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Monitoring corona virus disease 2019 (COVID-19) pandemic outbreak in Africa

Abstract

This study is a monitoring analysis of COVID-19 in Africa. The data used for the study is sourced from the Africa Centre for disease Control (Africa CDC) as t 10:00PM on the 24th of April, 2020 which comprises number of Africa countries with laboratory confirmed cases, number of death and number of discharged/recovered cases. The quality pandemic monitoring/control tools used in this study is fish-bone diagram, Pareto analysis, control chart, bar chart and pie chart. The fish bone diagram depicts the likely symptoms to check out for in a patent infected by COVID-19; the Pareto analysis shows that 14 countries to the left of this line (South Africa, Egypt, Morocco, Algeria, Cameroon, Ghana, Ivory Coast, Djibouti, Tunisia, Nigeria, Guinea, Niger and Burkina Faso) constitute 80% of all the infected countries; the trend analysis shows that the spread of the pandemic is still on an increase rate; and lastly, from the performance assessment, it is seen that the pandemic is still under control from the pie chart while the death rate is already out of control.

Keywords: fish bone, pareto, africa, trend, pie chart

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Introduction

On 10th of January 2020, Chinese health officials reported 41 cases of pneumonia due to a novel corona virus (2019-nCoV), including seven patients with severe illness and one death. Symptoms have included fever, cough, and difficulty breathing.[1] The earliest diagnosis date for a case identified in China is 08 December 2019. Preliminary analysis of viral genomes from China and other countries suggests that initial transmission from a zoonotic reservoir to humans could have occurred as early as late October. The first cases reported had links to a seafood and live animal market in Wuhan, China, suggesting infection of humans from an animal source.[2,3] Health authorities in China have limited transportation in and out of heavily affected cities and are continuing to monitor close contacts, including health care workers, for illness. Several territories in Asia and countries across the globe are screening incoming travelers from Wuhan. Corona viruses (COVID-19) are large family of viruses. There are several known human corona viruses that usually only cause mild respiratory disease, such as the common cold. However, at least twice previously, corona viruses have emerged to infect people and cause severe disease: severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS).[4–6] The cases in this outbreak tested negative for both SARS and MERS. Clinical characteristics of infection, such as incubation period, have not yet been determined. Based on the incubation period of SARS and MERS, signs of 2019-nCoV could appear from 2-14 days after exposure. Human to human transmission has been documented, and healthcare workers have been infected. Like other corona viruses, people may be infectious before showing any symptoms of the disease.[3,7]

As of 9 am, 14 April 2020, a total of 15,284 COVID-19 cases and 816 (CFR: 5%) deaths have been reported in 52 African countries. Out of 52 Member States that have reported cases, six have community transmission, 44 have local transmission and two have imported cases only. Since the last brief, the number of COVID-19 cases has increased by 52% (5,198 cases). The five countries in Africa with the highest cumulative number of cases (proportion of reported cases in Africa) are South Africa (2,272; 15%), Egypt (2,190; 14%) Algeria(1,914; 13%), Morocco (1,763; 12%) and Cameroon (820; 5%). When population is taken into consideration, Djibouti (30.2), Mauritius (25.5), Seychelles (11.2), Tunisia (6.1), and Morocco (4.8) are reporting the most cases per 100,000 population within the continent. Fifteen countries are reporting case fatality rates higher than the global case fatality rate of 6%. See Figure 1 for the full list of countries in Africa reporting cases, deaths, and COVID-19 recoveries in addition to transmission type being reported. Africa CDC is working with all affected countries and is mobilizing laboratory, surveillance, and other response support where requested.[8-11]

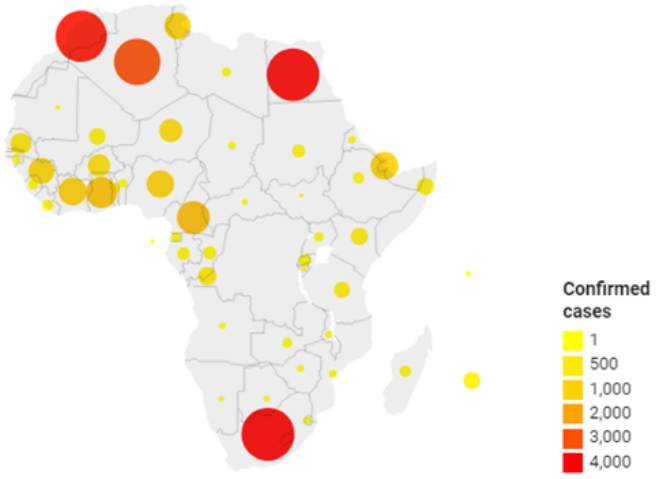

Figure 1 COVID-19 pandemic in Africa as at 24th of April 2020. Source: Africa CDC (https://africacdc.org/covid-19).

Intervention of Africa CDC response

a) Africa CDC activated its Emergency Operations Center and Incident Management System (IMS) for the 2019-nCoV outbreak on 27 January 2020.

b) Africa CDC is obtaining test kits for and working with laboratories in Member States to test specimens for novel corona virus infection. Training of 16 African laboratories will occur in Senegal on 6-7 February.

c) In collaboration with WHO, Africa CDC is setting up a specimen referral system. After training is complete, Africa CDC will share the list of laboratories with capacity to test for 2010-nCoV with all Member States and how to submit specimens.

d) Africa CDC is working to train and deploy epidemiologists at headquarters and within the RCCs for daily event tracking and risk analysis to be communicated with Member States.

e) Africa CDC will provide training and technical support to at risk African airports.

f) Africa CDC is developing informational materials on infection prevention that will be shared with Member States.

g) Africa CDC is holding weekly updates with national public health institutes in Member States and forming working groups for high priority areas of corona virus control.

h) Africa CDC will be working with Member States to build infection prevention and control capacities in healthcare facilities and with the airline sector to support screening of travelers.

i) Africa CDC will continue to provide updated and relevant information to Member States as the outbreak evolves.

j) Africa CDC initiated a continent-wide network of 300 clinicians from across the continent to discuss COVID-19 clinical management and is holding weekly webinars. The next webinar is scheduled for 16 April 2020 to discuss management of frontline healthcare workers.[10–14]

The question is how fast should health management organizations intervene in order to curtail the spread across the infected countries by intervention organizations? Secondly, if proper action is not duly taken, what will be the status of the spread of the pandemic in Africa as a continent?

Materials and methods

In the course of proffering solution to the above posed questions, quality control tools were adopted to monitor the pandemic. Quality health control can be applied to various aspects of health care. Timeliness in health control relates to obtaining needed care while minimizing delays in intervention on any disease outbreak. Quality health control also looks at consumer point of view of health care needs and intervention by government (health management organizations/ ministries). Appropriate steps must be taken by physician and other health providing activities whenever there is an epidemic or pandemic outbreak so as to maintain quality health standard in any society. In order to understand the problem posed by the delay in the recent global ravaging outbreak (COVID-19), it may be useful to describe the trend of the outbreak so as to mitigate the impact of the virus spreads in Africa. The control tools used in analyzing COVID-19 data include fish bone diagram, Pareto chart, control chart, bar chart, trend analysis and pie chart (Figure 1).

Results and analysis

The data used in this write-up were up to date published data in NCDC official website (https://africacdc.org/covid-19) as at 10:00PM on the 24th April, 2020.

Fish bone diagram

The figure below depicts the symptoms to check out for in a COVID-19 infected person in Africa. The Figure 2 above depicts the full list of symptoms associated with a COVID-19 infected patient at both the initial and late stage of the disease in Africa.

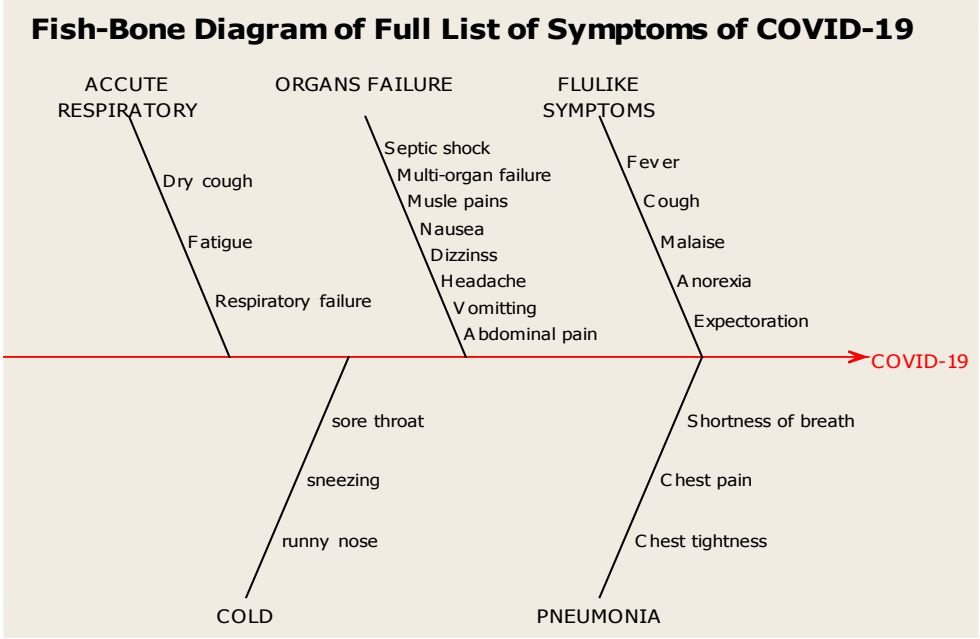

Figure 2 Fish bone diagram of COVID-19 symptoms.

Citation: Odunayo BJ, Nnamdi E, Oluwatosin ES. Monitoring corona virus disease 2019 (COVID-19) pandemic outbreak in Africa. *MOJ App Bio Biomech.* 2020;4(3):67–71. DOI: 10.15406/mojabb.2020.04.00137

Pareto chart

To identify the Areas (Countries) where more intervention would be more needed, we would draw a horizontal line from the 80% mark on the vertical cumulative percentage axis and where it crosses the line graph, a line down to the horizontal axis is also drawn. From the Pareto chart above, intervention efforts by World Health Organization (WHO) and other intervening bodies like Organization for African Unity should be more centered on the 14 countries to the left of this line (South Africa, Egypt, Morocco, Algeria, Cameroon, Ghana, Ivory Coast, Djibouti, Tunisia, Nigeria, Guinea, Niger and Burkina Faso), which are referred the 'vital few'. Therefore, the government and other intervention bodies should intervene more in these 14 countries among other African countries since they contribute 80% of the total out in the entire infected countries in the continent.

Trend analysis

Figure 3 below shows trend plot for the pattern of outbreak of COVID-19 in Africa. The Figure 4 above shows an increasing trend of laboratory confirmed cases and an upward and downward trend of the daily confirmed cases since 17th of March, 2020. The increase in the rate of spread indicate that more effort need to be put in place to curb this pandemic spread both government and intervening bodies across Africa and the world. The bar chart above shows that Northern Africa has the highest cases of COVID-19 with Western Africa the next, followed by Southern Africa, Eastern Africa and the least being Central Africa.

Cumulative sum (CUSUM) chart

The cumulative sum (CUSUM) control scheme is an efficient monitoring tool in detecting small shifts in the mean of a process (death rate). In particular, the Average Run Length (ARL) of CUSUM control charts shows that they are better than Shewart control charts when it is desired to detect shifts in the mean that are less 2 sigma or less. Let max(a,b) be the maximum of a and b. The ith CUSUM for upward shift, $S_h(i)$ for the ith observation (deaths) is defined as; $S_h(i) = \max(0, S_h(i-1) + x_i - \mu_0 - k_1)$, where k_1 is the reference value for the upward CUSUM. The Figures 5-7 above shows the CUSUM chart of daily death cases of COVID-19 between 4th of March and 24th April, 2020. The chart reveals that the recorded cases of COVID-19 in Nigeria is out of statistical control, since the CUSUM points from the last four days (i.e. 21st April to 24th April) plotted above the upper control limit.

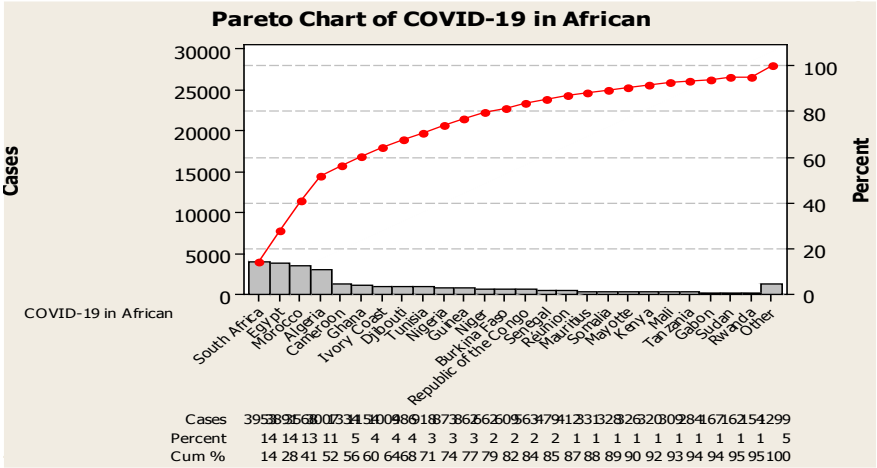

Figure 3 Pareto plot of COVID-19 infected African Countries.

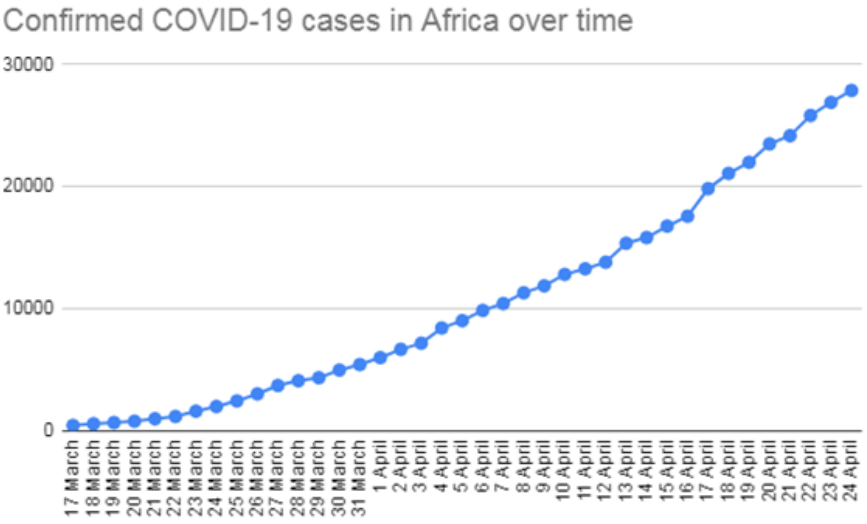

Figure 4 Trend plot of both active and daily confirmed cases are on increasing trend since 17th March till 24th of April.

Citation: Odunayo BJ, Nnamdi E, Oluwatosin ES. Monitoring corona virus disease 2019 (COVID-19) pandemic outbreak in Africa. *MOJ App Bio Biomech.* 2020;4(3):67–71. DOI: 10.15406/mojabb.2020.04.00137

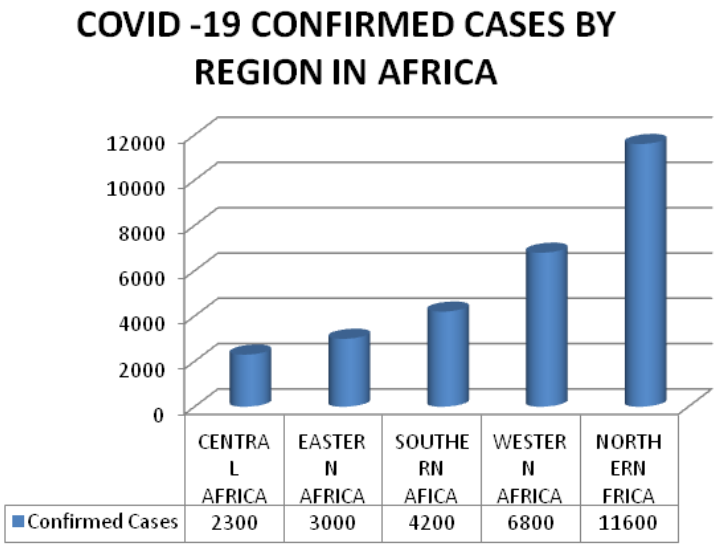

Figure 5 Bar chart of confirmed cases of COVID-19 by region outbreak in Africa.

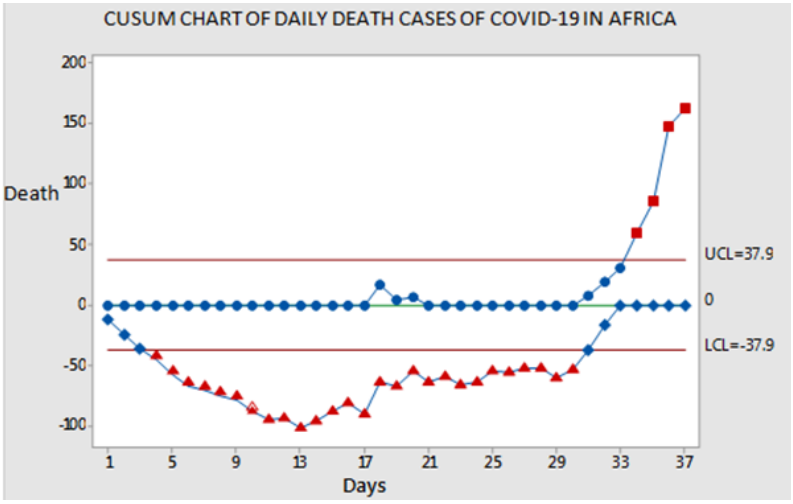

Figure 6 CUSUM chart of daily death cases of COVID-19 in entire Africa.

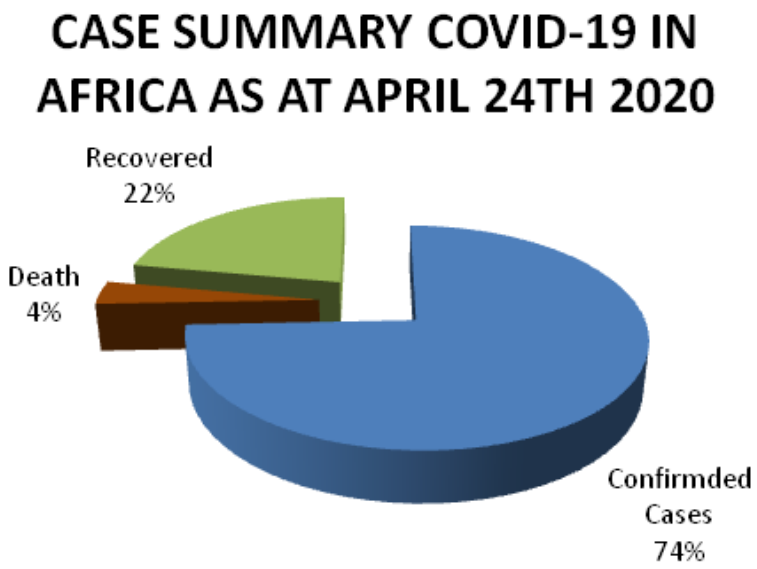

Figure 7 Pie chart of summary of COVID-19 cases in Nigeria.

Citation: Odunayo BJ, Nnamdi E, Oluwatosin ES. Monitoring corona virus disease 2019 (COVID-19) pandemic outbreak in Africa. *MOJ App Bio Biomech.* 2020;4(3):67–71. DOI: 10.15406/mojabb.2020.04.00137

Pie chart

In order to assess the performance of strategies put in place to monitor and curb the outbreak of this pandemic in Africa continent, number of laboratory confirmed cases, number of death and number of discharged cases on testing negative after treatment were plotted in a pie chart using their percentages. The number of recovered and discharged cases after treatment is 22% and number of death is 4%. This shows that the pandemic control is still under control in Africa.

Conclusion

This study was aimed at monitoring the outbreak of COVID-19 in Africa as a continent and to make out the effect of palliative measure put in place to curb the spread of the virus by national and international bodies. The study reveals that 14 countries was more vulnerable comprising of South Africa, Egypt, Morocco, Algeria, Cameroon, Ghana, Ivory Coast, Djibouti, Tunisia, Nigeria, Guinea, Niger and Burkina Faso. The said 14 constitute the vital few (80%) of the entire outbreak in entire Africa continent. The pandemic is also on an increasing trend; with Northern Africa having the highest cases of COVID-19 with Western Africa the next, followed by Southern Africa, Eastern Africa and the least being Central Africa. The study also shows that the death rate of the pandemic is already out of control since 21st of April, 2020. Lastly, the spread outbreak is still under control with the measures carried out by various organizations and government in curtailing the spread of the pandemic.

Acknowledgments

None.

Conflicts of interest

The authors declare, that there is no conflict of interest.

Funding

None.

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