

PROJECTION OF COVID–19 PANDEMIC IN UGANDA

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Abstract

COVID–19 (Corona Virus) is caused by Severe Acute Respiratory Syndrome Corona Virus 2 (SARS–COV–2). The virus that was first discovered in China Wuhan Province about 3 months ago (first cases were reported in Wuhan on December 31st 2019) has spread world wide. The six (6) top countries (excluding China) most affected so far include; USA, Italy, Spain, Germany, France and Iran. With Italy showing the highest death toll.

In Uganda where it was discovered on 19/3/2020 with one (01) case has just in nine (9) days, increased to thirty (30) infected individuals. This model is a wake up call over the rate at which COVID–19 is likely to spread throughout the country. Thus it is a guide for policymakers and planners to benchmark on for solutions to this deadly virus.

Keywords: COVID–19, Awareness, Infection rate, Pneumonia

1 Introduction

COVID–19 is caused by Severe Acute Respiratory Syndrome Corona Virus 2 (SARS–COV–2) [1]. Corona viruses are widely distributed in many different species of animals, including bats, cattle, cats, birds, and camels [4]. The type of pneumonia caused by the 2019 novel corona virus disease (COVID–19) is a highly infectious disease, and the ongoing outbreak was declared by World Health Organization (WHO) as a global public health emergency on 1/2/2020 [2].

An individual may fail to differentiate between symptoms caused by COVID–19 and a common cold or flu because symptoms are alike. COVID–19 symptoms include; fever and cough that may

NOTE: This preprint reports new research that has not been certified by peer review and should not be used to guide clinical practice.

advance to a severe pneumonia triggering shortness of breath [13]. From the time of exposure/contact to virus, symptoms may take up to two (2) weeks [1-14 days] to show up [11]. In severe cases the disease may consequently lead to death [12].

The top 6 countries reporting the most outside China, globally, Table 1 and Table 2 [9]. The mortality due to COVID-19 varies from country to country, the age and health of the population seem to be aged above 60 years old [6]. Confirmed COVID-19 stand at 657,434 and 30,420 (CFR 4.6%) related deaths have been reported [9]. As of 28 March 2020, 46 African countries have contracted the disease, 8 countries are virus free and there are 3,977 cases, 117 (CFR 3%) deaths, and 286 recoveries across the continent [10].

Table 1: Confirmed COVID-19 Cases Reported in Africa as per 28th March 2020, [9]

Country	Total of infected cases	Sum of COVID-19 related death	No. of Recovered	Transmission type [7, 8]
South Africa	1,187	02	12	Local transmission
Egypt	576	36	121	Local transmission
Algeria	454	29	29	Local transmission
Morocco	359	24	11	Local transmission
Tunisia	227	7	2	Local transmission
Burkina Faso	207	11	21	Local transmission
East African Region				
Rwanda	60	–	–	Local transmission
Kenya	38	1	1	Local transmission
Uganda	30	–	–	Imported cases only
Tanzania	13	0	0	Imported cases only

Table 2: Top six (6) confirmed COVID-19 Cases Reported outside Africa as per 28th March 2020, [9]

Country	Total of infected cases	Sum of COVID-19 related death	No. of Recovered	Transmission type
USA	120,204	1997	141,419	Local transmission
Italy	92,472	10,023	12384	Local transmission
Spain	72,251	5,812	12285	Local transmission
Germany	56493	421	4107	Local transmission
France	37,611	2,314	5,700	Local transmission
Iran	35408	2517	11,679	Local transmission

In Uganda the trend of infected cases is on an increase Table 3. Immunocompromised individuals are likely to be more affected. It should be noted that as of 31st March 2020, no reported COVID-19 related death and no Recovered

Table 3: Confirmed COVID–19 Uganda cases as per 31st March 2020, as announced by Ministry of Health Uganda

Date	New cases	Total number of infected cases	Transmission type
19/3/2020	01	01	Imported cases only
21/3/2020	8	9	Imported cases only
24/3/2020	5	14	Imported cases only
27/3/2020	4	18	Imported cases only
28/3/2020	5	23	Imported cases only
29/3/2020	10	33	Imported cases only
31/3/2020	11	44	Local transmission & Imported cases

2 The exponential growth model for projecting number of infections in Uganda

Assumptions:

- (i) No COVID–19 related death has occurred in Uganda as per the records
- (ii) The rural population is unaware of the existing control measures
- (iii) In two days 9 infected individuals are tested positive and quarantined

2.1 The Model

Let the infected population at time t be $I(t) = I$. We assume the rate of increase of the infected population ($\frac{dI}{dt}$) to be directly proportional to the infected population (I).

$$\begin{aligned} \frac{dI}{dt} &= KI, \\ \int \frac{dI}{I} &= \int K dt. \end{aligned} \quad (1)$$

From eqn (1),

$$\ln I = Kt + c \quad (2)$$

. We note at the beginning of the epidemic Uganda (East Africa–Sub–Saharan Africa) reported 9 infected individuals (2 days) [I(2)=9]. Current information from Ministry of Health–Uganda (25/3/2020)

shows an increase by 5 more infected cases, rising to fourteen (14 infected individuals)/ cases in four days($I(4)=14$) [5].

From eqn (1) we have

$$\ln 9 = 2K + c \quad (3)$$

$$\ln 14 = 4K + c \quad (4)$$

Solving the above equations:

$$I(t) = 5.7858e^{0.2209t} \quad (5)$$

Therefore, from eqn (5) we observe in 2 weeks[14 days]: $I(14) \approx 127$ infected individuals. In a month (30) days, $I(30) \approx 4,369$ infected individuals.

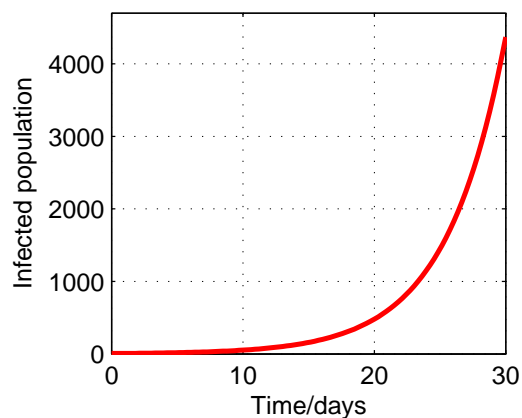


Figure 1: The exponential projection of the number of infected individuals due to COVID-19 in Uganda without interventions (2020)

From Figure 1 above, the trend of infected individuals is observed to increase exponentially. In 14 days, the number of infected individuals is expected to be 127 if no control measures are taken.

Conclusion

With such increasing infected cases, the susceptible population should follow the Ministry of Health guidelines and the advice given by His Excellency Y.K. Museveni the President of the Republic of Uganda. Awareness campaigns [door to door] should be extended to rural populations that have no access to media [Televisions, Radios, Newspapers e.t.c]

No delay in seeking medical care by infected individuals as COVID–19 has a high transmission rate and there is a likelihood of co–infections with other diseases such as Pneumonia (spread by pneumococcus bacteria and influenza A virus, presenting same symptoms), malaria, Tuberculosis and HIV–AIDS.

Acknowledgment

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Data Availability

The data supporting this exponential model is from the daily updates on COVID–19, in the world, and they have been suitably cited as references in this paper in Table 1, Table 2 and Table 3. Parameter values have been estimated using data released on a daily basis from the Ministry of Health Uganda.

Conflicts of Interest

The author declares that she has no conflicts of interest.

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- [8] Local transmission: indicates locations where the source of infection is within the reporting location; Imported cases: only indicates locations where all cases have been acquired outside the location of reporting.
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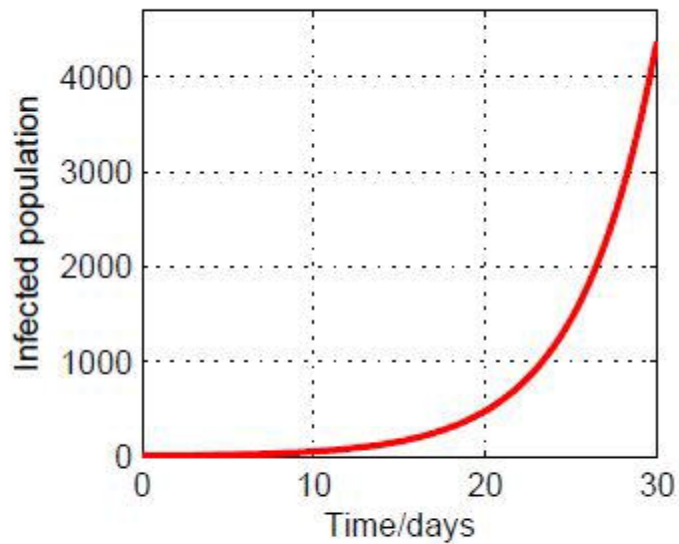


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