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COVID-19 Across Africa: Epidemiologic Heterogeneity and Necessity of Contextually Relevant Transmission Models and Intervention Strategies

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Coronavirus disease 2019 (COVID-19) has rapidly emerged as a global public health threat with epicenters in regions of China, parts of Europe, and larger urban centers across North America (1). By comparison, population-level COVID-19 diagnostic rates and associated morbidity and mortality have been limited to date in much of the African continent. Initially, multiple mathematical models projected substantial increases in COVID-19 incidence and related deaths across Africa, with one estimating 300 000 to 3 million people dying, although newer models have estimated lower mortality (2, 3). These models have assumed homogeneity in the transmission dynamics of respiratory pathogens between the African continent and other regions of the world as well as across the African continent. In addition, there has been limited integration of the diverse range of country-led mitigation strategies. Furthermore, these models have not included evaluation of competing health risks to COVID-19 associated with disruptions to the health and social systems in countries across the continent. Finally, they overlook the contextually specific heterogeneities in environmental, social, and structural factors that may potentiate or reduce COVID-19 risks in countries across Africa.

To date, the burden and outcomes associated with COVID-19 have varied substantially across the African continent. Specifically, 8 of the 54 African countries—South Africa, Egypt, Nigeria, Algeria, Ghana, Morocco, Cameroon, and Sudan—account for two thirds of all known COVID-19 cases (1). Furthermore, Egypt, Algeria, and South Africa alone account for more than one half of all deaths. And even within these countries, the epidemiology of COVID-19 appears to be, similar to other infectious diseases, not evenly distributed, with concentration of risks in urban epicenters, among lower socioeconomic status communities, with certain occupations, and within congregate living settings.

The transmission and mortality models have been parameterized primarily with European and Chinese data, with the primary adjustment being for different age distributions across Africa (3, 4). Moreover, the assumptions have further included higher morbidity and mortality among youth because of preexisting comorbidities, including malnutrition, HIV, tuberculosis and diagnosed or undiagnosed noncommunicable diseases (4). However, there has been limited consideration of factors driving the diversity in the transmission dynamics of respiratory pathogens across the continent. These include temperature, humidity, and population structure and density, which affect transmission of COVID-19 as well other respiratory viral pathogens, including influenza (5). Influenza surveillance remains limited in much of Africa, but substantial diversity in influenza seasonality and strains has been observed even between neighboring countries (6). Moreover, there is evidence of substantial phenotypic and genetic diversity in Middle East respiratory syndrome coronavirus in West and North Africa compared with serotypes observed in the Arabian Peninsula (7). Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is immunologically new to humans but is a lipid-enveloped respiratory pathogen, and the integration of historical transmission dynamics of other respiratory pathogens is critical in estimating the potential morbidity and mortality of this virus. Assumptions of homogeneity in transmission dynamics challenging estimations with COVID-19 similarly affected model estimations of Ebola across West and Central Africa in 2014–2016 (8).

In early March, governments across Sub-Saharan Africa implemented interventions to mitigate COVID-19 along a continuum of specificity that included interruption of international and domestic travel; banning large gatherings, including worship and sporting events; and closure of schools and nonessential businesses. Some countries, including South Africa and Algeria, implemented versions of a complete lockdown, whereas others, including Botswana and Mozambique, implemented less stringent measures (9). Although the differential impact of these interventions is yet to be empirically measured, there have been disconnects between COVID-19 incidence and breadth of public health interventions, including in South Africa; this reinforces the need to characterize other determinants of COVID-19 heterogeneity across the continent. Testing for COVID-19 is still challenging in Africa and worldwide owing to limited availability, variable sensitivity of polymerase chain reaction–based tests as well as variable accuracy of available serologic tests. Thus, the actual case numbers and deaths are probably higher than the reported numbers, but the trends within countries are critical, as testing and surveillance have only increased over the past several weeks. Outside of North Africa, more than 6 months into the COVID-19 pandemic, there has been no evidence of exhaustion of existing health system resources. And a critical lesson heeded in many countries from the Ebola outbreak was balancing the management of the outbreak and disruptions to health systems.

Competing health risks to COVID-19 across the African continent include both endemic communicable and noncommunicable diseases. And the level of health disruption is probably associated with the breadth of the social distancing mandates potentially affecting the provision of malaria, HIV, tuberculosis,

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vaccination, and maternal and child health programs; sexual and reproductive health and rights; and noncommunicable disease services across the continent (10). Telemedicine programs are not scalable across most countries, and there may be substantial morbidity, mortality, and years of life lost in the coming months from these interventions. Similar to other countries worldwide, countries across Africa may experience increases in all-cause mortality that significantly exceed official COVID-19–related mortality, but it is vital to assess what proportion is uncounted direct mortality due to the SARS-CoV-2 virus and what proportion represents indirect mortality from the COVID-19 response. Furthermore, several countries across Sub-Saharan Africa are particularly sensitive to the downstream economic consequences of COVID-19 that will probably disrupt expansion of social and health services. Specifically, it has been estimated that economic growth will slow at a rate of 1.8% to 2.6%, potentially resulting in 27 million new individuals across Africa becoming extremely poor, with associated food insecurity and even starvation (2).

Coronavirus disease 2019 represents a public health emergency for countries across Africa. However, African public health institutions, such as the Africa Centres for Disease Control and Prevention, have a long history of effective measures to mitigate infectious diseases, such as Ebola, Zika, malaria, and dengue, among others, suggesting cautious optimism being warranted now. To increase utility, forecasting models that are being used to guide implementation strategies should effectively integrate historical trends for the high level of continental and intercontinental heterogeneity in respiratory pathogens, because the transmission dynamics of COVID-19 appear to be equally heterogenous. It is likely that SARS-CoV-2 will remain in circulation across Africa for the foreseeable future; thus, adaptation of mitigation strategies to sustainable approaches with evolving epidemic trajectories is similarly critical. Ultimately, as African data are rarely used to parameterize models of transmission or inform implementation strategies for Europe or Asia, so too should the international community be hesitant in developing forecasts and prevention strategies in the absence of integration of African data and leadership by African institutions.

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