World Health Organization

Global genomic surveillance strategy

for pathogens with pandemic and epidemic potential

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ABBREVIATIONS AND ACRONYMS

To be developed

1. INTRODUCTION

Genomic surveillance is transforming public health action by providing a deeper understanding of pathogens, their evolution and circulation. Used with clinical, epidemiological and other multi-source data, genomic data for pathogens with pandemic and epidemic potential inform risk assessments and can support development of vaccines, therapeutics, diagnostic assays, and decisions on public health social measures. New technologies in sequencing and bioinformatics have emerged in recent years, and some countries have made major strides in establishing capabilities and capacities.

The COVID-19 pandemic has exposed challenges for genomics in public health surveillance systems. Laboratories and networks dedicated to specific disease threats such as influenza, tuberculosis, measles/rubella and polio, were mobilized to support SARS-CoV-2 genomic surveillance efforts. In some contexts, repurposing capacities came at a cost to the disease programs and their own surveillance and diagnostic needs. In addition, the scale, geographic representativeness, timeliness, quality, comparability and integration of genomic surveillance outputs with epidemiological and clinical surveillance findings remain weak.

We are now at an important nexus. Genomic surveillance has a clear role to play and there is growing global recognition among countries, partners and other stakeholders of the need to scale up in the context of COVID-19. In January, July and October 2021, the International Health Regulations (IHR) Emergency Committee for COVID-19 recommended increasing global sequencing capacities, encouraging the rapid sharing of data including meta-data, and for WHO to actively support countries to strengthen systematic genomic surveillance. Further, in its report to the Seventy-fourth World Health Assembly in May 2021, the Independent Panel for Pandemic Preparedness and Response recommended regular funding for the delivery of specific global public goods including genomic sequencing as part of pandemic preparedness. This culminated in the 74th World Health Assembly resolution 74.7 on strengthening WHO preparedness for and response to health emergencies. The Assembly urged Member States to increase their capacity to detect new threats, including through laboratory techniques, such as genomic sequencing.

While recognizing its specialized contribution, genomic surveillance comes at a high cost technically and financially especially in resource-limited settings. Therefore, public health authorities need to carefully consider the value-add of such an investment, including in the broader surveillance and public health landscape. Questions include: how should country capacities developed for genomic surveillance of SARS-CoV-2 be strengthened in a cross-cutting way to serve the rubric of current disease program needs as well as for future public health threats? How can this be done in a way that is forward-thinking, coherent and cognizant of existing initiatives?

Historically, similar questions were asked about scaling up laboratory services generally for diagnosis and care. Countries and partners recognized the need for an integrated approach that sustained improvements in laboratory systems as part of the greater health system from a public health perspective. Countries, supported by donors and partners, were encouraged to take a strategic approach that integrates laboratory support for public health disease priorities, and to strengthen laboratory capacities in a way that fosters national ownership and collaboration including in building public-private partnerships and innovation. Importantly, systems need to be trusted by users, covering both the public and private spectrum.

In the context of public health emergencies, there is further impetus for taking cross-cutting approaches. The International Health Regulations (IHR) require Member States to develop national capacity for the detection, investigation and reporting through WHO of potential public health emergencies of international concern. Reliable and accessible laboratory services that produce quality-assured results in a timely manner is critical for any country's surveillance capacity and early warning function, so that information is available on public health threats that can then rapidly trigger public health interventions.

Specialized laboratory techniques such as genomic sequencing are increasingly being used in the investigation and acute management of diseases that could constitute public health emergencies including cholera, Ebola virus disease and polio. These programs also have momentum to embed genomic sequencing capacities at country level and integrate with other disease surveillance systems. For example, the Global Polio Eradication Strategy 2022-2026 recognizes that the Global Polio Laboratory Network (GPLN) serves as the gold-standard in poliovirus surveillance and molecular epidemiology has been used throughout recent outbreaks of Ebola virus disease (EVD) to assess transmission chains.

For influenza, the Global Influenza Surveillance and Response System (GISRS) has been using the genomic sequencing as an integral part of response to outbreaks of zoonotic influenza and pandemic preparedness as well as seasonal influenza surveillance to inform influenza vaccine virus recommendations and for monitoring of susceptibility to antivirals. In March 2020, GISRS was leveraged to integrate SARS-CoV-2 into sentinel systems for influenza-like illness (ILI), acute respiratory infection (ARI) and severe acute respiratory infection (SARI) to inform policy and the national response to the COVID-19 pandemic.

However, with the need to sustain genomic surveillance in perpetuity as a growing component of public health intelligence, work is underway to transform approaches and shift genomics from academic research into routine public health practice. The transformed approach includes supporting countries to establish and take ownership of rigorous quality standards for surveillance and shifting laboratory testing and sequence analysis to the country level, where possible.

Building on the lessons of the past, the lessons being learnt from the COVID-19 pandemic and thinking ahead to future-proof and sustain investments, this strategy focuses on the specialized role of genomics as a cross-cutting capacity within the broader health system from a public health lens. The strategy does not focus on one pathogen or a specific public health threat. Rather, it aims to provide a unifying vision for using genomics as a powerful addition to address public health needs for pandemic and epidemic preparedness and response broadly. It seeks to build on the strengths and capacities that exist through other initiatives, link and embed within the broader surveillance and public health architecture, and identify opportunities to establish capacities, partnerships and systems including norms and standards where needed.

The strategy focuses on genomic surveillance for pathogens with pandemic and epidemic potential, and will anchor and complement initiatives that operationally strengthen global cooperation. As the genomic surveillance use cases extend beyond pandemic and epidemic preparedness and response, the strategy facilitates the coordination and dialogue with other disease control programs and surveillance networks to strengthen the cross-cutting essential public health laboratory functions underpinning genomics holistically.

The strategy articulates the overarching goal, objectives and strategic actions needed. These are dependent on commitments from countries, partners and WHO for their implementation.

2. TARGET AUDIENCE

The document is intended to be used at national, regional and global level. Target audiences include national health authorities, partners, donors, public health officers, academia, private sector, laboratory specialists, and technical or non-technical experts seeking an overview on integrating genomic surveillance into the broader public health architecture for the preparedness and response to pandemic- and epidemic- prone pathogens.

3. STRATEGY GOAL

The goal of the strategy is that genomic surveillance for pathogens of pandemic and epidemic potential is strengthened and scaled for quality, timely and appropriate public health actions within local to global surveillance systems.

The strategy will equip public health agencies to incorporate genetic sequencing data (GSD) that enable the connections across country, regional and global levels to prepare for and respond to pandemic- and epidemic- prone pathogens. There are five objectives which will support the achievement of the strategy's goal (Figure 1). Each objective is underpinned by a set of strategic actions. Collectively, these objectives outline the features of the ecosystem that will contribute to the enhanced integration of genomic sequencing across local, regional and global surveillance and response efforts for pathogens of pandemic potential and persistent infectious disease threats.

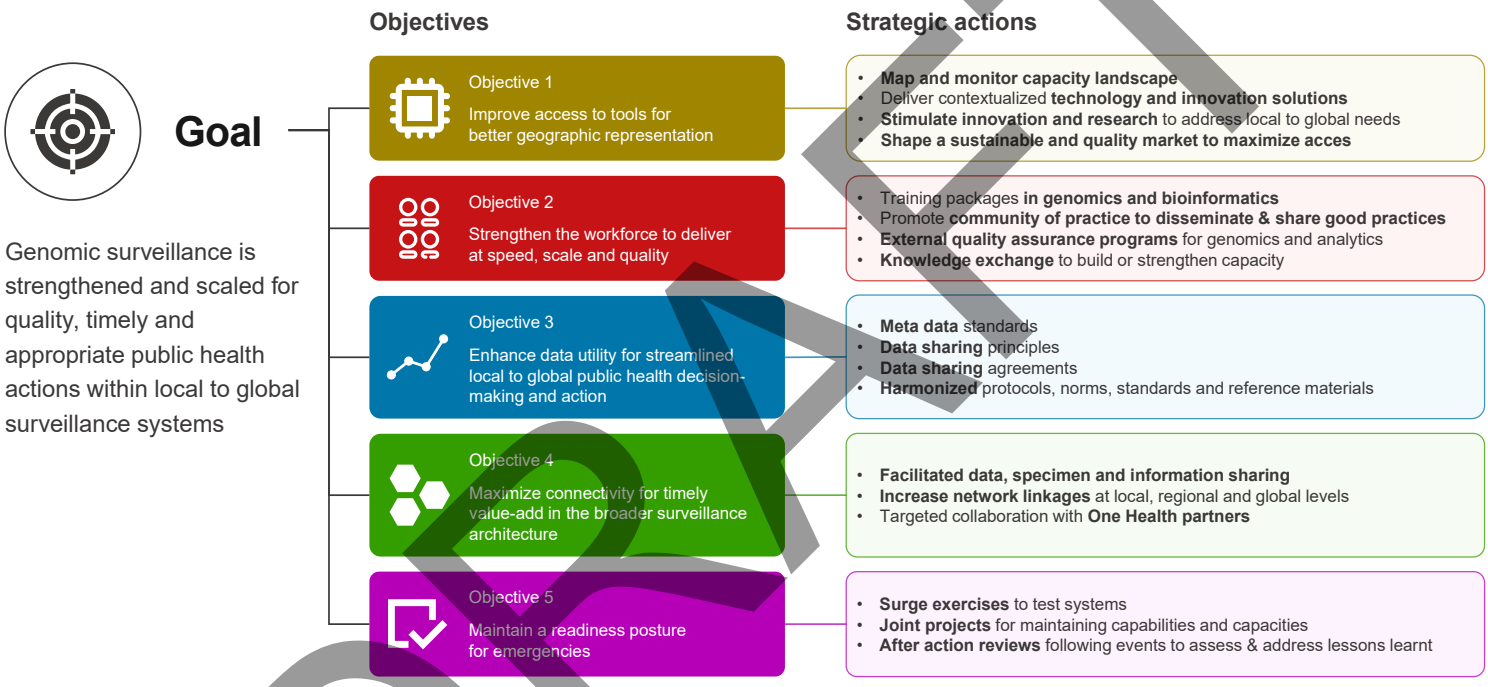

Figure 1: Results hierarchy of objectives and strategic actions

4. OBJECTIVES

The five objectives are presented below along with the role of the WHO secretariat in facilitating and advancing the strategy's goal globally.

Objective 1: Improve access to tools for better geographic representation

This objective focuses on ensuring appropriate technology and infrastructure are available; the aim is to not only expand access to **accurate and sensitive laboratory systems**, but also expand computational infrastructure and provide the right **analytics to interpret and contextualize the very rich and complex information generated**. These tools should be **adapted to local needs** (infrastructure, human resources, decentralized support) and available at costs that are applicable for all countries. Without optimized, simple, interoperable and affordable tools, genomic surveillance architecture will continue to be scaled

in an inequitable and unsustainable manner, leading to gaps and impaired early warning and response systems. The four strategic actions recognize that genomic sequencing and bioinformatics infrastructure are essential but must be implemented across geographies to be right sized to ensure sustainability.

Strategic Actions:

a. **Map and monitor capability and capacity landscape** to maximize efficiencies, availability and geographic representativeness.

b. **Deliver contextualized technology and innovation solutions** to ensure simple and optimized workflows to enhance access and information sharing.

c. **Stimulate innovation and research to address local to global needs** to promote the development of tools that are optimized to address global public health needs.

d. **Shape a sustainable and quality market to maximize access** to enable more equitable uptake and implementation of sequencing technology and associated bioinformatics and analytics.

Role of the WHO Secretariat

The role of the WHO Secretariat in improving access to the right tools is to develop and facilitate consensus-driven plans, to engage and convene funding and research partners and to promote, review and synthesize the generation and sharing of evidence and new developments, with a specific link to the WHO Research and Development Blueprint and vertical disease surveillance efforts. In addition, the WHO Secretariat across its global, regional and country offices, will promote harmonization to ensure needs at each level of the value chain are addressed.

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

This objective focuses on the establishment of an **enhanced technical workforce to enable country-ownership** to detect, monitor and respond. The aim is to have strengthened country capacity through **the creation of enabling resources and systems that are adapted to local and regional needs, while ensuring harmonization**. Without elevating the appropriate capabilities across geographies, efforts to engage policy makers, public health agencies and communities in prevention, control and response will be limited. The four strategic actions included below aim to promote the exchange of technical information, while promoting standardization and quality to ensure trust and confidence across the ecosystem.

Strategic Actions:

a. **Training packages in genomics and bioinformatics** for improved competencies and to facilitate evidence-driven decision making.

b. **Promote communities of practice to disseminate & share good practices** to enhance information exchange and cross-country engagement.

c. **External quality assessment programs for genomics and analytics** to ensure accuracy of data and trust in the system.

d. **Knowledge exchange programmes to build or strengthen capacity** to accelerate and amplify competencies, and pair institutions in collaborations to address common challenges.

Role of the WHO Secretariat

The role of the WHO Secretariat in strengthening capacity is to provide technical assistance and standards, to identify synergies and support integration across efforts, develop guidance to ensure the necessary investment in training to empower national agencies to have primary ownership and responsibility for genomic surveillance and coordinate support for additional expertise and surge capacity needs.

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

This objective focuses on promoting standardization to **enable interoperability** of systems to generate data and information that can be used for timely decision making and action. Explicit, minimum, harmonized norms, policies, standards and principles are required to avoid fragmentation of information that will hamper **local to global situational awareness and surveillance efforts**. In addition, rigorous quality standards are needed to enable accurate data and confidence in information. Recognizing the far-reaching potential of genomic surveillance and the various initiatives, it is imperative that the system is easy to contribute to, access and utilize, each of which requires a foundation of quality and trust. The four strategic actions associated with this objective aim to articulate the **baseline architecture necessary to facilitate appropriate transparency, attribution, exchange and collaboration**.

Strategic Actions:

a. **Meta data standards**, which recognize the importance of data privacy and national sovereignty, while balancing the importance of contextual information to accompany genomic sequencing data.

b. **Data sharing principles** that are widely agreed upon and explicit to foster transparency for rapid and equitable dissemination.

c. **Data sharing agreements** that are already in place in advance of acute events to promote timely collaboration and coordination.

d. **Harmonized protocols, norms, standards and reference materials** to facilitate high quality information sharing.

Role of the WHO Secretariat

The role of the WHO Secretariat in enhancing data utility is to provide guidance, and support country-led approaches, harnessing the work and expertise internally including by the Science Division and from different organizations and expert networks. In this capacity, WHO will provide leadership regarding ethical sharing, standardization and harmonization to promote high quality data generation and exchange, including convening advisory, technical and working groups to build consensus on protocols, norms, standards and principles. WHO will also support the generation of reference materials, where necessary, and develop or update guidance, including establishment of global targets linked to epidemiological context and monitoring frameworks to measure impact.

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

This objective focuses on ensuring connections across countries, disease areas and disciplines to maximize impact, alignment and efficiency, enabling more effective and timely preparedness and response actions. Genomic surveillance for pandemic and epidemic preparedness and response will be most successful by **encouraging linkages to build on existing strengths and capacities, requiring effective multi-sectoral partnerships and participation of a broad coalition of stakeholders**. The three strategic actions listed below serve to facilitate engagement across multiple levels.

Strategic Actions:

a. **Facilitated data, specimen and information sharing** to foster effective, rapid collaboration to drive public health action.

b. **Increase network linkages** at local, regional and global levels to minimize information siloes and maximize impact.

c. **Targeted collaboration with One Health partners** for comprehensive, integrated surveillance.

Role of the WHO Secretariat

The role of the WHO Secretariat in maximizing connectivity is to enable coordination and expand partnerships including with FAO, OIE and UNEP to facilitate transparency, openness and alignment across OneHealth sectors. In addition, the WHO secretariat will advocate to ensure adequate funding and investment is available to facilitate integrated genomic surveillance.

Objective 5: Maintain a readiness posture for emergencies

This objective focuses on building and sustaining local, regional and global readiness to use and surge genomic surveillance appropriately for emergencies. Genomic surveillance is anchored in the routine needs of disease control programs, but there will periodically be a need to scale up sequencing as part of acute events or emergencies – be this for known pathogens and public health priorities or for emerging threats. Readiness actions are critical to cope with the added pressure of an emergency. A number of strategic actions need to be applied to develop and maintain this readiness posture including having surge procedures for bolstering technical and material resources for increased sequencing and computational throughput, exercising genomic surveillance surge within the end-to-end early warning alert response system, undertaking joint projects that foster cooperation, trust and functionality among stakeholders that would be involved during emergencies, and conducting periodic evaluations or after action reviews to identify ways that continuously improve the contribution of genomic surveillance within the public health surveillance architecture. Collectively, these actions provide confidence that the systems and procedures are functional and appropriately responsive when scaled up for an emergency.

Strategic Actions:

a. **Surge exercises** to test the ability of national genomic surveillance systems and capacities to stretch during an emergency and to mobilize additional support when needed.

b. **Joint projects** for maintaining capabilities and capacities and for consistently priming systems, networks and knowledge needed during an emergency.

c. **After action reviews** and other processes to foster a culture of learning and continuous improvement in the systems, approaches and collaborations needed to effectively use genomics as part of the end-to-end surveillance system.

Role of the WHO Secretariat

The role of the WHO Secretariat is to advocate to stakeholders the need for having and investing in a readiness posture, developing and disseminating technical guidance and tools to facilitate the objective, building the country-to-global level capacities needed including among intersectoral partners and stakeholders within the broader health ecosystem, and participating in the readiness actions either through the disease specific initiatives or cross-cutting upstream steps that are pathogen-agnostic.

5. IMPLEMENTATION APPROACH TO THE STRATEGY

This strategy provides a landscape of global priorities and considerations for building global genomic surveillance capabilities, capacities and competencies for over the next 10 years. There is a landscape of competing priorities for development and expansion of laboratory and surveillance systems, therefore implementation of this strategy will require a collaborative approach across governments, networks, programmes, and partners for maximal impact and contribution to public health.

Actions are expected at the local, regional and global levels, as shown in Figure 2. Additional frameworks and initiatives may be necessary to articulate and define implementation for different contexts or stakeholders including at regional or country levels. WHO encourages adaptation and adoption so that maximal coherence and harmonization are maintained locally to globally. The strategy is underpinned by a set of core principles and enablers which help set collective expectations and approaches for implementation (Figure 2).

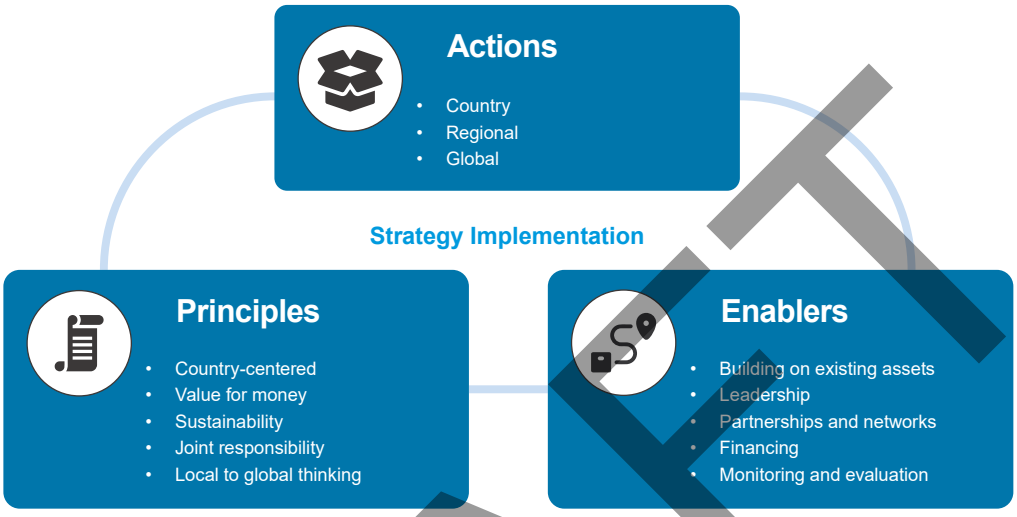

Figure 2: The principles and enablers for delivering the strategic actions needed at country, regional and global level

Principles

There are five principles at the centre of this global strategy that will guide its implementation to ensure an effective and ethically grounded approach:

1. Countries at the centre of the strategy;
2. Value for money;
3. Sustainability;
4. Joint responsibility; and
5. Local to global thinking.

These core principles are further described below.

1. Countries at the centre of the strategy

Strong and effective capacities at country level underpin regional and global public health. This places countries at the centre of the strategy so that a solid foundation is available and sustained for generating, analyzing, using and sharing GSD for public health action. To strengthen genomic surveillance for pathogens with pandemic and epidemic potential, country-focused activities, work plans and outputs are needed with strong commitment and ownership by government. Countries are encouraged to develop, refine and share their national plans and policies for integrating the use of genomics into laboratory and surveillance systems, and to advocate for national funding to be directed towards their specific requirements as part of pandemic preparedness and response.

2. Value for money

Value for money is fundamental to ensure that the information generated is used optimally while being cognizant of the resources and context at hand. In 2018, WHO launched a five-dimensional approach to guide value for money in public health practice which ensures that actions by stakeholders contribute to shared public health impact:

- **Economy:** keeping inputs (human and financial resources) as lean as possible;
- **Efficiency:** using those inputs to obtain or "buy" as much output as possible;
- **Effectiveness:** keeping the quality of output as high as possible to have the greatest possible impact;
- **Equity:** taking into consideration the extent to which outputs benefit and ensure coverage of the most vulnerable and hard-to-reach population; and
- **Ethics:** ensuring that inputs, outputs and outcomes uphold the fundamental ethical principles of respect, goodwill, justice and not causing harm.

As high-throughput sequencing and bioinformatics for pathogens with pandemic and epidemic potential are cost-intensive and remain out of reach for many, the value for money approach establishes a common understanding of the implementation approach needed for the strategy. As the technological landscape advances, maximizing and sustaining access are key requirements to inform global innovation. Similarly, programmes that strengthen workforce capacities, connectivity between networks and readiness for surge and stretch need to optimize delivery with value for money in mind.

3. Sustainability

Genomics is a growing frontier in the surveillance and response to pathogens with pandemic and epidemic potential, and a long-term vision is required so that sustainable programs are built over time. Defining the needs, optimizing implementation and aligning with other in-country priorities for pandemic and epidemic prone pathogen surveillance is critical for the sustainability of genomics. This will require stepwise capacity building and continuous reassessment of needs and opportunities. Programs should be balanced considering the need for routine activities and demand for surge capacity. Sustainability can be cultivated by strengthening national and international networks, as well as developing capabilities and capacities according to a needs-based approach.

4. Joint responsibility

Genomic surveillance for pathogens with pandemic and epidemic potential contributes to public health action within local, regional and global systems. While countries at the heart of the strategy, there are various stakeholders with critical responsibilities in advancing and supporting the implementation of the strategy including academia, the private sector, philanthropy, inter-governmental agencies and civil society. WHO plays a central role in enabling and maximizing coherence globally so that the national and international ecosystem of stakeholders and their unique contribution is recognized and fostered into a joint responsibility for achieving the goal and objectives of this strategy.

5. Local to global thinking

The range and impact of emerging and re-emerging pathogens in the past century demonstrate the importance of coherent local to global genomic surveillance systems. Regional and global action are inherently tied to local action, and strong commitment, governance and investments are needed to enable timely, appropriate and quality public health preparedness and response at all levels. Countries are encouraged to develop their genomic surveillance capacities cognizant of the international interface since pathogens know no borders.

Enabling factors for implementation

In order for this strategy to be implemented in a cohesive manner according to the core principles, certain enabling factors must be in place. Five enabling factors will facilitate implementation of the strategy:

1. Building on and aligning with existing assets;
2. Leadership;
3. Partnership and networks for greatest gains;
4. Financing; and
5. Monitoring and evaluating implementation.

These enablers are further described below.

1. Building on and aligning with existing assets

Genomic surveillance requires a broad range of expertise and brings together cross cutting areas. To develop a robust strategy and support countries to build their capabilities and capacities, a wide network of partners must be aligned towards the common goal. Implementation of genomic surveillance will build on the work done by a wide network of partners and cross cutting WHO assets and strategies. Key WHO assets are described in Annex 1. Stakeholders at global, regional and country levels are invited through this strategy to indicate and 'catalogue' their assets and initiatives to facilitate information-sharing, maximize coherence and drive partnerships. Having a consolidated understanding of the landscape is key for genomic surveillance to be strengthened.

As implementation work plans are developed for each objective, the landscape of assets and existing strategies need to be leveraged so that country, regional and global level activities can optimize efficiency and sustainability. Importantly, the existing global workforce and infrastructure for genomic surveillance is a key resource that should be leveraged, strengthened, and appropriately positioned in order to attain maximum benefit and contribution to the objectives of this strategy.

2. Leadership

WHO provides global leadership on public health emergencies including pandemic and epidemic preparedness and response. In the context of this strategy, key elements of WHO's Health Emergencies Programme leadership include defining the global use cases for genomic surveillance for pathogens with pandemic and epidemic potential, facilitating the work of the different global disease networks, developing standardized and coherent approaches for strengthening local to global capacities, and utilizing genomic surveillance data to inform global risk assessments and public health action. WHO also facilitates the sharing of data and information, including within the context of other international bodies and agreements, such as the Nagoya Protocol to the Convention on Biological Diversity. For this, WHO's Science Division leads the translation of the latest in science, evidence, innovation, and digital solutions to improve health and health equity for all. The Science Division holds a critical global role in coordinating science so that access to new therapies, diagnostics, and vaccines under development is equitable and that they are available to all who need them.

3. Partnerships and networks for greatest gains

Genomic surveillance requires international multisectoral engagement to leverage global resources effectively. The COVID-19 pandemic demonstrated the power of scientists and countries working together to detect, analyze and utilize genomic data to inform public health action. The large-scale need for sequencing and bioinformatics during the COVID-19 pandemic has introduced or reinforced collaborations with partners in academia, industry and the private sector. Looking ahead in the context of this strategy, partnerships and networks are critical to strengthen genomic surveillance capabilities and capacities globally. Successful implementation of the country, regional and global strategic actions described in the results hierarchy undoubtedly require the continued engagement from government, non-governmental and international organizations.

4. Financing

Surveillance is a costly yet essential public health function to underpin pandemic and epidemic preparedness and response. National, regional and global implementation plans in line with this strategy need to be costed so that genomic surveillance delivers the relevant quality and timely data needed. Those in leadership positions must advocate for direction of funds towards the implementation of genomic surveillance. Dedicated budgets and national funding commitments should adhere to the principles described in the previous section, particularly in regard to country ownership and sustainability.

5. Monitoring and evaluating implementation

Monitoring and evaluation are key to understand progress towards the strategy's results hierarchy. Indicators for genomic surveillance should be monitored for each 'routine' pathogen use case since functional capacities underpin readiness for pandemics and epidemics.

For cross-cutting aspects of this strategy, a number of high-level measures should also be monitored to ensure that all countries have access to genomic surveillance. Measures including the following:

- Countries with in-country capability to perform next generation sequencing;
- Countries sharing genomic data to publicly accessible databases or as guided by WHO programmes;
- Countries participating in global quality assessment programmes for sequencing and bioinformatics;
- Countries participating in surge exercises to test genomic surveillance systems.

Implementation plans developed by countries and partners should include monitoring frameworks and align with this strategy's results hierarchy. Periodic landscape analyses will be used to understand the qualitative aspects of implementation and help refine and shape collective progress.

6. REFERENCES

To be developed

7. ANNEXES

Annex 1: Key WHO assets for the strategy

(Other annexes to be developed as needed)

Annex 1: Key WHO assets for the strategy

- ***International Health Regulations (IHR, 2005)*** *Laboratory and surveillance comprise core capacities of the IHR 2005. Aligning this strategy with the IHR helps countries strengthen policies, systems and the workforce in a way that facilitates and fulfils international obligations for public health emergencies.*
- ***WHO's global footprint*** *In addition to its headquarters, WHO has six regional offices and 152 country offices that provide leadership, policy dialogue, strategic support, technical assistance and service delivery. This global footprint enables the roll-out of different public health initiatives, and will be a critical driver and resource to coherently strengthen genomic surveillance for preparedness and response.*
- ***WHO Hub for Pandemic and Epidemic Intelligence*** *With a focus on strengthening pandemic and epidemic intelligence through better data, better analytics and better decisions, the Hub in Berlin is a fulcrum for innovation and good practices to maximize data utility and public health action. Serving all WHO Member States, the Hub will facilitate the global coherence of genomic data into international surveillance systems to directly inform public health action.*
- ***Public health laboratory strengthening*** *Building genomic surveillance capacities is contingent on having a strong foundational national laboratory system. WHO's body of work through country, regional and global teams, including the Public Health Laboratory unit based in WHO Office in Lyon-France, strengthen the essential public health functions of laboratories for pandemic and epidemic preparedness and response. The WHO Lyon Office is at the centre of international laboratory support for country readiness and focuses on the specific needs of resource-limited and vulnerable countries.*
- ***Disease specific networks with genomic surveillance use cases*** *There is a breadth of laboratory and surveillance experience across existing disease specific networks globally. Experiences within established systems such as the Global Influenza Surveillance and Response System (GISRS), Global Polio Laboratory Network (GPLN), HIV ResNet, AMR GLASS, INFOSAN, as well as TB, measles, rubella and arbovirus networks need to be harnessed and leveraged at country, regional and global level. Opportunities for collaboration and economies of scale should continually be advocated through this strategy.*
- ***Global Outbreak Alert and Response Network (GOARN)*** *GOARN is a network of partners across all regions at the core of global coordination for international support. The Emerging and Dangerous Pathogens Laboratory Network (EDPLN) is a critical component of support mobilization. Many GOARN partners are among the global leaders in genomic surveillance and this expertise can be rapidly mobilized to continue to contribute to provide country and regional support for readiness and response to emergencies.*
- ***R&D Blueprint*** *The R&D Blueprint is a global strategy to facilitate rapid activation of research and development during epidemics. It aims to fast-track availability diagnostics, vaccines and therapeutics that can be used to save lives and avert large scale crises, with a pre-defined list of priority pathogens, including "Disease X".*
- ***BioHub*** *The WHO BioHub is a recent initiative to establish a coordinated mechanism for the provision of biological specimens. The intent is to provide a safe, reliable and transparent mechanism for Member States to share and request materials on a voluntary basis, whilst ensuring fairness in access to any benefits arising from this.*