Resilient Laboratory Systems: Capacity Building and Coordination with Epidemiological Intelligence

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PAHO
Pan American Health Organization
World Health Organization
Americas Region

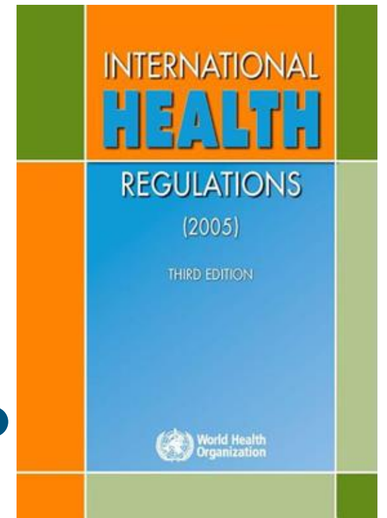
SARInet plus
Severe Acute Respiratory Infections Network

RESVIGEN
Respiratory Viruses Genomic Surveillance Regional Network

SARINET PLUS & RESVIGEN
REGIONAL LAB MEETING
BRAZIL - NOVEMBER 2025

The Context: Why Are Laboratory Platforms Necessary?

- Without a laboratory, any surveillance system is incomplete.
- The only way to confirm the etiology of an outbreak is through laboratory methods, using validated protocols and ensuring the quality of the results.
- The laboratory system must be fully integrated with all components of surveillance.
- It must comply with the IHR*.



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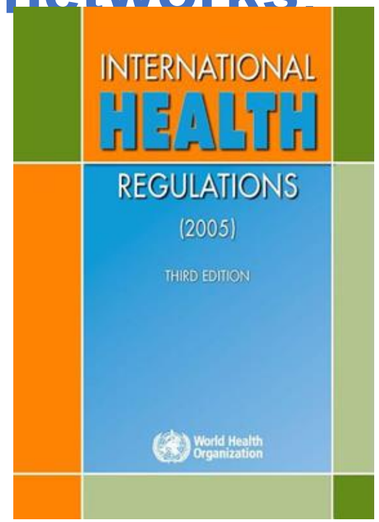
REGIONAL OFFICE FOR THE Americas

Background: IHR (2005)

- Beyond the surveillance of endemic pathogens, WHO Member States **must be prepared to detect and characterize** the emergence of new agents with epidemic potential in a timely manner*.

- Mechanisms must be ensured for **timely access to national and regional reference laboratories, as well as to laboratory networks**.

- The quality of results must be ensured.



* IHR Core Capacity No. 8
**C4 Laboratory, SPAR

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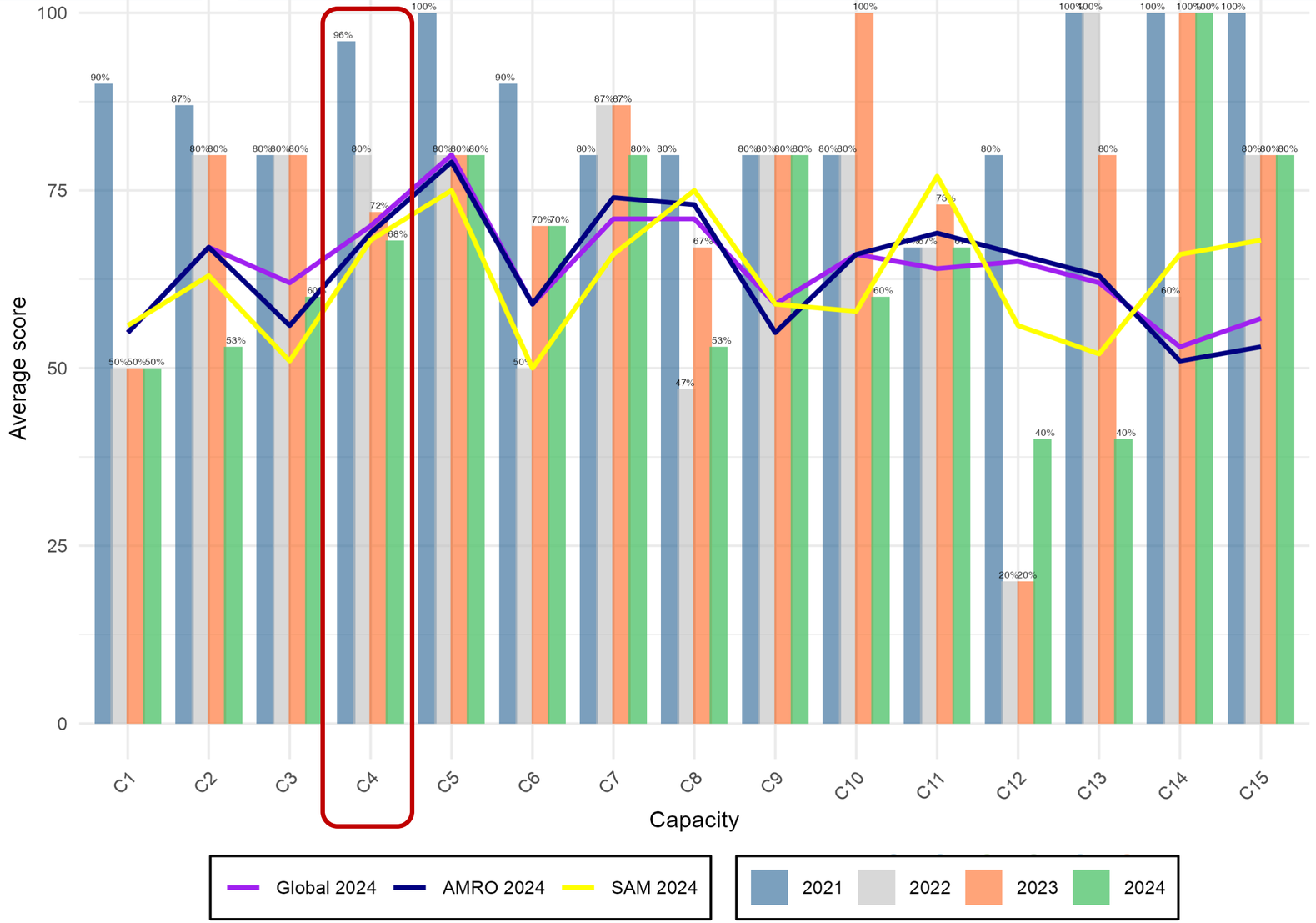
Average capacity as reported in SPAR Americas Region, 2021–2024

C1. Policy
C2. Coordination
C3. Funding
C4. Laboratory
C5. Surveillance
C6. Human Resources
C7. Public health emergency management
C8. Health Care Delivery
C9. Infection Prevention and Control
C10. Risk communication and community engagement
C11. Points of entry and border health
C12. Zoonotic diseases
C13. Food safety
C14. Chemical incidents
C15. Radiological emergencies



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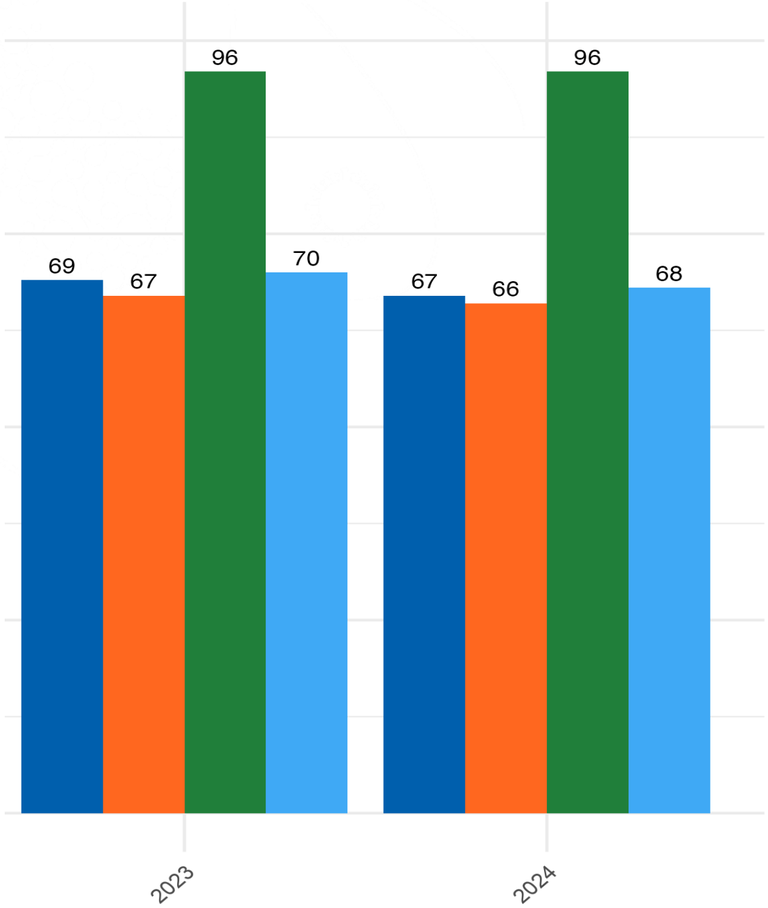
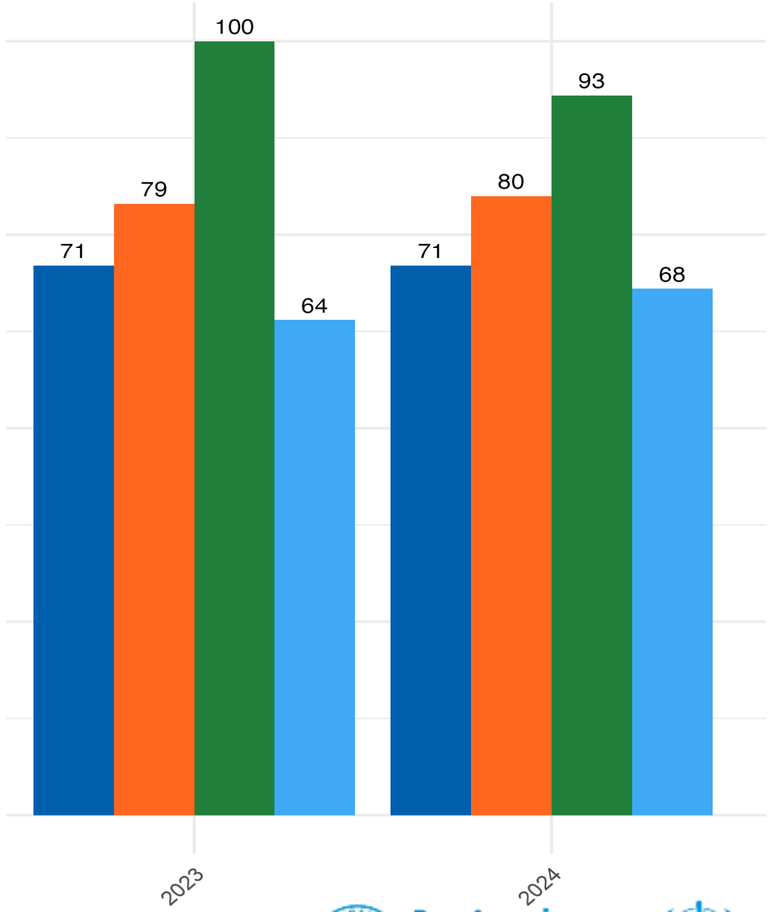
C4: Laboratory capacity indicators by subregion in the Americas, 2023–2024

C4. Average laboratory capacity



C4.1 Sample referral and transport system



Central America
Caribbean
North America
South America

Source: e-SPAR platform, 2021- 2024. https://extranet.who.int/e-spar

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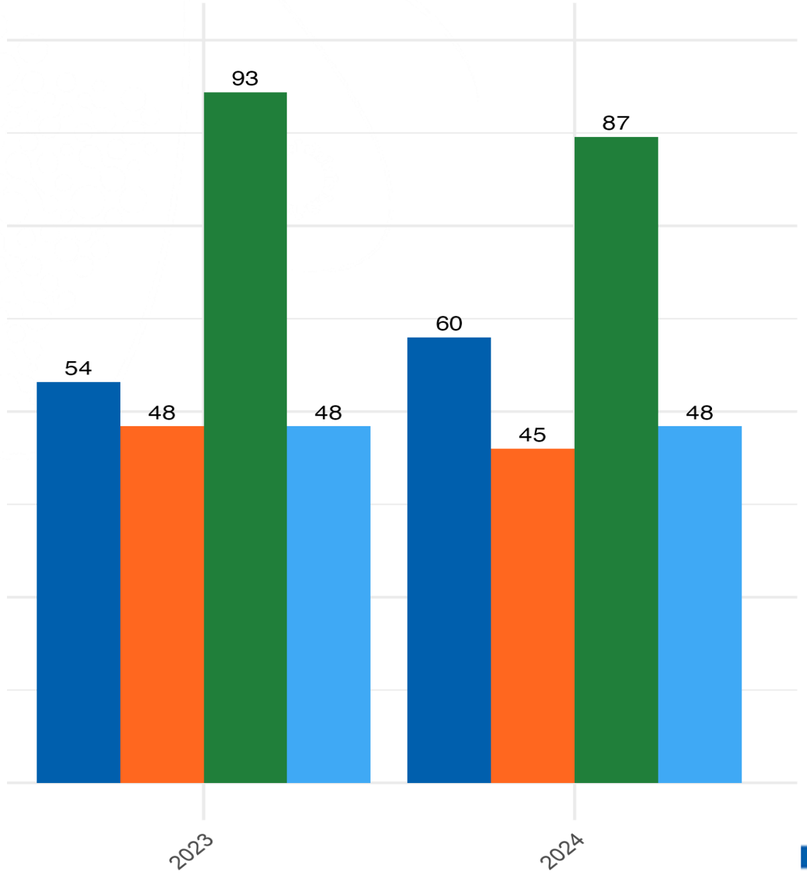
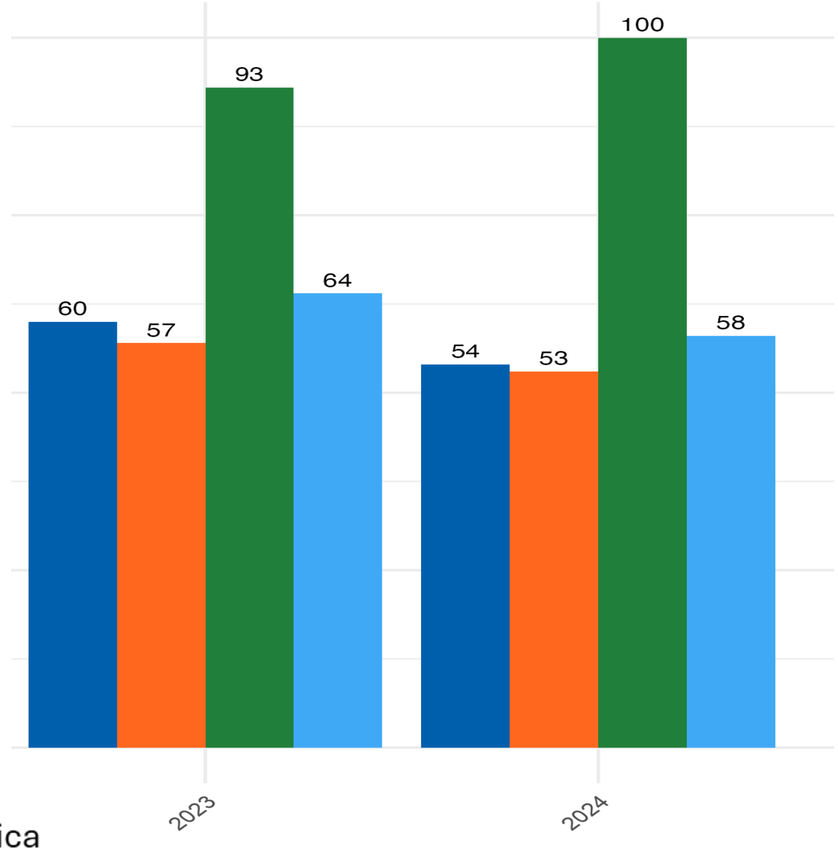
C4: Laboratory capacity indicators by subregion in the Americas, 2023–2024

C4.2 Implementation of a biosafety and biosecurity regime in laboratories



C4.3 Laboratory quality system



Central America
Caribbean
North America
South America

Source: e-SPAR platform, 2021- 2024. https://extranet.who.int/e-spar

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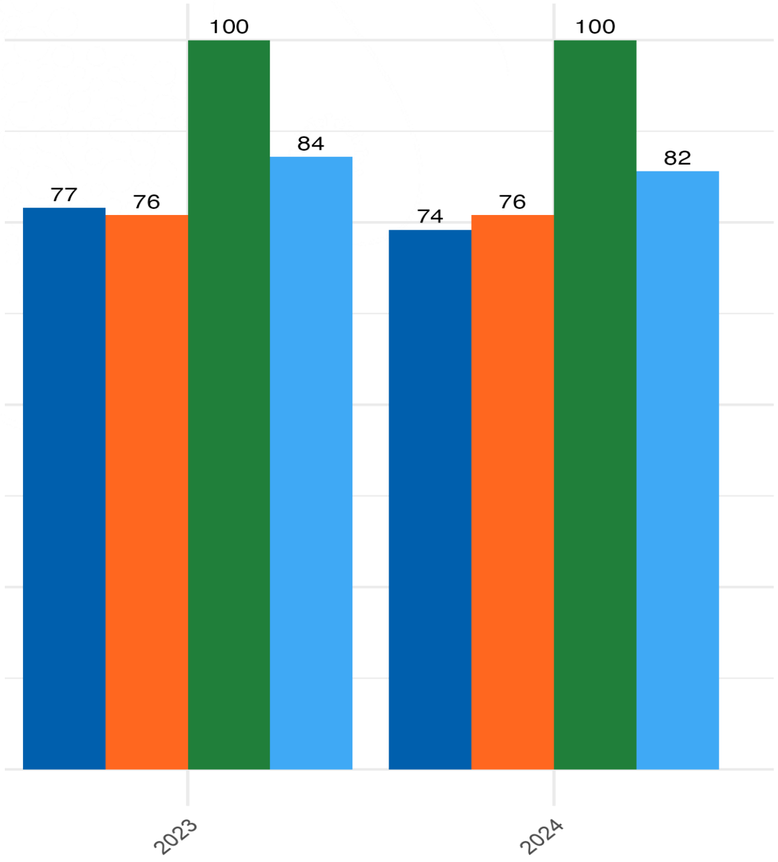
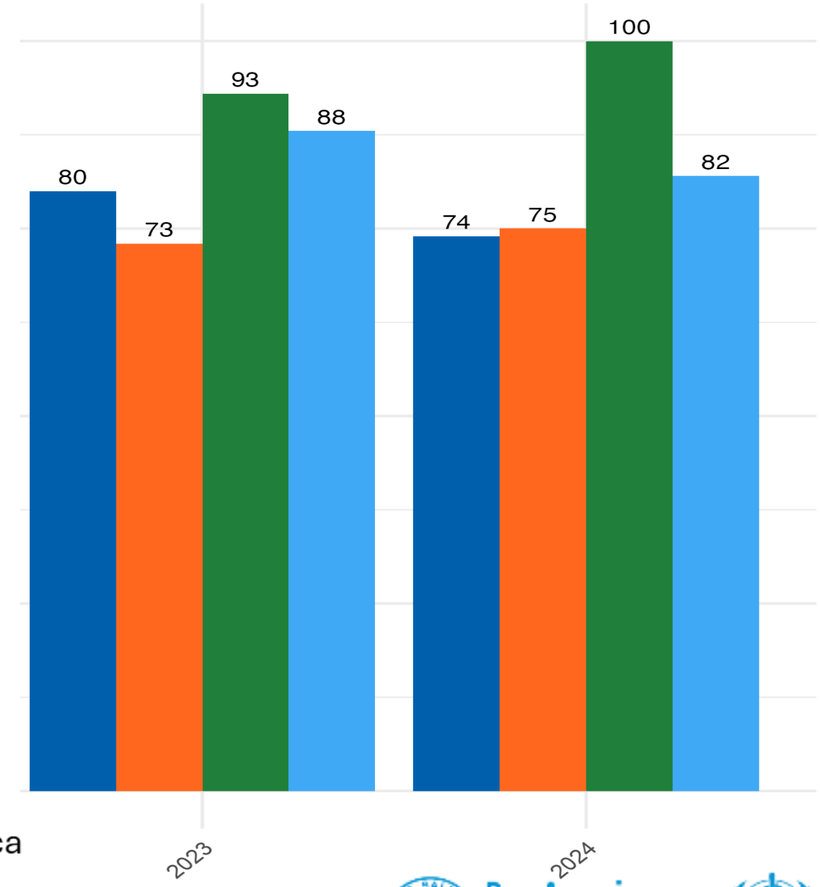
C4: Laboratory capacity indicators by subregion in the Americas, 2023–2024

C4.4 Modalities of laboratory testing capacity



C4.5 Effective national diagnostic network



Central America
Caribbean
North America
South America

Source: e-SPAR platform, 2021- 2024. https://extranet.who.int/e-spar

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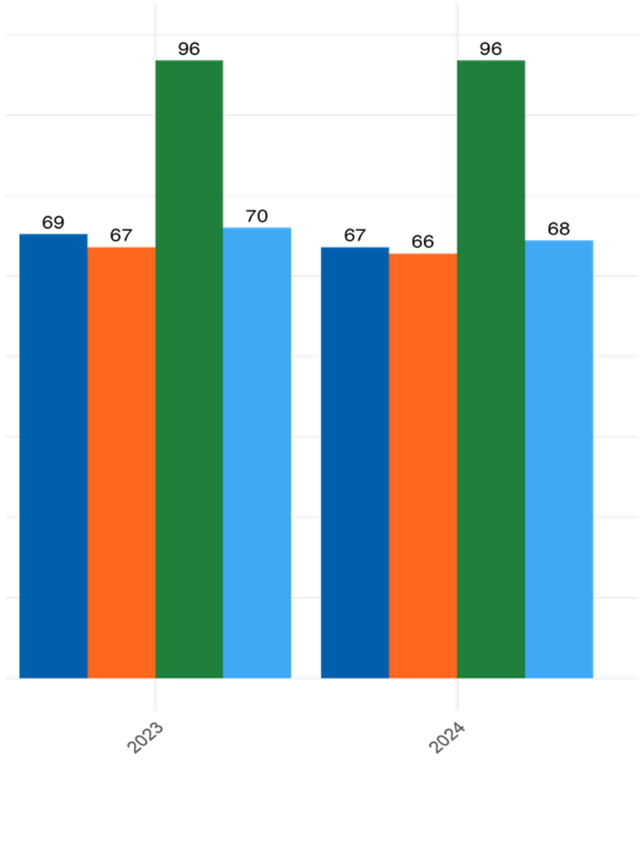
C4 Laboratory Capacity Indicators by Subregion in the Americas, 2023–2024

AMRO	2023	2024
C.4 Laboratory	75	74
C.4.1 Sample Referral and Transport System	78	78
C.4.2 Implementation of a biosafety and biosecurity regime in laboratories	60	60
C.4.3 Laboratory quality system	68	66
C.4.4 Modalities of Laboratory Testing Capacity	84	83
C.4.5 Effective national diagnostic network	83	82



Source: e-SPAR platform, 2021- 2024. https://extranet.who.int/e-spar

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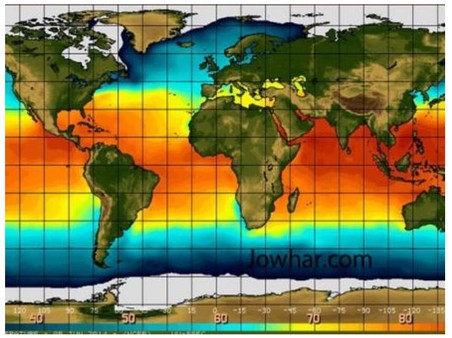
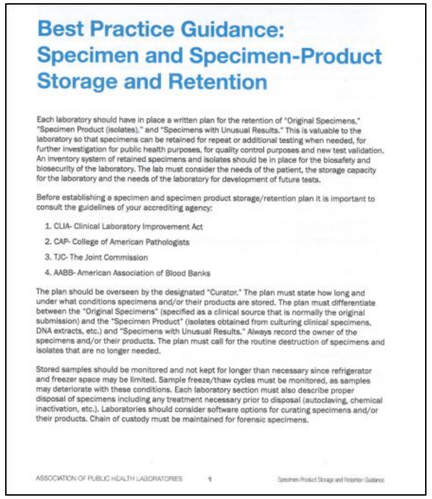
Challenges (identified) in emergency situations

- Inadequate or damaged infrastructure (containment, maintenance)
- Challenges for staff
  - Unusual event
  - Unknown/emerging pathogen
  - New variant/genotype
  - New virulence factors
  - New resistance pattern
  - Interpretation of a diagnostic failure
- Inadequate or insufficient equipment, reagents, and supplies
- Timeliness and accuracy of the diagnosis
- Increased demand
- **Media and political pressures**
- Lack of information
- Limited referral options
- Obstacles to shipping biological materials
- Space for storing samples/strains





Best Practice Guidance:
Specimen and Specimen-Product
Storage and Retention

Each laboratory should have in place a written plan for the retention of "Original Specimens," "Specimen Product (isolates)," and "Specimens with Unusual Results." This is valuable to the laboratory so that specimens can be retained for repeat or additional testing when needed, for further investigation for public health purposes, for quality control purposes and new test validation. An inventory system of retained specimens and isolates should be in place for the biosafety and biosecurity of the laboratory. The lab must consider the needs of the patient, the storage capacity for the laboratory and the needs of the laboratory for development of future tests.

Before establishing a specimen and specimen product storage/retention plan it is important to consult the guidelines of your accrediting agency:

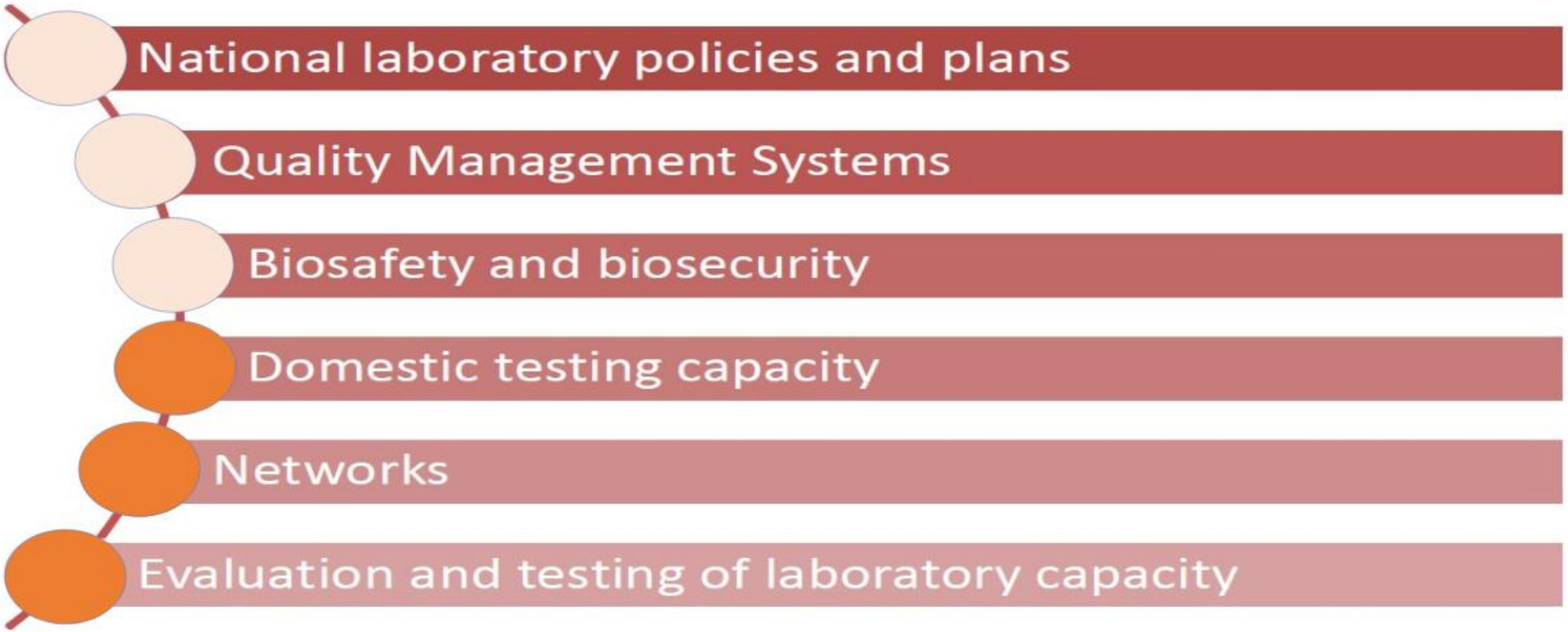
1. CLIA- Clinical Laboratory Improvement Act
2. CAP- College of American Pathologists
3. TJC- The Joint Commission
4. AABB- American Association of Blood Banks

The plan should be overseen by the designated "Curator." The plan must state how long and under what conditions specimens and/or their products are stored. The plan must differentiate between the "Original Specimens" (specified as a clinical source that is normally the original submission) and the "Specimen Product" (isolates obtained from culturing clinical specimens, DNA extracts, etc.) and "Specimens with Unusual Results." Always record the owner of the specimens and/or their products. The plan must call for the routine destruction of specimens and isolates that are no longer needed.

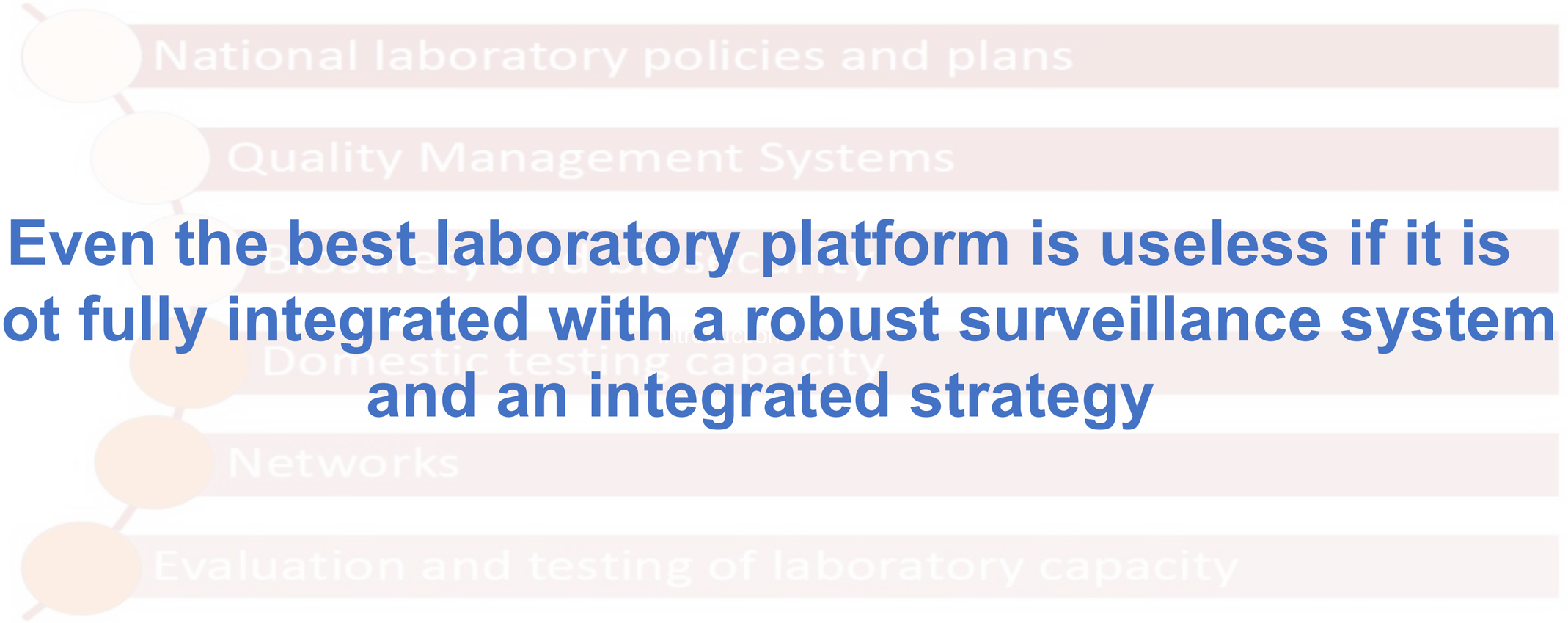
Stored samples should be monitored and not kept for longer than necessary since refrigerator and freezer space may be limited. Sample freeze/thaw cycles must be monitored, as samples may deteriorate with these conditions. Each laboratory section must also describe proper disposal of specimens including any treatment necessary prior to disposal (autoclaving, chemical inactivation, etc.). Laboratories should consider software options for curating specimens and/or their products. Chain of custody must be maintained for forensic specimens.

ASSOCIATION OF PUBLIC HEALTH LABORATORIES 1 Specimen Product Storage and Retention Guidance

Strengthen the comprehensive laboratory platform for surveillance and response

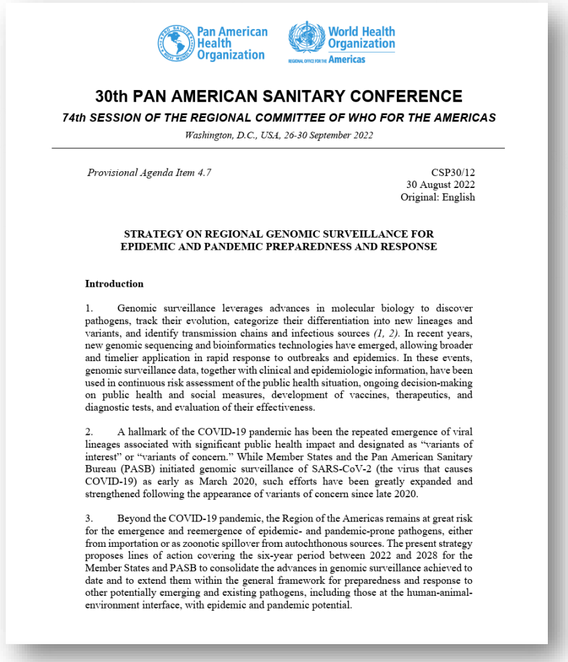


Strengthen the comprehensive laboratory platform for surveillance and response



Even the best laboratory platform is useless if it is not fully integrated with a robust surveillance system and an integrated strategy

Promote the implementation of critical regional mandates



Pan American Health Organization | World Health Organization Americas

30th PAN AMERICAN SANITARY CONFERENCE

74th SESSION OF THE REGIONAL COMMITTEE OF WHO FOR THE AMERICAS

Washington, D.C., USA, 26-30 September 2022

Provisional Agenda Item 4.7

CSP30/12
30 August 2022
Original: English

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.

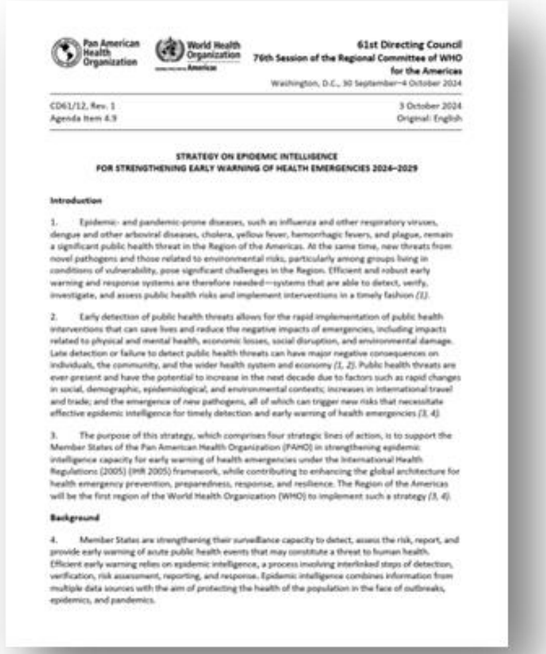
2. A hallmark of the COVID-19 pandemic has been the repeated emergence of viral lineages associated with significant public health impact and designated as "variants of interest" or "variants of concern." While Member States and the Pan American Sanitary Bureau (PASB) initiated genomic surveillance of 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.

- **CSP30/12 - Strategy on regional genomic surveillance for epidemic and pandemic preparedness and response.**

- **CD61/12 Rev. 1 - Strategy on Epidemic Intelligence to Strengthen Early Warning of Health Emergencies 2024–2029**

- *"Regional coordination protocols or mechanisms established to enable information exchange between PAHOGen, INFOSAN, IHR National Focal Points, and other relevant networks."*



Pan American Health Organization | World Health Organization Americas

61st Directing Council
76th Session of the Regional Committee of WHO for the Americas
Washington, D.C., 30 September–4 October 2024

CD61/12, Rev. 1
Agenda Item 4.9

3 October 2024
Original: English

STRATEGY ON EPIDEMIC INTELLIGENCE FOR STRENGTHENING EARLY WARNING OF HEALTH EMERGENCIES 2024–2029

Introduction

1. Epidemic- and pandemic-prone diseases, such as influenza and other respiratory viruses, dengue and other arboviral diseases, cholera, yellow fever, hemorrhagic fevers, and plague, remain a significant public health threat in the Region of the Americas. At the same time, new threats from novel pathogens and those related to environmental risks, particularly among groups living in conditions of vulnerability, pose significant challenges in the Region. Efficient and robust early warning and response systems are therefore needed—systems that are able to detect, verify, investigate, and assess public health risks and implement interventions in a timely fashion *(1)*.

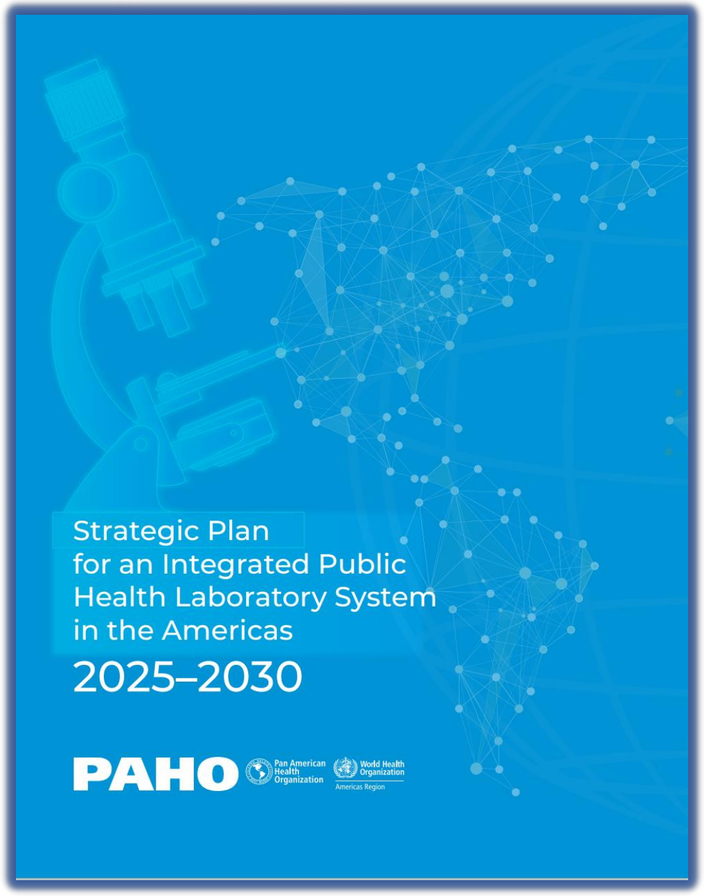
2. Early detection of public health threats allows for the rapid implementation of public health interventions that can save lives and reduce the negative impacts of emergencies, including impacts related to physical and mental health, economic losses, social disruption, and environmental damage. Late detection or failure to detect public health threats can have major negative consequences on individuals, the community, and the wider health system and economy *(1, 2)*. Public health threats are ever present and have the potential to increase in the next decade due to factors such as rapid changes in social, demographic, epidemiological, and environmental contexts; increases in international travel and trade; and the emergence of new pathogens, all of which can trigger new risks that necessitate effective epidemic intelligence for timely detection and early warning of health emergencies *(3, 4)*.

3. The purpose of this strategy, which comprises four strategic lines of action, is to support the Member States of the Pan American Health Organization (PAHO) in strengthening epidemic intelligence capacity for early warning of health emergencies under the International Health Regulations (2005) (IHR 2005) framework, while contributing to enhancing the global architecture for health emergency prevention, preparedness, response, and resilience. The Region of the Americas will be the first region of the World Health Organization (WHO) to implement such a strategy *(3, 4)*.

Background

4. Member States are strengthening their surveillance capacity to detect, assess the risk, report, and provide early warning of acute public health events that may constitute a threat to human health. Efficient early warning relies on epidemic intelligence, a process involving interlinked steps of detection, verification, risk assessment, reporting, and response. Epidemic intelligence combines information from multiple data sources with the aim of protecting the health of the population in the face of outbreaks, epidemics, and pandemics.

Promote the implementation of critical regional mandates



- **Strategic Plan for an Integrated Public Health Laboratory System in the Americas 2025–2030.**

- Strengthen resilient and integrated laboratory networks that support disease elimination, emergency response, and the “One Health” approach through innovation, strong governance, and sustainable capacity development.

- Ensure timely, evidence-based responses to health threats by fostering resilience, innovation, and collaboration across the human, animal, and environmental health sectors.

The Role of Laboratories in Supporting Epidemiological Intelligence

- **Epidemiological intelligence:**

  A systematic process of **detecting**, verifying, analyzing, and interpreting health data and signals to identify potential threats to public health, particularly outbreaks of infectious diseases, and to support timely risk assessment, decision-making, and response.

  Detection: Continuous scanning of data sources for unusual health-related events or patterns (e.g., clusters of cases, syndromic trends, **laboratory results**).

Early detection and surveillance rely on advanced laboratory networks and capabilities

RELDA (Arbovirus Laboratory Network)
Sarinet (National Influenza Centers)
Releva (Entomovirology Network)
PulseNet (foodborne pathogens)
Virored (public and academic laboratories)
PAHOgen (Genomics Network)

WHO-CC

CDC, Fort Collins, USA
CDC, Atlanta, USA
InDRE, Mexico
IPK, Cuba
INEVH, Argentina
IEC, Brazil
ICGES, Panama

Early detection and surveillance rely on advanced laboratory networks and capabilities

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SOCIEDAD

OMS declara pandemia global al coronavirus

11/03/2020

"Esta pandemia no es sólo una crisis de salud pública, afecta a todos los sectores, y todos los gobiernos y sociedades deben involucrarse en la lucha", dijo el director general de la OMS.

EL PAÍS 50 Sociedad 1 AÑO, COP$ 40.500

La visión más completa de la a

CORONAVIRUS >

La OMS declara el brote de coronavirus pandemia global

El director general de la organización asegura que está preocupado por los niveles alarmantes de propagación del virus y de inacción

Windows
gs to activate

11 de marzo de 2020

SALUD

La OMS declara oficialmente el coronavirus como una pandemia

PILAR PÉREZ / CRISTINA G. REAL
Madrid

Actualizado Miércoles, 11 marzo 2020 - **21:53**

Ver 30 comentarios

La OMS ha calificado oficialmente de pandemia la crisis del coronavirus. el organismo insiste en que no hay que tomar a la ligera el término y que no hay que cambiar lo que se estaba haciendo.

Tedros Adhanom, director general de la OMS. FABRICE COFFRINI AFP

Directo. Últimas noticias sobre coronavirus

Ya es oficial: la Organización Mundial de la Salud (**OMS**) califica a la crisis sanitaria del **coronavirus como pandemia**,

Early detection and surveillance rely on advanced laboratory networks and capabilities: PAHO Response to COVID-19 in the Americas

- We didn’t start from cero...
- All NICs and NPHLs responsible for the influenza and ORV response had already implemented molecular platforms.

WHO Collaborating Center (U.S. CDC)

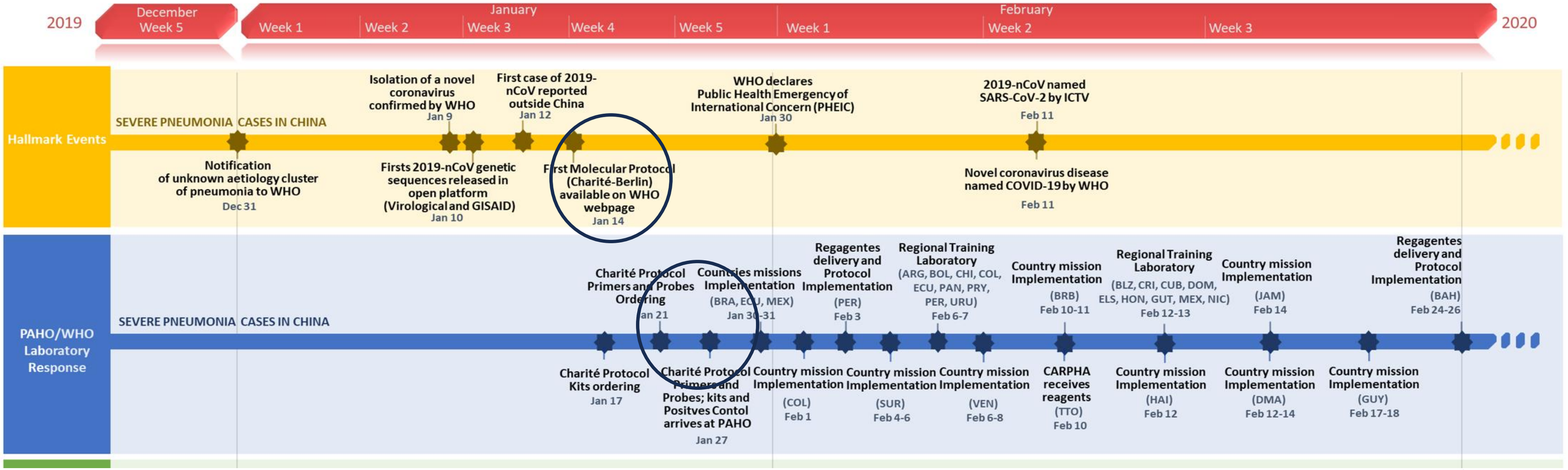
30 National Influenza Centers (NICs) in 26 countries

SARInet plus
Red de infecciones respiratorias agudas graves

National Influenza Centers and NPHL network (Sarinet)

SARI, severe acute respiratory infections | ILI, influenza-like illnesses

Early detection and surveillance are based on advanced laboratory networks and capabilities: PAHO's Response to COVID-19 in the Americas



PCR reagents (kits, primers, probes, controls) were procured and distributed beginning on **January 27.**

January 27 → **February 21**

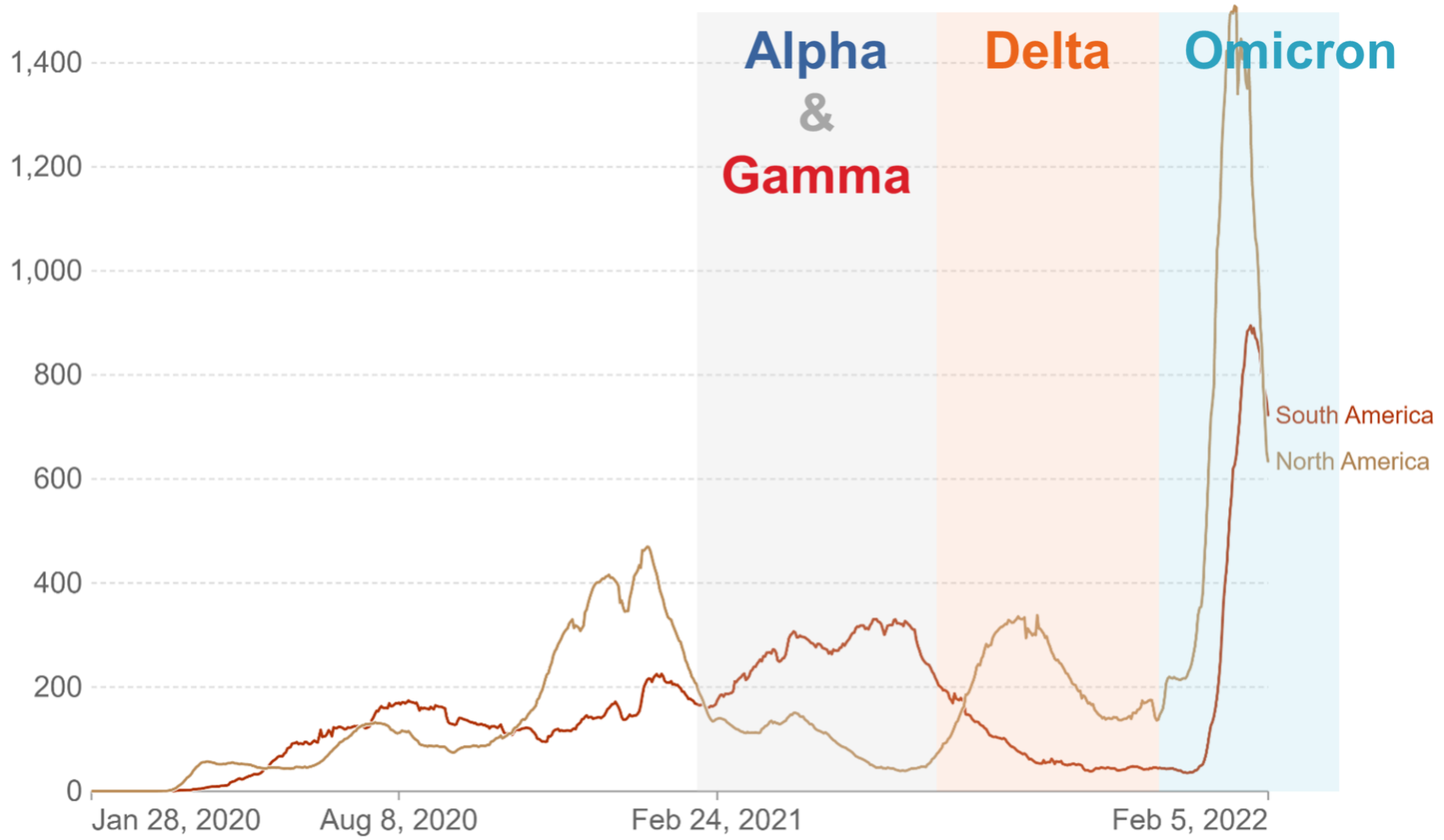
7 country missions for implementation

2 subregional practical workshops: BRA and MEX (18 countries)

29 countries with reagents and detection protocol in place

Early detection and surveillance rely on advanced laboratory networks and capabilities: Genomic Surveillance

Emergency of different Variants of Concern (VOC) has shaped the behavior of the COVID-19 pandemic



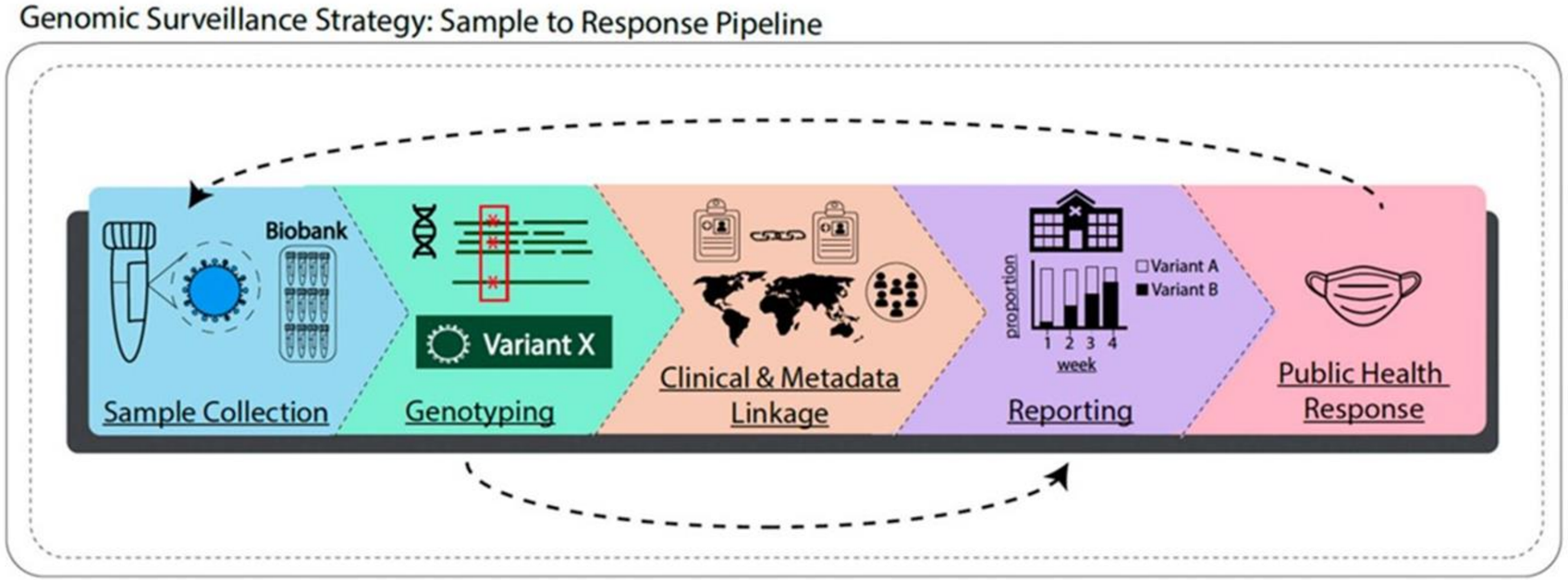
Modified from ourworldindata.org with superposition of approximate concomitance of VOC-specific dominace.

SARS-CoV-2: Expanding the Concept of Genomic Surveillance

Pathogen / Group	Estimated Public Genomes	Main Platforms / Databases	Notes

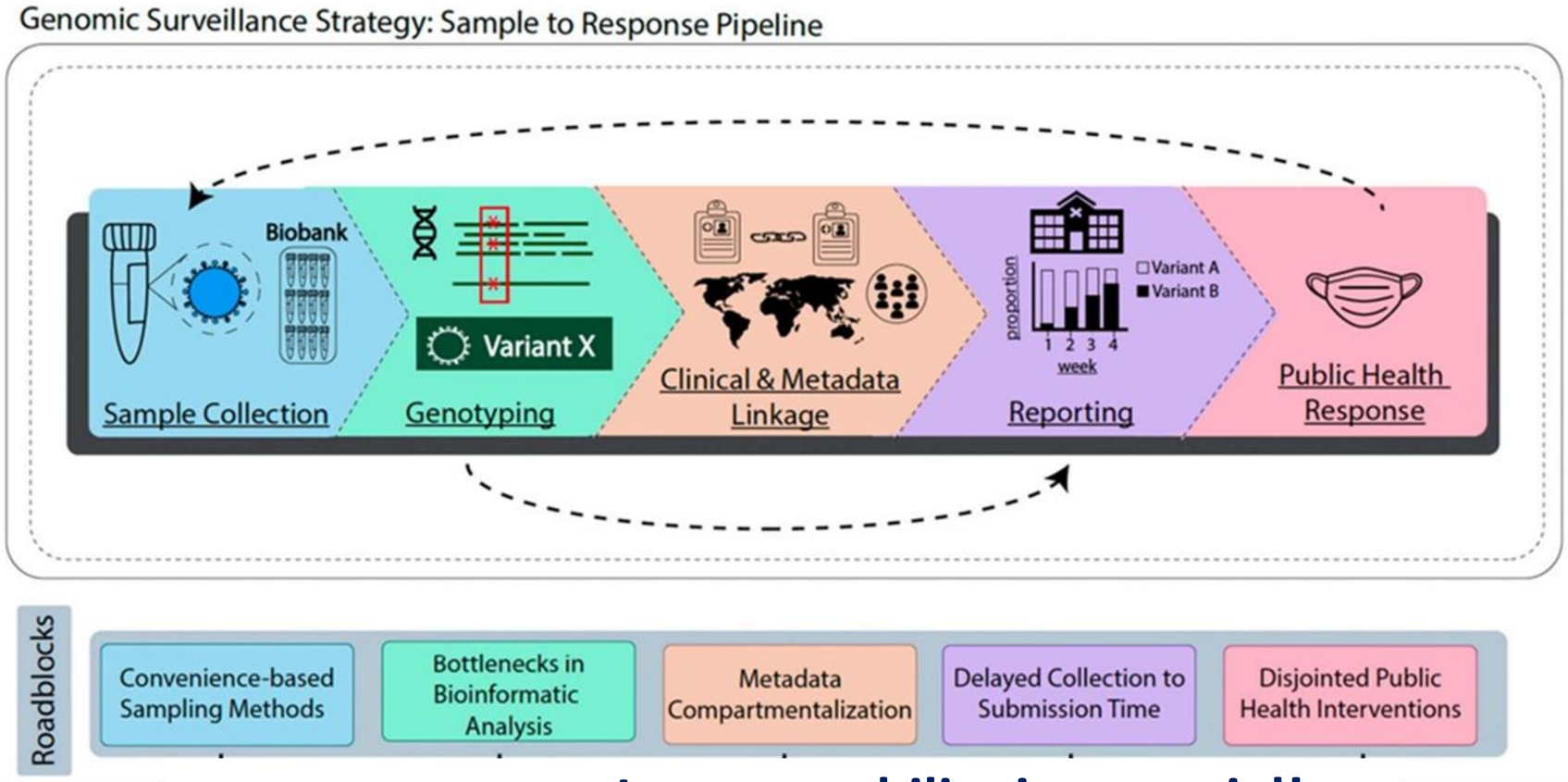
December 2025

Laboratory results for public health decision-making



https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9698389/pdf/viruses-14-02532.pdf

Laboratory results for public health decision-making



Interoperability is essential!

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9698389/pdf/viruses-14-02532.pdf

Laboratory results for public health decision-making: Several challenges remain to be addressed...

- Those responsible for laboratory surveillance often think differently from those responsible for decision-making:
  - Different stakeholders may approach the problem of controlling the spread of pathogens (through surveillance) from different perspectives*
  - Decisions must be made with a multidisciplinary approach in mind.
  - There is a (significant) gap between scientific language and the language of decision-making: policymakers may not prioritize investment in interventions if they do not fully understand the importance of early detection and rapid response to disease outbreaks*.
  - It is our responsibility to translate information into practical (specific) messages.

- A good strategy must include effective communication and understanding with decision-makers; if the information is unclear, the recommendations may not be appropriate.

Genomics for public health decision-making: Ideas for better communication

- The goal isn’t for decision-makers to become bioinformaticians, but to understand what is essential and actionable.
- Simplify without losing accuracy: translate technical findings into clear, concise messages.
- Connect science to real-world impact: explain how results influence vaccination, diagnostics, or outbreak response.
- Speak the language of risk: use trends, probabilities, and alerts instead of technical terms.

Genomics for public health decision-making: Tips for better communication

- Instead of saying: “A clade 3C.2a1b.2a2 with a substitution at site HA-156 was detected.”

Genomics for public health decision-making

- “The real value of genomic surveillance lies not in the number of sequences, but in the decisions they enable.”
- Standardize how genomic findings are communicated.
- Create multidisciplinary teams—scientists, epidemiologists, and communicators.
- Integrate genomic data into regional public health intelligence systems.
- Advances in technology and bioinformatics in pathogen genomics present a unique opportunity to use molecular epidemiology to improve public health responses.

Resilient laboratories: Final remarks

- Laboratories are essential for the characterization and surveillance of emerging pathogens
- It is essential to have contingency plans in place to quickly reorganize laboratories and respond gradually without significantly disrupting operations
- It is not necessarily about having all the installed capacity, but rather about having access to laboratory and reference networks
- Decentralization at the national level can be phased and tailored to need
- Quality is non-negotiable… all quality assurance processes must be maintained in accordance with quality policies adapted to the epidemiological situation (pandemic/emergency)

THANK YOU!

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REGIONAL LAB MEETING
BRAZIL - NOVEMBER 2025