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REGIONAL OFFICE FOR THE Americas

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Provisional Agenda Item 4.7

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STRATEGY ON REGIONAL GENOMIC SURVEILLANCE FOR EPIDEMIC AND PANDEMIC PREPAREDNESS AND RESPONSE

Introduction

1. Genomic surveillance leverages advances in molecular biology to discover pathogens, track their evolution, categorize their differentiation into new lineages and variants, and identify transmission chains and infectious sources *(1, 2)*. In recent years, new genomic sequencing and bioinformatics technologies have emerged, allowing broader and timelier application in rapid response to outbreaks and epidemics. In these events, genomic surveillance data, together with clinical and epidemiologic information, have been used in continuous risk assessment of the public health situation, ongoing decision-making on public health and social measures, development of vaccines, therapeutics, and diagnostic tests, and evaluation of their effectiveness.

2. A hallmark of the COVID-19 pandemic has been the repeated emergence of viral lineages associated with significant public health impact and designated as "variants of interest" or "variants of concern." While Member States and the Pan American Sanitary Bureau (PASB) initiated genomic surveillance of SARS-CoV-2 (the virus that causes COVID-19) as early as March 2020, such efforts have been greatly expanded and strengthened following the appearance of variants of concern since late 2020.

3. Beyond the COVID-19 pandemic, the Region of the Americas remains at great risk for the emergence and reemergence of epidemic- and pandemic-prone pathogens, either from importation or as zoonotic spillover from autochthonous sources. The present strategy proposes lines of action covering the six-year period between 2022 and 2028 for the Member States and PASB to consolidate the advances in genomic surveillance achieved to date and to extend them within the general framework for preparedness and response to other potentially emerging and existing pathogens, including those at the human-animal-environment interface, with epidemic and pandemic potential.

Background

4. The Pan American Health Organization (PAHO) has a long and rich history of regional cooperation in preparedness and response to health emergencies. Preparedness and response to pathogens with epidemic and pandemic potential needs coordination. Among the national-level core capacity requirements for surveillance and response in public health responses set by the 2005 International Health Regulations, countries are expected to provide laboratory analysis of samples, performed either domestically or through collaborating networks *(3)*. Today, genomic sequencing is expected in laboratory analyses, as this approach accurately identifies and characterizes pathogens with epidemic and pandemic potential *(1, 2)*.

5. In May 2021, the World Health Assembly (WHA) adopted Resolution WHA74.7 to strengthen preparedness and response to health emergencies *(4)*. This resolution urges Member States "to increase their capacity to detect new threats, including through laboratory techniques, such as genomic sequencing." The World Health Organization (WHO) followed up by consulting with Member States and developing a Global Genomic Surveillance Strategy for Pathogens with Pandemic and Epidemic Potential *(1)*. Launched in March 2022, this global strategy has five objectives: to improve access to tools for better geographic representation; to strengthen the workforce to deliver at speed, scale, and quality; enhance data sharing and utility for streamlined local to global public health decision-making and action; to maximize connectivity for timely value-add in the broader surveillance architecture; and to maintain readiness for emergencies. Additionally, strategic actions are proposed for each objective.

6. In recent years, the WHA has repeatedly addressed unintended public health implications of implementation of the Nagoya Protocol on the prompt sharing of human and zoonotic pathogens and their genetic sequence data *(5, 6)*. Of note, Article 8.b of the Nagoya Protocol asks countries to ensure that national access and benefit-sharing rules and procedures do not interfere with present or imminent public health emergencies *(7)*. In May 2021, the WHA reaffirmed the need to promote early, safe, transparent, and rapid sharing of samples of pathogens with pandemic and epidemic potential, as well as their genetic sequence data *(4)*.

7. In September 2021, the PAHO Directing Council adopted Resolution CD59.R4, One Health: A Comprehensive Approach for Addressing Health Threats at the Human-Animal-Environment Interface *(8)*. This resolution urges Member States to "foster multisectoral technical activities, including strategic planning, emergency preparedness and response, rapid and transparent information, data and sample sharing, in accordance with relevant international agreements, integrated surveillance, laboratory strengthening, and other best practices, with demonstration projects to drive scientific evidence-based collaborative actions".

8. Public health agencies' progressive adoption of pathogen genomics to achieve greater effectiveness in the response to infectious disease threats has been reviewed *(2)*. The continued development in sequencing technologies as well as the experience gained during the COVID-19 pandemic is likely to accentuate this trend. Several recent experiences have been published in peer-reviewed literature. For instance, Lemieux et al. used genomic epidemiology to investigate the introduction and spread of SARS-CoV-2 in Boston, United States of America, during the first wave of the pandemic in March-May 2020 *(9)*. Notably, these researchers uncovered an amplification of transmission in an urban setting, as well as the impact of superspreading events on local, national, and international spread.

Situation Analysis

9. The Region of the Americas is at great risk for the emergence and reemergence of pathogens with epidemic and pandemic potential. In 2009, the last influenza pandemic caused by a novel influenza A/H1N1 virus began in North America *(10)*. During 2015-2016, virus importations from Africa and Pacific islands caused mosquito-borne chikungunya and Zika epidemics that affected Latin America and the Caribbean at an unprecedented scale *(11, 12)*. During 2016-2019, epizootic spread of the yellow fever virus reached the southeast coast of Brazil for the first time, causing human infections in densely populated areas *(13)*. Climate change, unplanned urbanization, encroachment of human settlements in sylvatic areas, and increased travel are risk factors for more frequent emergence and spread of pathogens, regardless of their origin in importations from other continents or autochthonous reservoirs *(14)*. The ecologically diverse Amazon basin and Darien Gap harbor potentially emerging pathogens, with potential reservoirs or intermediate species, that could spill over to human populations *(15)*. For instance, the investigation of a hemorrhagic fever cluster in Bolivia in 2019 eventually revealed the reservoir of the etiological pathogen (Chapare virus) in an autochthonous rodent species *(16)*.

10. When epidemics and pandemics occur, the Region of the Americas is often greatly affected. As of 11 May 2022, in the ongoing COVID-19 pandemic, 30% of all cases and 44% of all deaths reported globally had occurred in the Region (which accounts for 13% of the world's population) *(17)*. Socioeconomic determinants likely play a significant role in this disproportionate impact, given that the Americas is the region of the world with the highest levels of inequity *(18)*.

11. It is thus imperative that the Region equip itself with advanced tools for early detection and monitoring of high-threat pathogens within a comprehensive preparedness and response framework for health emergencies. More than a year before the issue of variants of concern became prominent in mid-2021, PASB spearheaded the creation of the COVID-19 Genomic Surveillance Network of the Americas (COVIGEN) in March 2020 to monitor the SARS-CoV-2 virus *(19, 20)*. From the onset, COVIGEN has focused on detecting any change in sequence that may influence the ability of the virus to spread faster and cause more severe disease, as well as to reporting on the effectiveness of vaccines, treatments, diagnostics, and public health and social measures.

12. The COVIGEN network was based on decade-long experience with the SARInet network. SARInet is a globally renowned regional surveillance and laboratory network that has had a catalytic effect in building national capacity in the Americas for surveillance and laboratory diagnosis of influenza and other respiratory viruses *(21).* These capacities were an unquestionable strength for the Region when the COVID-19 pandemic broke out—proving that the response to pandemic and epidemic threats must be prepared before emergencies arise.

13. As of August 2022, the COVIGEN network included 30 countries and territories in the Americas. Its primary impact has been to strengthen and expand national SARS-CoV-2 sequencing and genomic surveillance capacities. Countries with existing sequencing capacity have been supported with key reagents, standardized protocols, training, and human resources. Countries that lack or have limited sequencing capacity have also been provided with access to eight regional reference sequencing laboratories. Through the work of the network and PAHO Member States, nearly 427,000 full genome sequences of SARS-CoV-2 from Latin America and the Caribbean were uploaded to the GISAID global platform between July 2021 and August 2022. During the same period, more than 24 shipments were completed with specimens from eight countries that lacked or had limited capacity, eventually leading to the generation of over 500 sequences from areas that would not have had this information otherwise. As of August 2022, 55 countries and territories in the Americas have detected at least one of the five variants of concern (VOC), that is Alpha, Beta, Gamma, Delta, and Omicron. A total of 54 countries have detected Delta VOC and 53 have detected Omicron VOC.

14. In addition to COVIGEN, the Region of the Americas has long-standing laboratory networks that carry out genomic surveillance of acute health events in humans and farm animals, such as SARInet for influenza and syncytial respiratory viruses, the Arbovirus Diagnosis Laboratory Network of the Americas, PulseNet for foodborne disease outbreaks, a global network for highly pathogenic avian influenza, and a regional network for foot-and-mouth disease virus in cloven-hoofed animals. An inherent feature of these networks is a well-defined hierarchy of global, regional, national and, in some instances, subnational laboratories, each level having predefined responsibilities and capacities. Within these networks, higher-level reference laboratories play a leading role in the standardization of protocols, diagnosis of challenging specimens, and management of external quality assurance programs.

15. Leveraging the power of regional partnership, these networks are also a community of practice that connect and develop laboratory professionals throughout the Region. For instance, the footprint of COVIGEN goes beyond the generation and publication of SARS-CoV-2 genomic sequences: it also provides a forum for professionals from national reference laboratories, ministries of health, national institutes of health, clinics, and partner institutions to share experiences, collaborate, and define best practices. PASB, regional reference laboratories, and partners have organized trainings and regular updates within the framework of COVIGEN.

Proposal

16. This strategy includes the following lines of action:

a) Expand and consolidate a regional genomic surveillance network of public health, animal health, and environmental health laboratories for early detection and monitoring of emerging and existing pathogens of potential public health concern, including at the human-animal-environment interface.

b) Strengthen technical capacity for genomic sequencing, including in bioinformatics.

c) Strengthen genomic data reporting, including linkages to case data, and its integration with public health systems.

d) Build capacity and define best practices for the use of genomic data in the response to outbreaks, epidemics, and pandemics, including mechanisms for intersectoral coordination and integration among public health, animal health, and environmental health surveillance teams, to generate timely information for decision-making and to generate public policies.

17. These strategic lines of action are closely aligned with the five objectives of the WHO Global Genomic Surveillance Strategy for Pathogens with Pandemic and Epidemic Potential *(1).* The first Strategic Line of Action aligns with global objectives 1 and 4, the second with objectives 2 and 5, and the third with objectives 3 and 4. Finally, the fourth Strategic Line of Action extends the global strategy by building capacity and defining best practices for the use of genomic surveillance in response to outbreaks.

18. Regional efforts to expand, consolidate, and strengthen genomic surveillance for epidemic and pandemic preparedness and response should follow three key principles. First, it is imperative to maintain readiness for emergencies, which means that capacities for timely detection of emerging pathogens and scalability must be built, strengthened, and sustained in periods between outbreaks and epidemics. Second, ownership of specimens and data should be harmonized with established international agreements, including those on access and benefit-sharing. As this field evolves globally, regional efforts will have to be made to regularly check international and national compliance in order to ensure timely and safe sharing of samples and genetic sequence data of pathogens with pandemic and epidemic potential. And third, assurance and control of laboratory quality and biosafety must be a shared, priority commitment, with regionally coordinated activities.

Strategic Line of Action 1: Expand and consolidate a regional genomic surveillance network of public health, animal health, and environmental health laboratories for early detection and monitoring of emerging and existing pathogens of potential public health concern, including at the human-animal-environment interface

19. PASB, Member States, and partners should expand and consolidate the COVIGEN network as a comprehensive system to address emerging pathogens beyond SARS-CoV-2. Key efforts should include the establishment of linkages to other existing networks for

genomic surveillance of acute health events in order to leverage the breadth of laboratory and surveillance experience across existing disease-specific networks, both globally and in the Region. Linkage is also a practical necessity to assure sustainability during inter-epidemic periods and upward scalability when emergencies occur. Cross-pollination should also be sought to further develop governance within the regional network. To the extent acceptable to participating Member States, this strategy should link to other global initiatives that are being developed, such as the WHO BioHub System and the WHO Hub for Pandemic and Epidemic Intelligence.

20. According to capacity in each country, expansion should include laboratories outside the area of human public health. When coordinating inter-sectoral laboratories, care should be taken to develop coordination and monitoring mechanisms to minimize the time between specimen collection, sample transport, sequencing, and data sharing. The intersectoral approach should also lead to strengthening the capacity of public, animal, and environmental health services to diagnose emerging and existing pathogens of potential public health concern, bringing this approach under intersectoral mechanisms at the national, subregional and regional levels.

21. In all sectors, the awareness and capacities of field personnel (such as health care workers and farmers) and the availability of specimen collection and transport supplies in the field are important prerequisites that need strengthening in most countries. The flow of quality specimens and accompanying information must be assured through communication between field surveillance personnel and their laboratory counterparts.

22. In large countries, national networks that include subnational or local laboratories may be necessary to guarantee both geographic coverage and timely specimen testing. Countries may define a governance structure that links national-level and subnational laboratories, designate a laboratory to lead and coordinate the national network, and establish a hierarchical structure within the network. Quality assurance and control activities should be implemented in national networks.

23. Depending on national conditions, the inclusion of private laboratories, whether in academia or the private sector, may be needed to expand capacity during emergencies. In any case, the participation of private laboratories should be framed within national networks and subject to the same quality and biosafety conditions as any participating laboratory.

24. In addition to establishing and strengthening bench capacities, regional and national networks should serve as knowledge hubs to facilitate the sharing of information and data. As communities of practice, they should play a central role in the training and continuing education of professionals of the Region. Ultimately, through their tangible and highly structured activities, the networks should promote the strengthening of regional and international cooperation in health emergency preparedness and response.

25. An agenda for applied or operational research should be developed and promoted. This research agenda should focus on threats at the human-animal-environment interface as well as the identification of hotspots, i.e., areas posing the greatest risk of zoonotic spillover events of emerging pathogens.

Strategic Line of Action 2: Strengthen technical capacity for genomic sequencing, including in bioinformatics

26. Laboratory capacities and capabilities specific to next-generation sequencing and bioinformatics are the technical cornerstone of genomic surveillance. Efforts by Member States and PASB since March 2020 in response to the COVID-19 pandemic should be enhanced further so that such capacities and capabilities become standard and sustainable in public health laboratories. This will require continued strengthening of the workforce in order to deliver at the speed, scale, and quality needed for large-scale, real-time genomic epidemiology. High-throughput bioinformatic pipelines should be established in national public health laboratories.

27. The range of pathogens that can be potentially detected and characterized with genomic techniques should constantly be reviewed and expanded. With an initial focus on RNA viruses, it is necessary to continuously pursue the development and application of improved laboratory techniques for the identification of new pathogens, including in routine diagnostic activities. Genomic epidemiology tools should increasingly be applied in the investigation of emerging diseases and outbreaks of unknown etiology.

28. Continued funding will be needed for infrastructure, facilities, equipment, supplies, and trained personnel. As in previous emergencies and for countries and territories with fewer resources, key support for financing and procurement may be provided through international cooperation and national risk management and emergency response systems, leading to the scalability required to respond to epidemics and pandemics. In particular, timely availability of laboratory reagents and surge personnel should be guaranteed, including the preparation of the necessary administrative processes and financial resources. Regionally coordinated fundraising initiatives could support national investments. Joint projects for maintaining capacities and capabilities should be implemented and surge exercises should be used to test systems. Laboratory capabilities must be maintained to optimize flexibility and surge capacity in order to address unanticipated public health threats adequately, efficiently, and safely. The use of a broader range of metagenomics applications, as well as the swift adoption of technological innovations that are likely to become available over the period of this strategy, should contribute to sustainability.

29. As an essential component of any laboratory network, quality control and assurance programs should be established within regional and national genomic surveillance networks. Network membership should foster the adoption and sharing of good laboratory practices and encourage external quality assurance programs for genomics and analytics. The network will also facilitate the harmonization of norms, standards, benchmarks, and reference materials.

Strategic Line of Action 3: Strengthen genomic data reporting, including linkages to case data, and its integration with public health systems

30. Genomic data should be reported in a timely fashion through validated sequence repositories. Dissemination of and training on international access and benefit-sharing agreements should be considered. Metadata on the demographic, epidemiologic, and clinical information of patients from whom specimens were collected should be an integral component of reporting, since this information provides context to genomic data. Such data should be fully leveraged through advanced phylodynamic methods in order to understand the evolution, diversity, transmission patterns, and clinical and epidemiological impact of emerging pathogens while protecting confidentiality according to national and international standards.

31. Communication and integration of information among national public health, animal health, wildlife, and environment health laboratories should be established or strengthened. Best practices in periodic joint analyses should also be defined and applied. In the longer term, sustainable digital infrastructure for pathogen genomics surveillance should be developed and used across health programs.

Strategic Line of Action 4: Build capacity and define best practices for the use of genomic data in the response to outbreaks, epidemics, and pandemics, including mechanisms for intersectoral coordination and integration among public health, animal health, and environmental health surveillance teams

32. The strategy will foster an intersectoral and integrated approach to the diagnosis, prevention, response, and control of emerging and existing pathogens with epidemic and pandemic potential. It should strive to strengthen multidisciplinary and cross-sectoral aspects of existing mechanisms and frameworks related to the human-animal-environment interface. Where needed, multisectoral working groups and coordination committees should be established and strengthened to enhance preparedness and response at the national level. Overall, the activities under this strategic line should lead to the generation of information for decision-making and the development of public policies.

33. In the implementation of the strategy, multisectoral activities should be promoted that include strategic planning, emergency preparedness and response, integrated disease surveillance (including case finding and investigation), and laboratory differential diagnosis. In the public health sector, the different actors on the continuum, from detection in communities and health care facilities to surveillance and laboratory workup, including clinicians, epidemiologists, and laboratory professionals, should be integrated and coordinated to ensure that genomic sampling strategies, specimen collection and handling, and metadata collection are appropriately targeted and performed for the intended and optimal analyses. National public health and veterinary bodies, such as ministries of health, agriculture, and animal services, should support genomic sequencing programs, ensuring sustainability, and appropriate channels of communication. The goals of these programs should respond to key virological and epidemiological questions.

34. As part of the strategy, country capacities for case investigation and case finding should be developed and strengthened with the use of genomic surveillance data. Metadata should be standardized, for instance in case report forms, on the basis of surveillance priorities that are predefined and streamlined to scale up data integration. Such standardization should favor the management of acute events that might constitute or lead to public health emergencies. Joint analyses of surveillance data of relevance to the human-animal-environment interface should be institutionalized and carried out frequently.

35. Best practices in the use of genomic surveillance data and the coordination of multiple sectors at the local, national, and regional levels should be collected and shared. These practices should inform continuous improvement in genomic surveillance and maximize its impact and sustainability. Network activities will also facilitate the definition, analysis, and dissemination of best practices.

Monitoring and Evaluation

36. This strategy will contribute to 12 outcomes of the PAHO Strategic Plan 2020-2025, most directly to outcome 24. Its strategic lines of action will be operationalized through the Organization's Program Budget. Performance and outcome indicators of the genomic surveillance systems for COVID-19 and other high-threat pathogens will support the monitoring and evaluation of the strategy's implementation and progress. A mid-term report will be issued in 2026 to evaluate the progress achieved and a final report will be presented to the Governing Bodies of PAHO in 2029, when implementation of the Strategy has concluded.

Financial Implications

37. The total estimated cost of PAHO technical cooperation to implement the complete cycle of this strategy from 2022 to 2028, including personnel and activity costs, is US$ 25,000,000. Member States will assume financing of their activities, although regionally coordinated fundraising initiatives for the strategy may provide strategic support, especially in the inception phases, depending on specific national gaps and financial needs. Annex B "Report on the Financial and Administrative Implications of the Proposed Resolution for PASB" provides more detailed information.

Action by the Pan American Sanitary Conference

38. The Conference is invited to review the information presented in this document, provide any comments it deems pertinent, and consider approving the proposed resolution presented in Annex A.

Annexes

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PROPOSED RESOLUTION

STRATEGY ON REGIONAL GENOMIC SURVEILLANCE FOR EPIDEMIC AND PANDEMIC PREPAREDNESS AND RESPONSE

***THE 30th PAN AMERICAN SANITARY CONFERENCE*,**

(PP1) Having reviewed the *Strategy on Regional Genomic Surveillance for Epidemic and Pandemic Preparedness and Response* (Document CSP30/12);

(PP2) Considering the social and economic impact of the COVID-19 pandemic, as well as previous epidemics in the Region of the Americas linked to socioeconomic inequities;

(PP3) Considering that the Region of the Americas is at great risk for the emergence and reemergence of pathogens with epidemic and pandemic potential due to its ecological diversity, increased urbanization and other changes in human settlement, and the intense movement of people;

(PP4) Recognizing the need for enhanced multidisciplinary and intersectoral approaches in the preparedness and response to pathogens with pandemic and epidemic potential, including at the human-animal-environment interface;

(PP5) Acknowledging the key contribution of genomic surveillance in the response to the COVID-19 pandemic and the role that genomic surveillance will likely play in future health emergencies,

RESOLVES:

(OP)1. To approve the Strategy on *Regional Genomic Surveillance for Epidemic and Pandemic Preparedness and Response* (Document CSP30/12).

(OP)2. To urge all Member States, considering their contexts, needs, vulnerabilities, and priorities, to:

a) contribute to the expansion and consolidation of a regional genomic surveillance network of public health, animal health, and environmental health laboratories for early detection and monitoring of emerging and existing pathogens of potential public health concern, including at the human-animal-environment interface and, where appropriate, to the establishment of national networks;

b) strengthen technical capacity for genomic sequencing, including in bioinformatics, and assure its sustainability in periods between outbreaks and epidemics through investment and funding for infrastructures and facilities, equipment, supplies, and personnel;

c) assure timely reporting of genomic data through validated sequence repositories and their integration with public health systems, including strengthened communication and integration of information among national public, animal, wildlife, and environmental health laboratories;

d) build capacities and participate in the definition of regional best practices for the use of genomic data in response to outbreaks, epidemics, and pandemics, including mechanisms for intersectoral coordination and integration among public, animal, and environmental health surveillance teams.

(OP)3. To request the Director to:

a) provide technical cooperation to Member States to strengthen technical and managerial capacities that contribute to implementation of the strategy and achievement of its lines of action;

b) propose governance modalities for a regional genomic surveillance network for epidemic and pandemic preparedness and response, including the role of the Pan American Sanitary Bureau as its secretariat;

c) support the planning, establishment, and strengthening of supply chains for equipment, reagents, and other laboratory products during interepidemic periods, including strategic procurement and distribution of supplies during the initial phases of the strategy and during health emergencies;

d) urge the international donor community to increase its financial assistance to strengthen country programs for health emergency prevention, mitigation, and preparedness, thus increasing the health sector's resilience;

e) report periodically to the Governing Bodies of the Pan American Health Organization on the progress made and challenges faced in the implementation of this strategy, with a mid-term report in 2026 and a final report in 2029.

CSP30/12
Annex B

Report on the Financial and Administrative Implications of the Proposed Resolution for PASB

1. Agenda item: 4.7 Strategy on Regional Genomic Surveillance for Epidemic and Pandemic Preparedness and Response
2. Linkage to Program Budget of the Pan American Health Organization 2022-2023: *Outcome 4:* Increased response capacity of integrated health services networks (IHSNs) for prevention, surveillance, early detection and treatment, and care of communicable diseases, including vaccine-preventable diseases *Outcome 8:* Increased equitable access to essential medicines, vaccines, and other health technologies that are safe, affordable, clinically effective, cost-effective, and quality-assured, and rational use of medicines, with strengthened regulatory systems that contribute to achieving universal access to health and universal health coverage *Outcome 9:* Strengthened stewardship and governance by national health authorities, enabling them to lead health systems transformation and implement the essential public health functions for universal health *Outcome 12:* Risk factors for communicable diseases reduced by addressing the determinants of health through intersectoral action *Outcome 17:* Health systems strengthened to achieve or maintain the elimination of transmission of targeted diseases *Outcome 18:* Increased capacity of health actors to address social and environmental determinants of health with an intersectoral focus, prioritizing groups in conditions of vulnerability *Outcome 20:* Integrated information systems for health developed and implemented with strengthened capacities in Member States and the Pan American Sanitary Bureau *Outcome 21:* Increased capacity of Member States and the Pan American Sanitary Bureau to generate, analyze, and disseminate health evidence and translate knowledge for decision making at national and subnational levels *Outcome 22:* Strengthened research and innovation to generate solutions and evidence to improve health and reduce health inequalities *Outcome 23:* Strengthened country capacity for all-hazards health emergency and disaster risk management for a disaster-resilient health sector *Outcome 24:* Countries' capacities strengthened to prevent and control epidemics and pandemics caused by high-impact and/or high-consequence pathogens *Outcome 25:* Rapid detection, assessment, and response to health emergencies *Outcome 27:* Strengthened PASB leadership, governance, and advocacy for health

3. Financial implications:

a) Total estimated cost for implementation over the lifecycle of the resolution (including staff and activities):

Areas	Estimated cost (in US$)
Human resources	2,610,000
Training	975,000
Consultants/service contracts	1,323,000
Travel and meetings	1,284,000
Publications	42,000
Supplies and other expenses	18,766,000
Total	**25,000,000**

This estimated cost does not include Member States' infrastructures and most personnel costs for implementation at national- and subnational levels, which will vary from country to country. However, all supplies cost, which include sequencing equipment, enzymes, reagents and other lab supplies are directly for Member States. Also, training, consultants/service contracts, meetings and all supplies will be implemented jointly with Member States. It is anticipated that over 90% of the total cost can be financed through voluntary contributions by Member States or grants from philanthropic institutions.

b) Estimated cost for the 2022-2023 biennium (including staff and activities):

The estimated cost for the biennium is approximately US$ 14,550,000. This amount includes existing voluntary contributions from the U.S. Government as well as grants from philanthropic institutions that are being finalized. It is estimated that two existing staff (P-4/5) will contribute 25% of their time to the implementation of the Strategy in the biennium and that a new, fulltime technical advisor position (P-4) will be needed.

c) Of the estimated cost noted in *b),* what can be subsumed under existing programmed activities?

Approximately US$ 185,000, representing existing staff time contribution, will be covered with PAHO regular funds.

4. Administrative implications:

a) Indicate the levels of the Organization at which the work will be undertaken:
The work will be carried out at the country, subregional, and regional levels.

b) Additional staffing requirements (indicate additional required staff full-time equivalents, noting necessary skills profile):
A technical advisor position (P-4) will need to supplement existing staff of the PHE Infectious Hazard Management's Unit. This professional should have a doctoral degree in virology and experience/expertise in genomic sequencing and bioinformatics.

c) Time frames (indicate broad time frames for the implementation and evaluation):
The Strategy on Genomic Surveillance is linked to the 2030 Agenda for Sustainable Development and the Sustainable Health Agenda for the Americas 2018–2030, and its implementation is proposed to cover the period 2022–2028.

CSP30/12
Annex C

Analytical Form to Link Agenda Item with Organizational Mandates

1. Agenda item: 4.7 Strategy on Regional Genomic Surveillance for Epidemic and Pandemic Preparedness and Response

2. Responsible units:

- Health Emergencies (PHE): Infectious Hazard Management (PHE/IHM)
- Communicable Diseases and Environmental Determinants of Health (CDE): Pan American Center for Foot-and-Mouth Disease (CDE/AFT)

3. Preparing officer(s): Dr. Ciro Ugarte, Dr. Sylvain Aldighieri, Dr. Ottorino Cosivi, Dr. Andrea Vicari, Dr. Jairo Mendez, Dr. Maristela Pituco, Dr. Juliana Leite, Dr. Lionel Gresh.

4. Link between Agenda item and the Sustainable Health Agenda for the Americas 2018-2030:

Goal 1: Expand equitable access to comprehensive, integrated, quality, people-, family-, and community-centered health services, with an emphasis on health promotion and illness prevention.

Goal 2: Strengthen stewardship and governance of the national health authority, while promoting social participation.

Goal 3: Strengthen the management and development of human resources for health (HRH) with skills that facilitate a comprehensive approach to health.

Goal 5: Ensure access to essential medicines and vaccines, and to other priority health technologies, according to available scientific evidence and the national context.

Goal 6: Strengthen information systems for health to support the development of evidence-based policies and decision-making.

Goal 7: Develop capacity for the generation, transfer, and use of evidence and knowledge in health, promoting research, innovation, and the use of technology.

Goal 8: Strengthen national and regional capacities to prepare for, prevent, detect, monitor and respond to disease outbreaks and emergencies and disasters that affect the health of the population.

Goal 10: Reduce the burden of communicable diseases and eliminate neglected diseases.

Goal 11: Reduce inequality and inequity in health through intersectoral, multisectoral, regional, and subregional approaches to the social and environmental determinants of health.

5. Link between Agenda item and the Strategic Plan of the Pan American Health Organization 2020-2025:

As stated in Annex B, this policy will contribute to achieving Outcomes 4, 8, 9, 12, 17, 18, 20, 21, 22, 23, 24, 25, and 27 of the PAHO Strategic Plan 2020–2025.

6. List of collaborating centers and national institutions linked to this Agenda item:

The implementation of this Strategy will require multisectoral, inter-country, and inter-programmatic *cooperation* and collaboration, as well as the strengthening of alliances with partners at all levels.

These partners include:

- Ministries and national government agencies, particularly on public health, animal health, wildlife and environment.
- The national laboratories that participate in the COVID-19 Genomic Surveillance Network of the Americas (COVIGEN), included the eight regional reference sequencing laboratories: Fundação Oswaldo Cruz (FIOCRUZ), Brazil; Instituto Nacional de Salud Pública (INSP), Chile; Instituto Nacional de Salud (INS), Colombia (INS); Instituto Costarricense de Investigación y Enseñanza en Nutrición y Salud (INCIENSA), Costa Rica; Instituto de Diagnóstico y Referencia Epidemiológicos (InDRE), Mexico; Instituto Conmemorativo Gorgas de Estudios de la Salud (ICGES), Panama; University of the West Indies (UWI), Trinidad and Tobago; Centers for Disease Control and Prevention (CDC), United States of Americas (USA).
- PAHO/WHO Collaborating Centers, including but not limited to the following: WHO Collaborating Centre for Reference and Research of Arbovirus and Hemorrhagic Fevers Virosis, Instituto Nacional de Enfermedades Virales Humanas "Dr. Julio I. Maiztegui", Pergamino, Argentina; WHO Collaborating Centre for Emerging and Re-emerging Arboviruses and other Emerging Zoonotic Viruses, Instituto Evandro Chagas, Ministério da Saúde, Ananindeua, Brazil; WHO Collaborating Centre for Arboviruses, InDRE, Mexico; WHO Collaborating Centre for Studies on the Ecology of Influenza in Animals, St. Jude Children's Research Hospital, University of Tennessee, Memphis, USA; WHO Collaborating Centre for Surveillance, Epidemiology and Control of Influenza, CDC, Atlanta, USA; WHO Collaborating Centre for Viral Hemorrhagic Fevers, CDC, Atlanta, USA; WHO Collaborating Centre for Surveillance, Epidemiology and Control of Foodborne Diseases and Enteric, Fungal Pathogens, CDC, USA; WHO Collaborating Centre for Arthropod-Borne Viruses Reference and Research, CDC, Fort Collins, USA.
- Institut Pasteur de la Guyane, French Guiana
- Food and Agriculture Organization of the United Nations (FAO)
- World Organisation for Animal Health (OIE)
- Inter-American Institute for Cooperation on Agriculture (IICA)
- International Regional Organization for Plant and Animal Health (OIRSA)

7. Best practices in this area and examples from countries within the Region of the Americas:

- COVID-19 Genomic Surveillance Network of the Americas (COVIGEN) https://www.paho.org/en/topics/influenza/covid-19-genomic-surveillance-regional-network
- Argentina, Proyecto PAIS, http://pais.qb.fcen.uba.ar/
- Brazil, Fiocruz Genomic Network, http://www.genomahcov.fiocruz.br/
- Colombia, Red nacional de laboratorios secuenciación genómica, https://www.ins.gov.co/Noticias/Paginas/coronavirus-genoma.aspx
- United States Centers for Disease Control and Prevention, Advanced Molecular Detection, https://www.cdc.gov/amd/
- United States of America, SARS-CoV-2 Sequencing for Public Health Emergency Response, Epidemiology and Surveillance (SPHERES) consortium, https://www.cdc.gov/coronavirus/2019-ncov/variants/spheres.html

- Leite JA, Vicari A, Perez E, Siqueira M, Resende P, Motta FC, et al. Implementation of a COVID-19 Genomic Surveillance Regional Network for Latin America and Caribbean region. PloS one. 2022;17(3):e0252526. https://pubmed.ncbi.nlm.nih.gov/35239677/
- PulseNet Latin America and the Caribbean (PNLAC), https://pulsenetinternational.org/networks/latinamerica/
- Severe Acute Respiratory Infections network (SARInet) of the Americas, http://www.sarinet.org/
- GISAID, https://www.gisaid.org/ (global initiative, including the Americas)
- Nextstrain, https://nextstrain.org/ (global initiative, including the Americas)

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