DATA INSIGHT

COVID-19 in Africa

SUMMARY: The COVID-19 pandemic will evolve differently in African countries than other parts of the world, as there are factors unique to the population and the environment which will likely affect disease transmission and severity. Fortunately, the epidemic has not grown exponentially in Africa. This may be a temporary observation if local transmission continues over time, so governments should continue to build capacity to prevent transmission and treat cases to minimize the impact of the disease.

There has been great concern that COVID-19 could cause disproportionate suffering in Africa, where many countries have critical gaps in epidemic preparedness, higher poverty rates, less health and economic resilience, poor access to health care, and other factors that put their populations at high risk for negative social, economic and health impacts of the pandemic. Though countries in Africa respond to infectious disease outbreaks regularly, including ongoing outbreaks of cholera, Ebola, hepatitis E, Lassa fever, measles, monkeypox and plague, these outbreaks often result in preventable deaths and disability.

Reported cases have not matched early predictions of explosive spread

To date, several studies have examined the potential impact of COVID-19 in Africa. One preliminary report predicted average clinical attack rates of 17%-39% in various African countries over the first 12 months, meaning that 17% to 39% of a country's population would be infected. A preprint article modeling the epidemic in Kenya using various scenarios found a high percentage of the population would become infected (median estimate >80% at six months) which would overwhelm current health care system capacity. An Imperial College report on the global impact of COVID-19 found that in the absence of any mitigating interventions, there would be more than 1 billion infections and 2.4 million deaths in sub-Saharan Africa.

Health systems around the world are struggling to manage COVID-19 cases; many of those in Africa are at a particular disadvantage due to limited critical care capacity and other resource constraints. There are estimated to be fewer than 2,000 ventilators across 41 African countries and less than 5,000 intensive care unit (ICU) beds across 43 African countries (both estimates based on countries with available data). Democratic Republic of the Congo has five ventilators and unknown ICU capacity for a population of 90 million (compared to Germany, which has approximately 25,000 ventilators and 28,000 ICU beds for a population of 84 million people.) DRC's health system is also taxed by the Ebola epidemic that has been ongoing since August 2018. The supply of supplemental oxygen is also severely constrained across Africa which can affect treatment of moderately severe cases. More importantly, across Africa there is a shortage of trained staff who can manage critically ill patients, so that even if more equipment is obtained it will be difficult to use effectively in the near term.

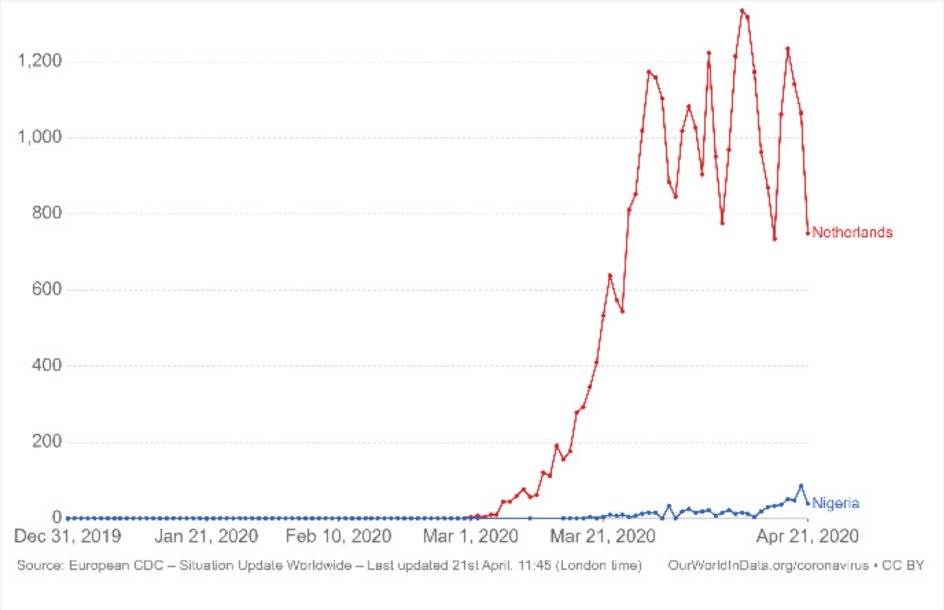

Figure 1: Daily new confirmed COVID-19 cases

But the predicted explosive growth in COVID-19 cases in Africa has not materialized as it has in other parts of the world. The first confirmed COVID-19 infection on the continent was identified in Egypt on Feb. 14, 2020, with the first infection in sub-Saharan Africa identified in Nigeria on Feb. 27, 2020. The Netherlands, which reported its first case on the same day as Nigeria, has since has detected over 34,000 cases and 3,900 deaths. Nigeria has reported just over 650 cases and 22 deaths *(See Figure 1)* in the same time period.

Identifying People With COVID-19

A major consideration when examining COVID-19 transmission in Africa (and elsewhere) is whether there is sufficient testing to identify people who are infected. Globally, data on testing is variable in availability and quality, and more comprehensive, detailed and regularly updated data are needed. Several metrics can be used to describe testing, including total tests done, tests per capita, tests per day or week, and tests per confirmed case (or, similarly, the positivity rate, which is the percentage of tests that are positive). Two of the most useful metrics are the per capita test performed and the tests per confirmed case.

Per capita testing rates (e.g. per 1,000 people) are an indicator of the coverage of the testing. In Africa the number of tests per 1,000 people is far below that of other countries *(see Figure 2)*, many of which have higher incomes. This means that in these countries there are fewer people whose infection status is known, and that infections may be missed.

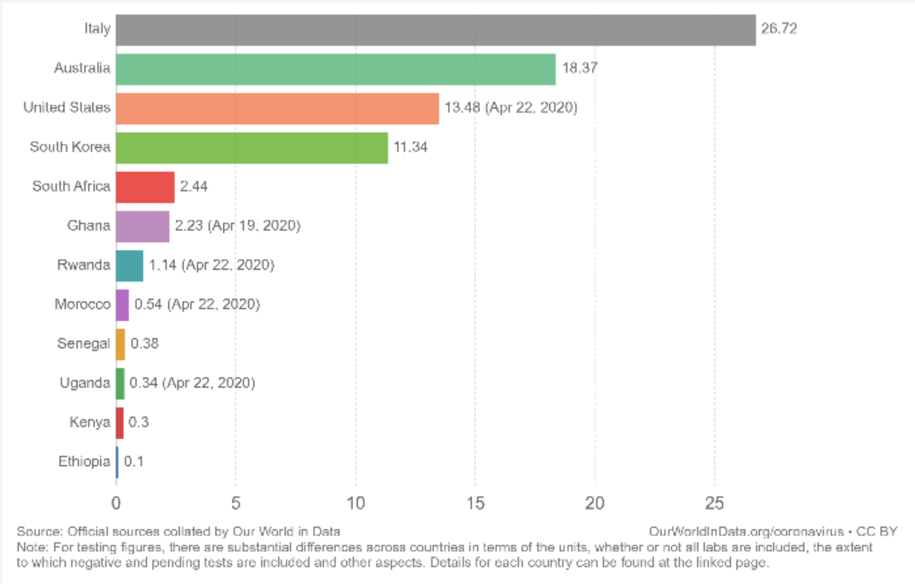

Figure 2 Total COVID-19 tests per 1,000 people, Apr 23, 2020

However, in a smaller outbreak, fewer tests are needed, so the absolute number of tests done per capita may not be as useful earlier in the epidemic curve . For example, in an outbreak of five cases, the total number of tests done in the country would be lower than in an outbreak of 500 cases.

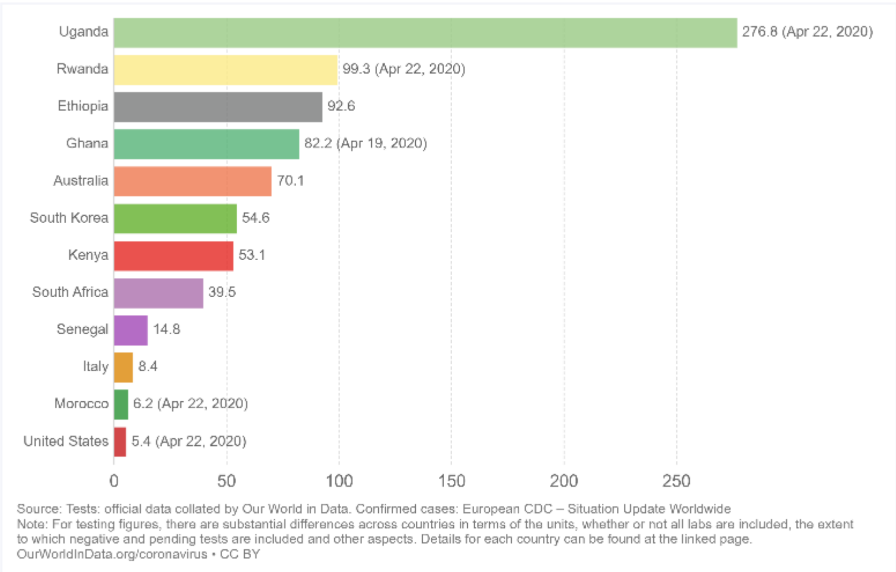

Figure 3 Number of COVID-19 tests per confirmed case, Apr 23, 2020

The tests per confirmed case metric (test positivity rate) is most suited for assessing the adequacy of testing volume regardless of outbreak size. It indicates whether a country is testing enough people to get a reliable assessment of epidemic spread assuming that the quality of the tests (including sample collection and test performance) is sufficient. In a limited comparison of select countries, it appears that many countries in Africa have robust testing when using this metric (See Figure 3). The number of tests per confirmed case is higher in Uganda, Rwanda, Ethiopia and Ghana than it is in Australia, Italy and the United States. Assuming that testing of high-priority groups is equivalent across countries, one could conclude from the test positivity rate that in some African countries, sufficient testing is being performed. However, within a country testing may vary significantly and can miss clusters of cases if it is not widely accessible. As the outbreak evolves and more cases are detected, it will be necessary for countries in Africa to expand their testing capacity to support the rapid isolation of cases and quarantine of contacts.

Contextual Factors Related to COVID-19

In addition to testing, one must consider other important factors when assessing the spread and impact of COVID-19 in Africa. Table 1 shows some of the most important factors, their status in Africa when compared to other regions, and implications for COVID-19 impact.

Factor	Context in Africa (compared to other regions)	Potential impact on COVID-19 (compared to other regions)
Age distribution	Younger population structure in Africa	Less severe disease
Age distribution within households	Older people living with younger people	More transmission to vulnerable groups
BCG (tuberculosis) vaccination	Slightly lower BCG vaccination rates but higher than in many countries most heavily affected by COVID-19	Currently there is an uncertain relationship between BCG and COVID-19
Detection of cases	Variable testing per capita or per case detected	Fewer cases detected and higher overall severity (as measured by the case fatality rate, or CFR) in areas with less testing. More cases detected and lower overall severity (CFR) in areas with more testing.
Detection of deaths	Less robust vital statistics systems	Fewer deaths detected and lower severity (because of lower CFR)
Environmental hygiene	Less accessibility to water and sanitation	More transmission
Household size	More persons per household	More household transmission
Malnutrition	Higher rates of malnutrition	Uncertain, complex relationship but potentially more transmission and more severe disease

Factor	Context in Africa (compared to other regions)	Potential impact on COVID-19 (compared to other regions)
Noncommunicable disease burden	Lower rates of total NCD burden	Uncertain impact on transmission, less severe disease, but many undiagnosed so true burden of NCDs unknown
Other infectious disease burden	Higher rates of HIV, AIDS, TB and malaria, more frequent exposure to a variety of infectious diseases, insufficient data on influenza burden	Uncertain relationship with transmission and severity
Population density	Lower overall population density Certain locations with high population density	Less transmission overall, but more transmission in areas with high population density such as large cities and urban slums
Sex distribution	Nearly equal male to female, similar to rest of world	Similar impact
Temperature	Warmer average temperature, variable humidity	Uncertain, possibly less viable conditions for virus stability in warmer regions
Travel	Lower proportion of international travelers from high-risk countries	Less importation of cases (not considering travel restrictions)
Urbanization	Lower proportion of urban population	Less overall transmission, but still high in cities and other dense areas
Vitamin D	Higher rates of vitamin D deficiency	Uncertain impact on transmission, more severe disease

A younger age distribution, lower overall population density, warmer temperature, less urbanization and other factors common in Africa tend to favor less transmission and less severe disease. Conversely, larger households, high rates of malnutrition, high rates of infectious diseases and other factors may lead to additional burden in comparison to other regions. The balance of these factors will drive trends in the number of people who become sick and the number who die, regardless of whether disease surveillance is optimal.

Impact of Other Diseases on COVID-19

To date, there are few studies that look at whether diseases such as tuberculosis, malaria or HIV, or conditions such as malnutrition, have any impact of COVID-19 infection, severity or mortality. To date there is no evidence on COVID-19 and HIV from Africa, despite the high prevalence of HIV in many African countries. However, a meta-analysis looking at other, non-COVID-19 acute respiratory tract infections (including other coronaviruses) found that case fatality rates were significantly higher in people living with HIV, particularly in children under 5.

COVID-19 Severity and the Impact of Age Distribution

Applying pandemic influenza frameworks to COVID-19 can help estimate impacts and identify appropriate mitigation strategies, including public health and social measures. A pandemic severity assessment framework (PSAF) allows for initial and ongoing assessment of how infectious and severe a virus is, which informs decision-making.

Although data is continuing to evolve and there is some uncertainty, COVID-19 is currently at between three and five on a five-point scale for transmissibility, and between four and six on a seven-point scale for severity, projecting to a high to very high severity pandemic globally. *(See Figure 4)*

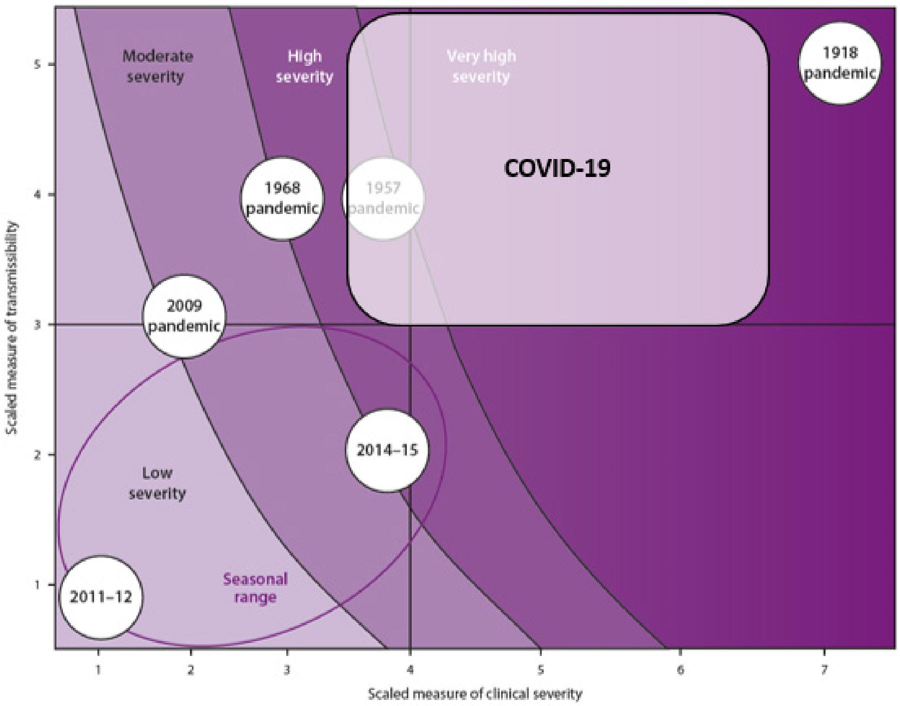

Figure 4 Global COVID-19 PSAF - 25 April 2020

As the pandemic progresses, more accurate categorization will be possible. The most recent comparable influenza pandemics may be those in 1957 (H2N2) and 1968 (H3N2), which resulted in an estimated 1.1 million and 1 million deaths, respectively, albeit in a much different global context. Vaccines and medications can be developed more rapidly than a half-century ago. Intensive care is more effective now, but today diseases can have greater impact due to increased travel and urbanization, larger populations of older people and those with underlying health conditions, and wide disparities in preparedness across the world. Although there is now more timely access to information compared to the 1950s and 1960s, there is also faster spread of misinformation.

Estimates of transmissibility based on the estimated basic reproductive ratio (the number of secondary cases arising from a single case, represented as Ro) range between 1.4 and 5.7. In addition, there is likely little or no population immunity to the virus that causes COVID-19. Transmissibility estimates may be inflated if secondary cases arise from unrecognized index cases (meaning the source case is not identified) and underestimated if mild or asymptomatic secondary cases are underdiagnosed.

Available measures to assess severity include case-fatality ratio (CFR), deaths-to-hospitalization ratio, and proportion of intensive care unit (ICU) admissions. Severity may be overestimated since it is easier to detect more severe cases but may be underestimated if mild or asymptomatic cases are not identified or if complications are delayed. The global CFR of 6% to 7% is likely an overestimate, because it is calculated based on identified cases of COVID-19. To correct for both underreporting of mild cases and the time lag between cases and deaths, the infection fatality rate (proportion of all people with infection who die), which the World Health Organization (WHO) estimated at 0.1-0.8%, was considered. To more accurately ascertain disease severity, longitudinal monitoring of outcomes of infected patients should be undertaken, stratifying by age, sex and medical comorbidities. Mortality surveillance in places with strong vital statistics programs should be established to track the trends and the pandemic's impact on overall mortality.

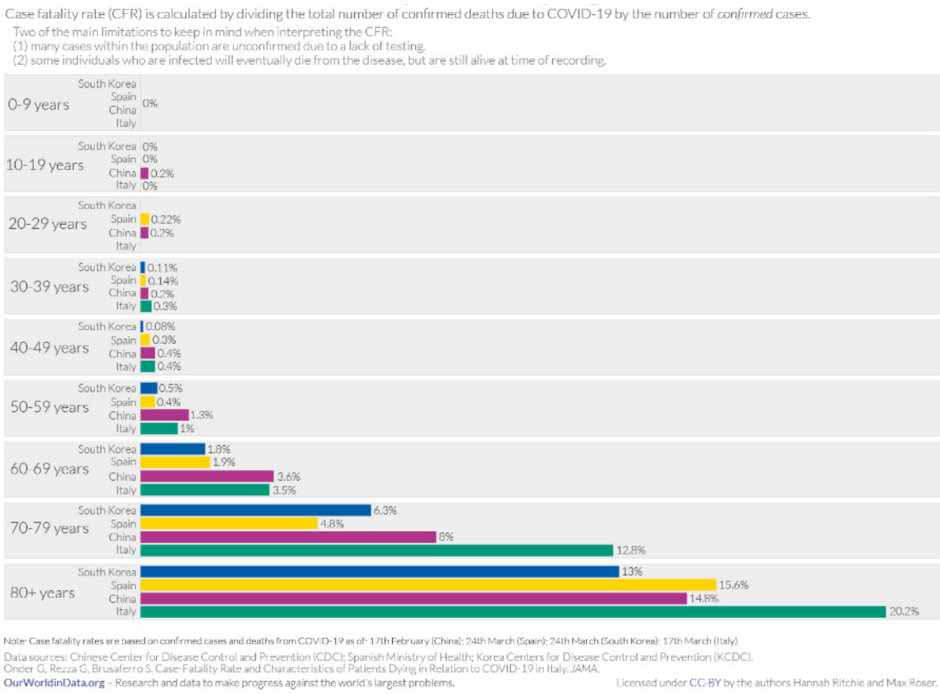

Figure 5 Coronavirus: case fatality rates by age

In Africa, contextualization of the pandemic severity assessment framework is important especially when considering the age structure of the population and how it varies from other regions which have been heavily affected by COVID-19 so far. Based on our current understanding of the clinical spectrum of COVID-19 illness, age is the most important factor in disease severity. Documented case-fatality rates rise significantly with age (See Figure 5). Notably, in the 60- to 69-year-old age group and above, the case-fatality rate starts to exceed 1% and rises with age. Conversely, in younger age groups COVID-19 has a much lower case-fatality rate, including very few pediatric deaths. In countries with high COVID-19 mortality such as Italy, France, Spain and the United State, the proportion of the population older than 65 is much higher when compared to countries in Africa *(See Table 2)*. As expected, the observed case-fatality rates are also higher in these countries.

Country	Percent of population greater than 65 years	Cumulative case-fatality rate as of April 23, 2020
France	20%	13%
Italy	23%	13%
Spain	19%	11%
United States	16%	5%
Democratic Republic of the Congo	3%	7%
Ethiopia	4%	3%
Nigeria	3%	3%
South Africa	5%	2%
Sub-Saharan Africa	3%	5%
World	9%	7%

One can disaggregate the pandemic severity assessment framework by age, to better understand the potential impact of COVID-19 on different segments of the population. Using age-specific transmissibility estimates and severity estimates from countries around the world, the framework shows a wide-range of COVID-19 pandemic severity between different age groups (See Figure 6). For those age 60 and above, this is a very high-severity event with significant mortality. For those in the middle age groups (20-59 years), this is a moderate to high severity event. For those less than 20 years old, COVID-19 is a low severity pandemic similar to seasonal influenza. In Africa, which has a higher proportion of younger people than any other continent, this means that based on age alone we might expect COVID-19 to have less severe clinical impact than in other regions of the world. This also means that the populations we believe are most vulnerable (older and those with underlying conditions) can be more easily shielded, since they are fewer and tend to live in more rural locations . One preliminary modeling study examining COVID-19 response strategies in Africa concluded that high uptake of shielding in vulnerable populations, when coupled with self-isolation of symptomatic people and moderate physical distancing, reduced predicted peak mortality estimates by 60% to 75%. The feasibility of such an approach much be considered to better understand how it might be implemented successfully.

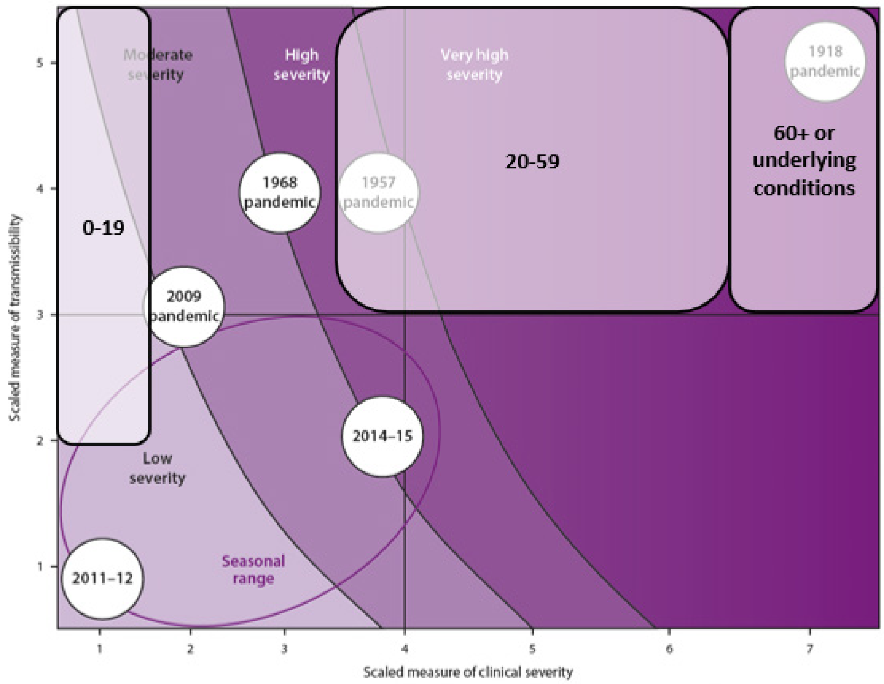

Figure 6 Future: Age-specific COVID-19 PSAF - April 25, 2020

Other considerations for measuring and mitigating the impact of COVID-19

As the COVID-19 pandemic continues to evolve in Africa, other factors affecting transmission should be considered. These include:

Awareness of country gaps. Almost all African countries have undertaken preparedness assessments (Joint External Evaluations) since 2016, and have a baseline understanding of their gaps in preparedness for outbreaks. Many countries had started implementing activities in their national action plans for health security and some of the previous gaps were being addressed. The work done by countries ahead of time to develop country pandemic preparedness plans and develop and implement national health sector strategic plans have helped countries be relatively better prepared than they were in the past. Community surveillance systems for polio, contact tracing systems for other infectious diseases, and investments in laboratory systems supporting other diseases have been useful tools for tracking imported cases that led to the first wave of COVID-19 infections in most countries.

Early aggressive action. Many African countries began preparations for COVID-19 before there were any cases detected on the continent, as they witnessed the evolution of the pandemic in other parts of the world. South Africa declared a national state of disaster and implemented a national lockdown before reporting its first COVID-19 death. Uganda suspended public gatherings before the first documented case in the country. Nigeria set up COVID-19 screening at international airports and established a Coronavirus Preparedness Group nearly one month before the first case was detected. These early actions likely contributed to reduced transmission rates and a reduction of disease spread.

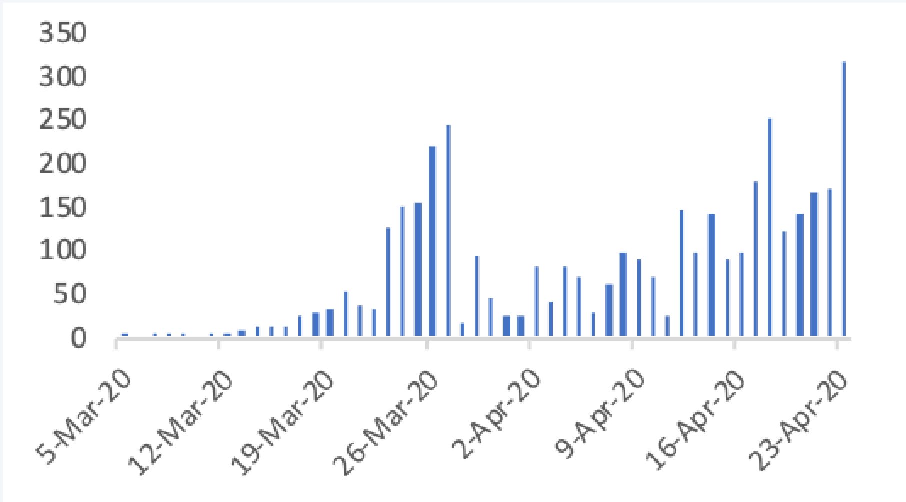

Figure 7 New COVID-19 cases in South Africa, by date

Distinct transmission phases. In many countries, the majority of confirmed cases during the initial phase of epidemic were in travelers and their close contacts. Containment of those clusters delayed progression to widespread community transmission. For example, in South Africa, there was an initial peak in cases in late March linked to travel, followed by a decline in daily cases. There was another rise in cases in late April that primarily represented locally acquired disease. Overall, if this pattern is repeated in other countries, then we may still see an exponential increase in cases in the coming weeks as community transmission continues, especially if public health and social measures are lifted or imperfectly implemented.

Estimate of total cases. In Africa, as in many parts of the world, many cases are going undetected. One way to understand how many total cases might actually exist is to extrapolate the total cases based on death data , since deaths are generally easier to detect. Using death also has limitations in areas where most deaths occur in the community and might not be captured in vital statistics. One recent estimate of the infection fatality rate, or the percentage of deaths among all of those who are infected, is around 0.66% people out of every 1,000 with COVID-19 will die. As of April 28, 2020 there were 1,469 deaths and 33,566 COVID-19 cases reported in Africa. Using the infection fatality rate to determine total cases based on deaths suggests that many cases are not being reported: if 0.66% of those infected die, and 1,469 have died, we can expect 222,576 total cases. This is a simplistic estimate but useful as a rough indication that there are many undetected cases in Africa, as there are in every other region in the world.