Final report

Ad hoc expert consultation in the Region of the Americas: Challenges, gaps, and next steps in COVID-19 surveillance and its integration into influenza and other respiratory viruses surveillance

Panama City, 29 - 30 March 2022

PAHO Pan American Health Organization World Health Organization Americas

PAHO/AMRO WHO Influenza and other respiratory viruses' team
Infectious Hazards Management Unit | PAHO Health Emergencies Department

Contents

Executive summary

During the COVID-19 pandemic, surveillance has been a universal component for the detection and follow-up of all cases and thus supported their correct isolation, follow-up and medical attention in addition to providing information that allows the monitoring of different aspects at the population level.

Universal surveillance involves a large consumption of economic and human resources so due to changes in the current epidemiological context, the need to respond in a more efficient and sustainable way has arisen considering the existing surveillance systems such as sentinel surveillance of influenza and other respiratory viruses together with other existing complementary surveillance systems or those that emerged during the COVID-19 pandemic providing standardized and quality information. For this reason, and as part of the WHO initiatives at the global level, an ad hoc regional consultation of experts in epidemiological and laboratory surveillance of SARS-CoV-2, influenza and other respiratory viruses was held from 29-30 March 2022 in Panama City with the objective of identifying the challenges, gaps and next steps in COVID-19 surveillance and its integration in the surveillance of influenza and other respiratory viruses. In order to carry out this transition, it was stated that there is a need to make adjustments both in the current surveillance of influenza and other respiratory viruses and in other complementary surveillance systems to guarantee correct monitoring of the transmission, severity and impact of the disease, as well as in other key aspects related to the detection of emerging events of potential public health interest, vaccination coverage and efficacy, immune response and sequelae or episodes after the acute episode of COVID-19.

The role of sentinel surveillance of respiratory viruses was highlighted as a key to monitor transmission, severity of the disease, as well as vaccine efficacy with an integration of the genomic surveillance component for monitoring circulating lineages/sublineages of SARS-CoV-2 and the detection of potential new variants. At the same time, the importance of reinforcing other complementary surveillance systems was highlighted. Firstly, for the impact component (on health systems and society) that currently requires information from registries not linked to the epidemiological surveillance of influenza and other respiratory viruses but that have been developed throughout the pandemic of COVID-19. In addition, the importance of implementing and strengthening surveillance systems for potential emerging events for public health and integrating them with the genomic surveillance component for the detection of new variants of potential concern was also mentioned.

Finally, the main needs for a effective transition were the existence of regional guidelines that will guarantee a homogeneous transition that can count on political and technical support that includes specific training in different aspects of surveillance, as well as a reinforcement of the component of epidemiology in sentinel surveillance of influenza and other respiratory viruses and extraction and application of the lessons learned during the COVID-19 pandemic, guaranteeing the consolidation of the knowledge acquired (including the generated capacities).

Ad hoc regional expert consultation – Challenges, gaps and next steps in COVID-19 surveillance and its integration into influenza and other respiratory virus surveillance.

1.Background:

Since the introduction of SARS-CoV-2 in the region of the Americas, the countries have responded in a sustained manner, acquiring great epidemiological and laboratory surveillance capabilities that have allowed optimal monitoring of the epidemiological situation to guide public health measures as well as other interventions to limit transmission and mitigate the impact of COVID-19. This surveillance has had a universal component for the detection and follow-up of all cases of COVID-19 to guarantee their correct isolation, follow-up and medical attention, in addition to providing information that would allow the monitoring of different aspects at the population level which has required great efforts both in economic terms and in human resources. However, during times of very high activity it has been difficult to report cases in terms of frequency and completeness. This, together with the fact that the epidemiological situation has been evolving due to various factors, among which the population's immunity (either naturally acquired or induced by vaccination) and the evolution of the SARS-CoV-2 virus, raised the need to plan the transition from an acute response to the COVID-19 emergency to a sustainable response over time with a more efficient epidemiological surveillance model that includes other respiratory viruses.

For this reason, initiatives have emerged at the global level by WHO, which have in turn generated the need to carry out a consultation with regional experts in the field of epidemiology and laboratories involved in the surveillance of COVID-19, as well as influenza and other respiratory viruses, in order to make an evaluation of the priorities for surveillance of COVID-19 from the perspective of the countries that allows responding to the critical needs in a sustainable way in the Region of the Americas.

This ad hoc consultation of regional experts took place on March 29 and 30, 2022 in Panama City, with the objective of identifying the challenges, gaps and next steps in the surveillance of COVID-19 and its integration in the surveillance influenza and other respiratory viruses. It was attended by 26 participants from 15 countries in the Americas, as well as from WHO, the WHO Collaborating Center for the Americas (U.S.A. CDC), the Caribbean Public Health Agency (CARPHA), as well as the Secretariat of the Council of Ministers of Health of Central America and Dominican Republic (SE- COMISCA).

This consultation was divided into different blocks, First, the presentation of the contextual framework at the global and regional level and then four blocks consisting of group activities with participatory dynamics followed by plenary discussions for which the participants were divided into six working groups with both laboratory and epidemiology participants in each one, as well as geographical representation of the different subregions of the Americas.

1.1 Objectives:

- Identify priorities in public health surveillance of COVID-19, influenza and other respiratory viruses that countries have to respond to the current pandemic and future epidemics.
- Determine how sentinel surveillance and complementary surveillance systems should be organized to respond to these priorities.

- Understand and help countries overcome surveillance obstacles in the transition from acute response to the pandemic to sustainable surveillance models that cover targets beyond COVID-19.
- Respond to WHO global consultations on COVID-19 surveillance and integrated surveillance of SARS-CoV-2, influenza and other respiratory viruses.

2.Results of the working groups

The working groups identified and prioritized the following aspects: critical areas for surveillance of COVID-19, approaches to assess indicators of transmission, severity and impact of the disease; integration of SARS-CoV-2 genomic surveillance in surveillance of other respiratory viruses; identified surveillance systems and adjustments required for a transition from universal surveillance of COVID-19 to integrated surveillance of respiratory viruses and the needs for a transition to sustainable, integrated surveillance of SARS-CoV-2, influenza and other respiratory viruses.

2.1 Critical areas for surveillance of COVID-19 and other respiratory viruses (Anex 3 Table 1)

During the consultation, seven critical areas were identified within which were the priority public health questions that COVID-19 surveillance must respond to in a sustained manner.

- Transmission (current and future projection)
- Severity of cases and risk factors
- Impact on the health system and society
- Post-COVID-19 condition and sequelae
- Vaccination
- Immune response and infection
- Emerging events of interest to public health

The main surveillance systems identified that currently answer these questions were universal surveillance of COVID-19, sentinel surveillance of influenza and other respiratory viruses, as well as surveillance for the detection and early warning of events of potential health interest (unusual events or cases, outbreaks, etc.) among other complementary systems that respond to specific questions.

2.2 Approaches to assess transmission, disease severity, and impact of SARS-CoV-2

(Anex 3 Table 1 and Table 2)

For transmission monitoring, parameters were proposed based on the number of cases (according to syndromic case definitions from more generic for respiratory viruses such as ILI-influenza-like illness- or ARI-acute respiratory infection- to more specific as a confirmed case of COVID -19) as well as the percentage of positivity of cases that meet a syndromic definition. The main surveillance systems proposed to provide this information were respiratory virus sentinel surveillance and universal surveillance (either based on individualized cases, ICD-10 codes, or syndromic).

For monitoring the severity of SARS-CoV-2 disease, proportions with both general (positive cases for the etiological agent) and specific (hospitalized cases for the etiological agent) denominators were proposed as parameters. Confirmed cases with adverse outcomes such as admission to intensive/critical care units or deaths were proposed as numerators. This would allow the calculation of different proportions such as the case fatality of confirmed SARS-CoV-2 cases, the proportion of cases hospitalized for SARS-CoV-2 that required admission to the ICU or that died. One of the main challenges to calculate these highlighted parameters was the need to monitor cases throughout the episode to determine the presence or absence of adverse outcomes and the need to obtain this information from health centers with a sufficient level of medical assistance to ensure follow-up until the end of the episode. The main proposed surveillance systems capable of providing this information were sentinel surveillance of respiratory viruses and universal surveillance (based on individualized cases with follow-up).

Two key aspects in monitoring these indicators were discussed. In the first place, representativeness, pointing out the importance for sentinel surveillance when selecting sentinel centers to cover aspects such as rural and urban settings, geographical areas with climatological differences, border areas or areas with a high flow of migrants and travelers, as well as areas with stable population, age groups and other demographic differences that may reflect social inequalities and access to health systems. Secondly, in terms of flexibility depending on the epidemiological context, in contexts of difficult management and great uncertainty (high transmission and severity with a large susceptible population), the need to cover these indicators with universal coverage was pointed out, while in contexts of epidemiological cases in which the severity is less and a high percentage of the population has immunity, the suitability of monitoring these indicators on a sentinel basis was indicated, but guaranteeing certain aspects of representativeness mentioned previously. In this way, the suitability of having a flexible surveillance was proposed that, in the event of relevant epidemiological changes, representativeness can be increased until universal coverage is achieved in the most serious scenarios of a pandemic. Especially, when the implementation of strict population measures is required and sometimes with a level of local intervention, which entails a high political implication.

2.3 Approaches for the integration of genomic surveillance in respiratory virus surveillance

(Anex 3 Table 3)

To meet the goal of genomic surveillance of knowing the distribution over time of circulating lineages/sublineages, the sentinel respiratory virus system was proposed as the ideal surveillance system, since it guarantees adequate representativeness for other indicators (transmission and severity). To ensure correct representativeness there are different sampling techniques (random, sequential, consecutive, etc.) always taking into account the quality criteria of the samples that allow a correct genomic sequencing.

In order to meet the objective of detecting a new variant of potential concern or a variant of concern previously identified in other areas of the world, in addition to sentinel surveillance that could partially cover this objective, the need to complement it with other surveillance systems

with universal coverage was raised. This may provide samples with a high degree of suspicion due to the presence of epidemiological characteristics that suggest greater transmissibility, severity, immune evasion capacity, changes in clinical presentation or in risk groups, or similar. Although sentinel surveillance could provide samples that meet these requirements, it does not have the universal coverage necessary to guarantee the detection of any case or unusual event that occurs and therefore limits the capacity for intervention, which is why complementary systems are required.

There are different challenges associated with genomic surveillance, such as the difficulty in integrating clinical and epidemiological information with laboratory information, the main cause of which lies in the lack of single information systems or interoperability of systems for each component, and automation of the processes of capturing and reporting this information, including reporting flows to national institutions when academic/private institutions are involved in the sequencing process. Another of the main challenges is the delay in response times from when the patient's sample is taken until the sequenced sample is shared nationally and globally. The main causes that were identified were also related to the automation of information capture and reporting, as well as the transfer times of samples to laboratories with sequencing capacity. Finally, another of the main challenges discussed was the minimum sample size that would allow adequate monitoring of circulating lineages/sublineages, and in this sense the main limitations were found in the capacity of the laboratories (which should be reinforced/maintained) and in the quality of the samples that can finally be sequenced.

2.4 Priority questions, surveillance systems, and required adjustments for a transition from universal COVID-19 surveillance to integrated respiratory virus surveillance (Anex 3 Table 1 and Table 2)

Of the seven blocks of critical needs for COVID-19 surveillance previously indicated, transmission, severity of the disease (including associated risk factors), impact, vaccination and potential emerging events were categorized with very high priority interest for public health. The surveillance system proposed to provide sustained answers to questions related to transmission and severity (including risk factors) was respiratory virus sentinel surveillance. However, it was almost unanimously expressed that there is a need for adjustments to this system in order to respond optimally, especially to questions related to gravity. Sentinel surveillance was also proposed for the vaccination component related to vaccine effectiveness, with necessary adjustments by some countries.

Regarding the prioritized questions within the impact block, the need to use other information systems was identified (hospital management/admission to determine the occupation of beds and civil registries or vital statistics to provide mortality from all causes), as well as to guarantee its articulation to the surveillance of respiratory viruses. Similarly, to respond to the vaccine coverage component within the vaccination block, national vaccination registries/programs were proposed (widely developed during the COVID-19 pandemic), whose interoperability with sentinel surveillance systems would be key to facilitating the registration of vaccinations and history of vaccination in cases captured in sentinel surveillance.

Ad hoc regional expert consultation – Challenges, gaps and next steps in COVID-19 surveillance and its integration into influenza and other respiratory virus surveillance.

In relation to the questions included in the block of emerging events with potential interest for public health, the need to use complementary surveillance systems was identified (for the detection of outbreaks, cases or unusual/unusual events, event-based surveillance, etc. with a universal coverage) and in a significant proportion of countries it also requires adjustments to provide an adequate response on a sustained basis.

Within these blocks, genomic surveillance must be articulated with sentinel surveillance (to determine which are the circulating lineages/sublineages), as well as with complementary surveillance systems for the detection of emerging events with potential interest for public health associated with detection of potential variants of concern or detection of others already identified.

Lastly, other blocks of critical needs in which questions with high priority were identified were those related to the immune response (re-infections or breakthrough infections) and post-COVID-19 episodes. In response, the proposed surveillance system was the respiratory virus sentinel system for what is related to infection and immune response, integrating information on vaccination and previous infections, but with the need to make adjustments. While for the detection of sequelae and post-COVID-19 episodes, there was no consensus on which system could respond.

2.5 Identification of needs for a transition towards sustainable, integrated surveillance of SARS-CoV-2, influenza and other respiratory viruses

(Anex 3 Table 4)

Experts identified the following critical needs for a transition to integrated sustainable surveillance of SARS.CoV-2, influenza, and other respiratory viruses:

- Have regional guidelines that guarantee a gradual, homogeneous, and standardized transition with identified priorities.
- Global/regional framework that allows transferring the technical recommendations to a regulatory framework in the countries.
- Establish proper planning and management of resources to guarantee the sustainability of this integrated surveillance of respiratory viruses.
- Technical support to guarantee the correct implementation of the necessary adjustments for integrated surveillance during the transition with training for specific components based on the needs of the countries (examples: severity and impact, integration of animal surveillance with a One Health approach, surveillance of Post-COVID-19 episodes etc.)
- Strengthen the epidemiology component in respiratory virus surveillance, as well as incorporate other surveillance capabilities developed during the COVID-19 pandemic.
- Evaluate the functionality of the information provided by the data from the universal surveillance of COVID-19 in comparison with the data obtained through the integrated sentinel surveillance of respiratory viruses together with the complementary surveillance systems.

- Have integrated information systems and an automation component that improves notification in terms of frequency, timeliness and quality of information.
- Document lessons learned during the COVID-19 pandemic to prepare for future threats and integrate them into health policies.
- Consolidate networks in the region that allow the exchange of experiences.

3. Conclusions

The main critical areas within which are the priority public health questions that COVID-19 surveillance must respond to in a sustained manner and expand to other respiratory viruses with pandemic potential are:

- Transmission (current and future projection)
- Severity of cases and risk factors
- Impact on the health system and society
- Post-COVID-19 condition and sequelae
- Vaccination
- Immune response and infection
- Emerging events of interest to public health

Surveillance of influenza and other respiratory viruses must be adjusted to optimally respond to these needs and thus be able to guarantee an effective transition. To cover all identified needs efficiently and sustainably, sentinel surveillance of respiratory viruses plays an essential role, but it needs to be accompanied by other complementary surveillance systems that cover those aspects that require a universal component or information recorded through other information systems.

To cover the monitoring of the transmission and severity of the disease caused by SARS-CoV-2, sentinel surveillance is an optimal solution that requires readjustment in some contexts to integrate SARS-CoV-2 and especially to adequate follow-up of the severity of the disease. In addition, the genomic surveillance component integrated into this sentinel surveillance is essential to monitor the evolution of the distribution of circulating SARS-CoV-2 lineages/sublineages and thus be able to associate them with the severity of the cases, comorbidities, age groups most affected among other risk factors.

To cover other aspects, it is necessary to maintain or strengthen other sources of information or surveillance systems. Specifically, to measure the impact caused by circulating respiratory viruses, the need has been raised to use other information systems that have been developed during the COVID-19 pandemic, and that would require their maintenance over time. While to detect events of potential public health interest, it is necessary to have other complementary surveillance systems that are capable of detecting outbreaks, events or unusual cases and that can be linked to genomic surveillance to detect new variants of potential concern or previously identified variants of concern in the case of COVID-19 or new respiratory viruses with pandemic potential. To meet the needs related to aspects of vaccination, immune response and subsequent condition associated with an acute infection, some questions could be answered

through sentinel surveillance while others will require other complementary systems based on the capacities acquired by the countries during the COVID-19 pandemic. 19.

Finally, to guarantee a correct transition in general terms, the establishment of homogeneous guidelines for the region was identified as necessary, as well as technical support considering the lessons learned and capacities acquired for both epidemiological and laboratory surveillance specifically during COVID-19 pandemic.

Anex 1: Agenda

March 29, 2022		
HOUR	**ACTIVITY**	**RESPONSIBLE**
8:00-8:30	Opening remarks and objectives of the expert consultation	Ministry of Health of Panama Andrea Vicari, PAHO
8:30-9:00	Presentation: COVID-19 epidemiological context which leads to the current debate and *ad hoc* consultation including potential future scenarios.	Maya Allan, WHO
9:00-9:30	Presentation: Current framework for surveillance strategies to address pandemic and seasonal objectives as well as integrated sentinel surveillance.	Siddhivinayak Hirve, WHO Isabel Bergeri, WHO
9:30-10:00	Presentation: Mapping the situation of universal COVID-19 and SARS-CoV-2 integrated surveillance in the Region of the Americas	Ana Riviere, PAHO Lidia Redondo, PAHO Jorge Jara, PAHO
10:00-10:15	Break	
10:15-11:15	Breakout groups 1: Identification of priority Public Health questions that COVID-19 surveillance needs to answer and main challenges to meet the needs (at short, medium and long term).	Working groups
11:15-11:45	Plenary discussion	All participants
11:45-12:45	Lunch	
12:45-13:15	Presentations: Evaluation of key parameters to assess transmission, severity, and impact during COVID-19 pandemic from country experiences	Country experience presentation
13:15-14:15	Breakout groups 2: Best approaches to assess transmission severity and impact	Working groups
14:15-14:45	Plenary discussion	All participants
14:45-15:00	Break	
15:00-15:20	Presentation: Current recommendations for genomic surveillance	Juliana Leite PAHO
15:20-16:20	Breakout groups 3: Best approaches and main challenges for Integrating genomic surveillance into sentinel surveillance	Working groups
16:20-16:50	Plenary discussion	All participants
16-50-17:00	Summary of key points from day 1	Angel Rodriguez, PAHO

March 30, 2022		
HOUR	**ACTIVITY**	**RESPONSIBLE**
9:00-9:15	Summary of key points from day 1	Andrea Villalobos, PAHO
9:15-9:45	Presentations: Examples of countries with integration of SARS-CoV-2 into sentinel surveillance system during the pandemic.	Country experience presentation
9:45-10:00	Laboratory algorithms for SARS-CoV-2 integration	Juliana Leite, PAHO
10:00-11:00	Breakout groups 4: Consideration of country experiences evaluating indicators and information collected through sentinel surveillance to meet the needs for monitoring the pandemic.	Working groups
11:00-11:30	Plenary discussion	All participants
11:30-11:45	Break	
11:45-12:45	Breakout groups 5: Best ways to monitor other critical needs with complementary surveillance systems	Working groups
12:45-13:15	Plenary discussion	All participants
13:15-14:15	Lunch	
14:15-15:15	Breakout groups 6: Best approaches to transition from acute response to a sustainable surveillance	Working groups
15:15-15:45	Plenary discussion	All participants
15:45-16:15	Roadmap, main gaps, and priority actions to be carried out for the adaptation and transition of COVID19 surveillance	All participants
16:15-16:30	Summary of key points from day 2	Angela Hinds, CARPHA
16:30-17:00	Questionnaire	All participants
17:00-17:15	Conclusions and next steps	Andrea Vicari, PAHO

Anex 2: Participants list:

Country/Institution	Name
Argentina	Carla Voto
Bahamas	Felicia Balfour-Greenslade
Brazil	Walquiria Aparecida Ferreira de Almeida
Canada	Christina Bancej
CARPHA	Angela Hinds
US CDC	Eduardo Azziz -Baumgartner
	Lindsey Duca
	Kinda Zureick
Chile	María Fernanda Olivares
	Patricia Bustos
Colombia	Diana Carolina Malo
SE-COMISCA	Maribel Orozco
Costa Rica	Hebleen Brenes
Dominican Republic	Raquel Pimentel
Ecuador	Pablo Acosta Hidalgo
	Alfredo Bruno
Guatemala	Antonio Paredes
Mexico	Gisela Barrera Badillo
	Rosaura Idania Gutierrez Vargas
Panama	Yadira Isasa de Molto
	Brechla Moreno
Paraguay	Von Horoch, Marta
	Elena Penayo
Uruguay	Adriana Alfonso
	Héctor Chiparelli
PAHO	Jorge Jara
	Andrea Patricia Villalobos
	Angel Rodriguez
	Lidia Redondo
	Juliana Leite
	Andrea Vicari
	Ana Riviere
WHO	Maya Allan
	Siddhivinayak Shriram Hirve
	Isabel Bergeri

Anex 3: Concept tables

Table 1. Priority questions, surveillance systems and adjustments needed for sustainable surveillance of COVID-19 and other respiratory viruses

Priority questions, surveillance systems and adjustments needed for sustainable surveillance of COVID-19 and other respiratory viruses					
Critical knowledge Areas	Specific information for the questions	Priority	Main sustainable surveillance systems	Special considerations	Adjustments needed to proposed surveillance systems
Transmission (current and future projection)	• New cases and location • Age groups of cases • Co-circulating respiratory viruses • Circulating variants or lineages • % positivity • Next epidemic wave • Seasonality	Very high High	Respiratory viruses sentinel surveillance + Genomic surveillance component to determine circulating lineages/sublineages + Modelling	Currently, countries that have integrated SARS-CoV-2 surveillance in sentinel surveillance can measure transmission parameters.	Yes Needed for some countries that have not included SARS-CoV-2 in this surveillance and for those countries that do not have sentinel surveillance of respiratory viruses.
Severity of cases and risk factors	• Severity of the cases (ICU admission or death) • Risk factors for severe episode • Vulnerable groups • Case fatality rate • Cases of multisystem inflammatory syndrome in children	Very high High	Respiratory viruses sentinel surveillance	Requires a longitudinal follow-up of the cases, in centers with a sufficient level of care to follow the entire episode (e.g., ICU admission).	Yes Needed in most countries to ensure follow-up of cases
Impact on the health system and society	• Occupation of hospital beds and/or ICU beds • Excess mortality from all causes	Very high	Admission records or services for hospital management of beds or Civil registries /Vital statistics	Capacity has been built during the COVID-19 pandemic. The difficulty lies in the fact that the	Yes Needed to maintain capacity acquired

				information does not depend on the epidemiology services/units	during the COVID-19 pandemic
Post-COVID-19 condition and sequelae	• Cases of post-COVID-19 condition • Sequelae due to COVID-19	High	Universal hospital Reporting?	Not currently monitored, it should be implemented.	Yes Needed for implementation, possibility of capture through hospital-based surveillance There is no consensus
Vaccination	• Vaccine effectiveness • Vaccination coverage	Very high	Respiratory viruses sentinel surveillance National registries/programs	Vaccination coverage registries have developed extensively during the COVID-19 pandemic	Yes Especially needed for vaccine effectiveness in some countries.
Immune response and infection	• Breakthrough infections	High	Respiratory viruses sentinel surveillance	Some countries have implemented it in universal COVID-19 surveillance.	Yes Needed in most countries that must include the vaccination history records
Emerging events of interest to public health	• Outbreaks or clusters • Unusual cases/events • New viruses/variants circulating • Virological changes modifying transmission or severity	Very high	Respiratory viruses sentinel surveillance + Complementary systems + Genomic surveillance component to detect new variants of potential interest/concern (VOC/VOI) or already identified VOC/VOI	Sentinel surveillance is insufficient (only in some cases unusual signals in the indicators could be detected), it must be complemented with other alternative surveillance systems (as Event Based Surveillance).	Yes Needed in most countries

Table 2. Sentinel surveillance of respiratory viruses with integration of SARS-CoV-2

Sentinel surveillance of respiratory viruses with integration of SARS-CoV-2		
What can be measured (from very high and high priority questions)	Needed adjustments	Consideracions
Transmission parameters	Incorporate SARS-CoV-2 as a pathogen within the surveillance algorithm.	Modeling studies can be carried out with the data obtained from the transmission parameters to make projections and predictions. The genomic surveillance component integrated into sentinel surveillance will allow carrying out the representative strategy to determine circulating lineages/sublineages.
Severity parameters and risk factors	Acquire or strengthen the ability to longitudinally follow up notified cases until the end of the episode in centers with a sufficient level of care. Characteristics related to severe disease must be followed in confirmed cases, so it is important to confirm a sufficient number of cases to allow population inferences.	The genomic surveillance component integrated into sentinel surveillance will allow carrying out the representative strategy to determine circulating lineages/sublineages and associate them with severity patterns
Vaccine effectiveness	Countries that have already conducted vaccine effectiveness studies for influenza may include SARS-CoV-2 as the etiological agent. Those countries that have carried out vaccine effectiveness studies with universal surveillance of COVID-19 will be able to adapt the study protocols to sentinel surveillance. Countries that have not carried out vaccine effectiveness studies should adjust the system in such a way that it allows these studies.	The genomic surveillance component integrated into sentinel surveillance will allow carrying out the representative strategy to determine the circulating lineages/sublineages and associate them with the estimated vaccine effectiveness.
Breakthrough infections	Incorporate the history of vaccination as variables that allow the study of this phenomenon.	The genomic surveillance component integrated into sentinel surveillance will allow carrying out the representative strategy to determine circulating lineages/sublineages and associate them with the presence of infections in people with complete vaccination.
Detection of unusual patterns in the measured parameters	Ability to pick up signals early that indicate an unusual pattern. For this, the times from when the cases seek health	Depending on the level of comprehensiveness in terms of coverage of

that can trigger the investigation of a potential emerging event	care until they are notified with the available laboratory results, as well as the information captured, must be as short as possible. In addition, to determine that a pattern is unusual, it is necessary to have references to previous usual patterns.	the population under surveillance, the system will be more or less sensitive to detect these signals. The genomic surveillance component integrated into sentinel surveillance will allow carrying out the representative strategy to determine circulating lineages/sublineages and associate them with the presence of unusual patterns in the areas where they are detected. It could also respond to the oriented/directed strategy for the detection of new potential VOC/I or to identify those VOC/I previously identified.
Main challenges	Considerations	
Sentinel sites selection	Representativeness of the population under surveillance with the selection of sites based on the identified priorities. It was considered necessary to obtain sufficient representativeness to guarantee at least information on: Rural and urban areas; different climatological zones that may present different seasonal patterns, areas with a high flow of people (both migrants and travelers) and areas with a stable population; different age groups. The suitability of having flexible surveillance systems that in pandemic contexts allow that when the scenarios assume high severity and uncertainty, the coverage of the surveillance system is universal and as this decrease, it is possible to return to sentinel surveillance.	
Laboratory capacity	Proportion of samples that can be processed and therefore confirmed, which may decrease validity if the number is low, which in turn limits the final number of cases followed up to determine severity parameters, collect exposure variables and risk factors for other studies such as vaccine effectiveness. In addition, it limits the number of samples that can be selected for genomic sequencing since they require minimum quality standards that are not always met in all samples. It is necessary to strengthen and give continuity to the installed capacities (especially in the NICs).	
Information and reporting systems	Integration of information from different sources: clinical, epidemiological, vaccination and laboratory without the need to enter it repeatedly in different information systems, using single or integrated information systems. Automation of information reporting processes that reduce reporting times, incompleteness, as well as other factors that reduce the frequency, timeliness and quality of data.	

Table 3. Integrated genomic surveillance in respiratory virus surveillance

Sustainable surveillance systems to integrate genomic surveillance strategies:	• Representative strategy to determine circulating SARS-CoV-2 lineages and sublineages from respiratory virus sentinel surveillance samples. • Targeted/Oriented strategy to detect new variants of potential interest/concern or variants of interest/concern already identified.
Improvement areas:	• Information systems that are unique or that allow integration of information: clinical, epidemiological, vaccination and laboratory. • Automation of reporting processes (information systems) to improve completeness and avoid delays in the different components of the process. • Improvement in the transport of samples or decentralization of the sequencing capacity under strict supervision of the NIC, to reduce delays in distant or difficult-to-access geographic areas. • Selection of the samples according to adequate epidemiological criteria for sequencing (on the one hand, for a representative strategy and on the other for a targeted strategy) guaranteeing an improvement in the quality of taking the samples selected for sequencing (fewer samples of better quality to meet epidemiological and laboratory criteria, considering NICs validation).

Table 4. Needs for a transition towards sustainable, integrated surveillance of SARS-CoV-2, influenza and other respiratory viruses

Needs for a transition towards sustainable, integrated surveillance of SARS-CoV-2, influenza and other respiratory viruses	• Regional guidelines that guarantee a gradual, homogeneous, and standardized transition with identified priorities. • Global/regional framework that allows transferring the technical recommendations to a regulatory framework in the countries. • Proper planning and management of resources to guarantee the sustainability of this integrated surveillance of respiratory viruses. • Technical support to guarantee the correct implementation of the necessary adjustments for integrated surveillance during the transition with training for specific components based on the needs of the countries (examples: severity and impact, integration of animal surveillance with a One Health approach, surveillance of Post-COVID-19 episodes etc.) • Strengthen the epidemiology component in respiratory virus surveillance, as well as incorporate other surveillance capabilities developed during the COVID-19 pandemic. • Evaluate the functionality of the information provided by the data from the universal surveillance of COVID-19 in comparison with the data obtained through the integrated sentinel surveillance of respiratory viruses together with the complementary surveillance systems. • Have integrated information systems and an automation component that improves notification in terms of frequency, timeliness and quality of information. • Document lessons learned during the COVID-19 pandemic to prepare for future threats and integrate them into health policies. • Consolidate networks in the region that allow the exchange of experiences