From Data to Action: Understanding how WHO's Global Surveillance on Coronaviruses informs Response

Introduction

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Team Lead, WHO Global COVID-19 and other Coronaviruses Programme

5 November 2025

World Health Organization

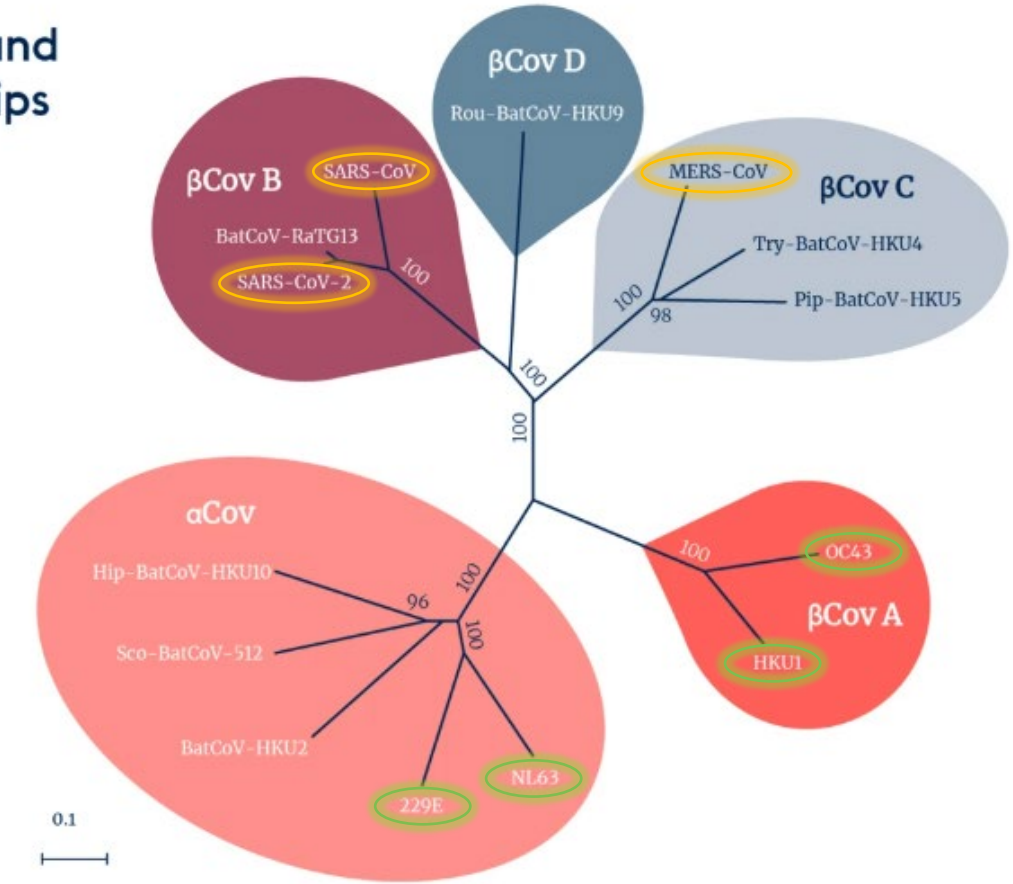
Coronaviruses

The Coronavirus family includes hundreds of viruses, divided into four groups:

- *Alphacoronaviruses*
- *Betacoronaviruses*
- *Gammacoronaviruses*
- *Deltacoronaviruses*

Most human diseases are caused by Alpha- and Betacoronaviruses

Phylogenetic Tree and Genetic Relationships of Different Coronaviruses



Coronavirus groups and subsets.
Credit: Trends in Immunology

Pandemic potential

Endemic human coronaviruses

*The Coronaviruses | CEPI

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Past, present and future zoonotic coronavirus threats:
SARS – MERS – COVID-19 and *novel Coronaviruses*

2002 2005 2008 2012 2014 2017 2020 2025

Emergence of a novel Coronavirus (Not if, but when?!)

Civet cat

SARS

Summary of probable number of SARS cases with onset of illness from 1 November 2002 to 31 July 2003

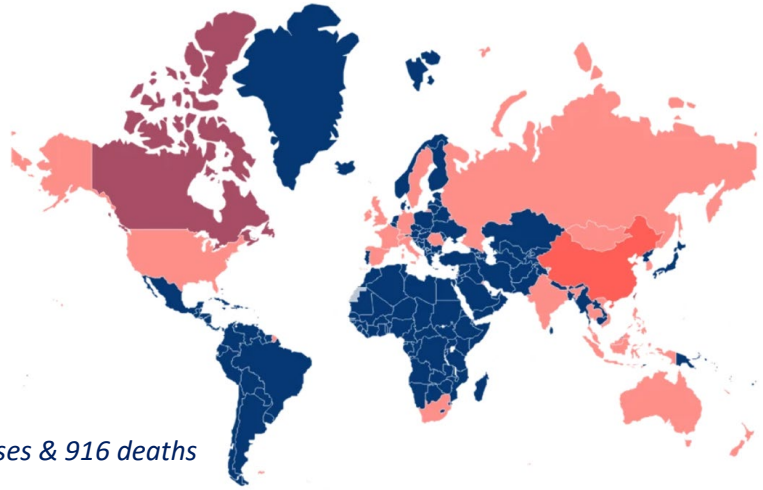
Dromedary camel

MERS cases reported to WHO (cumulative total since 2012)

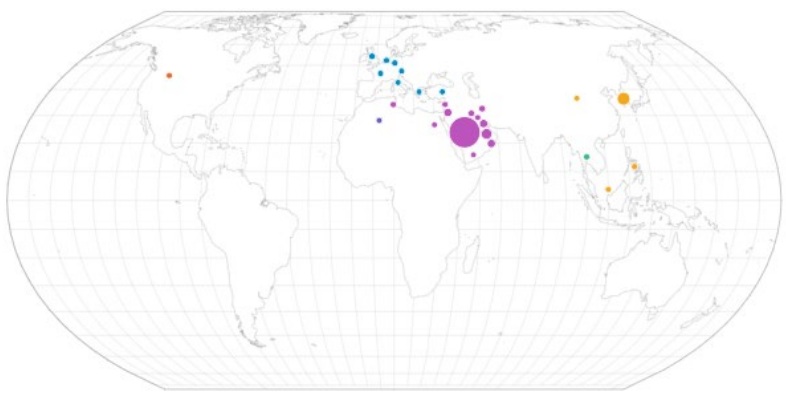
2 630 cases & 960 deaths

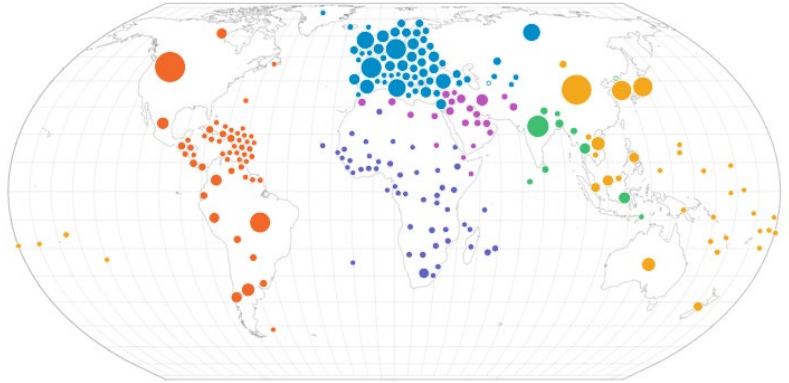
COVID-19 cases reported to WHO (cumulative total since 2019)

778 M cases & >7M deaths; ~20M excess deaths



8 422 cases & 916 deaths





WHO Regions Africa Americas Eastern Mediterranean Europe South-East Asia Western Pacific

*The Coronaviruses | CEPI

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Coronaviruses continue to genetically evolve and can acquire new features, such as human infectiousness, increased virulence, etc.

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The strategic direction of coronavirus disease threat management efforts continues to evolve

From Emergency Response to Long-Term COVID-19 Disease Management: Sustaining Gains Made During the COVID-19 Pandemic

Goal: End the emergency phase of the COVID-19 pandemic in all countries and shift from emergency response to sustainable comprehensive management of COVID-19 within broader disease prevention and control programmes.

AT A GLANCE

World Health Organization

Strategic and operational plan for coronavirus disease threat management

Advancing sustained, integrated coronavirus disease threat management: 2025-2030

2025 – onwards

Shift into the programmatic management of coronavirus disease threats, incl. COVID-19, MERS, etc.

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WHO's Global Coronavirus Programme is organized around the 5 Cs of the HEPR framework and its Strategic Plan has four objectives

5 C's of the Health Emergency Prevention, Preparedness, Response, and Resilience (HEPR) framework

AT A GLANCE

World Health Organization

Strategic and operational plan for coronavirus disease threat management

Advancing sustained, integrated coronavirus disease threat management: 2025-2030

Strategic objectives

The plan aims to support and guide Member States and the broader global health community to:

1. **Sustain** essential, evidence-based COVID-19 and other coronavirus disease threat management activities across core public health capabilities to reduce morbidity, mortality, and socio-economic disruption, right-sized to burden.
2. **Integrate** coronavirus disease threat management into broader disease prevention and control programmes and systems, across all levels (local, national, regional, global), in particular with other respiratory diseases, like influenza and respiratory syncytial virus (RSV).
3. **Enhance** core capabilities as outlined in the HEPR Framework to identify, prioritize, and address operational gaps in coronavirus disease threat management.
4. **Generate**, share, and apply evidence to close knowledge gaps and translate research and lessons learned into improved programmes, policies, and evidence-based guidance and control tools.

Surveillance / monitoring ➡ risk evaluation ➡ decision making

WHO monitors and assesses coronaviruses and evaluates their impact on countermeasures, including vaccines, therapeutics, diagnostics or effectiveness of public health and social measures.

Virus ▼ **Monitoring & surveillance**

TAG-VE
- Determines which variants warrant further investigations
- Assesses whether variants alter
  - transmission or disease characteristics or
  - performance of vaccines, therapeutics, diagnostics or
  - effectiveness of public health and social measures

Ayşe Açma – Epidemiologist

James Otieno – Bioinformatician/ Genomics

Vaccine ▼ **Research, evidence & assessment**

R&D Blueprint for epidemics
- COVID-19 Vaccines Research Expert Group

TAG-CO-VAC
- Assesses the impact of SARS-CoV-2 variants on current COVID-19 vaccines
- Determines whether changes to vaccine composition are needed

Bart Haagmans – TAG-VE Chair

Vaccine implementation ▼ **Policy**

SAGE
- Recommends policies and strategies on vaccine use and immunization programmes through evidence-based assessment

Annelies Wilder-Smith – SAGE Secretariat

Vaccination Programmes
- Global status
- Resources available to support programme strengthening

Shoshanna Goldin – MCM Technical Officer

World Health Organization

Please welcome our speakers today!

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How WHO monitors the current COVID-19 situation

Ayşe Açma, Epidemiologist

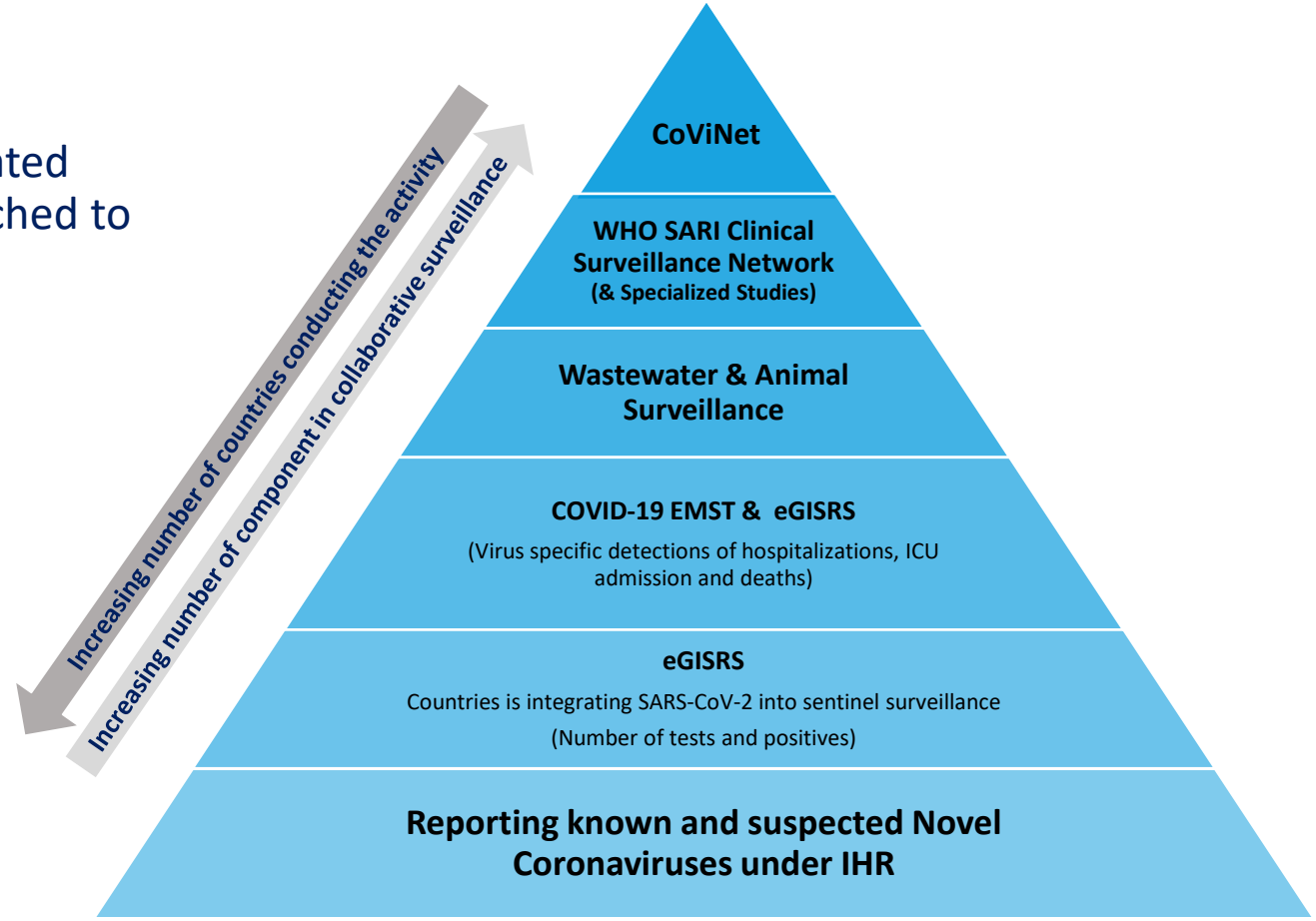
James Richard Otieno, Bioinformatician/Genomic Epidemiologist

5 November 2025

World Health Organization

Comprehensive and complementary surveillance approaches for COVID-19 within the Mosaic Framework

Countries can implement multiple surveillance approaches, as coordinated and collaborative systems, well-matched to specific priority objectives



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WHO Mosaic Respiratory Surveillance Framework March 2023

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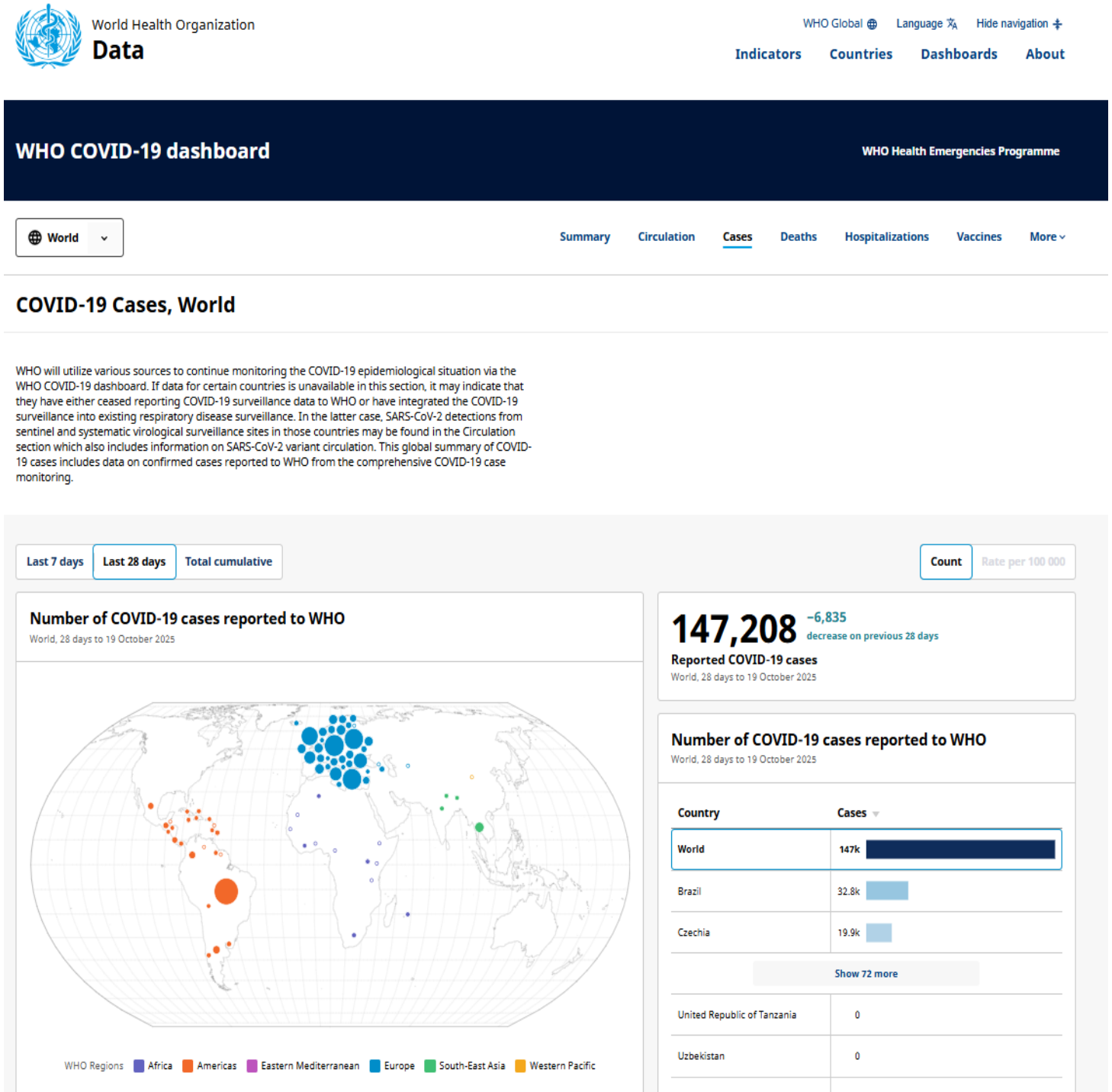
Surveillance types and data flow

- Integrated Sentinel surveillance
- Detailed surveillance
- Genomic surveillance
- Environmental surveillance
- Event based surveillance
- Vaccine coverage monitoring
- Animal surveillance (Partner Organizations)

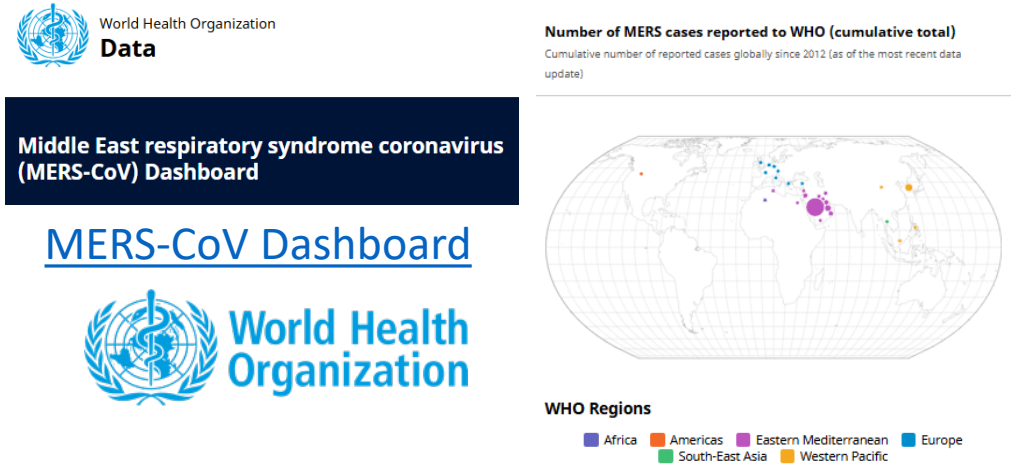
WHO Global COVID-19 Dashboard

Integration and triangulation of the latest global data and insights on various components of COVID-19 within a unified platform.

[COVID-19 Dashboard]



Other Coronavirus Dashboard



[MERS-CoV Dashboard]

World Health Organization

Regional Office Information Sources

ERVISS European Respiratory Virus Surveillance Summary

erviss.org

OPS Organización Panamericana de la Salud / Organización Mundial de la Salud Américas

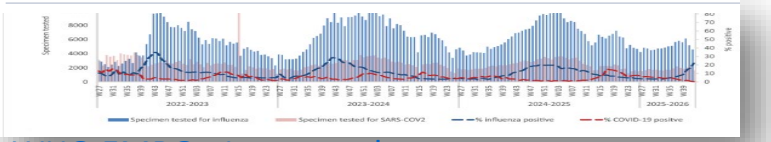
Situación de Influenza, SARS-CoV-2, VSR y otros virus respiratorios - Región de las Américas

respiratory viruses

Covid-19 newsletters

Coronavirus (COVID-19) | WHO | Regional Office for Africa

Influenza and other respiratory viruses updates



WHO EMRO - Latest updates

South-East Asia Region - Influenza Situation Update

COVID-19 situation reports

WHO Western Pacific Bi-weekly situation update by date

COVID-19 situation reports | WHO Western Pacific

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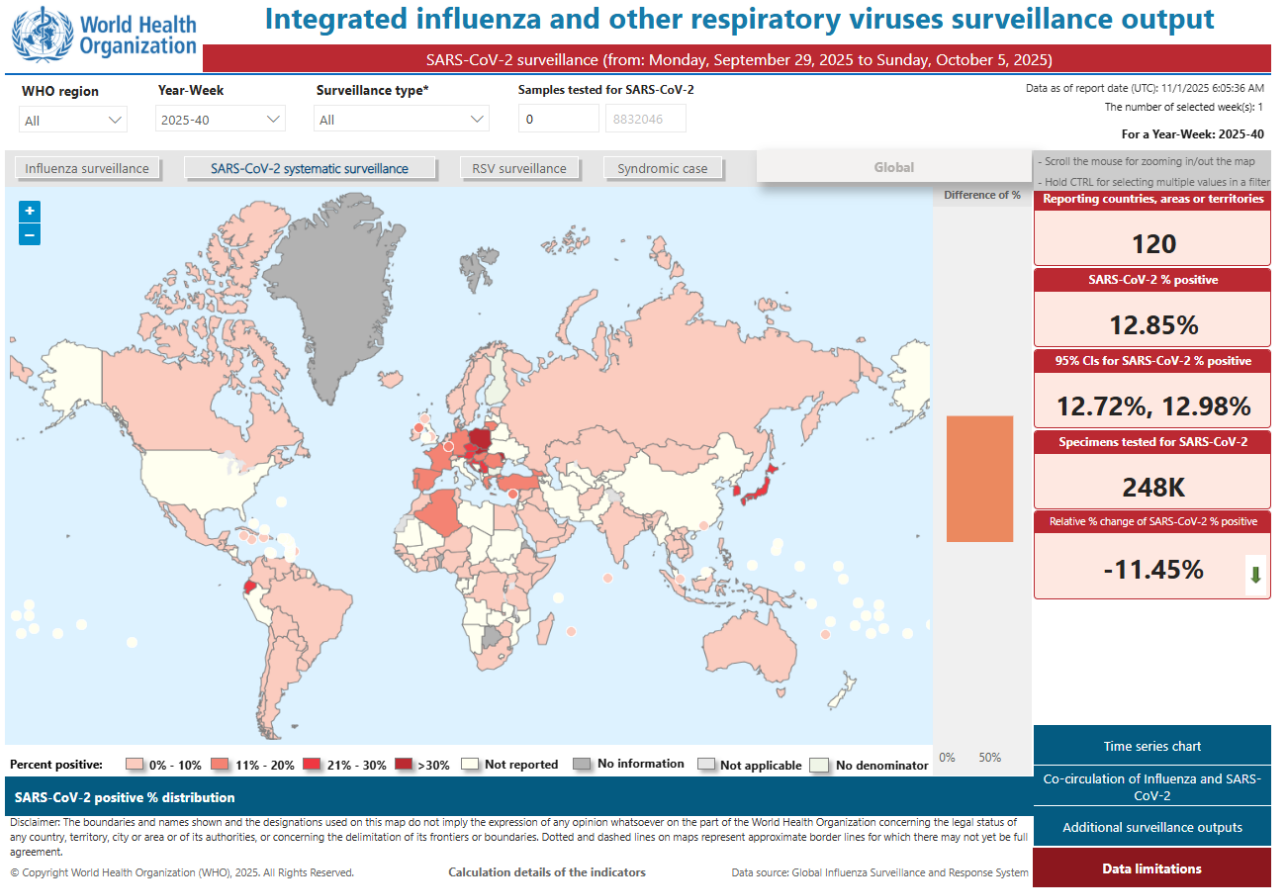
Integrated Surveillance
Global Influenza Surveillance and Response System



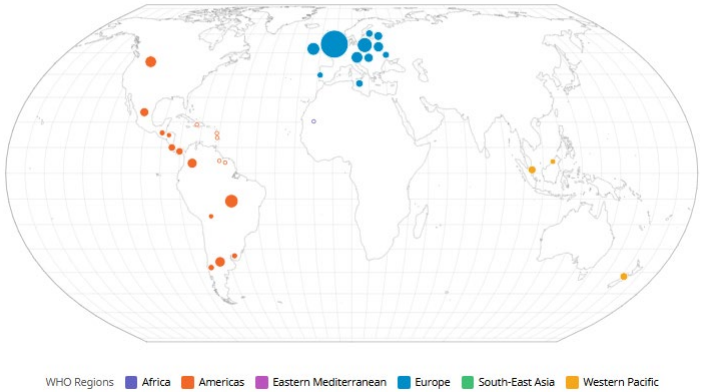
- *Countries are encouraged to integrate SARS-CoV-2 surveillance into existing respiratory disease surveillance systems.*
- *Currently, 77% of WHO Member States have adopted this more sustainable approach by incorporating SARS-CoV-2 surveillance into influenza sentinel or systematic virological surveillance systems,*
- *and are reporting data through the expanded GISRS platform.*

Integrated influenza and other respiratory viruses surveillance dashboard

Health impact data (detailed surveillance)

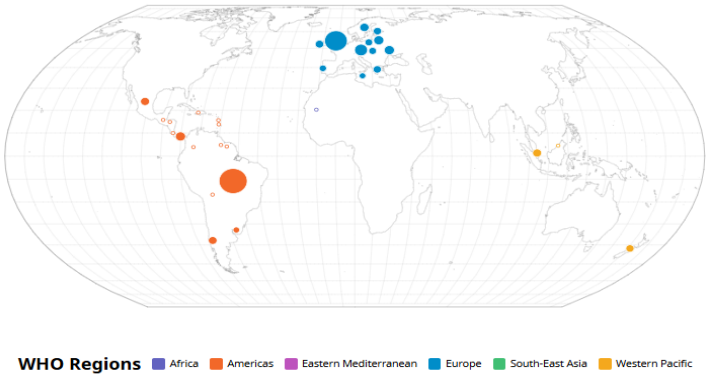
Number of hospitalizations due to SARS-CoV-2 in last 28 days

World, 28 days to 19 October 2025



Number of ICU admissions due to SARS-CoV-2 in last 28 days

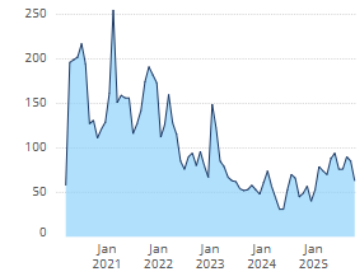
World, 28 days to 19 October 2025



Severity Rate per 1000 Hospitalizations, World

Rate of deaths per 1000 hospitalizations reported to WHO (28 days)

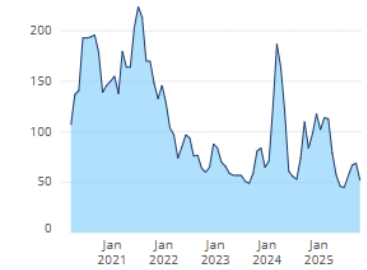
World



Source: World Health Organization

Rate of ICU admissions per 1000 hospitalizations reported to WHO (28 days)

World

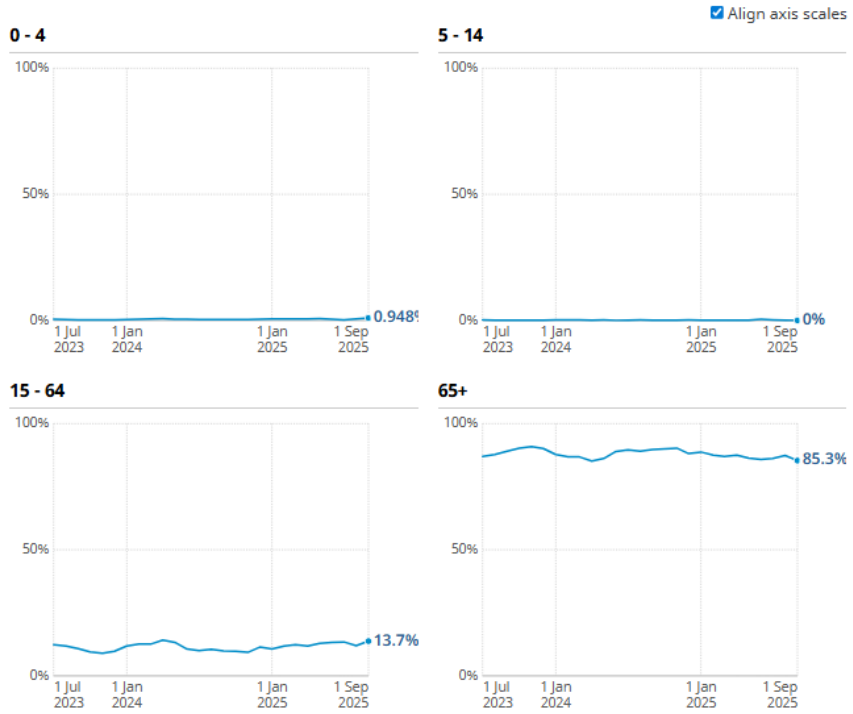


Source: World Health Organization

Data may include corrections and be incomplete for the latest week

Trends in COVID-19 deaths by age, World

Proportions of deaths reported due to COVID-19 (monthly)



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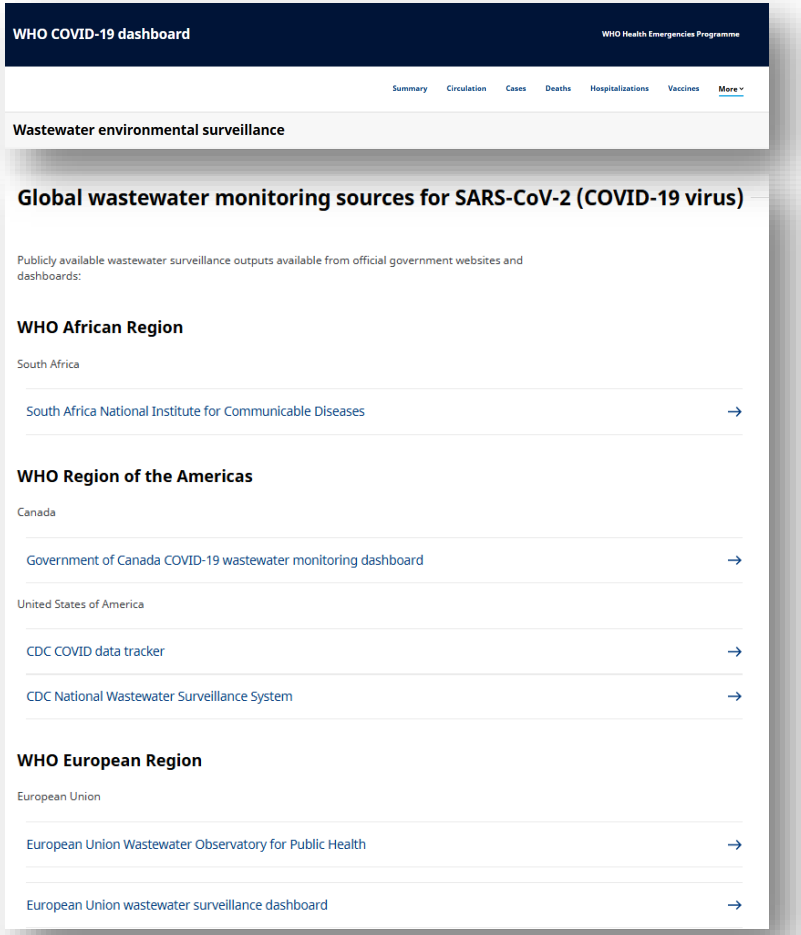
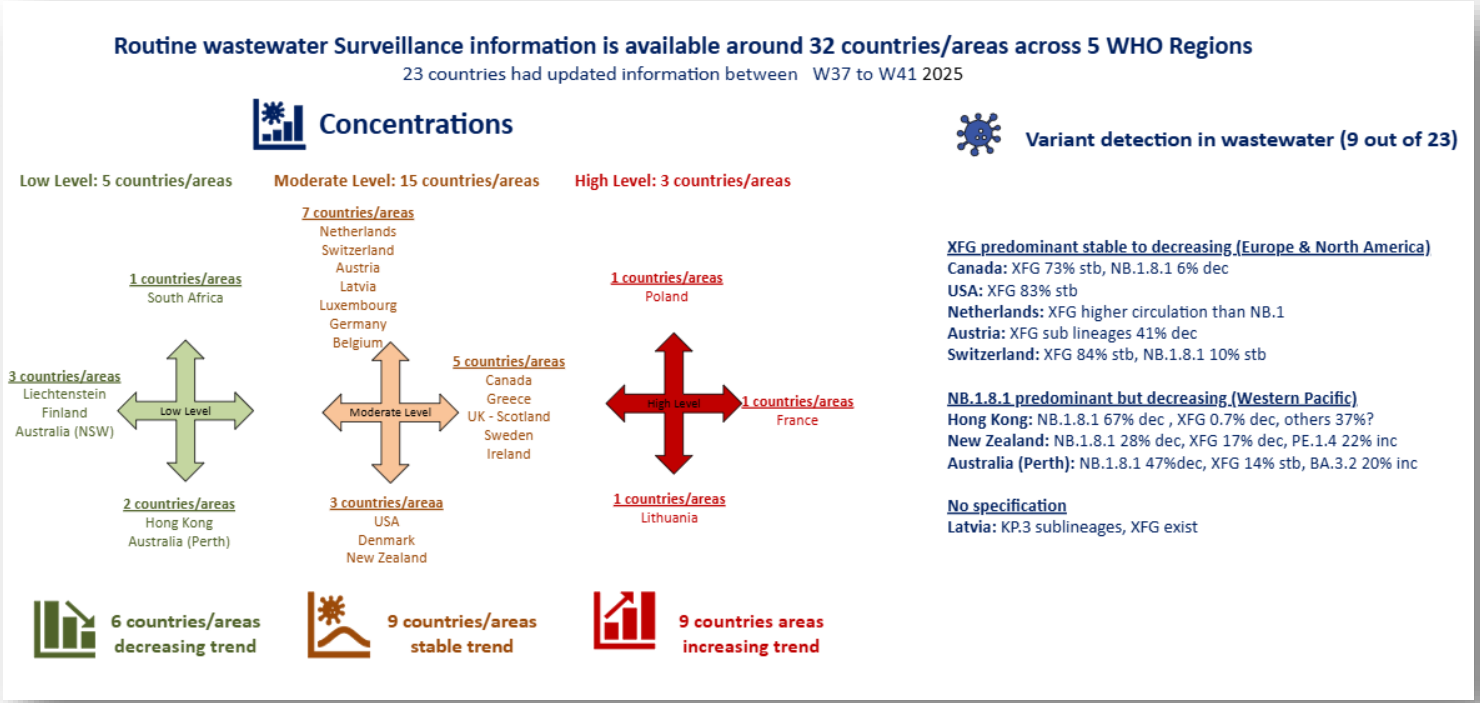
Wastewater Surveillance





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Event Based Surveillance

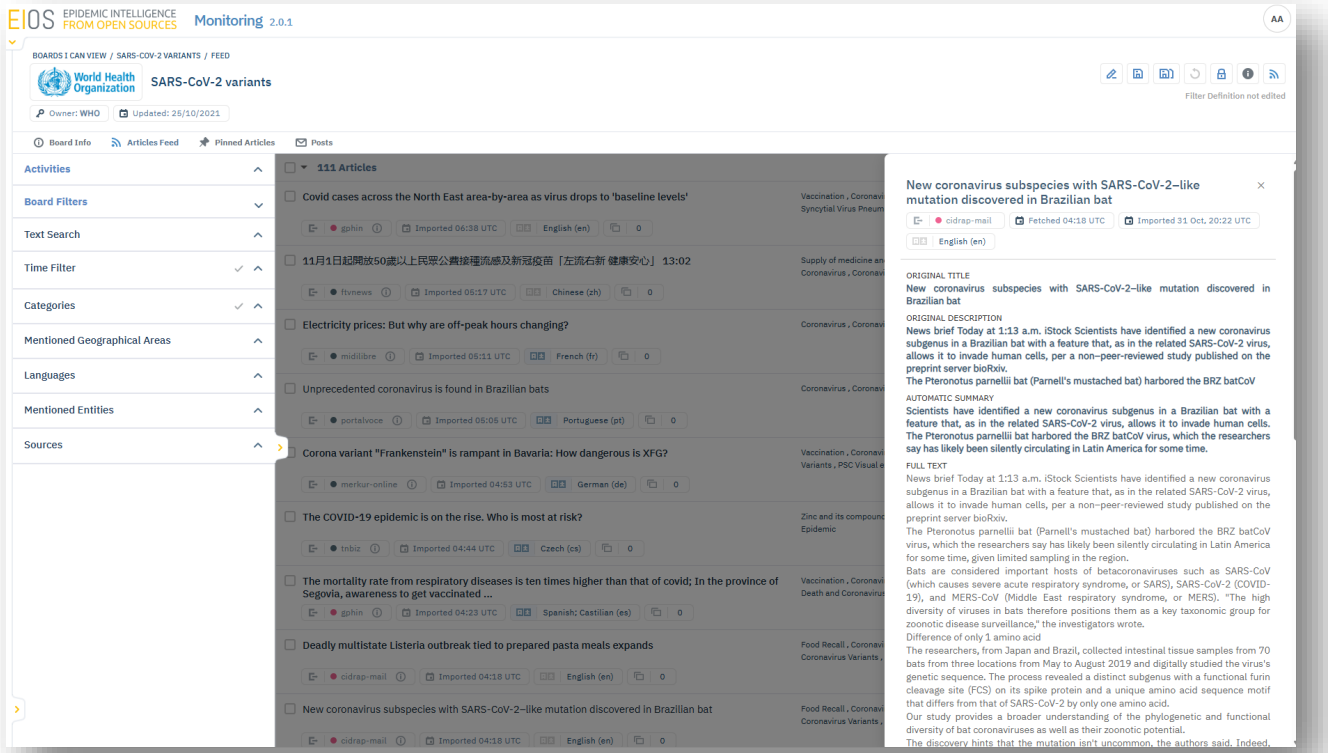
1. Official country public health institution websites:
   - dashboards,
   - situation reports,
   - special reports,
   - statements
2. Media monitoring (mainly via EIOS)

EIOS is a global WHO-led collaboration that unites public health actors worldwide.

- Articles from selected websites, RSS feeds, social media and other open-source information
- Text mining, algorithms and analytical modules sort and categorize articles
- Adaptable criteria to meet specific surveillance needs

Allows professionals to quickly access multitude of sources based on time period, topic of interest, country/area, language, source type.

Epidemic Intelligence from Open Sources



Animal surveillance via partner organizations


Joint statement on the prioritization of monitoring SARS-CoV-2 infection in wildlife and preventing the formation of animal reservoirs

By Food and Agriculture Organization (FAO), World Organisation for Animal Health (OIE) and World Health Organization (WHO)

7 March 2022 | Statement |Reading time: 3 min (834 words)

[Joint statement on the prioritization of monitoring SARS-CoV-2 infection in wildlife and preventing the formation of animal reservoirs]

The Food and Agriculture Organization of the United Nations (FAO)

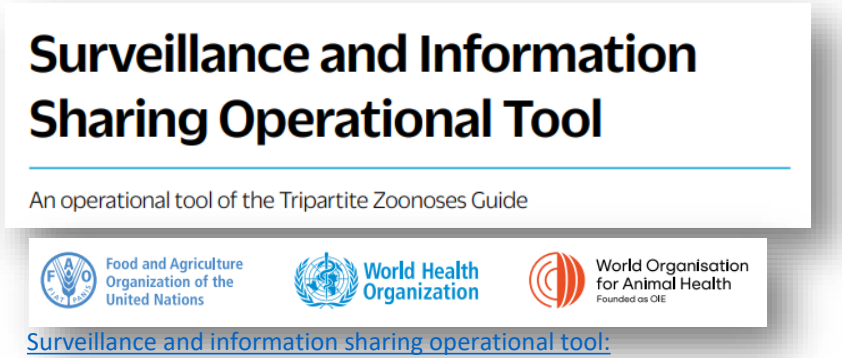
Emerging zoonotic coronaviruses in animals' situation updates

Updates

September 2025

- Two new MERS-CoV human cases reported in Saudi Arabia, with one fatality;
- SARS-CoV-2 virological findings reported in animals in Argentina, Brazil and Bulgaria;
- MERS-CoV virological findings reported in animals in Kenya;
- 3 new species reported naturally infected by SARS-CoV-2;
- 13 new relevant publications.

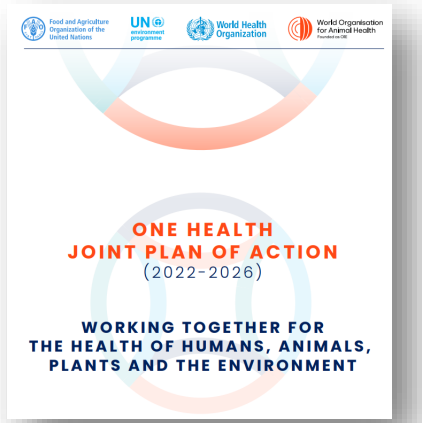
[Emerging zoonotic coronaviruses in animals]


Surveillance and Information Sharing Operational Tool

An operational tool of the Tripartite Zoonoses Guide

Food and Agriculture Organization of the United Nations | World Health Organization | World Organisation for Animal Health Founded as OIE

[Surveillance and information sharing operational tool: an operational tool of the tripartite zoonoses guide] Sept 2022



[One health joint plan of action (2022–2026): working together for the health of humans, animals, plants and the environment]

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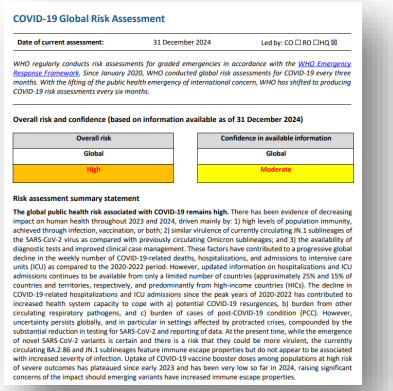
HEALTH EMERGENCIES programme

Guidelines, Reports and Risk Assessments

COVID-19 Global Risk Assessment



COVID-19 Global Risk Assessment

Date of current assessment: 31 December 2024 Led by: CO ☐ RO ☐ HQ ☒

WHO regularly conducts risk assessments for graded emergencies in accordance with the WHO Emergency Response Framework. Since January 2020, WHO conducted global risk assessments for COVID-19 every three months. With the lifting of the public health emergency of international concern, WHO has shifted to producing COVID-19 risk assessments every six months.

Overall risk and confidence (based on information available as of 31 December 2024)

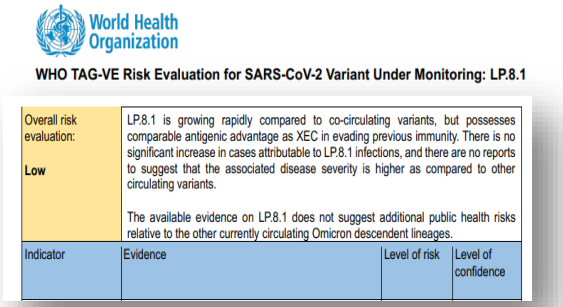
Overall risk	Confidence in available information
Global	Global
High	Moderate

Risk assessment summary statement

The global public health risk associated with COVID-19 remains high. There has been evidence of decreasing impact on human health throughout 2023 and 2024, driven mainly by: 1) high levels of population immunity, achieved through infection, vaccination, or both; 2) similar virulence of currently circulating JN.1 sublineages of the SARS-CoV-2 virus as compared with previously circulating Omicron sublineages; and 3) the availability of diagnostic tests and improved clinical case management. These factors have contributed to a progressive global decline in the weekly number of COVID-19-related deaths, hospitalizations, and admissions to intensive care units (ICU) as compared to the 2020-2022 period. However, updated information on hospitalizations and ICU admissions continues to be available from only a limited number of countries (approximately 25% and 15% of countries and territories, respectively, and predominantly from high-income countries (HICs). The decline in COVID-19-related hospitalizations and ICU admissions since the peak years of 2020-2022 has contributed to increased health system capacity to cope with a) potential COVID-19 resurgences, b) burden from other circulating respiratory pathogens, and c) burden of cases of post-COVID-19 condition (PCC). However, uncertainty persists globally, and in particular in settings affected by protracted crises, compounded by the substantial reduction in testing for SARS-CoV-2 and reporting of data. At the present time, while the emergence of novel SARS-CoV-2 variants is certain and there is a risk that they could be more virulent, the currently circulating BA.2.86 and JN.1 sublineages feature immune escape properties but do not appear to be associated with increased severity of infection. Uptake of COVID-19 vaccine booster doses among populations at high risk of severe outcomes has plateaued since early 2023 and has been very low so far in 2024, raising significant concerns of the impact should emerging variants have increased immune escape properties.

[COVID-19 Global Risk Assessment]

SARS-CoV-2 Variant Risk Evaluations



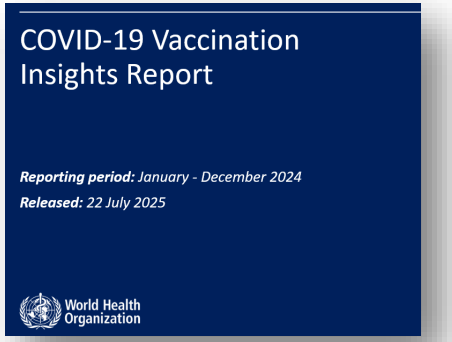
World Health Organization

WHO TAG-VE Risk Evaluation for SARS-CoV-2 Variant Under Monitoring: LP.8.1

Overall risk evaluation: **Low**	LP.8.1 is growing rapidly compared to co-circulating variants, but possesses comparable antigenic advantage as XEC in evading previous immunity. There is no significant increase in cases attributable to LP.8.1 infections, and there are no reports to suggest that the associated disease severity is higher as compared to other circulating variants. The available evidence on LP.8.1 does not suggest additional public health risks relative to the other currently circulating Omicron descendent lineages.		
Indicator	Evidence	Level of risk	Level of confidence

[Tracking SARS-CoV-2 variants]

COVID-19 Vaccination Insights Report



COVID-19 Vaccination Insights Report

Reporting period: *January - December 2024*

Released: *22 July 2025*

World Health Organization

[COVID-19 Vaccination Insights Report]

Integrated surveillance

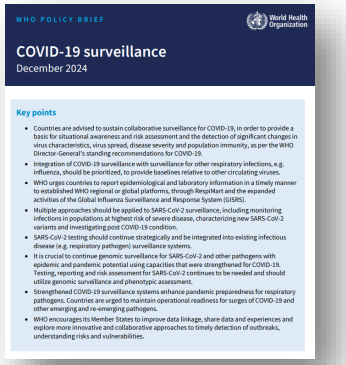
Implementing the integrated sentinel surveillance of influenza and other respiratory viruses of epidemic and pandemic potential by the Global Influenza Surveillance and Response System

Standards and operational guidance

GISRS

[Implementing the integrated sentinel surveillance of influenza and other respiratory viruses of epidemic and pandemic potential by the Global Influenza Surveillance and Response System: standards and operational guidance]

COVID-19 policy briefs



WHO POLICY BRIEF

World Health Organization

COVID-19 surveillance

December 2024

Key points

- Countries are advised to sustain collaborative surveillance for COVID-19, in order to provide a basis for situational awareness and risk assessment and the detection of significant changes in virus characteristics, virus spread, disease severity and population immunity, as per the WHO Director-General's standing recommendations for COVID-19.
- Integration of COVID-19 surveillance with surveillance for other respiratory infections, e.g. influenza, should be prioritized, to provide baselines relative to other circulating viruses.
- WHO urges countries to report epidemiological and laboratory information in a timely manner to established WHO regional or global platforms, through RespiMart and the expanded activities of the Global Influenza Surveillance and Response System (GISRS).
- Multiple approaches should be applied to SARS-CoV-2 surveillance, including monitoring infections in populations at highest risk of severe disease, characterizing new SARS-CoV-2 variants and investigating post COVID-19 condition.
- SARS-CoV-2 testing should continue strategically and be integrated into existing infectious disease (e.g. respiratory pathogen) surveillance systems.
- It is crucial to continue genomic surveillance for SARS-CoV-2 and other pathogens with epidemic and pandemic potential using capacities that were strengthened for COVID-19. Testing, reporting and risk assessment for SARS-CoV-2 continues to be needed and should utilize genomic surveillance and phenotypic assessment.
- Strengthened COVID-19 surveillance systems enhance pandemic preparedness for respiratory pathogens. Countries are urged to maintain operational readiness for surges of COVID-19 and other emerging and re-emerging pathogens.
- WHO encourages its Member States to improve data linkage, share data and experiences and explore more innovative and collaborative approaches to timely detection of outbreaks, understanding risks and vulnerabilities.

[COVID-19 policy briefs]

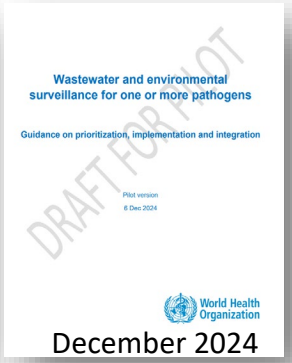
(6 Topics: Surveillance, Testing, Clinical management, Vaccination, IPC, RCCE)

Wastewater Surveillance

World Health Organization

Environmental surveillance for SARS-CoV-2 to complement other public health surveillance

12 September 2023



Wastewater and environmental surveillance for one or more pathogens

Guidance on prioritization, implementation and integration

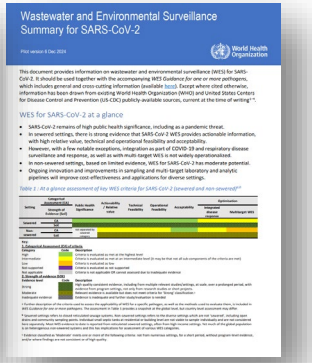
DRAFT FOR PILOT

Pilot version

6 Dec 2024

World Health Organization

December 2024



Wastewater and Environmental Surveillance Summary for SARS-CoV-2

World Health Organization

[Environmental surveillance for SARS-CoV-2 to complement other public health surveillance]

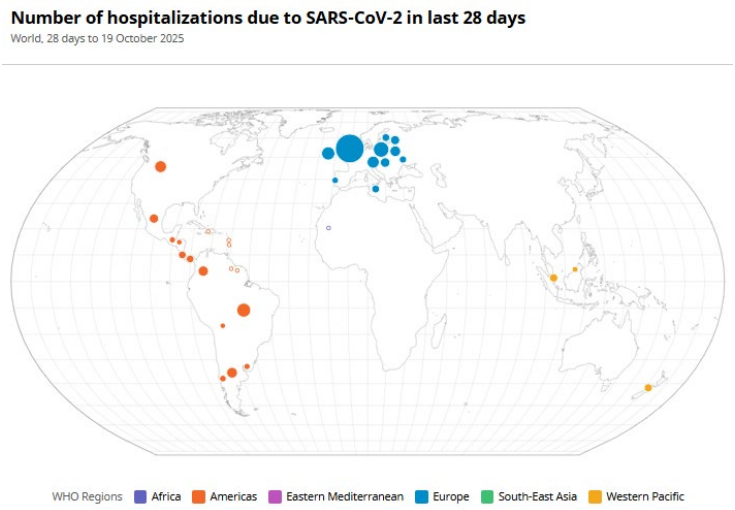
[Water Sanitation and Health]

World Health Organization

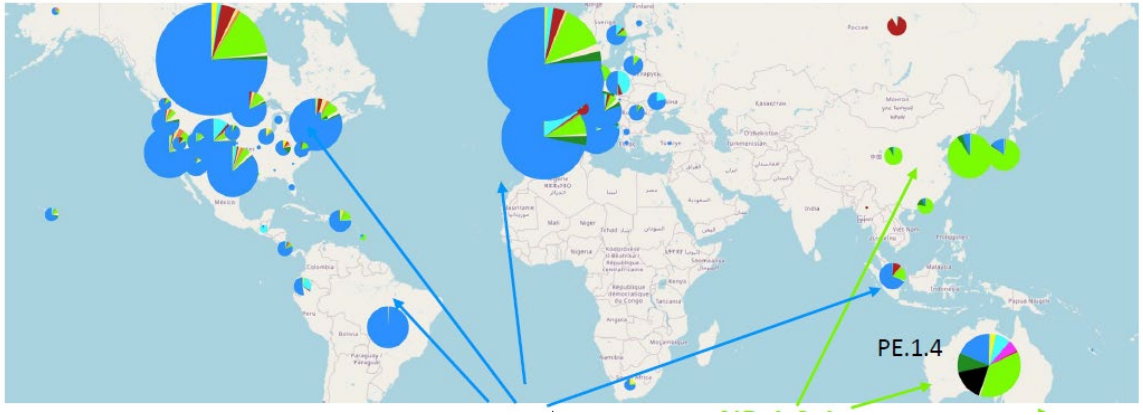
HEALTH EMERGENCIES programme

Key areas for strengthening

- Most available data comes from high-income settings.
- Limited geographical and income-level representativeness in assessing burden and variant surveillance.
- Evidence based decision making, guidance development and risk assessments are highly dependent to the information from limited geographical areas and high-income context.
- Countries from underrepresented regions are encouraged to monitor the burden of COVID-19 and SARS-CoV-2 variants and share information with global public health community.



SARS-CoV-2 variant sequence submissions Later: 2025-09-10 to 2025-10-20 (7045)

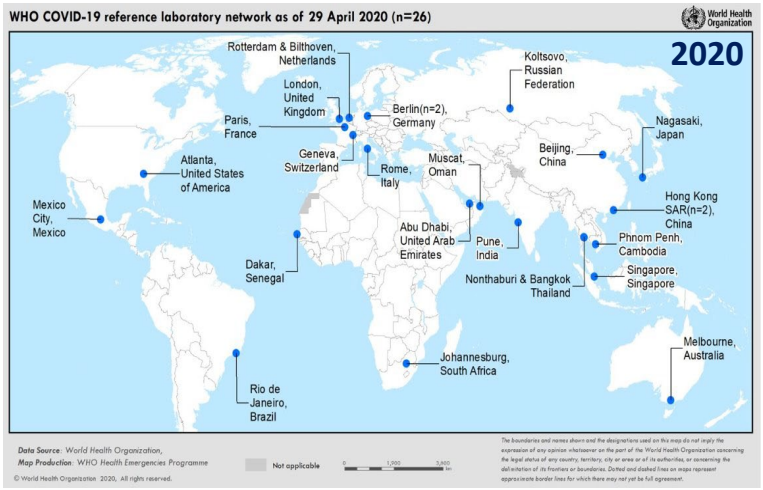


Courtesy of Bette Korber

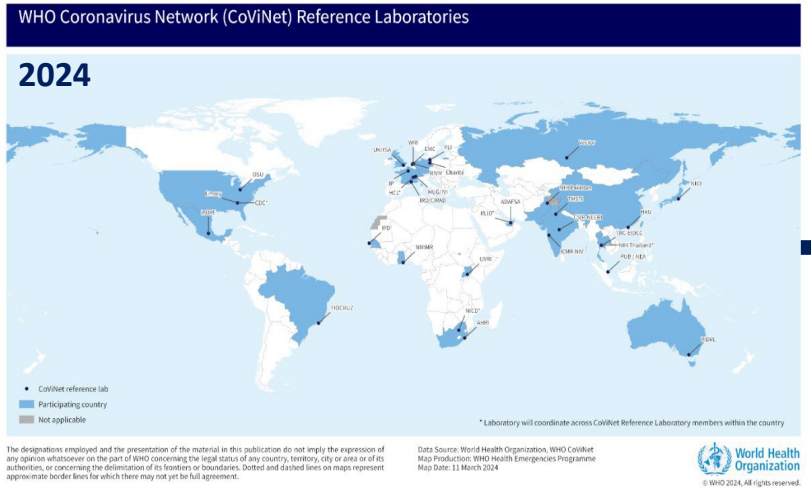
World Health Organization

HEALTH EMERGENCIES programme

WHO COVID-19 reference laboratory network evolved to the WHO Coronavirus Network



Labs from 26 countries across WHO regions



34 laboratories 21 countries

- Human health - 27 reference laboratories;
- Animal health - 2 FAO reference labs and 2 WOAH Collaborating Centres = 4
- Environment – 2 WHO CC + 1 (consortium) = 3

The second expression of interest was launched in 2025, and the selection process is currently underway. The network is expected to expand to include more than 48 laboratories across 35 countries.

Objectives:

- Facilitate early and accurate detection
- Support surveillance and monitoring of the global circulation and evolution
- Provide timely risk assessment to inform WHO policy related to a range of public health and medical countermeasures
- Support capacity building of laboratories relevant to needs of WHO and CoViNet, particularly those in low and middle-income countries

Activities 2024-2025

- SARS-CoV-2 antigenic characterization work for timely risk assessment facilitated by the WHO Biohub,
- Building advanced diagnostic capacity (neutralisation assays for coronaviruses) in Ghana and Pakistan
- Boosting SARS-CoV-2 sequencing in Africa (Uganda/South Sudan and Senegal)
- Harmonised protocols for panCoV detection by RT-PCR shared with CoViNet laboratories
- External Quality Assessment for zoonotic coronavirus sent to over 30 CoViNet reference laboratories
- …

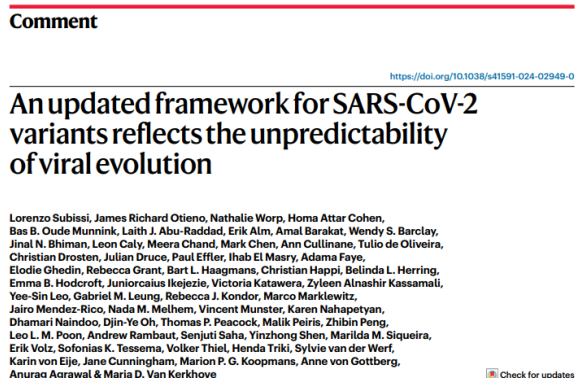
https://www.who.int/groups/who-coronavirus-network

SARS-CoV-2 Evolution

An early warning system for emerging SARS-CoV-2 variants

Global sequencing and surveillance capacity for SARS-CoV-2 must be strengthened and combined with multidisciplinary studies of infectivity, virulence and immune escape, in order to track the unpredictable evolution of the ongoing COVID-19 pandemic.

Lorenzo Subissi, Anne von Gottberg, Lipi Thukral, Nathalie Worp, Bas B. Oude Munnink, Surabhi Rathore, Laith J. Abu-Raddad, Ximena Aguilera, Erik Alm, Brett N. Archer, Homa Attar Cohen, Amal Barakat, Wendy S. Barclay, Jinal N. Bhiman, Leon Caly, Meera Chand, Mark Chen, Ann Cullinane, Tulio de Oliveira, Christian Drosten, Julian Druce, Paul Effler, Ihab El Masry, Adama Faye, Simani Gaseitsiwe, Elodie Ghedin, Rebecca Grant, Bart L. Haagmans, Belinda L. Herring, Shilpa S. Iyer, Zyleen Kassamali, Manish Kakkar, Rebecca J. Kondor, Juliana A. Leite, Yee-Sin Leo, Gabriel M. Leung, Marco Marklewitz, Sikhulile Moyo, Jairo Mendez-Rico, Nada M. Melhem, Vincent Munster, Karen Nahapetyan, Djin-Ye Oh, Boris I. Pavlin, Thomas P. Peacock, Malik Peiris, Zhibin Peng, Leo L. M. Poon, Andrew Rambaut, Jilian Sacks, Yinzhong Shen, Marilda M. Siqueira, Sofonias K. Tessema, Erik M. Volz, Volker Thiel, Sylvie van der Werf, Sylvie Briand, Mark D. Perkins, Maria D. Van Kerkhove, Marion P. G. Koopmans and Anurag Agrawal



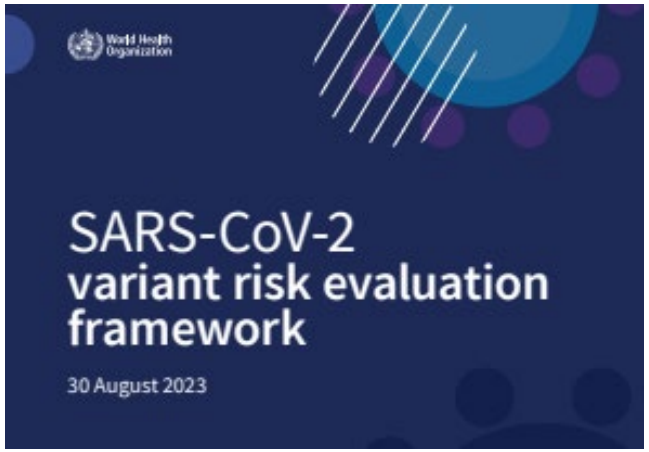
Comment

https://doi.org/10.1038/s41591-024-02949-0

An updated framework for SARS-CoV-2 variants reflects the unpredictability of viral evolution

Lorenzo Subissi, James Richard Otieno, Nathalie Worp, Homa Attar Cohen, Bas B. Oude Munnink, Laith J. Abu-Raddad, Erik Alm, Amal Barakat, Wendy S. Barclay, Jinal N. Bhiman, Leon Caly, Meera Chand, Mark Chen, Ann Cullinane, Tulio de Oliveira, Christian Drosten, Julian Druce, Paul Effler, Ihab El Masry, Adama Faye, Elodie Ghedin, Rebecca Grant, Bart L. Haagmans, Christian Happi, Belinda L. Herring, Emma B. Hodcroft, Juniorcaius Ikejezie, Victoria Katawera, Zyleen Alnashir Kassamali, Yee-Sin Leo, Gabriel M. Leung, Rebecca J. Kondor, Marco Marklewitz, Jairo Mendez-Rico, Nada M. Melhem, Vincent Munster, Karen Nahapetyan, Dhamari Naindoo, Djin-Ye Oh, Thomas P. Peacock, Malik Peiris, Zhibin Peng, Leo L. M. Poon, Andrew Rambaut, Senjuti Saha, Yinzhong Shen, Marilda M. Siqueira, Erik Volz, Sofonias K. Tessema, Volker Thiel, Henda Triki, Sylvie van der Werf, Karin von Eije, Jane Cunningham, Marion P. G. Koopmans, Anne von Gottberg, Anurag Agrawal & Maria D. Van Kerkhove

Check for updates



- SARS-CoV-2 variant risk evaluation in place since the emergence of variants
- Framework formally published in August 2023, and then updated, under the advice of the Technical Advisory Group on Virus Evolution (TAG-VE)

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Subissi et al Nat Med 2022; Subissi et al Nat Med 2024; SARS-CoV-2 variant risk evaluation framework

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Technical Advisory Group on Virus Evolution (TAG-VE)

What it is:
An independent, multidisciplinary advisory group assessing public-health implications of priority viruses and informing WHO policy.

Function:
1. Determines which variants warrant further investigations
2. Assesses whether variants alter
   -transmission or disease characteristics or
   -performance of vaccines, therapeutics, diagnostics or
   -effectiveness of public health and social measures

Outputs (2025):
MERS-CoV risk evaluation (27-10-2025)

Mpox
- Clade Ia risk evaluation (24-01-2025)
- Clade Ib risk evaluation (24-01-2025)

SARS-CoV-2
- LP.8.1 (03-02-2025)
- NB.1.8.1 (23-05-2025)
- XFG (25-06-2025)

Oropouche (10-06-2025)

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SARS-CoV-2 Risk Evaluation for XFG

Workflow:

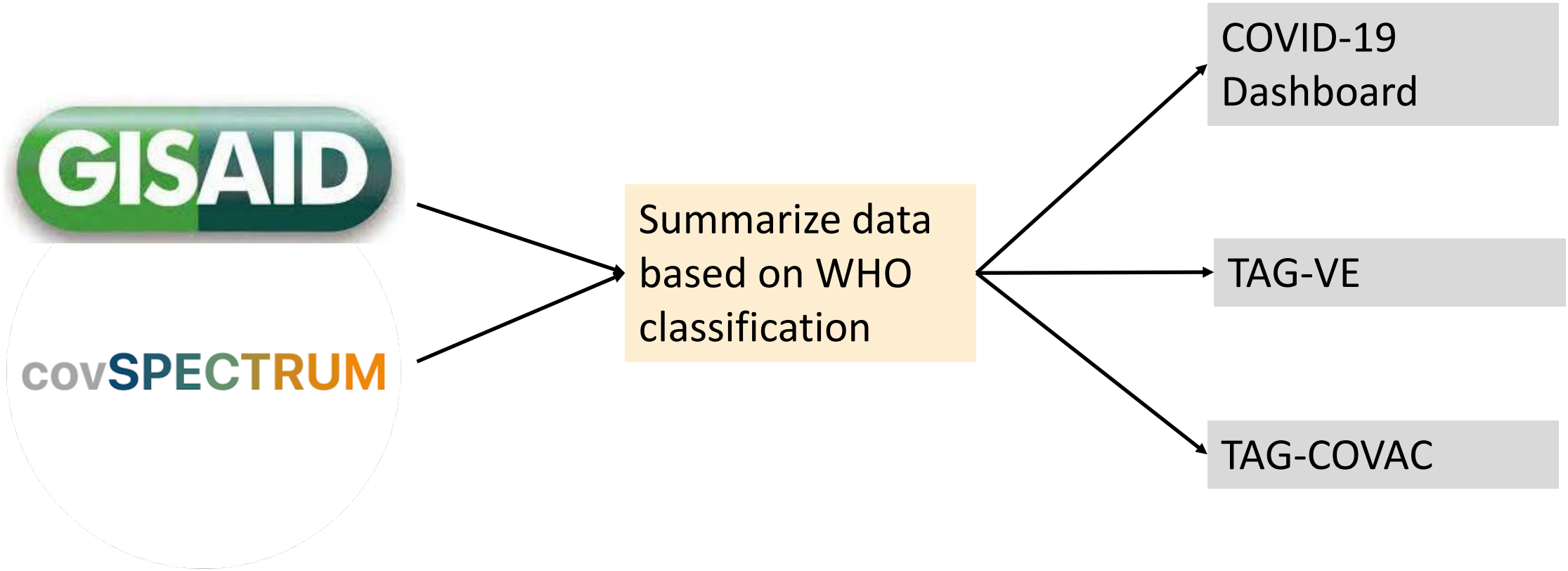
1. Surveillance and genomics inputs
2. Expert review
3. Risk evaluation
4. Recommendations/communication

VOC, VOI, and VUM definitions and actions (updated 4 Oct 2023)

TAG-VE: SARS-CoV-2 Variant Designation and Risk Evaluation, January 2024 to October 2025

- Lack of crucial studies, such as those that were on variant disease severity

Genomic surveillance data source and pipeline



Challenges: Number of Member States sharing genomic sequencing data

Source: Tracking global progress on preparedness for respiratory pandemics: 2023, (19 June 2025), https://www.who.int/publications/i/item/9789240110434

Technical Advisory Group on COVID-19 Vaccine Composition (TAG-CO-VAC)

Dr Bart Haagmans, TAG-CO-VAC Chair

EPI-WIN Webinar

From Data to Action: Understanding how WHO's Global Surveillance on Coronaviruses informs Response

5 November 2025

World Health Organization

COVID-19 vaccines

- **Fact**: COVID-19 vaccines developed early in the pandemic provide high levels of protection, particularly against severe disease and death.

- **Problem**: SARS-CoV-2 continues to evolve to escape vaccine induced immunity and vaccine induced immunity wanes in time.

- **Solution**: COVID-19 vaccines are updated to respond to circulating SARS-CoV-2 variants.

WHO Advisory Groups for COVID-19

Aim: Monitor and assess SARS-CoV-2 variants and evaluate their impact on countermeasures, including vaccines, therapeutics, diagnostics or effectiveness of public health and social measures.

TAG-VE
- Determines which variants warrant further investigations
- Assesses whether variants alter
  - transmission or disease characteristics or
  - performance of vaccines, therapeutics, diagnostics or
  - effectiveness of public health and social measures

R&D Blueprint for epidemics
- COVID-19 Vaccines Research Expert Group

TAG-CO-VAC
- Assesses the impact of SARS-CoV-2 variants on current COVID-19 vaccines
- Determines whether changes to vaccine composition are needed

SAGE
- Recommends policies and strategies on vaccine use and immunization programmes through evidence-based assessment

World Health Organization

HEALTH EMERGENCIES programme

TAG-CO-VAC Members

Chair

Dr Bart Haagmans

Associate professor at the Department of Viroscience of Erasmus MC, Rotterdam, the Netherlands

Learn more ›

Vice-Chair

Professor Cheryl Cohen

Professor in epidemiology at the University of the Witwatersrand and Head of the Centre for Respiratory Disease and Meningitis at the National Institute for Communicable Diseases

Learn more ›

Members

Dr Svein Rune Andersen ›
Scientific Director for Vaccines at the Norwegian Institute of Public Health, Norway

Prof Narendra Kumar Arora ›
Executive Director of The INCLEN Trust International, India

Prof Laith Abu-Raddad ›
Prof of Infectious Disease Epidemiology at Weill Cornell Medicine–Qatar, Cornell University, USA

Associate Professor Deborah Cromer ›
Lead of the Infection, Epidemiology and Policy Analytics Group at the Kirby Institute, University of New South Wales

Dr Irene Owusu Donkor ›
Fellow in the Epidemiology Department of the Noguchi Memorial Institute for Medical Research (NMIMR)

Professor Kanta Subbarao ›
Director of the WHO Collaborating Centre for Reference and Research on Influenza and Professor, Department of Microbiology and Immunology

Dr Hideki Hasegawa ›
Director of the WHO Collaborating Centre for Reference and Research on Influenza, Japan

Dr Janine Kimpel ›
Group leader and deputy Director at the Institute of Virology at the Medical University of Innsbruck, Austria

Prof Bette Liu ›
Professor at the Population Health Group at the National Centre for Immunisation Research and Surveillance (NCIRS) in Australia

Professor Elizabeth Miller ›
Professor in Infectious Disease Epidemiology at the London School of Hygiene and a visiting professor at the Sackler School of Public Health at Tel Aviv University

Dr Sergio Nishioka ›
Technical Adviser for Capacity Building and Clinical Evaluation of COVID-19 vaccines

Dr Stanley Perlman ›
Professor of Microbiology and Immunology, and of Pediatrics at the University of Iowa

Prof Derek Smith ›
Director of the Center for Pathogen Evolution, and Professor of Infectious Disease Informatics at the University of Cambridge in the United Kingdom

Dr Pragya Yadav ›
Director-in-Charge of the National Institute of One Health, Nagpur, and a Scientist 'F' at the Indian Council of Medical Research-National Institute of Virology (ICMR-NIV), Pune, India

TAG-CO-VAC Secretariat:
tagcovac@who.int

World Health Organization

More information:
https://www.who.int/groups/technical-advisory-group-on-covid-19-vaccine-composition-(tag-co-vac)/about

HEALTH EMERGENCIES programme

WHO Technical Advisory Group on COVID-19 Vaccine Composition

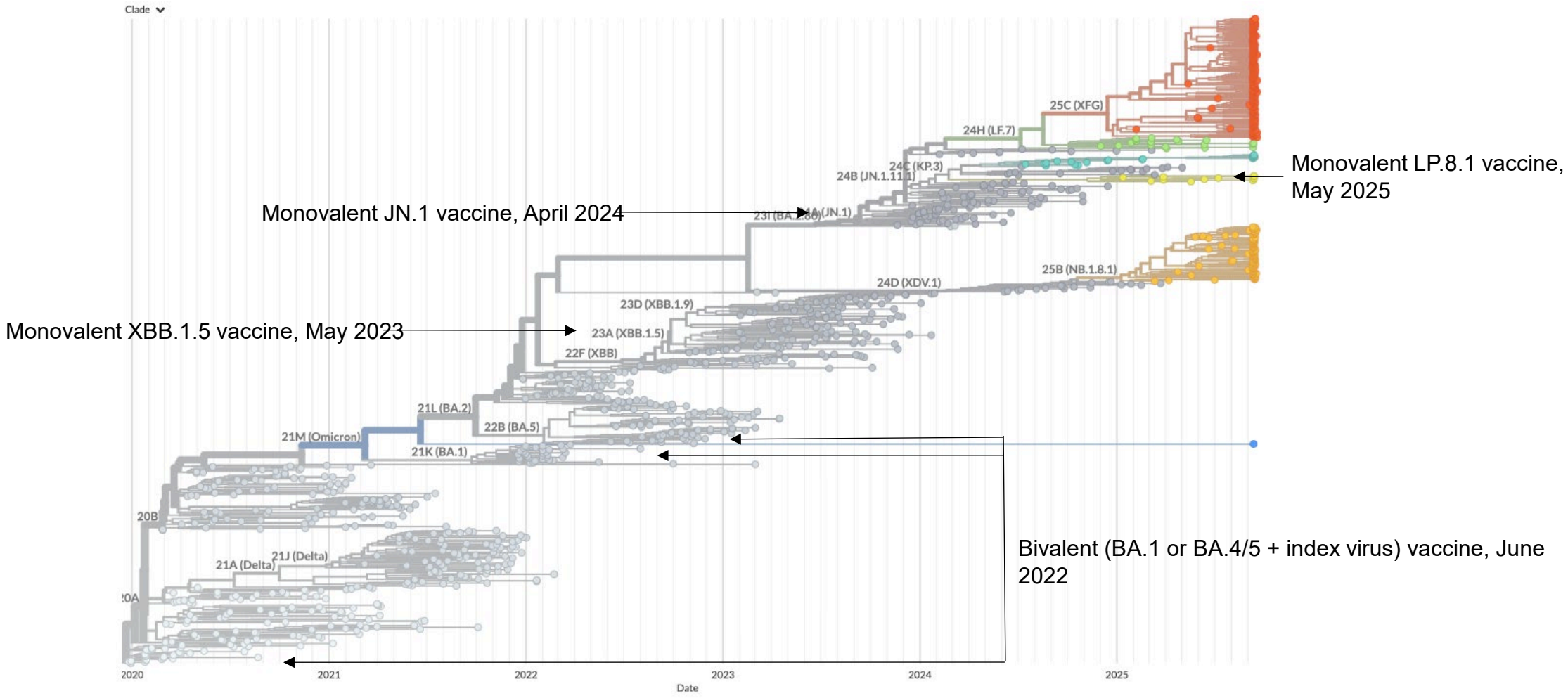
Functions of the TAG-CO-VAC:

- Make recommendations to WHO on the **methods to assess the impact of SARS-CoV-2 variants** on COVID-19 vaccines;
- Provide **interpretation of available evidence on the effect of SARS-CoV-2 variants on COVID-19 vaccines**, including but not limited to vaccine effectiveness;
- **Recommend to WHO, for each COVID-19 vaccine platform, adaptations (if any) needed** so that vaccines continue to safely provide protection against SARS-CoV-2 variants.

Meeting frequency:

- The TAG-CO-VAC continues to convene closed, decision-making meetings approximately every six months. After each meeting, recommendations to either maintain current vaccine composition or to consider updates are issued.

SARS-CoV-2 evolution and COVID-19 vaccine composition decisions



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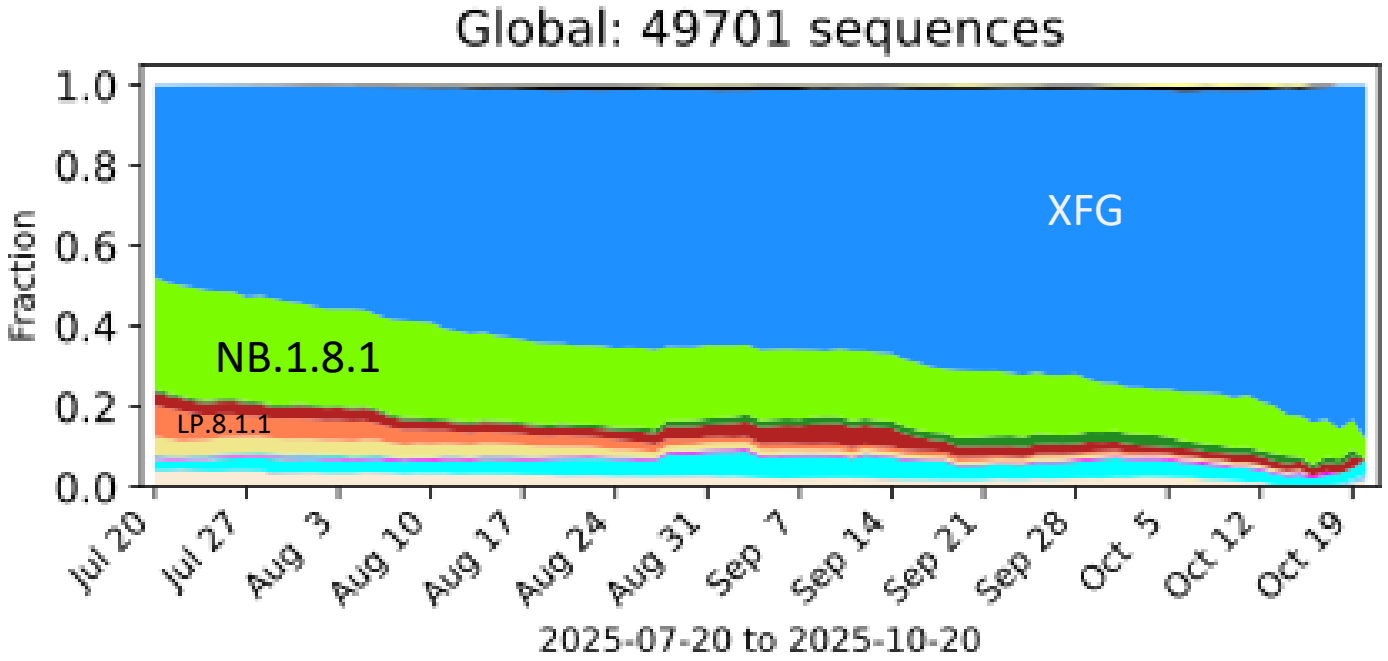
SARS-CoV-2 phylogeny: https://nextstrain.org/ncov
TAG-CO-VAC recommendations available at:
https://www.who.int/groups/technical-advisory-group-on-covid-19-vaccine-composition-(tag-co-vac)

HEALTH EMERGENCIES programme

Types of data considered by TAG-CO-VAC

Type of data	Comments
SARS-CoV-2 genetic evolution	With support from Technical Advisory Group on Virus Evolution (TAG-VE) Key variants include the list of Variants of Interest (VOI) and Variants Under Monitoring (VUM). This list is maintained on the WHO website: https://www.who.int/activities/tracking-SARS-CoV-2-variants



Bette Korber, Los Alamos

Types of data considered by TAG-CO-VAC

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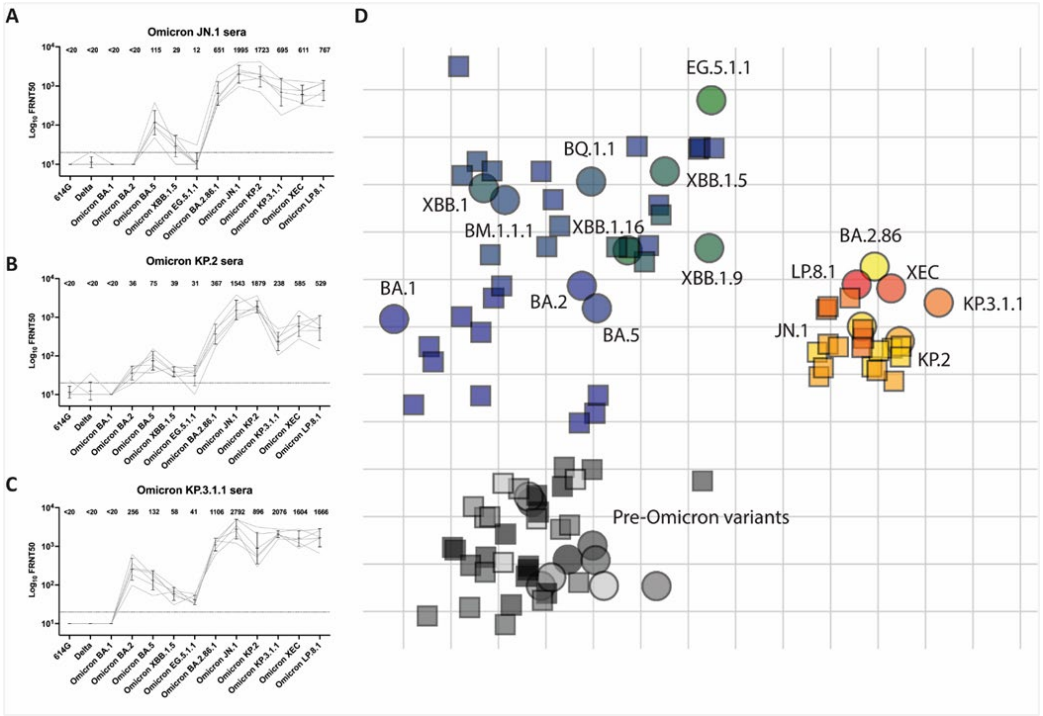

Types of data considered by TAG-CO-VAC

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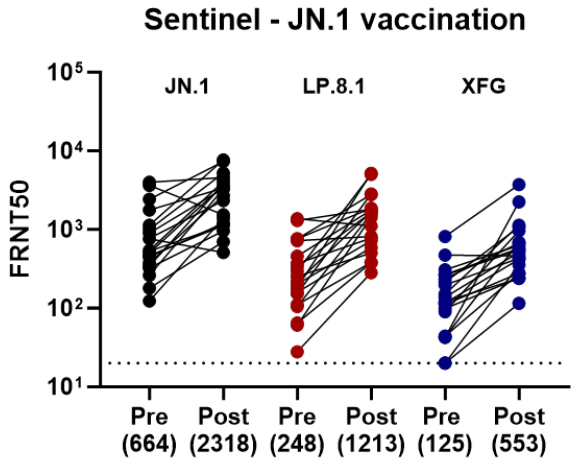
Antigenic characterization of previous and emerging SARS-CoV-2 variants	Animal sera following primary infection or vaccination analyzed in one-way and two-way neutralization tests (pseudotype and live virus neutralization assays).
Preliminary immunogenicity data on breadth and durability of immune responses following vaccination or infection with SARS-CoV-2 variant antigens	Neutralization of previous and recent variants by non-naïve animal sera (e.g., sequentially immunized or infected); Neutralization of previous and recent variants by both pre- and post-vaccination human sera; Neutralization of variants by sera from cohorts that are representative of recent population immunity.



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Vaccine effectiveness (VE) estimates of currently approved vaccines	Relative VE estimates in human populations of currently approved vaccines. Studies should provide variant-specific estimates and distinct estimates for vaccine antigen compositions across different vaccine platforms.

Types of data considered by TAG-CO-VAC

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Vaccine effectiveness (VE) estimates of currently approved vaccines	Relative VE estimates in human populations of currently approved vaccines. Studies should provide variant-specific estimates and distinct estimates for vaccine antigen compositions across different vaccine platforms.
Data from vaccine manufacturers	Animal and human data that demonstrate the breadth and durability in immune responses elicited by vaccines in current portfolio, as well as any vaccine candidates in development; Observational epidemiological data that demonstrate the efficacy or effectiveness of any vaccines in current portfolio, as well as any vaccine candidates in development.

TAG-CO-VAC decision-making meeting

Next meeting: December 2025

World Health Organization

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Home / News / Statement on the antigen composition of COVID-19 vaccines

Statement on the antigen composition of COVID-19 vaccines

15 May 2025 | Statement |Reading time: 7 min (1811 words)

Key points

- Vaccination remains an important public health countermeasure against COVID-19. As per the WHO Director General's standing recommendations for COVID-19, Member States are recommended to continue to offer COVID-19 vaccination based on the recommendations of the WHO Strategic Advisory Group of Experts on Immunization (SAGE).
- SARS-CoV-2 continues to undergo sustained evolution since its emergence in humans, with important genetic and antigenic changes in the spike protein.
- The objective of an update to COVID-19 vaccine antigen composition is to enhance vaccine-induced immune responses to circulating SARS-CoV-2 variants.
- The WHO Technical Advisory Group on COVID-19 Vaccine Composition (TAG-CO-VAC) advises manufacturers that **monovalent JN.1 or KP.2** vaccines remain appropriate vaccine antigens; **monovalent LP.8.1** is a suitable alternative vaccine antigen.
- In accordance with WHO SAGE policy, vaccination should not be delayed in anticipation of access to vaccines with an updated composition.

Related

Annex: Statement on the antigen composition of COVID-19 vaccines

News

Statement on the antigen composition of COVID-19 vaccines
15 May 2025

Annex: Statement on the antigen composition of COVID-19 vaccines

15 May 2025

Evidence to support considerations of COVID-19 vaccine antigen composition

The data highlighted below are representative examples of the data reviewed and considered by the TAG-CO-VAC to inform the recommendation on COVID-19 vaccine composition and include:

(1) SARS-CoV-2 genetic evolution;
(2) Antigenic characterization of previous and emerging SARS-CoV-2 variants using virus neutralization tests with animal antisera and further analysis of antigenic relationships using antigenic cartography;
(3) Immunogenicity data on the breadth of neutralizing antibody responses elicited by currently approved vaccine antigens against circulating SARS-CoV-2 variants using animal and human sera;
(4) Preliminary immunogenicity data on immune responses following infection with circulating SARS-CoV-2 variants;
(5) Available vaccine effectiveness (VE) estimates of currently approved vaccines during periods of JN.1 lineage circulation; and
(6) Preliminary non-clinical and clinical immunogenicity data on the performance of candidate vaccines with updated antigens shared confidentially by vaccine manufacturers with TAG-CO-VAC (data not shown).

The TAG-CO-VAC convenes a Subgroup comprised of Members and Advisors with virological and immunological expertise. The data highlighted below were also reviewed and considered by the Subgroup. Confidential data reviewed by the TAG-CO-VAC and the Subgroup are not shown.

1. SARS-CoV-2 genetic evolution

SARS-CoV-2 continues to evolve since its emergence in humans, with important genetic and antigenic evolution of the spike protein.

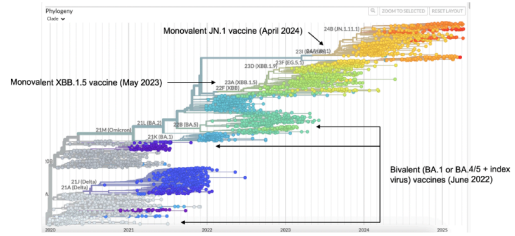

Figure 1: Phylogeny of SARS-CoV-2 variants since its introduction in humans illustrated using Nextsrain.[1] Time is shown on the x axis and selected named variants are labeled with their Nextstrain clade (Pango lineage) at their root nodes. Clades included as vaccine antigens are indicated with the date of the TAG-CO-VAC recommendation for this vaccine antigen composition.

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Strategic Advisory Group of Experts (SAGE) on Immunization

Informing decisions on vaccination – the work of SAGE

Annelies Wilder-Smith MD PhD MPH, Executive Secretary, SAGE Secretariat

WHO and SAGE's normative role in immunization policy is more critical than ever

- **WHO's 2025-28 strategy: 'developing evidence-based norms and standards' a key component for advancing equity and resilience in a turbulent world**
- **WHO's prioritization exercise highlighted immunization and policy as core function**


THE LANCET

CORRESPONDENCE · Volume 405, Issue 10485, P1140-1141, April 05, 2025 · Download Full Issue

Safeguarding immunisation: a core function of WHO

Rebecca F Grais on behalf of SAGE and RITAG

Affiliations & Notes · Article Info

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Show Outline

Vaccination remains the most cost-effective public health intervention, preventing millions of deaths and reducing disease burden worldwide.[1] However, their impact is rendered meaningless if vaccines are not epidemiologically relevant to the populations they serve, are not accepted by communities, or are not effectively delivered through routine or mass immunisation programmes. As history has shown, immunisation programmes have always faced threats—from political instability to misinformation—and these challenges are growing more severe in today's global landscape.[2]

The integrity of immunisation decision making must be upheld through robust, evidence-based guidance tailored to the needs of individual countries. The normative function underpinning the global immunisation structure—comprising the Immunization, Vaccines and Biologicals department at WHO, the Strategic Advisory Group of Experts on Immunization (SAGE), the Regional Immunization Technical Advisory Groups (RITAGs), and the National Immunization Technical Advisory Groups—plays a vital role in ensuring that vaccine policies are informed by scientific data and contextual realities.[3,4] Together they produce WHO Vaccine Position Papers that serve as global public goods, providing updated and harmonised guidance to support national immunisation programmes.[5] These structures are essential to help countries to maintain the credibility and effectiveness of vaccination strategi

The normative function underpinning the global immunization structure (SAGE, RITAGS & NITAGS) play a vital role in ensuring vaccine policies are informed by scientific data & contextual realities

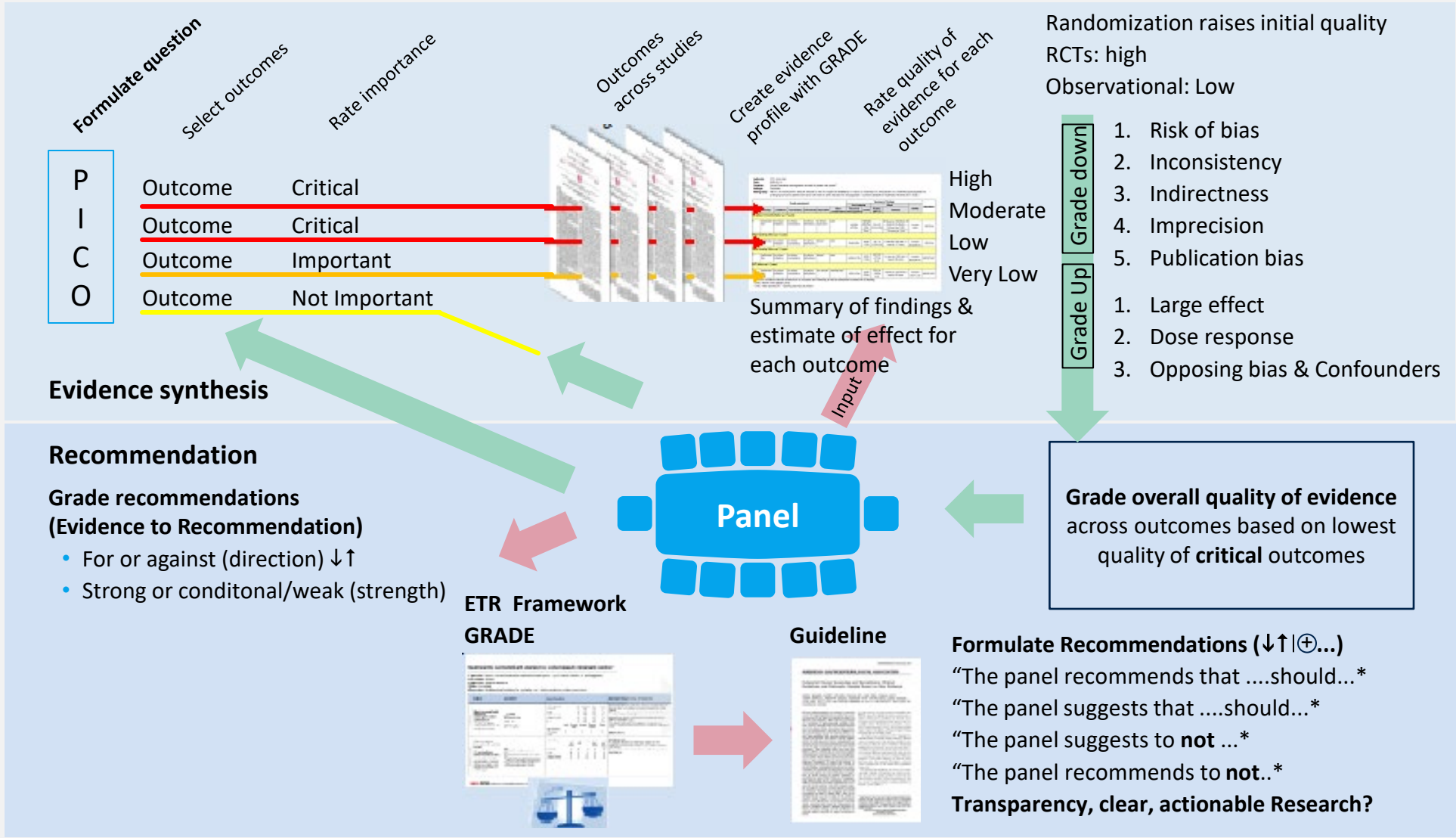
Key Attributes

- Transparency
- Independence
- Best available evidence
- Evidence to policy methodology
- Support country decision-making in evolving contexts

SAGE Methods

1. Identification of problem/ Terms of Reference/ Establishment of Working Group
2. Systematic review of the literature
   A. Definition of critical questions
   B. Systematic search
   C. Assessment of risk of bias
   D. GRADE
3. Development of evidence to recommendation table
4. Draft recommendations
5. Presentation to SAGE
6. SAGE discussion, deliberation and decision
7. Publication as WHO vaccine position paper

GRADE approach



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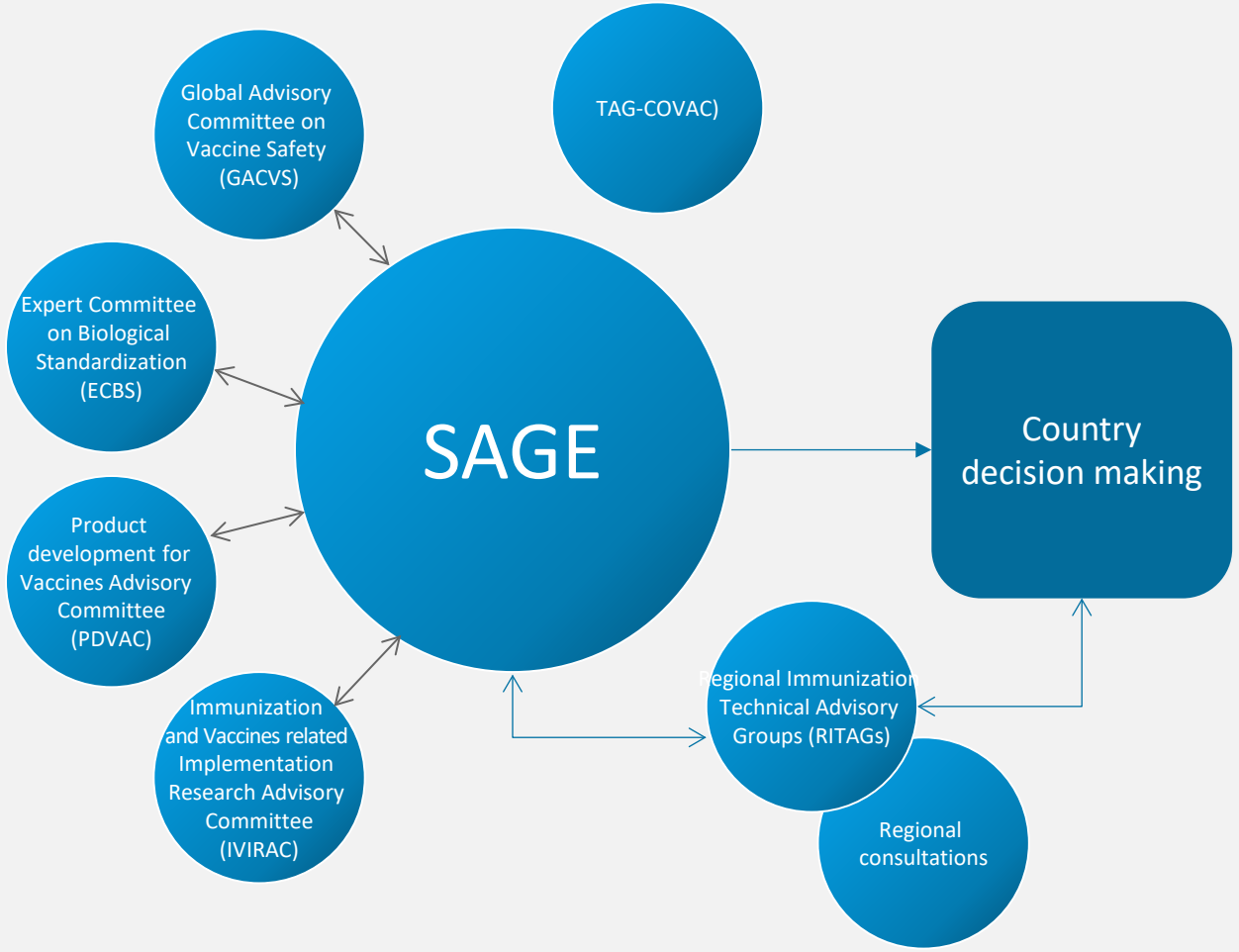
Evidence to Decision Table Criteria

- Problem Statement
- Benefits and harms plus GRADE
- Values and Preferences
- Resource use and cost-effectiveness
- Equity impacts
- Acceptability
- Feasibility

Concluding with

Balance of Benefits and Harms, Type of Recommendation and Recommendation Text

SAGE and other WHO advisory groups



WHO Interim Recommendations for the optimal use of COVID-19 vaccination

HIGH priority-use groups

Target population	Vaccination of persons who have never received a COVID-19 vaccine	Revaccination of persons who have received at least one dose of COVID-19 vaccine
Oldest adults[i] Older adults with multiple comorbidities that put them at higher risk of severe COVID-19	Single dose[iii]	6-12 months after previous dose
Older adults[ii] Other adults[iv] with severe obesity or a comorbidity that puts them at higher risk of severe COVID-19	Single dose[iii]	Approximately 12 months after previous dose

MEDIUM priority-use groups

Target population	Vaccination of persons who have never received a COVID-19 vaccine	Revaccination of persons who have received at least one dose of COVID-19 vaccine
Healthy adults[iv]	Single dose[iii]	Not routinely recommended[vi]
Children and adolescents aged 6 months to 17 years with severe obesity or a comorbidity that puts them at higher risk of severe COVID-19[v]		

LOW priority-use groups

Target population	Vaccination of persons who have never received a COVID-19 vaccine	Revaccination of persons who have received at least one dose of COVID-19 vaccine
Healthy children and adolescents aged 6 months to 17 years	If countries opt to vaccinate low priority-use groups[vii], they could consider single dose for ages 5 years and above; two doses for age 6 months to 4 years[v]	Not routinely recommended[vi]

Sub-populations with special considerations

Target population	Vaccination of persons who have never received a COVID-19 vaccine	Revaccination of persons who have received at least one dose of COVID-19 vaccine
Persons with moderate and severe immunocompromising conditions (adults, adolescents and children > 6 months)	Two or three doses in consultation with the health care provider	6-12 months after previous dose; optimal time interval should be determined in consultation with the health care provider
Pregnant adults and pregnant adolescents[viii]	Single dose in each pregnancy regardless of previous vaccination status; ideally during the second trimester or at any opportunity	
Health and care workers with direct patient contact	Single dose	Approximately 12 months after previous dose

i Age cut-off to be decided by countries; often it is 75 or 80 years. **ii** Age cut-off to be decided by countries: often it is 50 or 60 years. **iii** In vaccine-naïve persons, for programmatic purposes, a single dose can be considered for primary vaccination given that the vast majority of the population will have been infected at least once. For inactivated COVID-19 vaccines, two doses are required for the primary vaccine series. **iv** Age cut-off to be decided by countries: often it is 18 to 49 or 18 to 59 years. **v** Regulatory approvals or WHO EUL for the age indication differ by vaccine product; refer to the product-specific vaccine recommendations. **vi** "Not routinely recommended" means that such vaccines are not recommended because of minimal public health impact and low cost-effectiveness in most settings. However, vaccination may be offered in individual country-specific circumstances where added benefit is expected to be more substantial. This interim recommendation acknowledges that some countries may elect to offer such doses in the routine programme based on population risks, disease epidemiology, or public health priorities. **vii** Benefit of vaccinating healthy children and adolescents is substantially lower compared to vaccinating older persons or as compared to other childhood vaccinations. Countries could consider vaccination based on disease burden, cost effectiveness, and other programmatic priorities. **viii** Regulatory approvals or WHO EUL for the use in pregnancy may differ by vaccine product.

Proposed policy questions in the era of high population level immunity and Omicron sublineages

Should WHO continue to recommend 12 monthly boosters to high-priority use groups?
Should the most vulnerable populations (e.g., the very elderly and those with multiple comorbidities) continue to receive boosters every 6–12 months, or could this be adjusted to a 12-month intervals?
Should WHO continue to recommend 12 monthly boosters to health workers regardless of age and comorbidities?
Should WHO continue to recommend COVID-19 vaccination for each pregnancy?
Should WHO continue to *not* recommend annual boosters for medium- and low-priority use groups?

Systematic review of literature

A 

PICO question: re-vaccination with a variant-adapted vaccine in past year versus no vaccination in past year

B 

Assessment of the risk of bias of retrieved evidence

C 

Rating of the quality of the evidence (GRADE)

Thank you

Global status of COVID-19 vaccination programmes and resources available to support programme strengthening

Shoshanna Goldin – Technical Officer

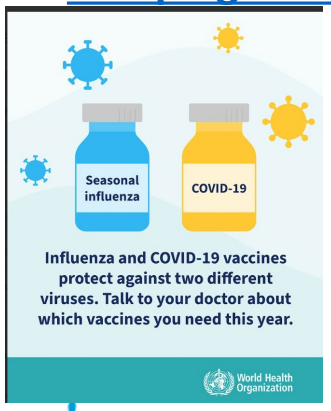
5 November 2025

World Health Organization

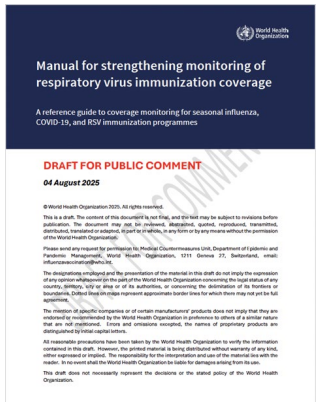
COVID-19 Vaccination Data (2024) and Tools

Target population group	No. of Member States with a policy for COVID-19 re-vaccination/boosters	No. of Member States reporting COVID-19 vaccination coverage data	Median coverage of reporting Member States
Older adults	108	42	6.5%
People with chronic conditions	102	17	1%
Health workers	90	20	7.2%
Pregnant persons	81	16	2.7%
Total COVID-19 vaccination (not disaggregated by target population group)	58 recommend for all adults 36 recommend for children/adolescents	31	3.94%

Campaign materials



Coverage manual



Toolkit - guidance, training, and tools

World Health Organization

HEALTH EMERGENCIES programme

How to achieve high uptake of COVID-19 vaccines?

1. Design data-driven and evidence-based interventions

- Support systematic collection and use of data on behavioural and social drivers
- Monitor and evaluate to guide continuous improvement

2. Target the structural and service-level barriers

- Improve service quality, ease of access, and reduce costs, e.g., meet their needs of priority populations
- Integrate vaccination in primary care and relevant adult vaccination platforms, especially in disadvantaged settings

3. Engage meaningfully with communities and civil society

- Genuinely listen: create spaces for dialogue to explore and address concerns
- Equip and empower advocates to promote positive norms and demonstrate the importance of vaccination
- Co-design interventions to increase outcomes and local ownership, e.g., human-centred design

4. Tailor communications and work through trusted messengers

- Communicate in ways that are honest, transparent, timely, credible, relatable and engaging
- Be ready to respond to vaccine-related events, e.g., AEFI, anti-vaccination activism

Tools and guidance: https://www.who.int/initiatives/act-accelerator/covax/covid-19-vaccine-country-readiness-and-delivery/acceptance-and-demand

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