CTAP
COVID-19 TRANSPARENCY & ACCOUNTABILITY IN AFRICA

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Fiscal Impact, Vaccines Financing & Civic Norms

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1.0 *Introduction*

Source: https://thevaultznews.com/economics/finance/banking/imf-staff-re-examine-the-use-of-financial-incentives-as-support-for-debt-restructuring-operations/

The outbreak of the COVID-19 pandemic has resulted in the death of many and disrupted the lives of people worldwide. What started from Wuhan City, Hubei Province of China transmitted worldwide in less than four months. The first case of COVID-19 in Africa was first confirmed in Egypt on 14th February 2020, while the first confirmed case in sub-Saharan Africa was first announced in Nigeria by the end of the same month.

In the space of two weeks, over 50 countries confirmed and reported their first case, making the virus the biggest one of the century. Speculations increased as figures from China, followed by Italy, Spain, and the USA, showed how fatal the virus is despite their advanced health system.

With a population slightly above 1 billion and designated to have the worst healthcare system globally, the world feared that Africa would not cope very well when the virus hit the continent, considering different predictions about possible worst case scenarios.

A report by the United Nations Economic Commission for Africa (UNECA) predicted up to 3.3 million deaths and 1.2 billion infections in Africa[1]

But a year and two months after the first coronavirus case worldwide was announced, Africa has the lowest infection and death rates in the world. Africa accounts for 5% of global cases

[1] Bavier, J. (2020, 04 17). HEALTHCARE & PHARMA. (P. Fletcher, Editor) Retrieved 02 22, 2021, from REUTERS: https://www.reuters.com/article/us-health-coronavirus-africa-un-idUSKBN21Z1LW

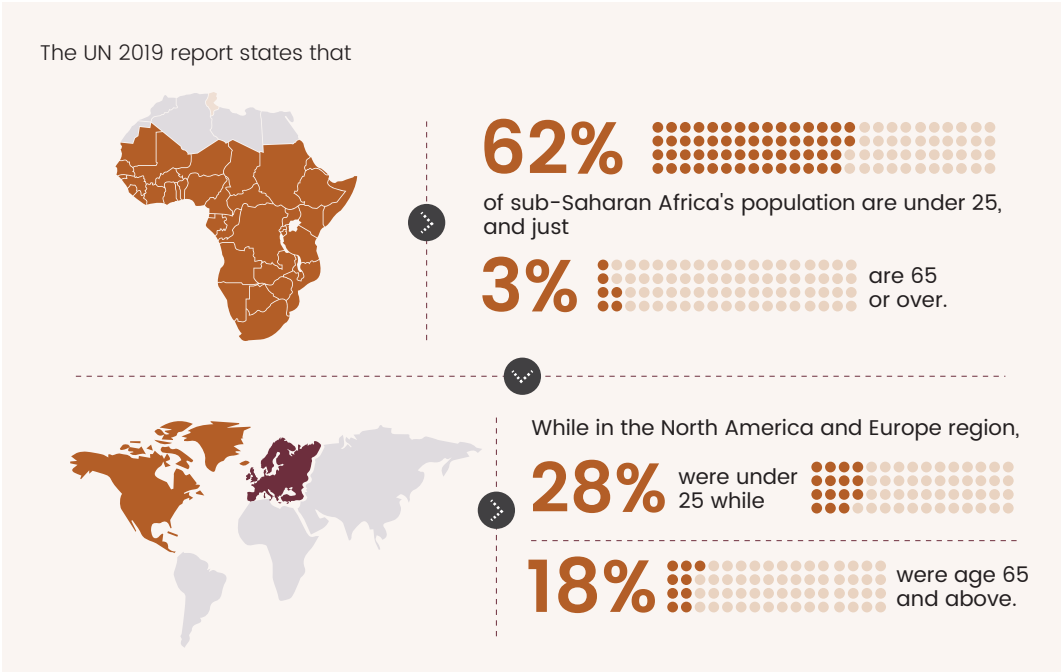
and 4 percent of global deaths[2].

However, this is not a positive indicator that the African countries are managing the virus's spread because there is insufficient data to back this up. While other countries carry out massive testing, the number of testing in Africa remains relatively low.

Some researchers have also attributed the reason for the low mortality rate to Africa's demography. According to Reuters[3], "the UN 2019 report states that 62% of sub-Saharan Africa's population are under 25, and just 3% are 65 or over. While in the North America and Europe region, 28% were under 25 while 18% were age 65 and above. A study has established that the risk of developing severe COVID-19 increases with age[4]."

The CoVID-19 Transparency and Accountability Project focuses on seven countries with varying degrees of fiscal and developmental challenges but still with a common thread of weak health systems and poor human capital.

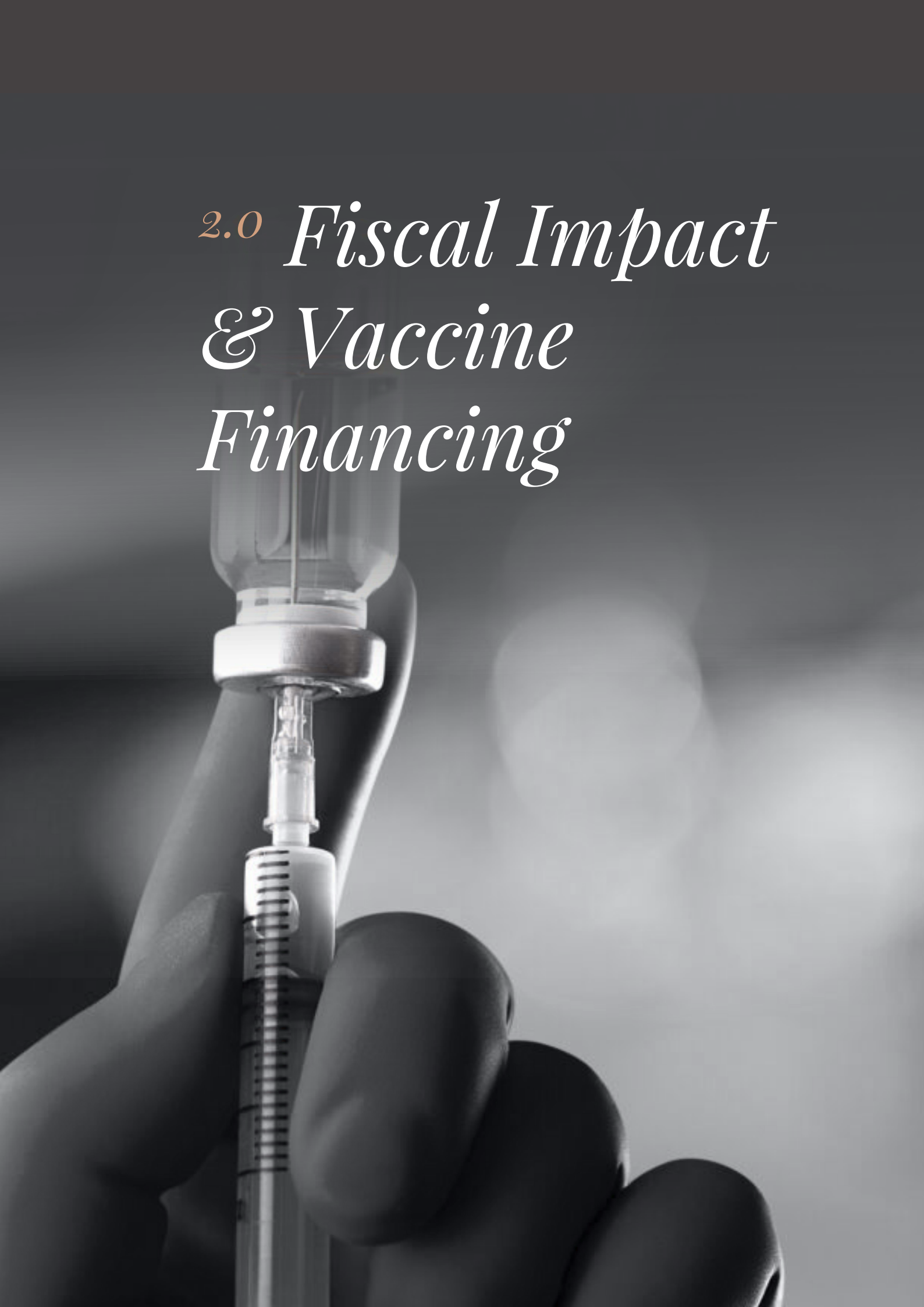
While the pandemic raged on and the whole economy hit a standstill, African countries with weak fiscal sheets faced an immense dip in revenues and a bleak macroeconomic outlook. In this report, we will review the state of the economy of seven focus countries, their ability to procure vaccines and their current dependency on global entities for vaccination.



[2] Prevent Epidemics. (2020, August 26). Update on COVID-19 in Africa. Retrieved February 22, 2021, from Prevent Epidemics Website: https://preventepidemics.org/COVID-19/science/insights/update-on-covid-19-in-africa/

[3] https://www.reuters.com/article/us-health-coronavirus-africa-mortality-i/puzzled-scientists-seek-reasons-behind-africas-low-fatality-rates-from-pandemic-idUSKBN26K0AI

[4] Winning, A. (2020, September 29). Puzzled scientists seek reasons behind Africa's low fatality rates from pandemic. (A. Zavis, & D. Gregorio, Editors) Retrieved February 22, 2021, from Reuters Website: https://www.reuters.com/article/health-coronavirus-africa-mortality-expl/puzzled-scientists-seek-reasons-behind-africas-low-fatality-rates-from-pandemic-idINKBN26K09L

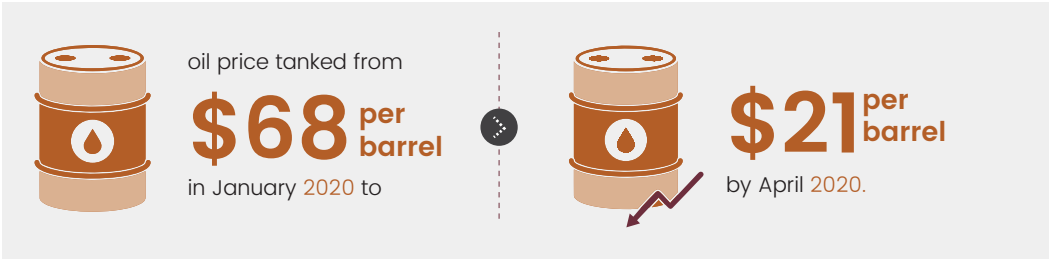


2.0 Fiscal Impact & Vaccine Financing

2.1 A Quick Assessment of COVID-19 Fiscal Impact on Focus Countries

Nigeria

Nigeria, Africa's most populous country, continues to face the challenges of an economy whose performance is connected to the oil price. With weak consumption in 2020,



The effect on Nigeria's economy was apparent, with negative growth of 3.6% as of Q3 2020. Nigeria's currency also lost value with the currency rate relative to the dollar collapsing from N306 to N420.

Nigeria has a high incidence of poverty, with 40% of its population adjudged to be poor, and according to the National Bureau of Statistics (NBS), between Q3 2018 and Q2 2020, Nigeria's unemployment rate rose from 23.1% to 27.1%[5], while the underemployment rate rose from 20.1% to 28.6%. Inflation is also not slowing down in Nigeria, reaching 15.75% as of December 2020. A significant part of the index is food inflation, which has risen to 20.57% due to the increasing cost of agricultural inputs and restriction of movements.

Nigeria's central government put up a stimulus program of N3.5tn in 2020 to mitigate the effect of CoVID-19 in Nigeria. This figure is less than 2% of its nominal GDP, but the country lacks the fiscal power to do more with its rising inflation and the record deficits recorded in recent years. The central government expenditure on health was N464bn in 2020, which means that with a budget of N10.59 trillion, the government spends less than 5% of its total budget on healthcare, and the health budget per capita is $84. The country continues to groan on increasing debt as it plans to convert its central bank overdraft to Federal Government, which totals N10tn to the domestic debt. This will significantly impact its debt-to-revenue ratio that currently has reached over 80%, an anomaly in public finance.

Ghana

Due to the pandemic, Ghana has revised its growth projections from 6.8 per cent to 0.9 per cent. The non-oil economy growth was also reviewed

[5] https://qz.com/africa/1892237/nigerias-unemployment-rate-tripled-in-five-years/

According to Ghana's President Nana Akufo-Addo, the country lost GH₵13.5 billion ($2.35bn) due to the pandemic. The combined effect of the pandemic amounted to GH₵25.3 billion ($4.4bn) or 6.6 per cent of Gross Domestic Product.

downwards from 6.7 per cent to 1.6 per cent. The country continues to battle the increasing cost of debt servicing and the energy sector debt to expand funding for the social sector.

With a population of 30.78m, Ghana took proactive steps to counter the pandemic's effect, but it still limited the tight fiscal space that previous debts had boxed it into.

Kenya[6]

The pandemic's impact was felt in Q2 2020 as its GDP contracted by 5.7% on a y-o-y basis. With the suspension of global travel and global trade contraction, Kenya's tourism sector faced a setback, and according to its statistics bureau, accommodation and restaurants (tourism) contracted by 83.3% y/y in Q2 2020. With the restriction in global travel at the outset of the pandemic, horticulture deliveries fell significantly.

The country is also facing a rise in public debt, which has grown to

65.6%

of GDP, and interest payments, accounting for

25.2%

of total revenue, are shortening resources for development.

According to the Kenya National Bureau of Statistics survey, the unemployment rate peaked at 21% as of June 2020, which is more than double its pre-COVID-19 level. According to the World Bank, "the increase in unemployment (especially in the informal sector), closure of small businesses, and closure of schools caused a drop in households' disposable income and private consumption."

After the shock in mid-2020, Kenya's exports such as flowers, tea, and manufactured exports have rebounded in late 2020.

[6] http://documents1.worldbank.org/curated/en/957121606226133134/pdf/Kenya-Economic-Update-Navigating-the-Pandemic.pdf

Sierra Leone

Sierra Leone received a sum of

US$143 million

under the Rapid Credit Facility (RCF) as the country struggled to meet the balance of payments and faced fiscal challenges due to the effect of COVID-19.

Sierra Leone has a high incidence of poverty, with a poverty rate at 56.8% as of 2018. While it might have gotten support to maintain its exchange rate stability, its GDP declined by 2.6% due to COVID-19. According to the government, it lost over $100m in revenues due to significant effects of COVID-19, and it also claims to have spent nearly US$40 million on prevention, detection, and treatment of COVID-19 cases.

Liberia [7]

Source: https://thevaultznews.com/economics/finance/banking/imf-staff-re-examine-the-use-of-financial-incentives-as-support-for-debt-restructuring-operations/

Like other countries in Africa, Liberia also got $50m, which accounts for 1.7% of its GDP from the IMF to meet the balance of payments challenges.

However, the IMF support is not enough as the current pandemic opens a balance of payment need due to revenue shortfall of up to $119m. Private sector confidence has remained weak in Liberia and growth has been projected at -2.5% for 2020. According to the World Bank, "in the absence of support, the poorest will feel the impact the most as there is little social safety net, and the food security of those relying on uncertain daily income is a pressing concern." The Liberia dollar has lost more than 40% of its value in the last three years with slowing down of aid flows and export receipts.

The country's unemployment rate is up to 80%, especially in its informal sector, and continues to face instability in terms of political transition and its option to borrow and seek other inflows continues to diminish.

A significant portion of the population rely on either informal trade or subsistence agriculture in rural and semi-urban environments, and they

[7]https://openknowledge.worldbank.org/bitstream/handle/10986/34271/Liberia-Economic-Update-The-COVID-19-Crisis-in-Liberia-Projected-Impact-and-Policy-Options-for-a-Robust-Recovery.pdf?sequence=4&isAllowed=y

Malawi[8]

Source: https://www.voanews.com/covid-19-pandemic/malawi-covid-19-response-gets-commonwealth-award

have been extremely vulnerable to the exogenous shocks of COVID-19 pandemic.

In 2020, the government launched a national COVID-19 Preparedness and Response Plan with a budget of US$ 212 million, which includes the World Bank US$ 37 million package of COVID-related support.

According to the World Bank, "Malawi is at a high overall risk of debt distress, which the crisis will further test. The April 2020 debt sustainability analysis indicates that Malawi is at a high overall risk of public debt distress, due to the increased incurrence of high-cost domestic debt."

Malawi's debt and dependence on trade with South Africa and China, coupled with its inability to mobilise resources to fix social protection is of critical concern.

The country continues to face external shocks to its main exports - tobacco, sugar, and tea - due to inelastic global demand. With worsening global trade, this will have a significant fiscal impact on Malawi's revenues and its ability to stimulate its economy, where 89% of its economy remains at informal levels.

[8]http://documents1.worldbank.org/curated/en/835161595529532367/pdf/Malawi-Economic-Monitor-From-Crisis-Response-to-a-Strong-Recovery.pdf

Cameroon[9]

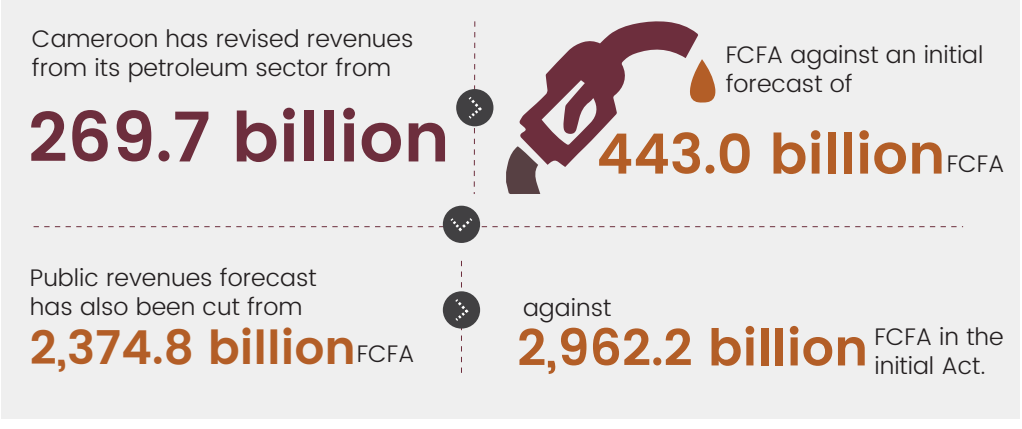
IMF projects that Cameroon's economy is expected to fall by -5.2% in 2020. In the Revised Finance Act (LFR) 2020, budgetary revenues are expected to fall by 11%. With the slowdown of economic activities, the pandemic is expected to lead to revenue losses.

Cameroon has revised revenues from its petroleum sector from 269.7 billion FCFA against an initial forecast of 443.0 billion FCFA. Public revenues forecast has also been cut from 2,374.8 billion FCFA against 2,962.2 billion FCFA in the initial Act. The country has also slashed its capital expenditure by 16%, with the budget deficit estimated to reach 4-5% of the GDP.

A survey conducted with support from ILO found that some 80 per cent of business chiefs in the formal sector have experienced a moderate or major slowdown in their activity. In the informal sector, this slowdown also exists and is around 82 per cent.

In general, eight out of ten business chiefs (82.6%) said they had seen a drop in their production. However, the situation is more pronounced in businesses in the formal sector than in the informal. Turnover has fallen in 95.5 percent of businesses, and half of them say they have seen a fall of over 50 per cent in their turnover.

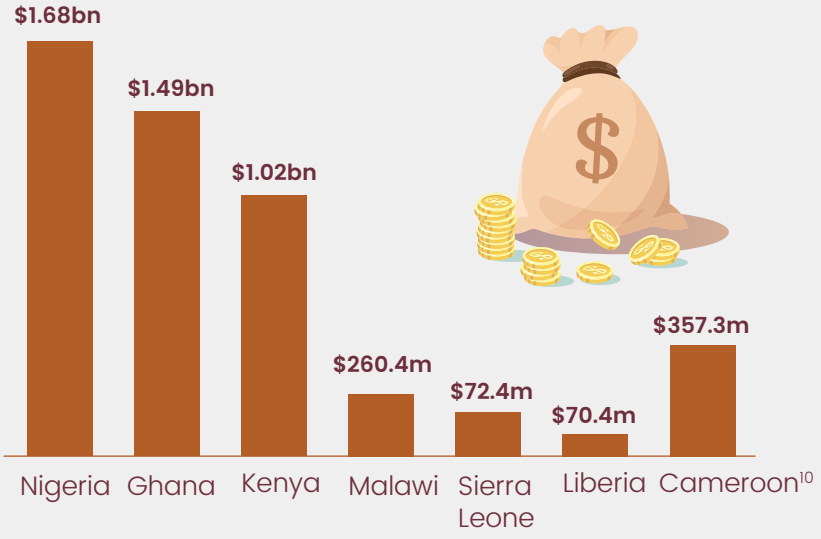
Cameroon keeps facing immense challenges due to the weak global economic slowdown caused by the pandemic.



[9]http://documents1.worldbank.org/curated/en/835161595529532367/pdf/Malawi-Economic-Monitor-From-Crisis-Response-to-a-Strong-Recovery.pdf

2.2 Health Budgets in Focus Countries

Based on 2020/2021 annual budget analysis for the following countries - health budget stands at:



These figures show a health budget allocation range within 4.0% to 12.4%, all below the 15% target set by the Africa Union[11] in 2001.

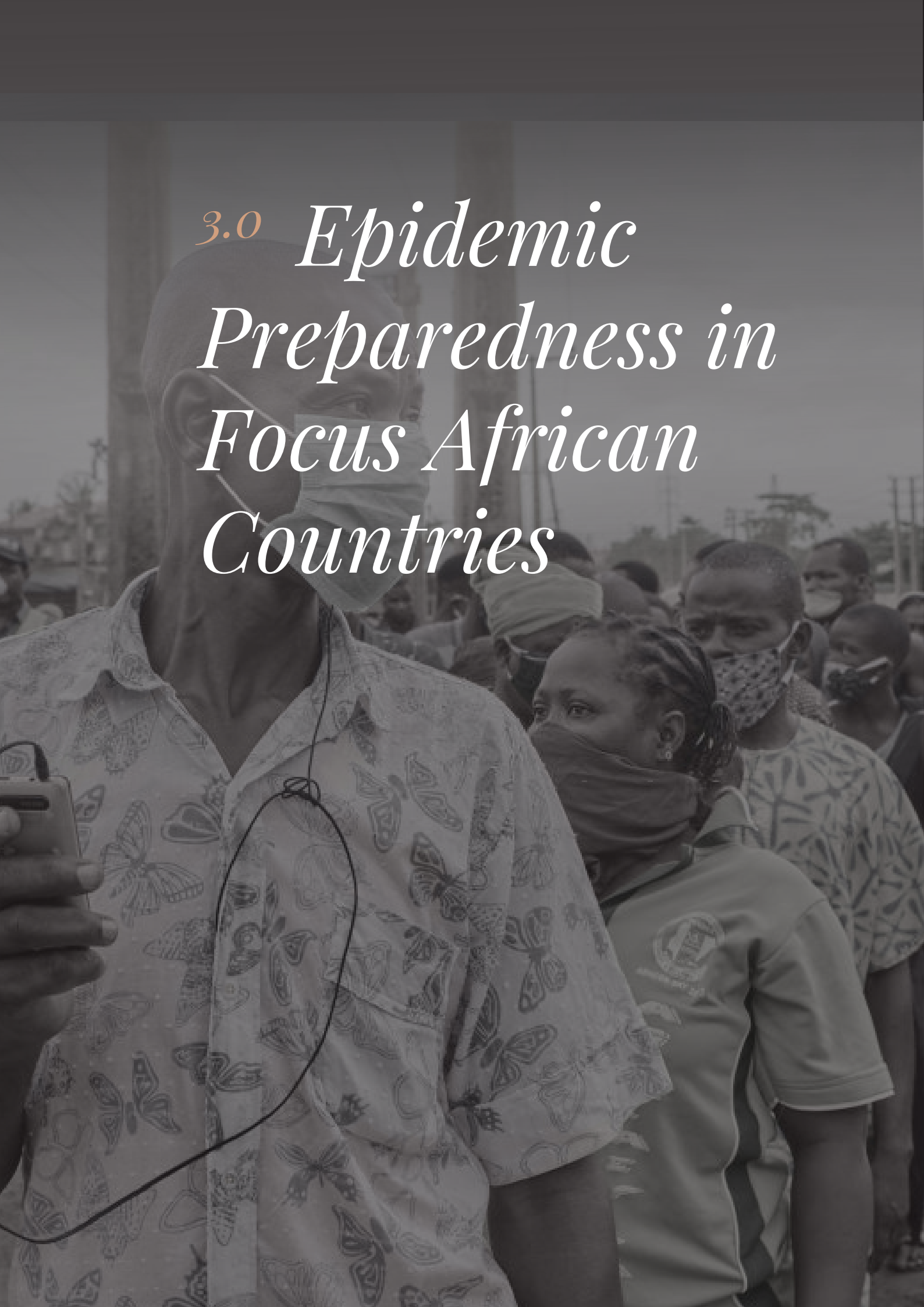
The target was set to enable African countries to improve their health system, but the countries under review have failed to meet the 15% target, especially in a pandemic.

The challenge is mainly due to the low-resource level of focus countries with revenue to GDP ranging from 8-15%. Most African countries also expend significant resources on debt servicing and heavy infrastructure such as roads and rail that shorten their capacity to intervene in social sectors such as education and health.

Table 1: Health Sector Funding in Focus Countries

Country	Total Budget (USD) mn	Health Budget (USD) mn	Health Budget as percentage of total budget	Health Budget per capita (USD)
Malawi	2,697	260.40	9.65%	12.48
Nigeria*	35,857	1,677	4.68%	8.13
Kenya	25,413	1,017	4.00%	20.89
Ghana	19,886	1,492.00	7.50%	48.47
Sierra Leone	935.30	72.39	7.74%	9.07
Liberia	570	70.42	12.35%	15.02
Cameroon	8,819	357	4.05%	13.67

[10]https://www.cabri-sbo.org/en/document
[11]https://www.who.int/healthsystems/publications/abuja_declaration/en/



3.0 Epidemic Preparedness in Focus African Countries

3.1 Shaping Africa's Epidemic Approach

https://www.nbcnews.com/health/health-news/latest-ebola-outbreak-now-worst-after-west-african-epidemic-n941921

The Ebola virus epidemic in Africa exposed major gaps in the world's capacity to prevent and respond to epidemics.

Apart from the Ebola virus, Africa has had a fair share of infectious disease outbreaks. Reports[12] highlighted that 41 African countries (87% of the continent) had at least one epidemic, and 21 countries (45%) had at least one epidemic annually.

The top five causes of epidemics were Cholera, Measles, viral diseases, malaria, and meningitis. Some of these countries have been able to deep-dive on issues generated from their responses to the outbreaks and have better strengthened their preparedness levels, although much work still needs to be done to meet global standards.

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On a regional scale, before the Western Africa Ebola Virus epidemic (2013-2016), which was the most widespread and devastating outbreak of Ebola virus disease in history, it will take an average of 418 days (well over a year) to take control of disease outbreaks in most African nations.

Now, African countries can detect and respond to disease outbreaks faster, and currently, it will take about 51 days[13] (under two months) to take control of disease outbreaks. However, this is still a long-time considering the health, political, environmental, security, and other socio-economic threats posed by

[12]Talisuna A.O., Okiro E.A., Yahaya A.A.,et al. Spatial and temporal distribution of infectious disease epidemics, disasters and other potential public health emergencies in the World Health Organisation Africa region, 2016-2018. Global Health. 2020; 16 ([published 2020 January 15]): 9https://doi.org/10.1186/s12992-019-0540-4

[13]WHO. IHR monitoring and evaluation framework. Geneva, 2018;. (http://apps.who.int/iris/bitstream/handle/10665/276651/WHO-WHE-CPI-2018.51-eng.pdf?sequence=1

public health emergencies.

The overwhelming effects and various setbacks experienced due to the Ebola virus outbreak in Eastern, Central, and Western Africa and other outbreaks around this period resulted in many initiatives mobilized to improve national preparedness. Key among them is the launching of the Joint External Evaluation (JEE) tool to independently assess national capacities to address public health threats in line with commitments under the International Health Regulations (IHR) (2005).

To date, forty-six countries in the WHO African Region have had their IHR capacities assessed through JEE, the highest number of JEEs among the WHO regions. All countries in the WHO African region have embraced the revised IHR monitoring and evaluation framework, including mandatory annual reporting, JEEs, after-action reviews (AARs), simulations, and exercises (SIMEX). Most countries have subsequently developed and funded their National Action Plan on Health Security (NAPHS)[14].

Liberia and Sierra Leone, two countries badly hit by the Ebola virus and suffered serious fatalities and economic slumps, have been able to strengthen public health outcomes. The epidemic in Sierra Leone resulted in more than 14,000 cases and nearly 4,000 deaths.

The infection and transmission rates were high because of traditional and cultural practices involving physical contact with corpses and sick people by loved ones and other complexities. They are now among the leading countries most prepared for an outbreak, as shown in the most recent JEE ReadyScore of the West African sub-region.

Sierra Leone's Infectious Disease Response System (IDSR), an internationally recognized reporting tool used to track critical diseases, was barely functional when Ebola hit. Health workers had no training to identify potential outbreaks, and

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[14]WHO. IHR monitoring and evaluation framework. Geneva, 2018;. (http://apps.who.int/iris/bitstream/handle/10665/276651/WHO-WHE-CPI-2018.51-eng.pdf?sequence=1,

there was no regular communication system to convey information from health posts in the communities to the Ministry of Health and Sanitation (MOHS) Headquarters. However, since Ebola, health workers across the country have been trained in reporting critical diseases.

Each of the country's nearly two hundred health facilities is expected to submit weekly reports detailing findings, with the MOHS routinely reviewing them to determine a response.

The IDSR helped identify potential cholera and measles cases and currently track maternal deaths across the country. The country has a functional Emergency Operations Center (EOC), which can kick into action anytime. These institutions are different from the 1-1-7 toll-free 24/7 line created to report illness and death and intense community-level coordinated campaigns to create awareness and engender protective behaviors.

In neighboring Liberia, key international health agencies and organizations collaborated with the country's Ministry of Health to identify significant gaps in response to the fast-accelerating epidemic, which at the time were: low coverage of contact tracing, denial and resistance in communities, weak data management, inadequate infection prevention and control in health facilities, insufficient outreach capacity, insufficient safe burial capacity, and ineffective leadership and coordination at a national level. WHO provided training for a cadre of General Community Health Volunteers and supervisors to improve the incomplete contact tracing.

A comprehensive assessment of financial, logistical, and human resource needs was incorporated into the Liberia Operational Plan for Accelerated Response to the Re-occurrence of Ebola Epidemic.

The Ebola outbreak was won eventually in the West African sub-region; the hard-won lessons resonated powerfully during the response to the COVID-19 pandemic, which was swift and coordinated.

Countries in this region were able to keep the number of infections relatively low compared to many other countries by using and building on the strategies adopted during the Ebola virus epidemic response.

The incidence of COVID-19 reported is between 2 and 5 cases per 10,000 people; this is about 22 times lower than the United States' rate.

3.2 Epidemic Preparedness of Focus Countries

A Joint External Evaluation (JEE) is a voluntary, collaborative, multisectoral process to assess countries' capacities to prevent, detect and rapidly respond to public health risks, whether occurring naturally or due to deliberate or accidental events.

The JEE helps countries identify the most critical gaps within their human and animal health systems to prioritize opportunities for enhanced preparedness and response[15] in line with IHR commitments. The JEE is not an audit of a country's abilities but a collaborative effort between the country's experts and the external evaluation team. The JEE examines capacities across 19 technical areas to establish a baseline assessment, enabling countries to better understand their gaps and weaknesses in health security, so they can focus efforts to improve in these areas.

The evaluation does not just examine the human health structure in a country but also encourages collaboration among those responsible for human, animal, and environmental health. Figure 1 shows the processes involved in the conduct of a JEE.

[15] Strengthening health security by implementing the International Health Regulations (2005): https://www.who.int/ihr/procedures/joint-external-evaluations/en/

Nigeria, Kenya, Cameroon, Sierra Leone, Ghana and Liberia understudied in this paper all had their JEEs carried out between 2016 and 2017 while Malawi had its JEE carried out in 2019 using the revised JEE score template.

Compared to countries in other regions, African countries have shown better commitments in the conduct of their JEEs. Almost all countries in the region have conducted their JEEs, highlighting strengths and gaps to effectively prepare for, respond to, and control disease outbreaks.

A review of the ReadyScore Dashboard of the Prevent Epidemics of Resolve to Save Lives Resource Library was conducted for this work.

This resource is an integrated and interactive analysis of the WHO JEE Global Mission Report, which provides concise and clear country-level data on epidemic preparedness and the ability to find, stop and prevent epidemics.

The JEE ReadyScore[16] of preparedness ranges between Not Ready, Work to Do, and Better Prepared with scores 0-39, 40-79, and 80-100, respectively. No African country has a JEE ReadyScore within the range of 80 and 100. Hence, none of the countries is said to be 'Better Prepared' for an epidemic.
The highest score recorded is by Morocco with a JEE Score of 70, followed by South Africa with 62 and the lowest scored by Gabon and Central African Republic with 27 and 26, respectively.

From the study, Nigeria from the last JEE in 2017 is not prepared for the next epidemic with a score of 39. Although in November 2020, the Nigeria Center for Disease Control (NCDC), with support from international partners, conducted a midterm JEE as a follow-up to the 2017 Evaluation.

As a reflection of Nigeria's sustained investments in its systems to find, stop and prevent epidemics, its ReadyScore increased from 39 to 46 from the 'Not Ready' to the 'Work to Do' category.

Areas including legislation, policy and financing; zoonotic disease; risk communication; emergency preparedness saw an increase. In 2022, Nigeria will likely conduct another JEE, and the ReadyScore will be officially updated.

Table 2: JEE Scores of focus countries

COUNTRY	Nigeria	Cameroon	Ghana	Sierra Leone	Liberia	Kenya	Malawi
JEE SCORE	39	38	45	43	46	50	30

[16] https://preventepidemics.org/map/?mode=scores

Table 3: 2017 JEE Ready Score and Analysis in Focus Countries

SCORES 1 = No capacity; 2 = Limited Capacity 3 = Developed Capacity
4 = Demonstrated Capacity 5 = Sustainable Capacity

TECHNICAL AREAS	INDICATORS	Nigeria	Cam-eroon	Ghana	Sierra Leone	Liberia	Kenya
		39	38	45	43	46	50
National legislation, policy and financing	P.1.1 Legislation, laws, regulations, administrative requirements, policies or other government instruments in place are sufficient for implementation of IHR (2005)	1	1	2	2	2	2
	P.1.2 The State can demonstrate that it has adjusted and aligned its domestic legislation, policies and administrative arrangements to enable compliance with IHR (2005)	1	1	2	2	2	2
IHR coordination, communication and advocacy	P.2.1 A functional mechanism is established for the coordination and integration of relevant sectors in the implementation of IHR	2	2	3	2	3	3
Antimicrobial resistance	P.3.1 Antimicrobial resistance detection	2	1	1	1	1	2
	P.3.2 Surveillance of infections caused by antimicrobial-resistant pathogens	2	1	1	1	1	2
	P.3.3 Health care-associated infection (HCAI) prevention and control programmes	2	1	2	2	2	3
	P.3.4 Antimicrobial stewardship activities	2	1	1	1	1	2
Zoonotic diseases	P.4.1 Surveillance systems in place for priority zoonotic diseases/pathogens	2	3	3	3	2	3
	P.4.2 Veterinary or animal health workforce	3	3	3	1	2	4
	P.4.3 Mechanisms for responding to infectious and potential zoonotic diseases are established and functional	1	2	3	1	2	3

Food safety	P.5.1 Mechanisms for multisectoral collaboration are established to ensure rapid response to food safety emergencies and outbreaks of foodborne diseases	2	2	2	1	2	3
Biosafety and biosecurity	P.6.1 Whole-of-government biosafety and biosecurity system is in place for human, animal and agriculture facilities	1	2	2	1	2	2
	P.6.2 Biosafety and biosecurity training and practices	1	1	2	2	2	3
Immunization	P.7.1 Vaccine coverage (measles) as part of national programme	3	3	4	3	3	3
	P.7.2 National vaccine access and delivery	4	3	3	3	4	4
National laboratory system	D.1.1 Laboratory testing for detection of priority diseases	3	4	3	4	1	2	4
	D.1.2 Specimen referral and transport system	2	2	2	3	1	3	2
	D.1.3 Effective modern point-of-care and laboratory-based diagnostics	2	2	2	3	1	2	2
	D.1.4 Laboratory quality system	2	2	2	2	1	1	3
Real-time surveillance	D.2.1 Indicator- and event-based surveillance systems	3	3	3	4	4	4
	D.2.2 Interoperable, interconnected, electronic real-time reporting system	2	2	2	2	2	2
	D.2.3 Integration and analysis of surveillance data	3	3	3	4	4	4
	D.2.4 Syndromic surveillance systems	3	4	3	4	4	4
Reporting	D.3.1 System for efficient reporting to FAO, OIE and WHO	3	3	3	3	2	3
	D.3.2 Reporting network and protocols in country	2	1	2	2	2	2
Workforce development	D.4.1 Human resources available to implement IHR core capacity requirements	3	3	2	2	1	3
	D.4.2 FETP1 or other applied epidemiology training programme in place	4	4	4	3	3	4
	D.4.3 Workforce strategy	2	3	2	2	1	2	2

Preparedness	R.1.1 National multi-hazard public health emergency preparedness and response plan is developed and implemented	1	1	2	1	1	1
	R.1.2 Priority public health risks and resources are mapped and utilized	1	2	2	1	2	2
Emergency response operations	R.2.1 Capacity to activate emergency operations	2	1	1	4	3	2
	R.2.2 EOC operating procedures and plans	2	1	1	3	4	2
	R.2.3 Emergency operations programme	3	3	2	4	4	2
	R.2.4 Case management procedures implemented for IHR relevant hazards.	2	2	2	2	2	2
Linking public health and security authorities	R.3.1 Public health and security authorities (e.g. law enforcement, border control, customs) are linked during a suspect or confirmed biological event	1	2	2	4	4	3
Medical countermeasures and personnel deployment	R.4.1 System in place for sending and receiving medical countermeasures during a public health emergency	1	2	1	2	4	1
	R.4.2 System in place for sending and receiving health personnel during a public health emergency	1	1	1	1	4	1
Risk communication	R.5.1 Risk communication systems (plans, mechanisms, etc.)	1	1	2	3	3	2
	R.5.2 Internal and partner communication and coordination	3	2	3	4	4	3
	R.5.3 Public communication	2	3	3	3	4	3
	R.5.4 Communication engagement with affected communities	1	1	1	1	1	1
	R.5.5 Dynamic listening and rumour management	3	2	2	3	3	2
Points of entry	PoE.1 Routine capacities established at points of entry	1	1	3	2	2	2
	PoE.2 Effective public health response at points of entry	1	1	2	1	1	2
Chemical events	CE.1 Mechanisms established and functioning for detecting and responding to chemical events or emergencies	1	1	2	2	1	2
	CE.2 Enabling environment in place for management of chemical events	2	1	2	2	1	2
Radiation emergencies	RE.1 Mechanisms established and functioning for detecting and responding to radiological and nuclear emergencies	3	2	2	2	1	1
	RE.2 Enabling environment in place for management of radiation emergencies	3	2	3	2	1	2

3.3 How Focus Countries Approach the Pandemic

Drawing experience from the 2014 Ebola virus disease crisis in West Africa, African leaders were keenly aware that failure to contain COVID-19 would threaten health, prosperity, and security. In response, many African countries used a combination of containment and mitigation measures to delay a surge in cases.

They concentrated early efforts on the capacitating of AU Member States for case detection and containment. Synergies among Africa CDC, the WHO, and the West Africa Health Organization led to increased COVID-19 testing laboratories in Africa from 2 to 43 between February and mid-March 2020[17].

By the end of March 2020, most countries had imposed travel bans on affected Asian and European countries and instituted mandatory quarantine periods for most travelers. More than 40 countries closed their borders through April and May, allowing only cargo, freight, and the eviction of foreign nationals. Mitigation measures, including restrictions on movement, public gatherings, and schools, were also implemented. As early as 20 March 2020, African countries that reported fewer than 100 cases were imposing lockdowns and curfews to prevent further COVID-19 transmission within their borders. Due to these early efforts, some African countries saw a reduction in average daily case growth.

In Malawi, the President took proactive steps[18] to establish a Crisis Cabinet Committee for COVID-19 on 7 March 2020 and declared a State of Disaster on 20 March 2020 before confirming the first cases. The first three coronavirus cases were reported on 2 April 2020, leading to a 21-day lockdown from 18 April to 9 May 2020. The reactionary measures implemented included banning gatherings of more than 100 people in churches, rallies, weddings, and funerals. The President instructed that both public and private

[17] Nkengasong, J. Nature https://doi.org/10.1038/d41586-020-01265-0 (2020).
[18] Mutharika lays out Malawi 'response plan' on Coronavirus: Bans gatherings of 100 people, schools closing". NyasaTimes.com. 20 March 2020. Retrieved 5 April 2020.

education institutions be closed from 23 March. He further urged the government to suspend hosting international meetings and banned public servants from attending regional and international meetings.

He called upon returning residents and nationals from affected countries to subject themselves to either self- or institutional quarantine.

The Malawi Prison Services and Juvenile were directed to present a list of prisoners and juveniles who committed "petty offences", including those that have served a significant portion of their sentences for moderate crimes, to the Minister of Homeland Security to decongest the country's overpopulated prisons. Currently, Malawi has about 31,000 confirmed cases, more than 10,000 active cases, more than 18,000 recoveries, about 1000 fatalities with a 3.27% fatality rate[19].

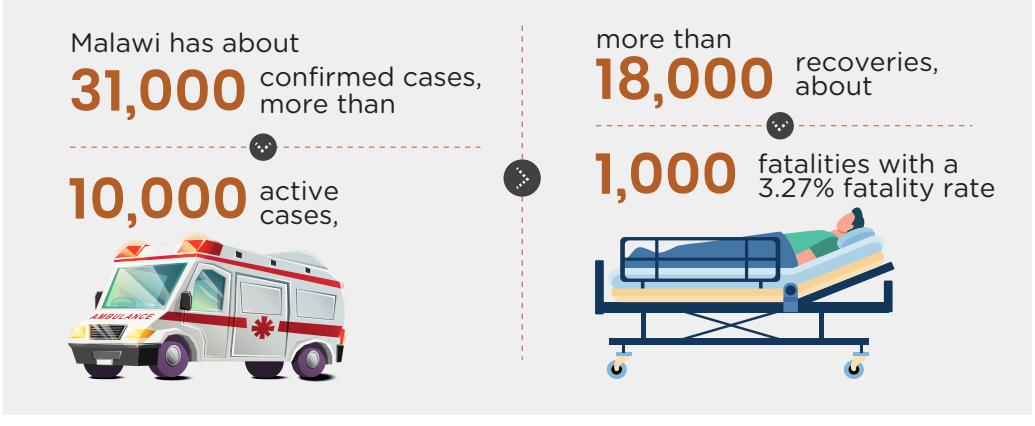
Nigeria was one of the first countries to recognize the risk and started planning the response for COVID-19. In a massive effort of national coordination, a multi-sectoral National Coronavirus Preparedness Group was established by Nigeria's NCDC on 7 January 2020, one week after China first reported the cases and three weeks before WHO declared the disease to be of international concern.

The country also established diagnostic capacity for COVID-19 in three laboratories within the country in one month.

According to a statement released by one of the President's Special Assistants, Nigeria had about four laboratories in its molecular laboratory network, with identified capacities to test for COVID-19 when the disease broke out in the country. Right now, there are 132 Labs nationwide (public and private), that can test for Covid, across every State of the Federation[20] with the latest addition being the brand-new molecular lab at Alex Ekwueme Federal Teaching Hospital, Ebonyi State.

Nigeria NCDC established a national team that met daily to assess the risk coronavirus poses to the nation and review its response. On 9 March 2020, the President appointed a Presidential Task Force to coordinate response activities.

Many states went into full lockdowns; schools and markets were shut; public and religious gatherings were banned, while international travels were suspended with restrictions on inter-state movements. Many public and private offices/organizations



**As at April, 2020*

[19] http://covid19.health.gov.mw/
[20] https://twitter.com/toluogunlesi/status/1366438761664503808?s=20

were also shut down, allowing their staff to work from home, while the education sector embraced the online/virtual learning method.

Many stakeholders mobilized to support government efforts, including the legislature, which developed legislation and appropriated emergency funds for COVID-19 response; the private sector donated money, medical equipment, and palliatives.

The country set up treatment facilities, testing centers and has continuously improved on its diagnostic capacity. To effectively mobilize domestic funding, the 2020 National Budget was revised, while in the 2021 National Budget, the health sector was prioritized, making provisions for COVID-19 response.

Currently, there are about 150,000 cases reported, with about 20,000 active cases. The country has recorded more than 130,000 recoveries and almost 2000 deaths with a 1.23% fatality rate[21].

Ghana consulted its past experiences with Ebola to inform its response strategy. In early preparation for the response, the Ghanaian government laid out five key objectives for mitigating the impact of COVID-19 within its borders, which were: limit and stop the importation of the virus; contain its spread; provide adequate care for the sick; limit the impact of the virus on social and economic life, and inspire the expansion of domestic capability and deepen self-reliance.

One of the first major government efforts was to scale testing massively, and Ghana became one of the countries that conducted the highest tests for COVID-19 in Sub-Saharan Africa. Ghana also scaled investment in the health sector and explored local production of medical supplies, while other countries battled globally disrupted supply chains.[22]

Kenya like most other countries also adopted the containment strategy by instituting policy measures and behavioral protocols to respond to the outbreak; although it had earlier established the National Emergency Response Committee (NERC) on coronavirus through an Executive Order which had the mandate of monitoring the evolving situation and taking all necessary measures for averting, containing and mitigating the transmission of the disease. The Committee put up some measures which included mandatory screening of all person coming into the country

Nigeria has about **150,000** cases reported, with about **20,000** active cases,

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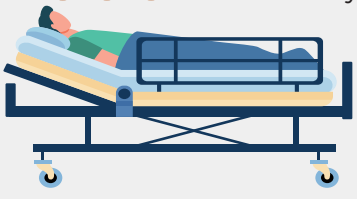

**As at April, 2020*

[21] http://covid19.ncdc.gov.ng/
[22] Preparation is the Key: Ghana Takes on COVID-19: https://preventepidemics.org/stories/ghana-takes-on-covid-19/

through airports, sea ports and land crossings; institution of isolation centers in level 4 and 5 hospitals across the country; training and sensitization of healthcare workers, service providers in the transport sector; provision of PPEs to all County health facilities, security and response teams; improved diagnostic capability at the National Influenza Center; and other measures like restrictions on movement, social and religious gatherings; wearing of face masks in public; social distancing; Covid-19 toll-free number e.t.c.[23]

There were also strategic economic responses to cushion the effects of policies. For instance, there were tax waivers and reduction of tax rates, bank transfer levy waivers, restructuring of non-performing loans, stimulus packages to stimulate creation of jobs, stipends for the vulnerable and the establishment of a Covid-19 Emergency Response Fund.

All the countries understudied in this research (Malawi, Cameroon, Nigeria, Ghana, Sierra Leone, Liberia & Kenya) have carried out their JEEs; and have developed and cost their NAPHS.

However, the same cannot be said about mobilizing the financing for preparedness. Financing remains a significant challenge in most African countries' health systems, most of whom are either low or middle-income countries.

Most of them rely on external funding and perform below par in mobilizing domestic funding to develop and effectively run their health sectors. Funding preparedness to close gaps identified in JEEs requires huge investment.

Nigeria has begun to respond to advocacies to commit more to investment and funding of the health sector. It began appropriating the Basic Health Care Provision Fund (BHCPF) established by its National Health Law to provide a minimum level of healthcare services for everyone in the country, particularly the most vulnerable.

The Fund is to be implemented at the subnational level to revamp and strengthen healthcare services provision at the primary health care (PHC) centers. With a mean PHC Performance score of 3.68[24], Nigeria still struggles with medical personnel, infrastructure, and equipment to effectively provide basic care and respond to disease threats at the PHC level.

Nigeria's NAPHS[25] will cost $439,123,340 to implement, with a strategic plan to strengthen immunization/vaccination and workforce development and deployment at the PHC level to respond to disease outbreaks effectively.

However, there are ongoing advocacies from a wide range of stakeholders to prioritize Nigeria's health security investment. Many are advocating for an appropriation for health security in national and subnational budgets and the inclusion of health security as part of the BHCPF, an innovative and statutory health financing mechanism in Nigeria.

Also, Nigeria's legislature is in the process of amending the country's National Health Law to fund health security adequately.

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[23] Kenya's Response to COVID-19
By Charity Mukiri Limboro. University Practice Connect. Azim Premji University. https://practiceconnect.azimpremjiuniversity.edu.in/kenyas-response-to-covid-19/
[24] Ebola: Primary Health Care System Survey In Focus Countries: BudgIT
[25] National Action Plan for Health Security Federal Republic of Nigeria (2018-2022): https://ncdc.gov.ng/themes/common/files/establishment/5e88f9e22d2b4e4563b527005c8a0c43.pdf

4.0 Vaccine access & development

4.1 *Partnerships & Vaccination in Focus Countries*

In December 2020, vaccines were rolled out after a year of clinical and human trials, and as of 19 February 2021, 201 million doses of vaccine have been administered worldwide. According to UN Secretary-General Antonio Guterres, 130 countries are yet to receive a single vaccination dose. In contrast, some countries like Canada have procured enough doses to vaccinate their population five times over, but how will low-income countries in Africa afford this without going into debt?

As part of COVAX (GAVI-led public-private vaccine partnership), developing countries will pay a subsidised price of up to $4 for a two-dose vaccine. Initially, COVAX promised free vaccines to low-income countries, but a September decision by GAVI's board opted to introduce a cost-sharing plan with countries. Still, GAVI says there is some flexibility in this requirement, and governments can make a case for why they cannot afford the discounted prices[26].

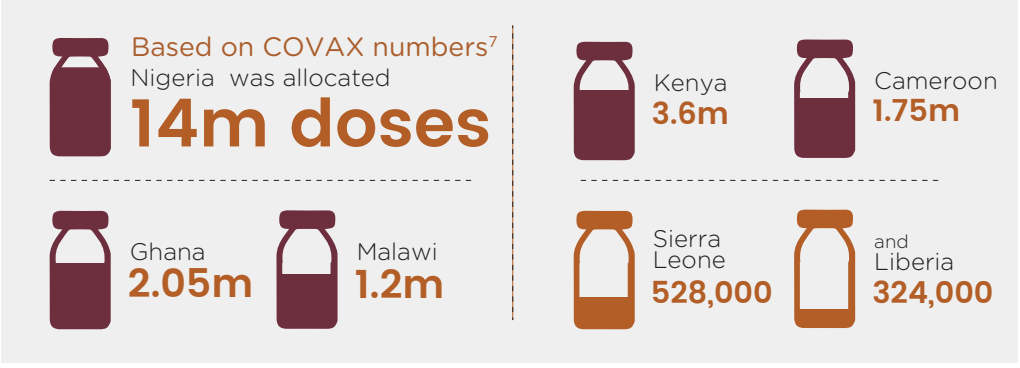
COVAX is designed to cover 20% of each nation's population at the end of 2021 and secure 672 million doses for Africa, and about 30million are expected to start arriving in March.

But this intervention is not enough since vaccination of more than 50% of a country's population is required to attain a level of community immunity. African Union has secured 270million doses for the continent, but they are not expected to arrive until April 2021.

More African countries opt for the vaccines made in China and Russia due to storage and financial constraints. Seychelles, Morocco, and Egypt administer the Chinese-made Sinopharm vaccine; Guinea, the Russian Sputnik V. South Africa, the country worst hit by the pandemic with over one million cases to date, has secured nine million doses of the Johnson and Johnson vaccine.

Based on COVAX numbers[27] Nigeria received 14m doses, Ghana (2.05m), Malawi (1.2m), Kenya (3.6m), Cameroon (1.75m), Sierra Leone (528,000), and Liberia (324,000).

Our analysis showed that there would be a massive gap in financing for the focus countries, as these countries don't have the financial capacity to provide vaccination for their population. These countries'



[26] GAVI: The Vaccine Alliance. (2020). REVIEW OF DECISIONS. Virtual: GAVI. Retrieved f 2021, from https://www.gavi.org/sites/default/files/board/minutes/2020/29-sept/Board-2020-Mtg-5-Review%20of%20Decisions.pdf

[27] https://www.gavi.org/sites/default/files/covid/covax/COVAX-First-round-allocation-of-AZ-and-SII.pdf

allocation to the health sector ranges from 4% to 12.4%, which is very low and might not afford the FX component. We have seen interest in institutions such as the Afrexim that procured 1.6bn doses for its 445m population. While Africa, with over 1.2bn people, has 207m procured doses so far.

Country	Revenues (USD mn)	Estimated Cost to vaccinate 70% of population (USD mn)	Vaccination cost as % of public revenues	Health Budget (USD mn	Projected vaccination cost as a % of health budget	Covax doses first round allocation vs population*
Malawi	1,620	177	10.93%	260	68.02%	4.31%
Nigeria*	20,807	1,750	8.41%	1,677	104.34%	4.73%
Kenya	17,261	413	2.39%	1,017	40.62%	5.23%
Ghana	12,410	261	2.11%	1,249	17.51%	4.76%
Sierra Leone	584	68	11.58%	72	93.56%	4.73%
Liberia	428	40	9.30%	70	56.53%	4.93%
Cameroon	6,265	222	3.54%	357	62.09%	4.79%

Source: National Budgets, GAVI and BudgIT Research
*central government only

4.2 *Dependence of Africa on Western Countries on Vaccine Access*

Vaccines have contributed to substantial reductions in childhood disease burden globally, saving millions of lives. For instance, polio is on the brink of extinction due to intense vaccination across the globe against the disease.

More children now live healthy lives, free of vaccine-preventable diseases. The impact of vaccines extends beyond public health to children's educational performance, increased household incomes, and, ultimately, improved national economic growth. Vaccination is one of the most successful and cost-effective public health interventions available.

Sadly, despite having the highest incidence of mortality caused by infectious diseases, Africa has been unable to manufacture vaccines that are essential to reduce mortality, improve life expectancy, and promote economic growth[28]. The continent has depended mainly on vaccines manufactured from other climes for its vaccination needs.

One of the challenges facing vaccine research and local production in Africa is financial commitment. Governments in Africa are interested in the idea but not ready to commit to it financially.

They would instead request external support for the investment or provide incentives to investors who want to invest. Unfortunately, global stakeholders are only willing to render technical support, as investing in local production is not their preference; also, the National Regulatory Authorities (NRAs) in Africa are still weak.

Most of them only perform oversight of pharmaceuticals, not biopharmaceuticals like vaccines. Other challenges include access to expertise, source of raw materials, consumables, equipment, market access, country's import policy, regulatory shortcomings, weak research and development, and long timelines for dossier review and approval. Other critical aspects include the construction of facilities, technology acquisition, and global community policies and incentives.

These have primarily contributed to

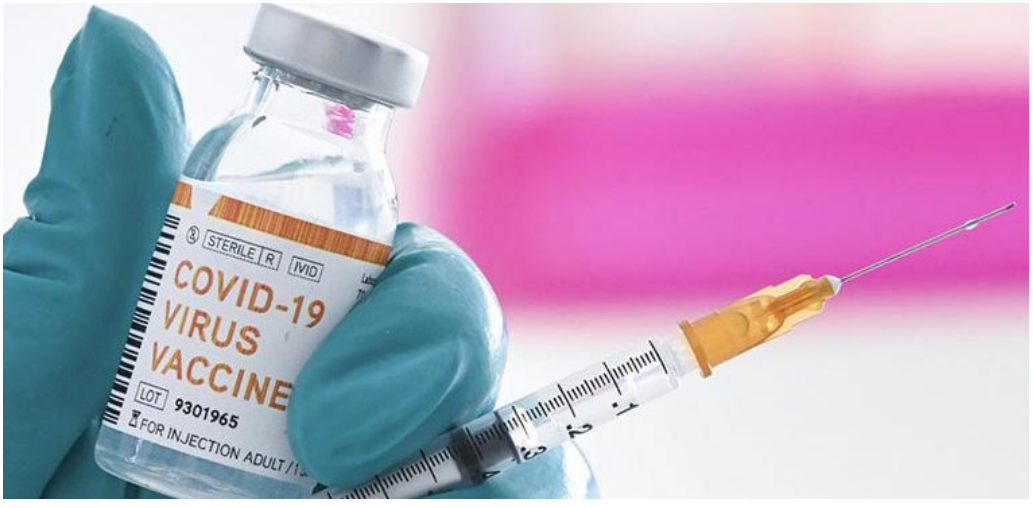
[28] Makenga G, Bonoli S, Montomoli E, Carrier T and Auerbach J (2019) Vaccine Production in Africa: A Feasible Business Model for Capacity Building and Sustainable New Vaccine Introduction. Front. Public Health 7:56. doi: 10.3389/fpubh.2019.00056

Africa's dependence on external suppliers for its vaccine/immunization needs.

Currently, there are eight vaccine manufacturing companies with existing or potential vaccine manufacturing capacities identified in Africa. Only one of these companies (Pasteur Institute in Dakar, Senegal) exports a WHO prequalified vaccine (Yellow Fever).

Two other companies (Pasteur Institute in Tunis, Tunisia, and Egyvac-Vesera in Egypt) with locally produced and marketed products can supply vaccines that include all upstream and downstream processes. A different company (Biovac in South Africa) is in the late vaccine development and manufacturing stage but limited to downstream processes.

Four companies (Pasteur Institute, Algeria, Pasteur Institute in Morocco, EPHI in Ethiopia, and Biovaccines in Nigeria) are considered at the preliminary planning phase of vaccine development and production, three of which have had experience in producing some basic vaccines[29].



[29] VMPA Study. Vaccine manufacturing and procurement in Africa. 2017. https://www.avmi-africa.org/wp-content/uploads/2017/09/VMPA-Study-e-book.pdf

4.3 *Investment in Local Vaccine Production in Africa*

Building a vaccine manufacturing facility with 20 million doses capacity can cost between USD60million to USD130million, depending on vaccine technology and formulation according to estimates made by WHO[30].

Capital expenditure attracts over 60% of all costs, and a highly specialized workforce is a crucial contributor to operational expenditure costs. Other equally essential costs include investment cost (estimated at 60% of total manufacturing cost), research and development cost, fixed costs, variable costs, indirect operational expenditure costs, admin and manufacturing overheads, spare parts and maintenance, and quality management systems cost.

Specific factors and drivers of vaccine manufacturing cost in Africa[25]

- Human resources and education: With few African educational institutions in the field of vaccinology, microbiology, and vaccine or biotech manufacturing, highly qualified personnel are scarce, leading to higher costs in attracting and retaining staff.

- Maintenance & calibration: With no effective vaccine manufacturing industry in Africa currently, an establishment of support infrastructure is needed to maintain manufacturing facilities.

  Maintenance is required regularly and quickly, and experts have told of long delays and increased travel cost in bringing in service personnel from Europe to remedy issues. Due to an underdeveloped vaccine manufacturing ecosystem and lack of infrastructure, the cost of maintenance and calibration is also higher than other Developing Countries Vaccine Manufacturers (DCVMs).

- Pricing and Price Independence: With vaccines being public sector goods with the government and UN agencies as major partners, they experience a strong downward pressure on the price, limiting independence and volume-linked elasticity.

  The pricing policy of governments in Africa (Egypt) is stringent and distant from free-market prices. Further, the lack of a domestic private market and inaccessible foreign public and private markets restrict revenue generation possibilities, the opportunity to cross-subsidize profits, and access to tiered pricing benefits.

- Utilities: Availability and (increased) cost of sustainable and reliable utilities (water, electricity, generators) lead to additional spending on water plants and purification units, backup UPSs, generators, and waste disposal systems.

- Demand dynamics and stability: It is riskier to establish demand stability with a very large single buyer with huge bargaining power coupled with stringent WHO Prequalification (PQ) Requirements.

[30] Syarifah Liza Munira: Viability of local vaccine production in developing countries: An economic analysis of cost structures, market shares and vaccine prices, Department of Global Health, Australian National University

- Functional local National Regulatory Agencies (NRAs):

  One of the factors outside the manufacturer's control but directly affecting its ability to generate profits includes the need for functional (as assessed by the WHO) NRAs.

  This restricts the manufacturers' ability to access export markets – both public and private - essential for profitability in sales volumes, tiered pricing, etc.

4.4 *Financing Sources for Vaccine Manufacturing in Africa*[25]

Finance sources for local vaccine production have been mainly from government budgets (public funding), supplemented by fee income and grants.

The majority of vaccine manufacturers in Africa have been funded and subsidized since their inception and continue to receive finance from government budgets coupled with revenue streams from ongoing business. There is also the existence of loan funding on a bilateral basis from donor development banks like the AFD and Islamic Development Bank with ties to the region.

It is inferred that government funding is predominant due to a lack of interest from other financing sources.

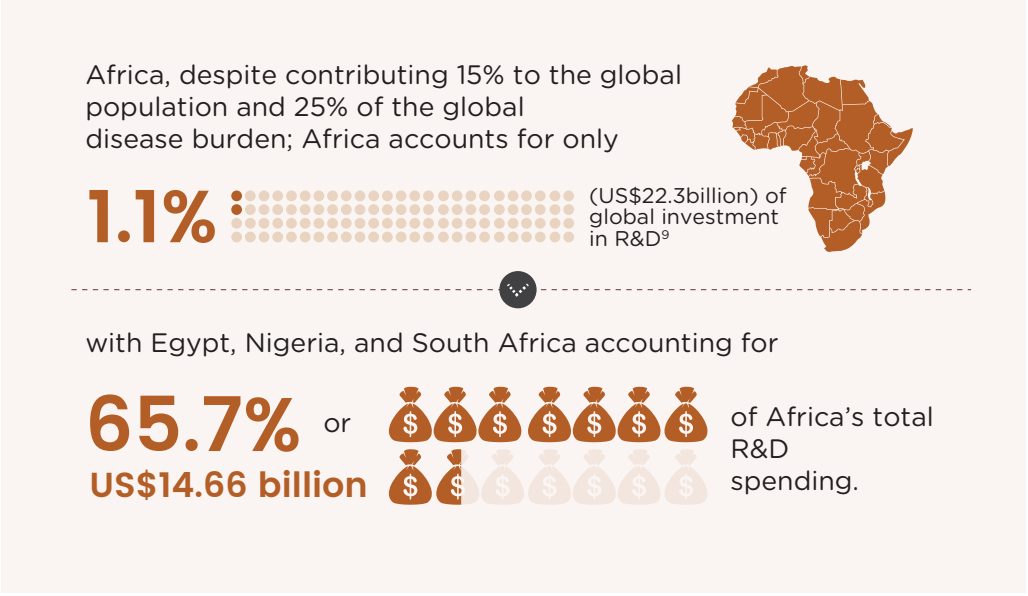
A few others use the Public-Private Partnership financing model, e.g., Biovacc in South Africa with shared ownership of the government (47.5%) and the private sector – Biovac Consortium (52.5%).

This is also the arrangement with Biovaccine in Nigeria. This financing model constitutes a mix of initial equity injection by the stakeholders, a defined fee charged for handling vaccines, local development bank loans, bilateral grants, and technical supports and grants by Departments of Trade and Industry to stimulate local production.

4.5 *Investment in Health Research at Public and Private Sector Levels*

Research and development (R&D) is a key component of vaccine manufacturing. R&D pipelines for diseases that disproportionately affect African countries and address Africa's unmet health needs are insufficient[31].

More needs to be done, including leveraging investment and supporting capacities for health science research across Africa. Despite contributing 15%



[31]Nwaka S , Ilunga TB , Da Silva JS , et al . Developing ANDI: a novel approach to health product R&D in Africa. PLoS Med 2010;7:e1000293.doi:10.1371/journal.pmed.1000293

to the global population and 25% of the global disease burden; Africa accounts for only 1.1% (US$22.3billion) of global investment in R&D[32], with Egypt, Nigeria, and South Africa accounting for 65.7%, or US$14.66 billion, of Africa's total R&D spending. Even after commitments to invest 1% of GDP for R&D, only a few African countries have invested close to this commitment.

By comparison, most of the world's largest developed economies have overall levels of R&D expenditure exceeding 2% of GDP.

Public investments in strengthening research capacity require extensive capital resources. However, rates of return are often unpredictable, and it is difficult to prioritise spending versus pressing government priorities in education, security, health, and infrastructure. In most countries of the Organisation for Economic Co-operation and Development, the largest source of R&D funding is the private sector.

African R&D has historically been mainly funded by the public sector, with international sources forming a substantial proportion of expenditures in many of its countries. For instance, foreign sources contributed significantly to 2015 R&D expenditures in Ghana (31%), Senegal (41%), and Burkina Faso (60%)[33].

Encouraging governments to increase public funding for R&D and incentivising strong private sector engagement in the financing and performance of R&D activities remains a key regional challenge.

Africa had an estimated 198 researchers, in all fields, per million inhabitants in 2014, according to UNESCO Institute of Statistics, 2017. This compares with 428 in Chile and more than 4000 in the UK and the USA.

The situation is worsened by the constant 'brain drain' of skilled researchers who leave Africa for several reasons. Over 10% of sub-Saharan African graduates emigrate; the number is even higher in the health workforce. Another crucial issue affecting research in Africa is education quality. Only 26 universities in Africa featured in the Times Higher Education's World University Rankings 2016-2017; out of 890.

The African region should also commit to investing in its indigenous research institutions. An evaluation has shown that investing in African training institutions has provided a regional training resource whose graduates stay in Africa after graduation.

A good proportion of the graduates work in research positions, have contributed research outputs, and have furthered higher degrees. This alone can strengthen demand and improve research quality on the continent.

The whole value chain for vaccine manufacturing, especially R&D, needs to be overhauled, and the private sector incentivised to invest and strategically build a local industry that can respond to the vaccine market needs of the African Region.

[32] R&D Magazine, 2016. Global R&D Funding Forecast. Available: https://www.rdmag.com/article/2016/02/2016-global-rd-funding-forecast-0 [Accessed 4 Feb 2019].

[33] UNESCO. Mapping Research and Innovation in the Republic of Malawi. In: Lemarchand GA , ed. GO-SPIN country profiles in science, technology and innovation policy. Paris: United Nations Education Scientific and Cultural Organization, 2014.

4.6 *Emerging Health Technology*

Health technology involves applying organized knowledge and skills to solve a health problem and improve the quality of lives. This includes pharmaceuticals, devices, procedures, and organizational systems used in the healthcare industry and computer-supported information systems. The provision of healthcare services worldwide has been going through a major transition since the development and widespread adoption of electronic health records (EHR).

What the future portends is that people will only go to hospitals or health centers for only major surgeries and critical illnesses. The outcomes of health technology are wide-ranging from the use of applications for medical records, supplies to health and medical devices, and more advanced processes and procedures like DNA therapy and editing, medical imaging, magnetic resonance imaging (MRI), 3D printing, assistive technologies, artificial intelligence among many others.

AI is now being developed to innovate new dimensions in healthcare. It is a technology designed to mimic human cognitive processes. An example is Google DeepMind Health which builds AI and mobile tools that mine medical data to improve how hospitals and health care professionals deliver care to patients.

It is currently being used to analyze eye scans more quickly and accurately than human specialists and also to rapidly and accurately identify cancerous and healthy tissues on CT and MRI scans of patients with head and neck cancers.

It is projected that the AI healthcare market will grow to US$8billion by 2022. Robotics involves design, engineering and use of robotic machines to perform partially or fully-automated physical and cognitive functions. There have been many innovations around robotics development; including wearable robots – devices used to rehabilitate or enhance a patient's physical capabilities, including automated prosthesis. The da Vinci robot-assisted surgical system controlled by a surgeon that uses minimally-invasive surgical instruments and 3D high-definition visuals to enhance accuracy and control has been used for surgical procedures. Market revenue for robots in healthcare is projected to reach US$2.8billion in 2021.
3D printing is another emerging technology with very useful application in medicine and health. It involves printing of solid three-dimensional objects from a digital file with an additive process using different materials such as metals, polymers, ceramics, epoxy resin or living cells.

Bioprinting living human or animal tissues using stem cell bioink has the potential to reduce the shortage of organs for lifesaving implants, while 3D printed drugs can be tailored to the specific needs of patients, such as the FDA-approved Sprintam. It is estimated that the global 3D value chain market will be worth US$1.8billion by 2027.

Nanomedicine utilizes nanotechnology, or the study of molecular structure for developing precise devices to advance biomedical research and clinical practice. Nanorobots injected into a patient's bloodstream can be used for drug delivery and disease monitoring. It has found applications in cancer management such as improving circulation, reducing toxicity, targeted drug delivery e.t.c; it can also be used to enhance pharmaceutical properties of drugs, developing synthetic vaccines, and more sensitive diagnosis and imaging.

Market project is US$261billion by 2023[34]. Many other health technologies are currently being deployed for healthcare; while various others are being researched. In Africa, the COVID-19 pandemic has galvanized the development of more than 120 health technology innovations that have been piloted or adopted in Africa. 57.8% of the technologies were ICT-driven, 25% were based on 3D printing and 10.9% were robotics.

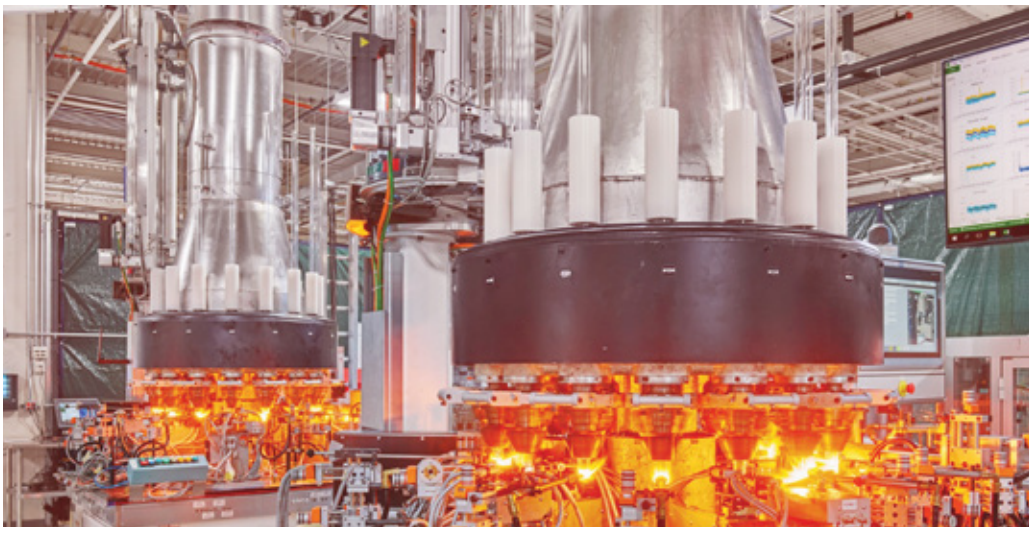
The ICT-based innovations for healthcare delivery include WhatsApp Chatbots in South Africa, self-diagnostic tools in Angola, contact tracing apps in Ghana and mobile health information tools in Nigeria. The countries with the most innovations were South Africa (13%), Kenya (10%), Nigeria (8%) and Rwanda (6%)[35]. Africa's health-tech sector is suddenly emerging as one of real value from an economic perspective; in the first half of year 2020, despite the COVID-19 situation, e-health start-ups alone generated over US$90million across the continent[36] Vaccine technology, development, and production are also a part of the currently emerging health technologies in the health-tech ecosystem. Based on demography, population predictions, disease burdens, etc., Africa has a ready market for vaccines in the long term. A high-level planning carried out to examine prospects and opportunities for a vaccine production line in Africa turned out to be a feasible business model for sustainable new vaccine introduction in Africa. Studies have suggested vaccine research and production in Africa is possible[37]. The study, just like WHO's estimates, predicted that it would cost USD 70million and USD344million depending on the planned capacity; over a five-year implementation period.

Africa can also leverage Vaccine Technology Transfer from other developed countries to catalyze local manufacturing in the region. South Africa's Biovacc and Aspen pharmaceuticals have already adopted this method for small-scale manufacture of vaccines for the South African market by collaborating with larger manufacturers like the French multinational pharmaceutical company – Sanofi, and Johnson & Johnson for local production of vaccines[38]. However, this approach to local manufacturing portends a huge challenge to R&D capacity in developing countries.

There also must be a value change and reorientation on the cost involved in investments in local manufacturing of vaccines in Africa. Establishing local vaccine manufacturing is not cost-effective, and vaccines should not be seen purely as commodities. However, factors such as national health security need to be considered. The establishment of a vaccine policy by countries may help countries identify how and when to consider local production[39]. This will engender adequate funding and government commitment not only for establishing a manufacturing line; but sustainability in the long run.

[34] Nwaka S , Ilunga TB , Da Silva JS , et al . Developing ANDI: a novel approach to health product R&D in Africa. PLoS Med 2010;7:e1000293.doi:10.1371/journal.pmed.1000293
[35] WHO Africa COVID-19 spurs health innovation in Africa: https://www.afro.who.int/news/covid-19-spurs-health-innovation-africa
[36] Appsafrica. 2020. Africa's e-health startups have raised over $90M this year: https://www.appsafrica.com/africas-e-health-startups-have-raised-over-90m-this-year/
[37] Vaccine Production in Africa: A Feasible Business Model for Capacity Building and Sustainable New Vaccine Introduction: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6435488/
[38] Vaccine production in South Africa: how an industry in its infancy can be developed: https://theconversation.com/vaccine-production-in-south-africa-how-an-industry-in-its-infancy-can-be-developed-153204
[39] Increasing Access to Vaccines Through Technology Transfer and Local Production: https://www.who.int/phi/publications/Increasing_Access_to_Vaccines_Through_Technology_Transfer.pdf

4.7 *Vaccine Production Giants in the Developing World*



Amongst developing countries worldwide, Brazil, Cuba, and India have successfully developed a vaccine manufacturing regime. Brazil and Cuba[40] are good learning examples for vaccine production set up by public institutions, while India is an example for private manufacturers[41].

These countries initially focused on domestic needs and later expanded to international supply. The likelihood of success for Africa is favored by the predicted population and thus market growth.

Brazil was able to successfully install an industrial base that has been important for guaranteeing national access to vaccination. Domestic production has been exclusively public and subordinated to technology transfer strategies. While this initiative has met the country's immediate vaccine needs, added to the GDP, and increased its local capacities for vaccine manufacture, it has not reversed the conditions of structural and long-term dependence, as shown by the economic, R&D, and trade balance data.

The incipient (nearly non-existent) share of domestic institutions and companies in patent filings in the Brazilian Patent and Trademark Office (INPI) for inherent technologies in the development and production of vaccines suggests a tendency to maintain or increase the dominance of the large global leaders' technological standard in the country.

Brazil needs to go beyond strategies that link domestic production base and domestic public demand to improving its capacity to innovate. This perspective contributes to resolving the global dilemma of orienting efforts in science, technology, and innovation in health to social needs with a sustainable and less asymmetric basis, allowing for a greater variety of players, countries, and technological alternatives[42].

[40] WHO Cuban Experience With Local Production of Medicines, Technology Transfer and Improving Access to Health. (2015). Available online at: http://apps.who.int/medicinedocs/documents/s21938en/s21938en.pdf [Ref list]
[41] Access to vaccine technologies in developing countries: Brazil and India. Milstien JB, Gaulé P, Kaddar M Vaccine. 2007 Nov 1; 25(44):7610-9.
[42] Gadelha, Carlos Augusto Grabois, Braga, Patricia Seixas da Costa, Montenegro, Karla Bernardo Mattoso, & Cesário, Bernardo Bahia. (2020). Access to vaccines in Brazil and the global dynamics of the Health Economic-Industrial Complex. Cadernos de Saúde Pública, 36(Suppl. 2), e00154519. Epub August 31, 2020.https://doi.org/10.1590/0102-311x00154519

India currently leads the world's largest national immunization program and globally supplies more vaccines by volume than any other country[43]. India has a very complex and long history of immunization/vaccination and vaccine manufacture. By the time of its independence, the country was self-sufficient in the production of the smallpox vaccine.

However, the most important development in vaccine manufacturing in the country was setting up vaccine manufacturing units by the private sector. According to an official statistic, there were nearly 19 vaccine manufacturing units in the public sector and 12 in the private sector in 1971. Indian vaccine manufacturers' capacity was put on the test when the need for a vaccine against Novel H1N1:2009 arose in the wake of a Pandemic alert. Three manufacturers developed a pandemic flu vaccine in a short time.

India's journey to achieving dominance in the pharmaceutical industry was catalyzed mainly by its strategic and innovative policies and legal reforms. For instance, the India Patents Act, 1970, was momentous in the history of the Indian pharmaceutical industry as it enabled domestic firms to replicate the drugs patented by multinational corporations, creating a booming generic pharmaceutical industry.

As multinational corporations began to exit the Indian market due to significantly diminished Indian Patent protection, the Indian pharmaceutical companies began to fill the void and dominate the global business. They used reverse-engineered, highly cost-efficient generics, which sold at exceptionally lower prices than their counterparts marketed by multinational corporations. This is how India's generic pharmaceutical industry became one of the most prolific drug manufacturing industries globally, ranking third globally in annual volume[44]. This has substantially contributed to its vaccine production prowess.

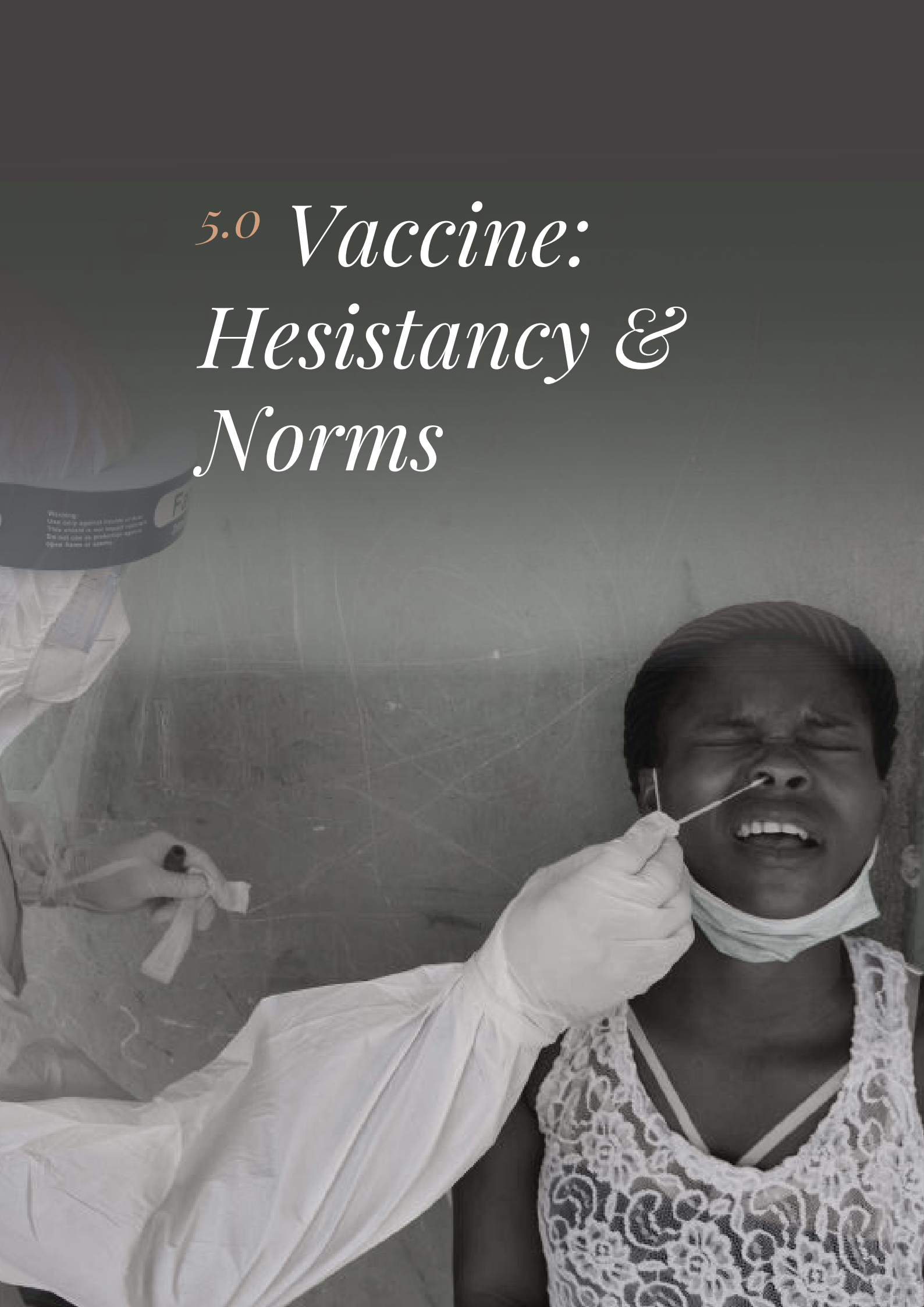
Also, the cost of producing drugs, including vaccines, in India is relatively low because of cheaper labor and the nation's large-scale manufacturing facilities. A rotavirus vaccine by Indian pharma Bharat Biotech, for example, costs one-fifteenth as much as the same vaccines developed outside of India.

The largest vaccine maker in the world is the Serum Institute of India, a private family-run drug company founded in 1966 and headquartered in the western Indian city of Pune. It partnered with pharmaceutical giant AstraZeneca to produce the Oxford University COVID-19 vaccine, which a World Health Organization (WHO) official dubbed the world's most advanced coronavirus vaccine candidate.

Serum plans to price one dose at $3 for India and other emerging economies[45]. In comparison, Pfizer and German biotech firm BioNTech SE made a deal with the U.S. government to charge $19.50 per vaccine dose, and in August 2020, Moderna said it is charging between $32 and $37 in some deals for its vaccine. The Pfizer vaccine is being manufactured in the U.S. and Germany; Moderna's vaccine is being manufactured at sites in the U.S. and Switzerland[46].

[43] View: India will play central role in equitable Covid-19 vaccine distribution across the world. Read more at: https://economic-times.indiatimes.com//industry/healthcare/biotech/pharmaceuticals/view-india-will-play-central-role-in-equitable-covid-19-vaccine-distribution-across-the-world/articleshow/80228447.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
[44] Major milestones in vaccine developments and licensing in India: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4078488/table/T3/
[45] Factbox: Development of AstraZeneca's potential coronavirus vaccine: https://www.reuters.com/article/us-health-coronavirus-astrazeneca-factbo/factbox-astrazenecas-potential-coronavirus-vaccine-idUSKBN25L1OH
[46] More than manufacturing: India's homegrown COVID vaccines could transform its pharma industry: https://fortune.com/2020/09/05/covid-vaccine-india-corona-development-manufacturing/

5.0 Vaccine: Hesistancy & Norms



"I will not take the vaccine even if it is free. I heard it is not safe yet." - Makena, Kenya.

"COVID 19 is a rich man's disease. It hasn't affected anyone around me so I can't even collect the vaccine. Let the politicians continue to share it among themselves."
- Balarabe, Nigeria.

"I might take the vaccine if people I know also take it and nothing happens to them. If not, I won't because I don't trust it."
- Dzifa, Ghana.

"I won't take the vaccine because my brother who is a microbiologist advised me not to. He said the vaccines are not yet safe."
- Fatou, Sierra Leone.

"I have registered for it and will be taking it once it is available in my area. I'm tired of being skeptical of going out or meeting people."
- Edeh, Nigeria.

"I will not take the vaccine because it is the mark of the beast. As the bible said in Revelations that there will come a time when we all need to be marked to have access to things, the time has come."
- John, Liberia.

5.1 *Surviving COVID-19*

> *"I will not take the vaccine even if it is free. I heard it is not safe yet." - Makena, Kenya.*

The economic predictions of the pandemic's effect on the continent have been correct, even more than forecasted. During the pandemic, the continent has suffered a devastating financial crisis which triggered the continent's first recession in 25 years, according to the World Bank. "In sub-Saharan Africa last year, the GDP fell by 2.6 per cent, and the IMF predicts that Africa will be the slowest growing large region in 2021," Regional Director of the WHO, Matshidiso Moeti, said at a press briefing marking one year of COVID-19 in Africa.

Forty-five percent of West Africans live on less than a dollar per day, so many saw the pandemic as a lesser threat than poverty. The stall of economic activities also took its toll on low-income earners[47].

While Western nations that enforced lockdowns provided palliatives and relief funds to their citizens, the Nigerian government provided 'audio' palliatives for its citizens. Months into the pandemic, citizens found locked warehouses full of foodstuff that was rotting away. Some politicians distributed it as party and birthday souvenirs to their favourite constituents[48].

Several allegations of subversion and favouritism trailed the disbursement of palliatives as citizens alleged that the process of distributing the items had been politicized and only shared among the ruling party members in each state[49].

However, in places where the government claimed that they distributed palliatives, residents in those areas reacted that they are not aware of such distribution. The government also embarked on conditional cash transfers to "vulnerable citizens" but gave no clear explanation on how they determined who is vulnerable[50].

When the lockdown continued without any form of relief, citizens became lackadaisical about safety measures, and activities began to return to normal again as they sought to fend for themselves. Many think the virus is the same as a regular common cold, or they are immune to it due to its malaria-like symptoms; and taking certain plants or drinking alcohol-laced herbs will cure them.

[47] Osai, J., Eleanya, M., & Amugo, F. (2013, February). Profiling Poverty in West Africa: A Sub-Regional Survey. An International Journal of Arts and Humanities, 184-190.
[48] Dabang, P., & Ukomadu, A. (2020, November 9). Health: Coronavirus. (A. MacSwan, & R. Kasolowsky, Editors) Retrieved February 22, 2021, from Reuters Website: https://www.reuters.com/article/uk-health-coronavirus-nigeria-food-idUKKBN27P0YZ
[49] Business Day. (2021, February 15). Retrieved from Business Day Newspaper Website: http://:lamentation-still-trails-lagos-fgs-palliative-packages-as-middlemen-hijack-programme/amp/
[50] Eranga, I. O.-E. (2020). COVID-19 Pandemic in Nigeria: Palliative Measures and the Politics of Vulnerability. International Journal of Maternal and Child Health and AIDS .

5.2 *Fake news & Conspiracy theories*

> *"The virus is not real. It is something they brought out so they can give everybody the 666 mark of the beast."*
> *– Theophilus (Liberia).*

However perfect the science, you need good politics and effective communications to survive a pandemic. The virus originated from China, so some conspiracy theorists believed it was human-made and engineered as a weapon. Africans are generally wary of Chinese presence and interests in Africa, which fuelled the conspiracies to spread like wildfire within Africa and even among western countries.

Even in the case of overwhelming evidence, some citizens choose denial. In May 2020, mysterious deaths occurred in Kano, Nigeria but locales said it was due to malaria, hypertension, and diabetes, not COVID. Many also saw it as a case of common cold, cough, and malaria, so they refused to believe it is a dangerous virus or adhere to preventive measures.

In May 2020, Pastor Chris Oyakhilome, a Lagos-based megachurch pastor with over 12million followers around the world, took to his ministry's TV station, where he made baseless conspiracy theories linking the coronavirus to the 5G network that rolled out. For months, he preached that there is a "global cover-up" on the covid19 pandemic being caused by 5G networks.

Former US President Donald Trump continues to call the coronavirus a "Chinese virus" and insists the label isn't racist, despite his aides and the World Health Organization warning that doing so could unnecessarily stigmatize Asian-Americans and people from China[51]. Chinese foreign ministry spokesman Zhao Lijian sent out five consecutive tweets on his official Twitter account, claiming the US military brought coronavirus to Wuhan without providing any evidence[52].

Conspiracy theories also thrived as it was a time to depict different prophecies in religious books. Famous religious leaders were boldly touting that the virus was artificial and an attempt to wipe off Africans by imprint monitoring chips in our system. In Zimbabwe, a government minister was attributed to having said that COVID-19 is God's punishment on former US President Donald Trump for enforcing economic sanctions on the country.

"Coronavirus is the work of God, punishing countries that imposed sanctions on us. They are now keeping indoors. Their economies are screaming just like they did to ours. Trump should know that he is not God," Oppah Muchinguri, Minister of Defence[53].

The distrust for government officials and politicians also aided the virus's spread through conspiracy theories and fake news. In Nigeria, when the initial lockdown was first announced,

[51] Sandler, R. (2020, March 18). Forbes: Breaking News. Retrieved February 23, 2021, from Forbes Website: https://www.-forbes.com/sites/rachelsandler/2020/03/18/trump-calls-coronavirus-a-chinese-virus-despite-racism-charge-and-a-warning-from-who/?sh=bc80bc575e3c
[52] Huang, C. (2020, March 19). ABC: News. Retrieved February 23, 2021, from ABC Website: https://www.abc.net.au/news/2020-03-20/coronavirus-conspiracy-theories-spreading-like-wildfire/12062516
[53] Moyo, J. (2021, January 27). Africa: COVID-19 targets politicians in droves. Retrieved February 23, 2021, from Anadolu Agency Website: https://www.aa.com.tr/en/africa/africa-covid-19-targets-politicians-in-droves/2124194

many rumoured that the reason for the lockdown was not because of communal safety but because big telecoms companies had bribed the government to allow them to run fibre optics around the country and also install 5G network.

Additionally, Africans attributed COVID-19 to be a "rich man's" virus and God's judgment on bad politicians when politicians across Africa who did nothing to improve healthcare systems in their country started dying from the virus.

The elitist view of the virus also stemmed from the fact that it was 'imported' and brought in from Western countries via international travel. Before local transmission began, the agency for disease control monitored travellers who had come in from COVID hotspot countries such as the UK, US, Canada, etc., and conducted contact tracing for flights that came in from those countries.

This further reinforced the belief that the lower-class masses who could not afford international travel were immune to it.

5.3 *Hunt for African Traditional Remedies*

African traditional remedies took to the spotlight during the first wave of the COVID-19 pandemic as discussions spread on the need to develop home-grown medicines that will cater to Africa's population against the virus.

From Madagascar to South Africa to Cameroon to Nigeria and beyond, traditional medical practitioners claimed to have the solution to cure COVID-19. The WHO's Africa office does not dismiss their claims but says it "supports scientifically-proven traditional medicine."

As a vital component of the African traditional healthcare system, medicinal plants have been crucial in treating and preventing diseases. In many parts of rural Africa, traditional healers prescribing medicinal plants are the most easily accessible and affordable health resource available to the local community as 85% of Africans rely on traditional medicines for their health needs[54]. It was evident during the South African HIV/AIDS epidemic peak when traditional Zulu healers used medicinal plants like Sutherlandia Frutescens or Cancer bush to treat HIV/AIDS patients.

> *"My neighbour and aunt had the virus. They were both using natural remedies like; steaming with herbs, drinking ginger and lemon with paw paw leaves and turmeric, and now they are all fine. I don't believe hospital medicine works."*
>
> *– Kondwani (Malawi).*

[54] Stanley, B. (2004, February 13). Recognition and Respect for African Traditional Medicine. Canada's International Development Research Centre. Retrieved February 23, 2021, from http://www.idrc.ca/en/ev-55582-201-1-DO_TOPIC.html

While some Africans use traditional medicine because of the drawbacks of modern drugs, others use it because it is a cheaper alternative to modern healthcare.

"Interest in traditional medicine as potential remedies for COVID-19 is growing in Africa. As the world races to find treatment and vaccines against the virus, research into traditional and orthodox medicines as potential COVID-19 therapy must be grounded in science, and today marks an important step in supporting these endeavours." said Dr. Matshidiso Moeti, WHO Regional Director for Africa.

In April 2020, Madagascar's president, Andry Rajoelina, criticised WHO for not endorsing its Covid Organics drink remedy for COVID-19 after the country had announced discovering a cure. In response, the WHO and Africa Centres for Disease Control and Prevention set up a Regional Expert Committee on Traditional Medicines for COVID-19 to test and endorse public use. However, none of the proposed remedies made it past stage 2 clinical trials. Meanwhile, some African countries, including Nigeria, Tanzania, and Equatorial Guinea, had purchased the drugs.

In Nigeria, a traditional king claimed to have a 'tested' cure for the virus. He also claimed that divine prophecies had been made about the coming of the virus in 2019, but no one paid attention. The monarch challenged medical researchers to extract vaccines from the natural herbs and also listed the ingredients he used but never gave a dosage or quantity of each herb to be used.

In Cameroon, as the COVID-19 cases soared, the country released 13 guidelines to curtail the spread on 17th March 2020. A month later, cases were still growing. Many who believe in traditional herbs turned to the Artemisia plant after an archbishop announced on national television that he had come up with the cure for the virus. People rushed to his church in a bid to get access to the remedy. The country's president also prompted citizens to further rely on the combination of local herbs to treat COVID-19.

To date, no traditional African medicine has been scientifically validated as a treatment for COVID-19.

5.5 *Vaccines Hesitancy in Africa*

> *"I will not take the vaccine because Oyinbo people want to use it to put something in our body and kill us."*
> *– Mark (Nigeria)*

African countries currently do not have the resources to vaccinate their entire population, which means the few doses they have access to will be rationed. Many will still be exposed to a virus spreading at a community level.

Even if the continent can secure enough vaccines for all its citizens, the denial of COVID-19 among many will influence COVID-19 vaccine hesitancy. The vaccine is currently being touted as a political and religious agenda[55].

Vaccine hesitancy refers to the delay in accepting vaccines or the refusal of vaccines, despite the availability of vaccination services. Some vaccine-hesitant individuals may take the COVID-19 vaccines because it is required to access some services, while some may refuse the vaccines outrightly. The problem with vaccine-hesitant individuals is that they hold unpredictable degrees of doubts and concerns about specific vaccines or all vaccines.

In 2003, political and religious leaders in Northern Nigeria boycotted the national immunization days organized in the global polio eradication initiative. It was also based on the distrust of western actions towards Muslim regions after 9/11 and the history of Pfizer's illegal trial in Kano in 1996, which led to several children's death[56].

This boycott led to a five-fold increase in polio incidence in Nigeria between 2002 and 2006 and contributed to polio outbreaks across three continents. Intense negotiations and actions had to occur between the state government, religious and community leaders, and WHO officials for well over a year before the immunization campaign could resume.

In 1990, a rumour that public health workers were administering a vaccine to sterilize girls and women spread throughout Cameroon. Schoolgirls leapt from windows to escape the vaccination teams, and they aborted the campaign.

In Nigeria, a sitting governor, Yahaya Bello of Kogi state, announced on the country's leading TV station, Channels TV, that he will not allow Kogi people to receive the vaccines as they are not guinea pigs. African countries have received the first batch of vaccines from COVAX, but will the distribution be equitable? In Nigeria, the NPHCDA (National Primary Healthcare Development Agency) has launched an e-registration portal for citizens who want to register to take the vaccine. Citizens are asked to visit nphcda.gov.ng for registration.

This is the only method that citizens can use to indicate their interest to

[55] Dwoskin, E. (2021, February 16). On social media, vaccine misinformation mixes with extreme faith. Retrieved February 23, 2021, from The Washington Post Website: https://www.washingtonpost.com/technology/2021/02/16/-covid-vaccine-misinformation-evangelical-mark-beast/
[56] Jegede, A. S. (2007, March 20). What Led to the Nigerian Boycott of the Polio Vaccination Campaign? Public Library of Science, 1. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1831725/

the agency for vaccination.

Although the agency announced that it would use TEACH, a strategy that accommodates a traditional and house-to-house electronic approach to vaccinate the country, only the electronic registration method has been executed.

According to the World Bank, only 25% of the population has access to the internet in Sub-Saharan Africa. What will be the fate of the remaining who do not have access to the internet and cannot participate in e-registration? This registration method will disenfranchise citizens who can neither access nor use the internet and further widen exclusivity.

5.6 *Promoting Vaccine Acceptance through Effective Communication*

West Africa has a population of 367million, and experts say it will take 3years or more to vaccinate every citizen at the current procurement rate. While African countries receive deliveries of the vaccines and inoculation has begun, the most crucial aspect of vaccination should be addressed – vaccine reception. Though vaccine reception has grown better over the years, this context will be different as citizens are filled with conspiracy theories about the COVID virus and vaccines.

The willing demand for vaccination is triggered through perceived benefits of vaccination or perceived risks of being vaccinated. For the latter, there needs to be a strong feeling of vulnerability to serious illness. Middle and upper-class people are eager to have the vaccines because there is an incentive to resume their regular lives travelling worldwide. In contrast, lower-class citizens currently do not have any perceived incentive to be vaccinated due to Africa's low fatality rate.

Communication is the most effective tool for behavioural change, albeit it takes time for results to manifest. For years, across different health issues, communication has been employed as a tool to inform, educate, and trigger change towards a belief or phenomenon [57]. Many research-based social science models and theories describe effective communications approaches leading to health protection action.

There is an imperative need to map communications channels and stakeholders; the mass media, the community, and interpersonal (Religious leaders, healthcare professionals, family, and friends). Interpersonal channels are vital when trying to influence attitudes and encourage the broader adoption of health behaviours.

They also provide opportunities for the audience to see others who have adopted the recommended behavior and serve as role models.

At the conception stage, community/traditional leaders, faith-based groups, and new media influencers should be consulted and oriented to understand their views and how best to win the people over.

[57] (2008). Tools for Behavior Change Communication. Center for Communication Programs . Baltimore: Johns Hopkins Bloomberg School of Public Health. Retrieved February 23, 2021, from https://www.thecompassforsbc.org/sites/default/files/strengthening_tools/INFO%20Reports_Tools%20for%20BCC_0.pdf

> *"Scientists have found vaccines that can protect us against COVID-19. Many countries have started using them as they have been certified safe and effective."*

A famous slogan, *"The medium is the message."* depicts how communication channels are just as important as the messaging. Channels should also be considered according to citizens' demographics.

Despite the growth of social media and access to mobile phones throughout West Africa, radio remains the leading source of information, far outpacing television, newspapers, and the internet.

It is a sustainable, cost-effective medium that can reach large populations in a way relevant to local cultures and oral traditions. Radio has the advantage of accessing both literate and illiterate audiences, making it more appropriate for people across Sub-Saharan Africa with low literacy rates[58]. 83.9% of Nigerians use radio for news purposes, compared to 64% and 28.2% for TV and internet, respectively.

Fortunately, the government used these existing channels and programs to educate the populace about COVID-19 information during the pandemic's peak. Citizens received frequent text messages; radio, TV, and new media were abuzz with the virus's news and guidelines. The official agency for disease control consistently released information and guidelines on how to combat the virus. The content was also released in indigenous languages, particular to each region, and community stakeholders organized sensitization campaigns in rural areas. The government can effectively utilize these channels to spread the vaccine acceptance campaign.

In Nigeria, the NPHCDA has resumed engaging the necessary stakeholders in sensitizing and securing the citizens' buy-in to the vaccine. The agency has been sending SMS to some citizens about vaccination, and one of such texts says:

"Scientists have found vaccines that can protect us against COVID-19. Many countries have started using them as they have been certified safe and effective."

Vaccination campaigns should be a collaborative effort between the government, health ministry, traditional, religious, community leaders, celebrities, and new media influencers. The several ways to address vaccine apathy and distrust are but not limited to:

Modelling: One of the major conspiracy theories being spread about the vaccine is that it is a ploy to kill black people and reduce their population.

The modelling method ensures that popular and respected figures in the nation/communities receive the vaccine in the public's full glare and are certified safe and healthy afterward. The best way to disprove

[58] The British Broadcasting Corporation. (2020, 03 16). BBC News Africa. Retrieved 02 22, 2021, from The British Broadcasting Corporation Website: https://www.bbc.com/news/world-africa-51906053

> *"I will not take the vaccine when they start bringing it, but only if my Pastor says it is okay, then I will change my mind." - Precious (Ghana).*

such theories is for people to see fellow humans they respect and look like, receive the vaccines and not die or fall ill.

The vaccinations of these sets of people can be publicised or done in the full glare of communities. The immunization of politicians has been adequately publicised, but the government can also ensure that community and religious leaders also receive the same publicity treatment when being vaccinated.

Religious Leaders: Africa is a deeply religious continent, with most of its citizens identifying with Christianity and Islam[59]. Many see their religious leaders as next to God, so their opinions and directives are revered.

The conspiracy theories have emerged from religious sentiments, so religious leaders must be a core agent in disproving these theories. Consultations and meetings should be held between the government and religious associations in the country for the religious leaders to convince their followers that the vaccine is safe and healthy.

Health Workers: Citizens trust their health providers to an extent, so they are crucial to influencing health decisions. Utilizing the close relationship between people and primary healthcare centres will be a major breakthrough in battling vaccine apathy. Health workers in these centres can be advised to use special consultation days, e.g., Vaccination days, to encourage nursing mothers to receive the vaccine and ask their relatives to do so while stating the benefits of receiving the vaccines.

Influencers: Celebrity endorsement is a success factor because when an average person selling a product tells you to try that product as it has helped them, there is a possible chance that consumers may or may not believe them, but when a celebrity says the same that the product has helped them, then the consumers tend to listen to the celebrity and accept and this impacts on consumers buying behavior favorably (Adam & Hussein 2017).

Organizations and private corporations use celebrity and social media influencers as ambassadors to penetrate and influence consumer decisions. Celebrity endorsements are now a thing today because of the influence they have over consumer behaviour. This can be tapped into by the government employing celebrities and social media influencers' services to encourage citizens to get vaccinated.

Traditional media: Despite the rise of online media, traditional media is still a major communication tool in African countries. This is because only 25% of the population in Sub-Saharan Africa has access to the internet. Traditional media is still the most popular and accessible media

[59] Pew Research Center. (2010, April 15). Tolerance and Tension: Islam and Christianity in Sub-Saharan Africa. Retrieved from Pew Research Center Website: https://www.pewforum.org/2010/04/15/executive-summary-islam-and-christianity-in-sub-saharan-africa/

channel in Africa. Independent radio and TV programs should encourage discussions around vaccine distrust and apathy, allow citizens to air their views then have professionals address the problematic views.

This method must be consistent and cut across radio and TV programs across the nation, maintaining peculiarity in different regions and communities.

Entertainment Education: This is a popular behavioural change communication method as it allows the audience to make decisions independently without feeling coerced. It also promotes framing messages in a simple, everyday manner that stimulates organic discussions about the issue being addressed.When HIV/AIDS first came into Africa, many believed it was a deadly virus that one could contact through touch and sharing of utensils, which influenced a high level of stigma towards those infected.

Now the story has changed. People are more informed about the virus, it's treatment, and infection modus operandi. This change was influenced by consistent media campaigns online and offline. Entertainment education was also used through Wetin Dey and MTV Shuga, a TV series on terrestrial tv stations that addressed AIDS, sexual and reproductive health.

This government can utilize this method by developing and airing mini-series (TV, Radio, YouTube) that subtly address vaccine distrust and its consequences. This will go a long way in reshaping the minds of the citizens towards the COVID vaccines.

Behavioural change is a gradual process; therefore, timeliness must be considered. Implementation should begin to give ample time for messages to sink in and spark the difficult conversations that will spiral change before the vaccines arrive. The government, health workers, CSOs, and NGOs have work cut out for them in the coming months as indicators point to heavy vaccine apathy and distrust.

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