Policy and Action
Expanding Genomic Sequencing Capacity in Africa

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Overview | Genomics at Africa CDC

2017 Africa CDC officially launched

Continental assessment

2019 Africa CDC Institute of Pathogen Genomics launched

2020 *Africa PGI was launched*

COVID-19 Response

2023 *Africa PGI 2.0 was launched*

2024 Africa CDC Institute of Genomics is under formulation

Africa CDC Institute of Genomics

- Pathogen Genomics
- Bioinformatics and Data
- Human Genomics and Precision Medicine

Overview | Genomics at Africa CDC

ENABLE
Create enabling and sustainability mechanisms for the integration of genomics in public health systems

STRENGTHEN AND DEMOCRATIZE
Strengthen sequencing and bioinformatics capacity and develop workforce in genomics and bioinformatics to deliver at speed, scale, and quality

NETWORK
Build a functional continent-wide network of laboratories, bioinformatics, data systems and human resource capacity

SHARE
Establish a continent-wide sample referral and data sharing strategy, systems, and governance to promote trusted, quality assured and timely data sharing

UTILIZE
Support the design and implementation of high-impact public health priority genomic use-cases and facilitate the utility of genomics data for policy and decision making

Building foundational capacity and workforce

Africa CDC – Africa Pathogen Genomics Initiative

Africa CDC and partners support Member States in establishing foundational capacity (focus on pathogens)

11	**NextSeq 2000/1000/550**
10	**GridION Systems**
16	**Automated liquid handlers**
14	**MiSeq Systems**
25	**MinION Systems**
33	**Servers/high performance computers**
10	**MiniSeq & iSeq**
18	**Tapestation/ Bioanalyzers/**
+75	**PCR/qPCR/ ancillary equipment**

- *Africa CDC's approach is line with action plan **A2 Strengthening bioinformatics and research infrastructure***
- ***Optimized expansion is urgently needed!***
- ***Sustainability mechanisms are also critical***

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Building foundational capacity and workforce

Africa CDC – Africa Pathogen Genomics Initiative

Africa CDC Support Member States in establishing foundational capacity

1000
Trainees

53
Member States

40%
Female

Boosting pathogen genomics and bioinformatics workforce in Africa

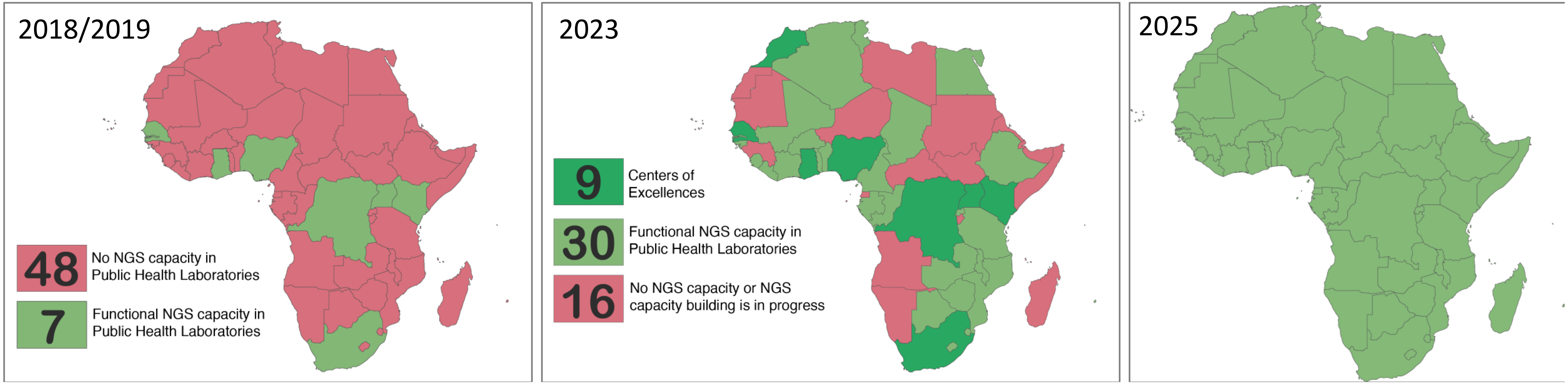
Harris Onywera, Pascale Ondoa, Faith Nfii, Ahmed Ogwell, Yenew Kebede, Alan Christoffels, Sofonias K Tessema

CrossMark

Africa CDC's approach is line with action plan ***A3 Capacity building of PM data generators***

NGS capacity is expanding in Africa

NGS capacity for pathogen sequencing - Operates under a hub-spoke model



*as of June 2023

*Africa CDC's approach is line with action plan **A16 Regional consortia/hubs***

Current Capacity

This capacity was built to respond to the COVID-19 pandemic but leveraged to respond to other outbreaks such as

- Ebola in DRC and Uganda
- Marburg in Tanzania and Rwanda
- Mpox clade 1b discovery
- Cholera in multiple countries
- other outbreaks across the continent

Africa Biobank Network (ABN) can be leveraged, strengthened, and expanded

ABN started with 11 countries – can be expanded to more institution and countries

- *Expansion of storage*
- *Data management*
- *Workforce development*
- *Modernization (BMIS)*
- *Visibility of stored isolates*
- *Governance*
- *Ethics*
- *Financing*

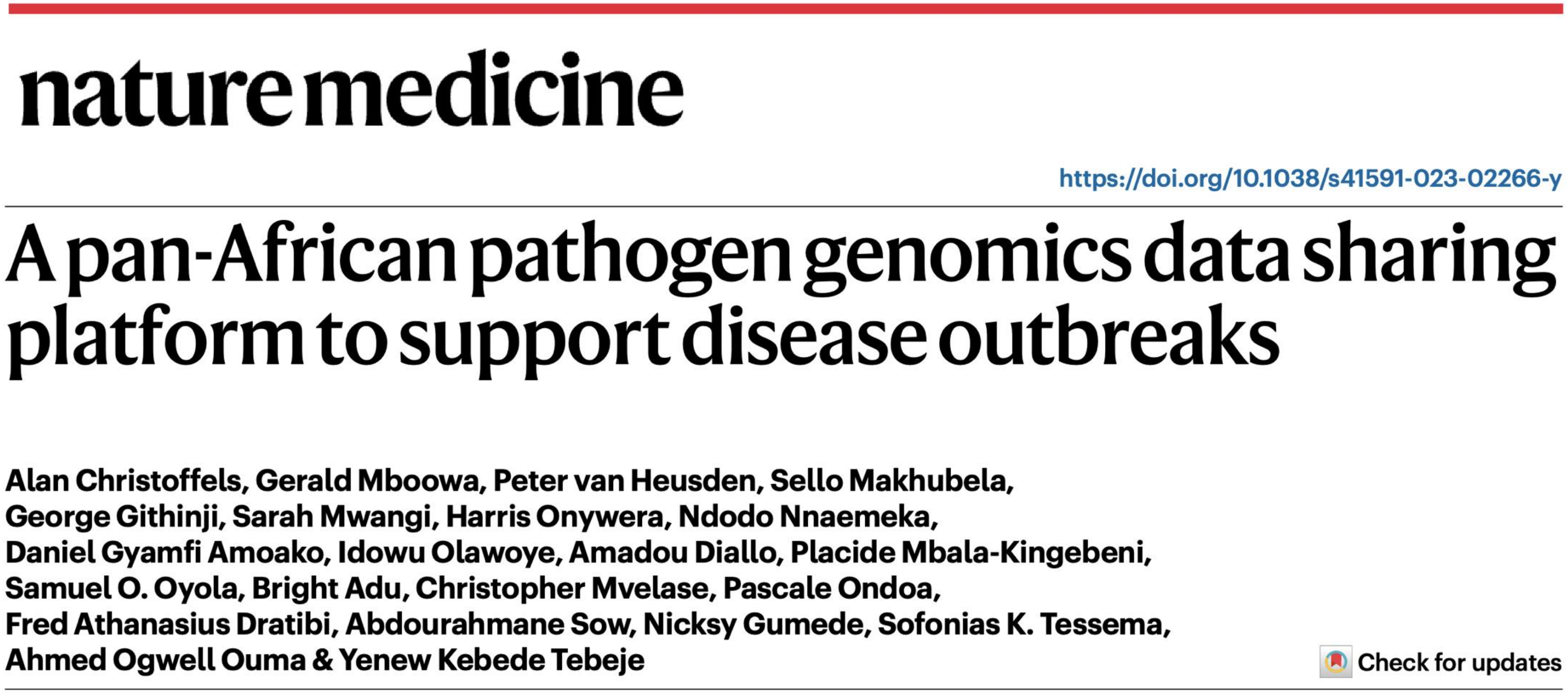
*Africa CDC's approach is line with action plan **A1 Biobank infrastructure/cohort network***

Unlocking barriers for data collection and sharing

Data Barriers in Africa

- Workforce development
- Data infrastructure
- Data quality
- Connectivity & cloud solutions
- Data standards
- Data governance & sharing

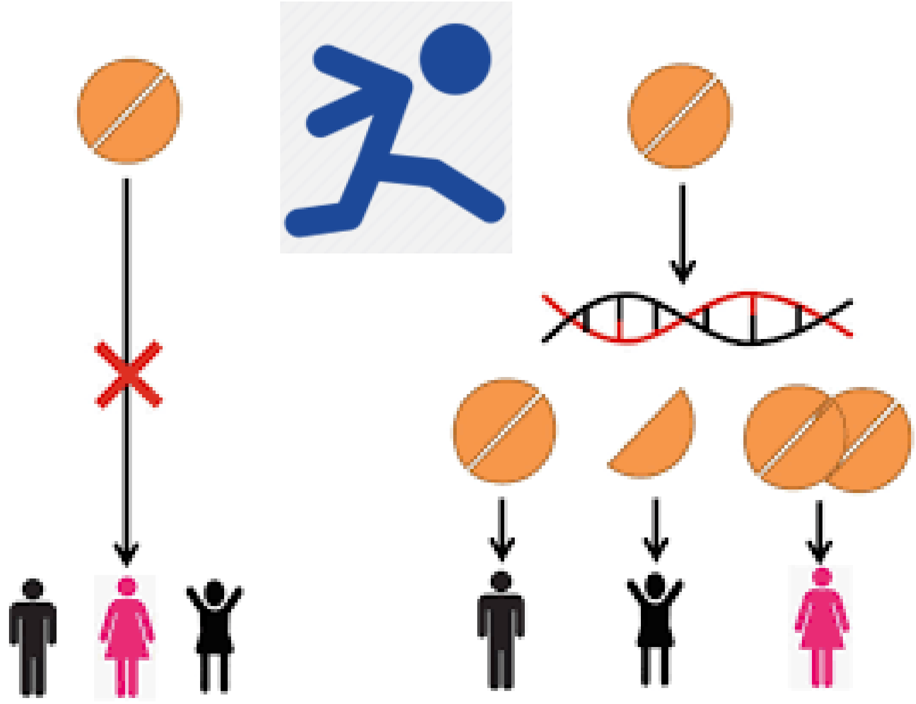
Timely sharing of quality assured genomic data



*Africa CDC's approach is line with action plan **A20 Regional and National Genome Archive; and A22 Genomic data network***

The way forward: Beating the clock

1. We must leapfrog to genomic medicine and the time is now



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The way forward: Beating the clock

2. Learn from others – and make it 'fit for the purpose and time'

Examples

European Genomic Data Infrastructure

DMI @CDC
DATA MODERNIZATION INITIATIVE

biobank uk

European data infrastructure for genomic and health data enabling secure federated data access

US CDC data modernization Initiative

UK biobank – since 2007

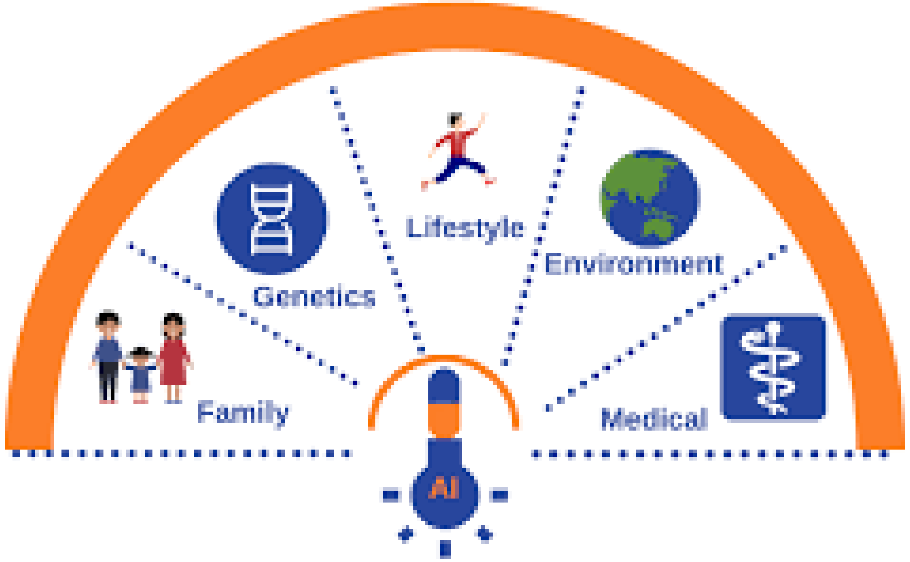
The way forward: Beating the clock

3. Leverage enabling mechanisms and act now

Strategy	Develop evidence-based strategies and policies at national, regional and global levels
Networks	National, regional, and continental networks
Priorities	National and regional priorities for genomics
Partnerships	"Single bracelet does not jingle". We have the late comer advantage

The way forward: Beating the clock

4. AI can unlock the barriers – ethical, social, and economic implications



The way forward: Beating the clock

5. Procure (and manufacture) locally – No to reagents and supplies in a suite case

Supply chain and customs major challenges

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We must do better

- **Coordinate, collaborate,** and **communicate**
- Genomics is revolutionary but **capacity needs to be expanded across the world**
- **Invest in African Genomics** to strengthen workforce and infrastructural capacity and unlock barriers
- **Build on the power of momentum, trusted partnerships, and leverage to** transition from projects to programs
- **Invest! Invest! Invest! – the return of investment in African Genomics is rewarding**

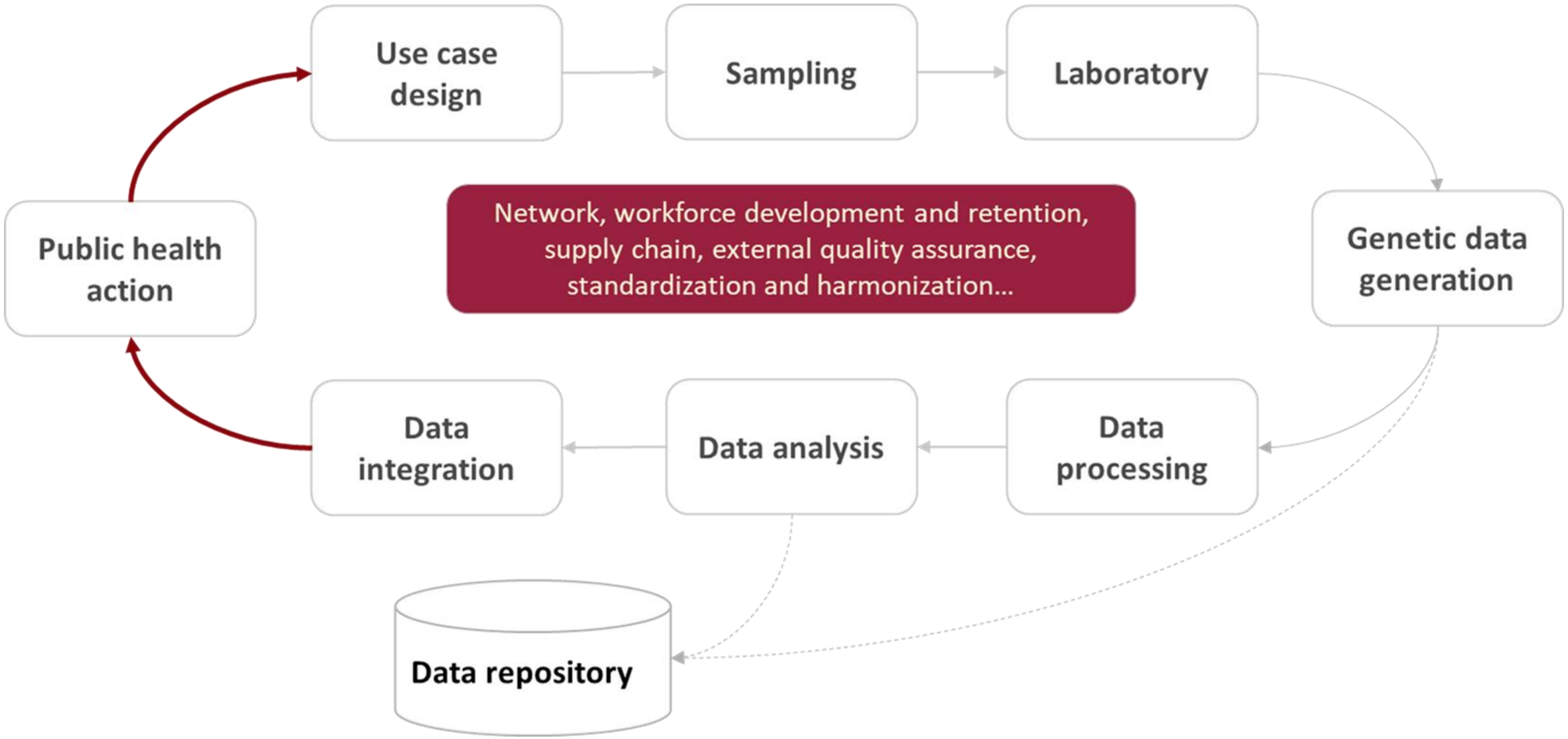
Supporting AU Member States in Developing Costed National Genomics Strategies

Towards integrating multi pathogen genomics leveraging on existing public health systems e.g. the TB tNGS

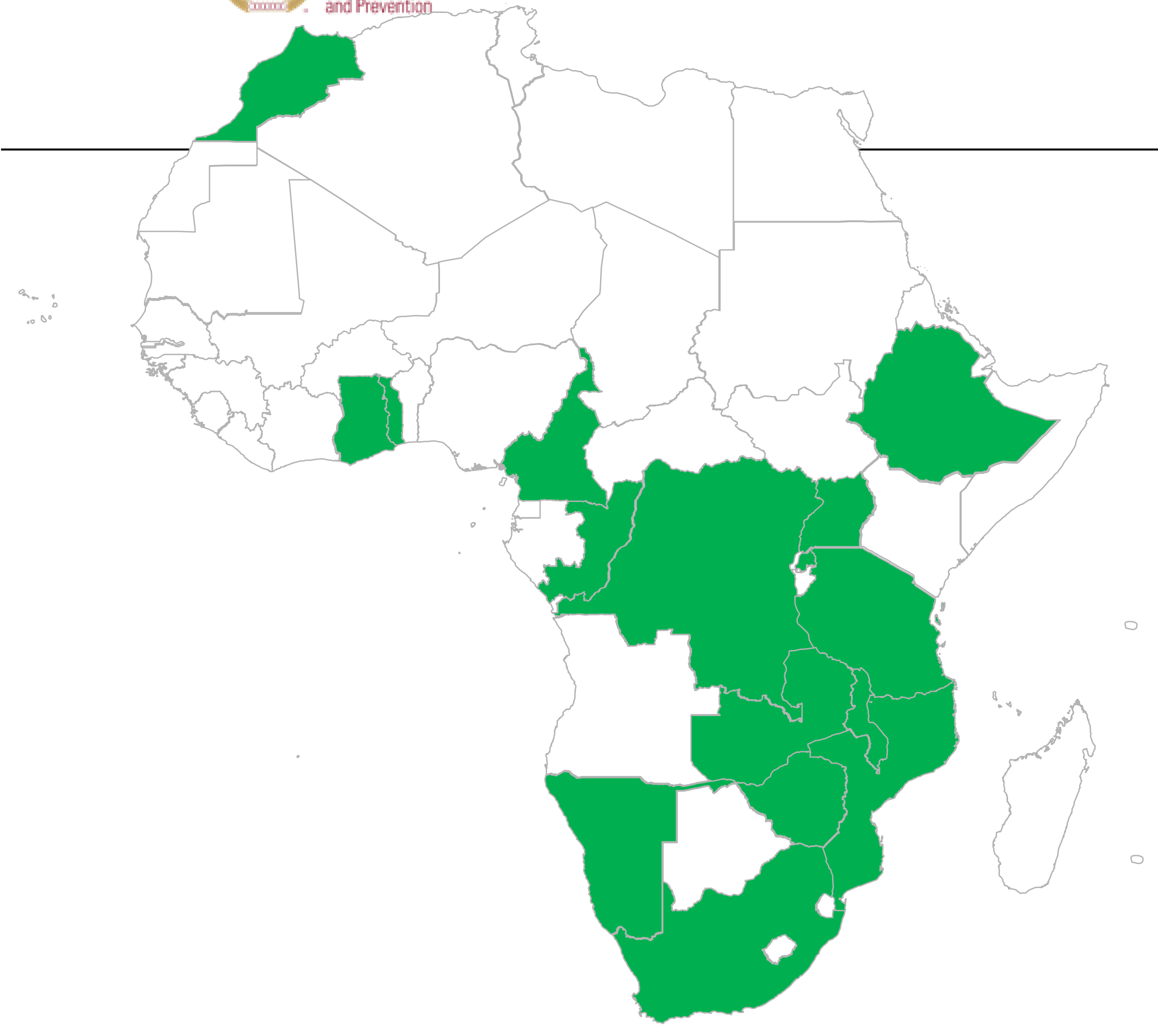
High-level summary of priority pathogens and genomic use cases for public health applications in Africa.

Group	Disease or pathogen	Potential genomics use case	Priority pathogens/use cases
I	Emerging and re-emerging diseases	Early warning surveillance, outbreak detection, investigation, and response	- ***Viral hemorrhagic fever (VHFs):*** *Ebola virus, Marburg virus, Crimean-Congo haemorrhagic fever (CCHF) virus, Lassa virus, Rift Valley fever (RVF) virus* - ***Influenza-like illness:*** *SARS-CoV-2, Respiratory syncytial virus (RSV), Influenza viruses, Avian influenza virus* - ***Arboviral diseases:*** *Yellow fever virus, Chikungunya virus, Dengue virus, and Zika virus* - ***Vaccine-preventable diseases (VPDs):*** *Mpox virus, Poliovirus, Rotavirus, Vibrio cholerae*, *anthracis, Rubeola (Measles) virus, Rubella virus, Yersinia pestis, Rabies virus (Rabies lyssavirus), Human papillomavirus (HPV)* - ***Meningitis:*** *Neisseria meningitidis, Streptococcus pneumoniae, Haemophilus influenzae* - ***Disease X –*** *detection and investigation of diseases of unknown etiology*
II	AMR pathogens	Monitoring the emergence and spread of AMR in Africa	- *Pathogens causing neonatal sepsis and hospital acquired infection - Klebsiella pneumoniae, and Escherichia coli, Acinetobacter baumannii, and Staphylococcus aureus* - *Salmonella enterica serovar Typhi,* - *Extended-spectrum β-lactamase (ESBL) producing Escherichia coli surveillance in a One health TriCycle framework including human, animal; and the environment sectors* *HIV and TV drug resistance*
IIII	Malaria	Monitoring drug, diagnostic, and insecticide resistance; and elucidating transmission dynamics	- *Parasite: Plasmodium falciparum and Plasmodium vivax* - *Vector: Anopheles mosquito species*

Multi Pathogens Genomics End to End Framework



Targeted countries



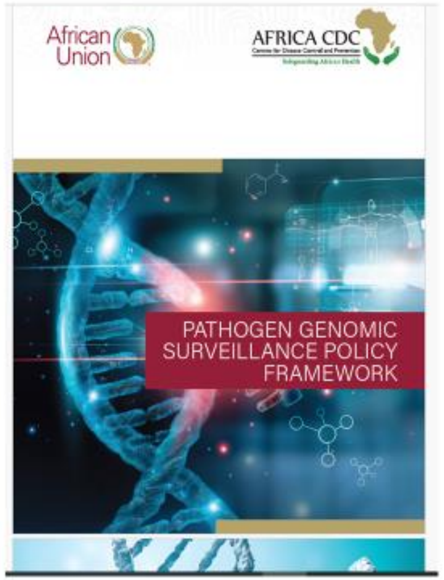
- 16 countries
- DR Congo, Uganda, Mozambique, Ethiopia, Cameroon, Malawi, Zambia, Republic of Congo, Zimbabwe, Ghana, Morocco, Togo, South Africa, Tanzania, Rwanda, Namibia,

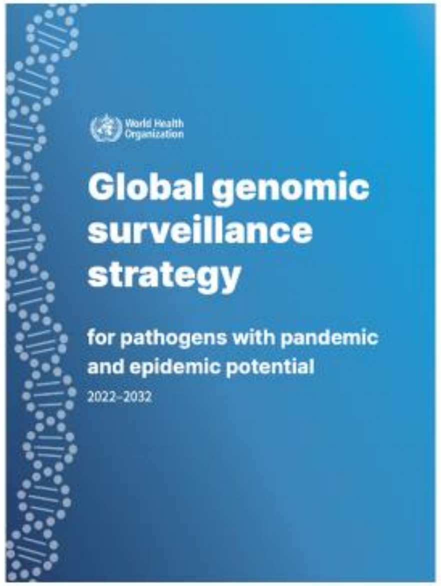
Strategy Development Process: Approach

- Regional workshop, in-country multi-sectoral stakeholder workshops for finalization and validation, then launch of the strategy

- Utilizing collaborative, one-health approaches, encompassing situational analysis, SWOT Analysis and integrating national, regional and global frameworks

Leveraging Africa CDC Pathogen Genomic Surveillance Framework, WHO Global genomic surveillance strategy





Continental: Genomic Surveillance Policy Framework: Africa CDC

Priority area 1 - Capacity expansion

- Assessment of pathogen genomic surveillance readiness
- Multi-sectoral approach
- Coordination capacity

Priority area 2 - Workforce development and retention

- Workforce capacity and competency
- Working environment
- Inclusion of pathogen genomic surveillance workforce national public health policy
- Training and development of the workforce

Priority area 3 – Coordination, governance and leadership

- Review of national health strategic policies and plans
- Networks
- Implementation of a continuous improvement strategy
- Use of research and information in strategic decision making

Priority area 4 - Quality Management Systems (QMS)

- Standards, accreditation, and regulation
- Laboratory standardization processes and methodologies
- Quality control and quality assurance

Priority area 5 – Supply chain and access

- Strengthening supply chain management
- Laboratory commodities security strategy
- Quantification of laboratory commodities
- Comprehensive approach to supply chains

Priority area 6 – Financing and sustainability

- Health financing
- Establishment of a sustainable funding models
- Establishment of cost-effectiveness plan and M&E strategy

Priority area 7 – Data analysis, sharing and technology

- Data scientists, bioinformaticians, and researchers
- Computing infrastructure
- Standardized data arrangements
- Data analysis, publication and visualization
- Data sharing
- Data storage, control and ownership

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Global Genomic Surveillance Strategy: WHO

Objective 1: Improve access to tools for better geographic representation

- Map and monitor capacity landscape
- Deliver contextualized technology and innovation solutions
- Stimulate innovation and research to address local to global needs
- Shape a sustainable and quality market to maximize access

Objective 2: Strengthen the workforce to deliver at speed, scale and quality

- Training packages in genomics and bioinformatics
- Promote community of practice to disseminate & share good practices
- External quality assurance programs for genomics and analytics
- Knowledge exchange to build or strengthen capacity

Objective 3: Enhance data utility for streamlined local to global public health decision-making and action

- Meta data standards
- Data sharing principles
- Data sharing agreements
- Harmonized protocols, norms, standards and reference materials

Objective 4: Maximize connectivity for timely value-add in the broader surveillance architecture

- Facilitated data, specimen and information sharing
- Increase network linkages at local, regional and global levels
- Targeted collaboration with One Health partners

Objective 5: Maintain a readiness posture for emergencies

- Surge exercises to test systems
- Joint projects for maintaining capabilities and capacities
- After action reviews following events to assess & address lessons learnt

Guiding Principles

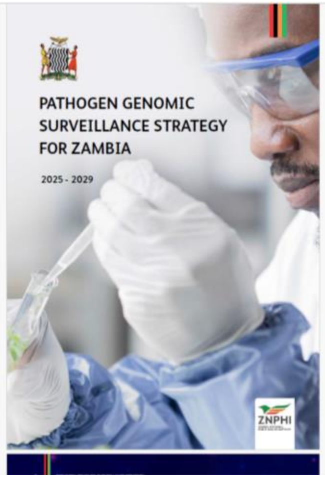
- **National Ownership**
Countries must lead genomic strategy development with input from all stakeholders, ensuring engagement and buy-in for sustainable implementation.
- **Public Health Focus**
Genomic tools are essential for preparedness, outbreak detection, tracking antimicrobial resistance, and informing timely treatment and control measures and priority pathogen.
- **Multi disciplinary partnerships**
Strengthen partnerships at local, national, regional, and global levels for coordinated and collaborative surveillance efforts.

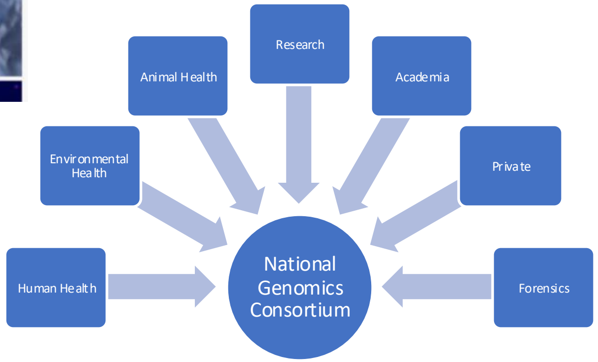
Equitability
A fair, objective, unbiased, and equitable approach should be designed in the deployment of resources for pathogen genomics
- **Sustainability**
Establish long-term, domestic funding and a reliable supply chain to maintain genomic surveillance infrastructure and resources.
- **Data Governance**
Establish standards and principles for data collection, storage, sharing, and analysis in alignment with national and AU guidelines.
- **One Health Approach**
Integrate pathogen genomics with human, animal, and environmental health sectors to address zoonotic and cross-species disease threats.
- **Emergency Preparedness**
Incorporate pathogen genomics into predictive systems for rapid response to emerging health threats at all levels.

Early Successes

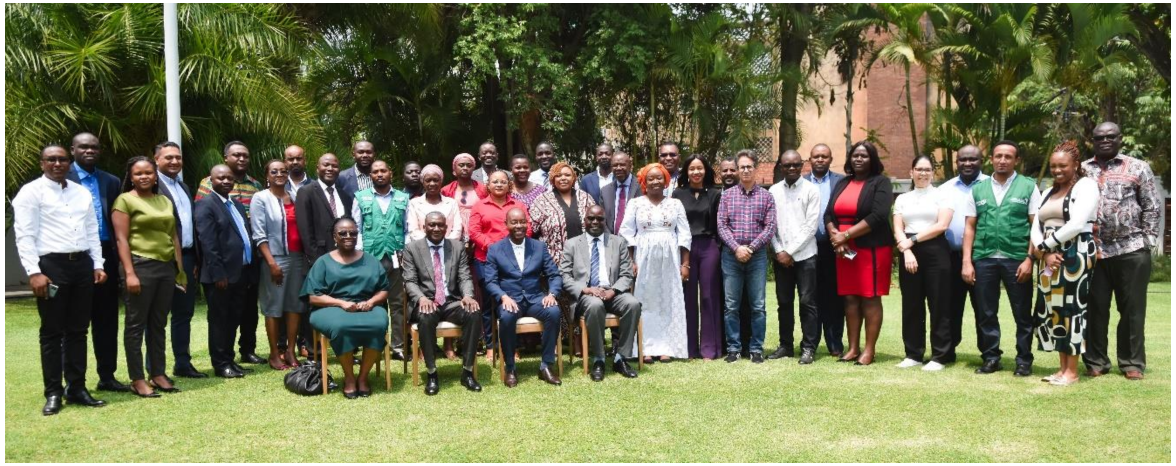
- 3 countries have launched their national strategies: These include
  - Ghana, Ethiopia (2024)
  - Zambia (2025 Q1)
- 8 countries completed validation workshops and launching in Q2
  - DR Congo, Uganda (2024 Q4)
  - Malawi, Republic of Congo, Zimbabwe, Togo, Mozambique, Rwanda
- Establishing and formalizing national genomics consortia: Multi stakeholders (academia, research, private and public health laboratories including one health
  - Launching coincide with signing of MoU
- Integrating human and/or forensic genomics into a national genomics strategy:
  - Uganda, Malawi, Mozambique, Rwanda

Zambia Launch Meeting, 9 Feb 2025





Early Successes



Regional workshop: Lusaka, Zambia, Oct 28 to 30, 2024

Uganda Workshop: Kampala, 12-13 Dec 2024

Zambia Validation Workshop: Lusaka, 14-15 Nov 2024

Malawi workshop: Lilongwe, Feb 24 - 25, 2025

Early Successes

Republic of Congo workshop: Brazzaville, Feb 27-28, 2025

Togo Validation Workshop: Lome, March 3-4, 2025

Mozambique Validation Workshop: Maputo, March 19-21, 2025

Rwanda Validation workshop: Kigali, March 31- April 1, 2025

Lessons Learned

- Collaboration between Africa CDC-Africa PGI with in country partners (Global Fund, WHO, US CDC, CHAI etc) is crucial in developing a comprehensive national strategies
- Seamless integration into existing public health programs or frameworks helps streamline implementation and maximize impact
- Prioritizing early engagement of all relevant sectors, rather than seeking buy-in on a completed document, is crucial for ensuring the strategy's relevance, feasibility, and ultimate success
- Comprehensive partnerships between public and private laboratories, academia, research institutes and other sectors will ensure sustainability of genomics in Member States. Grants application as a consortium
- Coordinated action among stakeholders to improve cross-sector learnings and address supply chain related challenges eg through PSM COP (Africa CDC, ASLM, CHAI)

Supply chain challenges

In African, among the matters that complicate the supply chain space, particularly for pathogen genomic sequencing include;

- Poor logistic infrastructure which limits the smooth and efficient flow of cold chain cargo intra and extra continentally and
- Heterogenous and stiff regulatory environments, specifically with regards to customs processes and cross-border regulations
- Lack of technical capacity within the laboratory networks specifically in forecasting, procurement and logistics.
- Lack of channel partner capacity to support sales, installation, training and maintenance support of Genomic Sequencing equipment and supplies

Short, medium and long- term solutions for the complex supply challenges

Advocacy – Advocacy by Africa CDC on (i) Equipment, Reagents and consumables, (ii) IT Systems and maintenance support (iii) Bioinformatics and data management.

Regulation – Engagement between various ministries and supply chain subject matter experts, to ensure more streamlined regulatory mechanisms

Engagement – with non-governmental organizations such as the Africa Medical Supply Platform (AMSP) and local manufacturers, donors in the medical supply chain space,

Commitment – from primary manufacturers e.g. namely Oxford Nanopore Technologies, Illumina and BGI in installation, trainings, service agreements and supplies via distributor networks.

Bioinformatics capacity building

THANK YOU

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ACKNOWLEDGMENT

World Health Organization African Region

BILL & MELINDA GATES foundation

mastercard foundation

The ROCKEFELLER FOUNDATION

illumina®

ASLM AFRICAN SOCIETY FOR LABORATORY MEDICINE

CDC

AFROSCREEN Sequencing capacity-building in Africa

AFD AGENCE FRANÇAISE DE DÉVELOPPEMENT

ROBERT KOCH INSTITUT

UK Health Security Agency

AFRICAN DEVELOPMENT BANK GROUP

Africa Public Health Foundation

APHL

- NPHIs
- TWGs
- CoEs
- ALL PARTNERS (Technical, logistics and supply chain partners)

FIND

Oxford NANOPORE Technologies