



COVID-19 Pandemic: A Concise Appraisal of the Current Status

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Authors' contributions

This work was carried out in collaboration among all authors. Authors OGR and AIO designed the study and wrote the first draft of the manuscript. Authors OOT, EDO, DHI, AWA, DFA, KGSN, ONO and MPP managed the literature searches and edited the final draft of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Covid-19 is caused by the Betacoronavirus SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus-2) which is an enveloped RNA virus causing diseases in both humans and animals. This research involved a systematic review with the aid of computerised literature search from PubMed, Scopus, Medline, ScienceDirect, Embase and Google Scholar and other recently published editorials. Specific words/phrases used for the search included COVID-19 pandemic, COVID-19 vaccines development, SARS-CoV-2 and COVAX. The rapid velocity by which the virus spreads, based on its unexpectedly high infectivity, requires urgent action towards both the development of a vaccine and effective viral inhibitors to decrease the virulence or eliminate symptoms. The COVID-19 pandemic has caused marked effect on global health and the economy worldwide being that it is shrouded in numerous uncertainties as scientist worldwide are yet to fully understand the virus. Although significant progress have been recorded by scientists, new information of the virus keeps emerging especially with the emergence of new variants and the capability of the virus to infect a multitude organ types apart from the respiratory tract. Consequently, there is a need for scientists all over the world to be constantly updated with recent information evolving from current research. This review is a concise appraisal of the current status of the COVID-19 pandemic across various regions of the world.

Keywords: COVID-19 pandemic; SARS-CoV-2; vaccines; pandemic; global health.

1. INTRODUCTION

The Coronavirus disease 2019 (COVID-19), is caused by SARS type 2 CoV (SARS-CoV-2), and primarily affects the respiratory system in humans leading to pneumonia [1-2]. The SARS-CoV-2 was firstly discovered by scientist in the Hubei province of China and was subsequently proclaimed a pandemic in early March 2020 by the World Health Organization. Globally, the COVID-19 pandemic has affected the public health systems and economy of many countries [3]. As of the second week of March 2021, over 119 million cases and more than 2.6 million deaths have been reported in over 190 countries [4]. As at present, The United states of America has the highest cases of COVID-19 with over 29 million cases with over 532,000 deaths. The COVID-19 pandemic is shrouded in numerous uncertainties as scientist worldwide are still studying the virus. Although significant progress have been recorded by scientists, new information of the virus keeps emerging. For example the possibility of recurrent infection, emergence of new variants and the capability of the virus to infect a multitude organ types apart from the respiratory tract [5].

There are Multiple COVID-19 variants reported in various regions worldwide [6]. A new variant of the SARS-CoV-2 (20I/501Y.V1, VOC 202012/01, or B.1.1.7) was discovered in the United Kingdom, and this variant is believed to be easily transmissible among the human population. Although there are no known data that this

variant causes more severe illness or high death rate in human. Genomic scientist discovered this variant in September 2020 and are still monitoring its spread across the United Kingdom. Numerous countries since then have reported the presence of this new variant most notably amongst them are United States and Canada. In October 2020, South Africa discovered a new variant (known as 20H/501Y.V2 or B.1.351) which shares similar mutations with the variant recently identified in the UK. This new variant has also been discovered in other countries and is said to spread quickly and more easily than other variants [6]. Scientists from the, Redeemer's University, Nigeria, discovered sequences of the COVID-19 Virus of the B.1.1.207 lineage. These newly discovered sequences shares only a single non-synonymous mutation in the spike protein (P681H) in common with the B.1.1.7 lineage but differs from the other 22 unique mutations of B.1.1.7 lineage. This new strain is still been investigated to determine if it is responsible for more severe illness or increased incidence of COVID-19 in the country [7]. Recent data indicate another unique variant of SARS-CoV-2 (known as P.1) which originated from Brazil, this new variant was identified in four Brazilian travelers, randomly tested during routine screening at an airport outside Tokyo, Japan [7]. Michel Nussenzweig at the Rockefeller University in New York City has suggested that the new variants of the coronavirus might reduce the potency of the two leading vaccines. It was discovered from a study within a small group of individuals that generated neutralizing antibodies

post vaccination were as effective against viruses carrying certain mutations in the spike protein as they were against widespread forms of the virus, but it was worthy of note that these neutralizing antibodies were only one-third as effective at blocking the mutated variants [8]. More recently, scientists in the University of Edinburgh have discovered a new SARS-CoV-2 variant which has been seen in the United Kingdom, United State, Nigeria and 11 other countries. The variant identified as B.1.125, is known to possess a mutation in its spike protein allowing it to enter and adhere to human cells. This has made scientists concerned as this mutation, known as E484K, may make current vaccines less effective [9].

In the African continent over 2.7 million cases of COVID-19 was recorded with approximately 65,000 deaths in 2020. It was noted that daily COVID-19 within the months of July and August in Africa drop rapidly [10]. This trend reversed by the month of October with many Africa countries reporting their first major rise in new COVID-19 cases or their second wave of the pandemic. A total of 28 out of the 54 countries in the continent have reported increase in the number of COVID-19 cases each since the start of October, this have resulted to an average of 22,000 reported new cases per day in December 2020 [10]. In the African continent, The COVID-19 second wave seems to be more pronounce in South Africa. According to the World Health Organization Africa Regional Office (WHO Africa), COVID-19 cases in the country starting from mid-October have reached an average of 46 000 cases per week. An increase in the number of cases towards the end of 2020, combined with the emergence of more contagious variants of the COVID-19 virus, poses a challenge for the Africa continent in 2021 [11]. This surge in the number of COVID-19 cases in the continent is projected to take a toll on the weak public health systems in countries like Angola, Benin, Burkina Faso, the Democratic Republic of the Congo, Lesotho, Mali, Mauritania, Niger, Nigeria, and Togo [11].

The World Health Organization (WHO) has indicated a likely third wave of the deadly COVID-19 pandemic in early 2021. Looking at the average number of confirmed cases reported round the world, it is most likely that the third wave has already started in most counties in Europe and the United States which make up nearly half of the worlds confirmed COVID-19 cases. The United State of America is now experiencing what many will call the "third wave"

of the COVID-19 pandemic with daily record of 200,000 cases and 2000 recorded deaths nationwide [12-13].

2. COVID-19 VACCINES DEVELOPMENT AND ADMINISTRATION

Scientist worldwide have come to the conclusion that developing a COVID-19 vaccine is the most effective means of controlling the COVID-19 pandemic. Several research institutes and pharmaceutical companies have been in forefront of developing a vaccine [14]. Several factors affects the efficacy of the COVID-19 vaccines being developed among which include type of vaccine (carrier or vector, adjuvant, excipients), Adherence to dose interval, route of administration, logistics of manufacturing and appropriate storage of the vaccines [15]. Coronavirus disease 2019 (COVID-19) is more severe in the elderly and people with comorbidities hence administering a safe and effective COVID-19 vaccine to these groups of individuals can help in two distinct ways: direct protection, by vaccinating high-risk groups to prevent disease, and indirect protection, by vaccinating individuals in contact with high-risk individuals to reduce transmission [16].

Several pharmaceutical companies with COVID-19 vaccine in efficacy testing (phase 2/3 or phase 3) have indicated that they are already increasing vaccine production prior to obtaining full approval by relevant regulatory agencies. These companies are collaborating with investors in order to scale up the production of millions of COVID-19 vaccine doses. AstraZeneca is collaborating with Serum Institute of India and SK Bioscience (Republic of Korea) for the development of its adenovirus-vectored SARS-CoV-2 vaccine. Sinovac in China has partnered with Butantan based in Brazil and Bio Farma based in Indonesia. Johnson & Johnson has recently partnered with Biological E (India) [17].

A global survey carried out in 19 countries to determine potential acceptance rates and factors influencing acceptance of a COVID-19 vaccine indicated that 71.5% of participants were willing to take the COVID-19 vaccine, when available, and approximately 48.1% reported they will only get a shot of the vaccine if it recommended by their employers [18].

In November 2020, there was the exciting news about the rollout of the COVID-19 vaccines,

since then a total of 7.25 billion doses of COVID-19 vaccines have been pre-purchased by some countries and organizations worldwide majority of which are high income countries. India has ordered more doses a (total of 1.5 billion doses) than any other country. The U.S has also pre-purchased a total of 1.01 billion COVID-19 vaccine doses [19].

There are currently more than 50 COVID-19 vaccine candidates in trials. As of August 11, 2020, 28 companies have reached the clinical trials stage with Moderna, Anhui Zhifei Longcom, Novavax, CanSino, BioNTech, Sinovac, Sinopharm, the University of Oxford, Inovio, Vaxine, Institute of Medical Biology, Zydus Cadila, and the Gamaleya Research Institute having moved beyond their initial safety and immunogenicity studies [20]. Most Vaccine developers with promising phase III trial results against COVID-19 have indicated that they can produce the required doses for approximately one-third of the world's population by the end of 2021. But low-income countries may have to wait longer to get supplies. Three vaccines manufacturers— AstraZeneca, Pfizer and Moderna — are having a wide spread distribution with a total production capacity of 5.3 billion doses for 2021 [21].

Majority of these vaccine being developed against COVID-19 are based on the S antigen either as inactivated vaccines, viral vectored vaccines, subunit vaccines, and nucleic acid-based mRNA or DNA vaccines. The Coalition for Epidemic Preparedness Innovations (CEPI) have provided funding to selected institutes developing the COVID-19 vaccine, using various techniques among which include Inovio Pharmaceuticals Inc. (DNA), Curevac Inc. (mRNA), Moderna, Inc. (mRNA), Novavax (nanoparticles), University of Oxford (adenovirus vector), University of Queensland (molecular clamp), Institute of Pasteur (measles vector) and University of Hong Kong (live-attenuated influenza virus) [22].

The large scale at which vaccines are being produced is key in ending the pandemic, and is possible due to a coordinated global effort by COVAX, the central mechanism in the global Covid-19 vaccination effort, under the supervision of the World Health Organization and GAVI, the Vaccine Alliance. COVAX hope to coordinate the rollout of close to two billion COVID-19 vaccine doses by 2021 with the hope of reaching citizens in 190 countries including

those from low-income countries (23). Some countries under the COVAX coordination have indicated interest in donating their surplus supply to countries that may be in need of doses of the COVID-19 vaccine particularly low-income countries [23]. With this coordination of COVID-19 vaccine distribution, High- and middle-income countries would make payment into a common fund and will be given some quantity of vaccines while Low income countries would be supplied doses of the vaccines at no cost [24]. Ghana has become one of the first country aside from India to be given 600,000 doses of the AstraZeneca/Oxford vaccine by COVAX. COVAX has also taken into cognizance vaccine types suitable for a various regions of the world, and is working round the clock to meet its target of providing a minimum of 2 billion doses of vaccine to participating countries worldwide. Also the Gavi COVAX AMC is supporting the supply of about 1.3 billion donor-funded doses to 92 lower-income participating countries [25].

As early as December 11, 2020, the U.S. Food and Drug Administration issued the first emergency use authorization (EUA) for the use of Pfizer-BioNTech COVID-19 Vaccine to be administered beginning with frontline healthcare workers and elderly and elderly people. On December 18, 2020 a second vaccine (Moderna COVID-19 vaccine) was granted emergency authorization for use in the UAS in individuals 18 years of age and older [26].

Israel, United Kingdom, France, China, Indonesia, Belgium, Canada, Bahrain, Belarus, Belarus, Switzerland, United Arab Emirates, Argentina, Serbia, Slovakia, Saudi Arabia, Czech Republic Russia, Qatar, Poland, Kuwait, Mexico, Costa Rica have started the administration of either one or a combination of the following COVID-19 vaccines Pfizer/BioNTech, Sinopharm, AstraZeneca, Sinovac, CanSino, Sputnik V coronavirus vaccine and moderna COVID-19 vaccine [27-28].

The Chinese state media have indicated that Sinopharm has received orders from over 100 countries, with many orders coming from Africa. The COVID-19 Sinopharm's vaccine is currently undergoing phase III testing in Egypt, Jordan, Argentina and other countries. Many countries are relying on China for supply of COVID-19 vaccines because the United States and European nations have pre-purchased billions of doses [29]. Sinopharm's COVID-19 vaccine is also desirable because it is made with

inactivated virus and unlike other COVID-19 vaccines it does not require extremely low temperatures allowing for easy transportation and distribution [29].

The biotechnology firm Novavax has revealed that its vaccine is efficacious against the fast spreading rapidly variants of the virus. The vaccine was 85% effective against U.K variant of the virus, but less effective against the South Africa variant [30]. Another vaccine recently developed by Johnson & Johnson (J&J) has proven to have an efficacy of 66%, although not as efficacious as most vaccine being administered worldwide, but the vaccine seems to have an advantage of controlling the outbreak, as a single shot of the vaccine is seen to protect against high morbidity and mortality. Johnson and Johnson has offered to provide doses of its vaccines at no cost during the pandemic. The company is collaborating with COVAX to distribute millions of its vaccine doses to low income countries [30]. Recently the United State regulators have given approval for the administration of a single-shot Johnson & Johnson (J&J) coronavirus vaccine. The vaccine is cost-effective and can be easily stored in a refrigerator [31]. Over 191 million vaccination shots against COVID-19 have been administered. More than half of these vaccine shots has been administered in 10 high income countries. It is estimated that these countries have purchased more than half of all COVID-19 vaccine doses from the major pharmaceutical companies [32].

3. COVID-19 VACCINE DOSING INTERVAL

Virologists had indicated their worry in altering the dosing interval from 3 weeks to 3 months. They are of the opinion that this could speed up the emergence of more virulent mutants of the COVID-19 virus by having a concentration of sub-immune vaccinated individuals possessing sufficient antibodies to slow the virus and avoid developing symptoms—but not sufficient enough to eradicate the virus [33].

In Late December, The Joint Committee on Vaccination and Immunisation (JCVI), announced that the second doses of the COVID-19 administered in the country (i.e Pfizer/BioNTech and Oxford University /AstraZeneca) can be given after 3months instead of the 3-4 weeks recommended by the

vaccine manufacturers, this decision was endorsed by the chief medical officers of all four UK regions. This decision was taken in order to vaccinate the greatest number of at-risk individuals within a very short period of time. There have been no substantive data on different dosing schedules of the vaccine candidates, as even trials carried out was conducted on a small subset of the population [34].

In a trial conducted in the UK and Brazil, the second dose of the Oxford vaccine was given between 9 and 12 weeks in a total of 59% and 18.6% of vaccinated individuals respectively (34). Result of the findings published in the *Lancet*, indicated that efficacy of COVID-19 vaccine 14 days after the second dose was higher in the group that was administered the vaccines than in a group that the second dose of the vaccine was administered after six weeks (34). China's Sinovac Biotech declared recently that clinical trial conducted in Brazil indicated a 20% increase in efficacy of its COVID-19 in a small sub-group of individual who received the two vaccine doses with a longer interval between. In the UK health regulators have reported that AstraZeneca and Oxford University COVID-19 vaccines are more efficacious when there is a longer interval between the 1st and 2nd doses [35].

The World Health Organization (WHO) vaccine advisory group gave a statement recommending that the Pfizer-BioNTech COVID-19 vaccine doses be ideally given 21 to 28 days apart but in certain situations the dosing interval can be extended to up to 6 weeks. The Centers for Disease Control and Prevention (CDC) in the United State also gave out a similar recommendation modifying the recommendations of the dosing schedule between the first and second doses of mRNA COVID-19 vaccines to up to 6 weeks, most especially if the recommended dosing schedule cannot be adhere to. The agency said there is limited data of how effective COVID-19 vaccines are beyond these recommended dosing interval [36].

Scientists in the United Kingdom have commenced a study that will involve administering 2 doses of COVID-19 vaccines produced by different companies (Oxford/AstraZeneca and Pfizer) to a study population in a bid to ease the challenges that comes with vaccinating a huge number of people within a short period of time and also to study the

level of immune response to this vaccination protocol. If this research produce a positive response, it would improve the flexibility of administering the COVID-19 vaccine shots to the populace, hence speeding up the process and reducing logistic challenges. Oxford has also indicated its interest in combining its own vaccine dose with that of the Russian Sputnik V COVID-19 vaccine [37].

4. ALTERNATIVE THERAPY TO VACCINATION

Although there is currently no approved treatment effective against COVID-19, a number of antiviral medications and systemic corticosteroid therapies such as ribavirin, methylprednisolone, acyclovir and oseltamivir, which are conventionally used for the management of viral infections have been reported to be ineffective in the management of COVID-19 and are therefore not recommended. However, Remdesivir which is a 1'-cyano-substituted adenosine nucleotide analog prodrug with broad-spectrum activity against a number of RNA viruses has been reported to be effective in both in-vitro and in-vivo models. Remdesivir interferes with NSP12 polymerase and has been reported to treat the first US case of COVID-19 successfully [38]. Further studies are currently being carried out to ascertain the potency and safety of this treatment. Also, chloroquine which is conventionally used to treat malaria has been purported to aid in the management of COVID-19. It is suggested that aside its immunomodulatory effects, chloroquine may function by inhibiting the pH-dependent steps involved in viral replication or by interfering with the glycosylation of SARS-CoV-2 cellular receptors. Clinical studies are currently underway to explore the potential of combining remdesivir and chloroquine in the management of SARS-CoV-2 [15].

Two drugs tocilizumab and sarilumab have been able to produce promising results according to researchers at the Imperial College London. The drugs have been able to lessen the body's immune response to the viral infection. People seriously ill with COVID-19 have tissue damage inflicted in them by their own immune response and also show increased activity of immune-system potentiated by the protein called IL-6. The drug treatment reduced the death rate by 28% among those who received tocilizumab and 22% for individuals who received sarilumab [39].

5. PREVENTION, CONTROL AND MANAGEMENT OPTIONS

With the current emergence of new strains of COVID-19 following rapid mutations, there is a possibility of the available vaccines not being effective in preventing the spread of the virus. Essentially, the effective prevention of COVID-19 requires an advanced understanding of the pathophysiology, clinical severity, mode of transmission, and the effectiveness of the available treatment options so as improve upon the diagnostics and therapeutic approaches. However, at present, isolation of infected person during treatment and ensuring social distancing within the entire population is still being practiced in most countries [40]. For COVID-19 vaccines being developed by pharmaceutical giants to be effective with the changing variants of the virus, there must be effective efficacy surveillance that must involve genetic and antigenic surveillance of SARS-CoV-2 [41]. Besides, voluntary quarantine at home following exposure, use of alcohol disinfectants, use of face masks, intensive random testing, as well as closure of educational institutions have been implemented by a number of countries in a bid to curb the spread of COVID-19 [42].

There is need for sustained surveillance for new COVID-19 variants and to access their sensitivity to antibodies produced by COVID-19. Finally, it is key for countries to ensure that their citizens are willing to accept being vaccinated against COVID-19 in order to help control the spread of the virus [17].

6. CONCLUSION

Scientists worldwide have risen up to the challenge of trying to control the wide spread of the SARS-CoV-2 virus infection by the development of the COVID-19 vaccine using several biotechnological methods. COVAX which is made up of Coalition for Epidemic Preparedness Innovations (CEPI), Gavi and the World Health Organization (WHO), UNICEF and other multilateral bodies has coordinated the effective supply and distribution of COVID-19 vaccine worldwide especially in low-income countries utilizing mainly the Oxford-AstraZeneca vaccine; and aims to supply a total of two billion vaccines by the end of 2021. Developed nations have been called upon to assist poorer countries to ensure they also vaccinate their citizens against Covid-19. In order to ensure that the

spread of COVID-19 is reduced to the barest minimum. In addition to vaccination against COVID-19, health authorities worldwide should ensure a sustained non-pharmaceutical intervention (NPI) public health measures with the aim of preventing community spread of SARS-CoV-2 infection.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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