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Research Article

Failed Healthcare System and Poor Leadership Outcome: A Huge Public Health Challenge towards the Management of COVID-19 Pandemic in Sub-Saharan Africa

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Abstract

Background: The emergence of viral microscopic organism has thrown the global world into an indefinite suspension till date. However, in December 2019, a cluster of people linked to a seafood wholesale market in Wuhan City, Hubei Province, China, presented with pneumonia of unknown cause. A previously unknown betacoronavirus was isolated from the pneumonia patients as the causative virus. The infection has spread across the various continents of the world, causing an alarming number of deaths daily. Interestingly, Africa as a continent with inadequate healthcare infrastructure is faced with a big challenge of containing this deadly disease.

Aim: To enlighten the public on the healthcare challenges in Africa amidst the COVID-19 pandemic, and to stimulate the leadership of Africa to be more concerned about the need for the development of robust healthcare infrastructure in the continent.

Methodology: Published research articles focusing on the COVID-19 pandemic and some previous outbreaks were systematically reviewed. The studies reviewed outcome comprised of observational and cross-sectional studies targeted on the above subject matter respectively.

Findings: Key findings revealed that the infection has an incubation period of 1-14 days, during which the viral particles can be transmitted via respiratory droplets from an infected individual to susceptible subjects, especially those with weak immunity and the elderly. It presents with symptoms resembling those of viral pneumonia such as fever, cough, dyspnoea, myalgia, fatigue, etc. The virus primarily attacks the lungs where it causes fibrosis, and in critical cases, it can cause death by multiple organ failure, acute respiratory distress syndrome (ARDS), shock, etc. So far, there is no specific treatment or vaccine for the illness. Hence, early detection and treatment of symptoms are the most potent means of helping patients recover in good time. Detection of viral RNA in patients' respiratory samples by real-time Reverse Transcription Polymerase Chain Reaction (rRT-PCR) serves as the confirmatory diagnostic procedure to detect the virus. Some countries with top and robust healthcare systems are obviously struggling to contain the outbreak, and most countries have adopted a partial or complete lockdown, as well as public health measures such as social distancing, quarantine, isolation and community containment strategy, to delay the spread of the virus and protect the healthcare systems.

Conclusion/Recommendation: There is an immediate need for African countries to develop their healthcare infrastructure to contain the current outbreak of COVID-19 and possibly future occurrences.

Keywords: Health Infrastructure; COVID 19; Poor Leadership; Personal Hygiene; Social Distancing; Lockdown; Africa; Poor Testing Capacity; Culture; PPE

Introduction

It is no longer a breaking news to many around the world that several local health authorities in China reported in late December 2019, about a group of persons with pneumonia, for which the cause was not known. However, the people were epidemiologically linked to viral particle contamination of seafood market in Wuhan, Hubei Province, China [1]. Nonetheless, a previously unrecognized betacoronavirus was later confirmed by unbiased evidence based sequencing of the viral samples taken from these pneumonia patients [2]. The World Health Organization (WHO) described the dis-

ease caused by the virus as Coronavirus disease-2019 (COVID-19) on 10 January 2020 [3]. However, on the 30th January 2020, the WHO revealed the causative virus as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), and due to the rapid spread of the disease, the body declared it a "Public Health Emergency of International Concern" [4, 5]. As of 11th March 2020, there were over 118,000 cases of the disease in 114 different countries around the world, and the WHO had to describe the outbreak as a pandemic given its fast spread from continent to continent in a speed of light [6]. Nevertheless, certain frequently updated measures such as social distancing, quarantine, repatriations of citizens and workplace preparedness have been proposed by health agencies to help delay and reduce disease transmission pattern, thereby reducing the pressure on health services across the globe [7, 8]. However, the effectiveness of the implementation of these measures is threatened by certain factors of the global society such as socio-political factors, human rights and proportionality of response, individual differences, associated stigma, and the shutdown of businesses and loss of jobs [7]. Even as the impact on religious and cultural importance in a place like Africa cannot be overlooked.

Nonetheless, Africa's weak preparedness against the COVID-19 pandemic highlights the vulnerability of the world's poorest continent in terms of response to outbreaks of infectious diseases [8, 9]. The WHO stated that at the start of the outbreak, only two countries in the entirety of Africa could test for COVID-19 [8]. Other disease outbreak in the past such as the Ebola outbreak has always exposed the hidden secrets agenda of many healthcare systems in Africa. These systems are usually poorly funded, extremely neglected and sometimes, virtually nonexistent [10]. However, this could probably be the act of insensibility and systemic rooted corruption on the part of African leaders, which had promoted medical tourisms to Europe, UK and USA among African leaders that supposedly took an oath to protect their citizens.

Nevertheless, according to a news published by Punch on March 4, 2020, in the wake of the COVID-19 outbreak, the Senate leadership of Nigeria, lamented that despite Nigeria having the largest economy in Africa, there was yet no completed isolation centre in any of her geopolitical zones that would provide emergency responses to the outbreak of diseases in the country [11]. This is the country's state of healthcare as at 2020, meanwhile, there have been several disease outbreaks in the past including Ebola, Monkey pox, Lassa fever, HIV AIDS, as well as the endemic malaria infection. It is also worthy of note that the Lassa fever outbreak is a yearly occurrence in Nigeria, especially during the dry seasons, yet, the country has no standard isolation centre according to the Senate President [12, 11].

Consequently, with the rapid escalation COVID-19, the WHO has urged governments in all countries to regard the disease containment as a top priority agenda [13].

The review aims to stimulate the leadership of Africa to improve on the healthcare infrastructure, thereby improving the continent's preparedness for future outbreaks of infectious diseases and reducing the risk of devastation posed to the continent following an outbreak of similar magnitude in future. The study would further identify gaps and inadequacies in the healthcare systems in Sub-Saharan Africa amidst the COVID-19 pandemic. Though, several studies have emphasized on the details of the pandemic, nature of the virus, diagnosis, associated dangers and containment strategies in their specific regions of the world [1, 4, 6]. However, not so many studies have underpinned specifically to elaborate on the healthcare challenges endemic in Africa, which put the continent at a relatively high risk of devastation resulting from the outbreak, hence there is paucity of data or information in this regard Nevertheless, different disease outbreaks have occurred in the past [14], but none has put the whole world at a standstill in recent times like COVID-19. However, it is on record that despite the poor healthcare infrastructure in Africa, some African countries has been able to show some high level of resilience and containment to these outbreaks. But the relatively low number of infections in Africa could probably be linked to the poor testing culture and practice in the continent. However, COVID-19 has caused massive ruins in countries with robust and well-coordinated healthcare systems, and this poses a huge health and socio-economic threat to Africa, a continent with staggering healthcare systems [15]. Finally, this review among other critical outcome would attempt to uncover the risks posed to Sub-Saharan African countries as a result of the healthcare inadequacies, as well as proffer the short and long-term solutions to these challenges.

Methodology and Study Design

Study Approach

The approach used for this study involved the systematic analysis of selected and published articles, according to the sequence of systematic review as described by Aveyard [16]. This author defined systematic review as an approach in which valid research evidence that applies to other studies are explicitly summarized and presented, following the critical assessment of a given body of knowledge. Following the extraction of their findings, the retrieved articles were assessed and presented.

Search Strategy and Search Terms

Electronic databases such as MEDSCAPE, WHO, LANCET, WHO AFRO, MEDLINE, Science Direct, Pub Med, BBC, NCDC, CDC, Research gate, NEJM and ECDC were searched, combining different keywords. A quick Google search was initially conducted to obtain different ways and keywords used for the description of the topic. Researchers searched through Google to discover global views about the topic, and this allows for the pinpointing of keywords associated with the topic area [17]. For each article retrieved, the abstract or summary was read to identify its focus and ascertain its relevance to the topic under review, as well as to identify the various ways of keywords combination in course of the literature search. Such keywords as coronavirus, COVID-19, SARS-CoV-2 and pandemic were combined in different ways while searching through the databases. Some other words used in the search include: Incubation period, signs, symp-

toms, disease, outbreak, as well as infection were equally used to search the web for articles. Boolean operators like 'AND' and 'OR' were also adopted in combining different keywords to increase the number of hits generated in a search.

Inclusion and Exclusion Criteria

Peer-reviewed published research articles revealing vital details of COVID-19 infection and SARS-CoV-2, as well as other articles revealing information about the regional differences in disease containment and healthcare, published in English language and focusing on the pandemic, were incorporated in this review. However, all articles that did not meet the above-listed criteria were excluded from the review.

Data Extraction and Methodological Quality of the Included Studies

The methodological qualities of the articles included were considered based on the following criteria; source reliability, validity, findings generalizability, design frameworks and simplicity of information. All sourced articles were appraised individually, and their findings were presented accordingly.

Findings

The search on electronic databases which employed various combinations of keywords yielded several themes. These include: Brief history of SARS-CoV-2, Epidemiology of COVID-19, Pathogenesis and clinical presentation, Routes of transmission, Diagnosis, Healthcare challenges facing Sub-Saharan Africa, Isolation, quarantine, social distancing and community containment, as well as Control and management of COVID-19 spread.

Brief History of SARS-Cov-2

Coronaviruses (CoVs) belong to a large family of non-segmented, positive-sense, single-stranded RNA viruses capable of infecting animals and also humans, causing respiratory, neurologic, gastrointestinal and hepatic diseases [18, 19]. Nonetheless, being the largest known RNA viruses, they are further divided into four genera: alpha-coronavirus (alpha-CoV), beta-coronavirus (beta-CoV), gamma-coronavirus (gamma-CoV) and delta-coronavirus (delta-CoV) [20]. Six human coronaviruses (HCoVs) have been discovered to date, and they include the alpha-CoVs (HCoVs-NL63 and HCoVs-229E) and the beta-CoVs (HCoVs-OC43, HCoVs-HKU1, severe acute respiratory syndrome-CoV (SARS-CoV) [21], and Middle East respiratory syndrome-CoV (MERS-CoV) [22]. However, the 2019 world pandemic disease (COVID-19) is caused by the novel Coronavirus known as SARS-CoV-2 [23].

SARS-CoV-2 is a previously unknown betacoronavirus that was discovered in December 2019. It was identified in the bronchoalveolar lavage samples obtained from clusters of patients who manifested pneumonia of unknown cause in Wuhan City, Hubei Province, China [24]. This virus belongs to the *Coronaviridae* family of viruses (*Sarbecovirus* subgenus) and is the seventh coronavirus with the ability to infect humans. SARS-CoV-2 has been found to share some similarities with SARS-like coronaviruses from bats, but it is different from SARS-CoV and MERS-CoV [25, 26]. So far, the potential animal reservoir and intermediate host(s) of the virus are not known. However, studies have suggested that they may derive from a recombinant virus between the coronavirus from bats and another coronavirus of unknown origin, though this is yet to be confirmed [27, 28]. The full genome sequence has been obtained and deposited in GenBank [29].

Epidemiology of COVID-19

The World Health Organization (WHO) China Country Office was informed on 31st December 2019, of cases of pneumonia in Wuhan City, Hubei Province, China, for which microbial etiology was not known. By 3rd January 2020, 44 cases had been reported and the majority of these patients were reportedly linked to large seafood and live animal market (Huanan South China Seafood Market) [30]. It was later announced by the WHO that the Chinese authorities had identified a novel coronavirus (nCoV) which was isolated on 7th January 2020 from samples obtained from these patients. Respiratory pathogens such as Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV), Middle East respiratory syndrome (MERS)-CoV, influenza, avian influenza, and adenovirus were ruled out as the possible causes of the pneumonia by laboratory tests [31].

Nevertheless, as at 1st March 2020, the National Health Commission of the People's Republic of China published that a total of 80,026 COVID-19 cases had been confirmed in 31 provinces in China (autonomous regions and municipalities), of which 44,462 were cured and discharged while 2,912 died (a case fatality rate of 3.6%) [32]. Data published by the Chinese Center for Disease Control and Prevention for the case series from 31 December 2019 to 11 February 2020 revealed a total of 72,314 number of cases in China. Subject aged between 30 and 79 years constituted the majority of confirmed cases (87%), 3% of the cases were aged over 80 years, 1% were aged between 10 and 19 years, and 1% were aged 9 years or younger. Approximately, the male gender constituted 51% of the cases while 49% were female. Almost 4% of cases were health care providers [33]. The disease has since then, spread outside China to various countries across different continents and major regions of the world.

Furthermore, as at 20th April 2020, the most affected country in the world was the United States of America (USA) who had recorded a total of 723,605 cases and 34,203 deaths (4.7% case fatality rate). Spain had the second highest number of cases (195,944) with 20,453 deaths (10.4% case fatality rate). Italy was severely affected and suffered a massive number of deaths initially but has got the spread under some control. The country still has the highest case fatality rate globally with a total of 23,660 deaths in 178,972 cases (13.2% case fatality rate). However, China (the disease origin) recorded a total of 84,237 cases and 4,642 deaths (5.5% case fatality rate) [34].

According to the WHO situation report-91, as of 20 April 2020, the regions of the world having cases of COVID-19 include: European Region (1,149,071 confirmed cases and

103,586 deaths: 9.0%), Region of the Americas (858,631 confirmed cases and 40,615 deaths: 4.7%), Western Pacific Region (132,438 confirmed cases and 5,648 deaths: 4.3%), Eastern Mediterranean Region (129,433 confirmed cases and 6,048 deaths: 4.7%), South-East Asian Region (29,576 confirmed cases and 1,275 deaths: 4.3%), and African Region (14,760 confirmed cases and 662 deaths: 4.5%) [34].

The first case of COVID-19 in Sub-Saharan Africa was confirmed in Nigeria on 28 February 2020. It was reported by the Nigerian officials that the case involved a citizen of Italy who had entered the country on 24 February 2020 via a Turkish Airlines flight from Milan through Istanbul [35]. The pandemic disease has since spread to other regions of Africa, across 45 different countries as of 20 April 2020 [34].

On the global scale, and as of 20th April, 2020, the total number of cases was 2,314,621 with a consequent 157,847 number of deaths (6.8% case fatality rate) [34]. The 6.8% case fatality rate of the COVID-19 reported cases globally implies that so far, this novel coronavirus does not seem to cause case fatality rates as high as those previously observed in the cases of SARS-CoV (10%) and MERS-CoV (37%) in the past two decades [36].

Pathogenesis and Clinical Presentation

According to recent estimates from the WHO and the US Centers for Disease Control and Prevention, the incubation period for SARS-CoV-2 ranges from 1 to 14 days [37, 38], with the mean incubation period estimated to be 5 days [2]. There is the possibility of the disease being transmitted from a carrier to a healthy individual during the incubation period [39]. Initial reports suggest that the number of people who can acquire the infection from an infected person (reproductive number R_0) is 2.2 but this value can either increase or decrease as the disease situation is still evolving [2, 40].

Although the pathogenesis of COVID-19 is currently unknown, an analysis of the structural features suggests that the virus may be able to bind to the angiotensin-converting enzyme-2 (ACE2) receptor in humans, which is similar to the pathogenesis of SARS [26]. It is strongly believed that SARS-CoV-2 has a unique spike glycoprotein receptor-binding domain responsible for the viral entry into the host cell. This unique spike potentially confers to the virus, a higher binding affinity for angiotensin-converting enzyme-2 (ACE2) on host cells when compared to SARS-CoV [41]. Furthermore, the spike protein of the virus has been identified to possess a furin-like cleavage site, a feature that does not exist in other SARS-like coronaviruses [42].

COVID-19 presents with signs and symptoms resembling those of viral pneumonia, and the illness may be mild, severe or critical as the case may be. Hence, adequate care must be taken to preclude misdiagnosis, which could be obviously dangerous. It has been estimated that around 80% of infected individuals present with mild illness, while 14% present with severe illness, and 5% suffer critical illness. Nonetheless, preliminary reports have suggested that the severity of illness is linked with older age and the presence of underlying health problems [33]. Some patients may experience minimal or no symptom(s). However, large-scale screening in non-endemic areas may reveal more of this type of patients [43]. Based on an early analysis of case series, the most common symptoms are fever, cough, dyspnoea, myalgia, and fatigue. Whereas, the less common symptoms include: Anorexia, sputum production, sore throat, confusion, dizziness, headache, rhinorrhoea, chest pain, haemoptysis, diarrhoea, nausea/vomiting, and abdominal pain [44, 45, 46].

It has also been estimated that around 90% of patients manifest more than one symptom, and 15% of patients experience fever, cough, and dyspnoea [45]. However, SARS, MERS, and influenza did cause prominent upper respiratory tract or gastrointestinal symptoms in more patients compared to the case of COVID-19 [44, 45]. Some patients may present with diarrhoea or nausea 1 to 2 days before the onset of breathing difficulties and fever [46]. Besides, most children experience mild symptoms, without pneumonia or fever, but they may present with signs of pneumonia on chest imaging despite having minimal or no symptoms [47, 48, 49].

When SARS-CoV-2 infects the lungs, it triggers an immune response in which immune cells are recruited to that part of the lungs, causing it to swell. This can spread to other parts of the lungs, causing it to become inflamed. In severe cases that affect both lungs, the swelling gets worse and the lungs fill with mucus, fluid and debris. In critical cases, the infection can damage the alveolar walls and linings, causing increased inflammation and fluid accumulation in the air sacs. This can result in difficulties in gaseous exchange in the lungs, and the patient may require a ventilator to breath [50]. The infection may also cause damage to other organs such as the liver, the heart and the kidneys, as well as to such organ systems as the blood and the immune system [44, 45, 46]. A patient may eventually die of multiple organ failure, acute respiratory distress syndrome (ARDS), shock, cardiac failure, arrhythmias, and renal failure [45, 51].

Generally, individuals with COVID-19 infection develop signs and symptoms, including mild respiratory symptoms and fever, within 5-6 days following infection (mean incubation period) [52].

Routes of Transmission

Contact between respiratory droplets (whether in the atmosphere or on a surface) and mucous membranes is the main route of transmission [53]. However, importance should also be attached to the asymptomatic cases as they may play a vital role in the disease transmission process [54]. Recently, the nucleic acid of SARS-CoV-2 was detected in the faeces of confirmed patients in Wuhan, Shenzhen and even in the first case in the United States. This indicates that the virus can replicate within the digestive tract, and suggests the possibility of faecal-oral transmission of COVID-19 [55]. However, it has not been scientifically proven [55]. There are also suggestions that faeces contaminated with the virus may form transmissible aerosol-containing droplets. Nonetheless, the WHO maintains that further evidence is required to ascertain the possibility of aerosol-transmission of CoVID-19 as there is yet no evidence of such [56]. A study in China showed that three mothers who were confirmed cases of

Table 1. WHO Report on the Confirmed Cases of COVID-19 in the African Region as at 13 April, 2020

S/n	Country	Total Confirmed Cases	Total Confirmed **New Cases** (last 24 hours)	Total Deaths	Total New **Deaths** (last 24 hours)	Transmission Classification	Days Since Last Reported Case
1	South Africa	3,158	124	54	2	Community transmission	0
2	Algeria	2,629	95	375	8	Community transmission	0
3	Ghana	1,042	208	9	0	Clusters of cases	0
4	Cameroon	1,016	0	21	0	Clusters of cases	2
5	Cote d'Ivoire	847	105	9	3	Clusters of cases	0
6	Niger	648	9	20	1	Clusters of cases	0
7	Burkina Faso	565	18	36	4	Clusters of cases	0
8	Nigeria	541	168	19	8	Clusters of cases	0
9	Guinea	477	0	3	0	Clusters of cases	1
10	Senegal	367	17	3	0	Clusters of cases	0
11	Democratic Republic of the Congo	332	5	25	0	Clusters of cases	0
12	Mauritius	328	3	9	0	Clusters of cases	0
13	Kenya	270	8	14	2	Clusters of cases	0
14	Mali	224	8	14	1	Sporadic cases	0
15	United Republic of Tanzania	171	23	7	2	Sporadic cases	0
16	Rwanda	147	3	0	0	Sporadic cases	0
17	Congo	143	0	6	0	Clusters of cases	2
18	Madagascar	121	1	0	0	Clusters of cases	0
19	Gabon	109	1	1	0	Sporadic cases	0
20	Ethiopia	108	3	3	0	Sporadic cases	0
21	Liberia	91	10	8	1	Sporadic cases	0
22	Togo	83	0	5	0	Sporadic cases	2
23	Equatorial Guinea	79	0	0	0	Sporadic cases	1
24	Zambia	61	4	3	1	Sporadic cases	0
25	Cabo Verde	55	0	1	0	Sporadic cases	3
26	Uganda	55	0	0	0	Sporadic cases	4
27	Guinea-Bissau	50	0	0	0	Sporadic cases	2
28	Eritrea	39	0	0	0	Sporadic cases	1
29	Benin	37	0	1	0	Sporadic cases	3
30	Mozambique	35	4	0	0	Sporadic cases	0
31	Sierra Leone	35	5	0	0	Sporadic cases	0
32	Chad	33	0	0	0	Sporadic cases	2
33	Zimbabwe	25	0	3	0	Sporadic cases	1
34	Eswatini	22	0	1	0	Sporadic cases	1
35	Botswana	20	5	1	0	Sporadic cases	0
36	Angola	19	0	2	0	Sporadic cases	11
37	Malawi	17	0	2	0	Sporadic cases	2
38	Namibia	16	0	0	0	Sporadic cases	14
39	Central African Republic	12	0	0	0	Sporadic cases	3
40	Seychelles	11	0	0	0	Sporadic cases	13
41	Gambia	9	0	1	0	Sporadic cases	8
42	Mauritania	7	0	1	0	Sporadic cases	9
43	Burundi	6	1	1	1	Sporadic cases	0
44	São Tomé and Príncipe	4	0	0	0	Pending	13
45	South Sudan	4	0	0	0	Pending	8

Data from WHO, 2020 [34].

COVID-19 gave birth to children who tested negative [23]. However, more research needs to be done to ascertain the possibility of vertical transmission.

Diagnosis

Clinical Diagnosis

a. Physical examination

Patients suspected to have SARS-CoV-2 infections should first be physically examined for the various symptoms of the infection. Individuals with mild symptoms may not show positive signs. However, patients with severe conditions may present with such symptoms as shortness of breath, increased or decreased tactile speech tremor, moist rales in lungs, dullness in percussion, and weakened breath sounds [57].

b. Imaging

The local infection prevention and control procedures of any region in the world should be used for all imaging examinations to prevent transmission. Imaging results may vary from patient to patient due to certain factors such as patient's age, immune status, disease stage at the time of scanning, underlying diseases and drug interventions [36].

Chest X-Ray Examination

During the early stage of pneumonia cases, multiple small patchy shadows and interstitial changes are observed in the X-ray image, these features are more pronounced in the lung periphery. In severe cases, the X-ray image may reveal bilateral multiple ground-glass opacity, infiltrating shadows, and pulmonary consolidation, with infrequent pleural effusion [36, 58].

Chest Computed Tomography (CT) Scan

A Chest CT scan reveals pulmonary lesions more clearly than an X-ray examination. It also reveals with clear details, ground-glass opacity and segmental consolidation in bilateral lungs particularly in the lung periphery. Children with severe infection may show multiple lobar lesions in both lungs. The result of CT scans of 21 SARS-CoV-2 positive individuals in a study revealed that 3 (14%) of them had normal CT scans, 12 (57%) had ground-glass opacity only, and 6 (29%) had ground-glass opacity and consolidation [59]. CT scan imaging results reported for CoVID-19 has shown similarities with those reported for SARS [60, 61], and MERS [62, 63]. These similarities may have resulted from the fact that the viruses involved are coronaviruses.

c. Laboratory Diagnosis

Blood and Sputum Cultures

Blood and sputum specimens should be obtained from all patients for culture in order rule out other causes of respiratory tract infection such as influenza viruses, parainfluenza virus, adenovirus, respiratory syncytial virus, rhinovirus, SARS-CoV, etc., as well as mycoplasma pneumonia, chlamydia pneumonia, and other bacterial pneumonia. Additionally, non-infectious diseases such as vasculitis, dermatomyositis, and organizing pneumonia should also be ruled out [53].

Molecular Testing

The routine confirmatory test for cases of SARS-CoV-2 infection is based on the detection of unique sequences of the viral RNA by nucleic acid amplification tests (NAAT). The most commonly used NAAT is the real-time reverse-transcription polymerase chain reaction (rRT-PCR) assay, with confirmation by sequencing of the nucleic acid when necessary. The samples required for this assay can be collected from the upper respiratory tract (oropharyngeal and nasopharyngeal) and lower respiratory tract (endotracheal aspirate, expectorated sputum, or bronchoalveolar lavage) of patients [64, 65].

Markers for SARS-Cov-2 Infection

Certain abnormalities observed in the blood can serve as markers to suggest the presence of the disease. The most common abnormalities observed in hospitalized pneumonia patients include leukopaenia, lymphopenia, leukocytosis, and elevated liver transaminases. Other abnormalities include: Thrombocytopaenia, neutrophilia, decreased albumin, decreased haemoglobin, and renal impairment [44, 45, 46].

During the early stage of the disease, leukocyte count may decrease or remain normal. Lymphocyte count decreases while increased or normal monocytes are also indicated in the diagnosis of CoVID-19 [53]

Healthcare Challenges Facing Sub-Saharan Africa

Some of the challenges Sub-Saharan Africa has faced in the past during outbreaks of infectious diseases include: Late detection of outbreaks and delayed response to the outbreaks. The Ebola outbreak of 2014 in Western Africa is one of the most recent examples as the disease took at least 10,000 lives. Guinea, being the origin of the outbreak, did not have a sophisticated disease-surveillance system. Hence, the local health workers did not identify the early cases of the outbreak as an emerging illness. When the authorities became aware of the outbreak, the country did not have the laboratory capacity to do the necessary testing, and this led to delays in detection and response to the outbreak. This can also lead to a rapid spread of the disease [66]. Most African countries face similar challenges as there is a massive lack of basic equipment and facilities, medical staff and supporting infrastructure. Hence, the health systems are virtually always overwhelmed by the emergence of infectious disease outbreaks [10].

The cost of preparing health systems to detect and respond to COVID-19 remains a huge challenge to African countries [66]. The World Health Organization Global Health Expenditure database has revealed that Sub-Saharan African countries spend $78.37 per capita on health annually, an amount sorely below the $9,325.71 spent in North American countries, $3,211.40 in the European Union, and $638.57 in East Asian and Pacific countries [67]. Dating back to 2001, African health ministers pledged (in the Abuja Declaration) to allocate not less than 15% of their national budgets to improve their health systems. However, a decade after the declaration was signed, the WHO revealed that 27 countries had

increased their health allocations, but the 15% target had only been achieved by Rwanda and South Africa. Contrarily, 7 countries had reduced their health budget while 12 had not made any progress over the same period [10].

Notwithstanding, over 30 African countries have been classified by the 2019 global health security index as the least prepared countries globally when it comes to prevention, detection and response to disease outbreaks, not excluding the African giants, Nigeria. Some other countries in the same category include Yemen, Syria, and Venezuela [68]. Conversely, in response to the initial outbreak of COVID-19 in China, the Chinese authorities in Wuhan built two hospitals within two weeks, to which more than 30,000 health workers from across the country were sent. On the contrary, the WHO announced that it has helped train about 11,000 health workers in Africa [66]. Hence, 11,000 health workers in the African continent were to be tasked with the same activities carried out by 30,000 health workers in a single city of China (Wuhan). This highlights the lack of preparedness of African countries to infectious disease outbreaks.

Additionally, the failure of African countries to shutdown international borders and airports has not helped in COVID-19 surveillance and prevention, given the poor health care facilities pertinent to the continent. Sub-Saharan Africa recorded its first case in Nigeria, involving an Italian who arrived in the country from Milan on 24 February 2020 [35]. As of this day, China already had 77,780 confirmed cases with 2,666 deaths, while Italy had 229 confirmed cases with 6 deaths [69]. In late March 2020, the only West African country without a case of COVID-19 (Sierra Leone) announced her first case involving a man who arrived in the country from France via an Air Brussels flight on March 16. Though he was put in quarantine immediately, it does not erase the fact that the first case in the country was as a result of open airports, and as of April 20, Sierra Leone had 34 more cases [70, 34].

Isolation, Quarantine, Social Distancing and Community Containment

In the previous outbreak of SARS-CoV in the past, the world was able to reduce human-to-human transmission, halt and eradicate the epidemic in the absence of vaccines and antivirals by rigorously implementing traditional public health measures. Comparably, the world is yet again faced with another outbreak involving a closely related virus for which there are currently no specific vaccines or therapeutics. Hence, the world still has to rely on classical public health measures to separate people and prevent human-to-human spread to interrupt disease transmission. The public health tools currently implemented include isolation, quarantine, social distancing and community containment [71].

Isolation entails the separation of infected individuals from healthy individuals to prevent disease transmission. Whereas, quarantine means the restriction of movement of persons who are currently not ill, but are presumed to have come in contact with an infected person or object and hence, may be in the incubation period of an infection [72]. In contrast, social distancing through a variety of means aims to minimize contact between potentially infected individuals/population groups and healthy ones to interrupt disease transmission [7]. In several areas of the world, isolation, quarantine and social distancing have not been potent enough to mitigate the disease spread, thereby necessitating the implementation of community-wide containment. Community containment is a continuum aimed at expanding social distancing measures to community-wide quarantine, restricting major movements of everyone. It is applied to an entire community, city or region, and aims at reducing personal interactions. However, minimal interactions are allowed to ensure the availability of vital supplies [71].

The implementation of these public health measures across various areas of the world has been faced with certain ethical challenges, especially those regarding human rights. According to the European Centre for Disease Prevention and Control (ECDC) [7], when implementing restrictive public health measures, special considerations should be given to existing national legislation, as well as international legal and ethical principles, such as the United Nations Siracusa Principles [73] and the Article 3 of International Health Regulations [74]. Based on these, the public health measures being implemented due to disease outbreak should meet certain conditions such as public necessity, reciprocity, demonstrated effectiveness and scientific rationale, proportionality and least infringement, justice and fairness [75]. Also, in the bid to protect the larger population, people should not be quarantined by isolation in high-transmission areas, and quarantine ought not to differentiate between social or economic groups in a population [76].

Furthermore, there is no one-size-fits-all approach to implementing public health measures. Hence, societal norms and values supporting the freedom of movement and travel have to be weighed against precautionary principles and the public acceptance of risks [77].

Control and Management of COVID-19 Spread

There is currently no vaccine available for the prevention of COVID-19. Hence, the principal public health method for controlling the outbreak is by avoiding exposure to the virus and preventing its spread. The general public has been advised to wash hands frequently with soap and water, or an alcohol-based hand sanitizer of at least 60% concentration, avoid touching the eyes, nose, and/or mouth with unwashed hands, avoid close contact with sick people, cough/sneeze into a folded elbow or a disposable tissue and dispose of immediately, disinfect frequently touched surfaces daily, seek medical advice promptly when symptoms (such as cough, fever, or dyspnea) appear and use nose-masks when ill [78, 79].

At the same time, all individuals in endemic areas have been advised to be vigilant for potential symptoms of infection, stay home as much as possible and practice social distancing (maintaining a distance of at least 6 feet from other persons) when it is necessary to leave home [80].

Importantly, individuals with increased risk of infection such as those who have come in close contact with suspected or confirmed cases and international travellers (including trav-

el on a cruise ship) should observe increased precautions. These include self-quarantining for at least 14 days from the time of the last exposure, maintaining a distance of at least 6 feet from all other persons and self-monitoring for the manifestation of cough, fever, dyspnea or abnormal temperature [81]. Contact tracing measures should also be implemented to detect individuals who have come in contact with suspected or confirmed cases [82]. The health workers, who are always in contact with patients, are advised to follow established occupational safety and health procedures, put on, use, take off, and dispose of personal protective equipment (PPE) properly, self-monitor for symptoms of illness and when ill, self-isolate and report the illness to managers [83].

Discussion

Global containment of the COVID-19 outbreak has been a major problem since the first case of the disease was identified in Wuhan City, China [30]. Between December 2019 and 20 April 2020, the disease had spread like wildfire throughout the world, affecting a total of 2,314,621 individuals and resulting in 157,847 deaths as of the working date of documentation of this article [34]. Major countries across Europe and America, with top healthcare facilities, have been literally in confusion with a surprising big punch by the outbreak as thousands of new cases are being diagnosed daily. Italy, being the second country with the best healthcare in the world [84], has recorded the highest case fatality rate globally (13.2%%) as of 20th April 2020 [34]. Similarly, Spain ranked seventh in terms of healthcare globally, has recorded the second highest case fatality rate (10.4%), while the United States of America has recorded the highest number of cases and deaths globally (723,605 and 34,203 respectively) as of the same period [84, 34].

Nonetheless, Northern Italy has well-trained health professionals and one of the best public health systems in the Western world. They seemed prepared when the outbreak began in Italy. However, they gradually became overwhelmed by the virus with thousands of new cases emerging, so many requiring intensive care, so many dying and health workers contracting the illness and dying as well. The seemingly well-prepared healthcare system was stretched to the breaking point that they had to allocate more hospital beds to COVID-19 patients, convert more hospital wards into intensive care units (ICUs), and as far as giving intensive care only to those more likely to survive from the illness. A complete lockdown was eventually issued throughout the country to reduce the spread [85]. This would eventually slow down the spread for further preparation on how to manage the scourge

On the other hand, the Chinese authorities in Wuhan initially responded to the outbreak by building two hospitals within two weeks and staffing them with over 30,000 health workers from across China [66]. The popular Chinese city was also placed on lockdown for months to control the spread of the virus [86]. Despite these timely interventions, the virus infected 80,026 individuals and killed 2,912 of them as at 1st March 2020 [32] before they got the outbreak under control. Besides, despite having 46,500 medical ICU beds, and another 46,000 ICU beds from hospital specialist units, the United States of America still fears that the nation's current healthcare facilities may not be enough should the illness get to a worst-case scenario, and rationing of health care may become unavoidable [87, 88].

Due to the poor health infrastructure endemic in Africa, political elites, as well as other elites of the continent, have historically shunned the local hospitals to seek medical treatment abroad [89]. Lack of preparedness for disease outbreaks has left Nigeria (one of the richest countries in Africa) with 169 ventilators, 350 intensive care unit (ICU) beds and only a few ill-equipped isolation centres for a population of nearly 200 million people [90, 91]. These can only be possible given the amount of neglect by the supposedly leaders of several administrations with the amount of money derived from oil since 1956 when oil of commercial quantity was discovered in Oloibiri, in the present-day Bayelsa State of Nigeria. The present situation of the global pandemic outbreak prompted the European and American countries, including the UK and USA to close their borders, and all abroad trips for medical treatments were stopped. These presented a hard but harsh lesson to African leaders to reason beyond the rhetoric on how to develop an effective health care facility with the robust laboratory outcome for fast and accurate diagnosis of any illness, should the present situations present itself in future against humanity.

Mass testing of the general public (both symptomatic and asymptomatic), and consequent isolation of infected persons have helped halt the spread of the illness and emergence of new cases in Vò town, Italy [92]. The WHO Director-General's also emphasized the need for testing, saying one cannot fight a fire blindfolded (one cannot fight an outbreak without the insight of who is affected) [6]. Earlier in February, among sub-Saharan countries, just South Africa and Senegal had existing laboratory facilities to test people for COVID-19, though about 40 countries were supplied equipment by the WHO thereafter [9]. South Africa has had the most potent response to the pandemic, shutting down its borders and declaring a general lockdown in the country before she announced her first death from the illness [93]. As at 11th April 2020, the country had conducted around 73,000 tests which are not comparable to over 700,000 tests conducted by Italy (with a similar population size) as of the same date [94, 95]. However, South Africa aims at testing about 30,000 people a day [94]. Uninterestingly, this is the highest feet attained by any African country. Zimbabwe had tested a total of 316 people while Namibia had tested 306 people (with testing done both locally and in South Africa) as at 2nd April 2020 [93]. It was also reported that Nigeria had tested a total of 8,003 people by 19th April 2020, way below South Africa [96]. The above scenarios clearly suggest that majority of the African countries are not prepared and already overwhelmed by the pandemic, lack of laboratory and clinical infrastructure remains a huge challenge as majority of her leaders had in the past abandoned to develop capacity in health, rather travel abroad with families to seek medical attention.

Furthermore, the Nigeria Centre for Disease Control (NCDC)

published that the country had expanded her COVID-19 diagnostic capacity, and currently has 11 activated laboratories, while 4 are in progress [97]. This implies that samples from all corners of the country have to be transported to any of these 11 testing centres if made operational. Hence, the effective diagnosis could be greatly affected by certain factors such as sample mismanagement, temperature change, as well as transportation hazards and delays, while disease transmission progresses. It was also announced by the WHO that about 11,000 health workers in Africa had been trained via the WHO online courses on COVID-19 [66]. This potentially sound very vague and unrealistic in a country like Nigeria with huge unreliable internet facility connection, high cost of data cannot be overemphasized, even when the health staff are not well paid.

Nevertheless, the 14,760 confirmed cases in Africa are far below the prevalence of the disease in several other continents [34]. There is a huge suspicion that the relatively low number of cases may be due to Africa's lack of testing capacity, suggesting that many positive cases are perhaps yet to be discovered. The lack of testing capacity may have also forced several African nations to work with vague and sometimes misleading estimates [94]. It is also worth knowing that so many African countries have not updated the situation reports on the spread of the infection within their territories for some days, ranging to weeks [34]. This could as well be contributing to the low reported number of cases within the continent. As African countries seek to improve their testing capacities, many clinical laboratories are being set up [95, 97]. The failure to set up standard public health laboratories in the various countries could still be a problem in the future.

Nonetheless, taking cognizance of other developed countries which had been badly hit by the illness, these statistics are not encouraging. Africa's regional director of WHO, Dr Matshidiso Moeti, has stated that the unavailability of testing kits is a serious challenge for many countries in Africa [93]. The WHO regards the health systems in Africa as fragile and has also prioritized support for 13 countries based on their close transport links with China. These countries include Algeria, Angola, Côte d'Ivoire, the Democratic Republic of the Congo, Ethiopia, Ghana, Kenya, Mauritius, Nigeria, South Africa, Tanzania, Uganda, and Zambia. However, the only laboratories in the continent capable of testing for COVID-19 initially were South Africa's National Institute of Communicable Diseases and Senegal's Institut Pasteur, and so were responsible for testing samples from other countries in Africa [98]. Effective diagnosis as at then may also have been affected by the same factors mentioned in the Nigerian case-study. The director of the Global Health Network at Oxford University, Trudie Lang, has also said that though the viral disease has a relatively low mortality rate, it could overwhelm healthcare provision in African countries [9].

However, according to the Global Health Workforce Alliance in its 2015 report, Sub-Saharan Africa is burdened with a severe shortage of health care professionals, while not being able to provide adequate healthcare coverage for people in need of medical attention. In the midst of these, the continent has the world's highest rates of communicable diseases such as malaria, tuberculosis and HIV/AIDS, etc. Study report shows that "Africa experiences 24% of the global burden of disease, yet it has only 2% of the global supply of doctors and less than 1% of expenditures on global health". This is as a result of inadequate funding of healthcare systems in the continent. For instance, despite having a national income of $594,257 billion (before the recent currency depreciation), Nigeria (one of Africa's richest countries) spends only 4.6% on healthcare [99]. Hence, political elites, as well as other elites of the continent, choose to seek medical treatment in countries with better healthcare systems [89].

Nonetheless, the WHO Africa reported that the African region had an average of 1.30 health workers per 1000 population as at 2015, which is far below the 4.5 per 1000 needed for Sustainable Development Goals (SDGs). The report revealed that the African region has the most severe health workforce (HWF) shortage, which has been estimated to reach 6.1 million by 2030 [100]. In the midst of this, unemployment in Sub-Saharan Africa has risen progressively, resulting in heavy wastage of the available healthcare workforce in the region [101]. Crumbling infrastructure, lack of drugs and poor renumeration have resulted in local doctors going to work abroad, thereby further reducing the available workforce. Instead of investing in the local healthcare systems, African leaders have consistently channeled substantial state resources to hospitals abroad [89]. With the countries on lockdown and international borders and airports closed, it has become difficult for the elites to travel abroad for treatment. The government of Nigeria has decided to invest locally by inviting doctors from China, a move that has been kicked against by the local health workers [102, 103, and 104].

Besides, while the outbreak of COVID-19 tends to stir up humanity and also remind us that the world is a global society [105], it also has several negative impacts on the global society. As a result of the various restrictions and lockdowns around the globe [84, 85, 93, 105], so many individuals have been left frightened, shattered, hopeless and jobless, while some others have repatriated. There is also a massive closure of religious places such as mosques, churches, and temples, as well as restrictions on several religious activities globally [105]. Several countries around the world (including Africa) have instituted either a partial or a complete lockdown as a result of the outbreak [106], and some countries are making crucial interventions to support the people during this period. For instance, the government of France initially mobilized €45 billion to support struggling companies [107]. Also, the government of the United Kingdom took the responsibility of paying grants that cover up to 80% of the salary of workers in the country if companies kept them on their payroll [108]. However, these measures of assistance by many countries of the world to their citizens are hard to come by in Africa. Unfortunately, Africa comprises majorly of impoverished and densely populated neighborhoods with overcrowded houses, and most families survive off informal work. These make it almost impossible for people to remain home, thereby making it more difficult for people to comply with the lockdown legislations [94].

Furthermore, if no cure is discovered and the outbreak continues for a longer period, the social distancing measures, as well as the lockdown legislations, are likely to be implemented throughout the period. While these measures may have little or no effects on the social life of adults, it can have massive impacts on the long-term social development of children, especially adolescents and teenagers [109]. Also, staying at home every day puts domestic violence victims (especially women) at high risk, particularly in Africa where female subjugation is too often justified as reflecting traditions [110]. Besides, the economic impact of the lockdown, as well as the possible increase in unemployment by the end of the lockdown may increase crime rate as people may find it difficult to cater for themselves and their families [111], hence these could stimulate the rapid spread of crime wave.

The emergence of COVID-19 is indeed, a wake-up call for Sub-Saharan Africa and the African continent at large [102]. The need to urgently develop our health standard to international repute remains a task that can never be overlooked at this point in time, as the spread of COVID-19 pandemic has blown the fowl's anus open for the entire world to see our weakness and wickedness in service to humanity in Africa.

Conclusion and Smart Recommendations

The rapid spread of COVID-19 poses a great threat to the African race. Despite the inadequacies in healthcare infrastructure, the disease is yet to get a worst-case scenario in Africa. Several countries with state-of-the-art and robust healthcare systems are literally wailing due to the drastic outcomes of the infection. With cases rising gradually by the day, Africa may be faced with a disaster should the pandemic get to a worst-case-scenario within the continent. Most African countries are currently lacking sufficient testing capacities and many positive cases of the infection may have been ignorantly overlooked, thereby exposing more people to the infection. Also, most African countries currently lack sufficient healthcare facilities and workforce to take care of the increasing number of cases. Several epidemics, including the Ebola and the Lassa fever outbreaks, as well as the endemic tuberculosis and malaria infections, have occurred and these has posed a strong hit to the struggling healthcare systems, and the continent had overcome them. However, COVID-19 has shaken the world and has confined the elites of the continent to the local healthcare systems, unlike in cases where they seek medical treatment abroad. Epidemics are bound to occur from time to time, and it is not out of place to expect more in the future.

Nevertheless, given the above critically analyzed ugly scenario the following SMART solutions would help to contain the pandemic, if strictly observed in Africa:

1. The social distancing and lockdown measures being implemented should be upheld for as long as the outbreak remains active.
2. African countries should invest massively to expand their healthcare capacities as an emergency response to contain the outbreak.
3. Every country in the continent should build standard isolation and quarantine centres to help the patients feel at home.
4. After the pandemic, the leadership of the continent should prioritize the development of the local healthcare systems, improvement of the infrastructure, advanced training of the health personnel and standardization of health care.

These measures are not only for the immediate resolution of the problem but will, in the long run, step up the preparedness for future outbreaks of infectious diseases, improve the overall healthcare services within the continent, reduce the rate of treatment-related travels to foreign countries and improve the economy of the nations.

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Conflict of Interest

None reported among authors

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