

Overview and the scenario of the SARS-CoV2 outbreak in Sudan (From March 20.2020 to March 20.2021).

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Abstract:

Sudan is one of the poorest African countries, suffers from many problems in education, economy, and health. Lack of health services facilities putting an enigma on the health authorities competing and controlling the SARS-CoV2 pandemic. The aim of this perspective review was to draw the current situation of SARS-CoV2 in Sudan, to identify the factors associated with the high mortality rate (6.2%) and to compare the scenario and the community compliance toward preventive measures with others.

On March 13.2020 Sudan announced the first reported case of COVID-19. As of March 20.2021, the total number of SARS-CoV2 patients was (29,419) while the mortality rate was (6.2%). About (38.28%) of the cases were the age group of 15-30 year-old. Unfortunately, community compliance toward the lockdown strategy was very poor until it was lifted on 7 July 2020. The number of reported daily new cases has declined following the lift of the lockdown till the start of the second wave on September 1st, 2020. The Sudanese Ministry of Health warned of such a third wave on the mid of March 2021. There is a need to consider the implementation of prevention strategy as stated by the WHO to avoid the scenario happening in some other countries that suffer a more intense outbreak.

Keywords: COVID-19, crude case fatality, lockdown, mortality rate.

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I. Global epidemiology of SARS-CoV2:

Patients with SARS-CoV-2 usually experience symptoms such as viral pneumonia, fever, cough, sore throat, myalgia, and fatigue, [1-5] and symptoms may vary from diarrhea [6], loss of smell and taste [7] and even without any foreseen symptoms. [8] SARS-CoV-2 cases are increasing each day with indeed affecting health's systems and economy worldwide [9]. The Virus can be transmitted easily and many factors which could be social, environmental and virus related factors fasten its transmission. [10] Assessing the severity of SARS-CoV-2 is important to detect the problems of countries health-care systems. We can calculate the case fatality ratios by dividing the number of deaths by the number of cases [11,12] The overall CFR (crude fatality ratio) varies between different areas, countries and speed of spreading of the disease. [13]

SARS-CoV-2 has affected about 221 countries. The disease causes the 123,041,564 laboratories confirmed cases and 2,715,743 deaths 99,157,147 recoveries worldwide till March 20 2021. The USA (30,427,991), Brazil (11,877,009), India (11,560,197), Russia (4,447,570), UK (4,285,684) are top five infected countries. While deaths reported in the USA (554,119), Brazil (290,525), Mexico (197,219), India (159,616), and Italy (104,241) these are the top five affected countries with SARS-CoV-2. [14]

As per WHO's situation report of 1 June 2020 all Arab countries have reported SARS-CoV-2 cases. Till March 2021; Iraq reported (789,390) the highest number of confirmed cases followed by Jordan (521,461), Morocco (491,019), United Arab Emirates (438,638), Lebanon (434,322), Saudi Arabia (384,653), Tunisia (244,776), Palestine (221,391), Kuwait (216,586), Egypt (194,127), Qatar (173,206), Libya (150,341), Oman (149,135), Bahrain (134,510), Algeria (115,970), Syria (17,077), Yemen (3,217) [14]

In Africa (as of 20 March 2021) African union member stated reporting 4,042,736 cases, 108,087 deaths, and 3,552,813 recoveries. African people are not immune to SARS-CoV-2; moreover, statistic records showed higher mortality rate of SARS-CoV-2 among African populations, this could be because of the weakness of health systems in African countries. [15]

Worldwide, the highest mortality rates were reported in the following countries are Yemen (22.1%), Mexico (9.08%), Ecuador (6.9%), Sudan (6.28) Bolivia (6.1%) Syria (5.7%) Chad (5.7%) Egypt (5.68%) China (5.03%) Liberia (4.95%). Other countries reported less mortality rates including Eritrea (0.2%), Qatar (0.2%) and Singapore (0.0%).

Scenario of SARS-CoV2 in Sudan:

Sudan announced the first confirmed case of SARS-CoV-2 on March.13.2020 followed by the second case on 19 March. On the 20th and 21st of March, the authorities opened the country's borders and permitted stranded people to return home. This decision relayed on citizen's honesty and loyalty to compulsory quarantine for 14 days. Unfortunately, many refused and escaped to their homes, leaving behind the wrong addresses.

Cases started to appear gradually among travelers and the first case of direct contact with a patient was on April.2. 2020. Although the Sudanese authorities started early precautions to prevent community spread of the disease by partial lockdown started 24 March 2020, from 8 pm to 6 am; but community transmission was reported on 13 April 2020. On April 18 the emergency committee adopted some precautionary measures and ordered national lockdown for 21 days, allowing movement only during the day from 6 am to 1 pm. Unfortunately, the lockdown was not implemented definitively leading to a sharp rise in SARS-CoV2 cases in the period from May 03 till June 20. As a result of the high infection rate; the lockdown was extended for more than 10 days started from 10 May 2020. [18]

On 19 May 2020, the government of Sudan decided to extend the lockdown for another two weeks because that was the timing for celebrating Eid after fasting Ramadan. Unfortunately, some broke the rules and had traveled from the Capital Khartoum, which has led to an increase in the prevalence of the disease and transmission to other Sudan states. [18]

The Federal Ministry of Health (FMH) established new strategies to deal with the SARS-CoV-2 pandemic. Patients in containment phase must undergo SARS-CoV-2 testing; then accordingly admitted to one of the SARS-CoV-2 quarantine hospitals. Furthermore, the FMH released the protocol for management of SARS-CoV-2 patients as guidance for clinicians [18]

At the beginning of June, the FMH started doing Surveys and polls. Since the ability to test the entire population for SARS-CoV-2 may be a long way off, testing a large enough number of people randomly, gives a sample group that is representative of the whole country. [18]

On Wednesday 8 July the high commission for health emergencies announced the gradual lifting of the lockdown by reducing the curfew hours, and gradually permitting the resumption of work. In Mid-August five Medical Rapid Response Team has been dispatched to Sudan to help combat the spread of infectious diseases. The SARS-CoV-2 cases continued to decline, however, the State of Health Emergency was maintained. [18] The second wave has started on 1st September 2020, and FMH called on the Sudanese to adhere to the health precautions, and keep social distancing. Unfortunately, people did not adhere to the precautions, so the number of registered positive cases started to increase steadily in October 2020. [18]

November 2020, was a bitter month in Sudan as the second wave of SARS-CoV-2; left several well-known figures dead moreover the pharmaceutical shortage and doctors' strike demanding better working conditions is compounding the crisis. [19]

The Ministry of Health announced several measures to avoid any possibility of lockdown that could throw Sudan's fragile economy into a further downward spiral. Precautions include enforcing corporate and governmental officials to stick to all the preventive measures and to work at 50 percent capacity. Measures also include the provision of paid leave for those who are older than 55. The government also directed universities and higher institutes to suspend studying, if one positive case is registered with students or employees [18]

The average daily SARS-CoV-2 case recorded has reached between 200 and 300 in December 2020. Khartoum State accounts for about 78% of all COVID-19 reported cases, but only for 37% of the reported SARS-CoV-2 deaths.[18]

In response to the Pharmaceutical crisis; the Minister of Health, announced the state's commitment to fund drugs at a value of USD 60 million, as a first step toward stabilizing the drug shortage in Sudan. However, this only covers 60 percent of the total value of needed drugs in Sudan. [18] The Sudanese people hope this commitment toward stability will halt the uptick in deaths due to the coronavirus and other illnesses.

As per 28 January 2021 the number of daily reported cases has declined to only (49) new cases; accordingly, the emergency committee and Ministry of education, confirmed the 1st of February 2021, as a date for opening of both primary and secondary schools. [18]

In the second week of March 2021 Sudan launched its SARS-CoV-2 vaccination campaign, after receiving its first shipment of the AstraZeneca vaccine through the global COVAX initiative for equitable vaccine distribution in developing countries. The Sudanese Ministry of Health warned of such a third wave, noting an increase in respiratory diseases and suspected SARS-CoV-2 cases. [18]

Table 1: The distribution pattern of the SARS-CoV2 cases in various Sudan states as of 20 March 2021 [18]

State	Number of confirmed cases
Khartoum	20834
Gezira	2510
North Kordufan	365

River Nile	913
West Kordufan	202
Red Sea	839
South Darfur	127
Ghadaref	702
Northern	660
North Darfur	192
Central Darfur	7
East Darfur	34
Sennar	533
West Darfur	61
Kassala	421
White Nile	427
Blue Nile	50
South Kordufan	47

Khartoum state has the highest number of the registered cases this is due to the fact that the population of each state is different; the outbreak cannot be compared only via the number of infections per state. Furthermore, opening the borders compromised the situation.

II. Discussion:

Sudan took a privileged preventive step on defeating the pandemic by early implementation of “lockdown” by the cessation of at most all social, educational, and economic activities. Borders have been locked against all stranded Sudanese citizens, banning traveling between the different Sudan States, use of media for educating the community toward prevention of the spread of the SARS-CoV2. The health authorities have prepared 36 isolation centers to beat the second wave of this pandemic. [20] In addition health authorities implemented surveillance strategy to control unpredictable steadily increasing of the numbers of suspicious and infected peoples. [18]

The health system in Sudan is simply not equipped to handle an outbreak on the scale that occurred elsewhere in the world. The number of undiagnosed SARS-CoV-2 cases could be more because the diagnostic strategy is based on the request for travel or suspicion cases when seeking treatment hospitals. [21] As compared to others, for example, India as well has not been testing enough people as compared to South Korea which considers testing as a very crucial method for the management of the pandemic. [22]

The initial outbreaks started in the capital of Sudan, Khartoum, which is directly linked to the SARS-CoV2 epidemic countries via trade/traveling. It can be concluded that in more populated cities, regardless of the geographical size (area) and population density, the disease prevalence will be higher. The reason behind this phenomenon is most likely the existence of common points of contact such as public transport, schools, common workplaces, and shopping malls, as well as the centralized urban structure of large cities, which put the majority of the residents of the city in direct contact with each other, regardless of the size (area) of the city. [23]

On 16 March 2020, the airports and borders were closed over fears about SARS-CoV-2 outbreak. It was reopened again on the 20th and 21 of March for 48 hours; to allow the stranded people to return back home. Unavailability of medical care for patients with chronic and debilitating diseases, worst the situation, and the number of deaths has increased to (1,986) on 20.3.2021.

Table 2: Major events since December 30.2019 till March 20.2021, WHO and Sudan [18,23]

30-DEC-19	first case was reported to WHO in china
11-Jan-20	first death reported in Wuhan, China
20-Jan-20	WHO declared public health emergency of international concern ²³
11-Mar-20	WHO recognized COVID-19 as Pandemic
13-Mar-20	first death reported in Khartoum, Sudan
14-Mar20	Sudan closed kindergartens and schools, postponed academic semesters
20-21.Mar-20	authorities opened the country's borders and permitted stranded people return home
24-Mar-20	the start of the partial lockdown
2- Apr-20	the first case of direct contact transmission with a patient
13-Apr-20	first case of community transmission in Sudan
18-Apr-20	emergency committee ordered national lockdown for 21 days
10-May-20	the second extension of the lockdown for 10 days
19-May-20	the third extension of the lockdown for 2 weeks

1-Jun-20	the ministry of health developed a Disease Surveillance systems
8-Jul-20	the gradual lifting of the lockdown
12-Jul-20	the start of the postponed the final Basic school exams
1- sep-20	The start of second wave of SARS-CoV-2
12-Nov-20	Ministry of Health announced several measures to avoid the lockdown
17-Nov-20	Universities & higher institutes suspended studies.
30-Dec-20	average daily SARS-CoV-2 case recorded has reached between 200 and 300
28-Jan-20	daily SARS-CoV-2 case recorded has declined to only 49
7-March-21	Sudan launched its SARS-CoV-2 vaccination campaign
15-March-21	The Sudanese Ministry of Health warned of such a third wave

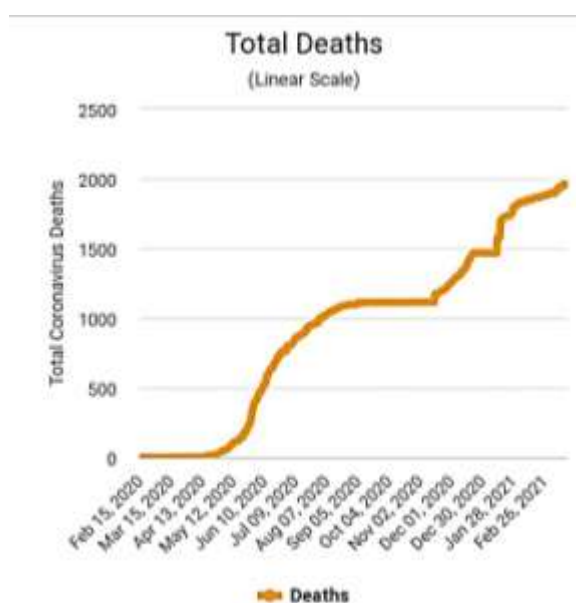


Figure 1: Total SARS-CoV-2 Deaths in Sudan up to 20 March 2021[14]

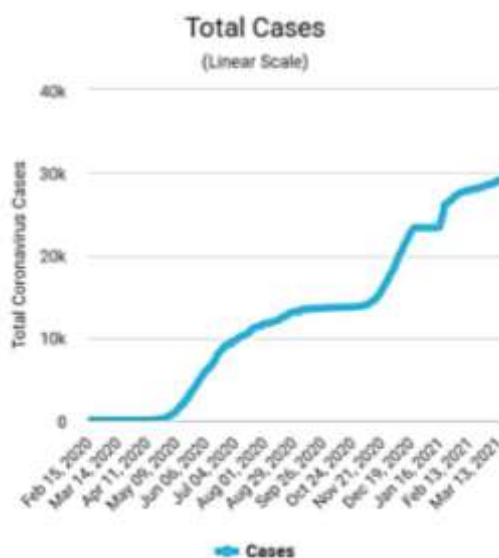


Figure 2: Total SARS-CoV-2 cases in Sudan up to 20 March 2021[14]

SARS-CoV2 mortality rate in Sudan:

Although it looks high, the mortality rate of Sudan was (6.2 %) which is lower than the other countries like Yemen (22.1%), Mexico(9.08%), yet it's higher than the rate in countries with a big outbreak like Singapore, South Korea, and Qatar. [17]

In just weeks, SARS-CoV-2 deaths have snowballed from only one case on March 13, 2020, to (1,986) cases on March 20, 2021, across the country [18]. The mortality rate of (6.2%) in Sudan is associated with various reasons. This is attributed to the delay in seeking medical care; some patients are immune-compromised or have other diseases. Also, the stigma related to the infection by the coronavirus causing patients to delay care for other ailments.

The reporting of deaths relies on death certificates rather than testing. Lack of testing means it's down to doctors to use their clinical judgment to decide the cause of death. [24] Investigations and medical tests are required; to diagnose the disease. SARS-CoV-2 should not be chosen as "default diagnosis".

There is a high probability in the recorded cases of SAR-CoV-2 underestimating the actual situation of the disease's spread in Sudan. Lately multiple epidemics weakened Sudan's health system in addition to the tough economic times the country is going through. [25].Some countries like China, South Korea, Singapore, and Hong Kong have effectively managed the pandemic through adequate testing. [21]

Countries like the USA and India have not done enough to prevent and control the community spread. The USA has not responded promptly to the pandemic the hospitals exceeded the maximum handling capacity and there is a shortage of hospital beds and ventilators. [21]

India needs to do aggressive and adequate testing for optimal control of the disease's spread. [25] Performing early testing would help Sudan to control the SARS-CoV-2 outbreak as has been proven in countries, like; Iceland, the Falkland Islands, the UAE, and Bahrain. [26].

In Sudan, hospitals need extra supplies and specific facilities to deal with SARS-CoV-2 cases. There is an obvious shortage of basic protective equipment. There is a shortage of hospital beds and ventilators. [18] Many of the clinicians are getting infected with SAR-CoV-2 due to the fact the many patients are hiding the symptoms of the diseases in the fear of being diagnosed with SAR-CoV-2 and accordingly getting isolated from the families.

A large number of peoples in Sudan are residing in rural areas;these people are in huge need for educational sessions teaching them about hand hygiene practice and the importance of social distancing controlling the spread of the disease [27].

The prevalence of the disease should be faster in more densely populated areas. However, a comparison of population density and the number of patients in different German states do not show a significant correlation between the population density and the disease prevalence. Instead, extend of the disease in an urban environment seems to be a direct function of its population size rather than density [22].

Algeria, Egypt, Nigeria, South Africa, and Sudan reported many deaths of SARS-CoV-2 recently [28]In Sudan Poor people particularly workers are the worst hit, they are struggling for food, and money; that's why some of them don't adhere to the Lockdown regulations and speed the spread of the disease. Proper planning ought to have been done before ordering the lockdown of 41 million people. Safety measures (social security) for poor, disadvantaged, and weaker sections of society should have been in place prior to lockdown [29].

Eating nutritious diet, a challenge for Sudanese people due to many reasons the more important one is the financial issues. Good nutrients status can influence a human's immune system to function in a good way. Deficiency of vitamins C and D other micronutrients such as zinc and selenium increases the risk for viral infections [30]

As of December 24.2020, according to a report of SAR-CoV-2 deaths majority of deaths were elderly people[16] However, the age group of (15-30) comprised about 38.28% of suspicion and confirmed cases in Sudan. Sudan must invest in the syndrome surveillance and case-finding which will help in controlling the spread of the disease. Britain and South Africa reported a new SAR-CoV-2 strain; while it was first seen in Britain on September 9. 2020 London, as 62% of COVID-19 cases were due to the new strain. [31] Which has a rapid rate of transmission yet it was not proved to have more aggressive symptoms. [32]

SARS-CoV-2 might result in high levels of global morbidity and mortality especially in resource- poor countries. [33]. People should follow and adhere to Government advisories strictly. Sudanese should take lessons from China and Italy that what this novel virus can create. The citizens should understand their responsibility positively that it is not for others or for Government, it is for their selves and for their families.

Sudan suffers from a pharmaceutical crisis. Now, this crisis has been aggravated due to the second wave of the coronavirus in Sudan. A major shortage of life-saving medications and oxygen threatens the lives of everyday citizens who often have to travel from one pharmacy to another to find necessary drugs [19]

Sudan is struggling to cope in the face of the SARS-CoV-2 pandemic. The healthcare system in Sudan is completely overstretched and low on supplies [21]. If no actions have been implemented most of the critical

patients will not get beds, people will continue to die in even higher numbers from SARS-CoV-2 and other diseases. Simply Sudan will face a looming catastrophe that appears as unstoppable as it is potentially lethal especially with the beginning of the third wave of SARS-CoV-2 pandemic.

III. Conclusion

With no compliance with preventive measures against coronavirus infection; new cases continue to rise. Although Sudan is considered one of the countries with a lower prevalence of SARS-CoV2, the mortality rate was higher (6.2%) than the rate in other countries with big outbreaks like Singapore, India, and Qatar. Improving health services, with additional preventive measures can combat this outbreak.

Compliance with ethical standards: No ethical approval is needed as it is an author's perspective of the scenario of SARS-CoV2 in Sudan

Conflict of interest: Both authors declare that they have no conflict of interest.

References:

- [1]. Chan JFW, Yuan S, Kok KH, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *Lancet*2020; 395: 514–23.
- [2]. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet* 2020; 395: 507–13.
- [3]. Guan WJ, Ni ZY, Hu Y, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med* 2020; published online Feb 28. DOI:10.1056/NEJMoa2002032.
- [4]. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020; 395: 497–506.
- [5]. Li Q, Guan X, Wu P, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med*2020; published online Jan 29. DOI:10.1056/NEJMoa2001316
- [6]. J Weicheng I, Zhijie F, Shitao R, Cuicui X, Xingyang X, Zexiao L, Qi Z, Wei QI. Diarrhea may be underestimated: a missing link in 2019 novel coronavirus. *Gut* <http://dx.doi.org/10.1136/gutjnl-2020-320832>
- [7]. CRISTINA M, Carole H, Claire J, Sebastien O, Tim D, Quantifying additional COVID19 symptoms will save lives, the *Lancet* DOI: [https://doi.org/10.1016/S0140-6736\(20\)31281-2](https://doi.org/10.1016/S0140-6736(20)31281-2)
- [8]. Harvard medical school. If you are at higher risk how to reduce risk of infection and what to do if you get sick. Harvard Health Publishing. <https://www.health.harvard.edu/diseases-and-conditions/if-you-are-at-higher-risk>. Published 28 January 2021. Updated 28 January 2021; accessed 29 January 2021.
- [9]. Ge, Z., Yang, L., Xia, J., Fu, X., & Zhang, Y. Possible aerosol transmission of COVID-19 and special precautions in dentistry. *Journal of Zhejiang University-SCIENCE B*. 2020. doi:10.1631/jzus.b2010010
- [10]. Samander K, Sulochana K, Yashika S, Ramesh K, Jaya PY, The Indian perspective of COVID-19 outbreak. *Indian Virological Society* 2020; <https://doi.org/10.1007/s13337-020-00587-x>
- [11]. Garske T, Legrand J, Donnelly CA, et al. Assessing the severity of the novel influenza A/H1N1 pandemic. *BMJ* 2009; 339: b2840
- [12]. Lipsitch M, Donnelly CA, Fraser C, et al. Potential biases in estimating absolute and relative case-fatality risks during outbreaks. *PLoS Negl Trop Dis* 2015; 9: e0003846.
- [13]. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19), 16-24 February 2020. World Health Organization. <https://www.who.int>. Published 24 February 2020. Updated 24 February 2020; accessed 30 March 2020.
- [14]. Coronavirus Update (live). Worldometer <https://www.worldometers.info/coronavirus/seenon>. Published 30 January 2021. Updated 30 January 2021; accessed 30 January 2021.
- [15]. .
- [16]. Chikwe I, Emmanuel A. Africa's response to COVID-19, *BMC Medicine* (2020) 18:151 <https://doi.org/10.1186/s12916-020-01622-w>
- [17]. COVID-19/Coronavirus . Statista.com <https://www.statista.com/statistics/1105061/coronavirus-deaths-by-region-in-italy/>. Published 20 December 2020. Updated 20 December 2020; accessed 30 December 2020.
- [18]. The Coronavirus Outbreak. *The New York Times*. <http://www.nytimes.com/news-event/coronavirus>. Published 6 June 2020 updated 6 June 2020 accessed 3 August 2020
- [19]. Coronavirus Report. Federal Ministry of Health. <https://www.fmoh.gov.sd>. Published 28 January 2021 updated 28 January 2021 accessed 30 January 2021
- [20]. Sudan Faces Second COVID-19 wave amid drug shortages and Doctors' strike. *GlobalVoices*. <https://globalvoices.org/2020/12/08/sudan-faces-second-covid-19-wave-amid-drug-shortages-and-doctors-strike/> Published 20 November 2020, Updated 20 November 2020 accessed 23 November 2020.
- [21]. Rhodes A, Ferdinande P, Flaatten H, Guidet B, Metnitz P, Moreno R. The variability of critical care bed numbers in Europe. *Intens Care Med* 2012;38:1647–53.
- [22]. Sudan coronavirus – COVID-19 country preparedness and response plan – CPRP, HCT/ UNCT May 2020, Reliefweb. <http://reliefweb.int/report/sudan/sudan-corona-virus-covid-19-country-preparedness-and-reponse-plan-cprp-may-2020>. Published 6 May 2020, Updated 6 May 2020, accessed 30 May 2020.
- [23]. Siavash G, Predicting the Prevalence of COVID-19 Pandemic in Germany: <https://www.researchgate.net/publication/340788812>
- [24]. Coronavirus – WHO. World Health Organization. https://www.who.int/health-topics/coronavirus#tab=tab_1. Published 6 June 2020, updated 6 June 2020 accessed 15 June 2020.
- [25]. Coronavirus Pandemic. *BBC News*. <http://www.BBC.com>. Published 2 June, Updated 2 June 2020; accessed 2020 4 June.
- [26]. Charani E, Cunningham AJ, Yousif AEHA, Seed Ahmed M, Ahmed AEM, Babiker S, et al. In transition: Current health challenges and priorities in Sudan. *BMJ Glob Heal*. 2019;4(4):1–8
- [27]. Leffler CT, Zhan S. Suppression of the Covid-19 Outbreak by Mass Testing and Tracing, and Other Measures: Real-World Data. April 17, 2020. Available from: <https://www.researchgate.net/publication/340720271>. Accessed May 17, 2020

- [28]. Zhong BL, Luo W, Li HM, Zhang QQ, Liu XG, Li WT LY. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. *Int J BiolSci* [Internet]. 2020;16(10):1745–52. Available from: <https://www.ijbs.com/v16p1745.htm>
- [29]. Chen X, Liu Y, Gong Y, Guo X, Zuo M, Li J, Shi W, Li H, Xu X, Mi W: Perioperative Management of Patients Infected with the Novel Coronavirus Recommendation from the Joint Task Force of the Chinese Society of Anesthesiology and the Chinese Association of Anesthesiologists. *Anesthesiology: The Journal of the American Society of Anesthesiologists* 2020, 132(6):1307-1316
- [30]. Coronavirus report. Population Pyramid. [Phttps://www.populationpyramid.net](https://www.populationpyramid.net). Published 15 May 2020 Updated 15 May 2020; accessed 2020 28 May.
- [31]. Covid-19; How to boost the immune system with vitamins. DW.com <https://www.dw.com/en/vitamins-are-essential-in-the-fight-against-covid-19/a-53360766>) Published 1 June 2020 updated 1 June 2020 accessed 24 June 2020.
- [32]. Coronavirus. TheHindu.com <https://www.thehindu.com/sci-tech/science/explained-the-new-coronavirus-variant-ibritain/article33391694.ece> Published 21 December 2020 Updated 21 December 2020, accessed 28 December 2020.
- [33]. How will our lives change after COID 19 Learning English.com. <https://learningenglish.voanews.com/a/new-type-of-coronavirus-identified-in-britain-south-africa/5709253.html> published 20 November 2020 Updated 20 November 2020, accessed 25 November 2020.
- [34]. Peter J, Maria E, Sunit K, Paul J, Shaden K. Will COVID-19 become the next neglected tropical disease? *PLOS Neglected Tropical Diseases* 2020; <https://doi.org/10.1371/journal.pntd.0008271>

ElhadiMohieldinAwooda, et. al. “Overview and the scenario of the SARS-CoV2 outbreak in Sudan(From March 20.2020 to March 20.2021)..”*IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 20(05), 2021, pp. 37-43.