Sub-Saharan Africa SARS-CoV-2 Surveillance System: Policy, Persistence & Transmission

Cameron Jones[1], Salem T Argaw[2], Charles B Moss[3], Robert Murphy[4], Chad J. Achenbach[5], Michael Ison[5], Danielle Resnick[6], Lauren Nadya Singh[7], Janine White[7], Tariq Z Issa[2], Michael J Boctor[2], James F. Oehmke[7], Lori Ann Post[7]

[1]Department of Emergency Medicine, [2]Feinberg School of Medicine, [3]Institute of Food and Agricultural Sciences, University of Florida, [4]Institute for Global Health, [5]Division of Infectious Disease [6]International Food Policy Research Institute, [7]Buehler Center for Health Policy & Economics

Background

- The world's scientific community has sought to better surveil, treat, and prevent COVID-19 since its emergence in 2019
- While sub-Saharan Africa's (SSA) aggressive and early response was advantageous, health system infrastructure remains a concern, as does the impact of lockdown measures on poverty and food insecurity
- Insufficient testing, asymptomatic infections, and poor reporting reveal a need for better and more accurate surveillance metrics

Research Objectives

- Improve infectious disease surveillance with new surveillance metrics of COVID-19 to measure the dynamics of the pandemic
- Use these metrics to explain where and how rapidly COVID is transmitting, and quantify shifts in the rate of acceleration or deceleration in order to inform policies to mitigate and prevent COVID and food insecurity in sub-Saharan Africa

Methods

- We derive COVID transmission in terms of: 1) speed, 2) acceleration or deceleration, 3) change in acceleration or deceleration (jerk), and 4) 7-day transmission rate persistence for separate 7-day periods (9/1-9/7, 9/8-9/15)
- We extracted 60 days of COVID data in 47 sub-Saharan countries and employed an empirical difference equation to measure daily case numbers as a function of the prior number of cases, the level of testing, and weekly shift variables

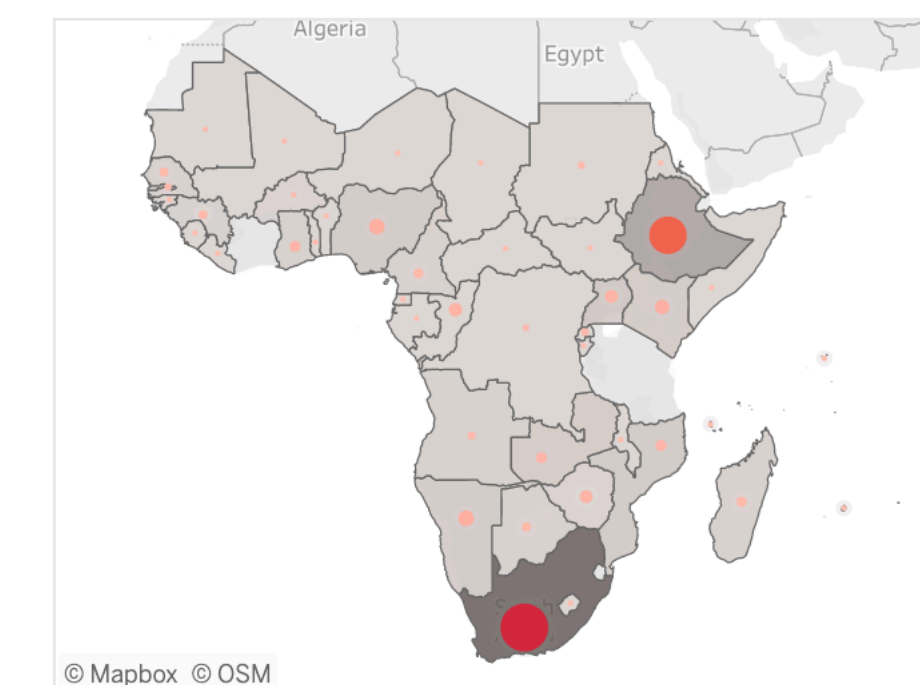## Weekly Statistics by SSA Country
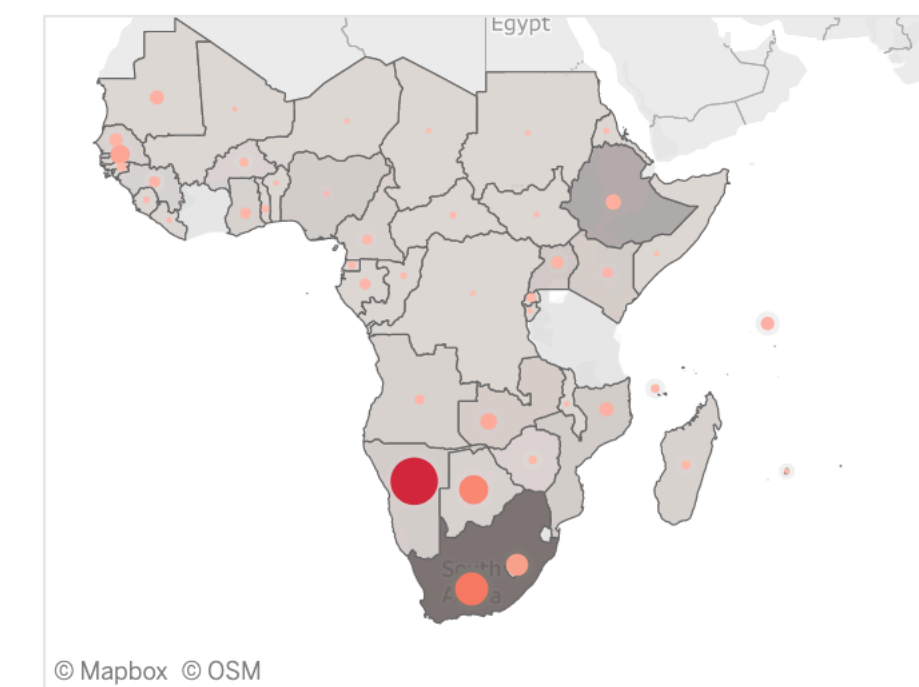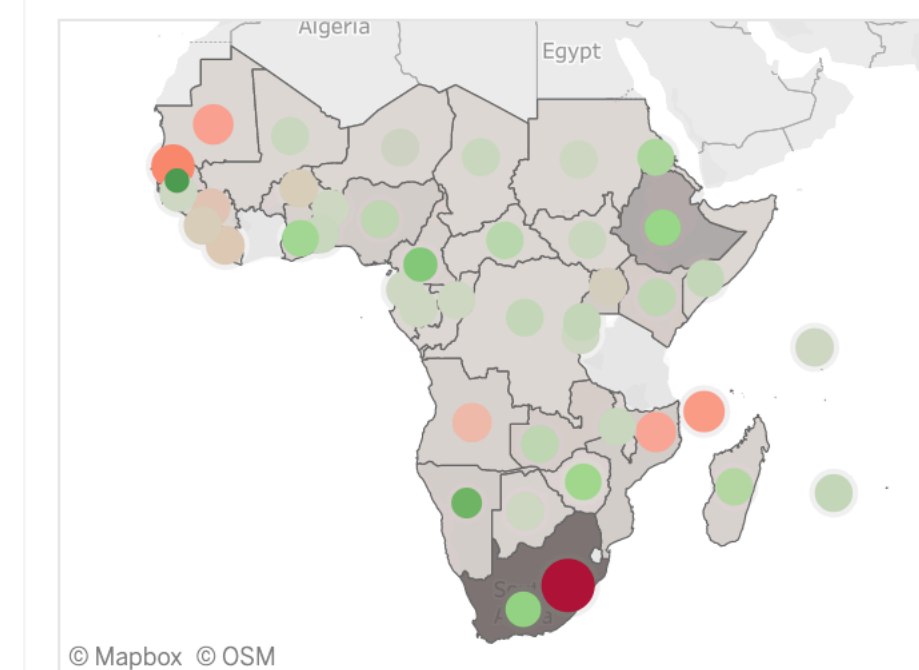

Speed: The number of new daily observed reported COVID-19 cases. Expressed as the number of new cases per day.

7-day persistence effect: the statistical impact of the 7-day Lag of Speed on today's value of Speed. Quantifies the echo effect of the new cases per day 7 days later.
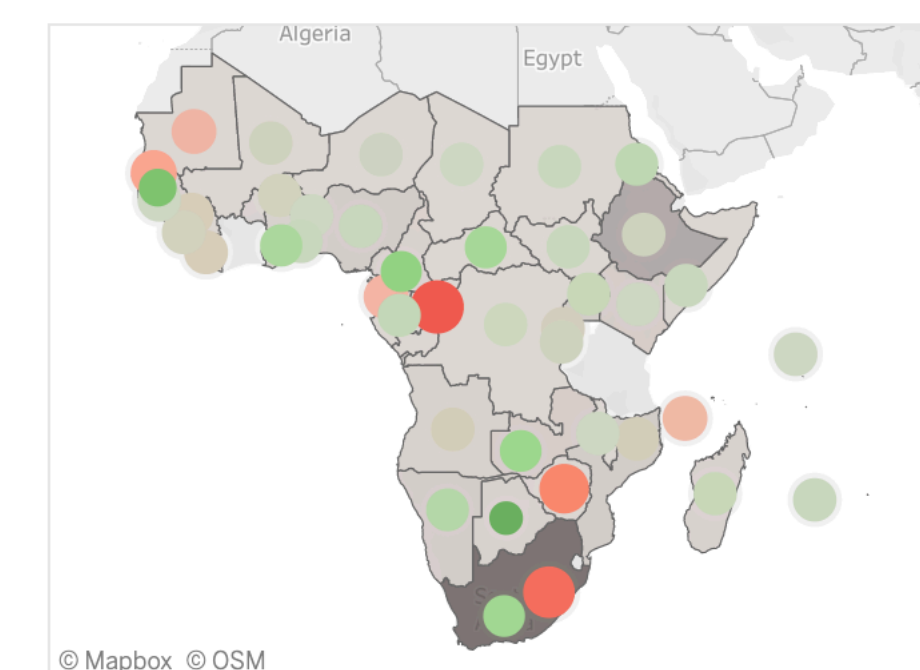

Acceleration: the day-to-day change in Speed, measured as a weekly average. A positive value indicated Speed is increasing, a negative value indicates Speed is decreasing

Jerk: the change in Acceleration, measured as the difference between this week's Acceleration and last week's Acceleration. It is the change in the change of new rates.

Results

- The speed, acceleration, jerk, and 7-Day persistence indicate rates of COVID transmissions differ from observed cases
- Cape Verde and South Africa have the highest rate of COVID infections per 100,000 (*speed)* for both weeks
- Senegal, Lesotho, and Cape Verde are rapidly accelerating and have the highest jerk rates, meaning that the acceleration of COVID transmissions has jerked the acceleration rate upwards
- The same 5 countries:--Nigeria, Kenya, Namibia, Ethiopia, and South Africa—have the highest 7-day persistence for both weeks
- The regression results validate the model
- The decrease in the transmission model R value is consistent with a de-escalation in the pandemic in SSA in general

Limitations

- Data are available at the country level, and additional data collection and analysis are necessary to understand variations within countries
- A lack of public health infrastructure in certain countries and regions often result in the release of several days worth of data on a single day, so we report average daily cases to limit the effect of batching

Conclusions

- Standard surveillance metrics such as daily observed new COVID cases or deaths are necessary but insufficient to mitigate and prevent COVID transmission
- It is also important to know where transmission rates are accelerating / decelerating, how quickly this rate is changing (*jerk)*, and how many cases today are a result of new infections 7 days ago
- SSA is home to some of the world's poorest countries, but development and population size are not necessarily predictive of outbreak severity; wealthier countries, such as the U.S., can learn lessons from SSA on effective mitigation efforts

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