Appraisal of COVID-19 Response in Nigeria: The Role of Test Data in Response Strategy

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Abstract

The aim of the thesis is to examine Nigeria's handling of the recent public health challenge - COVID-19 pandemic. The country has witnessed a coupled of diseases of public health significance in recent years. From Ebola Virus Disease (EVD), Cholera to Lassa Fever, the country's response and surveillance system has been tested on many occasions. However, COVID-19 crisis response and management presented a different level of challenge. The global dimension to the crisis calls for a lot of coordination and collaboration between the Federal Government and the States on the one hand, and among the various agencies on the other hand. For decision-makers, access to critical information such as testing, accurate number of fatalities, available ICU beds etc. is central to effectiveness and choice of response strategy. The study examines critical data as reported by the health agencies, data availability, testing facilities and contact tracing on the nature of government responses the crisis. At the end of the thesis, recommendations are made towards improving crisis preparedness and response framework in the country. It is believed that improved investment in the health sector, especially in laboratory facilities, would strengthen the public health system and its ability to respond to disease outbreaks in future. This would also expand the sector's capacity to save lives and resources as a result of timely and better response strategy.

Keywords: COVID-19, COVID-19 testing, pandemic, testing, test data

ii

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Dedication

This project is dedicated to the memory of my lovely mum. You left at the most critical stage of my life. To my lovely wife, Funmilayo, and my kids (Yasir, Hibbatullah, Khalid and Karima), I can not quantify your support to the success of this programme. Your patience and prayers make the difference. And to my friend, Kola, I am eternally grateful for your support. May God reward you all abundantly.

Table of Contents

Abstract	ii
Acknowledgement	iii
Dedication	iv
List of Figures and Tables	vi
1 Chapter 1 Introduction	1
1.1 Background	1
1.2 Structure of the thesis	6
2 Chapter 2 Nigeria's Health Sector Perform	nance7
2.1 General overview of Nigeria's healthcare sy	stem7
2.2 Healthcare Financing	9
2.3 The role of various government agencies	
2.3.1 Presidential Task Force (PTF) on CC	VID-19 Response14
2.3.2 Nigeria Center for Disease Control –	NCDC15
2.3.3 State Ministry of Health and Agencie	s 16
2.4 Health Surveillance System in Nigeria	
2.5 Integrated Disease Surveillance and Respo	nse system21
3 Chapter 3 COVID-19 Outbreak and Key Ev	ents Timeline24
3.1 Crisis Preparedness and Response Strateg	y24
3.2 Prevention Stage (Pre-outbreak: January 1	– February 27, 2020)24
3.3 Containment Strategy (February 28 – Marc	h 26, 2020)27
3.4 Containment and Suppression Strategy (Ma	arch 28 – June 30)31
3.5 Mitigation Stage (July 2020 – to date)	
3.6 Contact Tracing	
4 Chapter 4 Impact of Testing Data on Resp	onse Strategy36
4.1 Challenges with Testing	
4.2 Comparison between Nigeria and South Afr	ica40
4.3 Implication for the country's pandemic contr	ol strategy41
4.3.1 Different Region, Different Strategy .	
4.4 Testing at the Internally Displaced People (DP) Camp48
5 Chapter 5 Policy Recommendations and 0	Conclusion52
5.1 Recommendation	
5.2 Conclusion	
References	

List of Figures and Tables

<u>Figures</u>

Figure 1: Number of cases and deaths as at June 22, 2020	3
Figure 2: Spatial distribution of COVID- 19 among geopolitical zones (May 2020)	4
Figure 3: The general overview of health sector service delivery in Nigeria	8
Figure 4: Current health expenditure (% of GDP) - Nigeria, South Africa, Egypt, A	rab
Rep., Namibia, Sub-Saharan Africa, Lower middle-income countries	11
Figure 5: Nigeria's Health Spending vs Performance 2019	12
Figure 6: Health Efficiency Frontier 2019	12
Figure 7: Health Expenditure Spending Comparison	13
Figure 8: Major Disease Outbreaks between 2016 - 2018	15
Figure 9: Diagrammatic representation of medical Intelligence/surveillance	18
Figure 10: Nigeria's rating on preparedness to address public health risks	19
Figure 11: IDSR Framework in Nigeria	22
Figure 12: Nigeria's performance in terms of surveillance and laboratory performa	ance 22
Figure 13: Summary of Nigeria's Preparedness for COVID-19	26
Figure 14: Locations of laboratory facilities as of February 2020	27
Figure 15: Number of daily positive COVID- 19 cases (including 7-day moving av	/erage)
	30
Figure 16: COVID-19 Response Framework	
Figure 17: Laboratory facilities as of January 2021	34
Figure 18: SORMAS coverage after initiation of COVID-19 response	
Figure 19: Number of daily COVID -19 test per thousands of people	
Figure 20: Projected Number of cases in Nigeria (14 days) as at April 2, 2020	
Figure 21: Trajectory of testing samples as at April 9 2020	40
Figure 22: Daily COVID -19 tests (shown in 7-day rolling average (per 1 million) .	41
Figure 23: Number of people tested by Nigeria vs South Africa	41
Figure 24: Comparative test data per 100,000 of population	42
Figure 25: Stringency Index for Nigeria and South Africa	

Figure 26: Relationship between daily tests and confirmed cases for Nigeria* and South	۱
Africa4	3
Figure 27: Per Capita space in some selected IDP camps within the BAY states	
compared to other densely populated area5	0
Figure 28: Health Centers' Preparedness in handling COVID-19 across IDP camps in	
Northeast Nigeria as at May, 20205	1

<u>Tables</u>

Table 1: Trends in Health Budget Allocation from 2014 - 2020 (Amount in Billio	n Naira -
NGN)	10
Table 2: Comparison between Nigeria and South Africa	20
Table 3: Capacity improvement	

List of Abbreviations

- ACEGID African Centre of Excellence for Genomics of Infectious Diseases
- AE Advanced Economy
- EME Emerging Economy
- FAO Food and Agriculture Organization
- FCT Federal Capital Territory
- FMoH Federal Ministry of Health
- ICU Intensive Care Unit
- IDSR Integrated Disease Surveillance and Response
- IHR International Health Regulation
- IMF International Monetary Fund
- IOM International Organization for Migration
- LGAs Local Government Areas
- LIDC Lower Income Developing Countries
- LUTH Lagos University Teaching Hospital
- NCDC Nigeria Center for Disease Control
- NCPG National Coronavirus Preparedness Group
- NIMR Nigerian Institute of Medical Research
- OCHA Office for the Coordination of Humanitarian Affairs
- OxCGRT Oxford COVID-19 Government Response Tracker
- PPE Personal Protective Equipment
- PPP Purchasing Power Parity
- SORMAS Surveillance Outbreak Response Management & Analysis System
- WHO World Health Organization

1 Chapter 1 Introduction

1.1 Background

The first case of "Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)" infection was first reported in Wuhan, China, as "a cluster of cases of pneumonia" by Chinese authority in December 2019 (WHO, 2020c, p. 2). WHO declared it a "global pandemic" during media briefing on March 11, 2020, by which there had been 118,000 reported cases with 4,291 fatalities in 114 countries (WHO, 2020c). The disruption brought about by the pandemic is global and could be described as one of the unforeseen consequences of globalization (Amzat, 2020, p. 223). Given the impact of the pandemic on people's health and the need to halt the transmission, it is imperative to examine those factors that undermined Nigeria's effort at nipping it in the bud at the early stage of the outbreak (Omaka-Amari et al., 2020, p.88). Every information should be examined and could assume much importance during crisis situation as it can provide insights into existing problems.

Nigeria has poorly developed health infrastructures such as qualified personnel, laboratories, disease surveillance system etc. that could produce accurate and timely data about the number of patients that have been tested across all the states on a consistent basis. At some point, key decisions like whether to lockdown or reopen the economy was based on other qualitative information rather than scientific facts. The country was among those countries that were classified as "*13 high-risk countries*" as regards the spread of the virus (Amzat et al., 2020, p. 218). The announcement of the first confirmed case threw many citizens into panic mode for the obvious reasons. There were initial denials among a sizeable number of the populace that the disease was not meant for blacks. There are

others who have genuine cause for concern as a result of global interconnectivity through trade, education, businesses etc. Globalization and advancement in transport technology have reduced travelling time to a fraction of what it used to be in the past. Between when the first index case was reported and mid-March, four governors were reported to have been infected, among other high ranking political office holders, which led some section of the population to mis-interpret it as "disease of the elite" (Toromade, 2020). With many Nigerians travelling around the world, especially the volume of businesses and travelers to China, the worst was feared to occur within the shortest period of time. The deplorable state of healthcare facilities such as PPE, ventilators, isolation beds etc. also called for concern. The pandemic is a public emergency, with the response lying squarely with the Federal Ministry of Health (Alagboso & Abubakar, 2020). At the onset of the crisis, the country claimed to have capacity to conduct an average of 2,500 tests in a day for its population of over 200 million people (Maclean, 2020). The cases of infection within the first one month were mostly by returnees to the country (Amzat et al., 2020, p. 219). Test results for places like Kano took two weeks on average to come out, inclusive of medical doctors who would have to wait for that long before leaving the mandatory quarantine (Maclean 2020). The use of "real time polymerase chain reaction (rtPCR)", a gold standard in testing, which involves longer testing time and completion of analysis of specimen, complicated the delay further (Onyeaghala & Olusola, 2020, p. 2).

Primary healthcare facilities, which are located in the rural and peri-urban centers, are in total collapse and unable to offer any form of real support to other levels of healthcare (Olusola et al., 2020, p. 9). Critical facilities that are needed for effective functioning of the health system such as trained personnel, health centers and equipment lag behind the

minimum required to effectively serve the people, especially for people living in the rural areas (Welcome, 2011). With just 350 ventilators and same number of ICU beds for its population, it was apparent that the country would be unable to cope with full blown infection (Dixit et al., 2020).



Figure 1: Number of cases and deaths as at June 22, 2020

Source: Worldometer

In a way, the number of cases and total fatalities bear some linear resemblance. As can be seen from Figure 1, the rise in the number of confirmed cases spiked around the middle of April 2020. The sudden rise in the number, as well as the number of fatalities, could not be explained in line with the popular narrative that was accepted that time. Many states were reporting very low cases. The some of the factors responsible for it would be examined later in the study.

The problem of coordination was more feasible in areas like funding and declaration of lockdown, where there were conflicting interpretations as to whether governors could unilaterally declare lockdown order in their territories or not (Amzat, 2020, p. 223). The spatial distribution of the pandemic right from the onset has been skewed towards the Southern parts of the country, with Lagos alone responsible for the bulk of the infection.



Figure 2: Spatial distribution of COVID- 19 among geopolitical zones (May 2020)

Bulk of the early cases were being reported in the South West geopolitical zone of the country as shown in Figure 2. Many reasons were canvassed for the lopsidedness but there were little or no scientific explanation. The figures were not reflecting the realities of the population and other demographic variables; at least scientifically.

However, the figures being reported significantly influenced the type and the nature of measures taken by the Government, both economic and pharma-centric, in order to address the crisis. However, some of the measures, like the series of lockdowns, are not

Source: Onyeaghala and Olajide

consistent with facts given that either the data that were available were not accurate or took quite long to generate. This created a scenario were actual even lagged behind measures being proposed by the Government.

Enforcing some of the measures put in place by the Government also presented a lot of challenges. For example, security forces killed more people in the early stage of the implementation of the lockdown more than the reported number of fatalities from COVID-19 as at the second week of enforcement (Adegoke, 2021). The State governments complimented the Federal Government's effort in addressing the crisis. For examples, some states where the Federal Government did not declare lockdown order at the onset of the crisis had to impose curfew and other restrictive measures in order to minimize the risk of spread.

It needs be emphasized right at the beginning that no country was prepared to fight against the pandemic with adequate resources; neither the United States of America nor Sweden – just to mention two highly developed economies with different socio-economic models. However, Nigeria has a language advantage. English is widely spoken; expert can establish direct contacts with the leading countries and organizations such as WHO. Also, 90 per cent of the current literature on the topic is in English, too. The demographics are favourable: many young people with strong immune systems. Weather conditions help, too. People can spend most of their time outdoors.

Nigeria has experienced massive viral/bacterial infections at various point in time: Ebola, polio, Lassa fever etc. There is high prevalence of asymptomatic COVID-19 cases, meaning they do not present any noticeable clinical symptoms, thereby frequently escape detection from public health surveillance systems and are quite challenging for available

preventive measures of infection control such as self-quarantine (Syangtan et al., 2021, p. 1). This means that the officially recorded number of cases are gross underestimations in all countries, including the most advanced ones with adequate capacities of testing. Nigeria is no exception to this rule.

1.2 Structure of the thesis

The main part of the thesis shall be divided into four chapters, organised as follows: Chapter 2 shall discuss the general overview of Nigeria's healthcare system and the key agents/stakeholders in the system. The chapter shall also discuss briefly healthcare funding in Nigeria and the nature of healthcare surveillance system in use. Chapter 3 shall focus on the evolution of the pandemic in the country and the major highlights of each phase. Chapter 4 shall discuss the major challenges with testing and how it impacted on the country's strategy during critical stages of the pandemic. Chapter 5 shall discuss some recommendations towards improving the system going forward and end with conclusion.

2 Chapter 2

Nigeria's Health Sector Performance

2.1 General overview of Nigeria's healthcare system

Given that Nigeria has a federal structure of government, healthcare services come under concurrent legislation list¹. There are three layers of healthcare, aside privately provided services: Primary, Secondary (General Hospitals) and Tertiary Services (University Teaching Hospitals and Federal Medical Centers) (Olusola et al., 2020, p. 9; Jonathan, 2019, p. 10). This allows both the Federal, State and Local governments to provide certain services that could be complementary or overlap at times. Primary healthcare is the responsibility of the Local Government, the State Governments are responsible for providing secondary care, while the Federal Government is responsible for policy development, regulation, overall stewardship and providing tertiary care (PharmAccess Group, 2015, p.10). It consists of Orthodox, Alternative and Traditional methods, coexisting with one another within the system (Jonathan, 2019, p. 14). However, unlike the 1979 constitution, the 1999 Constitution was very vague of the specific role of each level of government within the healthcare system (lhekweazu, 2010). The laboratory system is also fashioned in a similar three-tiered format like the nation's healthcare system (WHO, 2018, p. 23).

Access remains one of the greatest challenges of healthcare services in Nigeria due in part to the demographic make-up of the country – 55% of the population live in the rural areas (Welcome, 2011). Critical facilities that are needed for effective functioning of the

¹ Concurrent legislative list contains items on which both the Federal and State governments have power to make legislation as enshrined in the constitution e.g., education, health, agriculture.

health system such as trained personnel, health centers and equipment lag behind the minimum required to effectively serve the people, especially for people living in the rural areas (Welcome, 2011). Policy inconsistency due to frequent change also cause major disruption to the system (Omoleke & Taleat, 2018, p. 212).





Source: Hafez 2018

For example, every level of government takes part in the provision of primary healthcare, the Federal and State governments have teaching hospitals under their management.

More than a decade ago, the conference on Nigerian National Health (NNH) 2009 concluded that the health care system remained weak as evidenced by lack of coordination, uncoordinated services, insufficient resources (drugs, medical supplies etc.), dilapidated infrastructure, very poor quality of care where access is available (Welcome, 2011).

2.2 Healthcare Financing

Healthcare financing is the process by which revenues are raised through various sources which could be primary or secondary (including out-of-pocket), donor funding, taxes (direct and indirect), investment in health, co-payment, voluntary and mandatory which are collected in the funding pool (Adebisi et al., 2020, p. 2).

LGAs remain the least funded among the three tiers of government and the worst in terms of organization, which in turn leads to weak base on which the healthcare system is built -poor funding has always translated to poor financing for healthcare (PharmAccess Group, 2015, p. 10). Part of the challenges at the local government level is the availability of qualified personnel and the cost of maintaining such.

In terms of allocation of government resources, the sector is grossly underfunded relative to other sectors like Defense, Education etc., with fewer doctors and other healthcare personnel per a thousand of the population. For example, average government expenditure on Education as a percentage of GDP is 8.7% as at 2020, with the sector achieving as high as average of 8.4% since year 2012. Health expenditure as a percentage of GPD is 3.86% as at 2018; it reached an all-time high of 5.1% in year 2003 but has been on a steady decline for most of the period (World Bank, 2021a). Whereas out-of-pocket expenditure had increased from 70.9% to 76.6% of total expenditure between 2013 and 2018 (World Bank, 2021b). The United Nations had recommended benchmark of between 8 to 10 percent of the GDP as health expenditure spending (Oni, 2014, p. 77). At the meeting of African Head of States meeting held in Nigeria on April 27, 2001 (popularly tagged "Abuja Health Declaration"), it was agreed that member states should spend a minimum of 15% of their respective annual budget to improve the health sector (Organisation of African Unity, 2001, p. 5). Ten years after, funding targets have been

consistently missed both by the domestic governments and international donor agencies, while twenty-seven countries, including, Nigeria, were making no or sufficient progress towards the funding targets set by the Abuja Declaration (WHO, 2011, p. 2). Budgetary allocation to the sector has increased in nominal term but has consistently declined in terms of proportion and the recommended percentage as contained under the Abuja Declaration. As shown by Table 1, the allocation to the sector has declined from an average of 7.23% in 2014 to 4.38% as of year 2020. This is in spite of the passage of National Health Act in 2014 which sought to increase funding to the sector through increased allocation by the National Assembly² (Adebisi et al., 2020, p. 3).

Year	Total National Budget (NGN Billion)	Total Health Budget (Federal Government)(NGN Billion)	% Health Budget	15% of Total Budget (NGN Billion)	Gaps (Amount Needed to Meet Abuja Declaration of 2001 (15% Of Budget Size) (NGN Billion)
2014	4695.19	339.38	7.23	704.28	364.90
2015	5067.90	347.26	6.85	760.19	412.93
2016	6060.48	353.54	5.83	909.07	555.53
2017	7441.18	380.16	5.11	1116.18	736.02
2018	9120.33	528.14	5.79	1368.05	839.91
2019	8830.00	372.70	4.22	1324.50	951.80
2020	10594.36	463.80	4.38	1589.15	1125.35 Activate Windows NGN 4.99 trillion

Table 1: Trends in Health Budget Allocation from 2014 - 2020 (Billion Naira -NGN)

Source: Adebisi et al.

The country's GDP per head as of 2018 was US\$2028. During the same period, Nigeria

spent an average of 3.9% of GDP on health, compared to 4.9%, 4.9%, 5.1%, 8% and 8.3%

² Section 11 (1) of the National Health Act (2014) provided for the establishment of Basic Health Care Provision Fund. The Fund is meant to be financed by the Federal Government through the allocation of annual grant that is not less than 1% of its Consolidated Revenue Fund (CRF), grants by donor agencies and other sources of funds. The National Assembly added additional NGN55.15billion in 2015 in fulfilment of the provision of the Act.

for Lower Middle-Income Countries, Egypt, sub-Sahara Africa, Egypt, Namibia, and South Africa respectively as shown in Figure 4.



Figure 4: Current health expenditure (% of GDP) - Nigeria, South Africa, Egypt, Namibia, Sub-Saharan Africa, Lower middle-income countries

In spite of modest gain made so far in certain areas of the health sector, the country still lags behind her contemporaries, with the country's healthcare spending classified as "inefficient" (IMF, 2020, p. 14).

Source: World Bank



Figure 5: Nigeria's Health Spending vs Performance 2019

Source: International Monetary Fund





Source: International Monetary Fund

In terms of healthcare spending per capita (in PPP), current structure lies far below the applicable point on the efficiency frontier. While the country spends more than LIDC countries in Dollar equivalent, it still derive less value in outcomes relative to LIDC countries.

As shown in Figure 7, Nigeria's expenditure on health per capita, measured in US dollar, is the lowest among the three largest economies in Africa. South Africa spent as high as 6 times (US\$526 per person) of Nigeria's average (US\$84 per person) as of 2018. Healthcare spending for the country has been on a steady decline since year 2014 when it reached an all-time high of US\$108 per person.



Figure 7: Health Expenditure Spending Comparison

Source: World Development Indicator

2.3 The role of various government agencies

There are several agencies working within the health sectors. However, there are other ad-hoc agencies (e.g. the Presidential Task Force) that are created as a result of the pandemic to ensure effective and coordinated effort. A few of them are examined below:

2.3.1 Presidential Task Force (PTF) on COVID-19 Response

The committee was set up by the President on March 9, 2020 "to coordinate and oversee Nigeria's multi-sectoral inter-governmental efforts to contain the spread and mitigate the impact of the COVID-19 pandemic in Nigeria" (FMoH). Part of the objectives of the agency include "provision of overall policy direction, guidance, and continuous support to the National Emergency Operations Center (EOC) at the NCDC, National Pandemic Response Center (NPRC) Coordination, and Epidemiology & Surveillance" (FMoH). The task force is expected to provide leadership and a coordinated front in managing the pandemic through scientific and technical recommendations both to other agencies as well as the general public through regular press briefing and updates (Dan-Nwafor et al., 2020). It is also coordinating material supports provided by private sector e.g., 300-bed capacity isolation center donated by ThisDay Media in support of Federal Government efforts at combating the scourge (Alagboso & Abubakar, 2020).

2.3.2 Nigeria Center for Disease Control – NCDC

The NCDC was established (as an agency under the Ministry of Health) in the year 2011 with mandate to respond to disease outbreaks in the country (NCDC, 2021, p. 3). The need for a national public health institution in Nigeria was conceived in 2007 as a platform to mobilize resources and provide a coordinator response to emerging public health diseases (Njidda et al., 2018, p. 1). By design, it is meant to be a platform for surveillance and response to disease outbreaks. The country has been witnessing regular outbreak of infectious diseases as cholera, meningitis, measles, and other diseases that are ravaging the local communities (Maxmen, 2019, p. 310). While till having its peculiar challenges, the agency has recorded some success in its capacity as public health authority. For example, the agency has managed some notable outbreaks as shown in Figure 8.



Figure 8: Major Disease Outbreaks between 2016 - 2018

Source: Nature Journal

The need for an agency such as NCDC is rooted in the belief that prevention through surveillance and effective response makes more economic sense than control because it enhances likelihood of saving lives and minimizing disabilities (Tomori, 2019).

NCDC had a staff capacity of 300 at the outset of the pandemic (NCDC, 2021, p. 3).

2.3.3 State Ministry of Health and Agencies

Given that Nigeria has a federal structure, COVID-19 response strategy is also aligned to reflect that structure. Each state has a Ministry of Health and it's in charge of the state's general hospitals. The primary role of the state health agency include the provision of curative care and basic medical specialties by state-owned specialist and general hospitals (Hafez, 2018, p. 18). Many state health facilities are grossly under-utilized as a result of reasons such as lack of qualified personnel, weak referral system, poor motivation, poor equipment, shortage of medical supplies etc. (Ihekweazu, 2010). With the subnational governments responsible for an average of one-third of total public spending on healthcare, the magnitude of shared responsibilities calls for improved coordination among the various levels of government on the one hand, and between the public and private sectors on the other hand (Hafez, 2018, p. 17).

2.4 Health Surveillance System in Nigeria

Public Health Surveillance refers to "the ongoing systematic identification, collection, collection, analysis and interpretation of disease occurrence and public health event data, for the purposes of taking timely and robust action, such as disseminating the resulting information to the relevant people, for effective and appropriate action." (FMoH, 2019, p. 5). Section 2 of the National Health Act, 2014, empowers the FMoH to provide quarantine

and port services, as well as "determine the minimum data required to monitor the status and use of resources" (Federal Republic of Nigeria, 2014).

Real time surveillance system is a big challenge in the country owing essential to its size and underfunding (WHO, 2017, p. 25). Medical intelligence and surveillance is a critical component in the health care system and control of diseases outbreak, bio-attack, etc. (Welcome, 2011). A system of active surveillance (as opposed to passive system) can provide a complete and more reliable data pertaining to a disease – but it could be expensive, short term in nature and requires well trained personnel to function (Nnebue et al., 2013, p. 483). Passive surveillance, the commonest method, is where a health institution gets routine reports as submitted by health facilities like clinics, hospitals, the community etc., using platforms such as health information system, health management or any public health information system (FMoH, 2019, p. 5).

Surveillance at the local government level remains the focus and hub of all integrated surveillance functions and must also collaborate with emergency response structure at every level to plan public health response actions (FMoH, 2019, p. 11). A surveillance focal person, located within a designated focal health facility at the local government level, is expected to extract data as contained in the health register and entering same in the IDSR reporting forms (Ibrahim et al., 2020, p. 601).

There is need to provide facilities like reagent, specimen transport etc. that could improve the capacity of the laboratories, as well as link the data so generated to syndromic surveillance (WHO, 2017, p. 30). During the Joint External Evaluation (JEE) conducted WHO in 2017, the country performed poorly in terms of "prevention" indicators (a pointer to "limited capacity to prevent biological, chemical, or radiation health risk") but performed

averagely well under "detection" indicators (Dixit et al., 2020). There is no structured system in place for moving specimen from regional level to national laboratories, including facilities such as cold chain (WHO, 2017, p. 24). Poor road network has always been a huge challenge in moving samples from one location to another for testing, thereby reducing the credibility of such sample (Onyeaghala & Olajide, 2020, p. 1647).

Data sources Laboratory *2 Clinical *1 Others *3 Web - mining Analysis Government Central organizations, Confirmation monitor/interpretation intelligence Deeper professional analysis Notification International medical intelligence/surveillance systems



Source: Welcome

- *1 this may include clinical complaints of patients about healthcare centers, sales of medication etc.
- 2* this is inclusive of test results and orders
- *3 other critical data such as absenteeism in school etc.

A specimen movement system is crucial for efficient laboratory diagnosis, enhancing surveillance capacity and ability to respond to infectious diseases outbreaks (WHO, 2017, p. 24).





Comparatively, South Africa performed better (or at least equally) than Nigeria in all the indices of evaluation across categories such as "National Laboratory System", "Surveillance" and "Reporting" as shown in Table 2. This gives an indication of capacity available to each country in terms of surveillance and testing system prior to the outbreak of the pandemic.

Technical Area	Indicators	<u>SA's</u>	NGR's	SA/NGR
		<u>Score</u>	<u>Score</u>	
Antimicrobial resistance	P.3.1 Antimicrobial resistance detection	3	2	Better
	P.3.2 Surveillance of infections caused by antimicrobial-resistant pathogens	3	2	Better
	P.3.3 Health care-associated infection (HCAI prevention and control programmes	1	2	Below
Zoonotic Diseases	P.4.1 Surveillance systems in place for priority zoonotic diseases/pathogens	4	2	Better
National laboratory	D.1.1 Laboratory testing for detection of priority diseases	5	3	Better
system	D.1.2 Specimen referral and transport system	4	1	Better
	D.1.3 Effective modern point-of-care and laboratory based diagnostics	3	2	Better
	D.1.4 Laboratory quality system	3	2	Better
Real-time	D.2.1 Indicator- and event-based surveillance systems	3	3	<mark>Similar</mark>
surveillance	D.2.2 Interoperable, interconnected, electronic real time reporting system	2	2	<mark>Similar</mark>
	D.2.3 Integration and analysis of surveillance data	4	3	Better
	D.2.4 Syndromic surveillance systems	4	3	Better
Reporting	D.3.1 System for efficient reporting to FAO, OIE and WHO	3	3	<mark>Similar</mark>
	D.3.2 Reporting network and protocols in country	3	2	Better

Table 2: Comparison between Nigeria and South Africa

Guide: SA = South Africa. NGR = Nigeria

Source: The Author, using data from WHO's 2017 Joint External Evaluation of IHR Core Capacities for Nigeria and South Africa

2.5 Integrated Disease Surveillance and Response system

Nigeria uses "Integrated Disease Surveillance and Response – IDSR". Under the system, each Local Government Area has a "Disease Surveillance and Notification Officers (DSNO)" that is equipped with smart phones, configured and supported monthly with voice and data recharge, to undertake active surveillance of communities and health facilities within their coverage areas (WHO, 2018). IDSR strategy offers a rational basis for decisionmaking as well as effective implementation of various interventions in response public health issues such as disease outbreaks (Ibrahim et al., 2021, p. 917). A good disease surveillance and notification system enables the detection and monitoring of potential health threat to the general populace in terms of source, person, time, and location (Isere et al., 2016). There are some key gaps like poor documentations, number of IDSR reporting facilities, poor personnel etc. that hinder the ability of the health system to generate relevant data for use (Ibrahim et al., 2020, p. 4). The country has upgraded from paper notification to electronic surveillance (e-Surve) which enables online, real time notification and also minimize the occurrence of unreported communicable diseases (WHO, 2018). Only 16,626 health facilities out of a total 32,233 facilities have facility for Integrated Disease Surveillance Response (IDSR) and it is limited to polio surveillance (WHO, 2017, p. 27). The general overview of the IDSR is as shown in Figure 11. IDSR relies on the community network in order to ensure coverage and timely gathering of information about diseases of public health importance. While the design appears to be perfect in designed, there are huge shortages of manpower and infrastructure which limit the ability of the IDSR system to detect and response to public health crisis.

Figure 11: IDSR Framework in Nigeria



Source: FMoH

Figure 12: Nigeria's performance in terms of surveillance and laboratory performance



Source: World Health Organization

From Figure 12, it can be observed that the country is doing better in terms of diseases surveillance. The country's average is higher than both the African regional and global averages before the advent of the pandemic. Contrastingly, the performance in terms of functional laboratories was not encouraging. There are not just fewer laboratories but also with limited capacity to conduct relevant tests. This provides an insight into the status of laboratory and testing facilities before the advent of the pandemic. The few laboratories that could conduct tests capable of keeping pace with widespread diseases outbreaks of certain magnitude. For example, in 2019, both the Center for Public Health Laboratory and National Reference Laboratory, Abuja combined only tested 13,000 samples for communicable diseases (Crone, 2020, p. 7).

3 Chapter 3

COVID-19 Outbreak and Key Events Timeline

3.1 Crisis Preparedness and Response Strategy

Despite being the first country in the sub-Saharan Africa region to report the first case, Nigeria acted "comparatively slowly and conservatively afterwards" in addressing the pandemic right from the beginning (Crone, 2020, p. 4). The country's response could be broadly defined as "medico-centric" and "reactionary" (Amzat, 2020, p. 221). For various reasons ranging from economic, the country was undecided (less decisive) about the most appropriate course of action to pursue in addressing the crisis. Many measures were considered, and in some cases, applied either in piecemeal or specifically to a particular area of the country in order to achieve a delicate balance between managing the epidemic and triggering civil unrest. Nevertheless, Nigeria's response to the crisis could be broadly divided into four (4) phases; prevention, containment, suppression/containment, and mitigation (Dan-Nwafor, 2020). Given the novel nature of the virus and limited information, especially at the early stage, there were various myth and misconceptions among the populace about what the virus was, and "what to" and "what not" to do (Omaka-Amari, 2020, p. 92).

3.2 Prevention Stage (Pre-outbreak: January 1 – February 27, 2020)

Nigeria has big relationship with the rest of the world, and China in particular, in many aspects such as economic, trade, education etc. that involve regular movement of people between the country and the rest of the world on a regular basis. However, Africa was generally classified as "low risk" in terms of transmission between the continent and China at the early stage of the pandemic (January 2020), except for four countries in the continent: Egypt, Ethiopia, Mauritius, and South Africa (Haider et al., 2020, p. 5). This accounted largely

for the refusal of Nigeria to restrict or place travel ban on China and other badly hit countries, especially for inbound flights. This narrative sat well with decision-makers and a large section of the population who felt the disease could not "thrive" in environment such as Nigeria's. The country is quite familiar with dealing with pandemics as it had dealt with Ebola virus crisis in the past. Its recorded success in the management of Ebola crisis, compared to the likes United State, was as a result of three key factors: timely tracing of infected patients and their contacts, monitoring of the affected contacts, and isolation of contacts that are potentially infectious (Courage, 2014). While the impact of Ebola in the US was not as devastating as what was experienced in some West African countries, nevertheless, it exposed the preparedness of the US for outbreak of infectious diseases (National Homeland Security Consortium, 2015, pp 1-2).

Although, the US's manual of biosafety provided that clinical specimen from suspected Ebola patients should be manipulated using "Biosafety Level – 4 (BSL-4)", majority of the clinical laboratories were BSL-2 as of then (Beneden et al., 2016, p. 77). Schaffner³, as quoted by Courage, opined that the US failed both on the clinical side as well as well as on the public health side – for example, there were misdiagnoses, insufficient training and less than optimal supervision (Courage, 2014). Nigeria was able to achieve 100% and 98% contact tracing in Lagos and Port Harcourt respectively (World Health Organization, 2014). Experience such as this gave some rays of hope as to the likelihood of the country being able to address the emerging crisis.

NCDC issued the first public health advisory on January 22, 2020 and followed it up with the formation of multisectoral "National Coronavirus Preparedness Group (NCPG) on

³ William Schaffner is the chair of the Department of Preventive Medicine and an infectious disease expert at Vanderbilt University.

January 26 (NCDC, 2021, p. 5). As at this time only four facilities nationwide were identified as capable of conducting test on COVID-19: NCDC National Reference Hospital – Abuja, Virology Laboratory at the Lagos State University Teaching Hospital (LUTH), African Centre of Excellence for the Genomics of Infectious Diseases (ACEGID) Laboratory located at Redeemers University, and Nigerian Institute of Medical Research, Lagos.

Outbreak phase	Public actions/health interventions	Strategy
Pre-outbreak (January 1 – February 27)	Inauguration of multisectoral National Coronavirus Preparedness Group (CPG) by NCDC	
	• Inauguration of inter-Ministerial Coordination Committee by Honourable Minister for Health	
	Review of Nigeria's Pandemic Influenza Preparedness and Response Plan	
	Activation of interim Medical Countermeasure Plan	
	Conduct of table-top Logistic Capacity Assessment for COVID-19	
	• Training and capacity building of health care workers on infection prevention and control (IPC), sample collection and testing and clinical management of COVID-19	
	Designation of three molecular Laboratories for COVID-19 testing	
	Designation of COVID-19 treatment centres	
	• Points of Entry (PoE) surveillance at international borders including airports and land crossings	
	Conduct of COVID-19 simulation exercise	

Figure 13: Summary of Nigeria's Preparedness for COVID-19

Source: Dan-Nwafor

It must be noted that three out of the four facilities are located in the southern part of the country (just across two states), while only one facility is available to service the entire Northern part of the country. This means in the event large scale emergency (which eventually happened), there would be need to move samples across several kilometers in the country. With poorly developed road network and unreliable air travel, it was a perfect recipe for a bigger problem. Within the framework of 2005 International Health regulation,

the country's target is "real-time biosurveillance with a national laboratory system and effective modern point-of-care and laboratory-based diagnostics" (WHO, 2017, p. 23).

However, COVID-19 presented a whole new challenge beyond contract tracing and isolation. The global dimension to the crisis, unlike Ebola, exposed the decay in the healthcare facility. Unlike Ebola outbreak that was located within the West Africa sub-region, COVID-19 occurred across multiple locations, which greatly exposed the frailties of the country's border control measures and magnitude of passengers across multiple entry points.



Figure 14: Locations of laboratory facilities as of February 2020

Source: NCDC

3.3 Containment Strategy (February 28 – March 26, 2020)

The first case of COVID-19 infection in sub-Sahara Africa was first reported in Nigeria on February 28, 2020 when an Italian man who flew into the country earlier on the 25th tested positive to the virus (British Broadcasting Corporation, 2020). While

government tried to strengthen the surveillance system at the country's various entry points (especially the airport), the first index case which even visited some states while in the country, called to question the effectiveness of the airport surveillance in place for the country (Amzat, 2020, p. 219).

Nigeria's strategic focus on the crisis, thereafter, shifted from that of "prevention" to "containment". The country eventually placed a total ban on all flights (both inbound and outbound) to 13 countries that were considered as "high risk" including China - with mandatory 14-day isolation for inbound passengers from the affected countries (Onuah, 2020). Subsequent to the confirmation of the first case, the NCPG was converted to "Public Health Emergency Operations Centre (EOC)" under the control of NCDC (NCDC, 2021, p. 7; Dan-Nwafor, 2020, p. 4). The second case, an asymptomatic case, was confirmed eleven days after the first index case (Dan-Nwafor, 2020). So far at this statge, the emphasis was never on testing. The focus was on restricting and monitoring people who were coming to the country from those countries considered as "high risk" and those contacts that interacted with them. As a result, the number of confirmed cases was extremely low compared to countries such as South Africa. There was no medical basis to determine whether the low number of infections was due to fewer cases or undetected as a result of lower number of tests being conducted.

A Multi-sectoral and State-level Emergency Operations Centers were activated by the NCDC and Ministries of Health in Ogun and Lagos states respectively to combat the infection given strategic importance of those two states (NCDC, 2020b, p. 2). On March 6, NCDC, in collaboration with ACEGID, LUTH and NIMR, published online the SARS-CoV-2 gene from the index patient (NCDC, 2020c, p. 1). This is in line with earlier report by WHO

which suggested that genetic sequence from humans pointed to outbreak from a point of introduction within the human population around the time it was first reported in Wuhan in 2019 (WHO, 2020a, p. 2). As of March 18, 2020 when Nigeria announced initial travel ban to and from the thirteen countries on the list, it had just eight (8) confirmed cases, while the virus was already confirmed in twenty-six (26) countries on the continent in spite of earlier projection (Onuah, 2020). From that moment, the evolution of cases was clearly beyond what was projected for the country. By March 27, 2020, the country had recorded 81 clinically confirmed cases (with one fatality), while more than half of the cases were detected in Lagos (Amzat et al., 2020, p. 219). It must be noted that the few tests that were being conducted in the country was limited to Lagos state alone. The need to send blood sample over long distance to Lagos for analysis greatly affected the accuracy of such tests.

This containment stage was a different thing compared to similar stage during Ebola. It must be noted that what the country did during the containment of Ebola crisis was basically routine but done with higher intensity given that the number of infections was very low – there were 989 identifiable contacts with 18,500 "in-person follow-up visits" between July 22 and October 1, 2014 (Courage, 2014).

The federal government, at this stage, tried other measures, with a view to nip the looming crisis in the bud before it turned a bigger problem that could potentially overwhelmed the entire health system.





Source: Dan-Nwafor

In line with measures to lessen the potential to large scale outbreak, the Federal Government, through the Minister of Interior, announced the release of 2,600 prison inmates, under certain conditions, in a bid to decongest the overcrowded prisons and minimize the possibility of large-scale outbreak⁴ (Abdur Rahman, 2020).

It is worthy to note that despite the growing risk of the pandemic in the country, Nigeria reported less than a hundred cases in the first 30 days of the outbreak. There were hardly any reported case from the Northern part of the country which is home to more than half of the total population.

⁴ The amnesty, however, excluded people convicted of offences such as armed banditry, rape, kidnapping, culpable homicide etc.

3.4 Containment and Suppression Strategy (March 28 – June 30)

The pandemic turned worst within the first 100 days when a total 553 out of the daily tested samples on May 30 turned out to be positive for the virus (Amzat, 2020, p. 221). Kano, the most populous city in the country, reported the first fatality on April 11, 2020 but it was estimated that the figure for the state was grossly under-reported, especially between April 22 – 27 as a result of factors such as limited testing facilities (Musa et al., 2020, p. 3). It is highly likely that the real extent of the pandemic in the Northern part of Nigeria is highly underestimated as local media are reporting huge number of unexplained deaths due to limited testing, poor infrastructure, and communication (Akinwotu & Burke, 2020).

The pattern of infection at the early stage of the pandemic showed that the elites (those within the political class, those with connections to the political class or international travelers) were mostly affected, which may be attributable to the fact that poverty had reduced air travels to almost exclusive means of travelling for the rich (Amzat, 2020, p. 220). The country was, thereafter, placed on a tough "non-pharmaceutical" intervention on March 30, 2020 which included restriction of non-essential movement, stay-at-home orders, and restriction of activities across three locations – Lagos, Ogun and FCT (Dan-Nwafor, 2020, p. 5). While the lockdown alone would not stop the virus from spreading, nevertheless, it served as a strong message in creating awareness and a stop-gap measure designed in the light of local realities (WHO, 2020b, p. 4). The restrictions were designed essentially to achieve 2 objectives: slowdown the spread of the virus and also buy more time to improve the capacity of the healthcare system to respond to the crisis (Dan-Nwafor, 2020, p. 5). However, the lockdown significantly reduced the ability to trace contacts or collect blood samples and surveillance (WHO, 2020b, p. 11).

Those that tested positive and in need of regular re-test could get it at many tertiary hospital-based laboratories, although not every healthcare facility that was accepting COVID-19 patients had the necessary equipment to undertake such with precision (Onyeaghala & Olajide, 2020, p. 1647). A total of 15,759 blood samples were tested between when the first case was reported and 30th of April, 2020 out of which 1,932 tested positive to the virus – 539 (28%) of them had contact with infected person, 210 (11%) had travel history, 197 (10%) had incomplete information, while the remaining 986 (51%) were from unknown source (Omaka-Amari et al., 2020, pp 88 - 89).

It is interesting to note that the increase in the number of confirmed cases coincided with the period when testing increased as a result of establishment more laboratories capable of conducting the test across the country. From five laboratories at the beginning of the outbreak, the number increased to twenty-six laboratories as at the end of May, 2020.

 Table 3: Capacity improvement in terms of number of laboratories

No. of Laboratories added 5	2	10	9	26

Source: The author, using data from NCDC daily report

Nevertheless, testing was still limited to samples among people who might have been exposed to or had contact with confirmed cases. While capacity to conduct tests had increased significantly, it is still a far cry from home compared to the need of the country.





Source: Amzat

3.5 Mitigation Stage (July 2020 – to date)

As at September 2020, little was still known about the mode of transmission of the virus, while only few countries could boast of sufficient personal protective equipment (PPE), ventilators, or even generalized testing globally (Amzat, 2020, p. 220). By January 2021, the Federal Government had been able to establish more than 70 and 36 additional public and private health laboratories respectively, with each state having a minimum of one laboratory (NCDC, 2021, p.12). In order to further manage the increasing number of confirmed cases, the Federal Government reintroduced lockdown in the month of August, with around 3.8million people in the informal sector at the risk of losing their jobs (GAVI, 2020). With large number of people in the informal sector and coupled with limited number of government economic palliatives, it was a huge challenge enforcing lockdown measures.



Figure 17: Laboratory facilities as of January 2021

Source: NCDC

3.6 Contact Tracing

Contact tracing is one of the ways the government is leveraging on technology to arrest the spread of the disease (Adegoke, 2021). This system made use of different technology such as anonymized aggregate data to monitor people's mobility and their contacts (Ekong et al., 2020, p. 4). The plan by NCDC was to have a data led intervention that is capable of data collection, analysis, and reporting on a regular basis, which informed the formation of "Surveillance Outbreak Response Management and Analysis System (SORMAS)" tool for case-based digital surveillance (NCDC, 2021, pp. 8 – 9). SORMAS is an open-source, mobile enabled and web application software which enables health workers to notify their central office about fresh cases during epidemic, as well as manage crisis response (Tom-Aba, et al., 2020, p. 3). Originally developed to cope with Ebola

outbreak, its flexible and modular design allows additional functionalities to be added based on need such as the outbreak of COVID-19 (Grainger, 2020, p. 5).

Another system "event-based surveillance" (EBS) system was also set up to provide extra source of information through phone calls, live chats, messaging, and automated web search tools (NCDC, 2021, p. 10). The idea behind its design was to facilitate real-time processing of data and integration of surveillance system based on the previous experience acquired overtime, especially during the 2014 Ebola outbreak (Crone, 2020, p. 7). However, only 17 (not covering all the local governments) out of 36 states in the country had structure in place to make use of SORMAS to disseminate data on COVID-19 real-time as at 2020 (NCDC, 2021, p. 9). From Figure 18, 19 states were added after COVID-19 outbreak.



Figure 18: SORMAS coverage after initiation of COVID-19 response

Source: NCDC

4 Chapter 4

Impact of Testing Data on Response Strategy

4.1 Challenges with Testing

The country's strategy of "test, treat and isolate" hit the rock due to lack of adequate equipment to conduct sufficient number of tests (Akinwotu and Burke, 2020). With only four facilities available to conduct tests as at the time of the first confirmed case, the initial priority of NCDC was the need to scale up the testing facility to a minimum of two test centers per each of the six geopolitical zones in the country (NCDC, 2021, p. 11). However, the capacity for testing more people did not increase despite increase in the number of available laboratories – the country was conducting an average of 2500 tests per day as at middle of April 2020 (Dan-Nwafor, 2020, p. 6). Contrastingly, the United Nations Development Programme (UNDP), quoting the Presidential Task Force on COVID-19, stated that Nigeria's capacity for testing as of April 2020 was actually 500 samples per day, with between 24-48 hours processing time from when the sample was received but planned to scale it up to 5000 tests per day as more laboratories are coming up (UNDP, 2020, p. 3). Low testing has the tendency to significantly reduce the ability of the country for early detection and control (Onyeaghala & Olajide, 2020, p. 1646). The Director-General of NCDC, Dr Chikwe Ihekweazu, admitted that the organization had challenges in managing the outbreak due to "low base of public-health infrastructure" and a "vulnerable position" at the start of the country's outbreak (Crone, 2020, p. 4). Going by the pattern of lockdown measure being implemented by the government, it was evident that it was based on the number of positive cases and the perceived risk of transmission among the states for example, as at March 29, 2020, when the first lockdown was put in place across three cities

of Lagos, Ogun and FCT, they jointly account for 92 cases (83%) out of the 111 cases. The only state government to self-declare lockdown measures aside the federally declared, Oyo State, had the third highest confirmed cases (7) as at that day.

Another critical factor that restricted NCDC's ability to respond to the COVID challenge in a timely fashion was the simultaneous occurrence of Lassa Fever and Measles alongside the COVID-19 outbreak (Crone, 2020, p. 4). Rather than concentrate on fighting COVID-19, the limited resources at the disposal of NCDC had to be allocated to addressing the other emerging emergencies. This also put additional pressure on the already stretched health facilities.

Although, there were shortages of doctors and PPE in the country before the occurrence of COVID-19, but the pandemic, coupled with the global supply shortages of PPE, amplified the problem (Akinola, 2020). Despite the increase in the number of laboratories with capacity to conduct test, about a third of all the states in the country were still sending samples to FCT Abuja because there was no facility for such (Amzat, 2020, p. 220). Despite donations of PPE by corporate bodies like Opay and Jack Ma, many hospitals reported huge shortages in PPE while patients in some public hospitals were asked to bring PPE from home before they could be attended to (Akinola, 2020). While the country has good surveillance system in place to trace and track suspected patients, it does not have enough capacity to conduct test on the scale that could match the size of the population as shown by Figure 19. For a longer stretch of time the country was testing far less than 0.01 per 1000 people. It was an average of 0.02 per 1000 for the remaining part of year 2020. The test were basically limited to those people that had shown symptoms of the virus. In instances where the country had internal capacity for undertaking higher level diagnostic

tests e.g. sequencing PCR and cell culture, the capacity were less than what was required for the entire country and restricted to national level (WHO, 2020a, p. 23). With two lockdowns in place at different intervals, the country was still plagued by limited testing capacity as less than 80,000 tests had been conducted, while reported cases had risen to over 12,400 cases as of June 7, 2020 (Okunola, 2020).

During the chaotic situation, medical doctors still went on strike between February 28 and June 7, 2020 (Akinola, 2020). This put further strain on the system and further reduce the country's ability to test people.





Source: Our World in data

Another factor that contributed to the poor testing was inadequate information and misinformation. Despite the impact on the global scale, many Nigerians still believed that

⁵ The observed spike in the number of test figures were as a result of some omitted days that were added to other days. Otherwise, test numbers remained fairly stable over a longer period of time.

the pandemic was a ruse (Akinola, 2020). This made many of them to either engage in risky practices or self-diagnoses. Some avoided going for test in order to avoid being confined to isolation centers. Many would rather be involved in unverified practices rather than going for test e.g. the use of lemon/lime, inhaling hot water etc. There were several instances where people still engaged in cultural and/or religious activities on the understanding that they could not be affected. Some went as far as tagging it a "Chinese disease" that could not affect a black man.

Using projections from two other countries and various econometric models, the country was projected to reach between 1,300 and 7,600 before the end of April 2020 as shown in Figure 20. However, the exact number declared by NCDC as at April 30, 2020 was 1932 cases.





Source: United Nations Development Programme

4.2 Comparison between Nigeria and South Africa.

There was a wide difference in test numbers between Nigeria and South Africa. Compared to Nigeria, South Africa could test an average of 9.6 people per 1000 at the onset of the epidemic, with private laboratories conducting 80% of those tests (Abdool Karim, 2020, pp. 1-2). While Nigeria test samples i.e. those people that are already showing symptoms or have come in contact with infected person, South Africa made testing available to the whole population. Consequently, South Africa was able to test a total of 15,500 people as at March 22, 2020 (approximately 2 weeks after the confirmation of index case), whereas Nigeria had only tested a paltry 152 people (Kazeem, 2020). By the end of March 2020, South Africa had tested nearly 40,000 people compared to around 4,500 people tested by Nigeria despite recording its index case one week after Nigeria's (UNDP, 2020, p. 4). South Africa's strategy rests on a tripod: Strict lockdown, mass screening and targeted testing (Cotterill, 2020). With fairly similar starting point with other countries, Nigeria was clearly playing catchup with other African countries as far as testing of people for COVID-19 is concern, notwithstanding the country's relatively large population.



Figure 21: Trajectory of testing samples as at April 9 2020

Source: Our World in Data



Figure 22: Daily COVID -19 tests (shown in 7-day rolling average (per 1 million)

Source: Our World in data

By the end of April 2020, South Africa had reached testing capacity of 10,000 plus, through

the use of both public and private laboratories (Cotterill, 2020).



Figure 23: Number of people tested by Nigeria vs South Africa.

Source: Our World in data

4.3 Implication for the country's pandemic control strategy

It is interesting to note that early confirmed cases were limited to those that showed symptoms of COVID – 19 and not as a result of testing. Testing enables decision makers to have a precise and scientific basis to decide on the course of action to take. There is

indeed a positive correlation between the number of reported infection and the number of testing conducted (Amzat, 2020, p. 221). Figure 24 showed that Nigeria was testing far less than the regional average. Nigeria with 15% of the total population in Africa was responsible for a paltry 2% (19,512) of the total test conducted across the continent as at May 6, 2020, compared that to 30% (268,064) for South Africa but with a population of less than 5% of the total (Houreld et al., 2020).



Figure 24: Comparative test data per 100,000 of population

Source: Reuters

For most period in the early stage of the infection, the nature of measures put in place were far less stringent; even throughout the entire year 2020. Using data from OxCGRT⁶ Stringency Index, Nigeria was consistently below South Africa in terms of stringency of COVID-19 response measures.

⁶ OxCGRT uses publicly available information across 20 identified government responses to categorize the response. The responses are grouped across "Containment and Closure", "Economic measures", and "Health System" policies





Source: The author, using data from Blavatnik School of Government/Oxford University's "Oxford COVID-19 Government Response" Tracker





Source: The author, using data from Our World in Data, Nigeria Center for Disease Control, National Institute for Communicable Diseases, South Africa, and Milken Institute

*Note that there are outliers in the number of daily tests being reported for Nigeria. This is due to data omission for some days that were added to other days. For example, the total of 8,760 recorded on May 28, 2020, consisted

of 1,038 tests conducted that day and a total of 7,722 omitted tests from previous days that were captured that day (Source: NCDC).

Figure 26 showed that there is a positive correlation between number of tests conducted and reported positive cases recorded by South Africa. The rise in the number of tests, as shown on the graph, coincided with the period of increase in the number of positive cases. Both curves actually exhibited similar pattern, indicating positive correlation between the number of tests being conducted and the reported number of positive cases for both countries.

The nature of measures being undertaking by most countries reflect the quantification of risk associated with the spread of the disease. Given that the number of confirmed cases for South Africa was in many folds higher than Nigeria, it was not surprising that it has a stringent lockdown measures relative to Nigeria as shown by Figure 25.

4.3.1 Different Region, Different Strategy

As at the time the country declared ban on inward and outward flight on March 18 (20 days after the first confirmed case), it had a total of 8 laboratory confirmed cases, with only 2 cases reported in the whole Northern part of the country. Most of the early strategies like lockdown, school closure, work from office etc. were focused on the Southern part of the country. Samples from the Northern part were transported to the Southern part for analysis due to the fact that no laboratory had the capacity to undertake that in the Northern part of the country. As a result of factors like distance, poor storage and cold chain facilities, it could take days before the specimen eventually got to the lab which really reduced the accuracy and reliability of information got from the data. By the time Kano was identified as

the epicenter of the crisis, the only lab established in the state was closed down for disinfection (Akinwotu & Burke, 2020). Kano index case was a high ranking polical appointee that decided to withhold critical information such as his travelling history, contacts, symptoms etc., thereby exposing health officers to the virus (Ezeamalu, 2020).

Prior to the official confirmation of the first fatality in Kano on April 11, the state had been witnessing steady rise in the number of older people with breathing difficulties, fever, coughs, and low oxygen saturation, but the state response team had refused to test or isolate patients due to lack of travel history (Maclean, 2020). According to Dr. Musa, as quoted by Akinwotu and Burke (2020), Kano state had witnessed a steep rise in the cases of pneumonia, with widespread suspicion by medical experts that it could be linked to COVID-19, since there were no test conducted to determine the actual cause. With a population of over 20 million people, Kano grew capacity to conduct between 200 – 400 daily tests only in the month of May 2020 (Akinwotu & Hodi, 2020). With little or no data from the Northern part of the country, the people were still carrying out cultural and religious rites that could aggravate the spread of the disease unabated.

Unfortunately, between 60 to 70 percent of those elderly patients that went to hospital with full symptoms of the virus eventually died without the opportunity of being tested (Maclean, 2020). Due to strong Islamic culture, the deceased were buried immediately without conducting any post mortem examination. In the face of stiff opposition from religious clerics, and without scientific facts, states like Katsina had to reverse the initial ban placed on Friday congregational prayer in the Muslim dominated Northern Nigeria (Hoechner, 2020). The public mistrust and disbelief about the evolution of the pandemic

still persist despite the "Daily Update" being released by the NCDC; with opinion ranging from encouragement to outright indignation (Onyemelukwe, 2020).

Since the Government relied on certain information such as the number of confirmed cases to determine the type of control measures to be put in place at every point in time, it was not surprising that there were some inconsistencies. For example, the initial lockdown order was only in Lagos, Ogun and Abuja since they were the only locations that were reporting cases. By the time the lockdown was being eased in the 3 locations during the first week of May, that was about time hard lockdown was being put in place in Kano state due to sudden rise in the number of unexplained deaths (Izundu, 2020). Given the complexity of the country, it was difficult restricting people to specific geographic location which reduced the effectiveness of the lockdown order – people simply found a way to move between the two locations.

It was apparent that while the government based the decisions such as travel ban, lockdown etc. on the number of confirmed cases, the test and fatality data being provided by the NCDC were potentially underestimated since testing were very limited. It was surprising that spike in "unusual" deaths in large states like Kano could be passed off as something else. Although, the state authority, through the Commissioner for Health, refused to attribute the sudden death of about 640 people to COVID-19, nobody could provide any valid explanation since tests were not conducted (Izundu, 2020). Reuter, quoting the Minster of Health, confirmed that between 50% to 60% of the 979 "unknown" deaths recorded across eight local governments in Kano was due to COVID-19, as the state recorded an average of 43 deaths per day in the affected area for the month of April as against average of 11 deaths per day typically recorded (Reuters, 2020). There were

heightened concerned that the virus might have been spreading in the city unnoticed due to limited testing capacity (Adebayo, 2020).

At some point, Kano State government claimed that majority of those "unusual" deaths were as a result of causes like diabetes, hypertension, meningitis or acute malaria (Maclean, 2020). Limited testing facilities, combined with poor infrastructure and communications, means this is likely to be a significant underestimate of the true extent of the disease. The problem was rather complicated by mistrust among the populace due to previous experience like the polio crisis in the early 2000s where contaminated polio vaccines were administered in the Muslim-dominated areas in the North (Hoechner, 2020). Similar to some other countries, Nigeria experienced high incidence of misinformation and disinformation which impacted the effectiveness of policy, disrupt public perception, trust, and many interventions by the government (Onyemelukwe, 2020).

The use of Rapid Diagnostic Test kits (RDTs) that could have saved a lot of time and bridged the shortages ran into a hitch when many of the imported consignments by the state ministries failed the validation test of the Medical Laboratory Science Council of Nigeria (Onyeaghala & Olajide, 2020, p. 1647).

With fewer tests being conducted, coupled with a higher-than-average number of asymptomatic patients, there was high likelihood that decisions being made on the basis confirmed cases was grossly misleading. As testing was being stepped up, the number of positive cases rose proportionally, indicating that the earlier projection by the Nigerian Government was likely underestimated (WHO, 2020b, p. 3). This further corroborated the fact that while the country was reporting fewer or no positive cases, many of the positive

cases might have been passed for something else. Note also that it was within this period that the Northern part of the country was recording high incidence of "unknown" deaths.

This could also offer explanation as to the nature of lockdown measures that the country adopted within the period. For example, using Figure 25, Nigeria has stringency index of 11.11 (this is basically a "no measure" classification) to 82.87% (involves school and workplace closure, prohibition of gathering and stay a home among other measures) between March 16 to March 30, 2020, as against 38.89% (involves cancellation of public events among other measures) and 87.96% (this involves various type of closure and restrictive activities) for South Africa within the same period. Despite the fact that South Africa recorded its first case roughly a week after Nigeria's, it went into stringent lockdown ahead of Nigeria. NCDC's target as of April 2020 was to complete 2 million tests within four months, but four months after the set target the center was nowhere near the half mark (Crone, 2020, p. 7).

4.4 Testing at the Internally Displaced People (IDP) Camp

As at July, 2020 the North East region of Nigeria was estimated to have 1.9 million IDPs, with 60% of the total being children - mostly under the age of five (Njoku, 2020). 83% of the IDPs as at 2019 are found in the three states of Borno, Adamawa and Yobe - generally referred to as "BAY" states (Office for the Coordination of Humanitarian Affairs (OCHA), 2020, p. 10). The pandemic added another layer of difficulty onto the inhabitants of the IDP camps because of increased focus on hygiene and social distancing in many camps that are already stretched beyond limit (Njoku, 2020). In a survey conducted by the International Organization for Migration, 65% of people in the camps and other camp-like situations were not taking any mitigation measures notwithstanding the precarious living

condition (International Organization for Migration, 2020b, p. 6). There were 425 confirmed cases in the BAY states as at June 13, 2020 (WHO, 2020b, p. 3). For example, a review of the existing health facilities undertaken by the Borno State Government revealed a huge resource gap, with just 52 and 83 bends in Intensive Care Unit and isolations centers respectively (WHO, 2020b, p. 4).

Given the limited capacity for testing, there was general fear of what could be the impact of COVID-19 outbreak in many of the IDP facilities located around the country. With only one hospital equipped to conduct test with the location of the largest IDP camp in Nigeria, the government decided to fumigate the IDP camp and put other measures in place to prevent a major outbreak within the facilities (Shaban, 2020). In the absence of any other mitigation measures, a transmission rate of 3.3 was projected for the highly congested camps (WHO, 2020, p. 11 joint). With the IDPs facing exclusion from critical health facilities like test kits, it would be difficult to achieve early detection, diagnosis, testing and contact tracing for such critical vulnerable members of the society (WHO, 2020b, p. 18).

However, Nigeria only reported 2 positive cases in all the IDP camp as at September 2020 (IOM, 2020c, p. 2). There is strong likelihood that positive cases within the IDP camps are under-reported due to limited testing capacity at various IDP camps (IOM, 2020a, p. 5). There was no provision for testing while other measures were not as stringent in spite of the fact that the place was overcrowded.





Source: UNDP

As shown by Figure 27, without serious mitigation plan in place, outbreak of the pandemic within the IDP facilities could lead to high fatalities due to high number of people per square meter. In Borno State for example, high incidence of insecurity, coupled with facility collapse and outbreak of measles which had infected 21,052 persons as December 2019, clearly complicated the already precarious situation (OCHA, 2020, p. 10). Outside the state capital that is equipped with fully functional laboratory facility and 100-bed isolation center, other locations within the state lack facilities such as isolation centers, fully functional triage ward for COVID-19 treatment as of June 2020 (WHO, 2020, p. 13 joint). In order to forge a united front and put in place effective response to the impending crisis, the United Nations office in Nigeria developed a multidimensional framework to make the best use of the existing facilities such as Camp Coordination and Camp Management (CCCM), Water Sanitation and Hygiene (WASH), Health, Shelter, Food etc. (WHO, 2020b, p. 3).



Figure 28: Health Centers' Preparedness in handling COVID-19 across IDP camps in Northeast Nigeria as at May, 2020

Source: International Organization for Migration

5 Chapter 5

Policy Recommendations and Conclusion

5.1 Recommendation

The following measures are being proposed as ways of addressing the problem: First, strengthening of the health sector capacity through improved funding and investment in the sector, with specific emphasis on the establishment of laboratory facilities. Similar to what is being done in the education sector (1% corporate tax dedicated to education and Tertiary Education Trust Fund), 20% of the recently created Health Trust Fund by the National Assembly should be statutorily provided for exclusive for the upgrading laboratory facilities as a matter of urgency.

Secondly, given that the existing laboratory capacity by the private sectors are largely underutilized due to high cost of the test, government should use them as "referral" especially in the large cities like Lagos and Abuja where the numbers are rising. Government could subsidize the cost in order to reduce the burden of cost. Funding for the subsidy could come from the COVID-19 Fund – a private sector led funding. Part of the fund should also be dedicated to providing support to the laboratories e.g. provision of PPE. Lastly, data gathering and medical surveillance should be prioritized and strengthened by the government. Currently, the framework for data collection is prone to error, as data are mostly treated semi-manually, with some either omitted entirely or subsequently combined with other days. This makes it difficult to place reliance on them as inputs in decision making. The process could be automated through the use of mobile technology, especially in remote areas. Timely reporting of data is as important as it generation. Delayed or omitted data distorts decision making.

5.2 Conclusion

The world would continue to experience disruption to public health at some point in time although on a varying scale. We might not be able to predict precisely when it would occur, but we can strengthen existing system in order to be able to respond effectively. This would largely depend on the strength of the surveillance system in place to detect disease outbreak in a timely manner. For the better part of year 2020, little was still known about COVID-19. The discovery of asymptomatic carriers and the possibility of transmitting the virus underscored the need to expand the scope of testing. Whereas testing was limited mostly to people that have showed signs of infection. Expanding capacity for test required time and resources which may be difficult to mobilize at the moment. At the time the Federal Government was contemplating whether to lock down or not based on the available information, further evidence suggested that such information were grossly inadequate, and misleading given that testing was significantly limited. Experience from other countries such as South Africa showed that testing has a positive correlation with the number of positive people. Several years of near neglect and policy inconsistency had render the sector incapable of meeting present day demand. Funding for the health sector in general, and laboratory facility in particular, should be enhanced similar to the arrangement that was designed for the education sector by way of tax legislation. Improving data gathering ability would improve decision quality and reliability. This would in turn reduce the tendency for people to rely on myth and unsubstantiated facts. Misinformation could impede the efficiency of policy interventions. If the country could learn from this and take steps towards strengthening the capacity in the heath sector, eventually public health infrastructure would develop to such level that could respond timely and efficiently to disease outbreaks with less disruption.

References

- Abdool Karim, S. S. (2020). The South African Response to the Pandemic. *New England Journal of Medicine*, *382*(24), e95. <u>https://doi.org/10.1056/NEJMc2014960</u>
- Abdur Rahman, A. S. (2020, April 12). *Coronavirus: Buhari meets VP, Task Force; speaker warns Chinese envoy*. Africanews. <u>https://www.africanews.com/2020/04/12/nigeria-confirms-third-coronavirus-case-index-patient-fully-recovers/</u>
- Adebayo, B. (2020, June 9). Over half of April's unexplained deaths in Nigeria's Kano state due to coronavirus, health minister says. https://edition.cnn.com/2020/06/09/africa/nigeria-spike-in-deaths-covid/index.html
- Adebisi, Y. A., Umah, J. O., Olaoye, O. C., Alaran, A. J., Sina-Odunsi, A. B., & lii, D. E. L.-P. (2020). Assessment of Health Budgetary Allocation and Expenditure Toward Achieving Universal Health Coverage in Nigeria. *International Journal of Health and Life Sciences*, 6(2), 8. <u>https://doi.org/10.5812/ijhls.102552</u>
- Adegoke, B. (2021, January 19). COVID-19, digital rights and Nigeria's emerging surveillance state. *Global Voices*. <u>https://globalvoices.org/2021/01/19/covid-19-digital-rights-and-nigerias-emerging-surveillance-state/</u>
- Akinwotu, E., & Burke, J. (2020, April 28). *Deaths in Nigerian city raise concerns over undetected* <u>http://www.theguardian.com/world/2020/apr/28/nigerian-authorities-deny-wave-of-</u> <u>deaths-is-due-to-covid-19</u>
- Akinwotu, E., & Hodi, M. (2020, May 14). The gravediggers of Kano: Why doctors and diggers alike face grim choices in this northern city. *Bhekisisa*. <u>https://bhekisisa.org/features/2020-05-14-the-gravediggers-of-kano-covid19-coronavirus-testing-outbreak-in-nigeria-lagos/</u>
- Alagboso, C., & Abubakar, B. (2020, June 2). *The first 90 days: How has Nigeria responded to the COVID-19 outbreak?* Medium. <u>https://nigeriahealthwatch.medium.com/the-first-90-days-how-has-nigeria-responded-to-the-covid-19-outbreak-covid19naijaresponse-a0974493efa6</u>
- Amzat, J., Aminu, K., Kolo, V. I., Akinyele, A. A., Ogundairo, J. A., & Danjibo, M. C. (2020). Coronavirus outbreak in Nigeria: Burden and socio-medical response during the first 100 days. *International Journal of Infectious Diseases*, 98, 218–224. <u>https://doi.org/10.1016/j.ijid.2020.06.067</u>
- Beneden, C. A. V., Pietz, H., Kirkcaldy, R. D., Koonin, L. M., Uyeki, T. M., Oster, A. M., Levy, D. A., Glover, M., Arduino, M., Merlin, T. L., Kuhar, D. T., Kosmos, C., & Bel, B. P. (2016). Early Identification and Prevention of the Spread of Ebola—United States. *MMWR Supplements*, 65, 75–84. <u>https://doi.org/10.15585/mmwr.su6503a11</u>
- Blavatnik School of Government, & University of Oxford. (2021, May 25). Oxford COVID-19 Government Response Tracker (OxCGRT). <u>https://covidtracker.bsg.ox.ac.uk/stringency-scatter</u>
- British Broadcasting Corporation. (2020, February 28). Coronavirus: Nigeria confirms first case in sub-Saharan Africa. *BBC News*. <u>https://www.bbc.com/news/world-africa-51671834</u>
- Cotterill, J. (2020, May 5). South Africa's mass screening helps stem the coronavirus tide. https://www.ft.com/content/98d0d7c6-9bfb-4a64-bcab-19e0854a3b4d

- Courage, K. H. (2014, October 8). *How Did Nigeria Quash Its Ebola Outbreak So Quickly?* Scientific American. <u>https://www.scientificamerican.com/article/how-did-nigeria-quash-its-ebola-outbreak-so-quickly/</u>
- Crone, D. (2020). *Insights From Africa's Covid-19 Response: The Nigeria CDC*. Tony Blair Institute for Global Change. <u>https://institute.global/sites/default/files/articles/Insights-From-Africa-s-Covid-19-Response-The-Nigeria-CDC.pdf</u>
- Dixit, S., Ogundeji, Y. K., & Onwujekwe, O. (2020, July 2). How well has Nigeria responded to COVID-19? Brookings. <u>https://www.brookings.edu/blog/future-development/2020/07/02/how-well-has-nigeria-responded-to-covid-19/</u>
- Ekong, I., Chukwu, E., & Chukwu, M. (2020). COVID-19 Mobile Positioning Data Contact Tracing and Patient Privacy Regulations: Exploratory Search of Global Response Strategies and the Use of Digital Tools in Nigeria.
- Ezeamalu, B. (2020, April 16). *Coronavirus: How Kano's index case deceived us—Medical Doctor.* <u>https://www.premiumtimesng.com/news/headlines/388214-coronavirus-how-kanos-index-case-deceived-us-medical-doctor.html</u>
- Federal Ministry of Health. (2019). National Technical Guidelines for Integrated Disease Surveillance and Response.
- Federal Republic of Nigeria. (2014). *Official Gazette of the National Health Act—2014*. Federal Republic of Nigeria. <u>https://nigeriahealthwatch.com/wp-content/uploads/bsk-pdf-manager/2018/07/01_-Official-Gazette-of-the-National-Health-Act-FGN.pdf</u>
- GAVI. (2020, August 11). How is Nigeria addressing the public health challenges due to COVID-19?
- Grainger, C. (2020). A software for disease surveillance and outbreak response: Insights from implementing SORMAS in Nigeria and Ghana. Federal Ministry for Economic Cooperation and Development (BMZ).
- Hafez, R. (2018). Nigeria Health Financing System Assessment. World Bank.
- Haider, N., Yavlinsky, A., Simons, D., Osman, A. Y., Ntoumi, F., Zumla, A., & Kock, R. (2020). Passengers' destinations from China: Low risk of Novel Coronavirus (2019-nCoV) transmission into Africa and South America. *Epidemiology and Infection*, 148, e41. <u>https://doi.org/10.1017/S0950268820000424</u>
- Hoechner, H. (2020, April 15). In northern Nigeria, distrust jeopardises the response to coronavirus. The Conversation. <u>http://theconversation.com/in-northern-nigeria-distrust-jeopardises-the-response-to-coronavirus-135347</u>
- Houreld, K., Lewis, D., McNeill, R., & Granados, S. (2020, May 7). *Virus exposes gaping holes in Africa's health systems*. Reuters. <u>https://graphics.reuters.com/HEALTH-</u> <u>CORONAVIRUS/AFRICA/yzdpxoqbdvx/</u>
- Ibrahim, L. M., Okudo, I., Stephen, M., Ogundiran, O., Pantuvo, J. S., Oyaole, D. R., Tegegne, S. G., Khalid, A., Ilori, E., Ojo, O., Ihekweazu, C., Baraka, F., Mulombo, W. K., Lasuba, C. L. P., Nsubuga, P., & Alemu, W. (2021). Electronic reporting of integrated disease surveillance and response: Lessons learned from northeast, Nigeria, 2019. *BMC Public Health*, 21(1), 916. <u>https://doi.org/10.1186/s12889-021-10957-9</u>
- Ibrahim, L. M., Stephen, M., Okudo, I., Kitgakka, S. M., Mamadu, I. N., Njai, I. F., Oladele, S., Garba, S., Ojo, O., Ihekweazu, C., Lasuba, C. L. P., Yahaya, A. A., Nsubuga, P., & Alemu, W. (2020). A rapid assessment of the implementation of integrated disease surveillance and response system in Northeast Nigeria, 2017. *BMC Public Health*, 20(1), 600. <u>https://doi.org/10.1186/s12889-020-08707-4</u>

- Ihekweazu, C. (2010, March 3). State Governments and the provision of health services in Nigeria. *Nigeria Health Watch*. <u>https://nigeriahealthwatch.com/state-governments-and-the-provision-of-health-services-in-nigeria/</u>
- International Monetary Fund. (2020). *Nigeria Technical Assistance Report-Additional Spending Toward Sustainable Development Goals.* International Monetary Fund. <u>http://elibrary.imf.org/view/IMF002/29071-9781513545202/29071-9781513545202/29071-9781513545202.xml</u>
- International Organization for Migration. (2020a). COVID-19: Impact on Mobility (West & Central Africa) (Monthly Reporting No. 3; Impact, p. 5).
- International Organization for Migration. (2020b). COVID-19 Situation Analysis: North East Nigeria MAY 2020. IOM Displacement Tracking Matrix.
- International Organization for Migration. (2020c). Impacts on IDPs Update.
- Isere, E., Fatiregun, A., & Ajayi, I. (2015). An overview of disease surveillance and notification system in Nigeria and the roles of clinicians in disease outbreak prevention and control. *Nigerian Medical Journal*, 56(3), 161. <u>https://doi.org/10.4103/0300-1652.160347</u>
- Izundu, C. C. (2020, April 28). What is behind Nigeria's unexplained deaths in Kano? *BBC News*. <u>https://www.bbc.com/news/world-africa-52454259</u>

Jonathan, G. G. (2019). Overview of structure of healthcare in Nigeria and newborn screening: An historical perspectives. Arise Train-the-Trainer Workshop.

- Maclean, R. (2020, May 17). Covid-19 Outbreak in Nigeria Is Just One of Africa's Alarming Hot Spots. *The New York Times*.
- Maxmen, A. (2019). This Nigerian doctor might just prevent the next deadly pandemic. *Nature*, 566(7744), 310–313. <u>https://doi.org/10.1038/d41586-019-00615-x</u>
- Musa, S. S., Zhao, S., Hussaini, N., Zuang, Z., Wu, Y., Wang, M. H., & He, D. (2020). *Estimating the under-ascertainment number of COVID-19 cases in Kano, Nigeria in the fourth week of April 2020: A modelling analysis of the early outbreak*. <u>https://doi.org/10.21203/rs.3.rs-34391/v2</u>
- National Homeland Security Consortium. (2015). *The Response to Ebola in the United States: Lessons Learned from a Multi-Discipline Perspective*. National Homeland Security Consortium.
- Nigeria Center for Disease Control. (2020a). COVID-19 Outbreak in Nigeria: Situation Report (S/N:001; p. 2).
- Nigeria Center for Disease Control. (2020b). COVID-19 Outbreak in Nigeria: Situation Report (S/N:002; p. 2).
- Nigeria Center for Disease Control. (2020c). COVID-19 Outbreak in Nigeria: Situation Report (S/N:007; p. 2).

Nigeria Center for Disease Control. (2021). One year after: Nigeria's COVID-19 public health response (February 2020—January 2021).

- Njidda, A. M., Oyebanji, O., Obasanya, J., Ojo, O., Adedeji, A., Mba, N., Oladejo, J., & Ihekweazu, C. (2018). The Nigeria Centre for Disease Control. *BMJ Global Health*, *3*(2), e000712. <u>https://doi.org/10.1136/bmjgh-2018-000712</u>
- Njoku, G. (2020, July 13). Displaced children navigate COVID-19 in camps in north-east Nigeria. <u>https://www.unicef.org/nigeria/stories/displaced-children-navigate-covid-19-</u> camps-north-east-nigeria

- Nnebue, C., Onwasigwe, C., Ibeh, C., & Adogu, P. (2013). Effectiveness of data collection and information transmission process for disease notification in Anambra State, Nigeria. *Nigerian Journal of Clinical Practice*, 16(4), 483. <u>https://doi.org/10.4103/1119-3077.116894</u>
- Office for the Coordination of Humanitarian Affairs. (2020). Addendum COVID 19 Response Plan 2020: Borno, Adamawa and Yobe States Nigeria.
- Okunola, A. (2020, June 9). 5 Challenges Facing Health Care Workers in Nigeria as They Tackle COVID-19. Global Citizen. <u>https://www.globalcitizen.org/en/content/challenges-</u> for-health-care-workers-nigeria-covid/
- Olusola, A., Olusola, B., Onafeso, O., Ajiola, F., & Adelabu, S. (2020). Early geography of the coronavirus disease outbreak in Nigeria. *GeoJournal*. <u>https://doi.org/10.1007/s10708-020-10278-1</u>
- Omaka-Amari, L. N., Aleke, C. O., Obande-Ogbuinya, N. E., Ngwakwe, P. C., Nwankwo, O., & Afoke, E. N. (2020). Coronavirus (COVID-19) Pandemic in Nigeria: Preventive and Control Challenges within the First Two Months of Outbreak. *African Journal of Reproductive Health*, 24(2), 87–97. <u>https://www.ajrh.info/index.php/ajrh/article/view/2294</u>
- Omoleke, I. I., & Taleat, B. A. (2018). Contemporary issues and challenges of health sector in Nigeria. *Research Journal of Health Sciences*, *5*(4), 210. <u>https://doi.org/10.4314/rejhs.v5i4.5</u>
- Oni, B. L. (2014). Analysis of the Growth Impact of Health Expenditure in Nigeria. *IOSR Journal of Economics and Finance*, *3*(1), 77–84.
- Onuah, F. (2020, March 18). Nigeria bans entry to arrivals from 13 countries to combat coronavirus. *Reuters*. <u>https://www.reuters.com/article/us-health-coronavirus-nigeria-idUSKBN2153RF</u>
- Onyeaghala, A. A., & Olajide, I. (2020). Managing COVID-19 outbreak in Nigeria: Matters arising. *Clinical Chemistry and Laboratory Medicine (CCLM)*, *58*(10), 1645–1650. https://doi.org/10.1515/cclm-2020-0748
- Onyemelukwe, C. (2020, August 19). COVID-19, Misinformation, and the Law in Nigeria. Bill of Health. <u>https://blog.petrieflom.law.harvard.edu/2020/08/19/misinformationdisinformation-covid19-nigeria-law/</u>
- Organisation of African Unity. (2001). *Abuja Declaration on HIV/AIDS, Tuberculosis and other Related Infectious Diseases* (OAU/SPS/ABUJA/3; p. 8). Organization of African Unity.
- PharmAccess Foundation. (2015). *Nigerian Health Sector Market Study Report* (p. 52). <u>https://www.rvo.nl/sites/default/files/Market_Study_Health_Nigeria.pdf</u>
- Reuters. (2020, June 8). At least half of mystery deaths in Nigeria's Kano due to COVID-19— Minister. <u>https://www.reuters.com/article/health-coronavirus-nigeria-kano-</u> <u>idUSL8N2DL4Z7</u>
- Shaban, A. R. A. (2020, April 17). *Nigeria fumigates IDP camp in Maiduguri, Borno gets COVID-19 center*. <u>https://www.africanews.com/2020/04/17/nigeria-fumigates-idp-camp-in-maiduguri-borno-gets-covid-19-center//</u>
- Syangtan, G., Bista, S., Dawadi, P., Rayamajhee, B., Shrestha, L. B., Tuladhar, R., & Joshi,
 D. R. (2021). Asymptomatic SARS-CoV-2 Carriers: A Systematic Review and Meta-Analysis. Frontiers in Public Health, 8, 587374.
 https://doi.org/10.3389/fpubh.2020.587374
- Tom-Aba, D., Silenou, B. C., Doerrbecker, J., Fourie, C., Leitner, C., Wahnschaffe, M., Strysewske, M., Arinze, C. C., & Krause, G. (2020). The Surveillance Outbreak Response

Management and Analysis System (SORMAS): Digital Health Global Goods Maturity Assessment. *JMIR Public Health and Surveillance*, *6*(2). <u>https://doi.org/10.2196/15860</u>

- Tomori, O. (2019, February 21). *Why Nigeria is battling to control disease outbreaks like Lassa fever*. The Conversation. <u>http://theconversation.com/why-nigeria-is-battling-to-control-disease-outbreaks-like-lassa-fever-111771</u>
- Toromade, S. (2020, March 20). *Timeline of coronavirus cases in Nigeria*. Pulse Nigeria. <u>https://www.pulse.ng/news/local/coronavirus-timeline-and-profile-of-cases-in-nigeria/k9p6lbk</u>
- United Nations Development Programme. (2020). *The COVID-19 Pandemic: Potential Impact on the North-East* (Brief 2; p. 10). UNDP.
- Welcome, M. (2011). The Nigerian health care system: Need for integrating adequate medical intelligence and surveillance systems. *Journal of Pharmacy and Bioallied Sciences*, 3(4), 470. <u>https://doi.org/10.4103/0975-7406.90100</u>
- World Bank. (2021a). Current health expenditure (% of GDP)—Nigeria | Data. https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS?locations=NG
- World Bank. (2021b). Out-of-pocket expenditure (% of current health expenditure)—Nigeria | Data. https://data.worldbank.org/indicator/SH.XPD.OOPC.CH.ZS?locations=NG
- World Health Organization. (2011). *The Abuja Declaration: Ten Years On*. World Health Organization.
- World Health Organization. (2014, October 14). Are the Ebola outbreaks in Nigeria and Senegal over? WHO; World Health Organization. https://www.who.int/mediacentre/news/ebola/14-october-2014/en/
- World Health Organization. (2017). *Joint External Evaluation of IHR Core Capacities: Federal Republic of Nigeria* (Mission Report, p. 75).
- World Health Organization. (2018). *How e-Surveillance strengthens health systems in Nigeria*. WHO | Regional Office for Africa. <u>https://www.afro.who.int/news/how-e-surveillance-strengthens-health-systems-nigeria</u>
- World Health Organization. (2020a). Coronavirus disease 2019 (COVID-19) Situation Report (No. 94; p. 12).
- World Health Organization. (2020b). COVID-19: Joint Support Framework for Multi-sectoral Response Northeast Nigeria. World Health Organization.
- World Health Organization. (2020c, March 11). WHO Director-General's opening remarks at the media briefing on COVID-19—11 March 2020. <u>https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020</u>