Modelers (“How do we identify beneficiaries?”)
 - Central Government (Regulatory Permission for Data Sharing)
 - Mobile money or Local Government (“How do we distribute funds?”)
- Sensitivities
 - Each operator’s competitive positioning in the MNO market
 - Politics – Politicians would prefer to create their own list and distribute
 - Civil Society – Are women, vulnerable groups protected?
 - Citizens – Can we really trust this system?
- Solution in Bangladesh?
 - We deploy the system in stages: 50 sub-districts first.
 - Track people’s reactions. Effects on food security via phone surveys
 - Scale up in stages only if the results look promising.

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