Simple and structured model to build sequencing capacity in west Africa

COVID-19 is one of the deadliest pandemics over the past 100 years.[1] Whole-genome sequencing and characterisation of SARS-CoV-2 has enabled detailed understanding of the pathogen's evolution and population structure.[2] Thus, the capacity to use available skills and techniques to quickly sequence the virus in different geographical settings has been essential for controlling its spread. As of May 31, 2022, more than 11 million SARS-CoV-2 genomes have been sequenced globally and been submitted to GISAID. Unfortunately, only 1% of the submitted sequences are from African countries, a major obstacle to understanding evolution of the virus in this continent.

A scarcity of sequencing infrastructure and basic skills for analysing genomic data to inform public health decisions have hindered the management of the COVID-19 outbreak in Africa, especially sub-Sarahan Africa.[3] Most countries in Africa close their land borders and airspace to prevent the spread of infection during a pandemic. However, the implementation of such intervention measures is only effective when informed by accurate genomic epidemiological data generated in a timely manner. Therefore, if sequencing facilities are not decentralised, laboratories are forced to ship samples elsewhere, preventing real-time contribution of sequences to monitor the evolution of the virus locally and to understand its global spread.

Thus, the idea to build genomics sequencing competency in sub-Saharan Africa by providing small and portable sequencers (MinION, Oxford Nanopore Technologies, Oxford, UK) and basic training on library preparation and bioinformatics analysis could help to control this situation and change the narrative. More importantly, building capacity for public health laboratories within the region will ensure that future pandemics are handled in a timely manner. In this Correspondence, we describe how our capacity-building model could be adopted for successful implementation of effective genomic surveillance in sub-Saharan Africa and other low-income settings for preparedness in response to future pandemics.

In January, 2021, the Medical Research Council Unit The Gambia (MRCG) at the London School of Hygiene & Tropical Medicine (LSHTM) received a grant through the UK Research and Innovation and The West Africa Network for Tuberculosis, Aids and Malaria to build genomics sequencing compacity across west African partners. Eight laboratories in six countries (Burkina Faso, Guinea-Bissau, Mali, Nigeria, Senegal, and Sierra Leone) were selected on the basis of the low number of SARS-CoV-2 genomes submitted to the GISAID database at the time (appendix p 1).

From February to June, 2021, during the second wave of the pandemic worldwide, we sent out teams to train more than 50 individuals in these six countries on SARS-CoV-2 library preparation, sequencing, and data analysis (appendix p 1). We spent a minimum of 4–10 days in each laboratory and donated enough library preparation reagents for 100 genomes, a portable sequencer (MinION or MinION-MK1C), and, in some cases, a laptop. Good quality genomes from each laboratory were submitted to GISAID for public access. A summary of this model and steps involved in its implementation are highlighted in the figure.

Following our hands-on training visits to all countries involved, we conducted bioinformatics analysis training over 2 weeks in June, 2021, at the MRCG at LSHTM campus, where two or three participants were invited from each of the laboratories visited. We trained a total of 15 people on SARS-CoV-2 data analysis using standard bioinformatics pipelines. Participants were also introduced to the high-power computing cluster hosted at the MRCG at LSHTM campus and trained on how to use this system to analyse sequence data.

We faced several challenges during the training in most of the laboratories that we visited, including a paucity of basic skills and knowledge in sequencing, constant power outage, poor procurement systems, and slow internet speed. For example, only one of the eight laboratories visited had a trained bioinformatician who needed minimal training on SARS-CoV-2 data analysis. To avoid this situation in future pandemics, funding from donors and governments should be directed towards training and building the capacity of staff in sequencing and bioinformatics. A proper procurement network should be established across west Africa to ensure quick and easy access to reagents and consumables. With this system, laboratories can borrow reagents or small equipment

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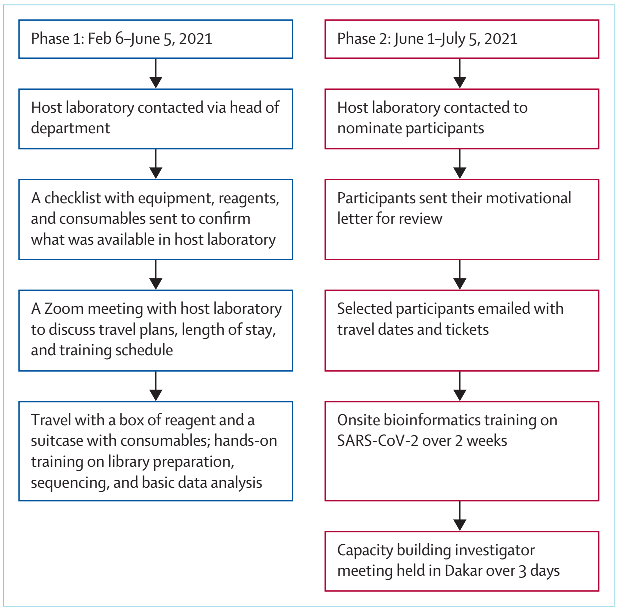

***Figure:* Implementation of a model to build genomic sequencing capacity in west Africa**

from each other while waiting for pending orders. Currently, all partner laboratories have access to the high-power computing cluster used for data analysis at the MRCG at LSHTM.

Within 6 months, we were able to train and support eight laboratories, and conducted bioinformatics training across west Africa. All of these laboratories are currently conducting real-time sequencing of SARS-CoV-2 isolated in their own countries. The real-time genomic data generated in each country is helping us to understand how the virus is evolving in the region and could provide accurate data to aid our response to future epidemics in Africa. To this end, we encourage government leaders and funders to direct more funding to support public health laboratories strengthen their capacity in genomics sequencing, for rapid and timely containment of emerging infectious disease epidemics.

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