as limited resources and health care systems. African countries have seen a more consequential impact of resource prioritization away from cancer patients compared with HICs. A welcome difference in response is the growing involvement of the diaspora in telemedicine, such as in virtual tumor boards and e-consultation. This trend is likely to increase and presents an opportunity for Africa to leapfrog into an era of tele-oncology while turning "brain drain" to "brain circulation," which will strengthen the health system workforce. There is already an emerging vision of building a comprehensive cancer center in the cloud (*15*) for Africa, accessible from anywhere for consultation, second opinion, follow up, continuous education, and so on, with considerable involvement of the diaspora. During the pandemic, apps have also been developed for the African health care setting that can be extended for use in oncology. For example, the surveillance outbreak response management and analysis system (SORMAS) app used during the recent Ebola outbreak for self-diagnosis and tracing could be adapted for applications in oncology, for example, for collecting symptomatic information and promoting cancer prevention and awareness education. Overall, COVID-19 has been a new challenge with opportunities that can be leveraged in Africa to improve oncology and global health. ■

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ACKNOWLEDGMENTS

We thank J. Nkengasong, M. Foote, and oncology health professionals across Africa for helpful discussions.

10.1126/science.abd1016

CORONAVIRUS

The puzzle of the COVID-19 pandemic in Africa

More data are needed to understand the determinants of the COVID-19 pandemic across Africa

By **Justin M. Maeda** *and* **John N. Nkengasong**

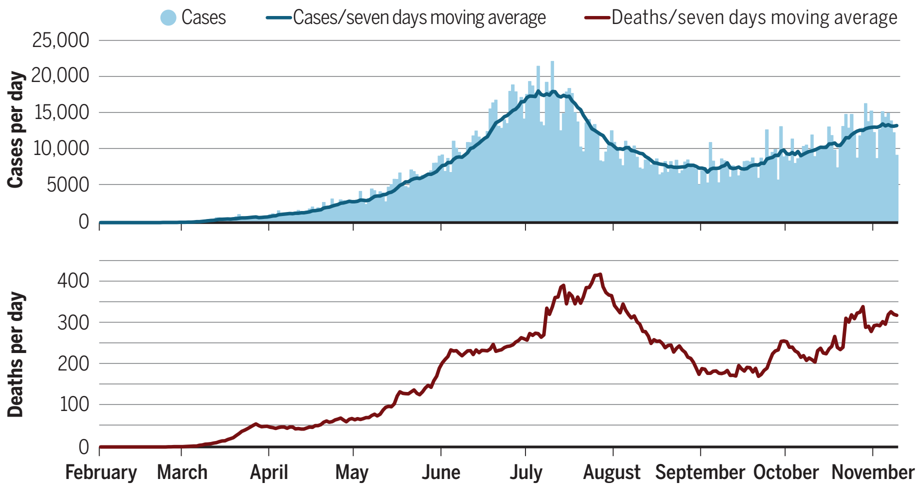
The COVID-19 pandemic has been puzzling to many public health experts because Africa has reported far fewer cases and deaths from COVID-19 than predicted. As of 22 November 2020, the continent of Africa, comprising 1.3 billion people, had recorded 2,070,953 cases of COVID-19 and 49,728 deaths (*1*), representing ~3.6% of total global cases (*2*, *3*). Because of the continent's overstrained and weak health systems, inadequate financing of health care, paucity in human resources, and challenges posed by existing endemic diseases—including HIV, tuberculosis, and malaria—earlier predictions suggested that up to 70 million Africans may be infected with severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) by June, with more than 3 million deaths (*4*). On page 79 of this issue, Uyoga *et al.* (*5*) report a serosurvey study (measuring the occurrence of SARS-CoV-2 antibodies) of blood donors in Kenya that suggested that the incidence of SARS-CoV-2 infection is much higher than expected from case numbers.

Using blood donor samples as a proxy, Uyoga *et al.* estimated that SARS-CoV-2 infections occurred in 5.5% of the population in Kisumu, 7.3% in Nairobi, and 8.0% in Mombasa, with an overall average of 4.3%. This translates to ~2.2 million total possible infections compared with the reported 77,585 infections in the country as of 23 November 2020 (*1*, *3*). Similarly, in October 2020, Mozambique reported less than 3000 confirmed cases of COVID-19; however, serosurveys found that 5% of households in the city of Nampula and 2.5% of households in the city of Pemba had been exposed to the virus (*6*). This suggests that there may be more infections than recorded.

There are several factors that may influence the trajectory of the COVID-19 pandemic in Africa. These include limited testing (which limits detection and isolation, and thus public health measures), a much younger population (and thus fewer severe cases and deaths), climatic differences (which could affect transmission), preexisting immunity, genetic factors, early implementation of public health measures, and timely leadership. Two key aspects that may contribute to our understanding of the pandemic puzzle in Africa include scaling up of

COVID-19 cases and deaths in Africa

The trend of daily reported cases of COVID-19 for the African continent, February to November 2020, shows the first peak of cases occurred July to August (mostly attributed to the Southern African Region) followed by a second peak, which started in October (mostly attributed to the Northern Region).



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testing and use of serosurveys.

One way to unravel the puzzle of SARS-CoV-2 spread is to understand how testing and reporting of cases has occurred. On 14 February 2020, the first cases of COVID-19 were reported in Africa, and by 17 April 2020, the continent had conducted an estimated 330,419 SARS-CoV-2 tests; that is 0.03% of the entire continent's population. In an effort to scale up testing, the Africa Centres for Disease Control and Prevention (Africa CDC) launched the Partnership to Accelerate COVID-19 Testing (PACT) in April 2020. Because of the PACT initiative, testing was scaled up rapidly from ~600,000 per month in April to ~3.5 million per month in November 2020, an increase of ~5.5-fold (*7*), with 39 of 55 (71%) countries reporting more than 10 tests conducted for every case identified, as recommended by the World Health Organization (WHO) (*8*). Testing capacity has varied over time, with positivity rate fluctuating between 5 and 15% regardless of the increased testing boost brought by the introduction of PACT.

Therefore, it is clear that testing has been challenging (*9*, *10*), which limits our understanding of the full extent of the spread of SARS-CoV-2 infection in Africa. As such, serosurveys are critical because they can provide data on SARS-CoV-2 infection trends, effects of interventions, demographic characterization, and vaccine effects. Such surveys can also inform on planning for vaccine deployment by providing data to guide prioritization between different populations. They can also aid understanding of the drivers of infection through linking current or previous infection with epidemiological and demographic data. Currently, the continent is facing a challenging phase of the pandemic with an observed second wave of cases (see the figure). More people need to be tested in different localities, including repeated testing over time, so that the patterns and risk factors of viral spread can be understood.

Several serosurveys have been conducted in Africa. The studies differ in methodological approach used: simple random sampling, use of existing sentinel sites, and targeted population (specific subnational unit, pregnant women, blood donors, and people living with HIV). The types of laboratory tests used (rapid tests and enzyme-linked immunosorbent assays) also differed between studies so as to unveil the drivers of infection and disease spread. Given the limited ability to conduct field surveys (the preferred method) owing to travel restrictions, Uyoga *et al.* investigated blood donors to reveal the pandemic puzzle in Kenya. From these surveys in Africa, seroprevalence of SARS-CoV-2–specific antibodies have ranged from 2.2 to 39% of the population in different settings and countries. However, none of the studies have used a national representative sample.

To ensure a harmonized and standardized method of conducting serosurveys in Africa, the Africa CDC is supporting multinational population-based, age, and gender stratified serosurveys that use standardized protocol and data collection tools (*11*). The protocol is built on a simplistic model, using point-of-care rapid test for antibody detection of current and previous infection, to ensure feasibility and simplicity while maintaining study quality and credibility of the evidence generated. A similar approach has been applied to national representative cohorts in Brazil and Spain (*12*, *13*).

Across Africa, policy makers are faced with the dilemma of striking a balance between limiting transmission and protecting economies, businesses, and livelihoods. This has created a demand for quality and comprehensive data. Serosurveys could therefore complement existing response strategies. Such surveys should adhere to the following principles: a national representative sample through well-designed sampling strategies that ensure inclusivity of all possible strata within the country; simplicity to guarantee feasibility and quick delivery; optimization of resources for implementation (human, material, and financial) to safeguard the already constrained resources for response; complementarity to already existing surveillance and response data; and the ability to longitudinally track the same aspect of data and information over time to inform adaptive strategies.

Timely leadership and coordination may be a second aspect that explains the pandemic pattern in Africa. The continent reacted in a timely and collective manner once the first cases of SARS-CoV-2 were reported in Egypt on 14 February 2020. Following that, on 22 February 2020, the Africa CDC convened an emergency meeting of all ministers of health at the headquarters of the African Union Commission in Addis Ababa, Ethiopia. The ministers adopted a joint continental strategy that had three goals: limit transmission, limit deaths, and limit social and economic harms and impacts on other endemic diseases, underpinned by the need to coordinate, cooperate, collaborate, and communicate efforts across Africa. In addition, the Africa Taskforce on Coronavirus (AFTCOR) was established to help implement the strategy and was endorsed by the Bureau of the Heads of State and Governments of the African Union, a validation at the highest level of the continent. This approach helped blunt the early spread of COVID-19.

Therefore, in March 2020, when several countries in Africa began reporting imported cases of COVID-19, there was clarity on the course of action to take. For example, as part of the AFTCOR, the Africa CDC rapidly supported member states to establish diagnostics capacity and expanded testing capacity from two countries in February to more than 43 by the end of March, through competency-based training of member countries at reference centers in Dakar, Senegal, and Johannesburg, South Africa. The coordinated approach ensured harmony in response strategies. For example, the establishment of the African Medical Supply Platform helped to streamline the procurement of response commodities.

The puzzle of the COVID-19 pandemic in Africa can partly be explained by decisive measures taken early to prepare the continent. However, more data are needed to complement what is routinely collected through surveillance and response to understand the different pieces of the puzzle that contribute to the pattern of the pandemic in Africa. Serosurveys and the use of genomic epidemiology can help to better understand disease spread. Further understanding of factors that influence viral pathogenesis and clinical spectrum of disease, and the impacts on endemic infections (HIV, tuberculosis, and malaria), are needed. Efforts to understand attitudes to COVID-19 vaccines are also a priority. ■

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10.1126/science.abf8832

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Science

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Science **371** (6524), 27-28.
DOI: 10.1126/science.abf8832

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