



ASSESSING THE RISK OF COVID-19 IN FEED THE FUTURE COUNTRIES

Jawoo Koo, Carlo Azzarri, Aniruddha Ghosh, and Wahid Quabili

In anticipation of the development of a safe and effective COVID-19 vaccine—the distribution of which will be a complex and sensitive issue—governments will need to assess the number and location of the most vulnerable people within their populations. Problematically, however, tracking data for most low- and middle-income countries are only available at the national level. The most widely used dataset by the Johns Hopkins University Center for Systems Science and Engineering (Dong, Du, and Gardner 2020), for example, does not include subnational data for Feed the Future's 12 target countries in Africa south of the Sahara (SSA) and South Asia: Bangladesh, Ethiopia, Ghana, Guatemala, Honduras, Kenya, Nepal, Niger, Nigeria, Mali, Senegal, and Uganda. For this reason, the Gender, Climate Change, and Nutrition Integration Initiative (GCAN) was commissioned to correlate Demographic and Health Survey data from the United States Agency for International Development (USAID) with geospatial data in order to develop a subnational dataset of key COVID-19 risk indicators based on which potential risk hotspots were identified. This policy note summarizes the study's analysis in the 12 Feed the Future countries and across subnational administrative units within each country.

Based on patient data compiled and analyzed worldwide, the science community's consensus is that key COVID-19 risk factors include age, sex, obesity, past respiratory illness, and cardiovascular disease. Hence, being old, male, and obese increases both vulnerability to infection and the likelihood of negative outcomes.

Overall Country-Level Risk

Four of the 12 target Feed the Future countries face the highest levels of Covid-19 risk: Nepal, Bangladesh, Honduras, and Guatemala (Table 1). These countries ranked high in both age- and obesity-related risk. Ghana recorded the highest risk among the SSA countries, followed by Senegal, Kenya, and Niger. The remaining four

METHODOLOGY

The study involved analyzing high-resolution geospatial data for each risk indicator at the second-level subnational administrative unit for each country. The risk factors included were (1) age, with the greatest risk occurring among those 85 years or older; (2) sex, with evidence suggesting that men are at higher risk based on greater prevalence of certain enzymes and hormones, combined with higher incidence of smoking and alcohol use (Bwire 2020); and (3) obesity, which is associated with an impaired immune system and is known to increase the risk of severe illness from COVID-19 (for example, Sattar, McInnes, and McMurray 2020). Data on other co-morbidity factors (past respiratory illness and cardiovascular disease) were not available at the subnational level and hence could not be included. A composite index that includes all risk factors for the second-level subnational administrative units was constructed using exploratory factor analysis (a statistical technique that reduces the number of variables). The resulting values were categorized as low, medium, or high risk leading to (1) an overall risk index for the districts in the Feed the Future countries used for cross-country comparisons, and (2) a country-specific risk index for the purpose of ranking districts within each country.

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TABLE 1. Country-level ranking of risk

Country	Age-related risk	Sex-related risk	Obesity-related risk	Overall risk index
Nepal	1.22	0.92	1.01	2.45
Bangladesh	1.26	0.98	1.00	1.83
Honduras	1.02	0.93	1.04	1.32
Guatemala	1.05	1.01	1.04	0.98
Ghana	0.86	1.04	1.02	0.69
Senegal	0.76	0.96	1.01	0.43
Kenya	0.77	1.03	1.02	0.34
Niger	0.71	0.96	1.01	0.05
Mali	0.65	0.91	1.01	-0.03
Nigeria	0.78	1.02	1.02	-0.04
Ethiopia	0.73	1.00	1.00	-0.04
Uganda	0.67	1.03	1.01	-0.34

Source: Authors.

Note: Values indicate each country's level of medium to high risk based on subnational analysis at the 70th percentile.

values. Variation in subnational risk factors is most pronounced in SSA—and especially in Kenya, Ethiopia, and Uganda—indicating that location-specific interventions will likely be needed, even though the overall risk in these countries appears to be comparatively low.

Almost all (99 percent) of the adult population of Honduras is located in areas classified as being under medium to high risk (Figure 1). Significant shares of the populations of Nepal, Bangladesh, and Guatemala are also located in medium to high risk areas. These countries show relatively high values of age-related risk. Within SSA, Ghana and Kenya report relatively high shares of their populations at risk, followed by Senegal and Ethiopia. Conversely, Uganda and Mali showed the lowest shares of adult populations at risk. And while large shares of the urban populations in some countries (such as Honduras and Nepal) are under medium to high risk, rural populations in several

SSA countries (Mali, Nigeria, Ethiopia, and Uganda) all recorded comparatively lower overall risk.

Most of the subnational administrative units in the four top-ranked countries (Nepal, Bangladesh, Honduras, and Guatemala) recorded relatively high COVID-19 risk index

countries (Bangladesh, Ghana, Kenya, Senegal, and Ethiopia) show comparatively higher risk than urban populations (Figure 2). Among all Feed the Future target countries, the highest values of age-related and obesity-related risk are reported in rural Bangladesh and rural Honduras, respectively.

FIGURE 1. Share of the adult population at risk (%)

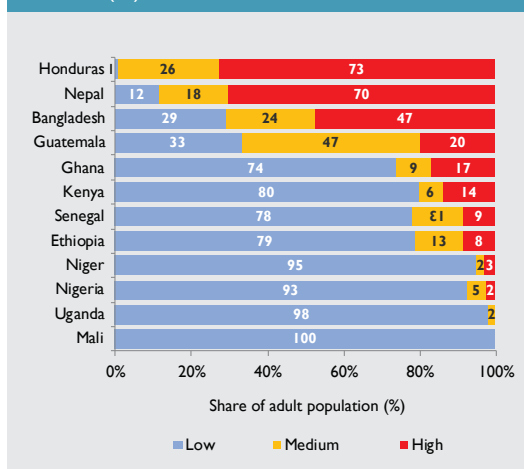
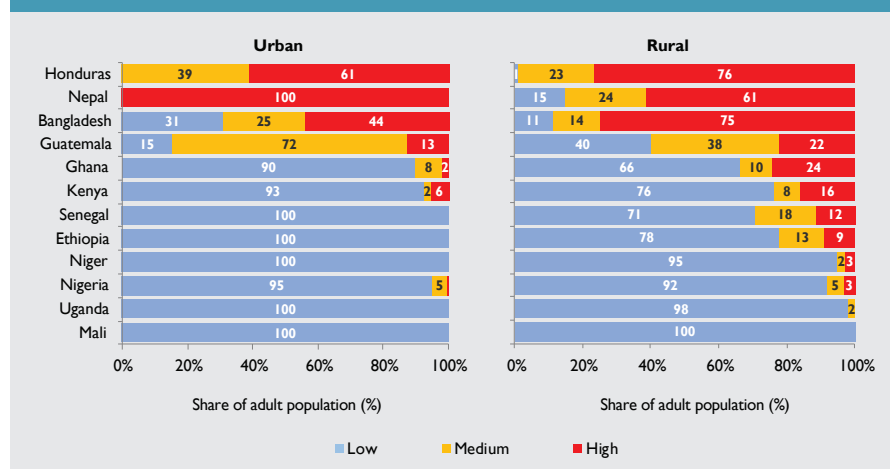


FIGURE 2. Urban versus rural share of the adult population at risk (%)



Source: Authors.

Notes: Classes of risk are based on the overall risk index. Adult population includes individuals over 18 years old.

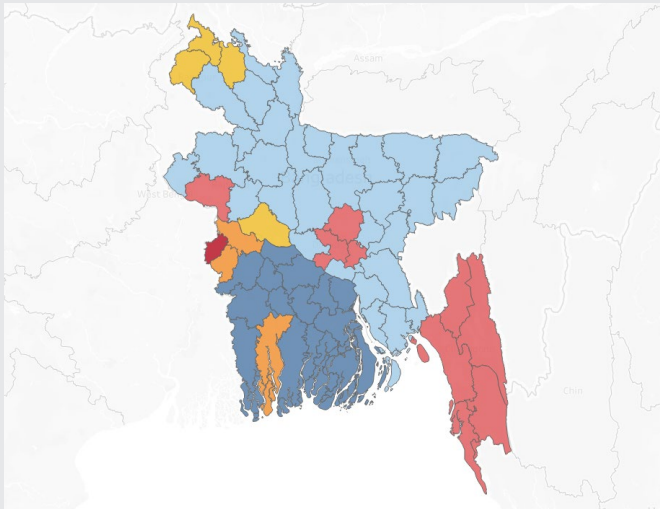
Subnational Risk Hotspots

The country-specific subnational risk index—categorizing low, medium, or high risk—is visually presented in Figure 3,

indicating hotspots (the redder colors) and cold spots (the bluer colors) in each country. ZOI indicates the zone of influence of the U.S. Government’s Feed the Future program.

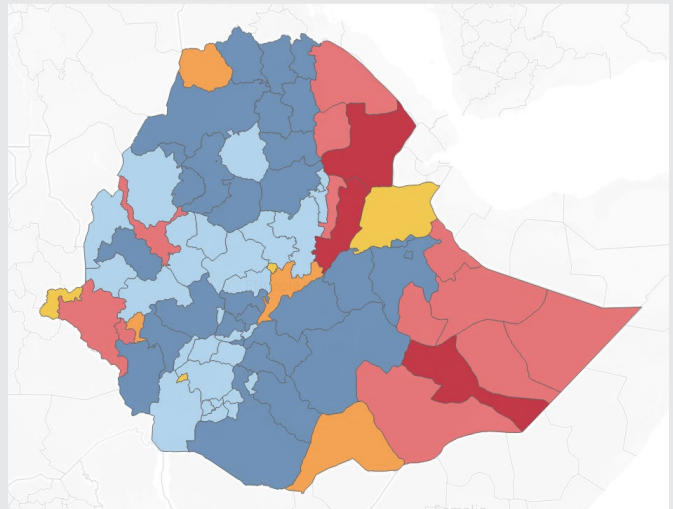
FIGURE 3. Subnational hotspots

a. Bangladesh



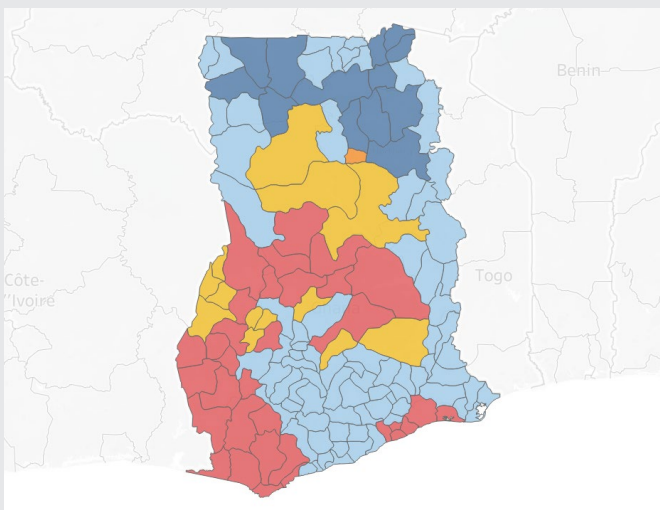
Areas of high risk are Bandarban, Chittagong, Cox’s Bazar, Dhaka, Gazipur, Khagrachhari, Meherpur, Narayanganj, Rajshahi, and Rangamati. The total population in the high risk areas is about 27.6 million.

b. Ethiopia



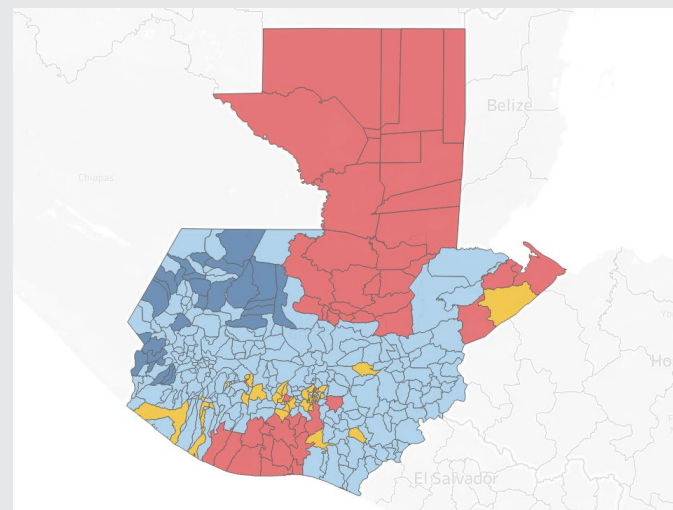
Areas of high risk are the Afar Zone 1/2/3/4/5, Afder, Agnuak, the Bahir Dar Special Zone, Doolo, Fafan, Jarar, Kemashi, Koraha, Majang, Nogob, and Shabelle. The total population in the high risk areas is about 3.5 million

c. Ghana



Areas of high risk are Accra, Ahafo Ano South, Ahanta West, Aowin-Suaman, Asunafo North, Asunafo South, Asutifi, Atebubu-Amantin, Bia, Bibiani Anhwiaso Bekwai, Dangbe East, Dangbe West, Ga East, Ga West, Jomoro, Juabeso, Kintampo North, Kintampo South, Mpohor Wassa East, Nkoranza, Nzema East, Pru, Sefwi Wiawso, Sekyere East, Sene, Shama Ahanta East, Sunyani, Tain, Techiman, Tema, Wasa Amenfi East, Wasa Amenfi West, and Wassa West. The total population in the high risk areas is about 6.5 million.

d. Guatemala

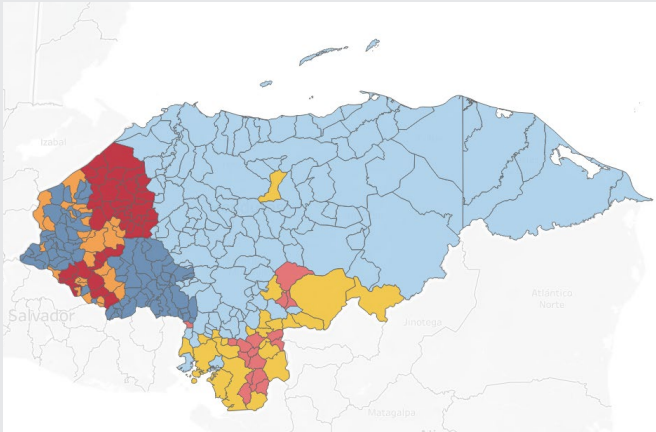


Areas of high risk are Chahal, Chisec, Cobán, Dolores, Escuintla, Flores, Fray Bartolomé de las Casas, Guanagazapa, Iztapa, La Democracia, La Gomera, La Libertad, Lanquín, Los Amates, Masagua, Melchor de Mencos, Nueva Concepción, Palín, Panajachel, Panzós, Pastores, Poptún, Puerto Barrios, San Andrés, San Benito, San Cristóbal Verapaz, San Francisco, San José, San José Pinula, San Juan Chamelco, San Luis, San Pedro Carchá, San Vicente Pacaya, Santa Ana, Santa Cruz Verapaz, Santa Lucía Cotzumalguapa, Santa María Cahabón, Sayaxché, Senahú, Siquinalá, Tactic, Tamahú, Tiquisate, Tzurú, and Villa Canales. The total population in the high risk areas is about 2 million.

■ ZOI, High risk ■ ZOI, Medium risk ■ ZOI, Low risk ■ Non-ZOI, High risk ■ Non-ZOI, Medium risk ■ Non-ZOI, Low risk

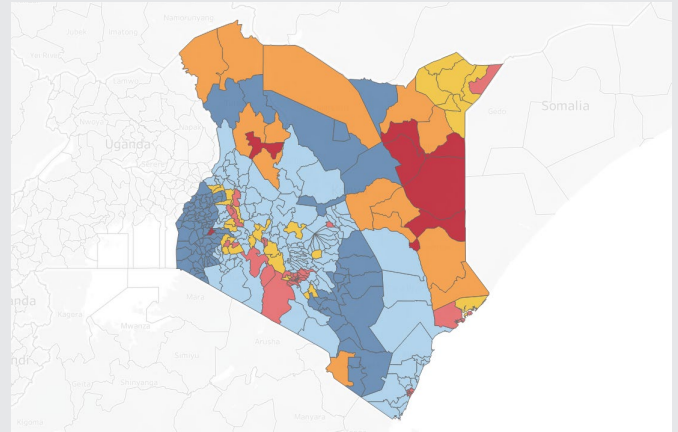
FIGURE 3. Subnational hotspots (continued)

e. Honduras



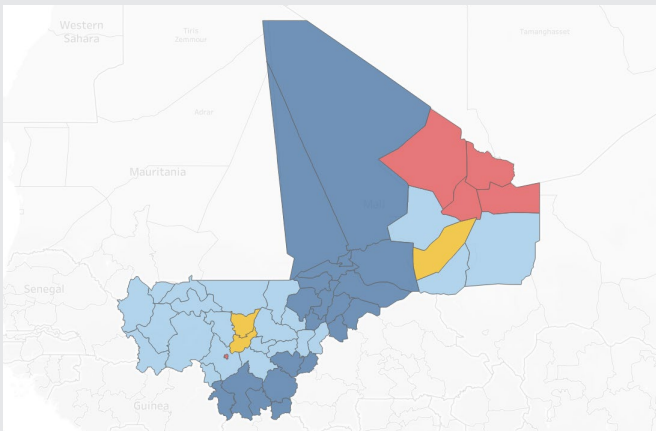
Areas of high risk are Apacilagua, Arada, Atima, Azacualpa, Belen, Caridad, Ceguaca, Chinda, Cololaca, Concepción de Maria, Concepción del Norte, Concepción del Sur, Duyure, El Corpus, El Nispero, Gualala, Gualcinco, Guarita, Ilama, Jacaleapa, La Campa, Las Vegas, Lepaera, Liure, Macuelizo, Namasigüe, Naranjito, Nueva Frontera, Nuevo Celilac, Orocuina, Petoa, Piraera, Potrerillos, Protección, Quimistán, San Andrés, San Antonio de Flores, San Francisco de Ojuera, San Isidro, San José de Colinas, San Luis, San Marcos, San Marcos de Caiquín, San Nicolás, San Pedro Zacapa, San Sebastian, San Vicente Centenario, Santa Ana de Yusguare, Santa Bárbara, Santa Rita, Soledad, Teupasenti, Texiguat and, Trinidad de Copán. The total population in the high risk areas is about 0.5 million.

f. Kenya



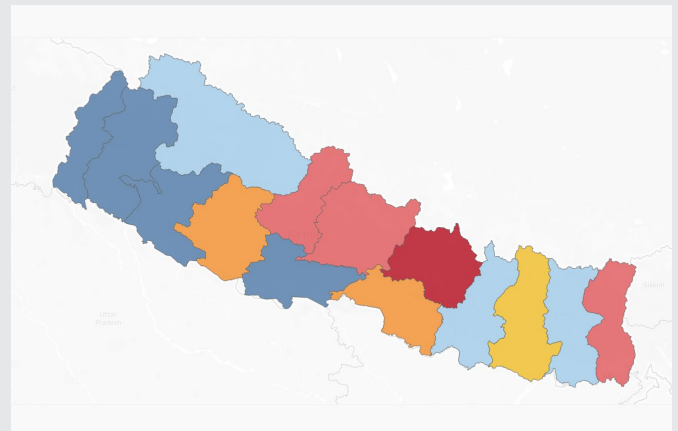
Areas of high risk are Belgut, Changamwe, Daadab, Dagoretti North, Dagoretti South, Eldas, Embakasi Central, Embakasi East, Embakasi North, Embakasi South, Embakasi West, Garissa Township, Jomvu, Juja, Kajiado North, Kajiado West, Kamukunji, Kapseret, Kasarani, Kesses, Kiambaa, Kiambu, Kibra, Kisauni, Kisumu Central, Kisumu East, Lamu West, Langata, Likoni, Limuru, Makadara, Mandera East, Mathare, Moiben, Mvita, Nakuru Town East, Nakuru Town West, Narok East, Narok North, North Imenti, Nyali, Roysambu, Ruaraka, Ruiru, Starehe, Thika Town, Wajir East, Wajir South, Wajir West, and Westlands. The total population in the high risk areas is about 7 million.

g. Mali



Areas of high risk are Abeïbara, Bamako, Kidal, Tessalit, and Tin-Essako. The total population in the high risk areas is about 1.7 million.

h. Nepal



Areas of high risk are Bagmati, Dhawalagiri, Gandaki, and Mechi. The total population in the high risk areas is 7.8 million.

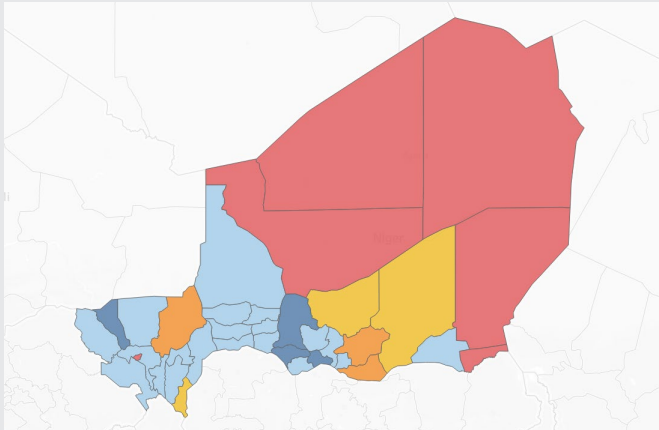
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Comparison of Overall Risk Index with Actual Country Status (As of January 2021)

The data underlying this study were sourced from existing literature and databases; unfolding trends of confirmed cases and deaths were not included. Nevertheless, as of early January 2021, the ranking of the four countries reporting the most severe spread of infection matched the study’s estimated national ranking based on the COVID-19 risk index, with the ranking of the remaining eight countries following a similar overall pattern. Correlating this study’s risk index with the number of confirmed COVID-19 cases per million people, the linear trend shows a statistically significant correlation ($R^2=0.54$; $p=0.006$).

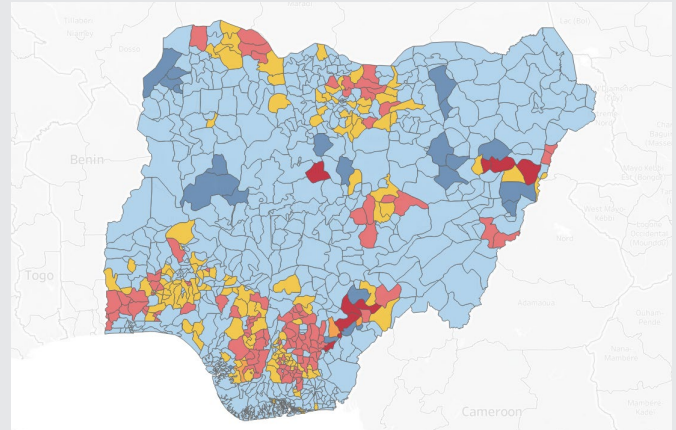
FIGURE 3. Subnational hotspots *(continued)*

i. Niger



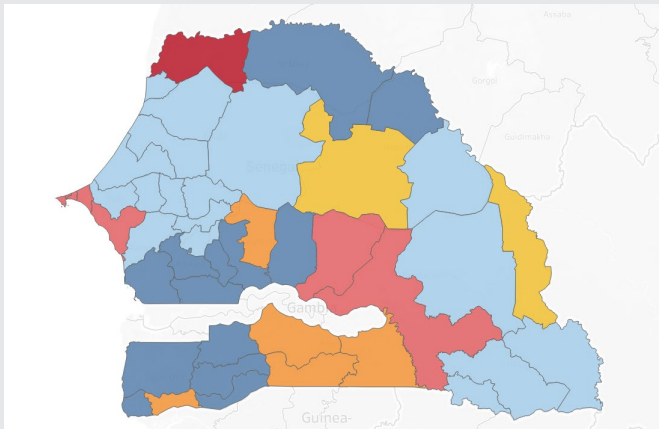
Areas of high risk are Arlit, Bilma, Diffa, N'Guigmi, Niamey, and Tchighozerine. The total population in the high risk areas is about 1.1 million.

j. Nigeria



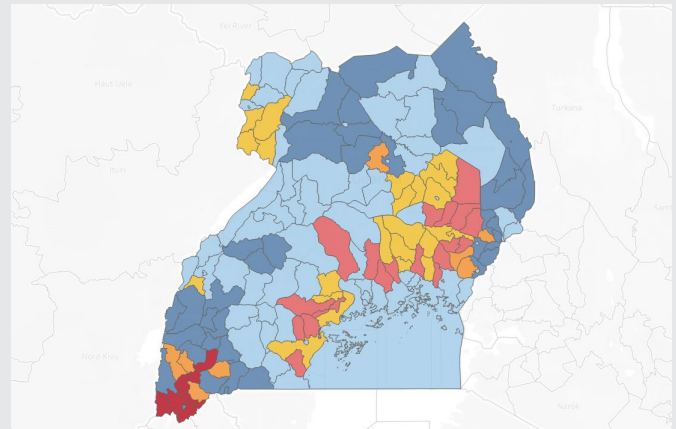
Areas of high risk are Abeokuta South/North, Aboh-Mba, Afijio, Afikpo, AfikpoSo, Akinyele, Aninri, AniochaN, AniochaS, Asa, Awgu, Bende, Bogoro, Bokkos, Dambatta, EgbadoNorth, EgbadoSouth, EsanCent, EsanNort, EtsakoEa, Ewekoro, Ezeagu, Ezinihit, Ezza North, Ezza South, Garki, Hawul, Hong, IbadanSouth-East, IbadanSouth-West, Igbo-eze North, Igbo-eze South, Igueben, Ijebu North-East, IjebuOde, Ikeduru, Ikenne, Ikwo, Ilejemeje, Ilesha East, Ilesha West, Ipokia, Isa, Ishielu, Isi-Uzo, Isiala Ngwa North, Isiala Ngwa South, IsokNor, Isuikwua, Jada, Kajuru, Kanam, Katsina (Benue), Kiyawa, Konshish, Kunchi, Kwaya Kusar, Lagelu, Madagali, Mangu, Mayo-Bel, Mbaïtoli, Michika, Minjibir, Ndokwa East, Ndokwa West, Ngor-Okp, Njikoka, Nkanu East, Nkanu West, Nsukka, Obafemi-Owode, Oboma Ngwa, Obowo, Odeda, Ohafia Abia, Ohaozara, Ohaukwu, Oji-River, Ondo West, Onicha, Orhionmw, Orlu, Oru East, OrumbaNo, Oshimili North, OwanWest, Owerri North, Owerri West, Owo, Oyo East, Qua'anpa, Remo-North, Ringim, Sabon Birni, Shinkafi, Sule-Tan, Takai, Tangazar, Taura, Udenu, Udi, Ukwuani, Umu-Nneochi, Umuahia South, Ushongo, Uzo-Uwani, Vandeiky, and Yala Cross. The total population in the high risk areas is about 13.2 million.

k. Senegal



Areas of high risk are Dagana, Dakar, Guédiawaye, Koupentoum, Mbour, Pikine, Rufisque, and Tambacounda. The total population in the high risk areas is about 2.7 million.

l. Uganda



Areas of high risk are Bamunanika, Budaka, Bugweri, Bukedea, Bukomansimbi, Busiki, Butambala, Gomba, Kajara, Kalungu, Kibuku, Kisoro, Kumi, Kyotera, Luuka, Nakaseke, Nakifuma, Ndoorwa, Ngora, Ntenjeru, Rubabo, Rubanda, Rukiga, Serere, Sheema, and Usuk. The total population in the high risk areas is about 2.2 million.

■ ZOI, High risk ■ ZOI, Medium risk ■ ZOI, Low risk ■ Non-ZOI, High risk ■ Non-ZOI, Medium risk ■ Non-ZOI, Low risk

Source: Authors.

Note: Classes of risk are based on the overall risk index. All maps © Mapbox © Open Street Map.

Specific Implications for Rural Areas

Given the relatively high estimated COVID-19 risk in rural areas in most of the countries analyzed, supporting interventions targeting agricultural laborers should be encouraged. Recently published studies also underscore that, across low- and middle-income countries, rural areas still show lower accessibility to safe water for personal hygiene (Deshpande et al. 2020) and to healthcare facilities (Weiss et al. 2020), with low rates of improvement. Another notable vulnerability in rural areas relates to household composition. In analyzing nationally representative household survey data from nine Feed the Future target countries, Nico and Azzarri (2020) found that, on average, rural households have 25 percent more elder members (those older than 65 years) than urban areas. While shares are higher in nonagricultural households (73 percent on average, with peaks in Uganda and Kenya), the higher shares of elder members across larger, rural households may render rural areas particularly vulnerable to the spread of COVID-19.

In order to reduce the risk of COVID-19 transmission across the agricultural sector, the U.S. Centers for Disease Control and Prevention has provided guidelines for grouping agricultural workers into cohorts for shifts or tasks, while keeping a minimum precautionary distance among individuals (CDC 2020). In India, local governments are disseminating guidelines for socially distanced farming practices, as well as encouraging younger, less vulnerable farmers to participate in labor-intensive field activities in which distancing might be more challenging, such as planting and harvesting. Other potential mitigating interventions promoted in India include collecting harvested grain at the farm gate, to minimize the need for farmers to travel to markets, and establishing informal social networks to coordinate fieldwork on rotating days. Additionally, given the high level of variability in COVID-19 risk factors between urban and rural areas, all countries are urged to monitor the COVID-19 situation at the subnational level and make data publicly available for targeted interventions and vaccine distribution. Where testing is limited, statistics on excess subnational mortality can be used as a proxy (Morgan et al. 2020).

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