Epidemiology, Natural History, Transmission and Prevention of COVID-19

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Adebimpe E. [1], **Egbewale F.** [2]
[1]Clinical II, Faculty of Clinical Sciences, Obafemi Awolowo University
[2]Preclinical II, Faculty of Basic Medical Sciences, Obafemi Awolowo University

INTRODUCTION

In December, 2019, the novel coronavirus, SARS-CoV-2 was first detected in Wuhan, China. The origin is believed to have been a seafood market in the province. What began as a few cases of severe acute pneumonia, metamorphosed into a global epidemic, becoming declared as a public health emergency by the World Health Organization on January 31, 2020 [1]. The epidemic did not only test the limit of our medical capabilities, but also of global leadership, human ingenuity and public adherence to governance. All of these have played a role in the success or failure to curtail the virus. In the last two decades, SARS-CoV-2, is the third member of the coronaviridae family to have burst onto the public scene as an epidemic; after the SARS-CoV of 2002 and MERSCoV (Middle East Respiratory Syndrome) of 2012 [2]. Although SARS-CoV-2 is significantly more transmissible than its predecessors, it has a much lower fatality rate [2]. As at May 6, 2022, there have been 513,955,910 confirmed cases of COVID-19 worldwide, including 6,249,700 deaths, according to the World Health Organization. In this review, we aim to review the epidemiology, origin, transmission, prevention and treatment of COVID-19, as well as prospect about overcome future pandemics.

MODELS OF TRANSMISSION

Much speculation has risen as to the transmissibility of SARS-CoV-2. Among the various speculations, two models have been highlighted as viable: the virus is transmitted either via large droplets or contact with infected surface [2]. Another speculative transmission mode includes fecal transmission, which hasn't been given any credence. Since the first case of the virus in China, the infection has soared tremendously across borders and continents. This perhaps is largely due to the asymptomatic and pre-symptomatic nature of SARS-CoV-2. It has been made known that most cases of transmission are perpetuated by asymptomatic persons or persons in the pre-symptomatic phase of the virus [3]. Whilst the phenomenon might be multi-varied, it's quite clear that asymptomatic or pre-symptomatic persons have a high potential to become super-spreaders. They are usually oblivious to their condition meaning that they do not isolate or properly observe other necessary precautions. The existence of asymptomatic and pre-symptomatic cases significantly inflates the rate of transmission. During a pandemic, the success of containment efforts largely depends on public adherence to government-backed public health directives [5]. In a state where safety directives are publicly flouted, transmission of infection is inflated. It should be noted that public adherence is not arbitrary [4]. Public mistrust in the government means that health guidelines are dismissed or demeaned with resulting higher transmission rates. The success of containing COVID-19 is definitely multi-factorial, but is also dependent on public trust in government.

ORIGIN OF COVID-19: FORMER VS. RECENT FACTS

Following its emergence at a seafood market in Wuhan in December 2020, the origin of COVID-19 still remains a mystery. No substantiated answer has yet been produced as the origin of COVID-19. Being a zoonotic disease, there are a number of speculations as to its origin and emergence in the human population, although no assumptions have yet been confirmed [6,7]. One speculation considers the possibility of a bat origin. Scientists, having isolated and sequenced the SARS-CoV-2 genome, discovered its similarity to two bat SARS-related coronaviruses (SARSr-CoV): RaTG13 and RmYN0 [6]. RaTG13 exhibited a 96.2% sequence identity to the SARS-CoV-2 and RmYN02 was 93.3% identical [6]. Though the similarity between genomes is striking, scientists do not believe it is sufficient evidence to conclude that a bat is the reservoir host [6]. Another theory to consider is the bat-pangolin recombinant virus hypothesis, also which was put forward as a result of similarities between SARS-CoV-2 and not only RaTG13, but Sarbecovirus discovered in confiscated Malayan pangolins [8]. Sarbecovirus was found to contain receptor-binding domain (RBD) similar to what is found in SARS-CoV-2 [6], the importance

of this region is that it facilities the propagation of SARS-CoV-2. This theory hasn't been given credence because the bat in question, R. affinis, and the pangolins do not share an habitat, making it improbable that both viruses would reside in the same host to synthesize SARS-CoV-2 [8]. It's also speculated that the virus could have been intentionally engineered. This is, in part, due to the presence of certain HIV sequences discovered in the SARS-CoV-2 genome, implying that HIV was used in its development [8]. This also has been disproved as the sequences were, upon analysis, deemed too insignificant to support the claim [8].

TRANSMISSION OF THE COVID-19 VIRUS

Unequivocal scientific evidence is available for both a direct (human-to-human transmission and droplet) and indirect (formite and airborne contagion) transmission of SARS-CoV-2. The human-to-human spread is through respiratory droplets from coughing, sneezing, talking or singing, by an infected person. Droplets conventionally cannot extend across more than six feet and usually stays intact for a restricted time. SARS-CoV-2 remains unimpaired and contagious in droplets (with a diameter less than 5 microns), and can exist as suspensions in the air for up to three hours [9].

With the indirect transmission, touching of surfaces contaminated with SARS-CoV-2 followed by a direct contact of the hands with mucous membranes such as the eyes, nose or mouth has been implicated as a cause of COVID-19 [10]. The indirect transmission was put between the one and five percent of cases [10]. This however varies with the location and efficiency of their infection control structures.

PREVENTION

In curtailing the highly contagious COVID-19, critical steps have been outlined by the WHO such as education, isolation, prevention, transmission control, and treatment of infected persons [11].

Home quarantine and avoidance of any direct contact infected persons: This is seen in avoiding unimportant trips, avoiding crowded public places; ensuring a safe distance of at least two meters between persons especially if they are sneezing or coughing; avoiding handshakes; observing proper hand washing protocol especially after directcontact with potential formites, or after handshakes; and usage of household sprays or wipes to disinfect surfaces.

Use of face mask: The usage of medical mask such as the N95 or a respirator is recommended for healthcare workers due to the long incubation period and presence of asymptomatic patients associated with the SARS-CoV-2. A surgical mask will suffice for public use and should be disposed after use. Proper hygiene protocols should be observed in avoiding contamination through the deposition of infectious particles on the surface. This includes sterilizing the multiple-use respirators and safe disposal of used masks [12].

Vaccination: On the subject of vaccines, several of them have been synthesized and proven effective. Among them are the Johnson and Johnson vaccine, the Astrazeneca, Moderna vaccine and Pfizer. Data suggests that being administered two doses of any vaccine is extremely effective. As at 7th of March, 2021, 63.2% of the world's population had received at least one dose of COVID-19 vaccine [13].

TREATMENT STRATEGIES; PAST APPROACHES AND PROSPECTS

Therapy given to patients infected with the SARS-CoV-2 is based on the presentation of the illness; whether ''non-severe'' as in administration of antipyretics for fever and pain, rehydration and adequate nutrition as recommended by WHO, or ''severe or critical'' as in oxygen therapy using a nasal cannula or a high-flow oxygen device such as the extracorporeal membrane oxygenation (ECMO), the treatment options available for the novel coronavirus infection goes beyond the general treatments of supportive therapy and bed rest.

Since the outbreak, a number of treatments options have been under development, with most of the treatment proposition having their basis from previous therapy researches of MERS and SARS. Some of these likely treatments for COVID-19 include cellular therapy, immunotherapy, antiviral therapy and some herbal interventions [14].

APPROACHING FUTURE PANDEMICS – LESSONS LEARNT FROM CURRENT PANDEMIC

The emergence of different zoonotic viruses that gave rise to devastating pandemics such as that of 2009 and 2020 has revealed our insufficiency as a human race to completely predict and control the threats infectious diseases pose to us. It is therefore not far-fetched to think that unless we develop a strategy that is more specific, sustainable and cost-efficient, we might accrue additional morbidity, mortality and economic costs to the staggering figures from previous pandemics. The goal in discussing new strategies is to discover new practices and systems that will be sustainable, preemptive and globally accepted. These strategies should be considered reliable in preparing the global assembly in escaping the fate of deadly outbreaks just as the influenza disease in 1918 and the raging COVID-19 in 2020.

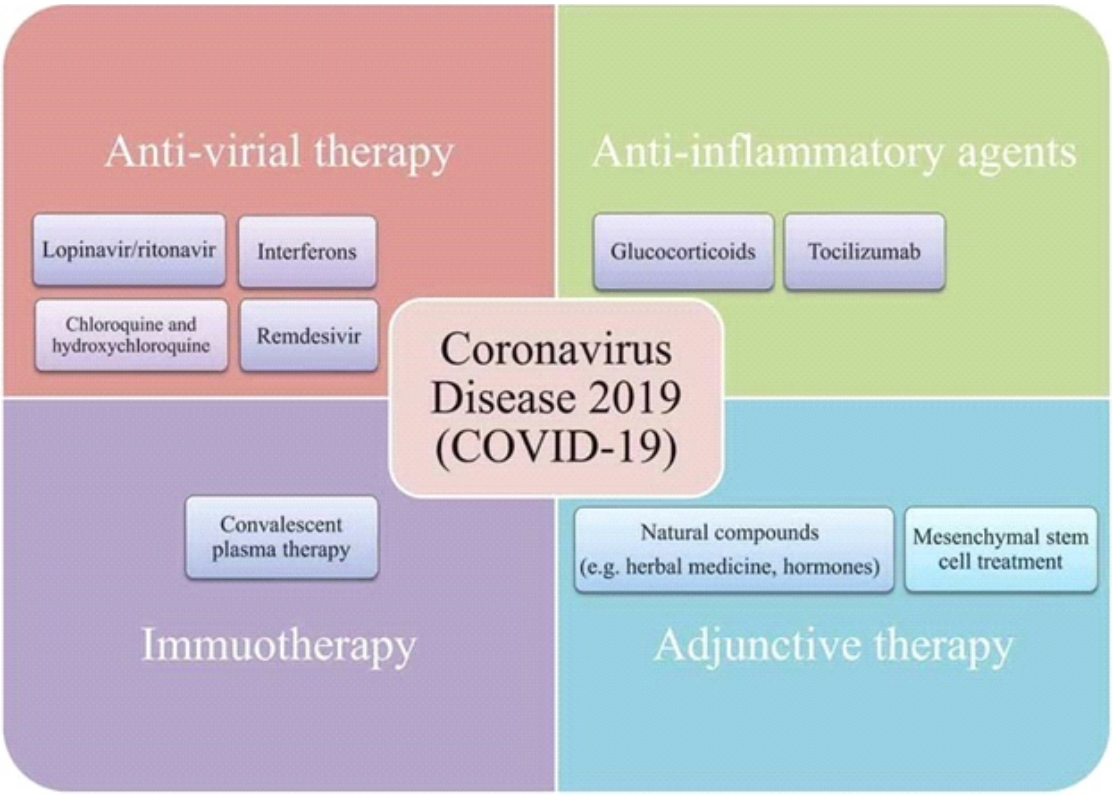

Figure 1: Treatment options for COVID-19
Source: Taylor and Francis. (2021)

The need for proactive drug development rather than reactive cannot be overemphasized as the lag time associated with creating vaccines could predispose to a risk of an outbreak. For example, the novel antibody therapeutics for COVID-19 were not approved for use until November 2020 as in contrast to the familiar broad-spectrum antiviral, remdesvir which was approved in May 2020. Although we all agree it is not an easy task, researchers should aim to have at least one drug that targets each virus family with the safety testing of the phase 1 completed and ready for quick deployment [15].

COVID-19: A LOCAL PERSPECTIVE

Nigeria's index case of COVID-19 was reported on the 27th of February, 2020 16 .Ever since, the Nigeria Centre for Disease Control (NCDC) and the Presidential Task Force (PTF) have coordinated a series of interventions towards minimizing transmission and mortality. Some of such interventions include social distancing measures, contact tracing, public health education campaigns, travel restrictions and curfew, self-isolation and quarantine measures, as well as source control measures. These implementations were necessary, but were enforced untimely. Travel restrictions into Nigeria were not announced until 3 weeks after the index case; March 18, 2020 [17]. This undermined the seriousness of the virus and allowed a greater risk of its importation into the country. Also of concern was the delayed implementation of a National lockdown, declared 8 weeks after the index case [17].

On the 29th of February,2020, NCDC started a daily situation report providing the number of cases, deaths and recoveries. Alongside, guidelines for infection prevention and control were provided for both health workers and the public. Eventually, efforts were made to enhance wide-spread COVID-19 testing [16]. The PTF corroborated efforts of the NCDC through regular press briefings on COVID-19, lock down measure and the publication of the Federal Government's policy documents on COVID-19.
The effect of COVID-19 was felt globally. Although the prevalence in Nigeria, and indeed Africa, was mild in comparison to other countries/continents. The extent to which the interventions led to a mild outcome is unknown, as the entirety of transmission dynamics are unidentified [17].

With the possibility of future pandemics considered, it is necessary that limitations as regards epidemic response: delayed implementation of response protocol, absence of electronic contact tracing capability, lack of socio-economic support for families and businesses, be surmounted.

CONCLUSION

In this paper, we reviewed the origin, epidemiology,

transmission, prevention, therapeutic strategies associated with the COVID-19 pandemic, and the possibility of future pandemics. With the origin of the disease still very much quarried, intensive research carried out to study the novel SARS-CoV-2 has revealed the priorities in curbing the spread of the infection. This can now serve as a guide to promote patient care and adequately lead future research efforts for the containment of the virus.

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