

A STUDY OF COVID-19 DATA FROM AFRICAN COUNTRIES

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Outline

- Introduction
- Global COVID-19 Situation
- Situation in Africa
- Impact on The African School of Physics (ASP)
- ASP COVID-19 Exercise
- Conclusions

Introduction

- The WHO predicts that 29 to 44 million Africans could be infected with SARS-CoV-2 during the first year of the pandemic and 83 to 190 thousand Africans could die if they don't uphold containment measures
- This grim prediction suggests that most African countries have a lower transmission rate than the other regions of the world such as Europe, the United States of America, and China
- However, the low transmission rate may prolong the outbreak over several years, putting pressure on economic resources
- The containment measures such as frequent hand washing, isolation, contact tracing, and social distance are a challenge in Africa—around 60% of the African population lives below the poverty line and cannot afford the basic hygienic amenities
- In Africa, the outbreak of COVID-19 has already claimed thousands of lives, rendered millions jobless, increased in-security and poverty level
- A number of studies have been performed on the evolution and impact of COVID-19 in Africa, and on the African responses to the pandemic
- **We hope that our study contributes to the understanding and containment of COVID-19**
 - <https://arxiv.org/pdf/2007.10927.pdf>

Global COVID-19 Situation

- <https://coronavirus.jhu.edu/map.html>
- <https://www.nytimes.com/interactive/2020/world/coronavirus-maps.html>

Situation in Africa

- <https://africacdc.org/covid-19/>

Impact on the African School of Physics

- **ASP2020, planned for July 2020 in Morocco, was postponed**
 - *ASP2020 students were already selected*
 - *Preparation was at an advanced stage*
- **We are studying options for a new date in 2021**
 - *Depending on the evolution of COVID-19*
 - *We will announce the new date in due course*
- **In the meantime, we've set up an online lecture series, since May 2020**
 - *Twice a week on Tuesdays and Thursdays*
 - *The calendar is accessible here <https://www.africanschoolofphysics.org/online-lecture-series/>*

ASP COVID-19 Exercise

- In March 2020, Dr. Kétévi A. Assamagan made a call to all the ASP alumni for this exercise
- Study and understand COVID-19 data from their country (of citizenship or residence)
 - *With the permission of their academic advisor*
- A number of ASP alumni responded to the call
 - *That's how this exercise got started*
- Ultimately, the countries that we studied are
 - *The countries of the alumni that have stayed the course*
 - **Togo** (Dr. Somiéalo Azote)
 - **Benin** (Cyrille E. Haliya)
 - **Mozambique** (Toivo S. Mabote)
 - **Rwanda** (Kondwani C. C. Mwale)
 - **Zambia** (George Zimba)
 - *Analysis in ROOT (Ebode F. Onyie)*
- **In the next few slides, we will introduce the analysis team**



Dr. Somiéalo Azote is a 33 years female physicist from Togo, currently working at the department of physics at the Université de Lomé in Togo, as part time researcher and lecturer assistant. She attended the ASP 2016.

- ❖ From April to June 2019, she worked as a part time lecturer at the Institut Nationale Supérieur de Technologies Industrielles (INSTI) of the Université Abomey Calavi in Benin.
- ❖ From July to October 2019 she worked at the physics department at Brookhaven National Laboratory (BNL) in New York (USA) as short-term postdoctoral researcher under the ASP Alumni program
- ❖ On December 2018, she has obtained her PhD in Physics (Biophysics specialty) from Stellenbosch University in South Africa.
- ❖ In 2015, she did a Master II internship for five months at Laboratoire Interdisciplinaire de Physique (LIPhy) of Grenoble in France.
- ❖ She has completed her Bachelor degree in Physics at Université de Lomé in 2011 followed by a Master II degree in Physics-Mathematics in 2014 from African Institute for Mathematical Sciences of Senegal



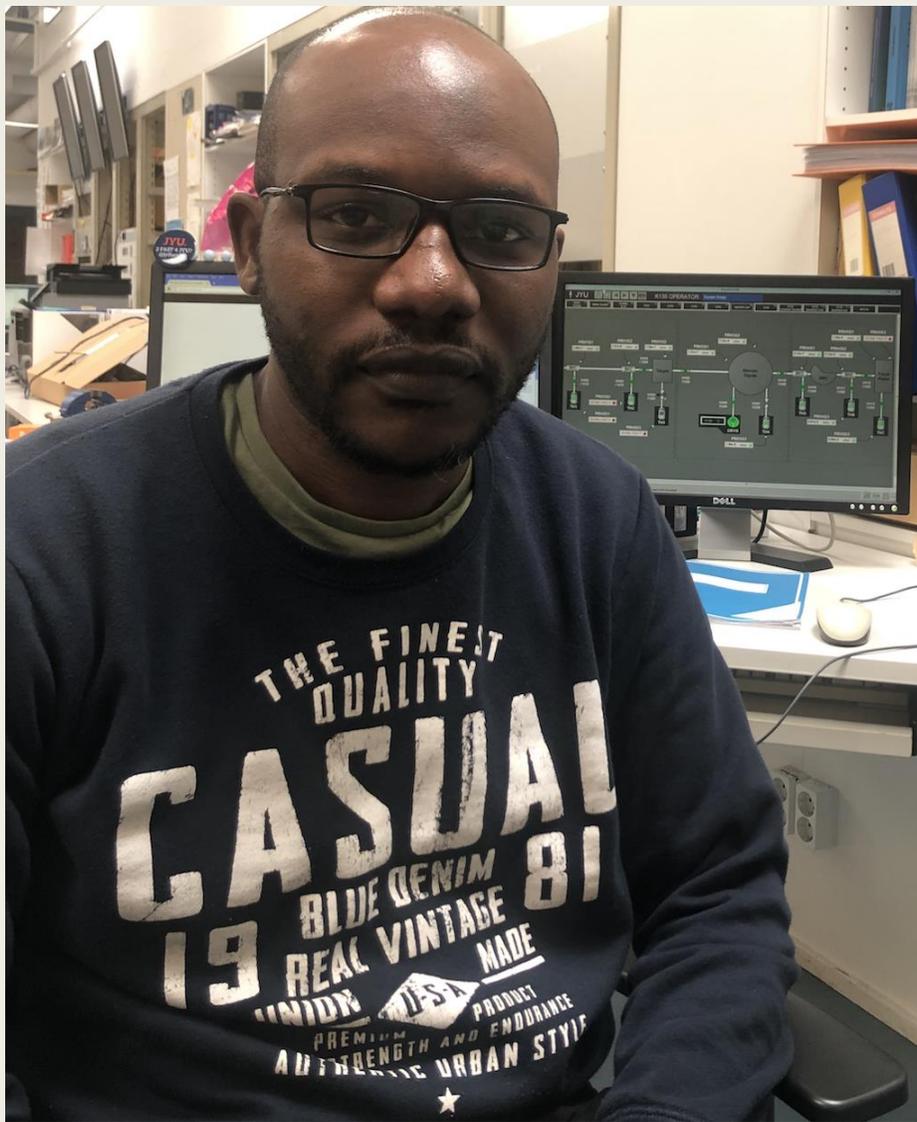
- **Toivo Samuel Mabote** is a young physicist (BSc finalist student in physics) at the Eduardo Modlane University (UEM), 24 years old and is doing his BSc project in Medical Physics

- Currently he is Tutoring the Introduction of Astronomy and Astrophysics Course at UEM.
- He belongs to ASP2020, which was postponed due to COVID-19, but now he is one of the students in the ASP2020 online lecture series.
- Since early 2019, he is coordinating many outreach activities in the Astrophysics and Space Science Group at UEM, where specifically promotes STEM through Astronomy.
- In 2019, he was part of a committee in which participated as a questioner and member of the jury, culminating in the choice of a Mozambican Bantu language to name an Exoplanet, as part of the celebration of the International Astronomical Union's 100th anniversary



EBODE ONYIE Fabien is Ph.D Student in a co-supervision between the University of Yaounde I at Cameroon and the in a project #Measuring the Charged Pion Polarizability in the $\gamma\gamma \rightarrow \pi + \pi -$ Reaction# which is A proposal to the 40th Jefferson Lab Program Advisory Committee at Jefferson Lab. This project plan to make a precision measurement of the charged pion polarizability by measurement of $\gamma\gamma \rightarrow \pi + \pi -$ cross sections using the GlueX detector in Hall D. His contribution in the project is to model the muon chamber which is a great part of the GlueX detector in HALL D to do measurements of pions and muons polarizability. For that, he uses Geant4 in order to model the detector, run some events in order to get the production of the optical photons beyond the secondary particles from muons and pions like primary particles.

He was one of the selected students for the participation at the School on the Fundamental Physics and Applications which has been held at the University of Rwanda, Kigali, from 31july to 19 august 2016.



- **George Zimba** is currently a PhD student in nuclear physics at the University of Jyväskylä. He earned his Bachelor of Science from the University of Zambia, in Zambia and a Masters from the University of Johannesburg in South Africa. George attended the African School of Fundamental Physics in 2016 in Kigali, Rwanda. George's current area of research are nuclei around the proton = neutron line. These nuclei have interesting physics properties, i.e. interchange of proton and neutron, the so-called mirror nuclei. These studies contribute to the knowledge of the fundamental features of the strong interaction.

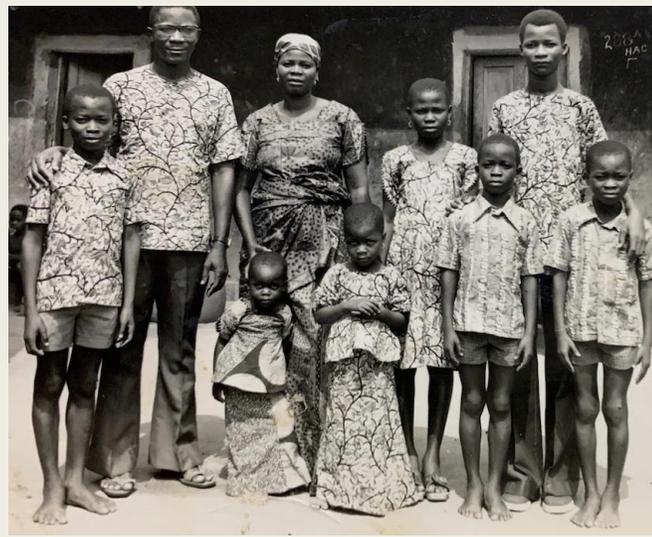


Cyrille Essossolim Haliya is born in March 1991 in Lome (Togo). He completed his master degree in Mathematical Physics in the year 2018 at the International Chair in Mathematical Physics and Applications UNESCO ICMIPA-CHAIR of the University of Abomey-calavi in Benin republic. **In 2019, He started a PhD program in the same institution but stopped few months latter due to financial issues.** He is currently teaching at Arc-en-ciel International High school of Lome (Togo). The main scope of research interest of Cyrille are nonassociative algebras, difference equations and numerical analysis; he has three submitted preprint for publication in algebra:

- On a pre-Jacobi-Jordan algebra: relevant properties and double construction ([arXiv:2007.06736](https://arxiv.org/abs/2007.06736))
- Double constructions of quadratic and symplectic antiassociative algebras ([arXiv:2007.11991](https://arxiv.org/abs/2007.11991))
- Analog of Drinfeld's double construction for anticenter-symmetric Jacobi-Jordan algebras (to be appear)



- My name is **Kondwani C.C Mwale**, a Physicists and Educationist, currently in the Final Year of a Master of Physics education at the African Center of Excellence in Innovative Teaching and Learning of Mathematics and Science (ACEITLMS) University of Rwanda- College of education Rukara Campus-(UR-CE).
- I'm a Bachelor of Education Science (Physics and Electronics) graduate from the University of Malawi Chancellor College. Am also a student at the African school of fundamental Physics and Applications (ASP 2020), In 2018 I was employed as a tutor in Physics at Lilongwe University of Agriculture and Natural Resources (LUANAR) where I worked for one year before winning a scholarship with the University of Rwanda under World Bank. I possess skills and expertise in programming like Python and Jupyter notebook which has made it possible for me to join the ASP alumni to study COVID-19 data from African countries



■ Dr. Kétévi Adiklè Assamagan

- *I am originally from Togo (father) & Benin (mother)*
- *Born in Gabon*
- *My wife is from South Africa*
- *Paternal ancestry from Ghana, Accra-Gbese, (migrated to Togo in 1665, in an attempt to avoid to be captured and sold in to slavery)*
- *I have family in West Africa, South Africa, Madagascar (until recently), soon Egypt, USA and Europe*
- *I came to the USA for graduate studies; spent post-doc time in Europe; Visiting Scientist in South Africa*
- *I've been at Brookhaven National Laboratory since 2001*
- *I am one of the organizers of the Africa School of Physics*
- *I wrote a book, "[Citizen and Traveler](#)", ISBN: 978-0-692-97479-7. I have a 2nd one in preparation*
- *I do research in experimental particle physics, searching for new physics beyond the Standard Model*

The simplest model – SIR



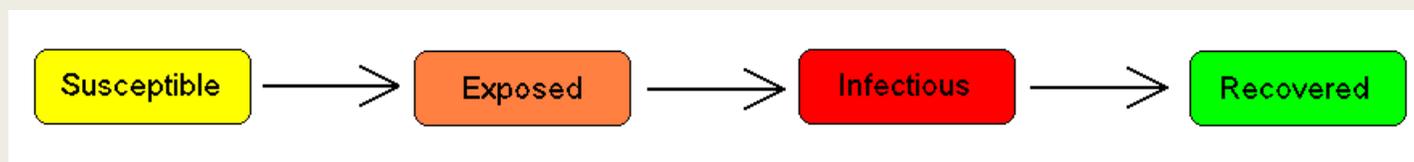
t is time, to be measured in days
 $S = S(t)$ is the number of *susceptible* individuals,
 $I = I(t)$ is the number of *infected* individuals, and
 $R = R(t)$ is the number of *recovered* individuals.
 N is the total population

$s(t) = S(t)/N$, the susceptible fraction of the population,
 $i(t) = I(t)/N$, the infected fraction of the population, and
 $r(t) = R(t)/N$, the recovered fraction of the population.

At each time t , $s(t) + i(t) + r(t) = 1$

More complicated models (1)

- The SIS Model with vital dynamics and constant population
 - *Introduce birth and death rates*
- The MSIR model
 - *For some infections such as measles, consider passive immunity (for a few months after births, babies are immune to the disease)*
- Carrier State
 - *Some people who have had an infectious disease such as [tuberculosis](#) never completely recover and continue to [carry](#) the infection, whilst not suffering from the disease themselves.*
- The SEIR model
 - *For many important infections there is a significant incubation period during which individuals have been infected but are not yet infectious themselves. During this period the individual is in compartment E (for exposed).*



More Complicated Models (2)

■ The SEIS model

- *The SEIS model is like the SEIR model (above) except that no immunity is acquired at the end*

■ The MSEIR model

- *For the case of a disease, with the factors of passive immunity, and a latency period there is the MSEIR model.*

■ The MSEIRS model

- *An MSEIRS model is similar to the MSEIR, but the immunity in the R class would be temporary, so that individuals would regain their susceptibility when the temporary immunity ended.*

■ Variable contact rates and pluriannual or chaotic epidemics

- *It is well known that the probability of getting a disease is not constant in time. Some diseases are seasonal, such as the [common cold viruses](#), which are more prevalent during winter. With childhood diseases, such as measles, mumps, and rubella, there is a strong correlation with the school calendar, so that during the school holidays the probability of getting such a disease dramatically decreases.*

Which model is best suited for COVID-19?

The SIR ...

- The rate of change in the susceptible population

1) $\frac{dS}{dt} = -bs(t)I(t)$

2) $\frac{ds}{dt} = -bs(t)i(t)$

- The rate of change in the recovered population

3) $\frac{dr}{dt} = ki(t)$

- The rate of change in the infected population

4) $\frac{ds}{dt} + \frac{dr}{dt} + \frac{di}{dt} = 0$

5) $\frac{di}{dt} = bs(t)i(t) - ki(t)$

- Finally, complete the equations by setting the initial conditions. These may / will differ for each country

- $S(0) = \text{number of people at time } t=0$ \rightarrow $s(0) = 1$

- $I(0) = \text{number of infected people a } t=0$ \rightarrow $i(0) = ?$

- $R(0) = \text{number of recovered people at } t=0;$ \rightarrow $0.$

- The parameters k and b might also be difference for different countries

The SIR in a specific example

- Assume that the population is 8 million. Further, hardly anyone was immune at the beginning of the epidemic, so almost everyone was susceptible. We will assume that there was a trace level of infection in the population, say, 1 person. Thus, our initial values for the population variables are:

- $S(0) = 8.0 e^6$

- $I(0) = 1$

- $R(0) = 0$

- $s(0) = 1$

- $i(0) = 0.125 e^{-6}$

- $r(0) = 0$

The complete set of equations specific example

$$\frac{ds}{dt} = -b s(t) i(t), \quad s(0) = 1,$$

$$\frac{di}{dt} = b s(t) i(t) - k i(t), \quad i(0) = 0.125 \times 10^{-6},$$

$$\frac{dr}{dt} = k i(t), \quad r(0) = 0.$$

We do not know what b and k are but they can be estimated / guessed for this particular example

- Assume each infected would make a possibly infectious contact every day, then **b** would be **1.0**
- Assume the average period of infectiousness at 2 days, so that would suggest **k = 1/2**

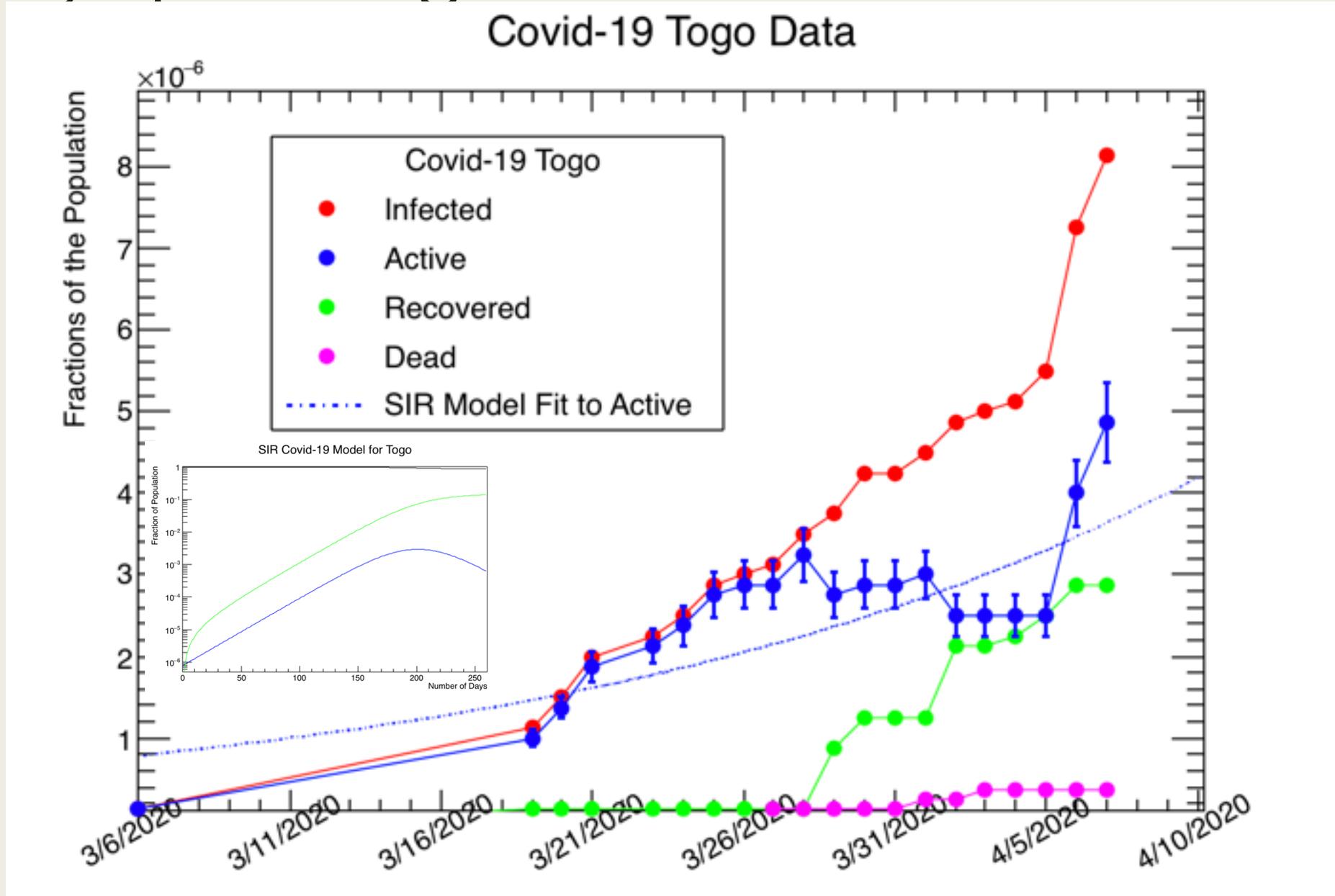
The Basic Reproduction Number R_0

- The basic reproduction number, R_0 , is defined as the expected number of secondary cases produced by a single (typical) infection in a completely susceptible population. It is important to note that R_0 is a dimensionless number and not a rate, which would have units of time^{-1} . In the SIR Model:
 - *In an epidemic, we require $di/dt > 0$*
 - *$bsi - ki > 0$*
 - *At the outset of the epidemic, everyone is susceptible, so set $s=1$*
 - **So $b/k = R_0 > 1$**
 - **$R_0 = \text{probability of infection (given contacts)} \times \text{average rate of contacts} \times \text{duration of infectiousness}$**
- R_0 is model dependent. In the SEIR Model with vital dynamics

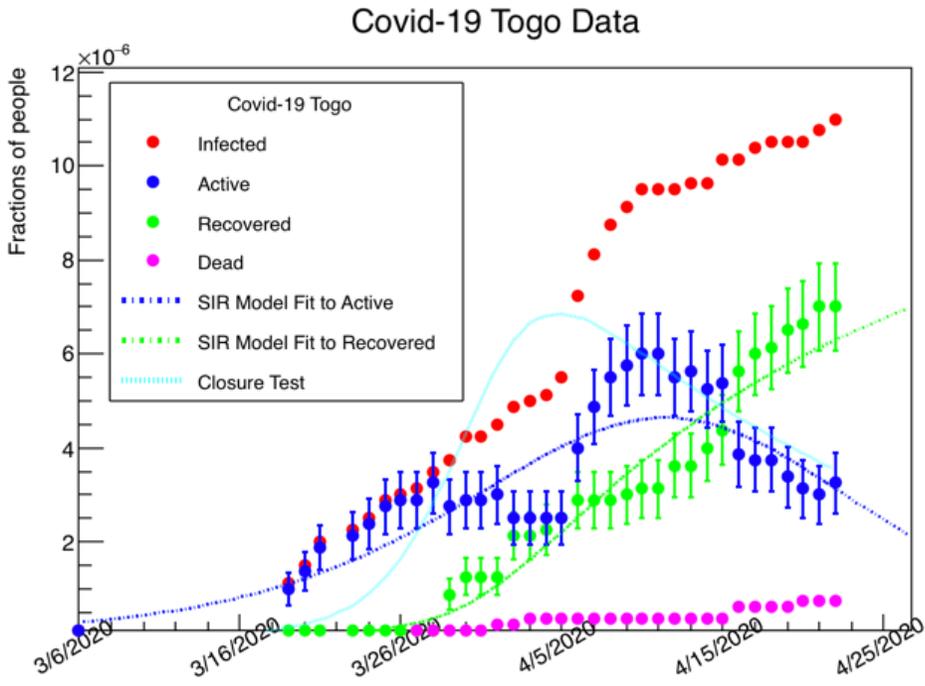
$$R_0 = \frac{k\beta\lambda}{\mu(k + \mu)(\gamma + \mu)}$$

- **$R_0 > 1$: epidemic continues; $R_0 < 1$: outbreak ends. R_0 can be used to estimate the fraction of people to vaccinate. R_0 must be applied with caution due to model dependency**

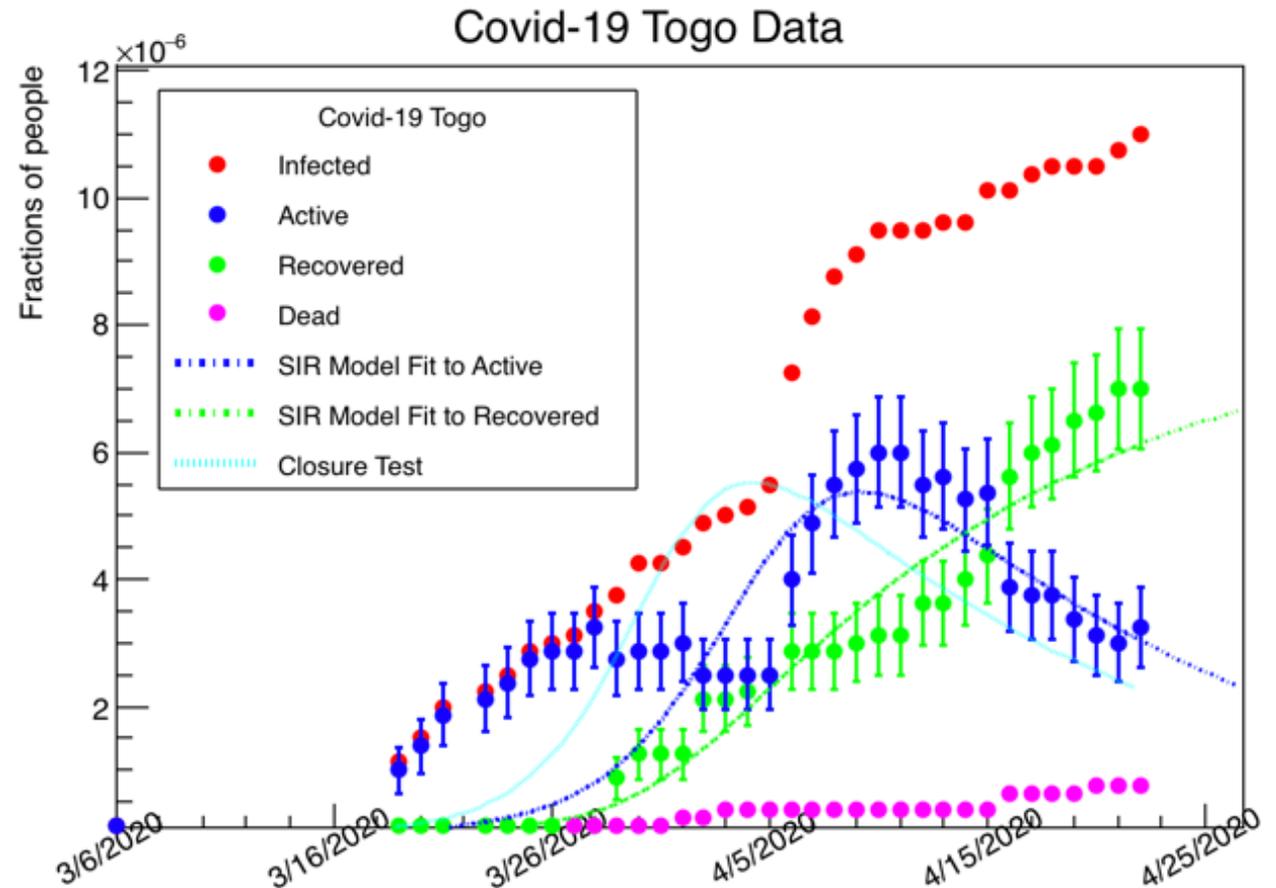
Early April in Togo



The SIR /SEIR Models do not fit the data



Features in the data (Active) are not well modeled by the SIR / SEIR

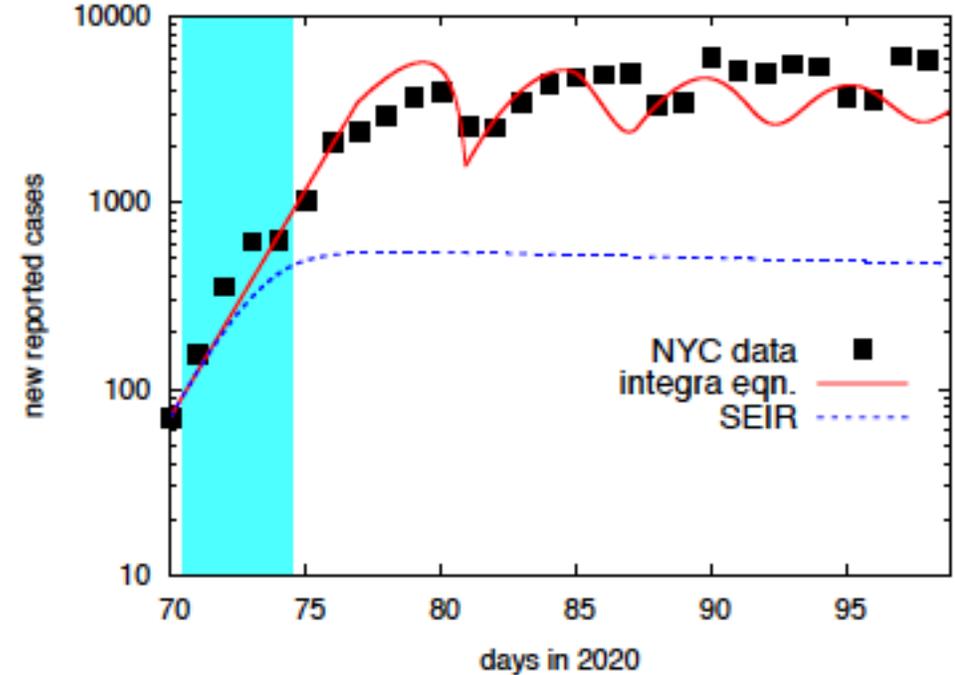
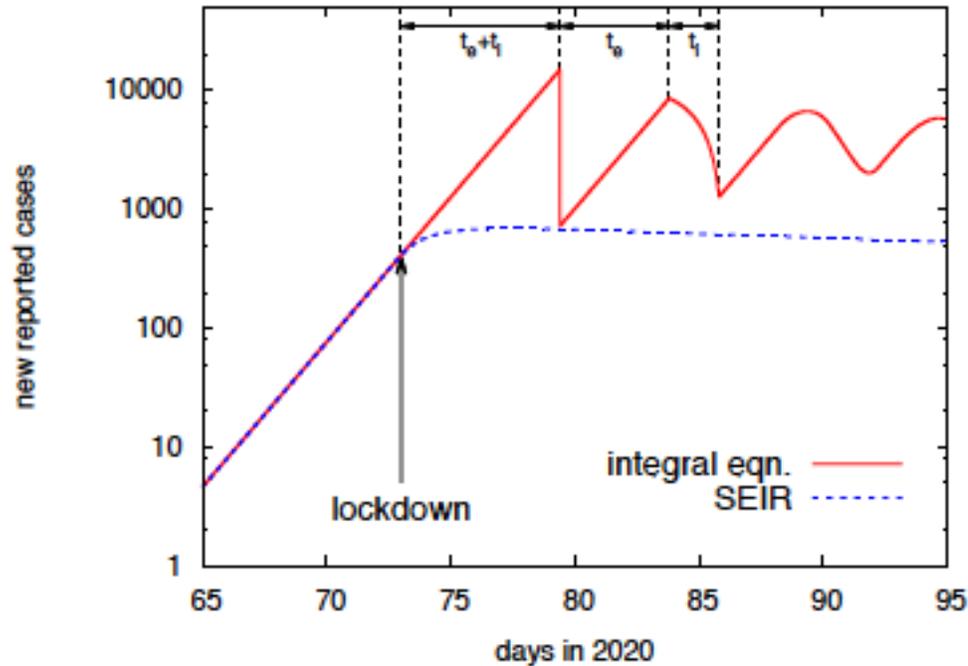


We then moved to the SEIR Model
But the mis-modelling did not improve

A successful model should fit
the 3 curves simultaneously

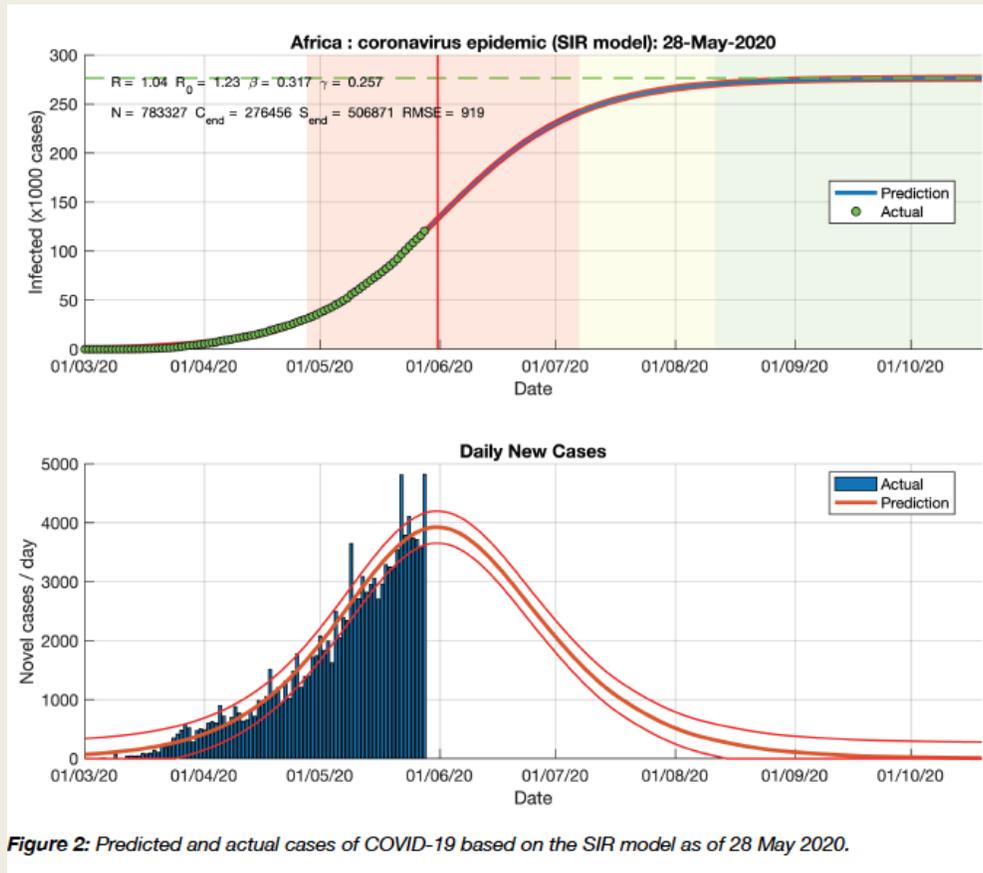
We looked at this paper

- Title: Why differential equation based models fail to describe the dynamics of epidemics
- Preprint arXiv:2004.07208
- <https://arxiv.org/pdf/2004.07208.pdf>



The COVID-19 Pandemic in Africa: Predictions using the SIR Model Indicate the Cases are Falling

doi:10.1101/2020.06.01.20118893



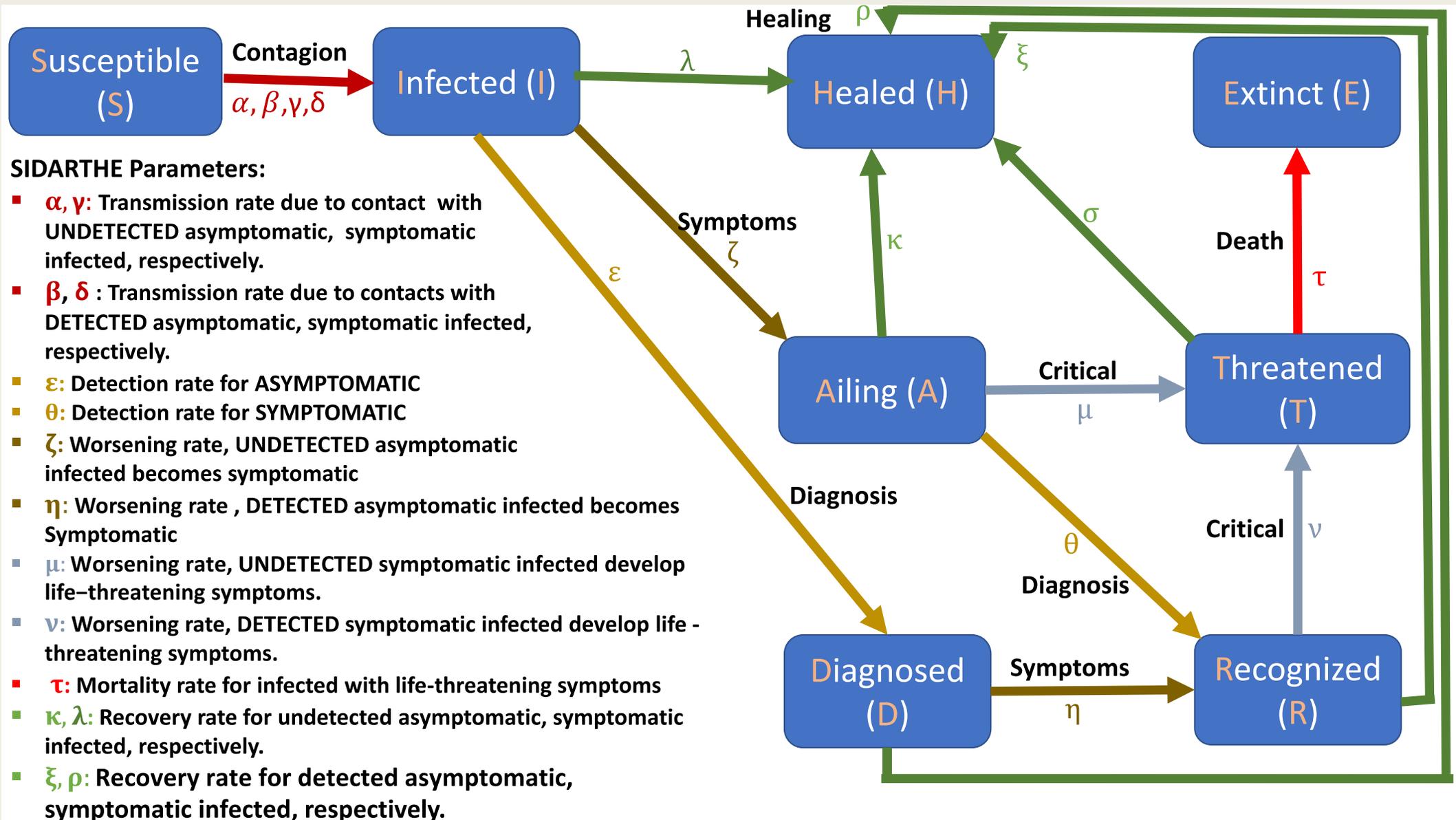
differed in the African setting compared to countries on other continents. To predict the spread of COVID-19 in Africa and within each country on the continent, we applied a Susceptible-Infectious-Recovered mathematical model. Here, our results show that, overall, Africa is currently (May 29, 2020) at the peak of the COVID-19 pandemic, after which we predict the number of cases would begin to fall in June 2020. Furthermore, we predict that the ending phase of the pandemic would be in Mid-August 2020 and that decreasing cases of COVID-19 infections would be detected until around December 2020 and January 2021. Our results also reveal

They used the SIR Model which we just showed does not model well the dynamical evolution in containment measures

The countries that we studied

- Benin
 - <https://covid19.who.int/region/afro/country/bj>
- Mozambique
 - <https://covid19.who.int/region/afro/country/mz>
- Rwanda
 - <https://covid19.who.int/region/afro/country/rw>
- Togo
 - <https://covid19.gouv.tg/>
- Zambia
 - <https://www.moh.gov.zm/>

SIDARTHE



Methods

SIDARTHE mathematical model. The SIDARTHE dynamical system consists of eight ordinary differential equations, describing the evolution of the population in each stage over time:

$$\dot{S}(t) = -S(t)(\alpha I(t) + \beta D(t) + \gamma A(t) + \delta R(t)) \quad (1)$$

$$\dot{I}(t) = S(t)(\alpha I(t) + \beta D(t) + \gamma A(t) + \delta R(t)) - (\varepsilon + \zeta + \lambda)I(t) \quad (2)$$

$$\dot{D}(t) = \varepsilon I(t) - (\eta + \rho)D(t) \quad (3)$$

$$\dot{A}(t) = \zeta I(t) - (\theta + \mu + \kappa)A(t) \quad (4)$$

$$\dot{R}(t) = \eta D(t) + \theta A(t) - (\nu + \xi)R(t) \quad (5)$$

$$\dot{T}(t) = \mu A(t) + \nu R(t) - (\sigma + \tau)T(t) \quad (6)$$

$$\dot{H}(t) = \lambda I(t) + \rho D(t) + \kappa A(t) + \xi R(t) + \sigma T(t) \quad (7)$$

$$\dot{E}(t) = \tau T(t) \quad (8)$$

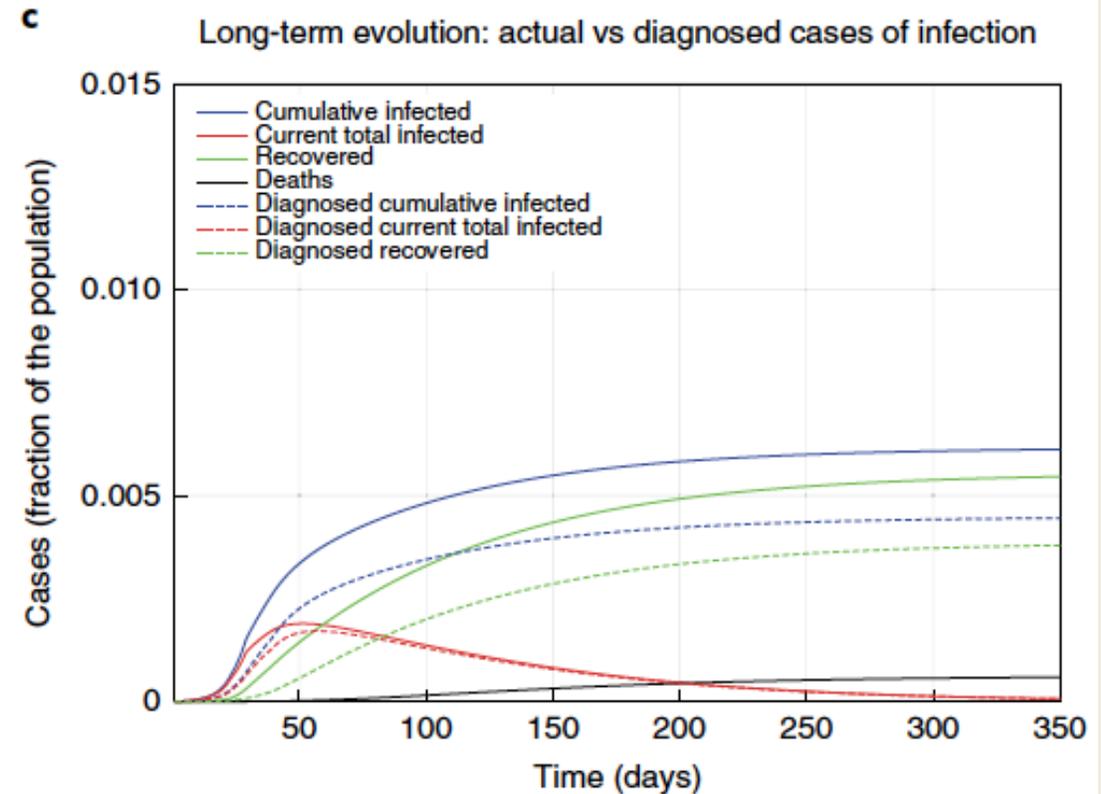
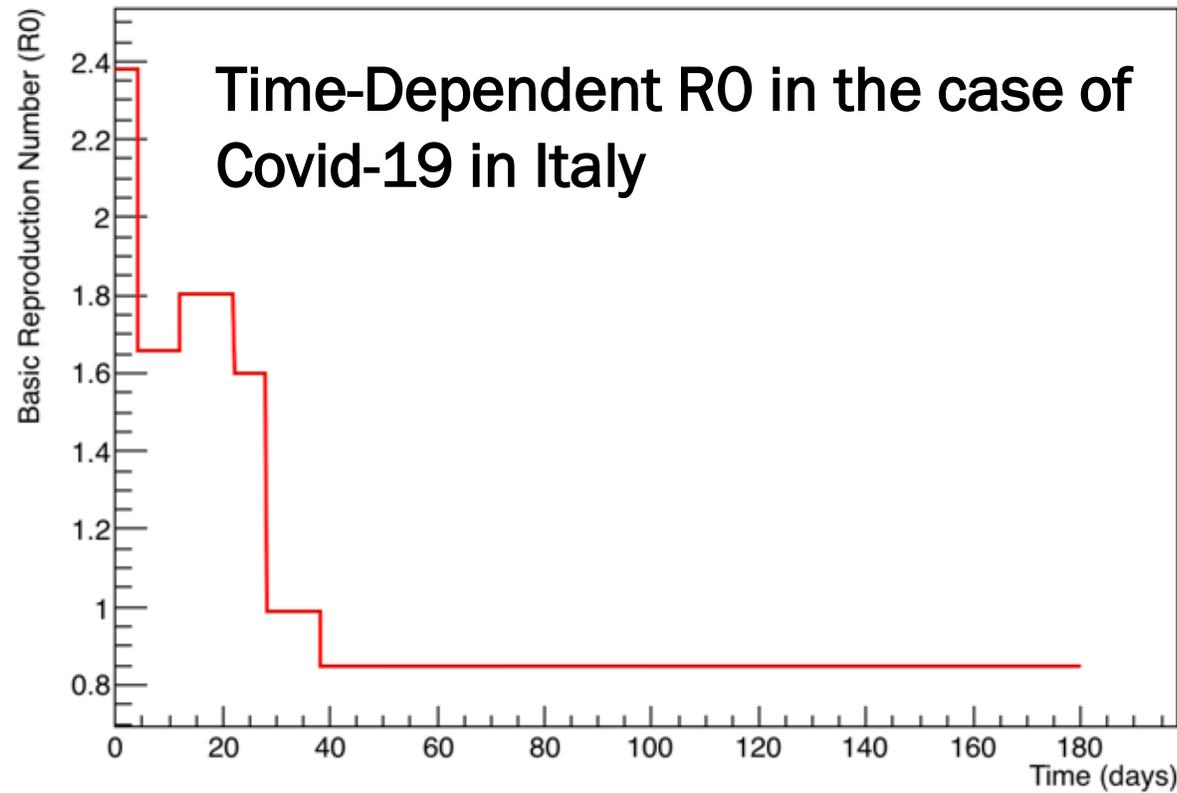
SIDARTHE – R_0 for Italy

The model parameters have been updated over time to reflect the progressive introduction of increased restrictions. On day 1, the basic reproduction number was $R_0=2.38$, which resulted in a substantial outbreak. On day 4, $R_0=1.66$ as a result of the introduction of basic social distancing, awareness of the epidemic, hygiene and behavioral recommendations, and early measures by the Italian government (for example, closing schools). At day 12, asymptomatic individuals were almost no longer detected, and screening was focused on symptomatic individuals (leading to $R_0=1.80$). On day

22, a partially incomplete lockdown, of which the effectiveness was reduced by the movement of people from the north to the south of Italy when the country-wide lockdown was announced but not yet enforced, yielded $R_0=1.60$. When the national lockdown was fully operational and strictly enforced, after day 28, $R_0=0.99$, finally reaching below 1. Moreover, $R_0=0.85$ was achieved after day 38 due to a wider testing campaign that identified more mildly symptomatic infected individuals. Figure 2a shows the model evolution

R_0 for Italy

SIDARTHE Model with Italy for a Time-Variied R_0



omatic infected individuals. Figure 2a shows the model evolution with the estimated parameters up to day 46; in the earliest epidemic phase, the number of infected was considerably underestimated. Of the total cases, 35% were undetected. In Fig. 2b, the infected

Modeling data from African countries

Togo – measures taken by the government

- On 6 March, Togolese government's officials announced the first COVID-19 case, a 42-year-old Togolese woman who travelled between Germany, France, Turkey, and Benin before returning to Togo. She was being treated in isolation and her condition was stable.
- Start contact tracing, monitoring of persons under quarantine and testing of symptomatic cases.
- Surveillance at point of entry, at the borders and airports



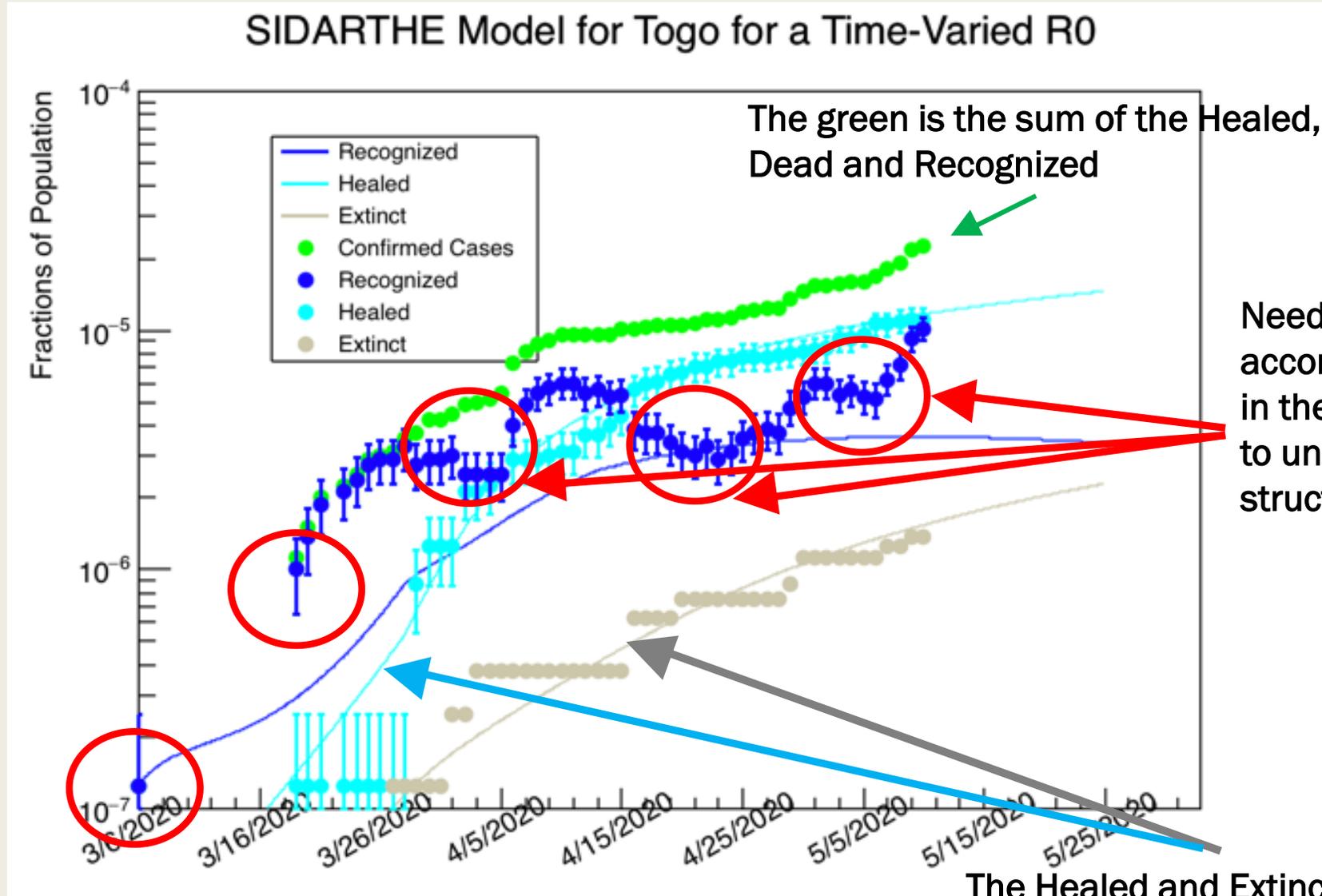
Togo continues

- After an extraordinary council of ministers on 16 March, the government established the following measures: suspending flights from Italy, France, Germany, and Spain; canceling all international events for three weeks; requiring people who were recently in a high-risk country to self-isolate; closing their borders; and prohibiting events with more than 100 people effective 19 March
- On 20 March, nine more cases were confirmed in Togo. On this day, the first case has recovered, as indicated by the Ministry of Health
- On 21 March, seven more cases were confirmed . In an attempt to control the spread of the virus in Togo, all borders to the country were closed. The cities of Lomé, Tsévié, Kpalimé, and Sokodé have been quarantined starting on 20 March. They advised social distancing, wear of masks
- For at least two and half months schools, universities, churches, saloons, bars,... were closed. Curfew established from 9pm to 6am.

Togo continues

- Truck drivers entering the borders carrying essential commodities are tested and then proceed to their destination under surveillance. The drivers are placed under quarantine if suspect to have been in contact with a confirmed case.
- On 27 March, the first death occurred.
- On 07 April, start of massive tests of both symptomatic and asymptomatic cases in cities with more than 10 cases.
- Between 5 and 20 May, the number of new cases sharply increased. This is because, neighboring countries have re-opened their borders leading to an influx of Togolese nationals returning to Togo with infections.
- From 09 June, the curfew is lifted. The government made the wear of mask compulsory for the whole population, and washing hand before accessing to any public, private services or market.

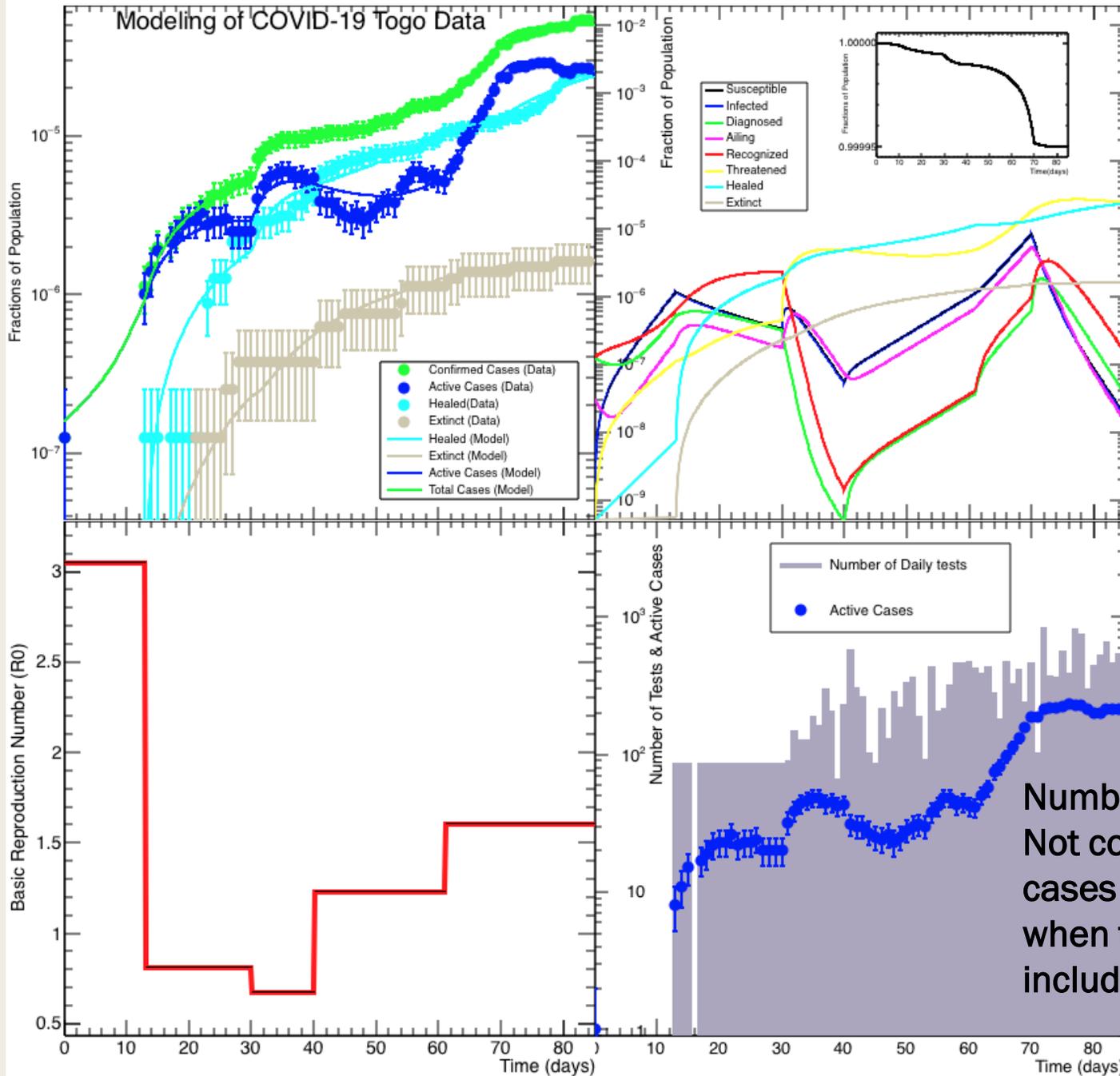
Togo data with “modified” R0 and Modified initial conditions



Understanding the Covid-19 data of Togo

- <https://covid19.gouv.tg/situation-au-togo/>
- Extinct \equiv Dead
- Healed \equiv Recovered
- **Before 7 April Active cases =**
Recognized +
Threatened
- **After 7 April Active cases =**
Recognized +
Threatened +
Ailing (or Diagnosed)

Togo



Number of daily tests
Not correlated with active cases except around April 6 when the tests started to include asymptomatic

Zambia

- Implemented closure of schools/Universities continued screening of travelers (suspension of non-essential travel to countries with confirmed Covid-19 cases).
- “locked down” churches, saloons and sports activities are still open however bars are closed :-)
- Encouraged social distancing?



Zambia continue...

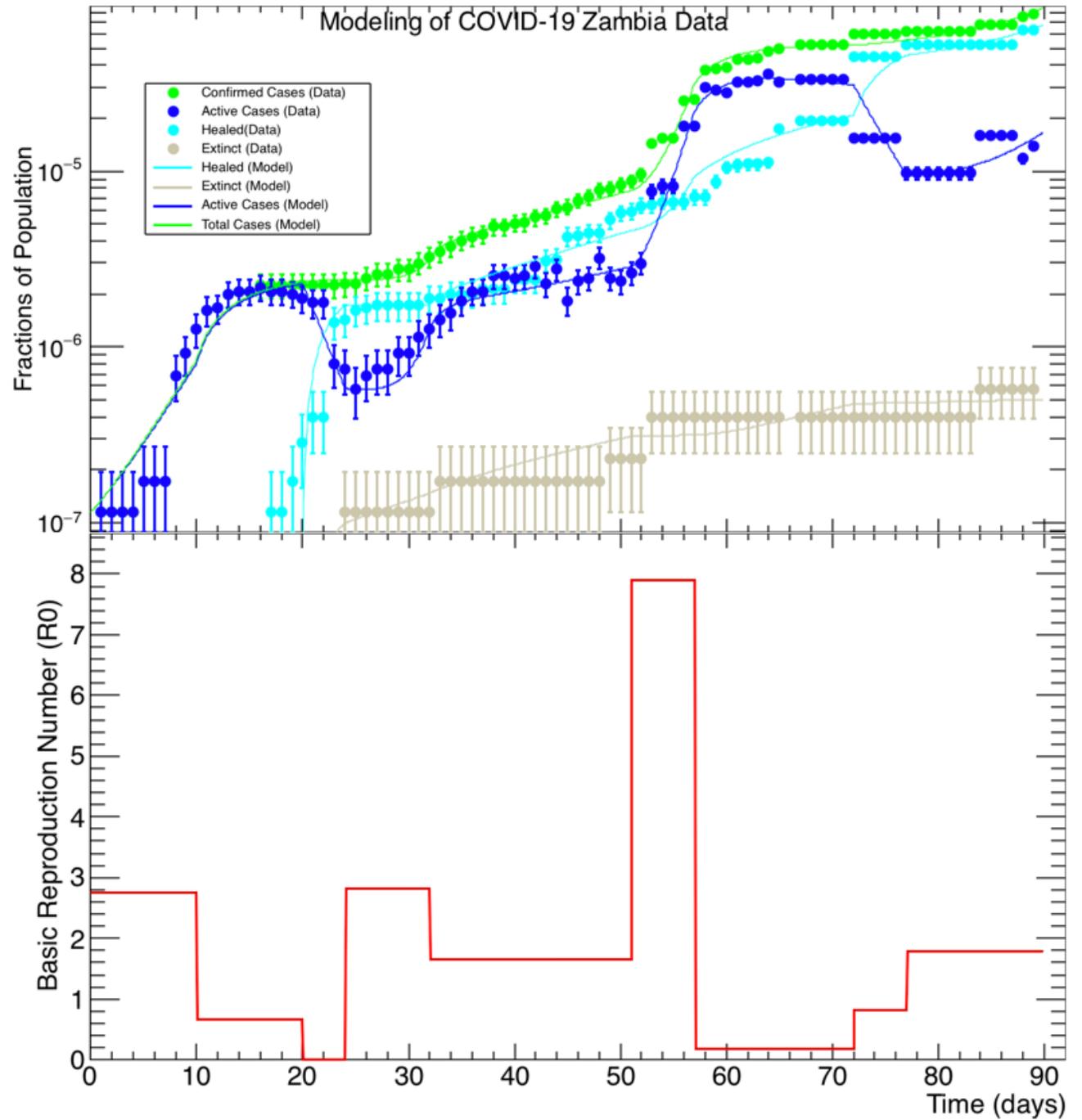
- Surveillance at community level, health facilities, point of entry (Trucks entering the borders carrying essential commodities proceed to their destination under secure escort, at which point the drivers are placed under quarantine pending test results. Other activities).
- Contact tracing and monitoring of persons under quarantine.
- **Criteria for testing:** individuals who meet the case definition or individuals who have had contact/been exposed to a confirmed positive case and/or are **symptomatic**. Testing has also been extended to all communities with confirmed cases. Testing of community alerts, suspects under quarantine, contacts of confirmed cases as well as re-testing of confirmed cases is ongoing

Zambia



On May 19, 50% increase in cases,
mostly from Nakonde

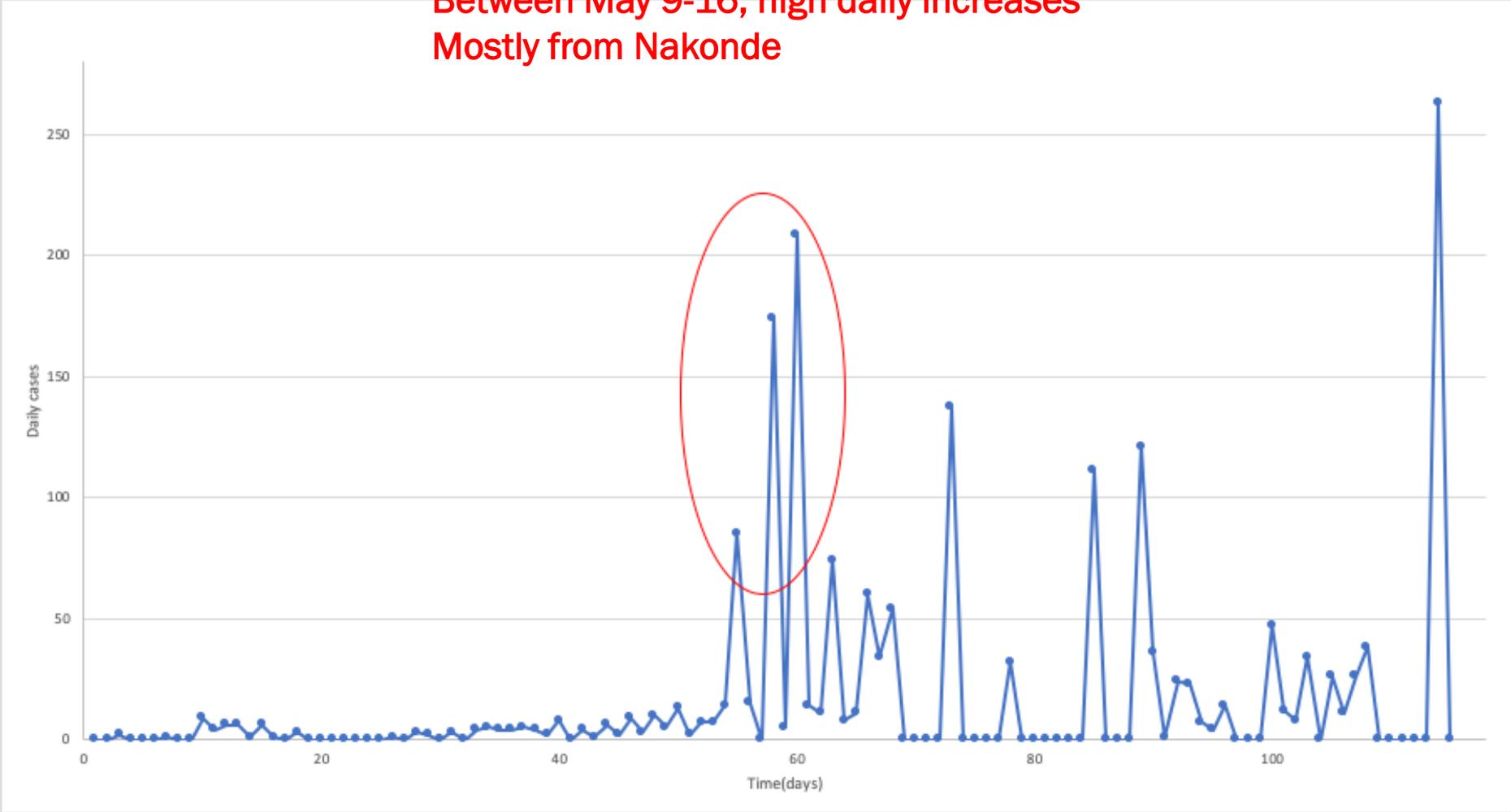
Between May 9-16, high daily increases
Mostly from Nakonde



Zambia

On May 19, 50% increase in cases, mostly from Nakonde

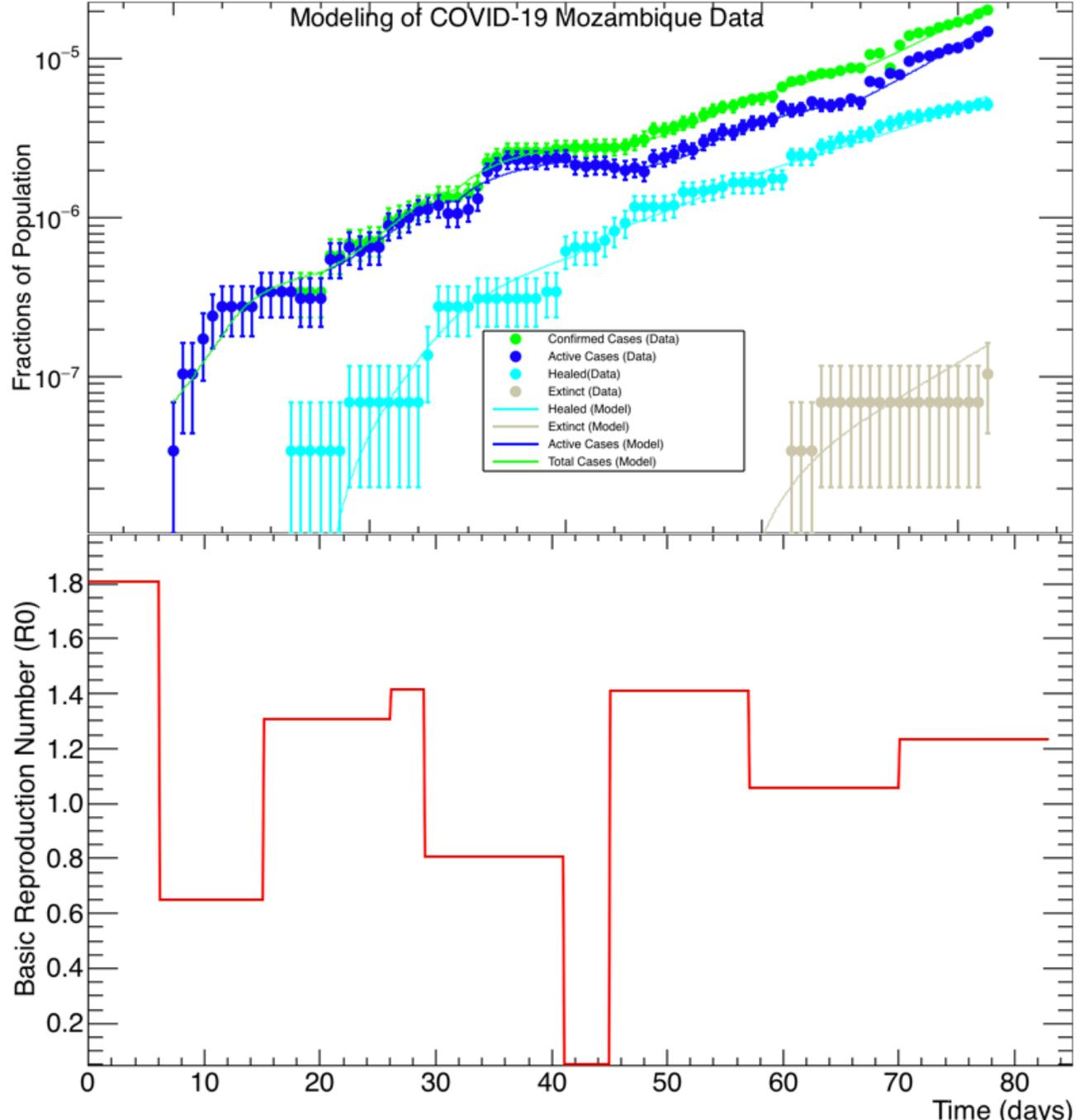
Between May 9-16, high daily increases Mostly from Nakonde



Mozambique

- The government has not imposed a lockdown yet
- The government and local authorities are studying schools re-opening strategies
- Until July 22, 1557 infected cases, 1021 active cases, 523 recovered cases and 11 dead
- Official website of Mozambican government “[Covid-19 fica atento](https://covid19.ins.gov.mz/)”
 - <https://covid19.ins.gov.mz/>

Mozambique



Understanding Covid-19 – Rwanda

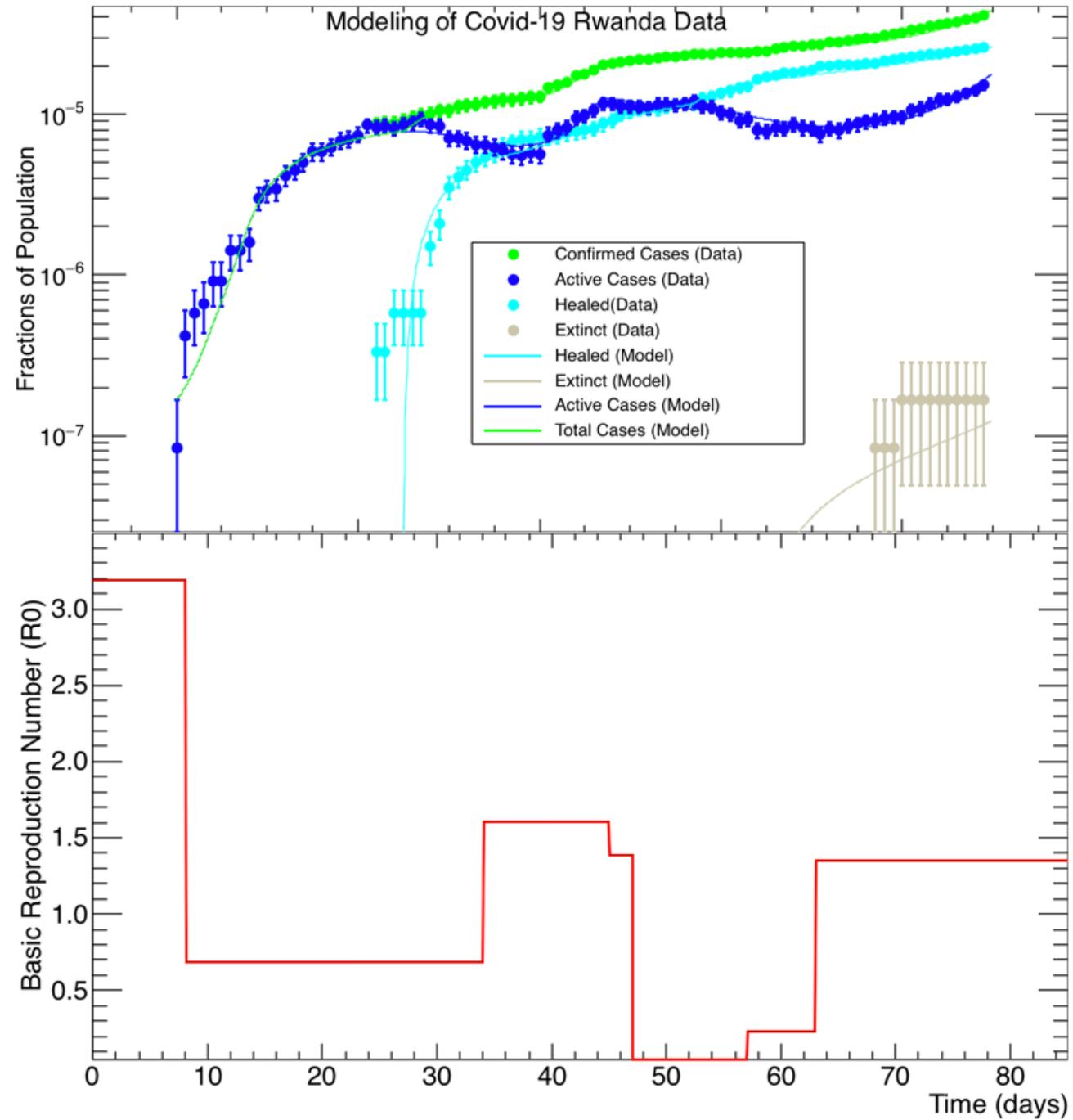
- On 14th March 2020 Rwanda confirmed first case of covid-19,
- It was a foreign national who in the country on 8th March 2020,
- He showed no symptoms upon arrival in Rwanda and he reported himself to a health facility on 13th March where he was tested immediately.
- By 15th March schools, places of worships, weddings were all postponed till further notice
- Testing of symptomatic cases started right away before the first case was identified just after world health declared covid-19 as a pandemic.
- Testing of asymptomatic cases and contact tracing started on the date same after identification of the first case on March 14th 2020.



Rwanda continue ...

- Due to increase in number of cases additional safety measures were taken, on 21st March 2020, Lockdown was implemented, by closing of markets, bars, borders, airports etc. except those selling essentials such as food and hygienic products
- **Additional information**
- Contact tracing is one of the best measures used by Rwandan Government to test asymptomatic individuals who came in contact with the infected persons
- Masks are required in all public places, markets and shops are provided with sanitizers to prevent further spread of the virus
- **NB:** Total Population of Rwanda is not less than 12 Million.

Rwanda



Benin

The first case of COVID-19 was discovered on the 16th March 2020. The government officials took these measures in response:

- Limitation to the extreme necessity of entry and exit at the land borders . Only essential crossings are authorized in conjunction with the authorities of neighboring countries. Reinforcement of control measures will be applied for the systematic quarantine of any suspect or who would try to circumvent the device.
- Restriction on issuing entry visas to Benin
- Systematic and compulsory quarantine of anyone coming to Benin by air. As a result, the Government has decided to requisition a thousand hotel rooms for this purpose.



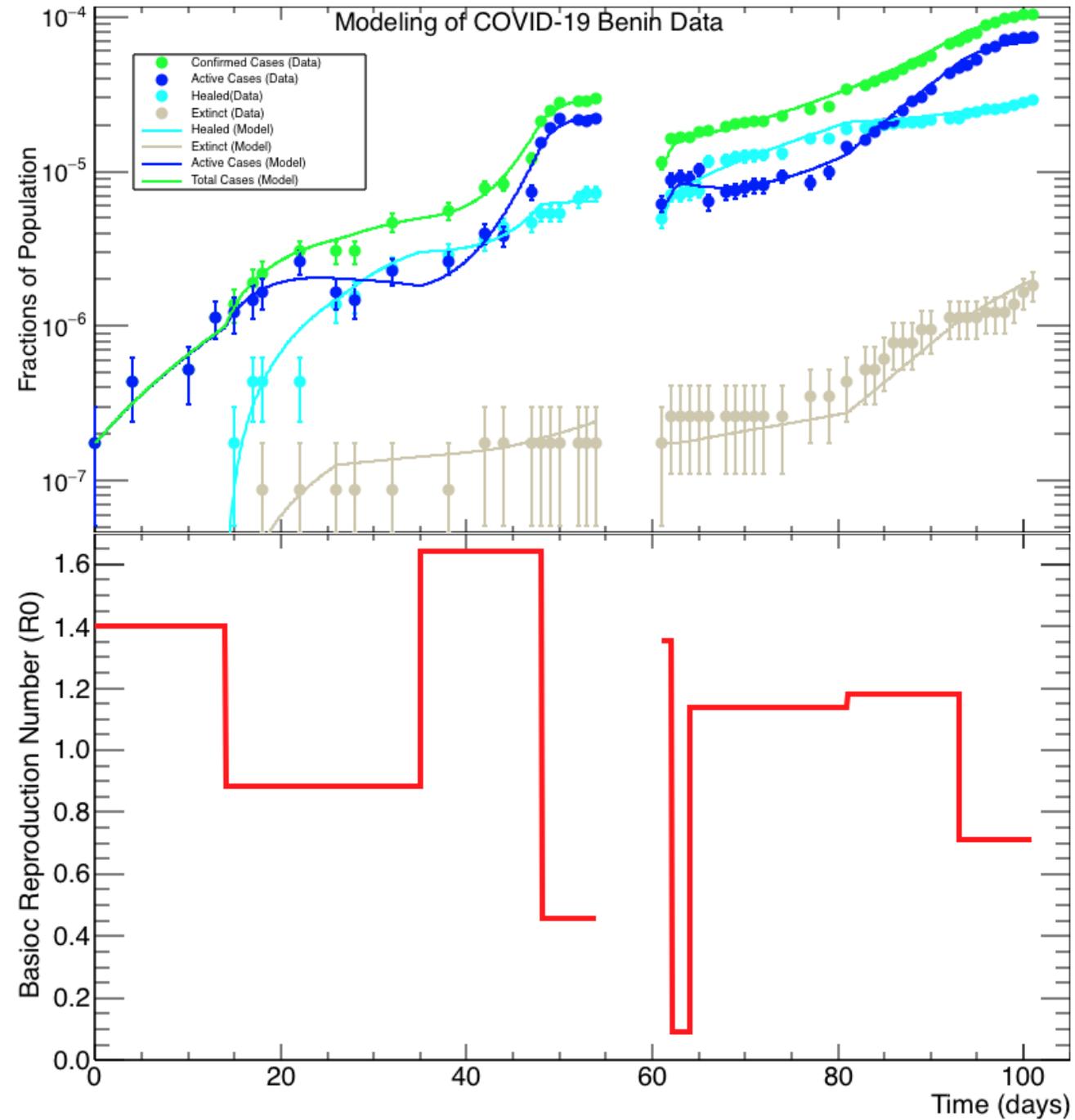
Benin

- Suspension of all missions outside the country for members of the Government and for executives of the public administration, except in case of absolute emergency. Private sector structures and individuals are urged to observe the same caution.
- Suspension of all demonstrations and all other non-essential sporting, cultural, religious, political and festive events; closing of churches and mosques.
- Obligation for public transporters to equip their employees as well as passengers in appropriate masks, and to respect the social distance of 1 meter between occupants
- Obligation for banks, supermarkets, restaurants, businesses and other establishments open to the public, to provide protection and hygiene measures, and to make customers and users aware of the social distance of 1 meter between them.
- Provision by the government, for the benefit of pharmacies, supermarkets and other structures, of stocks of protective masks whose prices will be controlled to remain accessible to all of our fellow citizens
- From Monday March 30 to Monday April 13 (note that this date was extended until 11th May), complete closing of schools and Universities

Benin

- From the 30th March a total lockdown for the most exposed to the pandemic that are Cotonou, Abomey-Calavi, Allada, Ouidah, Sèmè-Podji, Porto-Novo, Akpro-Missérété and Adjarra to isolate them from the rest of the country.
- From 30th April up to now financial donations and thousands of medical materials and equipment have been received.
- The government has requested the involvement of the medias in raising awareness in national languages
- The Republican police are intensifying awareness-raising and checks on the ground to make sure that restrictions are being observed .
- Anyone who knows of the return to Benin of people who have not self-isolated is invited to call the numbers 136 to inform the authorities.
- Note that from 11th May the lockdown on the above mentioned cities was raised and by 2nd June lot of activities restarted while respecting measures: wearing masks and social distancing between people.

Benin



The Malagasy Proposal – Covidorganics



- The World Health Organization (WHO) welcomes innovations around the world including repurposing drugs, traditional medicines and developing new therapies in the search for potential treatments for COVID-19
- The WHO recognizes that traditional, complementary and alternative medicine has many benefits and Africa has a long history of traditional medicine and practitioners that play an important role in providing care to populations. Medicinal plants such as **Artemisia annua** are being considered as possible treatments for COVID-19 and **should be tested for efficacy and adverse side effects.** Africans deserve to use medicines tested to the same standards as people in the rest of the world. Even if therapies are derived from traditional practice, establishing their efficacy and safety through rigorous clinical trials is critical.

04 May 2020

https://www.afro.who.int/news/who-supports-scientificallly-proven-traditional-medicine?gclid=Cj0KCQjwvIT5BRCqARIsAAwwD-RwTgav0Sw_-hE3YYU3BcZNWgN70fEhINq2rEBwvHin5DfkMOh31SAaAjiLEALw_wcB

Hydroxychloroquine

- Hydroxychloroquine has long been used as a treatment for malaria
- **Fact check: Hydroxychloroquine has not worked in treating COVID-19, studies show**
 - <https://www.usatoday.com/story/news/factcheck/2020/07/21/fact-check-hydroxychloroquine-hasnt-helped-covid-19-studies-show/5407547002/>
- Dr. Stella Immanuel was born in Cameroon and received her medical degree in Nigeria. In her speech, Dr. Immanuel alleges that she has successfully treated hundreds of patients with hydroxychloroquine. Studies [have failed to find proof](#) that the drug has any benefit in treating COVID-19, and the Food and Drug Administration in June [revoked](#) its emergency authorization to use it to treat the deadly virus, saying it hadn't demonstrated any effect on patients' mortality prospects.
 - <https://www.thedailybeast.com/stella-immanuel-trumps-new-covid-doctor-believes-in-alien-dna-demon-sperm-and-hydroxychloroquine>

Vaccines

- Exclusive: Russia claims it's on track to approve COVID-19 vaccine by mid-August. But speed of process raises questions
 - <https://www.cnn.com/2020/07/28/europe/russia-coronavirus-vaccine-approval-intl/index.html>
- “Dozens of vaccine trials are underway around the world and a small number are in large-scale efficacy trials, but most developers have [cautioned that much work remains before their vaccines can be approved.](#) “

Fake news and mis-information

- Some believe that COVID-19 is a scam, Africans are immune, and/or the disease has no impact in tropical climates
- Many weird video clips about COVID-19 have been shared on social media
- **A continuous campaign of community engagement with regular briefings is important; so are an active combat against fake news and misinformation**

Conclusions

- We have studied COVID-19 data from Benin, Mozambique, Rwanda, Togo and Zambia
- We modeled the data from these countries with the SIDARTHE, and extracted a time-dependent basic reproduction number for each country studied
- Our studies show that the initial reactions of African governments and populations were effective to bring the basic reproduction number below one
- However, relaxation and difficulties to maintain the measures over time drive the basic reproduction number in a time-dependent cyclic pattern of rises and falls
- We suggest that African countries find satisfactory economic supports for their most disadvantaged populations. This will encourage adherence to the containment plans