
RESEARCH ARTICLES

COVID-19 Outbreak Situation in Nigeria and the Need for Effective Engagement of Community Health Workers for Epidemic Response

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Abstract

The current Coronavirus Disease (COVID-19) outbreak has affected over 200 countries including Nigeria. It is one of the largest respiratory disease outbreaks affecting several countries simultaneously and a novel strain of Coronavirus (SARS-CoV 2) has been identified as the causative agent. Sequel to the advice of the International Health Regulation Emergency Committee, the Director-General of WHO declared the COVID-19 outbreak a Public Health Emergency of International Concern (PHEIC) on 30 January 2020 and characterized it as a pandemic on 11 March 2020. The aim of the study was to describe the current situation of the outbreak in Nigeria and argued the need for effective engagement of community health workers for an appropriate response to COVID-19. We reviewed published articles on COVID-19 and daily epidemiological reports from the website of the Nigeria Centre for Disease Control (NCDC) from 27 February 2020 till 3 May 2020 (Epidemiology week 7 – 17) to describe the outbreak. We also reviewed ongoing responses by the government and other relevant agencies. Our findings revealed possible evidence of ongoing and increasing community transmission of COVID-19 infections, inadequate testing capacity and overwhelming of health resources. Our review also revealed infection of several health workers in the face of existing critical skilled health workforce shortage. With surging of new COVID-19 cases and a huge number of contacts to be traced, we recommended that the government needs to promptly bring community health workers on board, deploy rapid epidemic intelligence and scale up the use of mobile Apps for contact tracing. This will result in an effective and coordinated response to the ongoing outbreak, sustain routine health services especially at the community level, reduce morbidity and mortality, and preserve health indices gains already made in the health system.

Key words: COVID-19, disease outbreak, epidemic response, community health workers, primary health care

Background

The World Health Organization (WHO), in December 2019, received reports on clusters of pneumonia cases of unknown causes in Wuhan City, Hubei Province of China. The Chinese authorities subsequently identified a novel strain of Coronavirus (SARS-COV 2) as the causative agent [1]. Sequel to the advice of the International Health Regulation Emergency Committee, the Director-General of the WHO declared the COVID-19 outbreak as a Public Health Emergency of International Concern (PHEIC) on 30 January 2020 and characterized it as a pandemic on 11 March 2020 [2]. The outbreak has been reported in all continents, with first case in Africa reported in Egypt in February 2020 [3]. Globally, over 2.6 million confirmed cases and over 186,000 deaths have been recorded [4].

Nigeria is one of the 210 countries affected globally. The first case was confirmed in Lagos State on 27 February 2020. This index case was a 44-year old man, an Italian citizen who returned from Milan, Italy, on 24 February and presented at a health facility on 26

February 2020 [5]. Following the confirmation of the index case, 216 people were identified as contacts to be followed up. Of these, 45 travelled out of Nigeria and one of the remaining 176 contacts was confirmed to be positive for COVID-19 on 9 March 2020 [6].

The country has continued to experience an increase in the number of cases, which has spread across several states. While majority of the initial cases were imported, most of the new cases have no travel history or contact with such people. This is highly suggestive of ongoing community transmission. Under the current circumstances, the Primary Health Care (PHC) Centres remain the most likely port of call for community members who develop symptoms that could be suggestive of COVID-19.

The Primary Health Care system is the bedrock of the country's health system [7] and the Community Health Workers (CHWs) are considered to be its backbone for several reasons [8]. In addition to contributing to several successful immunization, maternal, newborn, child health and reproductive health services, CHWs also

played a critical role in the epidemic response to the 2014 Ebola Viral Disease Outbreak (EVD) across several West African countries, including Nigeria [9]. In the face of continued COVID-19 community transmission, the health system may likely become overwhelmed with increased risk of health workers' infection. Considering the fact that most people use the PHC centres, especially those in the rural and hard-to-reach areas, it is important that the staff should be adequately informed and resourced to provide first level care such as screening and referral of patients. On this ground, we described the current situation of the outbreak and argued the need for effective engagement of community health workers for appropriate responses to COVID-19.

COVID-19 outbreak preparedness in Nigeria

Prior to the importation of COVID-19 into Nigeria, the government established a "Coronavirus preparedness group" through its nation's leading public health agency, the Nigeria Centre for Disease Control (NCDC), which commenced point of entry screening for travelers. Based on lessons learnt from the EVD outbreak, the NCDC strengthened the National Reference Laboratory with diagnostic capacity for epidemic-prone pathogens. Through this process, the NCDC supported 22 of the 36 states to establish emergency operation centres (EOC), and trained rapid response teams in all the 36 states [10]. Furthermore, the agency provided relevant public health advisory to the Nigerians; shared the case-definition and preventive information with networks of national and subnational public health workers; built capacity for contact tracing and case management; and strengthened five laboratories for diagnostic capacities [11].

Also vital to the COVID-19 outbreak preparedness is the country's Polio infrastructure - a programme originally aimed at the eradication of poliomyelitis. The structure brings on board its technical expertise, logistical capacity, human resources, community network and disease surveillance experience. The EOCs coordinating the outbreak response in each state are modelled after the Polio EOC operating under six functional units, namely: point of entry, epidemiology and surveillance, risk communication, management and communication, case management, and laboratory services [12]. The Polio infrastructure was vital to the success of the 2014 EVD outbreak response. Currently, it provides technical support to government agencies including NCDC [13] and has an on-ground network of human resources including traditional and religious leaders, community mobilizers and health workers to support the COVID-19 response. In addition, the Polio infrastructure had SMS-based application, auto-visual AFP detection and reporting (AVADAR), that support disease surveillance through networks of community volunteers and healthcare workers. This app has been useful for the current pandemic as COVID-19 surveillance questions have been added to this app [12].

Current situation and response to COVID-19 outbreak in Nigeria

As of 3 May 2020, 2,558 cases have been reported in the country across 35 states and the Federal Capital Territory (FCT) (Table 1). Of these numbers, 1,767 (69 %) are male, the age-group 21 – 30 years were the most affected (23%), 210 (8%) had international travel history; 400 (15.6%) cases have been discharged, and 87 deaths were recorded, bringing the case fatality rate (CFR) of confirmed cases to 3.4%, with a range from 0-15.2% by region [14]. Prior to report of the COVID-19 outbreak in Africa, the WHO identified a strong link between the continent and China and has sent out guidelines on preparedness for the outbreak. Nigeria is one of the thirteen top countries identified as high risk for COVID-19 importation based on either direct link or high travel volume to and from China [2]. The WHO also advised that countries develop capacity to promptly detect cases that will enable them to contain the outbreak early so that the health system is not overwhelmed [2].

Within 48 hours of isolating the index case, the country was able to make a laboratory diagnostic test for SARS-CoV-2 [5]. Similar capacity for early diagnosis, swift quarantine of cases and prompt contact tracing lead by the NCDC were strong points of the country's ability to promptly control the 2014 Ebola Viral Disease (EVD) outbreak as well as prepare the country for the COVID-19 response [15]. However, more is required to respond to the current COVID-19 pandemic, considering its mode of transmission and the possibility of asymptomatic and pre-symptomatic individuals transmitting the infection [16]. While COVID-19 is primarily transmitted through respiratory droplets and contact routes, there is a potential of airborne transmission [17], [18].

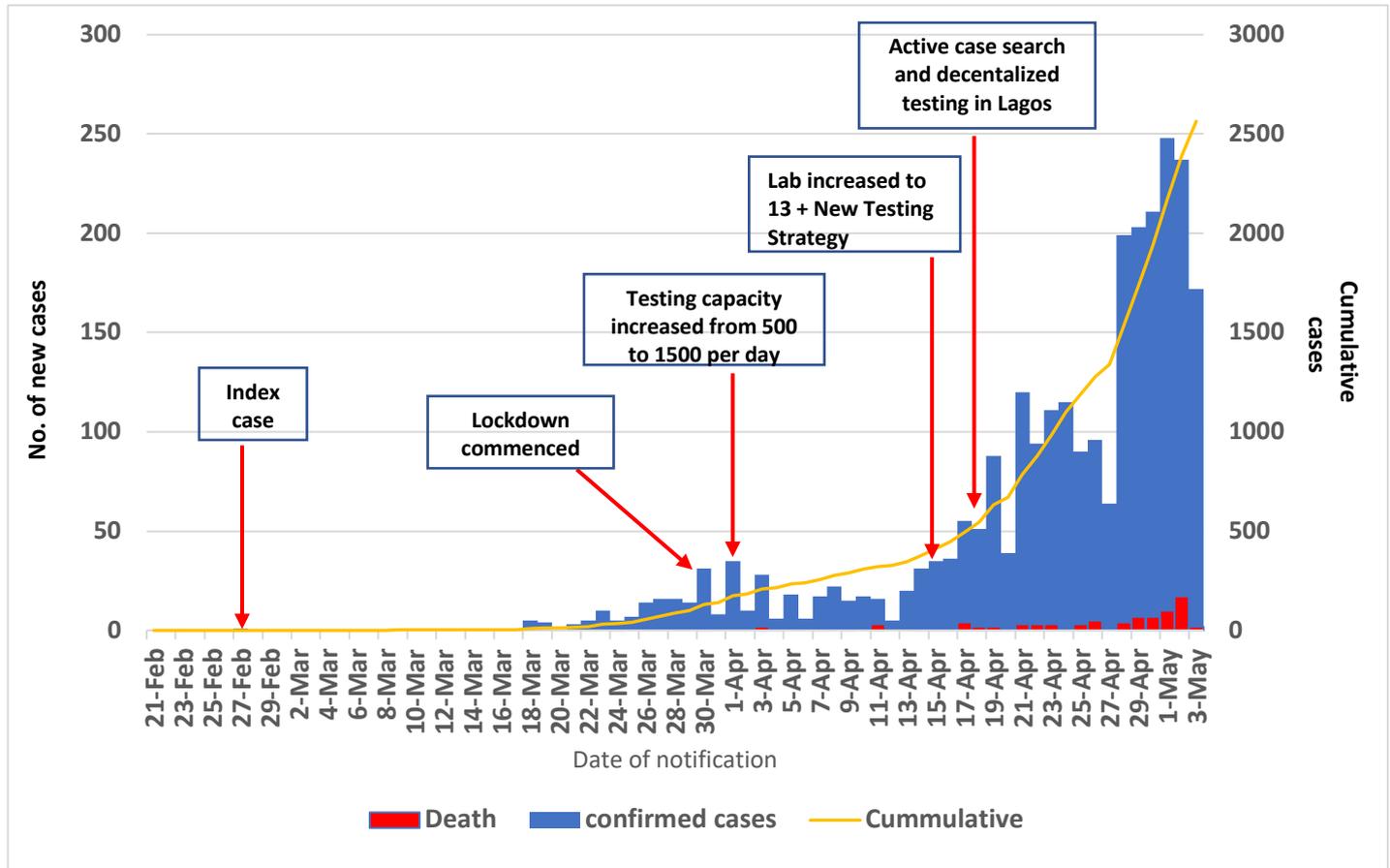
Following the detection of the index case, a multi-sectoral NCDC-led national emergency operation centre at Level 3, the country's highest level of public health emergency, was activated. This was followed by deployment of Rapid Response Teams with states leading contact tracing and other response activities. The confirmed case was also evacuated to a health facility designated for the treatment of COVID-19 [5].

While it was commendable that there was in-country diagnostic capacity for SARS-CoV-2, the testing capacity, however, was very low and is still limited to symptomatic cases. With the change in testing strategy, increases in number of laboratories from five to thirteen nationally across the six geopolitical zones [6], decentralized testing and active case search in states like Lagos and the Federal Capital Territory, the number of cases have surged in the last few days (Figure 1). However, the overall testing capacity is still low and estimated to be at 103 per 1 million of the population (18, 536 samples have been tested so far for a population of 205 million) [4]. Nigeria's testing capacity was also supported with a donation of 20,000 test kits by a private individual [20], and a private Biotech company, 54Gene, donated a COVID-19 mobile laboratory [21].

Table 1. Summary of COVID-19 Cases across different states in Nigeria as of 3 May 2020 [19]

S/N	States Affected	No. of Lab Confirmed Cases	No. of Active Cases (on admission)	No. Discharged	No. of Deaths	CFR (%)
1	Lagos	1,107	830	247	30	2.7
2	Kano	342	329	7	6	1.8
3	FCT	278	235	40	3	1.1
4	Gombe	96	96	0	0	0.0
5	Borno	82	70	0	12	14.6
6	Kaduna	81	72	8	1	1.2
7	Ogun	80	68	10	2	2.5
8	Bauchi	71	65	6	0	0.0
9	Sokoto	66	57	1	8	12.1
10	Edo	52	39	10	3	5.8
11	Katsina	46	33	6	7	15.2
12	Osun	36	11	22	3	8.3
13	Oyo	34	23	9	2	5.9
14	Delta	17	11	4	2	11.8
15	Akwa Ibom	16	4	10	2	12.5
16	Kwara	16	8	8	0	0.0
17	Rivers	14	10	2	2	14.3
18	Yobe	13	12	0	1	7.7
19	Ondo	13	10	3	0	0.0
20	Kebbi	12	12	0	0	0.0
21	Nasarawa	12	12	0	0	0.0
22	Zamfara	12	11	0	1	8.3
23	Ekiti	11	8	2	1	9.1
24	Enugu	8	6	2	0	0.0
25	Taraba	8	8	0	0	0.0
26	Jigawa	7	6	0	1	14.3
27	Adamawa	6	6	0	0	0.0
28	Bayelsa	5	5	0	0	0.0
29	Ebonyi	5	5	0	0	0.0
30	Plateau	3	3	0	0	0.0
31	Niger	3	2	1	0	0.0
32	Imo	2	2	0	0	0.0
33	Abia	2	1	1	0	0.0
34	Anambra	1	0	1	0	0.0
35	Benue	1	1	0	0	0.0
	Total	2,558	2,071	400	87	3.4

Figure 1. Epidemic curve of COVID-19 cases in Nigeria as of 3 May 2020



A Presidential Task Force (PTF) on COVID-19 was also established to respond to the outbreak through a multi-sectoral and inter-governmental approach [22]. In addition to initial flight bans for 13 COVID-19 affected countries and subsequent suspension of international flight [23], three states within the country that were early centres of the outbreak are currently under lockdown by presidential directives and several state governors have also implemented similar measures to curb the spread [24]. This includes bans on social and religious gatherings and restrictions of intra- and inter-state movements in order to limit disease spread. In addition to all of these, contact tracing and other public health measures have continued to be strengthened. NCDC has also deployed Surveillance Outbreak Response Management and Analysis System (SORMAS) to support contact tracing. It is an open source mobile and web application for disease outbreak detection, notification, management and response which was deployed during the 2014 EVD outbreak but has now been upgraded to include a COVID-19 module [25].

Challenges and impact of the current COVID-19 Outbreak on the Health Care System

With an Epidemic Preparedness Index of 38.9% [26], Nigeria has been rated better than many African countries to respond to the COVID-19 outbreak [27]. However, its capacity to adequately respond in the face of local and community transmission has been said to be

questionable [28]. As of 10 April 2020, over 9,000 contacts have been traced [29], which is an average of 3.5 contacts per confirmed case. About 118,000 house-holds were visited for active case searches within 2 days in Lagos, among which 119 confirmed cases were identified [30]. The continued increase in the number of cases has overwhelmed the human resources for health involved in the various aspects of response activities, particularly contact tracing.

Many clinical activities have been reduced or halted in order to control COVID-19 transmission [31]. More so, there have been numerous complaints about the shortages of personal protective equipment and ventilators needed to combat COVID-19 [24]. This is further compounded with reported COVID-19 infection among healthcare workers as a result of occupational exposures, a figure estimated as 113 (about 6% of confirmed COVID-19 cases) as of 1 May 2020 [32].

The COVID-19 outbreak is also coming at a time when the country is currently battling with Lassa fever outbreak and preparing for certification exercise to be declared polio-free [11]. As of the Epidemiological week 16 of the year 2020, the country has recorded 979 confirmed cases and 188 deaths (CFR 19.2%), against 546 confirmed cases and 123 deaths (CFR 22.5%) in the corresponding epidemiological week of 2019 [33]. Having being free of wild polio virus cases for a period of three years, the Independent Africa regional Certification is expected to make a decision in July 2020

to certify Nigeria polio-free [12]. Response activities to this outbreak have a tendency to divert the limited resources away from current health issues and gains previously made on other health indices. The fear of being infected by COVID-19 at health facilities and the current lockdown order is also likely to limit access to health services routinely provided by CHWs. These include routine immunization, ante-natal services, maternal, neonatal and child health services, family planning, HIV/TB, management of minor ailments, disease surveillance and health management information system. Disruption of these health services could lead to reduction in immunization coverage, and increases in morbidity and mortality of infectious diseases as well as maternal, neonatal and childhood health issues.

The need to engage Community Health Workers in the fight against COVID-19

Infectious disease outbreaks of large magnitude, such as COVID-19, need special attention beyond the routine in terms of resources and procedures, as they have tendency to significantly impact the nation's economy and health system [34]. These impacts are usually more felt at the community level where the existing health resources are usually limited. CHWs are able to fill in these gaps in the health system by extending health services to these vulnerable populations [34].

Successful responses to previous outbreaks of large magnitudes have demonstrated significant contributions by the community health workers. During the 2014 – 2015 EVD outbreak, CHWs participated in various response activities. About a thousand CHWs in Liberia and several others across Sierra Leone and Guinea provided services to sustain the health system in the face of public health crises. These include community-based maternal, neonatal and child-health services, community sensitization and case management of minor ailment. With more training, their roles were further expanded after adequate training to serve as contact tracers and active case finders. They isolated suspected cases and acted as the referral link between the community and the treatment centres. These were especially useful in the face of the high level of fear and lack of trust in the health system during the outbreak [35].

In Cote D'Ivoire, over 1,500 CHWs successfully conducted a community-led precautionary outbreak response to EVD in neighbouring countries of Guinea and Liberia [36]. During the 2015 Zika outbreak in Brazil, about 370 CHWs were trained and participated in response activities to reduce infection transmission among at-risk communities [37]. In Nigeria, some CHWs are also trained to participate in the Acute Flaccid Paralysis (AFP) surveillance which is a very vital component of the poliomyelitis programme structure deployed for the country's successful response for the 2014 EVD outbreak [38].

There is a critical shortage of skilled health workforce shortage in sub-Saharan Africa [39] and an effective

strategy for the COVID-19 response within the region should involve CHWs, especially as flattening of the epidemic curve is hinged on preventive measures. It is important that this should be done at the early stage because late engagement of CHWs in the 2014 – 2016 EVD outbreak was associated with disruption of PHC services and hampered outbreak response [40]. Many countries have already commenced this step. For instance, Republic of Rwanda has directed suspicious cases of COVID-19 to consult with CHWs [41], Kenya has sensitized 85% of its CHWs at 4th week into the outbreak [42], and Liberia is leveraging its CHW programme for COVID-19 infection prevention, case detection and response [43]. As of 8 April 2020, 2.5 million households across 27 countries have been reached by CHWs as part of countries' national strategies [42].

As of 1 May 2020, there are estimated 12,000 contacts to be traced and followed up [44]. This value is likely to be an underestimation of the total number of 2,174 confirmed COVID-19 cases as the average number of contacts is projected to be about 10 times the number of cases [45]. The significant human, logistic and financial resources needed, coupled with the rapid nature of COVID-19 spread, makes manual contact tracing non-feasible [46]. Taking all these into consideration, the government need to consider the use of digital technologies and mobiles applications such as AVADAR to overcome these challenges of critical shortages of human resources. It is said that the pandemic could be significantly reduced if 60% of the population uses such digital contact tracing applications [46]. This should be possible as the mobile phone usage rate in Nigeria is estimated to be about 88% [47].

In light of the aforementioned, it will be a good strategy for Nigeria to promptly and effectively bring the CHWs on board in the epidemic response against COVID-19 with two broad aims. The first is in the direct involvement in the various aspects of COVID-19 prevention and response activities, a contribution of adaptive resilience to the health system [34]. The second aim is to prevent a decline in health indices and sustain essential services, a contribution of inherent resilience to the health system [34].

With regard to involvement in COVID-19 prevention activities, CHWs are trained to provide health education to the population. They will be useful in providing health education to the community on the clinical features, route of transmission and access to care. Being healthcare workers who live and work within the community, they are often well trusted by the people. They are therefore better positioned to explain and help implement and monitor preventive measures such as social distancing, hand hygiene and cough etiquette compliance. Rapid outbreak containment has been associated with mobilization activities that generated trust between health workers and members of the community where they work [48]. It is therefore important that there should be rapid scale up of more CHWs to address current and future public health crises.

Community Health Workers can also be involved in COVID-19 case identification. While testing is not available at the Primary Health Care level, CHWs can be trained to identify signs and symptoms among community members. This is particularly applicable in hard-to-reach areas and the nomadic communities. Identification of such cases can flag and interrupt community transmission very early and minimize the magnitude of the outbreak [9]. Rapid epidemic intelligence should be deployed at all levels to collect and collate information on COVID-19 outbreak. With high mobile phone penetration and android usage, outbreak alerts can be obtained via WhatsApp and other social media sources. This has proven to be useful in previous outbreaks such as the 2014 EVD where it detected alerts three months prior to formal announcements [49].

CHWs can also be trained to support various aspects of management of patients that have died from COVID-19, such as dead body preparation. The national guideline encourages safe and dignified burial for people who died from COVID-19 [50] but family members are not permitted to perform final burial rites such as bathing, touching or kissing the dead goodbye. This is more painful if the person died at a treatment centre where no one was permitted to visit them during admission. The resultant disruption of traditional burial and mourning rites, otherwise seen as sign of last respect for the dead and are usually held in high esteem across various religions and ethnic groups [51], can lead to psychological effects, reduced support resources and diminished coping ability [52]. CHWs can also be helpful in providing bereavement support for the family.

As part of response strategy, CHWs can also participate in contact tracing activities especially as human resources will become increasingly overwhelmed by the rising number of cases and community transmission. They could also serve as referral link between symptomatic community members and the formal health system. The NCDC should continue to work with all relevant agencies to ensure the integration of the outputs from CHWs' response, data generated from mobile Apps' contact tracing and rapid epidemic intelligence data. This will ensure a coordinated and effective outbreak response. Beyond the current public health crisis, this integration should be institutionalized as part of epidemic preparedness and response.

The second aim of effectively engaging CHWs during this outbreak is to ensure sustenance of primary health care services. This is because, as community level transmission increases, routine health services would consequently be interrupted as the focus of health facilities shift to the COVID-19 outbreak [43]. The resultant effect will be increased morbidity and mortality due to non-COVID-19 causes. The PHCs need to restructure and strategize, such that CHWs continue to deliver services such as routine immunization, maternal and child care services and community management of infectious diseases especially for children. These will reduce morbidity and mortality, improve populations' health and reduce their susceptibility to infection [34].

Surveillance also needs to be strengthened, based on the Integrated Disease and Surveillance Response (IDSR) guidelines, with heightened index of suspicion for COVID-19 cases. Drugs and consumables supply chains need be maintained, so that clients visiting the health centres for non-COVID-19 cases can be adequately attended. This increases trust in the system and reduces the tendency of community members to self-medicate or avoid reporting illness.

In order to achieve all these, there is need for the national and sub-national levels of government and development partners, to rapidly support the CHWs and the PHC system now more than ever. While it is commendable that the government, through the National Primary Health Care Development Agency has developed a comprehensive guideline on preparedness and response plan for COVID-19 at PHC and community level [53], there is urgent need to ensure its prompt implementation and operationalization. As part of the support, there is a need for initial and continuous capacity building of the CHWs and other staff as PHC level. This will ensure that they are adequately equipped for the task ahead.

The government is recruiting from the pool of qualified but unemployed CHWs and has reengaged some CHWs who have retired. There is need for donor agencies to support the efforts of the government as well. Proportionate distribution should also be considered. This is because many PHCs are currently short-staffed and the high possibility of overwhelmed human resources at PHC level may lead to the collapse of the health system especially after the lockdown order is lifted.

Government at the national and sub-national level also need to quickly and adequately train the current and newly engaged CHWs in case identification and screening, contact tracing, follow up of isolated individuals and referral of cases that need medical attention. This will support the pool of graduates and residents of the Nigeria Field Epidemiologist Training Program. They should also be provided with enabling environment within the workplace to reduce the chances of occupational exposure. This includes provision of care and infection prevention protocols or guidelines, personal protective equipment, conducive environment to ensure physical distancing during encounter with patients, hand hygiene facilities (availability of running water and soap), and disinfection facilities. With consideration of task-sharing and task-shifting, they could also be trained on collection and transportation of sample if possible. It is also important that they are supported mentally and physically, and with adequate remuneration, considering the fact that these tasks are stressful with the likelihood of being infected. Job security beyond the engagement for the current pandemic should also be strongly considered.

In conclusion, while implementing this response strategy for the pandemic COVID-19 outbreak, the government should aim at engaging CHWs in building a resilient health system. This is achievable through a

review of their curriculum, current roles and career pathways, especially at this time when the health system has begun to apply the strategy of task-sharing and task-shifting. This will not only make the PHC a reliable healthcare system for major infectious diseases health events, but ensure that the system is better prepared to handle the rising scourge of non-communicable diseases.

References

- World Health Organization. Coronavirus disease (COVID-2019) R&D [Internet]. WHO. World Health Organization; [cited 2020 Apr 24]. Available from: <http://www.who.int/blueprint/priority-diseases/key-action/novel-coronavirus/en/>.
- World Health Organization. WHO ramps up preparedness for novel coronavirus in the African region [Internet]. WHO | Regional Office for Africa. [cited 2020 Apr 24]. Available from: <https://www.afro.who.int/news/who-ramps-preparedness-novel-coronavirus-african-region>.
- Gilbert M, Pullano G, Pinotti F, Valdano E, Poletto C, Boëlle P-Y, D'Ortenzio E, Yazdanpanah Y, Eholie SP, Altmann M, Gutierrez B, Kraemer MUG, Colizza V. Preparedness and vulnerability of African countries against importations of COVID-19: a modelling study. *The Lancet*. 2020 Mar 14;395(10227):871–7.
- Worldometer. Coronavirus (COVID-19) Pandemic Update (Live) [Internet]. 2020 [cited 2020 Apr 24]. Available from: <https://www.worldometers.info/coronavirus/>.
- Nigeria Centre for Disease Control. First Case of Corona virus Disease Confirmed in Nigeria [Internet]. 2020 [cited 2020 Apr 1]. Available from: <https://ncdc.gov.ng/news/227/first-case-of-corona-virus-disease-confirmed-in-nigeria>.
- Nigeria Centre for Disease Control. COVID-19 Outbreak In Nigeria Situation Report S/N 54. Abuja; 2020. [Internet]. 2020 [cited 2020 Apr 23]. Available from: <https://ncdc.gov.ng/diseases/sitreps/?cat=14&name=An%20update%20of%20COVID-19%20outbreak%20in%20Nigeria>.
- Federal Ministry of Health, Nigeira. National Strategic Health Development Plan II 2018 - 2022 [Internet]. 2019 [cited 2020 Apr 25]. Available from: <https://nipc.gov.ng/nshdp-ii-final-version-health-plan-pdf/>.
- Mailman School of Public Health, Columbia University, New York, USA., S F, B H, Women4Health Programme, Kano, Nigeria. Cost-Effectiveness of Alternative Models of Community Health Workers for Promotion of Maternal, Newborn and Child Health in Northern Nigeria. *Int J Transl Community Med*. 2017 Sep 12;85–97.
- Perry HB, Dhillon RS, Liu A, Chitnis K, Panjabi R, Palazuelos D, Koffi AK, Kandeh JN, Camara M, Camara R, Nyenswah T. Community health worker programmes after the 2013–2016 Ebola outbreak. *Bull World Health Organ*. 2016 Jul 1;94(7):551–3.
- Ihekweazu C. Steps Nigeria is taking to prepare for cases of coronavirus [Internet]. The Conversation. 2020 [cited 2020 May 8]. Available from: <http://theconversation.com/steps-nigeria-is-taking-to-prepare-for-cases-of-coronavirus-130704>.
- Adepoju P. Nigeria responds to COVID-19; First Case Detected in sub-Saharan Africa. *Nat Med*. 2020 Mar 11;26(4):444–8.
- World Health Organization. Nigeria's polio infrastructure bolster COVID-19 response [Internet]. WHO | Regional Office for Africa. 2020 [cited 2020 May 8]. Available from: <https://www.afro.who.int/news/nigerias-polio-infrastructure-bolster-covid-19-response>.
- Global Polio Eradication Initiative. Polio eradication staff support COVID-19 response [Internet]. 2020 [cited 2020 May 8]. Available from: <https://www.endpolio.org/polio-eradication-staff-support-covid-19-response>.
- Nigeria Centre for Disease Control. COVID-19 Outbreak In Nigeria Situation Report S/N 65. Abuja; 2020. [Internet]. [cited 2020 May 6]. Available from: <https://ncdc.gov.ng/diseases/sitreps/?cat=14&name=An%20update%20of%20COVID-19%20outbreak%20in%20Nigeria>.
- Ajisehiri WS, Chughtai AA, MacIntyre CR. A Risk Analysis Approach to Prioritizing Epidemics: Ebola Virus Disease in West Africa as a Case Study. *Risk Anal Off Publ Soc Risk Anal*. 2018;38(3):429–41.
- Ebrahim SH, Ahmed QA, Gozzer E, Schlagenhauf P, Memish ZA. Covid-19 and community mitigation strategies in a pandemic. *BMJ [Internet]*. 2020 Mar 17 [cited 2020 Apr 24];368. Available from: <https://www.bmj.com/content/368/bmj.m1066>.
- Liu Y, Ning Z, Chen Y, Guo M, Liu Y, Gali NK, Sun L, Duan Y, Cai J, Westerdahl D, Liu X, Xu K, Ho K, Kan H, Fu Q, Lan K. Aerodynamic analysis of SARS-CoV-2 in two Wuhan hospitals. *Nature*. 2020 Apr 27;1–6.
- van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, Tamin A, Harcourt JL, Thornburg NJ, Gerber SI, Lloyd-Smith JO, de Wit E, Munster VJ. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. *N Engl J Med*. 2020 Apr 16;382(16):1564–7.
- Nigeria Centre for Disease Control. NCDC Updates on COVID-19 (Coronavirus Diseases

- 2019) [Internet]. [cited 2020 May 4]. Available from: <http://covid19.ncdc.gov.ng/>.
20. AFP-Agence France Presse. Nigeria Receives COVID-19 Test Kits From Chinese Billionaire Ma [Internet]. [cited 2020 May 8]. Available from: <https://www.barrons.com/news/nigeria-receives-covid-19-test-kits-from-chinese-billionaire-ma-01585161306>.
 21. Onukwue AO. 54gene rolls out mobile laboratory to boost Nigeria's coronavirus test capacity [Internet]. TechCabal. 2020 [cited 2020 May 8]. Available from: <https://techcabal.com/2020/04/29/54gene-mobile-labs-coronavirus/>.
 22. Agbakwuru J. Buhari sets up 12 member Task Force to control Coronavirus -. Vanguard News [Internet]. 2020 Mar 9 [cited 2020 Apr 25]; Available from: <https://www.vanguardngr.com/2020/03/buhari-sets-up-12-member-task-force-to-control-coronavirus/>.
 23. Ogundele K. UPDATED: FG places travel ban on China, Italy, US, UK, nine others. Punch Newspapers [Internet]. 2020 Mar 18 [cited 2020 Apr 25]; Available from: <https://punchng.com/breaking-fg-places-travel-ban-on-china-italy-us-uk-others/>.
 24. World Economic Forum. COVID-19 in Africa: insights from our 23 April WHO media briefing [Internet]. World Economic Forum. 2020 [cited 2020 Apr 25]. Available from: <https://www.weforum.org/agenda/2020/04/covid19-in-africa-our-media-briefing-with-who/>.
 25. Grainger C. A software for disease surveillance and outbreak response - Insights from implementing SORMAS in Nigeria and Ghana [Internet]. Federal Ministry for Economic Cooperation and Development. [cited 2020 May 9]. Available from: http://health.bmz.de/en/healthportal/ghpc/case-studies/software_disease_surveillance_outbreak_response/index.html.
 26. Africa's Pulse – Assessing the Economic Impact of COVID-19 and Policy Responses in Sub-Saharan Africa [Internet]. Washington, USA: The World Bank, 1818 H Street NW,; 2020 Apr [cited 2020 Apr 25] p. 136. Report No.: Vol 21. Available from: <https://www.theelephant.info/documents/africas-pulse-assessing-the-economic-impact-of-covid-19-and-policy-responses-in-sub-saharan-africa/>.
 27. Donnelly E. Nigeria's Political Leaders Need to Win Trust to Tackle COVID-19 [Internet]. Chatham House. 2020 [cited 2020 Apr 25]. Available from: <https://www.chathamhouse.org/expert/comment/nigeria-s-political-leaders-need-win-trust-tackle-covid-19>.
 28. Ebenso B, Otu A. Can Nigeria contain the COVID-19 outbreak using lessons from recent epidemics? *Lancet Glob Health* [Internet]. 2020 Mar 11 [cited 2020 Apr 24];0(0). Available from: [https://www.thelancet.com/journals/langlo/article/PIIS2214-109X\(20\)30101-7/abstract](https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(20)30101-7/abstract).
 29. COVID-19: We have traced 8,932 people of interest – Task Force. Latest Nigeria News, Nigerian Newspapers, Politics [Internet]. 2020 Apr 10 [cited 2020 Apr 25]; Available from: <https://thenationonline.net/covid-19-we-have-traced-8932-people-of-interest-task-force/>.
 30. After Visiting 118,000 Households, We Identified 119 Persons With COVID-19 Symptoms –Lagos Government [Internet]. Sahara Reporters. 2020 [cited 2020 Apr 25]. Available from: <http://saharareporters.com/2020/04/14/after-visiting-118000-households-we-identified-119-persons-covid-19-symptoms-%E2%80%93lagos>.
 31. Salako O, Okunade K, Allsop M, Habeebu M, Toyé M, Oluyede G, Fagbenro G, Salako B. Upheaval in cancer care during the COVID-19 outbreak. *ecancermedicalscience* [Internet]. 2020 Apr 1 [cited 2020 Apr 25];14. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7134578/>.
 32. Abu-bashal dam. Nigeria: 113 healthcare workers infected with COVID-19 [Internet]. 2020 [cited 2020 May 5]. Available from: <https://www.aa.com.tr/en/africa/nigeria-113-healthcare-workers-infected-with-covid-19/1825398>.
 33. Nigeria Centre for Disease Control. Nigeria Centre for Disease Control Weekly Epidemiological Report, Week 16 [Internet]. 2020 [cited 2020 May 9]. Available from: <https://ncdc.gov.ng/reports/weekly>.
 34. Boyce MR, Katz R. Community Health Workers and Pandemic Preparedness: Current and Prospective Roles. *Front Public Health* [Internet]. 2019 [cited 2020 May 5];7. Available from: <https://www.frontiersin.org/articles/10.3389/fpubh.2019.00062/full>.
 35. Miller NP, Milsom P, Johnson G, Bedford J, Kapeu AS, Diallo AO, Hassen K, Rafique N, Islam K, Camara R, Kandeh J, Wesseh CS, Rasanathan K, Zambruni JP, Papowitz H. Community health workers during the Ebola outbreak in Guinea, Liberia, and Sierra Leone. *J Glob Health* [Internet]. [cited 2020 May 5];8(2). Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6030670/>.
 36. Gautier L, Hounghbedji KA, Uwamaliya J, Coffee M. Use of a community-led prevention strategy

- to enhance behavioral changes towards Ebola virus disease prevention: a qualitative case study in Western Côte d'Ivoire. *Glob Health Res Policy* [Internet]. 2017 Dec 22 [cited 2020 May 5];2. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5741877/>.
37. A Ministry of Sharing (AMOS) Health and Hope. Annual Report: On the Journey Towards Health for All. Hermitage: AMOS (2017) [Internet]. [cited 2020 May 5]. Available from: <https://1ji6o62loxsl3wnk3l36rhya-wpengine.netdna-ssl.com/wp-content/uploads/sites/62/2019/09/AMOS-Annual-Report-2017.pdf>.
 38. Vaz RG, Mkanda P, Banda R, Komkech W, Ekundare-Famiyesin OO, Onyibe R, Abidoeye S, Nsubuga P, Maleghemi S, Hannah-Murele B, Tegegne SG. The Role of the Polio Program Infrastructure in Response to Ebola Virus Disease Outbreak in Nigeria 2014. *J Infect Dis*. 2016 May 1;213(suppl_3):S140–6.
 39. World Health Organization. Global strategy on human resources for health: Workforce 2030 [Internet]. 2016 [cited 2020 May 5] p. 64. Available from: <https://apps.who.int/iris/bitstream/handle/10665/250368/9789241511131-eng.pdf?sequence=1>.
 40. Manzi A. Community health workers are crucial to pandemic response. How to support them [Internet]. *The Conversation*. 2020 [cited 2020 May 5]. Available from: <http://theconversation.com/community-health-workers-are-crucial-to-pandemic-response-how-to-support-them-134908>.
 41. Republic of Rwanda. Statement on New Measures to Prevent COVID-19 Coronavirus Transmission [Internet]. 2020 [cited 2020 May 5]. Available from: https://www.rbc.gov.rw/fileadmin/user_upload/annoucement/GoR-MOH%20statement%20ofinal.pdf.
 42. Langat B. Community Health Workers Champion Kenya's COVID-19 Response [Internet]. *Amref Health Africa in Kenya*. 2020 [cited 2020 May 5]. Available from: <https://amref.org/kenya/blog/community-health-workers-champion-kenyas-covid-19-response/>.
 43. Wiah SO, Subah M, Varpilah B, Waters A, Ly J, Ballard M, Price M, Panjab R. Prevent, detect, respond: How community health workers can help in the fight against covid-19 [Internet]. *The BMJ*. 2020 [cited 2020 Apr 25]. Available from: <https://blogs.bmj.com/bmj/2020/03/27/prevent-detect-respond-how-community-health-workers-can-help-fight-covid-19/>.
 44. Atoyebi O. Coronavirus: FG tracing 12,000 contacts, says NCDC DG [Internet]. *Punch Newspapers*. [cited 2020 May 5]. Available from: <https://punchng.com/coronavirus-fg-tracing-12000-contacts-says-ncdc-dg/>.
 45. Ferretti L, Wymant C, Kendall M, Zhao L, Nurtay A, Abeler-Dörner L, Parker M, Bonsall D, Fraser C. Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing. *Science* [Internet]. 2020 May 8 [cited 2020 May 9];368(6491). Available from: <https://science.sciencemag.org/content/368/6491/eabb6936>.
 46. Whitworth J. Coronavirus: why testing and contact tracing isn't a simple solution [Internet]. *The Conversation*. [cited 2020 May 9]. Available from: <http://theconversation.com/coronavirus-why-testing-and-contact-tracing-isnt-a-simple-solution-137214>.
 47. The World Bank. Mobile cellular subscriptions (per 100 people) - Nigeria | Data [Internet]. 2018 [cited 2020 May 9]. Available from: <https://data.worldbank.org/indicator/IT.CEL.SETS.P2?end=2018&locations=NG&start=1960&view=chart>.
 48. Beaubien J. Block By Block, Health Workers Lead Liberia To Victory Over Ebola. *NPR.org - Goat and Soda* [Internet]. 2015 May 9 [cited 2020 Apr 26]; Available from: <https://www.npr.org/sections/goatsandsoda/2015/05/08/405200905/block-by-block-health-workers-lead-liberia-to-victory-over-ebola>.
 49. Joshi A, Sparks R, Karimi S, Yan S-LJ, Chughtai AA, Paris C, MacIntyre CR. Automated monitoring of tweets for early detection of the 2014 Ebola epidemic. *PLOS ONE*. 2020 Mar 17;15(3):e0230322.
 50. Nigeria Centre for Disease Control. Guidelines for the Safe Management of a Dead Body in the Context of COVID-19 [Internet]. 2020 [cited 2020 May 10]. Available from: https://covid19.ncdc.gov.ng/media/files/MgtOfDeadBodies_elVIwls.pdf.
 51. Research Clue. The Belief on Burial Rite among the Yoruba People of Nigeria [Internet]. 2020 [cited 2020 May 10]. Available from: <https://nairaproject.com/projects/4962-the-belief-on-burial-rite-among-the-yoruba-people-of-nigeria.html>.
 52. Bortel TV, Basnayake A, Wurie F, Jambai M, Koroma AS, Muana AT, Hann K, Eaton J, Martin S, Nellums LB. Psychosocial effects of an Ebola outbreak at individual, community and international levels. *Bull World Health Organ*. 2016 Jan 21;94(3):157–232.
 53. National Primary Health Care Development Agency. Preparedness and Response to COVID-19 at Primary Health Care and Community Level [Internet]. 2020 [cited 2020 Apr 26]. Available from: <https://www.humanitarianresponse.info/ru/operations/nigeria/document/national-primary->

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