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COVID-19 pandemic: A review and update in Zimbabwe

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ABSTRACT*: The aim of this article is to identify and summarise information on the characteristics of SARS CoV-2 to enable policy makersdevice ways of reducing the spread and subsequently contain the outbreak.Many researchers have discovered that SARS CoV-2 falls under the beta coronavirus family sub group. COVID-19 uses the angiotensin converting enzyme as the receptor in the host. COVID-19 is highly contagious as the affinity between S glycoprotein of COVID-19 virus and ACE2 is 10-20 fold higher compared to that of SARS-CoV and ACE2. Apart from the prevention methods used to control the spread of the COVID-19 disease, the review summarised the latest research progress on the current treatment advancement.*

KEYWORDS*: COVID-19, host,receptor, zoonotic,*

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I. INTRODUCTION

In 2019, a novel zoonotic coronavirus disease now known as COVID-19 (SARS-CoV-2) was determined in patients who presented with a pneumonia like disease in Wuhan China. Since then the disease has spread to more than 200 countries and territories. The rampant effects of SARS-CoV-2 the world over has resulted in countries and States alike taking drastic measures to mitigate against its devastating effects and impacts. Some of the mitigation measures taken to reduce the rapid spread of the disease include but not limited to locking down the individual countries, mandatory wearing of masks and exercising social distancing.

Although the exact origin of the COVID-19 virus remains unknown, the rapid spread of the current pandemic is a result of human to human transmission either directly or indirectly. The air and water transport systems played a key role in spreading the coronavirus from one country to another as first cases confirmed in countries outside of China were at first imported.

The first coronavirus was identified in 1960. In the 21st century two types of coronaviruses emerged: In 2002 there was Severe Acute Respiratory Syndrome (SARS-CoV) followed by Middle East Respiratory Syndrome (MERS- CoV) in 2012. SARS-CoV persisted for 8 months killing 8000 people and recording a mortality rate of 10%. On the other hand MERS-CoV outbreak which lasted for 6 years, resulted in 804 casualties out of 2266 confirmed cases, recording a mortality rate of 35.6%.

A lot of fragmented research on COVID-19 by different institutions and groups since December 2019 have been conducted. This review on coronavirus (CoV) pandemic therefore serves to outline the major findings by the different researchers using mainly primary research articles and sources to contribute the knowledge gap to at least one of the following areas:

a. Virology
b. Epidemiology and clinical characteristics
c. Origins and reservoirs
d. Therapeutic and preventive options

II. VIROLOGY

COVID-19 disease is caused by a beta coronavirus that is enveloped and non-segmented positive sense ribonucleic acid (RNA) virus with a genome approximately 30 kilobases long [1][2][3]. The spherical virus structure is made up of four essential structural proteins namely spike (S) glycoprotein, small envelope (E) protein, matrix (M) protein and nucleocapsid (N) protein. Important to note is that the genome of COVID-19 virus is 96.2% identical to bat coronavirus and 79.5% identical to SARS-CoV [1]. Real time polymerase chain reaction (RT-PCR) tests have confirmed SARS-CoV-2 virus in feces, blood, saliva, semen, nasopharynx and oropharynx samples of COVID-19 infected persons[4].

Research also showed that angiotensin converting enzyme 2 (ACE2) acts as the receptor for SARS-CoV-2 in the host. The spike (S) protein of the coronavirus binds to the ACE2 receptor, enabling fusion between the envelope and host cell membrane in the process aiding viral entry into the host cell [4][5][6]. The affinity between S glycoprotein of COVID-19 virus and ACE2 is 10-20 fold higher compared to that of SARS-CoV and ACE2[7]. This finding can explain why COVID-19 is more infectious than SARS-CoV. Furthermore, research studies indicate that plasma concentrations of ACE2 were higher in males than females [8], [9]. According to Wang et al, Li et al and Huang et al, of the total number of confirmed SARS-CoV-2 cases, males make up 76;

56 and 73% respectively. The discovery indicate that females contract the highly contagious disease less compared to their male counterparts [10].

In Zimbabwe, there are more males being affected by COVID-19 (56%) compared to females who constitute 44%. The high number of COVID-19 cases is in the range of 20 to 40 years age groups. However, as the age rises to more than 90, more females are affected by COVID-19. The explanation could be that, there are no males in the age group 91 to 100 in Zimbabwe as shown in fig 1.0 [11].

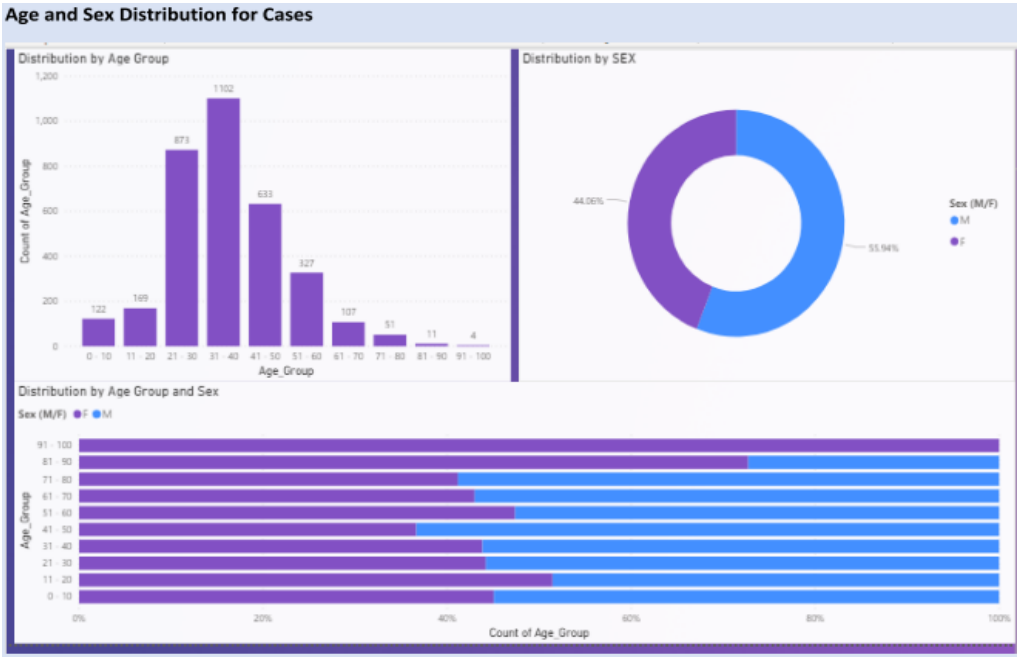

Figure 1.0: Analysis of age and sex of confirmed COVID-19 cases in Zimbabwe

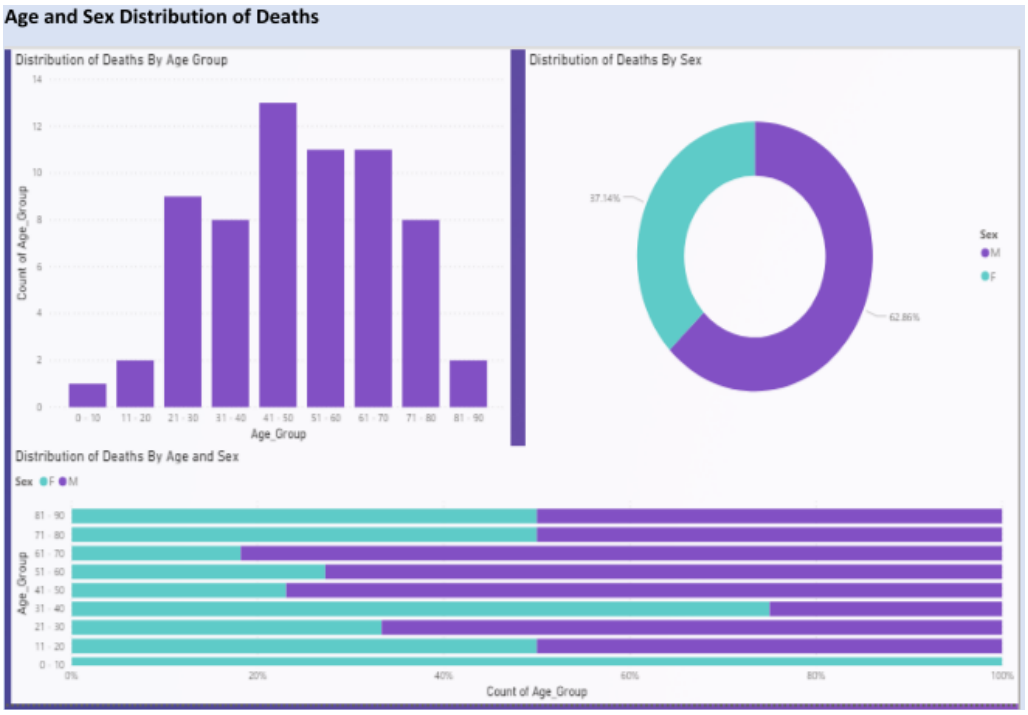

Figure 2.0: Analysis of age and sex of COVID-19 deaths in Zimbabwe

There are more deaths from males (62%) than from females (38%) even when age increases to 90 years which is the maximum for males as shown in Fig 2.0. Most deaths are witnessed in the 40 to 80 years age groups [11].

III. EPIDEMIOLOGY AND CLINICAL CHARACTERISTICS

As of the 14th of August 2020 the global total number of confirmed COVID-19 cases was 20 730 456 of which 751 154 were fatalities [12]. The current source of COVID-19 virus resulting in high number of infections are COVID-19 patients [13].

Table 1.0: Characteristics of COVID-19 patients

Condition	Description	Percentage
Asymptomatic, mild to medium	A person can recover	80.0
Severe	Results in breathless and pneumonia	13.5
critical	Septic shock, respiratory failure, multiple organ failure	4.5
Severe	Fatal disease	2.0

Data adapted from Shrikrushna et al 2020 [14],[15]

The median age of people succumbing to COVID-19 in Wuhan was 75 years. Furthermore, the median time to death from onset of symptoms was 14 days. The median time to death from onset of symptoms in people greater than or equal to 70 years was 11.5 days whereas for people less than 70 years was 20 days.

Just as in other CoV diseases, COVID-19 mechanism of transmission is through environmental and surface contamination of patient rooms. COVID-19 virus can remain on different surfaces for differing times as indicated in Table 2.0.

Table 2.0: Persistence times of COVID-19 virus on different materials

Index	Material	Time/ hours
1	Aerosol	3
2	Plastic	72
3	Stainless steel	48
4	Copper	4
5	Cardboard	24

Adapted from Sustainability of coronavirus on different surfaces by Rajiv Suman et al [16]

IV. ORIGIN AND RESERVOIR

From the four classes of coronaviruses in the *coronaviridae* family, the alpha and beta coronaviruses are the ones that usually infect mammals whereas the gamma and delta coronaviruses infect birds and fish. The bats aremostly the host of the alpha and beta coronaviruses whereas the swine are the host of the delta and gamma coronaviruses [10][17].According to Ruchi et al, the genus beta coronavirus has potential zoonotic pathogens with bats as primary host and palm civet cat and dromedary camels as intermediary host for SARS-CoV and MERS-CoV respectively [17][18].

The knowledge of the origin and reservoir of the novel coronavirus is crucial in coming up with preventive measures. Many researches conducted indicate that bats are the key reservoirs of the virus. Also, further research reveal that the glycoprotein of the COVID-19 virus, which serves as the receptor is developed from SARS-CoV subgroups beta coronavirus ZXC21 and ZC45 [19][20]. There is also need to get to the bottom of the intermediate zoonotic source of the novel virus considering that the seafood market remains just a suspected source.

According to Xiao et al, there is one amino acid difference in the receptor binding domain of the S protein of the pangolin coronavirus as compared to that of SARS-CoV-2, suggesting pangolins could be intermediates.

V. PREVENTIVE AND THERAPEUTIC OPTIONS

The spread of the pandemic was minimised through the issuance of travel restrictions within and among countries. Furthermore, practising of social distance of at least one meter, washing hands with clean running water, proper wearing of personal protective equipment, quarantining and isolating known cases and disinfecting contaminated surfaces contributed significantly in the reduction of transmission of SARS-CoV-2 [21].

Human neutralising monoclonal antibodies (MAbs) have been found to be able to block the binding sites of SARS-CoV-2 S protein. The two MAbs are CA1 and CB6. They showed specific neutralising activity in-vitro against SARS-CoV-2 [22].

An anti-Ebola drug, remdesivir can work well as an anti- SARS-CoV-2 agent. Research on the drug on an analogous nucleotide of MERS-CoV revealed that it can reduced viral replication, lung damage if administered before or after the infection [23]. Other drugs that have been tested and seen to yield positive results in blocking the virus entry, stop or slow down its multiplication include a combination of chloroquine or

hydroxychloroquine with azithromycin, oseltamivir, and lopinavir/ritonavir, duranavir, favipiravir, and ivermectin [4]. Important to note is that the success of antiviral treatment depends on the timing of application. Administration of the antiviral should be at the time of viral entry and replication as late application will give undesirable results [4].

A team of Bangladesh researchers led by Professor Tarek discovered that patients who previously tested positive to COVID-19 using RT PCR tested negative to COVID-19 after the administration of a combination of Ivermectin and Doxycycline. The administration of the combination drug was done by preselected COVID-19 patients of both sex, aged from 8 to 84 years. Retest results 4 to 18 days after taking the combination drug turned all negative to COVID-19, with symptoms improving within the first 72 hours without any noticeable side effects for the duration of the study [24].

VI. CONCLUSION

Since the outbreak of COVID-19 in China, a great deal of research has been done to understand its epidemiology, characteristics, control measures and possible treatment options. The SARS CoV-2 originated from bats as the reservoir though the intermediate is unknown this far. SARS CoV-2 binds to the ACE2 of the host with very high affinity. Males are mostly susceptible to attack by SARS CoV-2 compared to females because of the high plasma concentrations of ACE2 in males. The possible treatment regimens that are still under trials at different stages include remdesivir, combinations of chloroquine with azithromycin, lopinavirwith ritonavir and ivermectin with doxycycline.

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