Interim operational guidance on SARS-CoV-2 genomic surveillance in Africa: An updated guide

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Summary

Routine genomic surveillance of SARS-CoV-2 is essential to detect, monitor and characterize virus variants that can result in increased transmissibility, disease severity, or affect the effectiveness of diagnostics, vaccines and treatment. The updated document offers practical guidance to the African Union Member States on implementing genomic SARS-CoV-2 surveillance, including advice on sampling and sample referral logistics.

For genomic surveillance of SARS-CoV-2, Africa CDC and WHO/AFRO recommend representative sampling approaches to detect and monitor variants of concern (VOC). It is recommended that sampling be done weekly or bi-weekly, and efforts should be made to increase representativeness within the country by sampling among key groups such as by different age bands, geographical distribution, different spectrum of disease (e.g severe acute respiratory infections, acute respiratory infection), and clinically significant cases (e.g. fatal cases, vaccinated, immunocompromised, asymptomatic patients receiving any antiviral treatment, and re-infected cases)

Africa CDC and WHO/AFRO have jointly established a network for SARS-CoV-2 genomic surveillance including few specialized centers and regional sequencing hubs. Africa CDC and WHO/AFRO have worked with partners to support these laboratories and will also work with countries to facilitate sample shipment. Sequencing within the network is therefore supported and no additional costs may be incurred. This document highlights the laboratory referral plan and countries are encouraged to effectively use the network to ensure timely generation and use of pathogen genomic data.

Background

Most countries on the continent are either experiencing or have recently experienced a second and third wave of cases, including all countries in the Southern Africa region. It has been postulated that the second and third waves of infections could be associated with emergence of more transmissible variants [1–3]. Four new SAR-CoV-2 variants of concern (VOC), Alpha (B.1.1.7), Beta (B.1.351), Gamma (P.1), delta (B.1.1.617.2) have been reported from the United Kingdom (UK), South Africa, Brazil, and India respectively. These variants are estimated to increase the transmissibility of the virus by up to 75% [1–3]. In addition, the beta, gamma and delta have been associated with immune escape and may also potentially impact the efficacy of some vaccines and monoclonal antibodies-based therapeutic agents [4,5]. Data on the routine genomic surveillance of SARS-CoV-2 is limited in Africa.

As of July 2021, the alpha variant, first detected in the UK has been reported in 38 African countries. On the other hand, the beta variant first detected in South Africa has been reported in 32 African

countries and is currently the predominant circulating variant in the Southern African region. Twenty one countries have reported the delta variant.

The 6th International Health Regulations Emergency Committee for COVID-19 and the Africa Task Force for Novel Coronavirus have recommended increasing genomic surveillance in Africa. Subsequently Africa CDC and WHO/AFRO are working jointly to support countries to monitor the emergence, spread, response and impact of the emerging VOC. Key objectives for genomic to:

1. Determine the emergence and spread of SARS-CoV-2 variants of concern
2. To identify links between variants of concern and transmissibility, disease severity or risk groups
3. Monitor incidences of immune escape from vaccine and natural infection-escape
4. Monitor incidences of vaccine-derived infections and their transmissions patterns in countries rolling out inactivated or attenuated SARS-CoV-2 vaccines
5. Provide additional data to support effective vaccine development as well as other COVID-19 research questionsProvide information to support contact tracing and other public health COVID-19 interventions
6. Provide evidence of virus evolution over time in the African region

1. Establishing a regulatory framework for sample and data sharing between Sequencing Network laboratories and assigned countries

In January 2021, WHO/AFRO issued an interim guidance to guide SARS-CoV-2 genomics surveillance in the continent. This guidance is hereby being updated and it also include a guidance on sampling strategy. Overall, this guide contains information on

a) Sampling strategy

b) Sample referral and shipment logistics

c) Data analysis and reporting logistics

a. Sampling strategy

Due to limited sequencing capacity, Africa CDC and WHO/AFRO jointly with partners are supporting countries to conduct SARS-CoV-2 genomic surveillance primarily for monitoring the emergence and spread of SARS-CoV-2 variants. Based on this, it was recommended that a minimal sample size per country (see Table 1) to determine the point prevalence of specific variants with 95% confidence but without taking into account the precision. The sample size has been determined based on the current prevalence of SARS-CoV-2 and the expected proportion of the VOCs among all circulating variants. It is worth noting that the sample size may change in the country based on both SARS-CoV-2 incidence and the prevalence of the variant. It is proposed that sampling be done weekly, and efforts should be made to increase representativeness within the country by sampling among key groups such as by different age bands, geographical distribution, different spectrum of disease (e.g severe acute respiratory infections, acute respiratory infection), clinically significant cases (e.g. fatal cases, vaccinated, immunocompromised, asymptomatic patients receiving any antiviral treatment, and re-infected cases).

Table 1: Sample size calculation matrix for SARS-CoV-2 sequencing

Cases per week (Current prevalence of SARS-CoV-2)	Estimated prevalence of variant of concern among all circulating viruses*	Sample size per weekb
25,000	25%	12
	10%	30
	5%	60
	2.5%	120
	1.0%	300
10,000	25%	12
	10%	30
	5%	59
	2.5%	117
	1%	285
5000	25%	12
	10%	30
	5%	59
	2.5%	115
	1%	270
2500	25%	12
	10%	29
	5%	57
	2.5%	110
	1%	243
1000	25%	12
	10%	28
	5%	54
	2.5%	99
	1%	196
500	25%	11
	10%	27
	5%	49
	2.5%	83
	1%	141
100	25%	10
	10%	22
	5%	33
	2.5%	46
	1%	59

**For countries without preliminary data on 'variant of concern' prevalence estimates, it may be good to estimate this based on data from neighboring countries (with the least prevalence) if available but if not available, countries may consider the recommended minimum threshold of 5% prevalence. As of June 2021, data on VOCs was available in at least 45 countries with >29,000 sequences. Africa CDC and WHO/AFRO will be updating this information in their respective weekly outbreak briefs (https://africacdc.org/institutes/africa-pathogen-genomics-initiative/) and countries can adjust the expected prevalence based on this information.*

- *In situations where there is sufficient information concerning the prevalence of VOCs' to guide the response strategy, and where resources are limited, countries can choose to change the sampling frequency for example every two weeks or monthly.*

Example of how to use Table 1

If a Member State reports 2,500 cases per week and an estimated prevalence of VOC of 5%, then the Member State should sequence or send 57 samples per week or as per the predetermined sampling frequency as shown in Table 1.

b. Sample referral and shipment guide

Sample referral

Due to limited capacity in the continent and the logistic challenges, Africa CDC and WHO/AFRO have jointly established a network of few SARS-CoV-2 genomic referral laboratories to support countries in their region. This is an interim network created to timely support the countries for the emergence response. Africa CDC and WHO/AFRO have worked with partners to support these laboratories and will also work with countries to facilitate shipment of samples to sequencing laboratories. Sequencing within the network is therefore supported and no additional costs may be incurred. The laboratory referral plan is as below, and countries are encouraged to adhere to this plan so as to ensure timely generation and use of genomic data for effective epidemic response. In addition, it is advised that the samples be routinely shipped every week or bi-weekly as per the sampling guide above. Therefore, based on logistic in the ground the sample transportation could be aligned with the suitable flight itinerary in each of the laboratories.

Table 2: Countries distribution by reference laboratories

Africa CDC/WHO Regional Laboratory	Region	Countries Served
*Kwazulu-Natal Research Innovation and Sequencing Platform (KRISP), Durban, South Africa	Continental	All countries
*African Center of Excellence for Genomics of Infectious Diseases (ACEGID), Ede, Nigeria	Continental	All countries
National Infectious Communicable Diseases, Johannesburg, South Africa	Southern Africa region	South Africa, Angola, Botswana, Comoros, Eswatini, Lesotho, Malawi, Mauritius, Madagascar, Mozambique, Namibia, Seychelles, Zambia, Zimbabwe

Africa CDC/WHO Regional Laboratory	Region	Countries Served
The Kenya Medical research Institute (KEMRI) |Wellcome Trust Research Programme, Kilifi, Kenya	Eastern Africa Region	Kenya, Djibouti, Eritrea, Ethiopia, Somalia, Sudan
Uganda Viral Research Institute (UVRI), Entebbe, Uganda	Eastern Africa Region	Uganda, Burundi, Rwanda, South Sudan, Tanzania
Institute Pasteur, Dakar, Senegal	Western Africa Region	Senegal, Burkina Faso, Côte d'Ivoire, The Gambia, Guinea, Guinea-Bissau, Niger, Cape Verde
Noguchi Memorial Institute for Medical Research, Accra, Ghana	Western Africa Region	Ghana, Benin, Liberia, Sierra Leone, Togo
Institut National pour la Recherche Biomedicale, Kinshasa, DRC	Central Africa Region	DRC, Cameroon, Central African Republic, Chad, Republic of the Congo
Nigeria Centres for Disease Control, Abuja, Nigeria	Western Africa Region	Nigeria
Institute Pasteur Morocco	Northern	Morocco, Libya, Egypt, Tunisia, Algeria, Mauritania, and Sharawi Republic
Centre International de Recherches Medicales de Franceville, Franceville, Gabon	Central Africa Region	Gabon, Equatorial Guinea, São Tomé and Príncipe

** These are specialized centres that support the continent and countries may consider using these centres instead. However, a request has to be made to both labs as well as to Africa CDC and WHO/AFRO; Dr. Sofonias Kifle Tessema (SofoniasT@africa-union.org) and WHO/AFRO; Dr Nicksy Gumede-Moeletsi (gumedemoeletsih@who.int)*

Safety procedures during specimen collection

It is essential that during the specimen collection from suspected COVID-19 cases, health care workers strictly adhere to the safety and infection prevention and control procedures and measures as described in the national procedures and WHO guidelines.

Specimen type, packaging and shipment

1. Ability for accurate genomic data is dependent on the quality of specimen. It is recommended that countries send only specimens with a real-time reverse transcription polymerase chain reaction (RT-PCR) cycle-threshold (Ct) value of 30)
2. The acceptable specimen types are respiratory samples i.e. upper and lower respiratory specimens, including nasopharyngeal, oropharyngeal, nasal mid-turbinate, and anterior nares (nasal swab) specimens.
3. Only send specimens that have not been previously sent to avoid duplication and efficient use of the limited resources.
4. Preference should be made to send most recent specimens as per the sampling guide (in Table 1)
5. Attempts should be made to store the samples at -70°C prior shipment and shipment should be made on dry ice.
6. Countries should sign material transfer agreement with guidance from the recipient SARS-CoV-2 genomic referral centre. Member states should ensure concurrence with any national requirements for sharing of biological material with respect to the Nagoya Protocol. Please contact the Africa CDC and WHO/AFRO team (DorcasW@africa-union.org, njanpopb@who.int, moshas@who.int and dratibif@who.int) for assistance to complete the material transfer agreement.
7. Careful labelling of samples should be made, and specimens should be accompanied by sample meta data using the template in the following link (https://docs.google.com/spreadsheets/d/1EAqwJve0USPPRvSHd74yh8HZEn-89FDXt39Snj6o_KY/edit#gid=0)
8. Samples should be packaged and shipped as Category B infectious substances, and all requirements for proper packaging and shipping should be observed as per international guidelines[6]
9. Requests for assistance with shipment logistics should be made to DorcasW@africa-union.org, njanpopb@who.int, moshas@who.int and dratibif@who.int

c. Data analysis and reporting logistics

Data curation, analysis, reporting and interpretation will be supported by the SARS-CoV-2 genomic referral laboratory jointly with Africa CDC, WHO/AFRO and the South African National Bioinformatics Institute (SANBI) as needed by Member States. Countries are encouraged to provide patient meta-data as indicated above. Countries are also encouraged to deposit their sequences in a publicly accessible database e.g. the Global Initiative on Sharing All Influenza Data (GISAID) to allow for global monitoring of the pandemic to inform public health decision making. SARS-CoV-2 sequencing results can be tracked on the WHO/AFRO and the Africa CDC dashboards. Moreover, Africa CDC and WHO/AFRO will use this data to support countries in predicting the trajectory of the pandemic, as well as the impact of the variants on the pandemic countermeasures. This will help inform the countries response to the pandemic as well as on the prevention measures.

For this reason, countries are requested to share their data with Africa CDC and WHO/AFRO. For this support, countries should contact Dr. Sofonias Kifle Tessema (SofoniasT@africa-union.org) or Dr Nicksy Gumede-Moeletsi (gumedemoeletsih@who.int).

Appendix 1: SOP for sample shipment

a. Request Submission

- Once samples are selected for sequencing, please complete the WHO/AFRO/Africa CDC SARS-CoV-2 sequencing submission form.
  - For English version: https://forms.gle/MHQXnYRqtC25LBbE7
  - For French version: https://forms.gle/TpdfrH5npzua3Gz98
  - For Portuguese Version: https://forms.gle/m3SbcwvP3pWXARWT9
- The Africa CDC/WHO/AFRO team will review and provide feedback within 24 hours of submission of the electronic form
  - Send this to DorcasW@africa-union.org , njanpopb@who.int, moshas@who.int, and dratibif@who.int

b. Preparation for shipment

• Export documentation

- The shipping laboratory will be required to provide the following paperwork before shipping the samples:
  - ◊ the completed request form in A above
  - ◊ Material Transfer Agreement with the recipient institution (For a generic template contact DorcasW@africa-union.org, njanpopb@who.int, moshas@who.int, and dratibif@who.int)
  - ◊ Import permit for the recipient country
  - ◊ **NB:** Africa CDC/WHO/AFRO can provide assistance on export documentation upon request (DorcasW@africa-union.org , njanpopb@who.int, moshas@who.int, and dratibif@who.int)

• List of supplies needed for shipping specimens on dry ice

- Leak-proof primary container, 1.5ml tubes with O-rings (e.g NUNC vials, Sarstedt Tubes, etc) are preferred. If not available use 1.5ml tubes and wrap the cap with parafilm
- Leak-proof secondary container
- Absorbent material, enough to absorb all liquid in package
- Biohazard Label
- Pipette tips (1000uL tips)
- PPEs to aliquot and pack the samples
- Packaging boxes and dry ice can be provided up on request on the samples submission form

- **Safety Procedures**
  - All samples should be packaged and transported in accordance with biosafety precautions in standard triple packaging. Specimens should be packed according to International Air Transport Association (IATA) regulations and in compliance with regulations for UN3373 Biological Substance, Category B.
  - The packaging consists of three layers as follows.
    - ◊ **Primary container:** A labelled primary watertight, leak-proof receptacle containing the specimen. The receptacle is wrapped in enough absorbent material to absorb all fluid in case of breakage.
    - ◊ **Secondary container:** A second durable, watertight, leak-proof receptacle to enclose and protect the primary receptacle(s). Several wrapped primary receptacles may be placed in one secondary receptacle. Sufficient additional absorbent material must be placed in the secondary container to absorb the total volume of liquid in all primary containers. Bubble wrap can be used to cushion multiple primary receptacles, if necessary.
    - ◊ **Outer shipping package:** The secondary receptacle is placed in an outer shipping package which protects it and its contents from outside influences such as physical damage and water while in transit. Dry ice should be placed between the Outer package and the secondary container. Never place dry ice in the secondary container.

c. Sample shipment

- The Africa CDC or WHO/AFRO team will book designated courier to arrange the collection of the specimens as soon as possible.
- Africa CDC or WHO/AFRO team will notify the requesting lab on the booking and assist with the required documentations
- The courier agent will provide with the "JOB NUMBER" and will attach the required documentations.
- Once documentations are completed, the courier agent will schedule a collection date and time and communicate with Africa CDC or WHO-AFRO, the sending and recepient labs.
- The courier agent will provide dry ice, packaging and labelling materials required to comply with international transport regulations.
- Once picked up, the courier agent is expected to provide status update
  - ◊ Email World Courier (Customerservice@worldcourier.co.za) and Biocair (southafrica@biocair.com) for status updates and/or inquiries. For all emails, please include the "JOB NUMBER". Please ensure that communications are kept on a single mail thread, this ensures traceability and allows for anyone in the communication chain to have the most up to date information as there are multiple Customer service Agents working at different times.
- When specimens are delivered, the recipient lab will provide status update on the sequencing and sequencing results will be sent back within 14 days of shipment.

d. Questions?

Request/Questions related to	Responsible	Contact
• Genomic-based surveillance for SARS-CoV-2 and technical guidance on sampling strategy • Data management: data analyses, sharing, and reporting	Dr. Sofonias KIFLE TESSEMA Dr Nicksy GUMEDE-MOELETSI	SofoniasT@africa-union.org gumedemoeletsih@who.int
Samples shipment • WHO/AFRO/Africa CDC SARS-CoV-2 sequencing submission form • Assistance on Material Transfer Agreement • Assistance on export documentation upon request	Dorcas WARUGURU WANJOHI	DorcasW@africa-union.org
	Berthe-Marie NJANPOP	njanpopb@who.int
	Fred Athanasius DRATIBI	dratibif@who.int
	Fausta MOSHA	moshas@who.int
Courier Services • Specimen Status update after pick-up	World Courier	Customerservice@worldcourier.co.za
	Biocair	southafrica@biocair.com

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