Adapting public health response through lessons learnt: Nigeria’s experience from Lassa fever and COVID-19

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ABSTRACT
Response to public health emergencies requires continued adaptation and innovation. The Nigeria Centre for Disease Control (NCDC) is the country’s public health institute with the mandate to protect the health of Nigerians. Achieving such mandate in resource-limited settings with divergent demographic characteristics of the citizens, necessitates the readiness to learn from experience and to develop policies and activities in line with lessons learnt and best practices. This practice paper describes the initiatives of the NCDC towards adapting its public health response activities by establishing learning systems across its structure. The paper informs on some of the steps taken by the Centre regarding learning from the Lassa fever outbreak and the COVID-19 pandemic in Nigeria. It concludes that commitment and investments are key requirements for learning and adapting public health responses to achieve success with combating infectious diseases.

INTRODUCTION
Every year, Nigeria, Africa’s most populous country, is confronted with several public health challenges that continually strain her insufficient health facilities and resources. Between 2014 and 2019, the threats from Ebola and Lassa fever outbreaks indicated that response activities to disease outbreaks in the country need to be strengthened through cumulative learning from such experiences. Adapting public health responses through lesson learning was thus identified as one of the ways to adjust health system responses to outbreaks from ‘reactive’ to ‘prepared’ mode.

Nigeria is a Federal Republic with three tiers of government: National, State and Local Government Areas (LGAs). Significant activities occur at the subnational levels (State government areas and LGAs), but most of the available documentation and lesson learning are at the National level. There is also a wide variation in capacity between different states within the country due to differing levels of material and human resources available. By continually confronting outbreaks, the public health workforce in Nigeria requires health systems that create opportunities for real-time learning for an enhanced ability to implement evidence-based practices in their activities. As the country’s public health institute, the Nigeria Centre for Disease Control (NCDC) initiated efforts to make this possible by establishing learning and processes from Nigeria’s experiences with Lassa fever and the COVID-19 disease outbreaks. Lesson learning through NCDC’s initiatives could provide leverage for improving response activities to tackle future epidemics in the country.

Key among the NCDC’s initiatives was the deployment of Surveillance Outbreak Response Management and Analysis System (SORMAS), a real-time software application for outbreak and epidemic surveillance

SUMMARY BOX
⇒ Lesson learning is an identified knowledge management approach used to enhance public health functions and activities.
⇒ This practice paper reports the lesson learning initiatives deployed by the Nigeria Centre for Disease Control to document and share knowledge across the agency’s operational network, as gleaned from Nigeria’s response experiences to Lassa fever and COVID-19.
⇒ This paper could inform policy at national and subnational levels on knowledge documentation and sharing in global health practices. It could also serve as an exemplar for public health practitioners across the globe and inform knowledge management research in public health.
and response, the introduction of after-action review processes to continually appraise its field experiences and assess its response efforts, and the activation of knowledge management systems to engender opportunity for knowledge sharing, capturing and translation. SORMAS and after-action reviews transformed the way in which the health system has prepared for and responded to Lassa fever and other outbreaks, including COVID-19, and the recently activated knowledge management systems create further learning opportunities in preparation for the future.

**LASSA FEVER AS A STEPPING STONE**

NCDC coordinates the country’s response to disease outbreaks. The last 3 years have seen Nigeria responding to year-round outbreaks of Lassa fever, especially during the ‘Lassa fever season’, a term that is often used to describe the yearly December–May upsurge in the number of cases. Most cases of the disease in West Africa occur in Nigeria, and the 2019/2020 outbreak in the country holds the highest record for Lassa fever cases globally.

Despite its discovery in 1969, Lassa fever research and response in the country have not gained adequate traction due to a number of health system challenges, such as the level 4 biosafety facility requirement for viral research, geographical confinement of the pathogen mostly within the West African subregion and the lack of approved therapeutics for the disease even after five decades of its discovery. Consequently, response to Lassa fever outbreaks had depended on strict public health measures, political will and innovativeness of the public health workforce to tread uncharted paths in confronting the disease annually. However, learning through after-action reviews has provided an impetus for improving yearly responses. The response to Lassa Fever as well as other health emergencies have also been supported by donor agencies and partner organisations, such as the WHO, US Centers for Disease Control and Prevention, Africa Centres for Disease Control and Prevention, Bill and Melinda Gates Foundation, Dangote Foundation, Public Health England, Resolve To Save Lives, Tony Blair Institute, African Field Epidemiology Network (AFENET) and many others, have also supported the NCDC in response activities to public health challenges.

**Lassa fever after-action reviews**

Being an annual event, the NCDC recognised that response to Lassa fever outbreaks needed to be adapted to put the country in a ‘prepared’ mode, as against the ‘reactive’ mode. Initiating processes of after-action reviews to reflect on field experiences, has been instrumental in informing response activities to Lassa fever in the country: ‘An After-Action Review (AAR) is a qualitative review of actions taken to respond to a real event as a means of identifying best practices, lessons and gaps in response’.3

In deploying AARs for Lassa fever outbreaks, the NCDC has mostly used the Working Group AAR method,3 which brings together key stakeholders within thematic response groups to assess previous years’ response activities, with a view to identify best practices and recommend approaches for improving response to the outbreak going forward. This was deployed in 2017, 2018 and 2019 to review the preoutbreak status of the country in terms of policies, resources, preparedness and response approaches; and to capture innovations that positively contributed to the response.4–6

For example, in 2018, an AAR revealed that public sensitisation during organised football matches and the use of environmental sanitation days were contributory to increasing Lassa fever awareness among Edo State citizens. Lesson learning in this manner thus enabled the NCDC to continually adapt its responses to achieve better results in other outbreaks, including COVID-19. The Lassa fever experience has therefore ingrained a learning culture for improving public health functions in the NCDC and opened ways to explore other learning opportunities that can support in achieving similar goals.

**DEPLOYMENT OF DIGITAL SURVEILLANCE TOOL: SURVEILLANCE OUTBREAK RESPONSE MANAGEMENT AND ANALYSIS SYSTEM**

One of the challenges encountered with the outbreak reporting and response for the Ebola epidemic of 2014–2016 was the weak surveillance and notification system in Nigeria, occasioned by late case detection, poor data quality, and poor information exchange and flow among stakeholders in outbreak containment.7 During the period, healthcare providers used disparate tools, such as Open Data Kit and Microsoft Excel, to report cases to the government, resulting in data incoherence and non-standardisation.8 The NCDC thus became interested in moving the Surveillance Outbreak Response Management and Analysis System (SORMAS)—a system concerned with digitalising Surveillance Information System in Nigeria—from idea to reality. SORMAS provides real-time, multifunctional, bidirectional information exchange across all outbreak management levels. It improves data collection and situation assessment, and includes other elements of outbreak response such as contact tracing and rumour management.8 The SORMAS initiative was born in response to the threat to health security in Nigeria and the rising challenges of weak national capacity for disease surveillance and outbreak.

To strengthen the national capacity for disease surveillance, the NCDC, in conjunction with AFENET, partnered with the Helmholtz Centre for Infectious Disease Research to initiate the SORMAS open-source software, with the mandate to link all aspects of disease surveillance into one platform using the binding frameworks of International Health Regulations (IHR) and Integrated Disease Surveillance and Response (IDSR). This has, however, evolved, taking an iterative approach over time,
to include the One Health strategy, case management and other component plug-ins to provide harmonised disease surveillance and outbreak management functionality in a single digital platform.

In the last 3 years, the NCDC, in collaboration with several partners, spearheaded the nationwide deployment of SORMAS across the 36 states and the Federal Capital Territory in Nigeria (figure 1). The scope of the implementation took a painstaking process of stakeholders’ involvement through advocacy, trainings, deployment of devices and field support remotely and onsite. To sustain the deployment, the training method used involved didactic lectures, simple and complex scenarios of capturing cases’ data in the practical session, mentoring, an audiovisual overview of the SORMAS application, as well as the use of troubleshooting and users’ guides.

Aside from training, SORMAS users are provided with postdeployment field support through the NCDC toll-free line, a dedicated phone number for information technology (IT) support. The NCDC has thus identified that part of best practices for SORMAS is strong national ownership and investment through the inclusive design process and investment of human and material resources. The major challenges addressed by these strategies were those associated with the transfer of user knowledge to grassroot-level disease surveillance and notification officers (DSNOs), who had limited IT knowledge. The NCDC also spearheaded the provision of tablets for the officers to address challenges with IT access.

Currently, SORMAS covers 41+ IDSR diseases; deployed in all 36+ states in Nigeria, 774 local government facilities, 153 priority health facilities and 26 laboratories; and has about 3000 users, including nurses, clinicians, medical laboratory scientists, state epidemiologists, incident managers, DSNOs and other public health staffers across the country. SORMAS has also been adopted by 11 other countries through the Nigerian experience. The platform facilitates real-time learning and monitoring that continues to influence public health policies and activities in Nigeria. Having such a case-based surveillance system that specifically reports, manages and analyses priority notifiable infectious diseases in the country is one of the adaptive learning tools for enhancing the efficiency and effectiveness of NCDC public health functions.

**KNOWLEDGE MANAGEMENT SYSTEM ACTIVATION**

Recognising the importance of knowledge as the ‘fuel’ of the 21st century economy, the leadership of the NCDC in the year 2018 instituted plans to activate knowledge management system within the organisation. This, in line with the strategic direction of the agency, inclines towards using knowledge to ensure evidence-based
public health practices and activities within the country’s public health institute, which is a global best practice in protecting citizens’ health.\textsuperscript{11,12}

Establishing knowledge bases
Part of the efforts by the NCDC to activate its knowledge management system was the establishment of knowledge bases that will facilitate the curation and transfer of knowledge among the staff of the agency and with the public. Pre-COVID-19, establishing the NCDC Electronic Archives Management System (EAMS) had been an institutional goal of the NCDC to ensure that the organisation’s institutional memory is properly preserved in an archive. By mid-2020, the COVID-19 pandemic provided a good point to establish the EAMS in order to collect and preserve materials that contain valuable knowledge from the COVID-19 response activities. Nevertheless, the importance of this purpose in learning to improve public health functions has enabled the Archives to metamorphose into a central location for documents of enduring value across the agency’s functions and departments.

Consequently, the NCDC Archives is considered one of the best practices during the response to the COVID-19 pandemic because of its value in ensuring that knowledge is not lost amidst the public health activities of the Centre. Learning to improve on functions has thus become an integral part of the NCDC. The initial push to establish an archive emerged from lessons learnt from the Ebola and Lassa fever outbreaks, which informed the need for a centralised institutional memory where materials deployed in responding to an outbreak will be warehoused and easily accessible to everyone.

Creating an archive for materials of historical value is an age-long practice that offers the opportunity for today’s knowledge to be applied in future situations.\textsuperscript{13} Proper documentation and archiving of COVID-19 resources could thus be considered an aspect of preparedness for similar experiences in the future, as well as an opportunity to learn during a public health event. This is an aspect of institutional learning that the NCDC is building into its culture. Learning health systems explore opportunities to place learning at the centre of public health activities. The establishment of knowledge bases at the NCDC aligns with this by ensuring that important knowledge generated within the Agency is ‘arrested’ for others to learn from and to serve as an impetus for enhanced operational activities of the NCDC going forward.

Aside from the Archives, the NCDC Knowledge Repository, which was recently established in August 2021, offers an opportunity to externalise knowledge that has hitherto been only available within the NCDC network. The repository—a knowledge management project which aims to collect, preserve and distribute technical and intellectual knowledge of the NCDC—serves as NCDC’s knowledge-sharing platform that facilitates learning among the public health community within and outside Nigeria.

Knowledge capturing processes
Knowledge capturing provides the opportunity for tacit knowledge that resides in individuals to be converted into explicit knowledge that is documented and can be shared and easily stepped down to others. Public health operations frequently provide practitioners with the chance to gain knowledge from experience and field operations. Such knowledge could range from procedural know-how to learn skills. To harness the knowledge embedded in her staff strength and ensure they are available for use across the Agency, the NCDC initiated a learning system through its Library and Knowledge Management Unit to capture and document tacit knowledge from staff members and partners. The learning system was also widened to capture and integrate knowledge from state response teams across the country. This has been approached through key informant intra-action reviews of the ongoing COVID-19 response, knowledge share fair and mentorship, among others.

By leveraging on these approaches, lessons learnt from response activities to COVID-19 emergency are being documented and could serve as course-correction mechanisms and decision-making tools for policy development and activity planning. Approaches such as mentorship also provide opportunities across the NCDC to learn before, during and after events such as the COVID-19 pandemic; this is essential for preparedness and response activities in a public health system that desires to grow and ensures its workforce remain competent, knowledgeable and evidence-based, and practice-compliant to handle tasks at short notice. The outputs of knowledge capturing processes such as reports, audiovisual recordings, briefs, etc, are made available agency-wide through the Archives and repository.

Instituting knowledge management strategy
NCDC’s achievements on the activation of its knowledge management system commenced with a knowledge management strategy developed in 2020. The process of developing a knowledge management strategy, which stemmed from the need to entrench learning within the organisation, started before the advent of COVID-19 pandemic in Nigeria. However, the strategy formulation gathered momentum with the pandemic as the need to prioritise learning and knowledge-sharing activities became more prominent. Formulating a strategy to guide the course of action for knowledge management activation is one of the best practices that can be identified so far from NCDC’s experience.

As a first step in developing the knowledge management strategy, a knowledge audit was conducted in May 2020 to assess the knowledge assets and needs within the Agency. This provided an opportunity for the Library and Knowledge Management Unit, as well the leadership of NCDC, to recognise and document existing knowledge-sharing structure and infrastructure within the Agency, and thereafter develop the strategy, which was based on four strategic pillars: make information available and
accessible; enhance knowledge retention and capturing capacity; improve knowledge sharing and use; and advance knowledge generation, use and dissemination. Each strategic pillar of the strategy represents a priority area and is broken down into strategic objectives that are underpinned by strategic activities.

Through the knowledge management strategy, a roadmap for efficient library and knowledge services at the NCDC was developed. The roadmap, branched into five thematic areas (library space, knowledge resources, services, knowledge infrastructure and people), represents the immediate areas of focus from the strategic activities in the knowledge management strategy.

By leveraging on the roadmap, the Centre established a public health library stocked with relevant materials for its workforce, combined with an electronic library accessible via the internet. The roadmap also effected the delivery of knowledge services, such as expert literature searching and reviewing, a biweekly evidence synthesis (evidence brief), the establishment of the NCDC knowledge infrastructures such as the Archive and repository, and training of the workforce on knowledge management practices and approaches.

NATIONAL NETWORK OF PUBLIC HEALTH EMERGENCY OPERATIONS CENTRES

To enhance coordination and learning as regards public health emergencies, the NCDC collaborated with state governments to set up Public Health Emergency Operations Centres (PHEOCs). These PHEOCs serve as hubs for stakeholders within the states to prepare for, detect and coordinate responses to outbreaks and other public health emergencies. The subnational PHEOCs receive technical and financial support from NCDC through the National PHEOC (Incident Coordination Centre), and efforts are being made to ensure sustainability through funding from respective state governments. State PHEOCs also serve as centres for learning, training and documentation of practices. The COVID-19 pandemic gave high visibility to the PHEOCs, as they played leading roles in the response to the pandemic garnering some political support.

STRENGTHENING CAPACITIES FOR IMPLEMENTATION OF INTERNATIONAL HEALTH REGULATIONS 2005 AT SUBNATIONAL LEVEL

This is part of efforts to build the capacity of states by NCDC, and results from successful pilots in three states have shown that this has the potential to transform the health security landscape in Nigeria and to improve documentation. Among several interventions, the States IHR strengthening involves state Joint External Evaluations (JEEs), which are state-led peer review assessments of the various capacities for IHR. JEEs highlighted the importance of documentation to the states, as evaluation points could not be given for practices that have not been well documented. The state JEE process demonstrated the practical need for proper documentation to stakeholders at the state level. The gaps identified will inform the development of state action plans for health security. These processes have encouraged documentation and use of information for public health action, and NCDC plans to support all states to do this periodically.

CONCLUSION: COMMITMENT AND INVESTMENTS AS KEYS FOR ADAPTING PUBLIC HEALTH RESPONSES

Due to limited capacity among various stakeholders who need to document important lessons in the course of their work in public health, investments are required to build adequate capacity and institutionalise such processes. The commitment to learn and adapt as shown by the NCDC should be adopted and replicated at subnational levels for holistic national success with public health challenges. Instituting low-cost initiatives, such as after-action reviews, to harness lessons, adapt and enhance public health activities could be adopted at state and local government levels. The establishment of subnational PHEOCs has the potential to significantly improve response as well as documentation potential at subnational levels, and optimising the national network of PHEOCs promises to yield returns on investments.

Adapting public health responses by learning lessons from prior successes and challenges will provide a peer learning platform for Nigeria and other nations. Significant political will towards Lassa fever and COVID-19 from the Nigerian government has led to the availability of domestic resources to combat these diseases, as well as support from donor agencies and partners. These investments have aided the institute towards lesson learning from the public health responses to Lassa fever and COVID-19, and the gains from the lessons will continue to shape the future directions of public health functions in the country.

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