Genomic Surveillance of SARS-CoV-2 in Africa: connecting the dots between the clinical and the sequencing labs

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Outline

- Public Health Pathogen Genomics at the Africa CDC
- Accelerating SARS-CoV-2 sequencing in Africa
- Progress, challenges & lessons learned
- Summary

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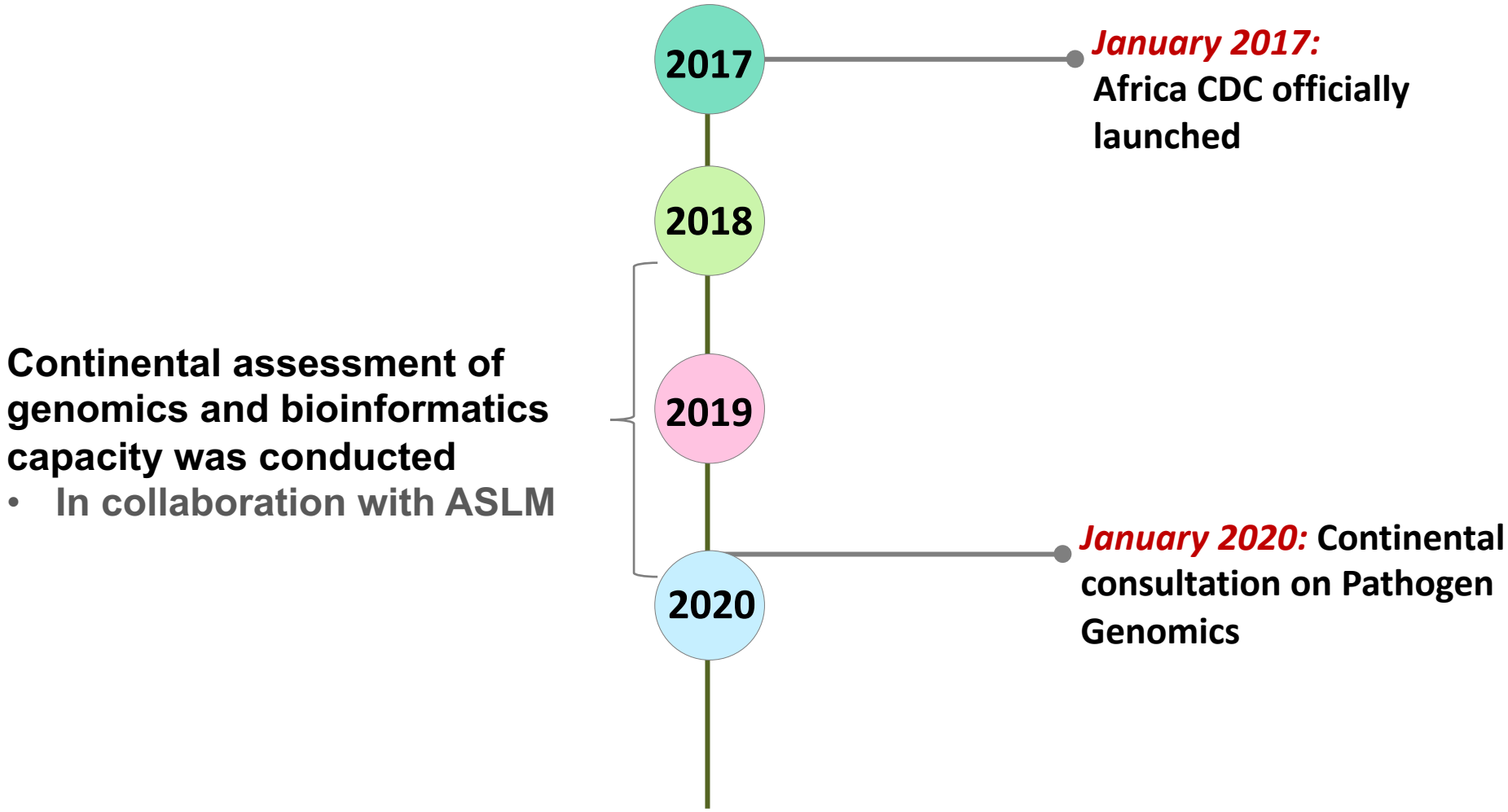
Public Health Pathogen Genomics at the Africa CDC



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Public Health Pathogen Genomics at the Africa CDC

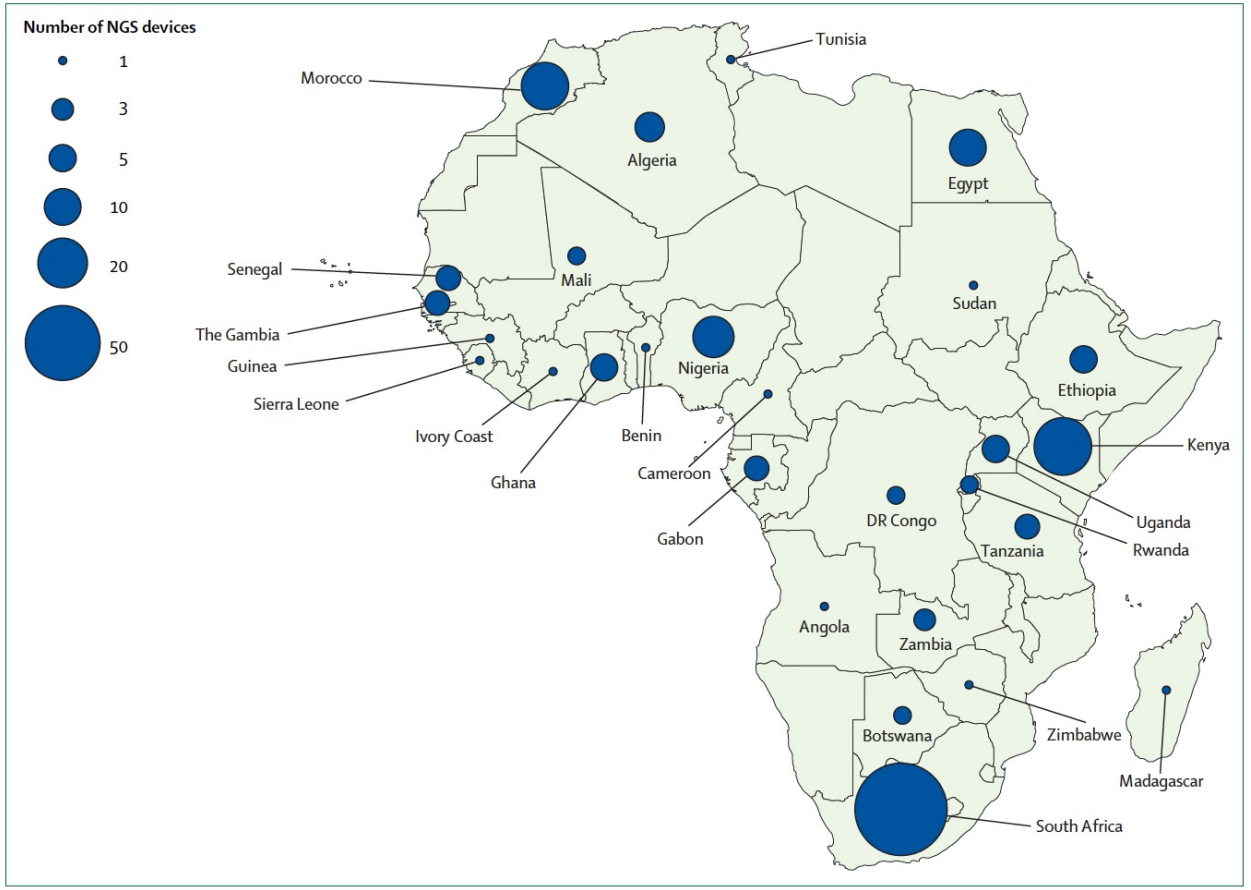
Major findings:

- **Limited infrastructure and skilled workforce**
  - Laboratory and bioinformatics
- **Enabling mechanisms**
  - Lack of policies and frameworks
  - Leadership and coordination
  - Supply chain, cost & custom challenges

Public Health Pathogen Genomics at the Africa CDC

Major findings:

- **Sporadic capacity**
  - >70% capacity in 5 countries
- **Limited capacity in public health institutions (< 30%)**



THE LANCET Infectious Diseases

Genomic-informed pathogen surveillance in Africa: opportunities and challenges

Seth C Inzaule, PhD · Sofonias K Tessema, PhD · Yenew Kebede, MD · Ahmed E Ogwell Ouma, PhD · John N Nkengasong, PhD

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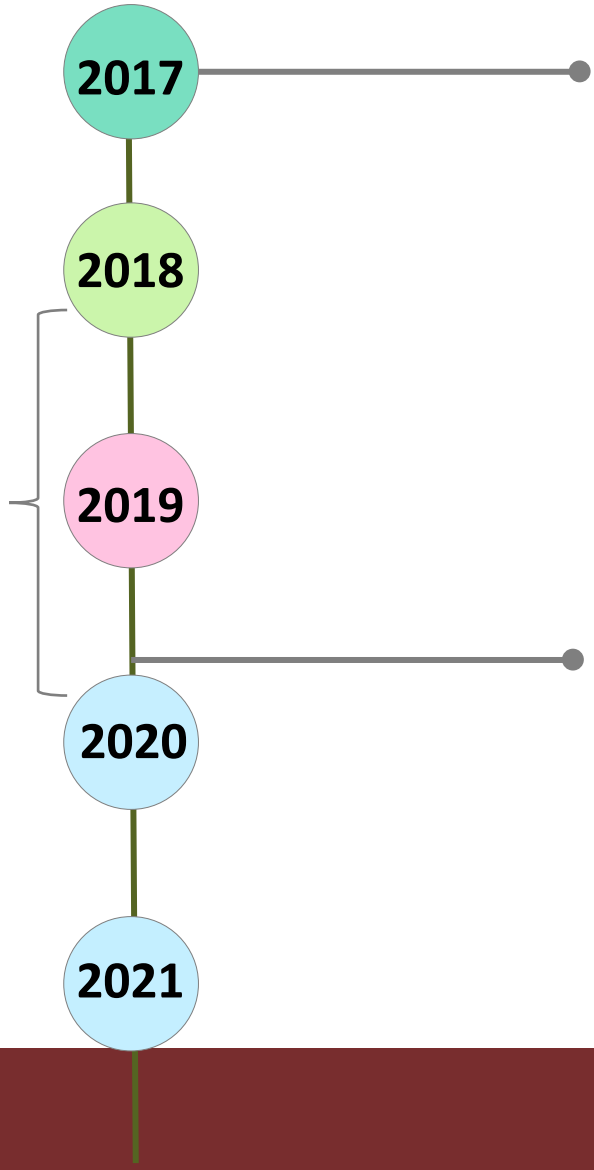
Public Health Pathogen Genomics at the Africa CDC

Continental assessment of genomics and bioinformatics capacity was conducted

- In collaboration with ASLM
- Funding from BMGF



January 2017: **Africa CDC officially launched**

November 2019: **Africa CDC Institute of Pathogen Genomics launched**

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2017

January 2017: Africa CDC officially launched

2018

2019

November 2019: Africa CDC Institute of Pathogen Genomics launched

2020

COVID-19 Pandemic

October 2020: Africa PGI launched

August 2020:

THE LANCET Microbe

Accelerating genomics-based surveillance for COVID-19 response in Africa

Sofonias K Tessema · Seth C Inzaule · Alan Christoffels · Yenew Kebede · Tulio de Oliveira · Ahmed E Ogwell Ouma · Christian T Happi · John N Nkengasong · Show less

2021

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Africa Pathogen Genomics Initiative

Strengthening Laboratory Networks and Surveillance Systems

In Partnership with:

BILL & MELINDA GATES foundation

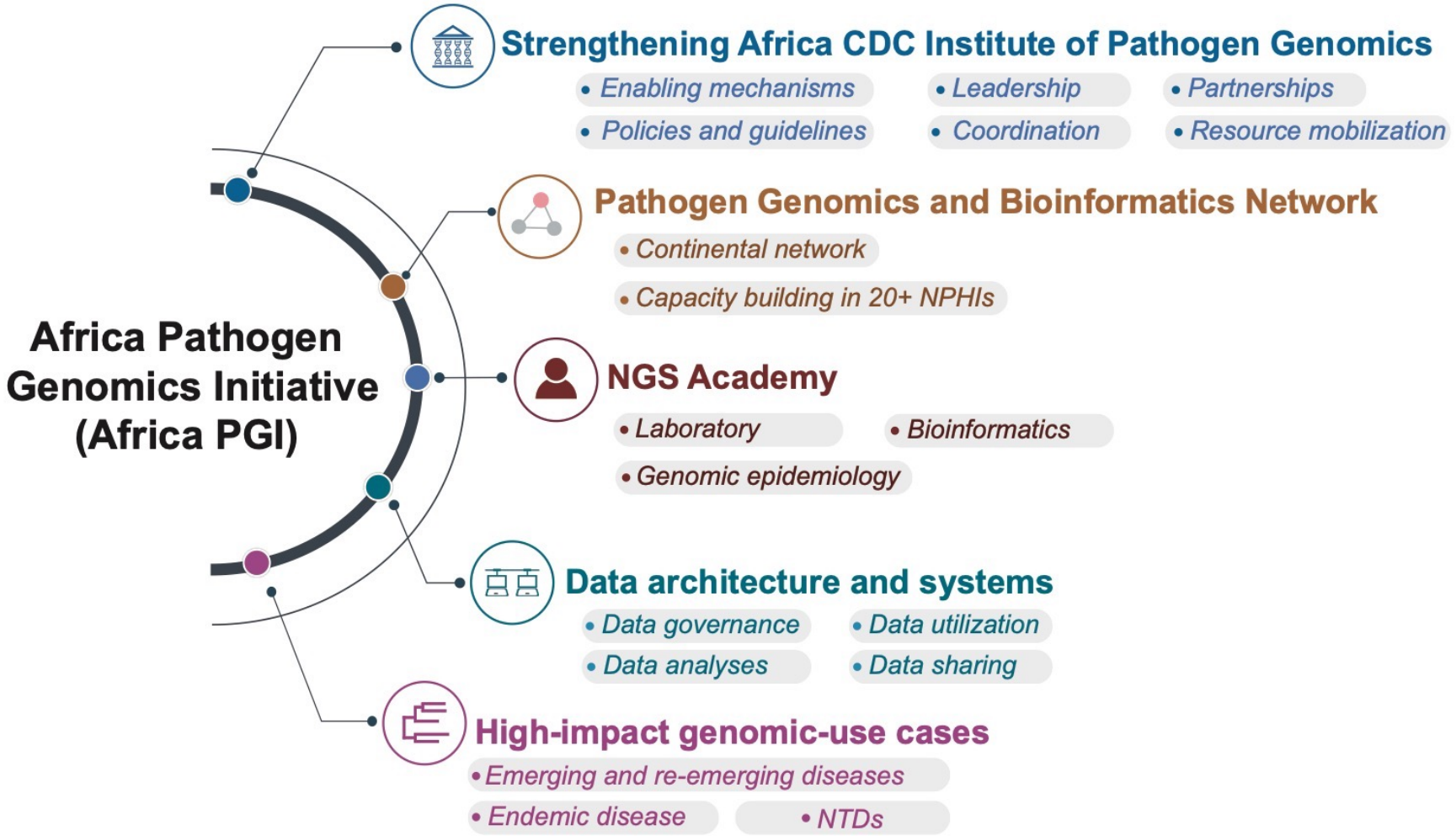
illumina

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Microsoft

Oxford NANOPORE Technologies

Key components of the Africa PGI



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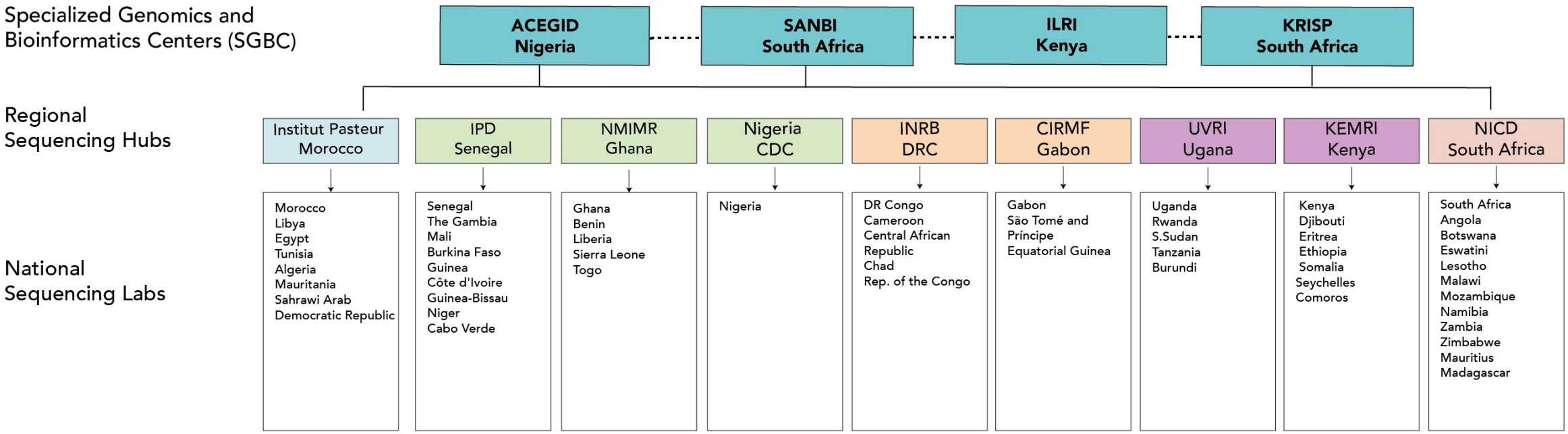
Acclerating SARS-CoV-2 sequencing in Africa

Africa CDC 2021 targets:

1. Operationalize the network and support the sequencing of **50,000 SARS-CoV-2 genomes**
2. Support member states with limited or no sequencing capacity through sample referral – **support at least 35 countries and 20,000 samples**
3. Conduct **hands on trainings to train at least 100 candidates** in support of SARS-CoV-2 Sequencing by Member States

Acclerating SARS-CoV-2 sequencing in Africa

Africa CDC and WHO AFRO COVID-19 Sequencing Network



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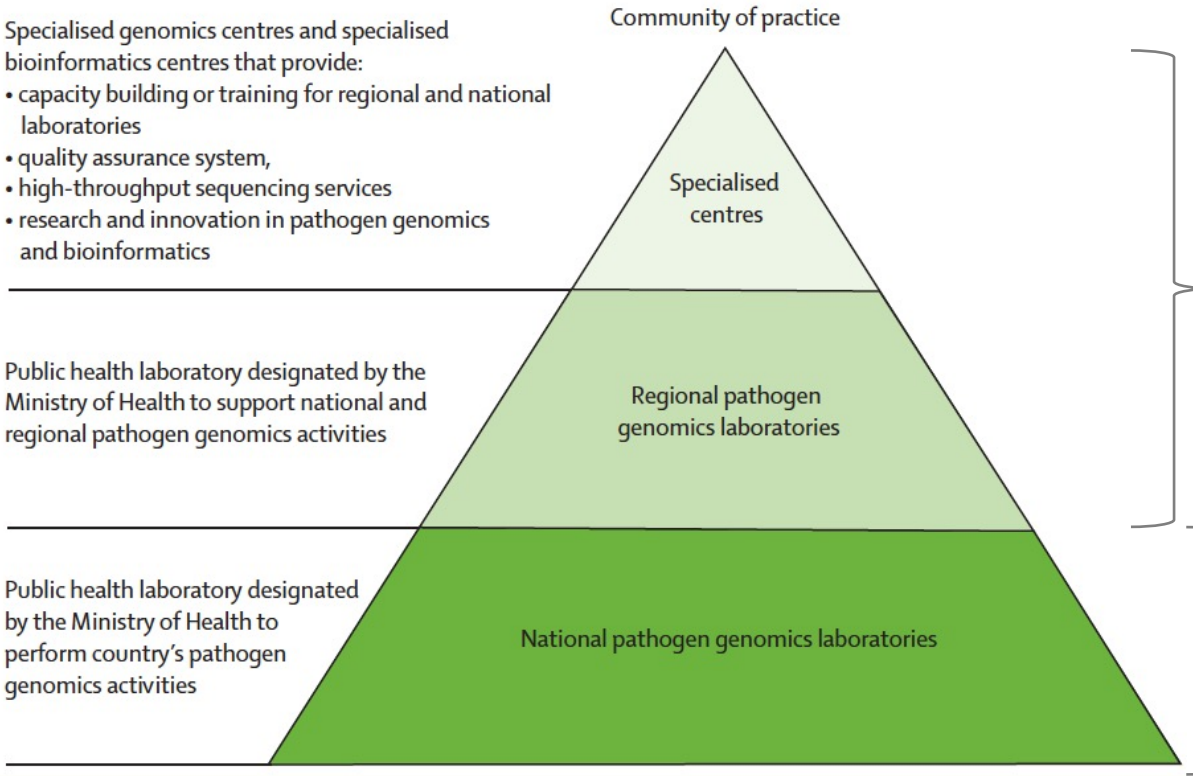
Acclerating SARS-CoV-2 sequencing in Africa



Leverage & strengthen

Expand & democratize

Network

[Access to sequencing]

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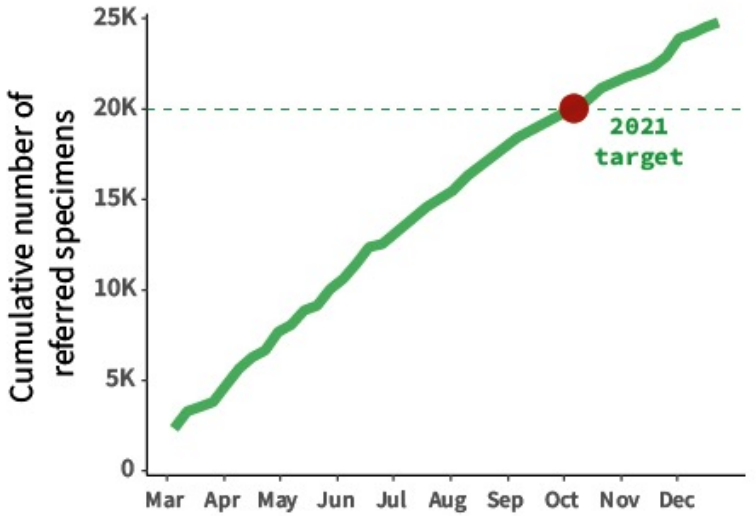
Acclerating SARS-CoV-2 sequencing in Africa

Sample referral network

36 Member States
referred SARS-CoV-2 specimens for sequencing

24,784
SARS-CoV-2 specimens referred (124% of our target)

3 days
Average number of days from sample pick up to delivery. It ranges from 1 to 15 days.



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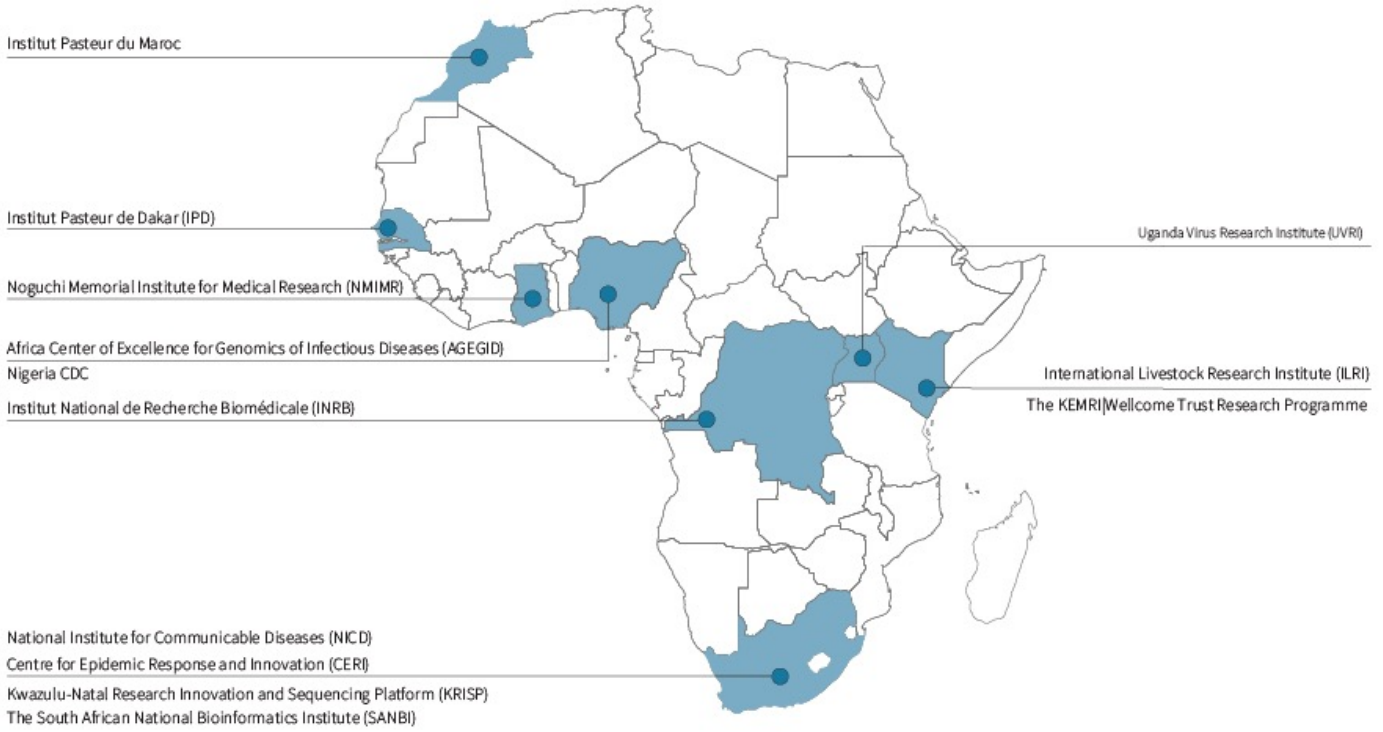
Acclerating SARS-CoV-2 sequencing in Africa

Leverage and strengthen regional hubs

$1.7M in subaward
to support SARS-CoV-2 sequencing in 10 regional hubs

+64,000 sequencing reagents
Reagents to sequence SARS-CoV-2 specimens

12 sequencing equipment
Illumina: 4x NextSeq 2000s & 1x MiSeq
ONT: 5x GridIONs & 2x MinION Mk1C



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Acclerating SARS-CoV-2 sequencing in Africa

Democratize and expand sequencing in NPHIs and NRLs

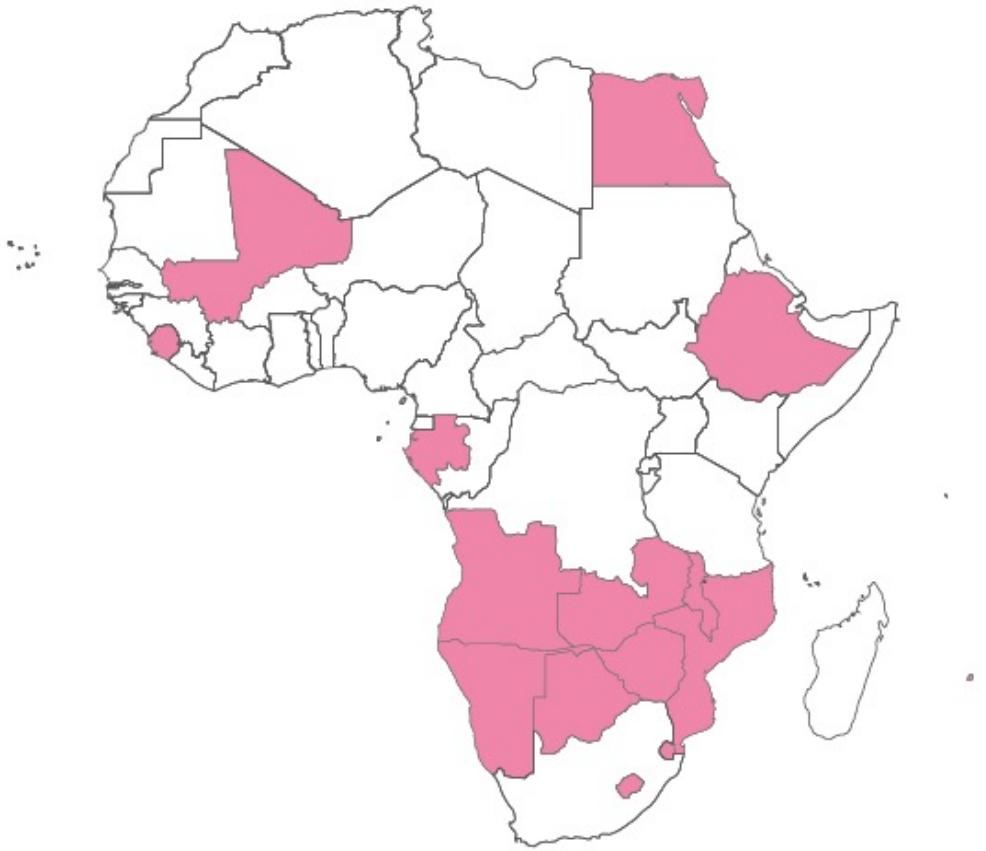
14 Member States

+35,000 reagents

Reagents to sequence SARS-CoV-2 specimens and/or to detect VOCs

12 sequencing equipment

ONT: 1x GridIONs & 11x MinION Mk1B/MK1C



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Acclerating SARS-CoV-2 sequencing in Africa

Trainings on COVID-19 sequencing:

46 Member States

6 trainings
(4 hands-on & 2 virtual)

117 trainees
on SARS-CoV-2 sequencing

- *79 trained in hands-on & 38 trained in virtual*
- *38 % of the trainees were females*
- *44 Member States included in the hands-on training*

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Acclerating SARS-CoV-2 sequencing in Africa

Training on infectious substance handling and transport

3 trainings
on Infectious Substances Transport

39 trainees
trained on Infectious Substances Handling and Transport

34 Member States
included in the 3 trainings

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Acclerating SARS-CoV-2 sequencing in Africa

…. several other intaitves at national and regional level are supporting SARS-CoV-2 seqeucning in Africa

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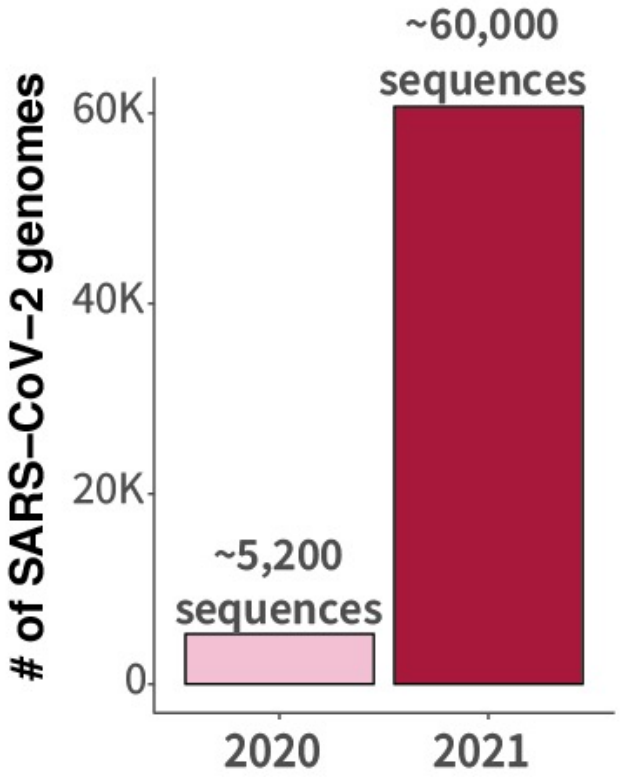
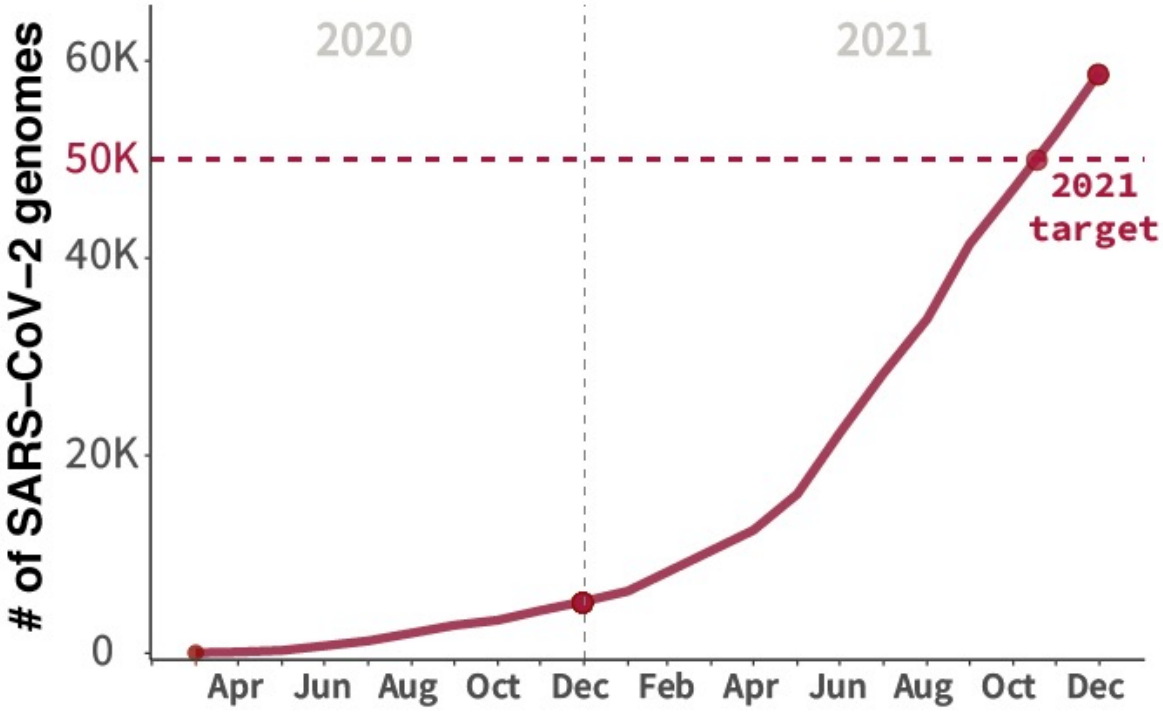
SARS-COV-2 sequencing in Africa | 2021 at a glance

12X

more SARS-CoV-2 sequences in 2021 (compared to 2020)





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SARS-COV-2 sequencing in Africa | 2021 at a glance

As of 31 Dec 2020

20
Member states with >10 sequences

6
Member states with routine* sequencing

0.19%
of confirmed cases sequenced

As of 31 Dec 2021

50
Member states with >10 sequences

25
Member states with routine* sequencing

0.87%
of confirmed cases sequenced

Member States with >10 SARS-CoV-2 sequences

Member States with limited or no SARS-CoV-2 sequences

*routine SARS-CoV-2 sequencing is defined by generating and sharing sequences in 7 out of the 12 months of the year

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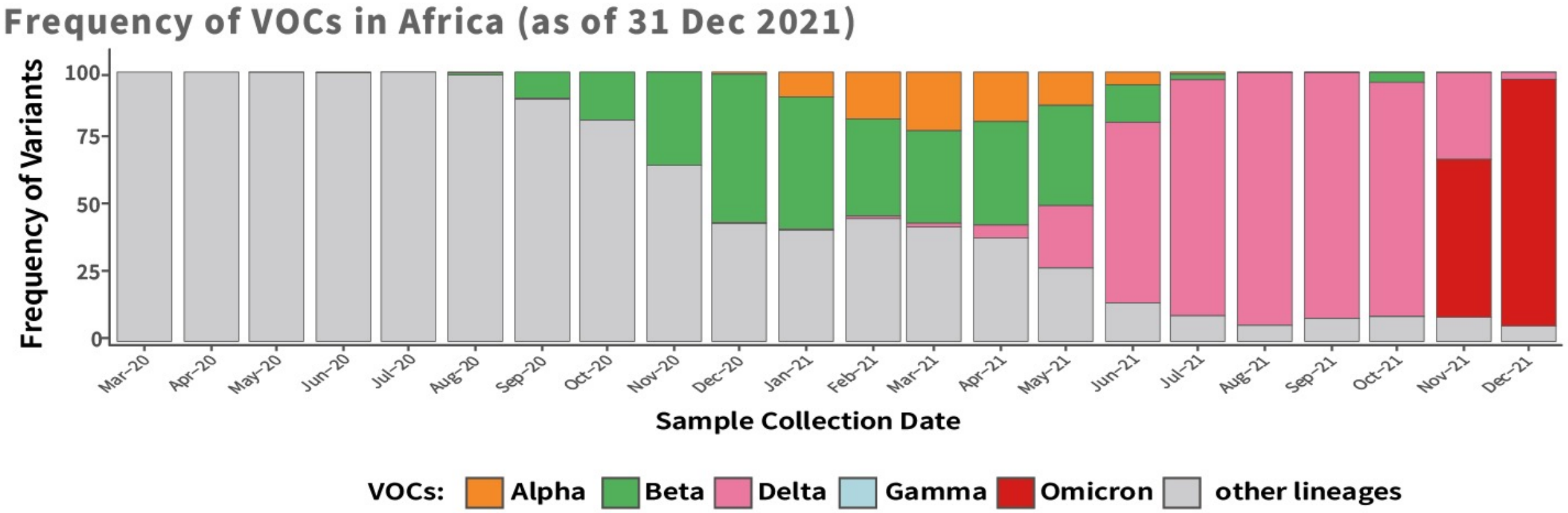
SARS-COV-2 sequencing in Africa | 2021 at a glance



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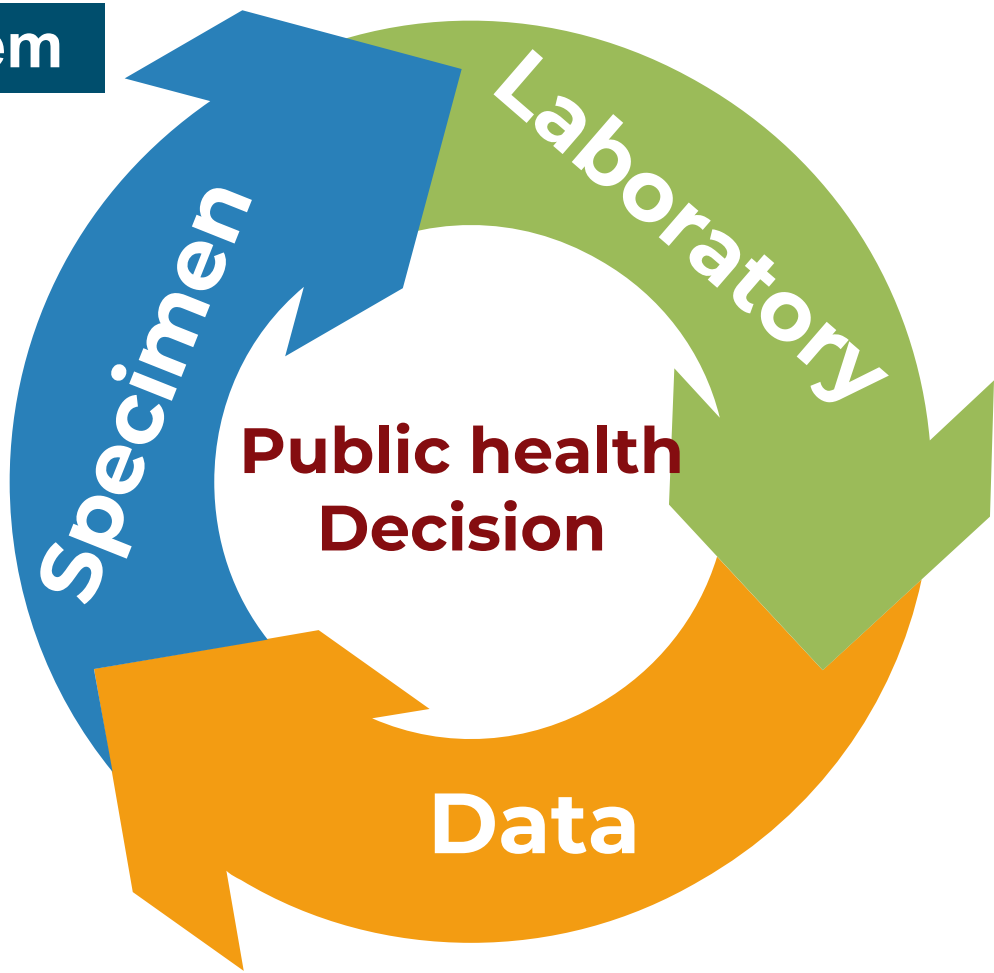
SARS-COV-2 sequencing in Africa | Connecting the Dots

Components of a genomic surveillience ecosystem

- Sampling & sequencing strategy
- Laboratory systems
- Data systems: analytics, interpretation
- Data interpretation and utilization to inform public health decision making



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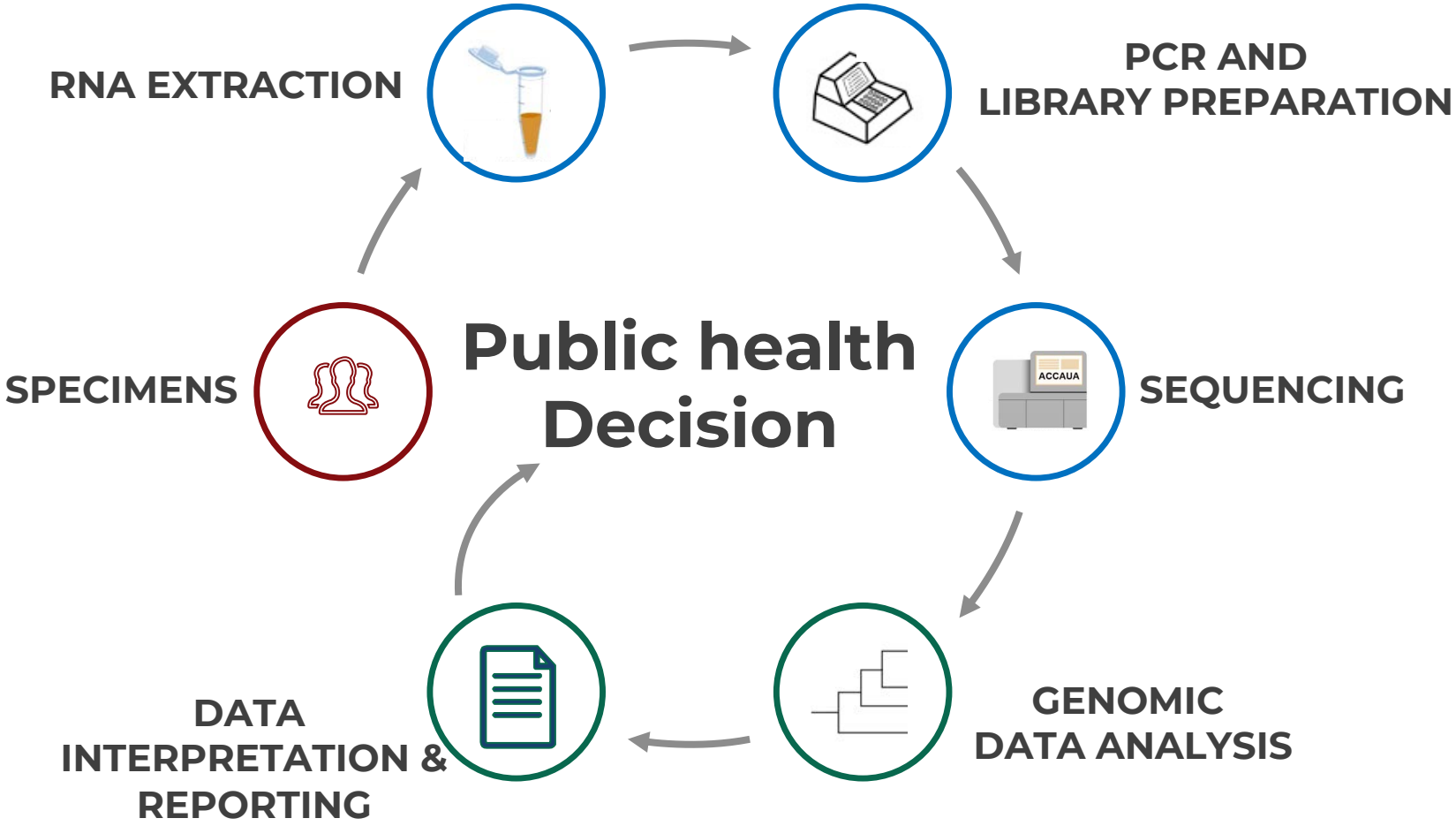
SARS-COV-2 sequencing in Africa | Connecting the Dots



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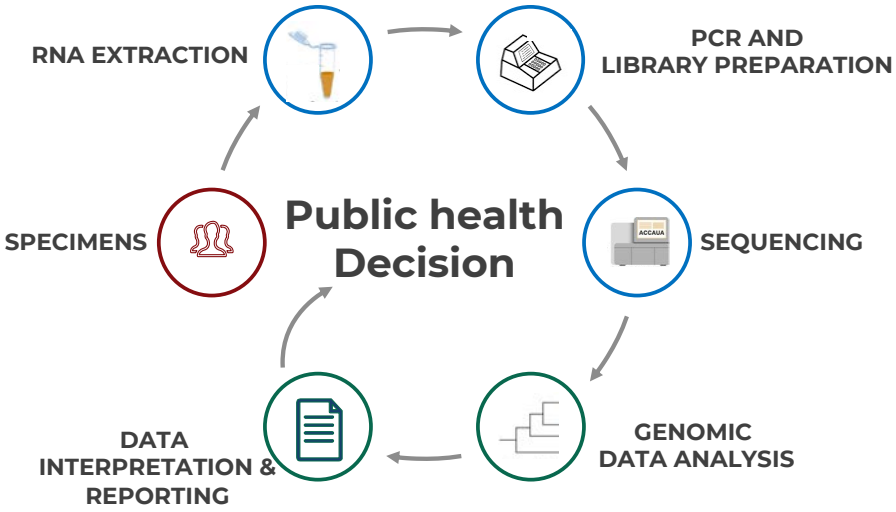
SARS-COV-2 sequencing in Africa | Sampling & sequencing strategy

Key considerations and lessons

Sampling & sequencing strategy

- Define the objective and purpose of sequencing
- Sampling and sequencing strategy should be developed based on the local context
  - **Representative sampling and sequencing** – to detect and monitor new variants of concern
  - **Targeted sampling and sequencing -** to investigate vaccine breakthrough infections, outbreaks, clusters of infections, unusual events



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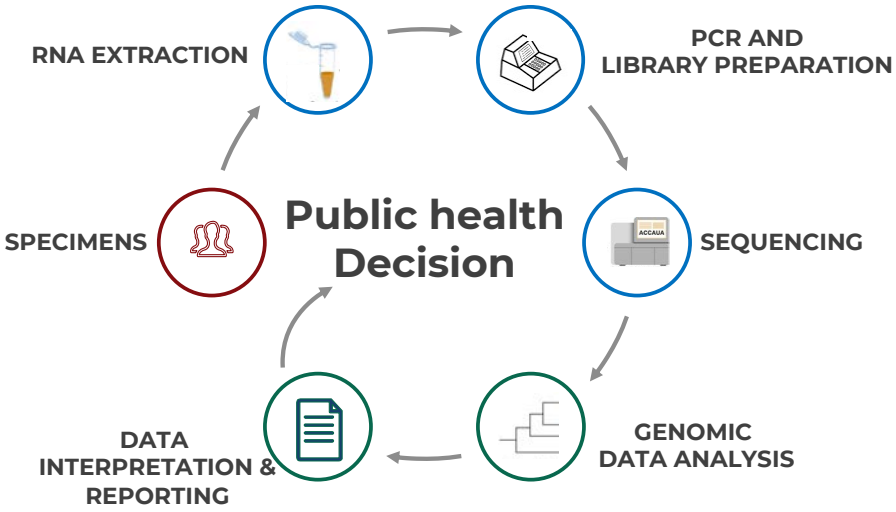
SARS-COV-2 sequencing in Africa | Sampling & sequencing strategy

Key lessons:

Sampling & sequencing strategy:

- Sample quality is key to have high quality genomes
- Samples must be accompanied by Metadata – clinical and epidemiological data to inform the interpretation of the genomic data
- Metadata templates are available:
  - PHA4GE: https://github.com/pha4ge/SARS-CoV-2-Contextual-Data-Specification
  - Africa CDC – https://forms.gle/VJsHiiwhdcZov36K9



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SARS-COV-2 sequencing in Africa | Sampling & sequencing strategy

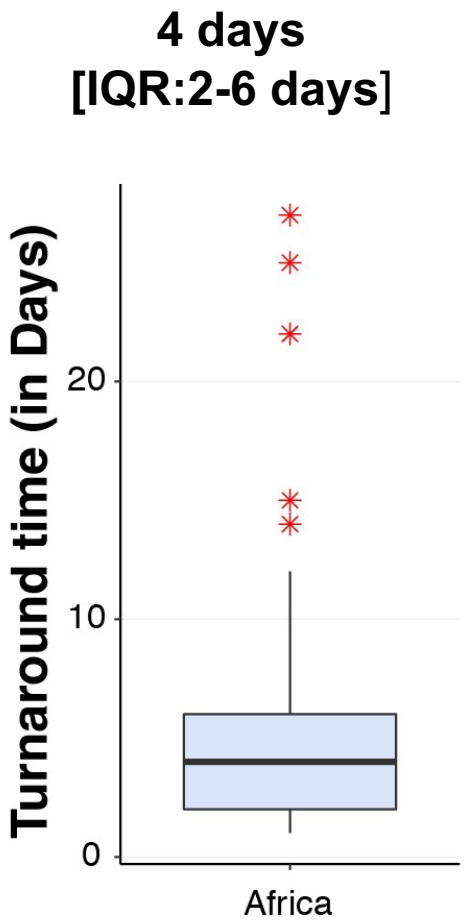
Sample referral network – challenges

Regulatory challenges:

- MTA
- Import & export permits

Cost of shipment:

- Courier efficiency & connectivity
- Dry ice & packaging materials
- COVID-19 related disruptions



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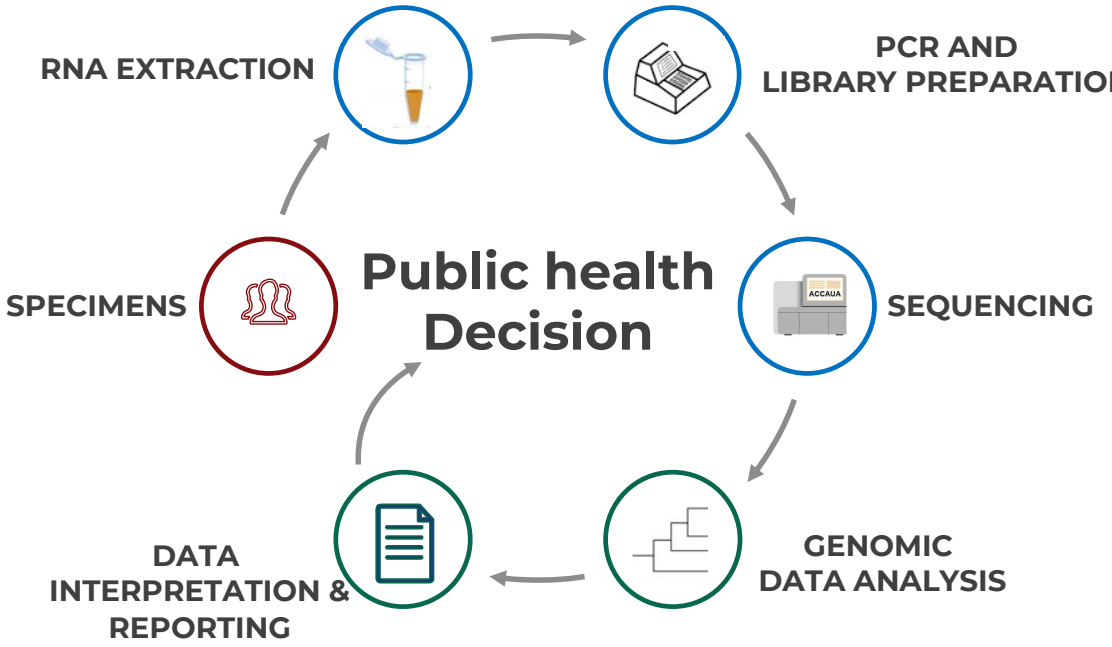
SARS-COV-2 sequencing in Africa | Laboratory systems

Key considerations and lessons

- Genomics infrastructure
- Well trained workforce
- Quality assurance
- Turnaround time



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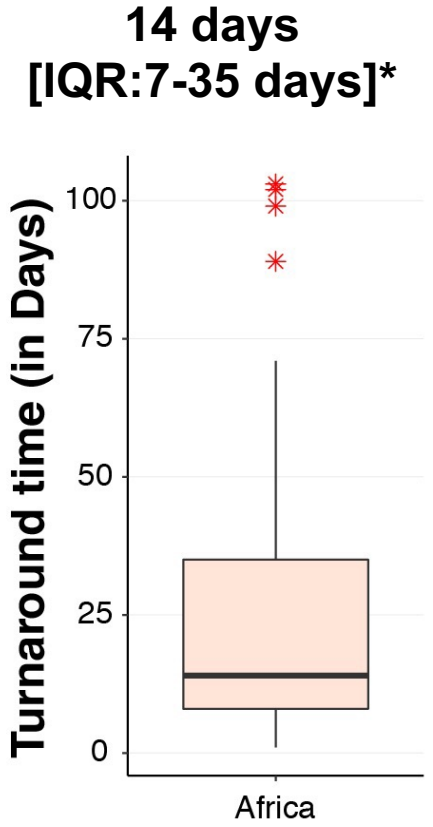
SARS-COV-2 sequencing in Africa | Laboratory systems

Key challenges lessons:

- Trained personnel, throughput and automation
- Turnaround time is key
- Reagents & supplies – global demand and supply chain disruptions
- Quality assurance – lack of EQA PT panels for genomics
- Sustainability and continuity of support is key



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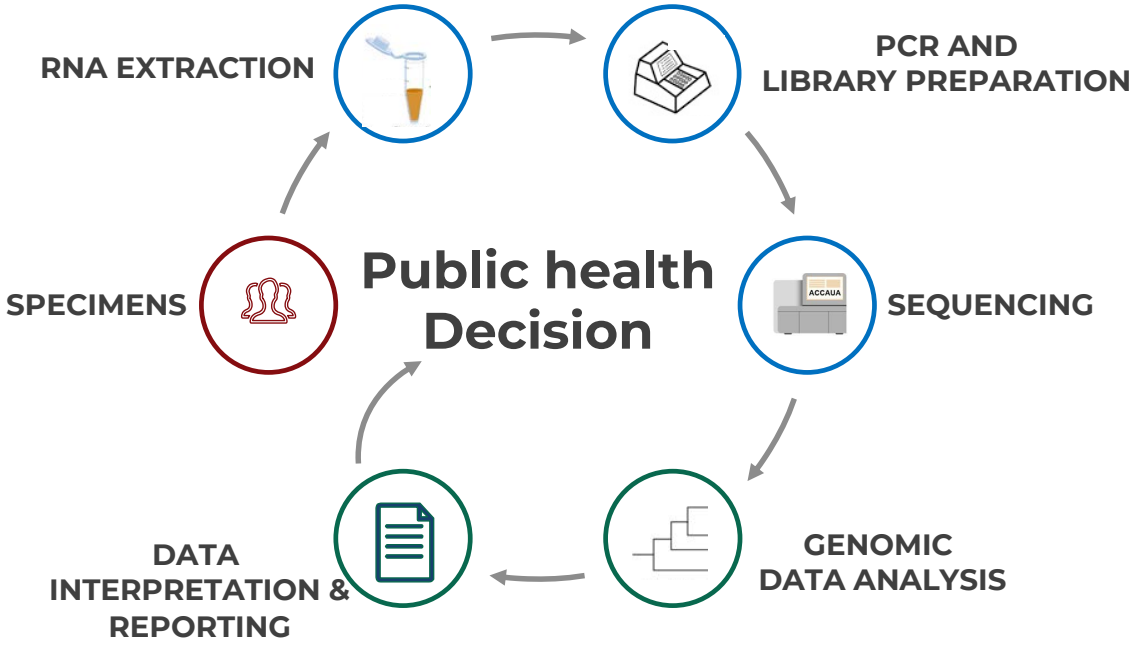
SARS-COV-2 sequencing in Africa | Data systems

Key considerations and lessons

- Data infrastructure
- Well trained workforce
- Quality assurance of the data
- Turnaround time



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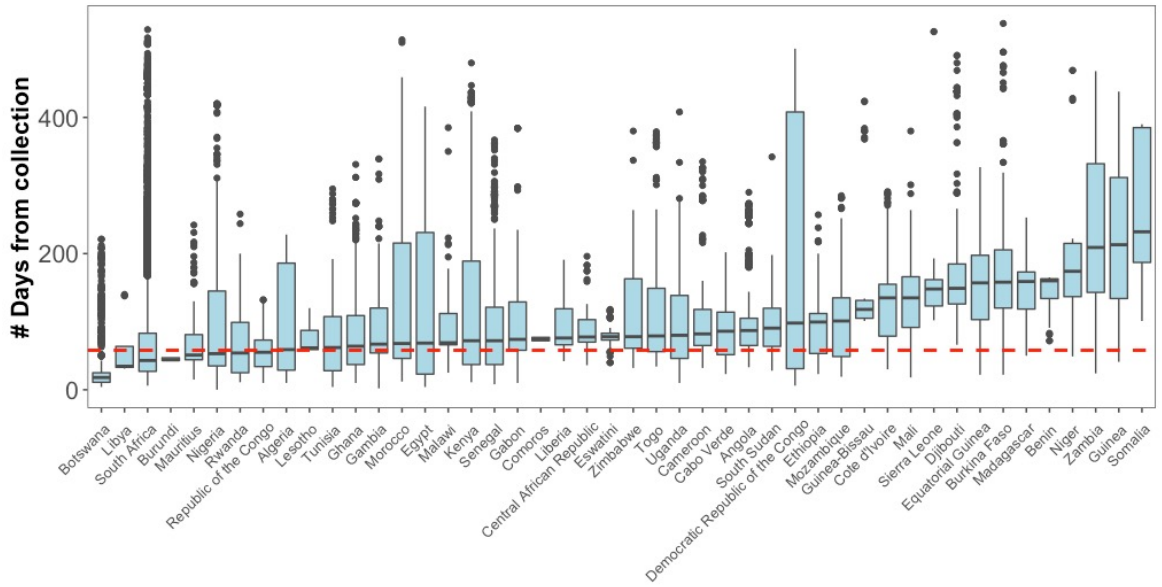
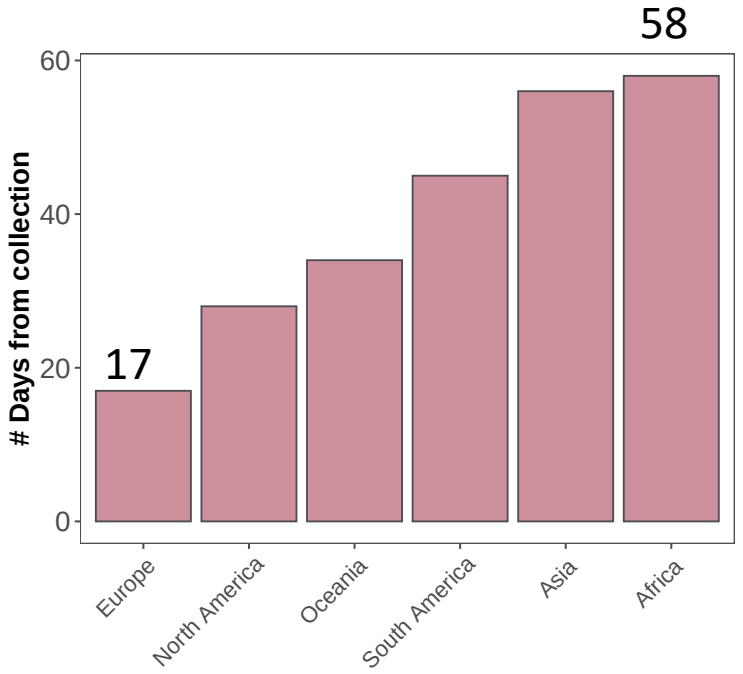
SARS-COV-2 sequencing in Africa | Data systems

Key challenges:

- Trained personnel in Bioinformatics
- Data sharing - Turnaround time is key





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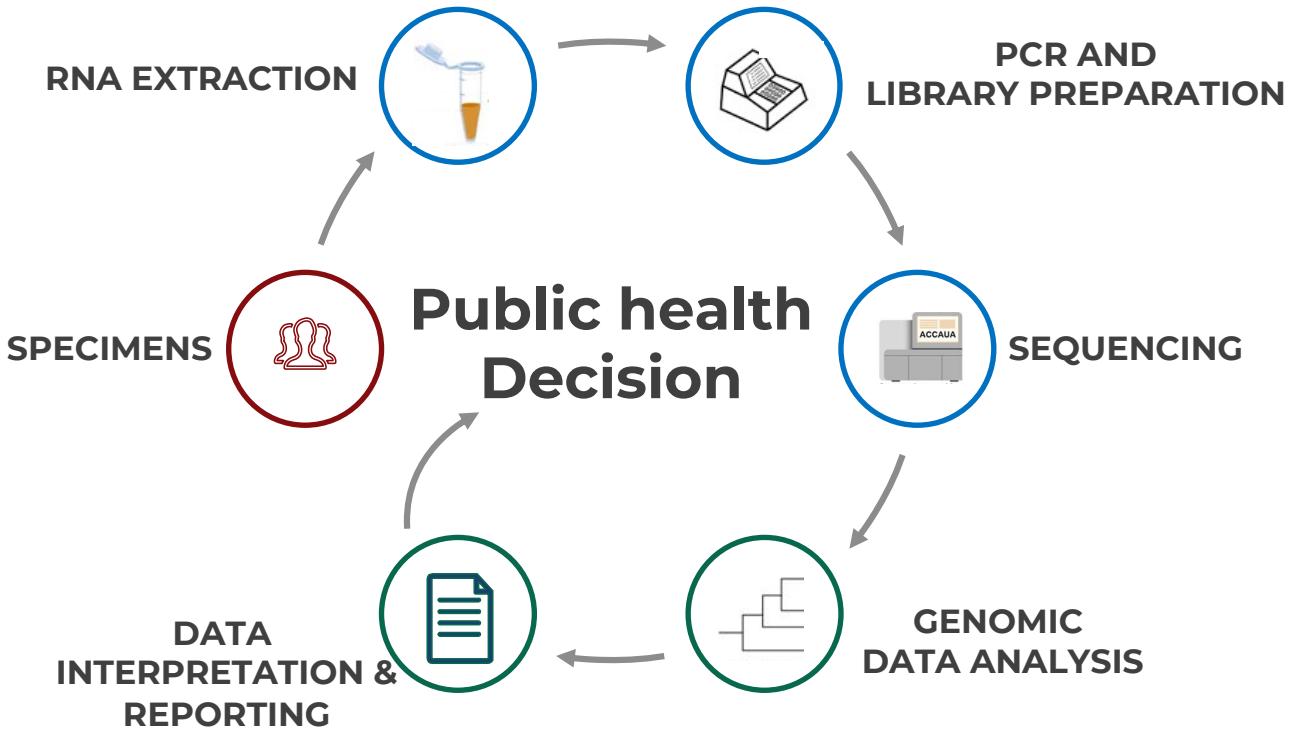
SARS-COV-2 sequencing in Africa | Data Utilization

Key considerations for data use

- Representative data
- Complete data & Metadata
- Quality assured
- Timely generated & analyzed
- Linked with the public health system
- **Inform public health decision making**



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How can we build on these efforts for pandemic preparedness and diseases surveilliance in Africa?

How do we use the network for other use-cases?

	Diagnosis	Surveillance	Vaccine Efficacy	Outbreaks	Transmission	Reservoirs
Emerging/Re-emerging Diseases	●	●	●	●	●	●
Malaria		●			●	
TB	●	●			●	
HIV		●			●	
Cholera		●			●	
Meningitis		●	●		●	
IPD		●	●		●	
AMR		●		●	●	
Polio		●	●	●	●	
NTDs		●			●	●

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Africa PGI aspires to create a unique platform for partnerships to effectively implement and translate pathogen genomics into public health action

Coordination

for multi-pathogen and integrated implementation of public health pathogen genomics across Africa

Collaboration

to develop and deploy state-of-the-art technologies and tools to translate genomic data into public health action

Commitment

to adopt enabling mechanisms, build trusted partnerships, and ensure long-term sustainability

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