



Mini Review

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Coronavirus (COVID-19); Review from A Nigerian Perspective

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Abstract

Coronavirus is no longer a new virus in virology. The novel coronavirus called *COVID-19* considering its powerful pathogenicity and transmissibility as confirmed to be more infectious than severe acute respiratory syndrome coronavirus (*SARS-COV*) and Middle East respiratory syndrome coronavirus (*MERS-COV*). The method employed in this study is a review of research articles, news and updates on coronavirus (*COVID-19*) in the area of Nigerian situation, medical laboratory testing and management of the pandemic, based on the political economy of the virus. The recommendations are provided for the Federal School of Medical Laboratory Technology (Science), Jos as an institution and Nigeria through Federal Ministry of Health. The institution contributes to the control of the pandemic through provision of hygiene products while expanding her diagnostic services to include *COVID-19* diagnosis.

Keywords: *COVID-19*, Nigeria, Medical laboratory service, Testing

Introduction

Federal Ministry of Health [1] announced her first case (index case) of *COVID-19* on 27th February 2020 to have come from an Italian doing a business with Ogun State. The coronavirus is believed to have come from Hunan Seafood Market in Wuhan China. This was based on Chinese Health Authority report of a type of pneumonia that could not be understood as at 31st December 2019 [2,3]. The situation and unabated increase in the number of infected Nigerians has made all activities in Nigeria to a standstill by the stay at home orders from the federal to state governments which is also binding on the Federal School of Medical Laboratory Technology, Jos. The Federal School as a training and research institution forms a committee to review the coronavirus (*COVID-19*) and that prompts this paper aimed at proffering a solution towards

prevention, management and treatment of the pandemic for the institution, state, Nigeria and the world at large.

History and taxonomy of coronavirus

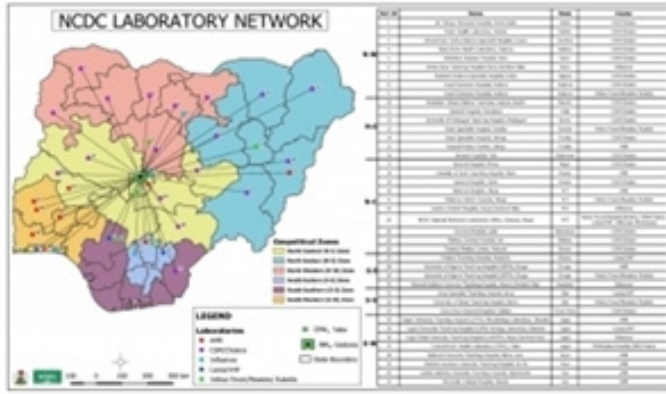
Coronavirus is as old as virus in its entirety. Coronavirus just like other viruses are surrounded by lipid envelope that is used to bind to plasma membrane of target cells by attaching to specific proteins on the cell surfaces [4]. History of coronavirus is traced to Great Flu Pandemic and have lasted 102 since discovery (Figure 1) and documented evidence of 1918 [5]. The pandemic claimed 50 - 100 million lives worldwide, including 675,000 in the United States and 454988 in Niger Area (Nigeria) where Southern Province was 255663 and Northern Province was 199,325 (Table1) and could be a benchmark for the current coronavirus outbreak.





Figure 1: A Treatment Center during 1918.

National Laboratory network



- 5 Lassa fever/VHF labs
- 4 (+ 3) yellow fever/measles/rubella labs
- 17 cholera/CSM labs
- 4 sentinel sites for Hepatitis E/Rotavirus
- 4 sentinel sites for influenza
- Goal: To have a Public Health Lab in all states in Nigeria by Q1 2021

Figure 2: Plan for National Public Health Laboratories in all states in 2021 without coronavirus in mind. Source: NCDC [49].

NCDC MOLECULAR LABORATORY NETWORK

As at 30th April, 2020

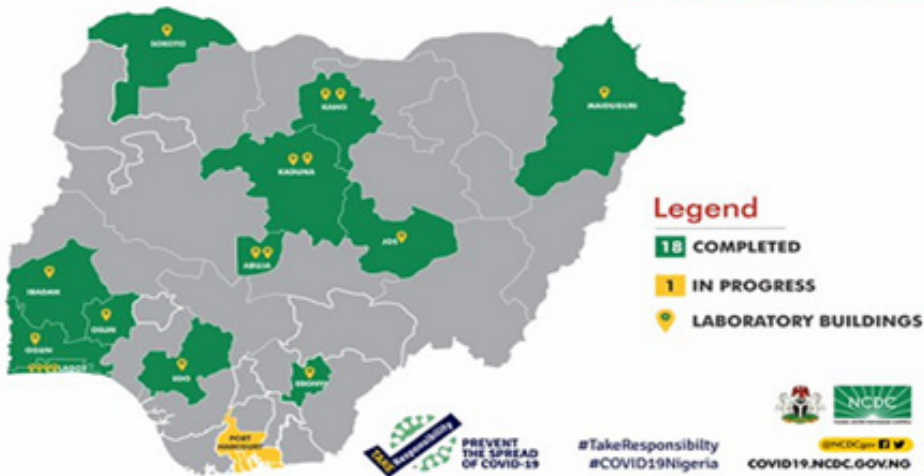


Figure 3: NCDC Functional laboratories as at 30th April 2020 Source: NCDC [51].

Table1: Niger Area (Nigeria) Data for the Pandemic 1918-19

Province	Total Population	No of Deaths	Percentages of death to population
Southern province			
Lagos Township	82000	1200	1.5
Lagos colony excluding Lagos Town ship	148000	2877	2
Abeokuta	328300	3283	1
Benin	388000	15700	2.6
Calabar	1182500	35175	2.9
Ogoja	923360	62832	6.8
Onob	316300	9490	3
Onistha	1970000	39510	2
Owerri	1372700	41181	3
Oyo	1550000	29750	1.9
Warri	614400	14663	2.3
Total	9075560	255663	2.8
Northern Province			
Bauchi	949461	17102	1.8
Bornu	731149	10000	1.4
Ilorin	527922	28884	5.5
Kano	2749727	57978	2.1
Kontagora	169485	3580	2.1
Munshi	569944	6695	1.2
Muri	222258	6003	2.7
Nassarawa	266248	10442	3.9
Nupe	266548	10684	3.2
Sokoto	1516326	30000	1.1
Yola	259056	11181	4.3
Zaria	327242	6776	2.1
Total	8615376	199325	2.3

Source: Public Record Office C0583/77. 5 September 1919

The name "coronavirus" was coined in 1968, because of the "corona"-like or "crown" -like morphology in the viruses when observed in the electron microscope during a study. The International Committee on the Taxonomy of Viruses in 1975 came up with Coronaviridae family. Also, in 2005 the International Nidovirus Symposium in Colorado Springs, divided the Coronaviridae family into two subfamilies, the coronaviruses and the toroviruses. The toroviruses of enteric diseases found in cattle and sometimes in humans, with the Arteriviridae and Roniviridae families, form the order called Noroviruses [6,7].

Coronaviruses has three genera I-III with human and animal types inclusive. Human coronavirus has two prototype - OC43 and 229E, which are found in common cold. The SARS-COV, where COVID-19 belongs has been the cause of SARS that have been noticed in humans as serious illness of coronavirus. The type of pneumonia (bronchiolitis and conjunctivitis) found in a child (7-month old) in group 1 coronavirus called HCoV-NL63 and in elderly is group 11

called HKU 1 [6]. Coronaviruses can be narrowed down to Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) based on severity or place of origin and the molecular make up.

Coronavirus as emerging / reemerging infectious agent

Severe acute respiratory syndrome (SARS) coronavirus (SARS-COV) though now called COVID-19 which is referred to as novel virus caused the first major pandemic noted in 1918 in human, 1930's in animals and recorded in humans again in the 1960's, then in 2003, in 1997 and now in 2020 after 100 years. Cheng and co Scientists [8] predicted the reemergence of the disease and here it is with new name COVID-19 when they posited that increased demand for games animals as sources of protein in China without adequate biosecurity measures may lead to escape of virus to humans. Consequently, SARS-COV-2 (COVID-19) has the capacity for human-to-human transmission. Also, there is inadequate hospital infections and control measures and poor awareness on the novel

virus leading to fast spread across the globe through international travels. This is where we are *SARS-COV-2* has returned and fully introduced with mutation, amplification, and transmission in such a dangerous virus called *COVID-19*.

Coronavirus is in the family of RNA viruses that infect birds and many mammals including humans. The viruses cause illnesses that range from common cold to more severe respiratory diseases and rarely gastroenteritis. *COVID-19* is caused by an emerging strain of *SARS-COV-2* that is novel in humans, though, belongs to severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS), for which can be referred as zoonotic in transmission and person- to-person transmission [8,9].

Current trend of coronavirus as COVID-19

Coronavirus (*COVID-19*) is currently ravaging the countries of the world, Nigeria inclusive. *COVID-19* was traced to Huanan Seafood Market of Wuhan city in the Hubei Province of China as declared by China CDC and Chinese Health Authority [10,11] while WHO first declared *SARS-COV-2* as a Public Health Emergency of International Concern (PHEIC) on January 30, 2020 [11,12]. *SARS-COV-2* (coronavirus disease) fondly called by many people as China disease was officially renamed *COVID-19* on 11th February 2020 [2,3].

Transmission of the novel virus *COVID-19* is human to human though said to have started from animals and can be direct in transmission from respiratory droplets produced by an infected person while coughing or sneezing or indirect transmission by touching a surface or object that has the virus on it and then touching their own mouth, nose, and eyes [13]. *SARS-COV-2* (*COVID-19*) has a unique pathogenicity and transmissibility, which has been confirmed to be highly infectious than *SARS-COV* and *MERS-COV* [14]. An encounter with *COVID-19* patient can easily lead to cross infection from one person to another in absence of personal protective equipment [15] for example: Masks, gown, goggles, boots, gloves etc. Wrapp et al. [16] explained that *SARS-COV-2* has a powerful infectivity as it binds to angiotensin-converting enzyme 2 (ACE-2) receptors in the afflicted patient thereby, showing a higher affinity than *SARS-COV-S*. Zou et al. [17] explained that viral nucleic acid in patients infected with *SARS-COV-2* is similar to that of influenza patients.

SARS-COV-2 has shown quick and easier transmission among the clusters, for example: family clusters, board room clusters, restaurant clusters etc. which has accounted for 50-80% of all confirmed cases of *COVID-19* [18]. Transmission between clusters of family members occurred in 13-21% of MERS patients and 22-39% of SARS cases [19] which shows the infectivity nature of *SARS-COV* and *MERS-COV* through nosocomial transmission in the assessment of human-to-human transmissions.

The evidence of contact transmission *SARS-COV* and *MERS-COV* via droplets, contacts and environment has been established [20,21]. To add, novel viruses have been found in the faeces of *COVID-19* patients [22,23], but faecal-oral transmission of the coronavirus has not been shown in *SARS-COV* having noted that the virus could survive at room temperature for at least 1-2 days in faeces [24]. There is a possibility for *SARS-COV* to spread via faecal-oral route [25] but not frequent. In patients with *MERS-COV*, faeces and urine samples also yielded viral RNA [26]. Given the evidence of faecal contamination of *SARS-COV* and *MERS-COV* as well as their ability to survive in faeces, then, *SARS-COV-2* can also be transmitted through the faecal-oral route [27] though subject to more research studies. It is also possible that gas from *COVID-19* patient after fat can infect close subjects just as spills of *COVID-19* patient urine can be very infectious.

Asymptomatic patients of *SARS-COV-2* may transmit virus to others just as patients with negative *SARS-COV-2* swabs may also be diagnosed with *COVID-19* but there is no current evidence that *SARS-COV-2* can be transmitted in the uterus [28] while *COVID-19* transmission via air (air-borne) is still under contention [29] which has thrown up arguments among researchers.

The Nigerian Situation of COVID-19

Nigeria had the index case of *COVID-19* on 27th February 2020 as announced by the Federal Ministry of Health (FMOH) [1]. The index case was an Italian that works in the country. Majority of the cases are Nigerians coming back from an endemic country. The global overview shows 3 356 205 confirmed with new cases of 90 399 and 238 730 deaths. African Region has 43 029 confirmed cases with 1 761 deaths and 14 343 recoveries. Nigerian current status after 17 566 medical laboratory tests shows confirmed cases of 2 558 with 400 recoveries (discharged cases) and 87 deaths recorded in Nigeria as at 3rd May 2020. The pandemic has affected 35 states of the country with Lagos leading at 1 107 cases followed by Kano at 342 and FCT at 278, and other states follow as reported by NCDC on 3rd May 2020. The Nigerian situation in the current *COVID-19* situation is likened to statement made by Anne [13] that "Epidemics Reveal the Truth about the Societies they Hit" [30] and this is very true about health services in the country especially with the medical laboratory services where Directorate of medical laboratory services is still missing in the FMOH and in most states of the country.

Precautionary measures with WHO/National Guidelines

In line with WHO, the FMOH [1] and Obeta et al. [34] advised Nigerians for their good hand and respiratory hygiene with necessary precautions on personal, respiratory and Hand hygiene including; physical distancing (least 5 feet), avoidance of crowd, adequate disposal of the used tissue or infected materials;

avoidance of self-medication and contact of proper authority and staying informed through official channels of FMOH and NCDC.

As a way to ensure adequate precautions and quality good medical laboratory practice during *COVID-19*, NCDC [13] provided some guides to Medical Laboratory Scientists and other professionals working in *COVID-19* testing centers. Coronavirus (*COVID-19*) Specimen Collection Guide deals with adequate labeling, Virus Transport Media (VTM) tube and any other sample tube standard packaging procedures as required by the NCDC with regards to *COVID-19* sample site collection, adequate personal protection equipment and hand hygiene.

Medical Laboratory Testing of *COVID-19*

The best testing methodology of *COVID-19* is real time reverse transcription - polymerase chain reaction (RT-PCR) as recommended by WHO [12,13] and implemented by NCDC [8]. This method could be well positioned at the geopolitical centers while lesser and cheaper methodologies could go on at the state and local government public health laboratories thereby bringing the test closer to the people. This could be achieved with Rapid Detection and Point-of-Care Diagnostics for *COVID-19* [3,13]. The testing protocol is however dependent on the NCDC and WHO guidelines in Nigeria.

In relation to China, NHC [12] and Nigeria [13] shows criteria that must be satisfied to be considered a potential *COVID-19* for

medical laboratory testing. They include:

a) Epidemiological history

Clinical features of:

- i. Symptoms of respiratory tract infection and fever,
- ii. radiographic evidence,
- iii. low or normal count of white-cell and lymphocyte.

Patients possessing an epidemiological history, consistent with any two clinical features, are diagnosed as suspected cases.

COVID-19 suspected cases are tested for confirmation by:

- A. Positive for *SARS-COV-2* using respiratory tract or serum specimens which are examined with real-time RT-PCR;
- B. The genome sequencing of the novel virus from respiratory tract or serum specimens which are identical to *SARS-COV-2* sequences.

Nonetheless, the quality of PCR results for *COVID-19* is directly proportional to the quality of the kits and that of the medical laboratory scientist or the laboratorian doing the testing as well as to the novel coronavirus's characteristics, sampling location, sampling volume, transportation and storage, with laboratory test conditions. The principle is based on the fact that *COVID-19* interacts with the ACE-2 receptor, a cell-surface protein mainly found on lung alveolar epithelial cells [31]. The procedural methodology with principles of RT-PCR is shown in Figure 4.

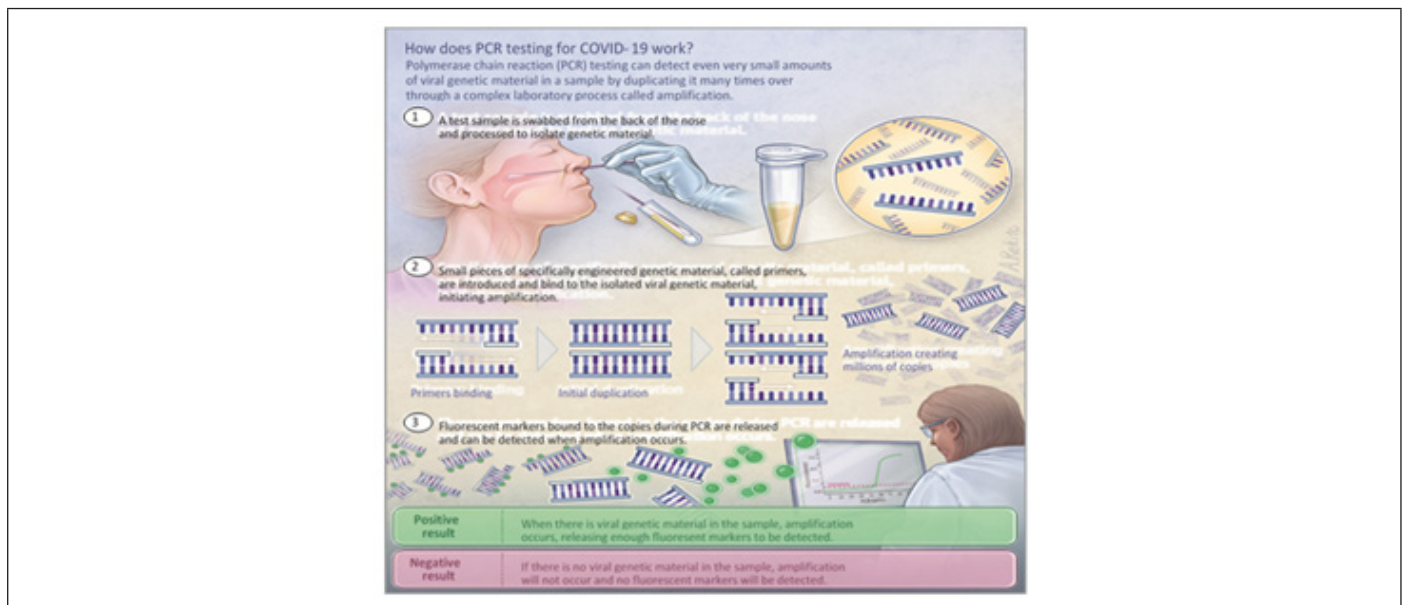


Figure 4: RT-PCR Testing of *COVID-19* Source: Wang et al. [52].

The alveolar lavage, sputum, pharynx swab are good samples for *COVID-19* testing [32] though, pharyngeal swabs are the most common sampling method, because of unproductive coughs but may cause missed diagnoses sometimes in *COVID-19* diagnosis. In addition, RT-PCR detection may be time consuming thereby increasing the testing turn-around time and in-turn hamper the

control of infectious diseases. Therefore, the revised version of the 5th edition added clinical confirmed standards for the Hubei Province [33] and as such necessary for consideration in Nigeria. It is also, very important to consider the use of rapid test kits as preliminary screening before confirmation with RT-PCR.

The NCDC planned for a Public Health Laboratory Network that shall cut across the states of Federal Republic of Nigeria and Federal Capital Territory, targeting the year 2021 (Figure 2) but the emergence of *COVID-19*, made NCDC to announce 2-testing sites which has increased to 18 (Figure 3) with 2 under construction as at 30th April 2020. It is instructive to note that at the time of writing this paper, the laboratory sites according to geopolitical zones are South West - 7 Laboratories (Lagos, Ibadan, Ogun and Osun), South South - 1 Laboratory (Edo), South East - 1 Laboratory (Ebonyi), North Central/ FCT - 3 Laboratory (Abuja, Jos,) North West - 5 Laboratory (Sokoto, Kano and Kaduna) and North East - 1 Laboratory (Maiduguri). It is therefore very urgent for the Nigerian government through NCDC to plan towards more *COVID-19* laboratories in all states and additional one in very large states for adequate handling of the Nigerian population [34].

For *COVID-19* diagnosis, the samples involved are nasal secretions, blood, sputum, and bronchoalveolar lavage (BAL). The samples are subjected to specific serological and molecular tests specific for *COVID-19* for laboratory diagnosis. Serological tests employ enzyme linked immunosorbent assay (ELISA) or Western blots that detects specific *COVID-19* proteins. Molecular approaches are based on Real Time-PCR (RT-PCR) or Northern blot hybridization with target of specific *COVID-19* genes [13,40]. Viral antigens present in the clinical specimens can also detected by using direct immune fluorescent assay (IFA) [35,36] and Antigen / Antibody reaction testing [37].

With the current scarcity of testing centers and PCR testing kits across the globe and particularly in Nigeria, there is need to consider rapid testing using new detection medical laboratory technology and point of care testing kits [28,38] or creating mobile biosafety laboratory as exemplified in Wuhan china [39] where the coronavirus started of recent. The NCDC have developed a very good safety and diagnosis procedures [13], however, the clarity in terms of job description and roles of the laboratory staff in the public health laboratories was not clearly stated. This calls for concern on the quality of test results expected in line with international best practices. There is a need to specify the role of Pathologists, Medical Laboratory Scientists, Public and Environmental Health professionals and logisticians in the scheme of planned public health laboratories.

Obeta et al. [34] based on the results of *COVID-19* released by NCDC during this article development agrees that results may be skewed to the proximity of testing centers, supports Chollom [42] when he advised government to upgrade the state epidemiological units to State Centers for Disease Control (SCDC). This has been corroborated by Governor Makinde's testimony when he tested negative to *COVID-19* as reported by Tribune online of 7th April 2010

Management and Treatment of Corona Virus

There is a management guideline by WHO globally as adopted by NCDC for use in Nigeria [13].

COVID-19 currently do not have a confirmed treatment though management is ongoing with various clinical trials with hope of developing / discovering vaccine as soon as possible. Many have been treatment and reported negative in various countries. Various trials made so far includes: Japan flu drugs, antiviral drug - Favipiravir or Avigan, Chloroquine and hydroxychloroquine, failed Ebola drug - remdesivir, HIV drug combination- combination of lopinavir and ritonavir, An immunosuppressant and an arthritis drug - Actemra, or tocilizumab with interleukin 6 (IL-6) ie cytokine, sarilumab or tocilizumab, blood pressure drug- Losartan, and possible use of large dose of Vitamin C. [43-45]. Though, Zhi [45], started a clinical trial in Zhongnan Hospital, China from 11th February, 2020, with some countries looking the other way in the issue of Vitamin C infusion [46], idea presented by Ohanube & Obeta [47] on the use of Vitamin C for the treatment of *COVID-19* could be another breakthrough.

The Presidential Task Force, the NCDC and NAFDAC in collaboration with CDC and WHO should look into the use of indigenous products that could help in the management of *COVID-19*. Such should include herbs eg. Dogon yaro, and Nigerian food like vegetables and fruits - Lemon, Bitter cola, Ginger, Garlic, etc.

Ethical Implications of COVID-19

Several ethical issues arise in any pandemic as observed during influenza pandemic just like *COVID-19* currently ravaging the whole world and Nigeria in particular. Such ethical concerns are noticed during planning, organizing and responses to issues surrounding any pandemic and no wonder it is very important as future pandemics are important to consider, so as to ensure that response efforts are not hindered in the event of any pandemic.

The priority for access to healthcare by patients during *COVID-19* pandemic in Nigeria is of great concern especially as Kano State citizens cry out due to neglect of treatment of the masses who need adequate healthcare and are been ignored because of the attention given to treating potential *COVID-19* patients. Though such treatment might have been necessitated by shortage of resources with increased demand of care and scarcity of human resources for health and personal protective equipment. The obligations of healthcare workers in amidst risks to their own health is a big challenge; and the balance between reducing disease spread through isolation, and travel measures whilst protecting the right of individuals to freedom treatment and movement creates an ethical issue [48].

Nuffield council [49] on Bioethics highlights that the public health measures need to be evidence-based and proportionate to the public. It is therefore imperative to add that coercion and intrusion into people's lives during the *COVID-19* should be as minimum as possible and consistent with treating all with respect, morality and equality. While public individuals in Nigeria are asked by the government to make sacrifices for the public good, the respect and fundamental human rights due for individuals should never be forgotten in the way in which interventions such as quarantine and self-isolation are implemented at any giving time. Importantly, solidarity is a crucial part of *COVID-19* intervention at the international level between countries like China and Nigeria for instance; private and business personalities in exercising their corporate social responsibility; and at the individual level in the way we all respond to the outbreak in day-to-day life of various people without discrimination and stigmatization.

The ethical issues of informed consent, confidentiality and right of movement is challenged by *COVID-19* in Nigeria, however, what is right and acceptable shall be applied to ensure safety and containment of the pandemic.

Political Economy of COVID-19

UNDP [50] posits that the growing *COVID-19* pandemic may threaten developing countries like Nigeria. The pandemic may not only be as a health crisis in the short term but there seems to be a looming and devastating economic crisis that may affect social and private lives for months and years to come. "This pandemic is a health crisis. But not just a health crisis. For vast swathes of the globe, the pandemic will leave deep, deep scars," as noted by Achim Steiner, Administrator of the United Nations Development Programme (UNDP). Also, "Without support from the international community, we risk a massive reversal of gains made over the last two decades, and an entire generation lost, if not in lives then in rights, opportunities and dignity."

The WHO and UNDP are working closely to help countries like Nigeria in the way they prepare for, respond to and recover from the *COVID-19* pandemic. The wealthy and philanthropic private individuals have also come to the rescue of Nigerians focusing particularly on the most vulnerable population in distribution of palliatives to add to what the government is doing to cushion the pandemic effect on the masses. Because of the economic impact of *COVID-19* on Nigeria, China, EU, IMF have come to the rescue of Nigeria by providing some financial and material assistance. *COVID-19* shows acute and dramatic impact on Nigerian economy and healthcare systems to the extent that many top government officials could openly admit the rot nature of health system in Nigeria as the case of Boss Mustapha, the Secretary to Government of the Federation. The effect of *COVID-19* is highly noticeable that government that depends on oil for running government budget like

Nigeria as oil prize falls, is thinking of borrowing, merging ministries and agencies, cutting down budget and lean economy. The economic experience in Nigeria and all over the world is not funny as both the rich and the poor is immensely affected. In Nigeria, un-budgeted fund is been released in the face of borrowing, while every product is going up in prize, the petrol prize at international community is going down. The IMF has announced the possible recession in this *COVID-19* era, and this shall affect Nigeria in particular due to over dependence in foreign products for her economy.

COVID-19, a Lesson for Nigerian Leaders on Health System Improvement

COVID-19 for the first time stopped the rich men and the political class from flying from one point to the other within and outside the country. They can easily be admitted into same rejected hospitals in their past life and medical tourism with capital flight was put to a halt. Construction of international hospitals and modern laboratory facilities by Nigerian government within a shortest time could be a lesson that Nigeria would learn from China that transported sample to Beijing from Wuhan for testing before deploying mobile biosafety laboratory for testing and subsequently build some laboratories close to the people with BSL-2 systems [51,52].

There is urgent need to use the experience of *COVID-19* to build health systems for Nigerians not minding one's class. Such developments should be backed up by enabling laws and other matters related to them like prohibition of medical tourism.

Recommendations for FMOH/NCDC/FG on COVID-19

1. Continue the construction of State by State laboratory network for easy access and quality medical laboratory testing (diagnosis) for all.
2. Recruit more Medical and Health Professionals with good insurance / payment packages to ensure optimal performance.
3. Decentralize testing of *COVID-19* and possibly use regional centers as confirmation where the states cannot confirm.
4. Encourage local production of *COVID-19* materials and consumables eg face masks, goggles, shoes, clinical and laboratory wears.
5. Facilitate local production of *COVID-19* test kits and *COVID-19* transport medium (Virus transport medium-VTM).

Recommendations for FSMLT, Jos on COVID-19

1. The management should approach FMOH/NCDC to attract the Jos PCR diagnostic center to the institutional environment
2. Facilitate *COVID-19* awareness package for students, staff and general public in form of prints, media, and social media

3. Develop online lectures platforms using compute unit, and encourage all lecturers to cue into online platforms for online lectures to students during the stay at home order and in future
4. Approve the production of Hand sanitizers under the

Medicals and diagnostic department for students, staff and general public

5. The management should commence full operation of medical laboratory services including advanced techniques such as RT-PCR etc.

Conclusion



Figure 5 (a-c): Hand Sanitizer Spray Produced by FSMLT, Jos, donated to FMOH, PLSG and the Public for Personal Hygiene during COVID-19.

The coronavirus (*COVID-19*) also called novel coronavirus (*N-COV-19*) remains new and unique and requires more research in Nigeria to unravel the genetic sequencing, pathogenicity and transmission, diagnosis and management. It also needs domestic research on the local foods and herbs that could be the cure for *COVID-19*. It is instructive to note that the Nigerian medical laboratory scientists have the capacity to reactivate the vaccine laboratory for the production of vaccines that could stop *COVID-19* if supported by the Federal Government of Nigeria. Figures 5(a-c) is evidence that *COVID-19* has stimulated Federal School of Medical Laboratory Science, Jos towards producing hand hygiene products (hand sanitizer spray) and equally providing them to government and the public.

The Federal School of Medical Laboratory Science Jos is strategically capable of providing the needed solution through research and training.

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