End-to-end integration of **SARS-CoV-2** and **influenza** sentinel surveillance

Compendium of country approaches

World Health Organization

End-to-end integration of SARS-CoV-2 and influenza sentinel surveillance: compendium of country approaches
ISBN 978-92-4-005670-1 (electronic version)
ISBN 978-92-4-005671-8 (print version)

Suggested citation. End-to-end integration of SARS-CoV-2 and influenza sentinel surveillance: compendium of country approaches. Geneva: World Health Organization; 2023. Licence: CC BY-NC-SA 3.0 IGO.

Cataloguing-in-Publication (CIP) data. CIP data are available at http://apps.who.int/iris.

Design and layout by Derek Ellis, Morfa.inc.

Contents

Acknowledgements

The World Health Organization (WHO) would like to thank the Global Influenza Surveillance and Response System, the Ministries of Health, national and international institutions, and individual experts who contributed with the submission and review of country examples. Details of contributors are listed under each country submission.

Acknowledgement also goes to WHO staff and consultants at headquarters and in regional and country offices who contributed significantly to the development and finalization of the compendium.

Acronyms

ARI	acute respiratory infection
GISRS	Global Influenza Surveillance and Response System
GP	general practitioner
ICU	Intensive Care Unit
ILI	influenza-like illness
MERS-CoV	Middle East respiratory syndrome coronavirus
NIC	national influenza centre
ORVs	other respiratory viruses
PAHO	Pan American Health Organization
PPE	personal protective equipment
PIP framework	Pandemic Influenza Preparedness Framework
RT-PCR	reverse transcription polymerase chain reaction
SARI	severe acute respiratory infection
SOPs	standard operating procedures
UNICEF	United Nations Children's Fund
US CDC	United States Centers for Disease Control and Prevention
WHO	World Health Organization
WHO CC	WHO collaborating centre

1. Country approaches for integrated surveillance

1.1 Background

The COVID-19 pandemic has posed many challenges to health systems around the world, among them, the capacity to continue influenza disease surveillance. Disruptions of primary and secondary health care delivery have been recorded in many countries, resulting in decreased testing for influenza or reporting of results to national and global platforms. Additionally, public health and social measures taken in response to the COVID-19 pandemic and changes in care-seeking behaviour have affected the routine surveillance systems for monitoring influenza epidemiology and virology (*1*).

The WHO Global Influenza Surveillance and Response System (GISRS) has played an important role in the COVID-19 pandemic response (*2*). By leveraging the existing influenza surveillance systems to integrate SARS-CoV-2 testing in specimens collected from influenza surveillance sources, countries have been able to maintain influenza surveillance and establish a system for monitoring SARS-CoV-2 circulation in communities. To guide countries in establishing this integration, in November 2020, WHO published the interim guidance *Maintaining surveillance of influenza and monitoring SARS-CoV-2 – adapting Global Influenza surveillance and Response System and sentinel systems during the COVID-19 pandemic* (*3*). The interim guidance contains considerations for addressing disruptions in influenza sentinel surveillance and extending it to include COVID-19 wherever possible. Updated algorithms for testing both influenza and SARS-CoV-2 for surveillance purposes are also included.

In February 2021, WHO published *Operational considerations to expedite genomic sequencing component of GISRS surveillance of SARS-CoV-2* (*4*), providing practical guidance to GISRS laboratories and other relevant national laboratories to move beyond virus detection to genomic sequencing of SARS-CoV-2 polymerase chain reaction (PCR) positive materials obtained from sentinel surveillance of influenza-like illness (ILI), acute respiratory infection (ARI) and severe acute respiratory infection (SARI). It contains considerations on sample selection for sequencing, numbers of viruses to be sequenced, metadata and timeliness for sharing genetic sequence data.

Broad experience has since been gained as countries adapted their influenza sentinel surveillance systems for the end-to-end integration of virologic and genomic surveillance for SARS-CoV-2. This required the existing systems to undergo a variety of adaptations and adjustments, and countries have employed various strategies to maintain existing influenza surveillance systems and sustain the surveillance of influenza while monitoring the activity of the SARS-CoV-2 virus in the community.

1.2. Country approaches collection initiative

In August 2021, WHO launched an initiative to collect examples of country approaches for integrating influenza and SARS-CoV-2 sentinel surveillance from countries worldwide. The objective was to take stock of experiences and lessons learned from countries in using influenza sentinel systems in sampling, testing, sequencing, reporting SARS-CoV-2 surveillance data and sharing SARS-CoV-2 genetic sequence data and shared this information with others.

Members of the GISRS network were invited to submit examples of approaches adopted in their country via an online submission form, available in English. In addition, the call for submissions was announced through WHO regional influenza surveillance networks and translated into French and Russian. Examples were collected from September to November 2021.

Countries were invited to submit any practice that functions to achieve the target of integrating influenza and SARS-CoV-2 sentinel surveillance. It must be a successful experience that has been tested in a specific context and can be recommended as a model to be replicated in different contexts.

A country example could include one or more of the following areas of integrated influenza and SARS-CoV-2 surveillance:

- **surveillance** (e.g. use of case definitions, maintaining sentinel site functioning, case recruitment/sample sourcing, use of surveillance data for reaching surveillance objectives and informing policy);
- **data management** (e.g. disaggregating data into that of sentinel and non-sentinel sources, reporting to FluNet);
- **laboratory** (e.g. surge testing, testing algorithm, use of multiplex, sequencing and sharing SARS-CoV-2 genomic data and sampling strategy in Global Initiative on Sharing All Influenza Data (GISAID)).

An expert committee that included members from the GISRS network, influenza surveillance officers and the WHO regional offices evaluated all submitted country approaches against the criteria listed in Box 1.

Box 1: Country approach selection criteria

- ***Relevant:*** *must address one of the areas for integrated influenza and SARS-CoV-2 sentinel surveillance*
- ***Effective:*** *must work and achieve results that have been measured*
- ***Efficient:*** *must produce results with a reasonable level of resources and time*
- ***Sustainable:*** *implementable or able to be maintained over a long period of time without any massive injection of additional resources*
- ***Replicable:*** *can be adopted and adapted in other contexts.*

1.3 Results and country approches presented in this compendium

Over the collection period, 29 submissions were received from 28 countries across all six WHO regions; one additional submission was received from the WHO Regional Office for the Americas on behalf of several countries in the Region. Of the 30 submissions, 27 met all the selection criteria and were included in this compendium.

A thematic analysis of the evidence provided in the submission forms was conducted after extracting and categorizing the information under three sections: surveillance, laboratory and data management. However, since many submissions addressed multiple areas of integrated influenza and SARS-CoV-2 surveillance, the compendium is organized by WHO region to avoid redundancy.

Challenges and associated actions/solutions adopted in the countries that have submitted their approach on integrated surveillance are summarized in Table 1.

Table 1. Summary of challenges and solutions for surveillance, laboratory, and data management

Challenges	Solutions
Surveillance – Disruption of activities at sentinel sites	
Influenza surveillance suspended	▪ WHO Regional Office for the Eastern Mediterranean recommendations to re-establish and expand sentinel surveillance after site visit assessment (Syrian Arab Republic)
Low ILI consultation rate and inability to collect enough samples due to: ▪ altered pathways redirecting patients away from primary care for SARS-CoV-2 testing ▪ changes in health-seeking behaviour ▪ health personnel concerns on high transmissibility of SARS-CoV-2 and lack of PPE	▪ Expansion of the number of sentinel GPs (Italy, Netherlands (Kingdom of the)) ▪ Expansion of ILI sentinel sites and updated case definitions (Oman) ▪ Sentinel site visit to assess performance and identify issues at sentinel sites (Togo) ▪ Enhancement of flexibility to establish new routines, including new laboratory testing algorithm (Netherlands (Kingdom of the)) ▪ Re-establishment of GP sentinel surveillance system for influenza and ORVs supplemented by samples collected at Covid Hubs (Scotland, United Kingdom of Great Britain and Northern Ireland) ▪ Training of sentinel sites personnel on integrated surveillance approach helped to strengthen biosafety and biosecurity measures (Togo)
Need to preserve sentinel surveillance with timely monitoring of COVID-19 rates	▪ Rapid integration of COVID-19 surveillance in primary (Germany) and secondary (Germany, Spain) care ▪ Expansion of the number of sentinel surveillance sites (Mongolia, Philippines, Timor-Leste)
Sentinel sites repurposed as COVID-19 centres	▪ COVID-19 negative ARI, ILI and/or SARI samples from sentinel and non-sentinel sites tested for influenza (India, Nepal)
Lack of collaboration between COVID-19 response teams and the staff involved in influenza surveillance at sentinel sites	▪ Effective communication to include relevant COVID-19 response stakeholders (Togo)

Table 1. Summary of challenges and solutions for surveillance, laboratory and data management

Challenges	Solutions
Surveillance – Human resources	
Shortage of staff	▪ Mobilization of health graduate students and retired health workers to support sentinel site activities (Mongolia)
Need for training/updating of sentinel site personnel	▪ Updating and sharing SOPs through face-to-face or virtual meetings/trainings (Argentina, Bangladesh, India, Madagascar, Mongolia, Oman) ▪ Training national teams on proper usage of PPE and on nasopharyngeal specimen collection (Afghanistan) ▪ Supportive supervision and mentoring of new staff (Nigeria) ▪ Provision of performance awards and incentivization (Nigeria) ▪ Dissemination of weekly or monthly updates (Bangladesh, Oman)
Laboratory – Infrastructure	
No or low number of samples from sentinel sites to laboratory	▪ COVID-19 samples from sentinel and non-sentinel tested for influenza (Chad, India, Nepal, Oman) ▪ Retrospective testing of COVID-19 samples (Nigeria) ▪ Expansion of the use of multiplex assays in all regional reference laboratories in a dedicated structured surveillance system (Italy)
Laboratory not equipped for multiplex assay testing	▪ Rapid adaptation of RT-PCR platforms (Chad)
Issues with shipment of specimens from sentinel site to laboratory	▪ Establishment of transport contracts with one or several carriers (Madagascar, Nigeria)

Table 1. Summary of challenges and solutions for surveillance, laboratory and data management

Challenges	Solutions
Laboratory – Infrastructure	
Large diagnostic demand for suspected COVID-19 cases interferes with ability to maintain influenza and ORV surveillance	▪ Decentralization of laboratory testing (Argentina, Costa Rica, India, Lao People's Democratic Republic, Nepal, Oman) ▪ Only positive influenza specimens to be sent to NIC; SARS-CoV-2 positive samples meeting defined criteria to be sent to NIC for genomic surveillance (Costa Rica) ▪ Introduction of new testing algorithm (Armenia, India) ▪ NIC develops in-house multiplex assay for influenza and SARS-CoV-2 (Belgium, India) ▪ Retrospective testing of samples collected at sentinel site and stored at NIC (Nepal)
Delay in procurement or shortage/ stock out of laboratory supplies	▪ Develop SOPs for supply stock management (Madagascar) ▪ Support of international agencies (WHO, UNICEF, etc.) (Democratic People's Republic of Korea) for procurement
Financial challenge of testing all sentinel samples for influenza, SARS-CoV-2 and ORVs	▪ Obtain government commitment to sustain surveillance programme (Oman)
Laboratory – Human resources and training	
Employee overload / shortage of human resources	▪ Reorganization of working schedule of laboratory staff (Chad, Madagascar) ▪ Increase in the number of staff (Chad, Timor-Leste) ▪ Increase in the number of working days (from 5 to 7 days) (Chad) ▪ Motivation of staff though incentivization (Chad)
Need for training	▪ Provision of updated SOPs and training (Argentina, Timor-Leste) ▪ Training delivered to public and private laboratories in the country and to NICs of several neighbouring countries (Mexico)

Table 1. Summary of challenges and solutions for surveillance, laboratory and data management

Challenges	Solutions
Data management	
Delay in reporting data to national, regional or global platforms	▪ Updating data collection tool to include both influenza and SARS-CoV-2 (Madagascar) ▪ Maintaining routine team meeting and remote assistance of data managers to sentinel sites (Madagascar) ▪ Dedicated staff for reporting (Madagascar) ▪ Sharing weekly report on COVID-19 and influenza with end users to increase awareness on the importance of reporting (Oman) ▪ Sentinel sites granted access to the national influenza system for reporting (Mongolia)
Management of data coming from different sources	▪ Development of a flexible web-based electronic system (PAHO, Russian Federation) ▪ Adaptation of reporting system (Argentina, PAHO)

ARI: acute respiratory infection; GP: general practitioner; ILI: influenza-like illness; NIC: national influenza centre; ORV: other respiratory viruses; PAHO: Pan American Health Organization; PPE: personal protective equipment; RT-PCR: reverse transcription polymerase chain reaction; SARI: severe acute respiratory infection; SOPs: standard operating procedures; UNICEF: United Nations Children's Fund.

1.4 Conclusion

The transfer of knowledge and experiences among countries facilitates the adoption and adaptation of approaches and can help improve health systems. The information shared by countries can be used to aid and inform other countries so that challenges can be overcome.

All approaches submitted for this initiative represent good and credible examples of outstanding work by national influenza centre (NIC) and surveillance officers with the support of national authorities and partners.

It is important to note that this compendium is not intended to be a comprehensive guide to all approaches currently being carried out by countries of the GISRS network. Only those submitted during the collection period are included here. It is plausible that members of the GISRS network may not have been aware of this initiative or may not have been able to make a submission due to time constraints or other limitations. WHO might consider repeating the initiative to collect more example of country approaches.

2. African Region

2.1. Analysis of COVID-19 samples to boost influenza surveillance in Chad (original submission in French)

Authors: Kadidja Gamougame[1], Maxime Djimadengar[1], Ahmat Izzo Abdelmadjid[1], Abdelsadick Hidjab[2], Issaya Singli Gad[2], Tao Vaizi[2], Frank Zongo[2], Honoré Djimrassengar[2] and Jean-Bosco Ndihokubwayo[2]

Background

The virology laboratory of the Centre Hospitalier Universitaire de Référence National (CHU-RN) coordinates the influenza sample collection system, storage, processing and transfer of data for ILI and SARI from sentinel surveillance sites. The number of samples from sentinel sites is small, and some sites do not have samples. With the outbreak of the COVID-19 pandemic, human and material resources (equipment and infrastructure) dedicated to influenza diagnosis have been reallocated for surveillance and management of COVID-19. COVID-19 has boosted influenza surveillance because COVID-19 samples are also tested for influenza. It should be noted that the four influenza sentinel sites have just been created in March and April 2021.

Challenges

- A low number of samples from sentinel sites.
- An overload of work since the start of the COVID-19 pandemic because the same people are responsible for influenza and COVID-19 surveillance.
- Recurring stock-outs and stock pressures on laboratory consumables due to the large number of COVID-19 samples.
- Incompatibility of available equipment with the Triplex Flu/SARS-CoV-2 reagent used, resulting in separate testing of samples for influenza and SARS-CoV-2, increasing the workload of responsible staff.

Country approach

- Analysis of COVID-19 samples for influenza. Many staff have been trained to perform throat and nasopharyngeal swabs for COVID-19. This has expanded the number of samples for testing and the geographical range of samples because the COVID-19 samples come from sentinel sites and non-sentinel sites.
- Reorganization of work in the laboratory by:
  - reduction of handling time on the machine by technicians
  - increasing the number of staff
  - increasing in the number of working days (from 5 to 7 days)
  - motivating staff with a snack allowance offered by the Ministry of Public Health and National Solidarity.
- Samples received were sent to the collaborating centre in Yaoundé with support from the WHO logistics team.
- The Ministry of Health ordered an ABI 7500 thermocycler that is compatible with the Triplex Flu/SARS-CoV-2 reagent.

Lessons learned

The key conditions (institutional, economic and social) for success included: the support of the national authorities for this activity; provision of funds, reagents, and consumables by the national government; and the availability of high-quality human resources.

Since the beginning of the COVID-19 pandemic, 22 COVID-19 diagnostic laboratories have been set up in the provinces. Some of these diagnostic sites could be strengthened and used for influenza surveillance testing. It will be necessary to build laboratory capacity at the provincial level to meet the standards so that these laboratories can perform influenza testing using reverse transcription polymerase chain reaction (RT-PCR).

[1] Virology Laboratory, Centre Hospitalier Universitaire de Référence National, Chad.
[2] WHO Country Office for Chad, N'Djamena, Chad.

2.2. Influenza and ARI surveillance in Madagascar

(original submission in French)

Authors: Laurence Randrianasolo[1], Norosoa Razanajatovo[2] and Vincent Lacoste[2]

Background

Madagascar has adopted Integrated Disease Surveillance and Response (SIMR) to identify early warnings and respond quickly to epidemic threats. The monitoring of ARI and ILI is part of this syndromic surveillance system and is coupled with virologic sentinel surveillance of influenza. Since the onset of COVID-19, many challenges have been encountered at both the sentinel surveillance sites and the laboratory level.

Challenges

Challenges at sentinel surveillance site level

- Due to the difficulties related with the lockdown, sentinel surveillance sites stopped sending samples to the laboratory.
- Only a few staff continued to ensure the roll-out of activities at health centres, prioritizing care to patients with severe conditions; other activities were suspended.
- Health centre attendance decreased because the population was concerned about risk of potential infection with SARS-CoV-2.
- Two sentinel sites suspended surveillance activities when staff contracted COVID-19.
- Triple packaging containers were in short supply due to the prioritization of COVID-19 sample delivery to health centres.

Challenges at laboratory level

- COVID-19-related activities were prioritized.
- All consumables and reagents were dedicated to the diagnosis of COVID-19, and delivery time was very long to replace these products.
- Testing for other diagnoses was processed later depending on the availability of laboratory technicians and supplies.
- As a result, reporting to national and global influenza surveillance platforms (such as FluNet and FluID) were significantly delayed.

Country approach

Madagascar responded to these challenges through a series of actions, including:

- updating the electronic SIMR data collection tool to include both the SARS-CoV-2 and the influenza virologic surveillance forms;
- setting up a central team to provide updates and remote assistance to sentinel site managers to ensure timely and continuous collection of ILI and ARI data;
- involving additional staff in the process of reporting to FluNet and FluID twice a month;
- reorganizing routine (twice a week) delivery of clinical samples to ensure that influenza diagnosis could occur through the provision of triple packaging, reminding staff in charge of sample delivery, and establishing transport contracts with several carriers;
- sharing standard operating procedures (SOPs) and updating staff at sentinel sites (through face-to-face or virtual meeting) on influenza sampling techniques, use of personal protective equipment (PPE), completion of questionnaires, and transport of samples;
- involvement of sentinel sites in surveillance, investigation and response activities in their health district to ensure sample collection and transport to the laboratory;

[1] Epidemiology and Clinical Research Unit, Institut Pasteur de Madagascar, Antananarivo, Madagascar.
[2] National Influenza Center, Institut Pasteur de Madagascar, Antananarivo, Madagascar.

- organizing opportunities for sentinel site managers to share experiences, lessons learned, and knowledge gained from the first wave of COVID-19;
- taking advantage of available COVID-19 funding to supply sentinel sites with PPE and equipment to implement influenza surveillance activities (e.g. thermometer, refrigerator, triple packaging) and cover the costs of sample transport;
- reorganizing the schedule of laboratory staff involved in the diagnosis of influenza to ensure processing of samples is carried out at least once a week;
- ordering testing reagents and other supplies as soon as possible and tracking stock status at least once a week to reduce the frequency of stock outs;
- motivating sentinel site staff through the quick return of laboratory results or the reduction of stock shortages (PPE, sampling kits, etc.);
- maintaining periodic meetings of the influenza team so they could identify issues likely to have an impact on influenza diagnosis and find solutions to those;
- ensuring the means to maintain robust communication with partners on the status of sentinel sites.

Lessons learned

These solutions had a positive impact on influenza activities since the country was able to establish and maintain a pace adapted to the COVID-19 situation. All sentinel sites (11 ILI sites and 3 SARI sites) were able to send samples suspected of infection with the influenza virus and SARS-CoV-2 with separate questionnaires. The sentinel sites were used as collection centres for samples from other health facilities in the district and to transport samples from regional level to the central laboratory. In addition, as some laboratory steps were already processed for COVID-19 testing, influenza diagnosis could be carried out up to twice a week. This approach had a positive impact on data reporting to national and global surveillance platforms, such as FluNet.

2.3. Integrated surveillance approach in Nigeria

Authors: Nigeria Centre for Disease Control, Abuja, Nigeria; Federal Ministry of Health, Abuja, Nigeria; WHO Country Office for Nigeria, Abuja, Nigeria; US Centers for Disease Control and Prevention, Atlanta, United States of America; Federal Ministry of Agriculture and Rural Development, Abuja, Nigeria

Background

Early in the COVID-19 pandemic, the National Influenza Sentinel Surveillance (NISS) team was responsible for generating awareness of both influenza and COVID-19 at sentinel sites. The COVID-19 response began using the platform of Influenza Technical Working Group led by the Principal Investigator of NISS. Upon confirmation of the first SARS-CoV-2 infection in Nigeria in late February 2020, the Director of Nigeria's Health Emergency Preparedness and Response and the COVID-19 Emergency Operations Centre (EOC) took over leadership of the response.

Challenges

Pandemic influenza surveillance in Nigeria has been thwarted by multiple challenges during the COVID-19 pandemic. Some of these include decreased ILI/ SARI case detection and sample collection due to changes in health-seeking behaviour. Additional challenges have included staff shortages due to the transfer of trained staff from influenza surveillance sites to other sites and the nationwide and local lockdowns, which disrupted transport of samples to the National Reference Laboratory (NRL). In addition, the National Reference Laboratory in Gaduwa was focused exclusively on testing SARS-CoV-2 samples, at the expense of other diseases including influenza.

Country approaches

Following the second wave of COVID-19, the Nigeria Centre for Disease Control (NCDC) collaborated with WHO to develop solutions that could mitigate the challenges caused by the COVID-19 pandemic. The solutions included: supportive supervision of surveillance staff and mentoring and capacity building of the NISS team and NCDC staff on influenza epidemiologic and virologic surveillance and data management to increase ILI/ SARI case detection and sample collection. WHO supported NCDC in conducting multiplex testing. In response to the issues affecting the transport of samples, Nigeria's federal government intervened to allow TRANEX courier to transport influenza samples in addition to SARS-CoV-2 samples. As a result, influenza surveillance resumed, and eight out of ten sites remain active to date. In addition, Nigeria began conducting retrospective testing of influenza using SARS-CoV-2 testing samples (both positive and negative) collected when influenza surveillance stopped during the course of the COVID-19 pandemic. This retrospective testing was important to rule out the possibility of co-infection of influenza and COVID-19.

Managing avian influenza outbreaks during COVID-19 pandemic

In 2021, 18 states in Nigeria experienced an outbreak of highly pathogenic avian influenza (H5N1) affecting birds in multiple farms. Avian influenza outbreaks pose a threat to human health and require action for early detection, response, control and prevention. In January 2021, when the outbreak began, the NISS team responded using a one health approach with the veterinary teams in the affected and neighbouring states to conduct risk assessments. Samples from people exposed to infected birds were tested to rule out transmission to humans. Fortunately, no human cases occurred during this outbreak. During the annual influenza review meeting, this multisectoral coordination approach was reviewed to identify challenges and solutions.

Lessons learned

For sustainability, it was key for the federal government (through the NCDC) to work closely with states and hospitals to conduct supportive supervision activities and advocate for the inclusion of influenza surveillance.

Onsite training was conducted for the staff in different contexts. Working with partners helped to support this process. Staff were motivated to attend trainings by performance awards and provision of food and funds for transport.

2.4. Togo: identifying and responding to factors contributing to decreased influenza sentinel surveillance samples

(original submission in French)

Authors: Issaka Maman[1], Fortune D. Salah[1], Zoulkarneiri Issa[1], Kissaou Kourkou Kpante[2], Christelle Nikiema[2] and Afiwa W. Halatoko[1]

Background

Influenza surveillance in Togo includes syndromic surveillance and sentinel surveillance. The syndromic surveillance is carried out for SARI, ILI, and pneumonia in children under 5 years of age. This type of surveillance ensures data collection in all health facilities without the possibility of laboratory testing. However, respiratory samples are taken during investigation of ILI clusters or unknown respiratory diseases in affected health districts. Sentinel surveillance for SARI and ILI was established in 2010 in six sentinel sites that provide substantial data on the epidemiology of influenza in Togo.

The global health crisis caused by COVID-19 has led to a reduction in the number of ILI and SARI cases reported from sentinel sites, a decrease in specimens of naso- and/or oropharyngeal swabs collected and a discontinuation of the detection of circulating influenza virus. Some hypotheses were put forward as possible reasons for the decreased number of samples including the impact of prioritizing COVID-19 on influenza surveillance activities and low circulation of influenza virus due to the presence of SARS-CoV-2 virus. This paper describes the methodological approach that were used to address the identified challenges.

Challenges

A drop in hospital attendance was observed. Outpatient consultations decreased by 84% with an associated drop of 78% in ILI cases. The same trend was observed in hospitalized patients (-42%) with an impact on SARI cases (-52%). The total number of samples collected also decreased by 52% in 2020, reflecting the trends observed for ILI and SARI.

This significant drop in the number of samples was a real concern because detection of circulating influenza virus is needed for surveillance and response and positive influenza samples are an essential source for vaccine composition and production each year. Consequently, it was important to identify and address the factors that contributed of these significant drops in notification and sampling to allow the continuity of influenza surveillance.

Country approaches

Understanding the reasons for the challenges

Two hypotheses were considered: first, the redirection of influenza surveillance activities into COVID-19 management due to the emergency; and second, the low circulation of influenza virus due to the presence of SARS-CoV-2 virus. To verify these two hypotheses, two methodological approaches were considered.

The first approach (hypothesis 1) was based on supervision in the sentinel sites, which is a routine activity in evaluating sentinel influenza surveillance. These supervision visits took place in July 2020 (two SARI sites in Dapaong) and in May 2021 in Tsévié (one SARI site) and Lomé (two ILI and one SARI sites). Staff visited at the sentinel sites were clinicians, site focal point, laboratory staff, data manager and the director. A meeting was organized to discuss the challenges and find potential solutions. Multiple reasons could explain the drop in the number of ILI and SARI cases and samples collected

[1] National Influenza Center, Institut National d'Hygiène, Lomé, Togo.
[2] Division of Integrated Surveillance for Health Emergencies and Response, Ministry of Health, Lomé, Togo.

- People were afraid to visit the health facilities due to the fear of isolation for suspected COVID-19 based on their symptoms.
- Health personnel were concerned about their safety due to the high transmissibility and virulence of the SARS-CoV-2 and the lack of PPE.
- There was an overload of work generated by COVID-19 management (filling and archiving of notification sheets and daily reports).
- People with ILI or SARI were considered suspect COVID-19 cases and referred systematically to the COVID-19 treatment centre. Consequently, samples were collected only for SARS-CoV-2 testing and not for influenza.
- There was a lack of collaboration between the COVID-19 rapid response teams and the staff involved in influenza surveillance at sentinel sites.

The second approach (hypothesis 2) was based on the investigation of influenza clusters in the districts that reported more cases through the syndromic notification on ILI and SARI cases. The goal was to understand the extent to which influenza viruses were circulating during the COVID-19 pandemic period. Between 20 and 30 January 2021, an investigation was carried out jointly with the Disease Surveillance and Response Unit and the National Influenza Laboratory in 16 districts of the six health regions of Togo.

During the investigation, all consultation logbooks were reviewed to retrieve additional patients based on SARI and ILI case definitions. Nasal and/or oropharyngeal swabs were then collected from all the patients who met the case definitions and consulted within a 14-day period. A total of 368 swabs samples were collected from 33 health facilities. Of 368 samples tested, 79 (21.5%) tested positive for influenza A, with 94% being subtype A(H1N1)pdm09 and 6% subtype A(H3N2). Influenza B was not detected. However, 19/368 (5,2%) were positive for SARS-CoV-2.

In conclusion, we observed that the influenza virus continues to circulate despite the presence of SARS-CoV-2, which highlighted the need to strengthen the influenza surveillance. Togo shared these data with WHO through FluNet.

Solutions

Sentinel site stakeholders were trained on the new surveillance approach – the integration of SARS-CoV-2 into influenza sentinel surveillance. The integrated approach to surveillance was developed to strengthen biosafety and biosecurity measures, provide consumables and PPE for sample collection, ensure and continue to collaborate with the COVID-19 rapid intervention teams for nasal and/or oropharyngeal swabs, redefine the patient and samples circuit, ensure daily transportation of samples by leveraging the transport means used for SARS-CoV-2 samples and to detect influenza and SARS-CoV-2 simultaneously in the laboratory using the new CDC Flu-SARS-CoV-2 protocol. The integrated approach has been successfully implemented in all the six sentinel sites. By the end of 2021, we had successfully collected 1965 swabs samples, which represents an increase of 19.6% compared with 2020 (785 samples).

Lessons learned

The integration of COVID-19 surveillance into the influenza sentinel surveillance is important to maintain this activity. Influenza viruses continue to circulate in the country despite the presence of SARS-CoV-2. Consequently, surveillance for influenza viruses needs to be strengthened by protecting health personal, reviewing surveillance and ensuring laboratory testing SOPs include SARS-CoV-2.

For the sustainability of the influenza surveillance programme SARS-CoV-2 and other non-influenza respiratory viruses should be integrated into influenza surveillance. Collaboration between the division of surveillance, the NIC and sentinel sites is essential to achieve this integration.

To reproduce this study in another context/geographical area, our experience suggests acting on the existing protocol and assessing the possible factors that are contributing to all challenges.

3. Region of the Americas

3.1. Integration of COVID-19 surveillance into the ARI surveillance in Argentina

Authors: Carla Voto[1] and Carlos Giovacchini[2]

Background

The COVID-19 pandemic led to a reorganization and adaptation of the National Health Surveillance System (SNVS2.0) in Argentina with the aim of timely response with quality information to support decision making. During this process, two major challenges were faced: a) integrating COVID-19 surveillance into ARI surveillance and b) maintaining influenza and other respiratory virus (ORV) surveillance.

In Argentina, the epidemiological surveillance of ARI are carried out through a national (universal) surveillance strategy based on the following events: ILI, bronchiolitis (in children under 2 years) and pneumonia, SARI and complementary national respiratory virus surveillance by laboratory of outpatient and hospitalized cases. Additionally, intensified surveillance is carried out with nominal registration of all positive influenza cases. The surveillance system's structure allows Argentina to monitor trends, viral types and subtypes associated with severe and fatal cases; determine the seasonality, magnitude and dispersion of viruses in the country; understand the distribution of influenza viruses and the main characteristics of affected populations; and identify unusual events. Within Argentina, public, private and social security health facilities; local, provincial and national epidemiology areas; the national network of laboratories for influenza and ORVs; private laboratories with capacity for diagnosis; and the national laboratories associated with the National Reference Laboratory (INEI-ANLIS) actively provide epidemiological, clinical and laboratory data to the SNVS2.0.

Through influenza and ORV surveillance by this national network of laboratories, the NICs and the National Reference Laboratory, Argentina participates in the WHO GISRS. The country has had experience with the organization and operation of the sentinel surveillance strategy of ILI and SARI since 2003. The implementation and sustainability of systematic epidemiological surveillance of ARI is of substantial importance for the timely detection of unusual events caused by respiratory viruses with pandemic potential. In addition, the surveillance systems support planning and adoption of appropriate prevention and control measures.

Challenges

In Argentina, the COVID-19 emergency impacted the structure of the national surveillance system for ARI, leading to its re-organization and adaptation to provide data for decision-making. The modification and expansion of the SNVS2.0 for the integrated registration of COVID-19 to the notification of ARI represented a challenge for the different stakeholders involved in the process of epidemiological surveillance. In addition, maintaining influenza and ORV surveillance during the development and evolution of the COVID-19 pandemic represented a challenge for laboratories that were experiencing large diagnostic demand from the sustained increase in suspected cases of COVID-19.

One of the biggest challenges for integrated data management was to bring together information from the different subsectors (epidemiology, clinical and laboratory) and stakeholders. In this context, the integration of COVID-19 surveillance into the existing surveillance system significantly expanded the number of users of the national notification and registration system.

[1] Surveillance Area, Epidemiology and Strategic Information Directorate, Ministry of Health, Buenos Aires, Argentina.
[2] Directorate of Epidemiology and Strategic Information, Ministry of Health, Buenos Aires, Argentina.

Country approaches

To achieve this integrated surveillance system, Argentina used the following methodology.

- The case definition for suspected COVID-19 was elaborated at the national level in accordance with the definition proposed by WHO and incorporation of mandatory notification of COVID-19 cases.
- A standardized data collection sheet with socio-demographic, epidemiological, clinical and evolution information and laboratory for the integration of COVID-19 to the surveillance of ARI was prepared.
- An active surveillance strategy with early detection of suspected and confirmed cases of COVID-19 through standardized case definition was developed and implemented. This included development and adaptation of diagnostic algorithms for the integration of the study of SARS-CoV-2 to ARI for monitoring the co-circulation of SARS-CoV-2, influenza and ORV. This also included establishment of SOPs for obtaining, preserving, and transporting samples for the study of SARS-CoV-2 using infection prevention and control protocols.
- Laboratory capacities for the implementation of molecular detection of SARS-CoV-2 by RT-PCR were expanded. As part of this work, Argentina incorporated the loop-mediated isothermal amplification technique that allowed the decentralization of diagnosis in jurisdictions with centralized RT-PCR laboratories in large cities, expanding diagnostic capacity. To expand laboratory capacities, the National Reference Laboratory provided technical support, operational considerations and training to the national network of laboratories to strengthen molecular diagnosis of SARS-CoV-2 in the different jurisdictions of the country. Argentina also provided laboratories with guidelines for processing and analysis of samples under appropriate and standardized biosecurity conditions. Simultaneously, Argentina maintained the molecular diagnostic platform for influenza with characterization of the viral types and subtypes circulating in the country and continued sharing of influenza samples to WHO collaborating centres (WHO CC) to contribute information useful for the composition of vaccines.
- A nominal registry of COVID-19 suspected cases to the SNVS2.0 was established through the creation of a new event called "Suspected case of COVID-19, influenza and ORV" with registration of epidemiological, clinical (different levels of severity and evolution) and laboratory data allowing the integration of SARS-CoV-2 surveillance into the usual respiratory events (ILI, pneumonia, bronchiolitis and SARI).
- A plan to strengthen and implement sentinel surveillance of ILI and SARI was developed. To this end, virtual meetings and online trainings were organized for the different participating stakeholders as was an operational guide on the integration of SARS-CoV-2 surveillance with sentinel surveillance of ILI and SARI, which was prepared and disseminated to the selected sites. Argentina also disseminated the national recommendations through the Ministry of Health's official website, updated the Operational guide for surveillance of ARI and organized weekly meetings to train users of the SNVS2.0.
- Integrated genomic sequencing for SARS-CoV-2 to the surveillance of ARI was developed and implemented. This included the formation of the National Network of Genomic Surveillance of SARS-CoV-2 by the public and private laboratories that carry out the genomic sequencing. The laboratories collaborated with health facilities that collect samples for genomic surveillance under the coordination of the Ministry of Health and the Laboratory Reference Network. The data were included in the SNVS2.0 and reported to GISAID.

Lessons learned

The COVID-19 pandemic had a major impact on the organization of the National Surveillance System in Argentina. The integration of COVID-19 surveillance into ARI surveillance allowed for real-time data exchange between local, regional, provincial and national networks from a single data system. This system provided access to background, diagnoses and integrated information about the cases/samples across different establishments. This integration also made it possible to comply with the country's commitments at the international level, including line list reporting of COVID-19 cases to PAHO and WHO headquarters within the framework of the IHR (2005) and to the international systems (FluNet and FluID) as part of the GISRS network.

The maintenance of influenza and ORV surveillance was possible through the etiological diagnosis of ARIs with a staggered strategy that began with the study of SARS-COV-2 and, in negative cases, if clinical suspicion persisted or in cases with severity criteria requiring hospitalization in critical care, continued with the study for influenza and ORVs. However, the containment measures adopted in the context of the COVID-19 pandemic have probably influenced the transmission pattern of all respiratory viruses in Argentina.

The development of national operational guides for integrated monitoring, the dissemination of information through continuous training and virtual meetings and the adaptation of the SNVS20 to serve as an integrated data platform made it possible to share information in a timely manner with decision-makers.

3.2. Costa Rica leverages influenza advances to combat COVID-19

Authors: Roberto Arroba Tijerino[1], Hebleen Brenes Porras[2] and Xiomara Badilla[3]

Background

Costa Rica has a long history of influenza surveillance guided by a multi-sectoral technical group comprising the Ministry of Health, the NIC, INCIENSA and the Social Security Fund (CCSS). In recent years, Costa Rica has strengthened the surveillance of influenza and ORVs in accordance with the Pandemic Influenza Preparedness Framework. This acquired capacity allowed Costa Rica to use the syndromic platform for COVID-19 sentinel and universal surveillance. As the country manages the ongoing pandemic, technical experts have worked with regional and national colleagues to adapt the influenza surveillance system and protocols to support the COVID-19 response. Integrated epidemiological, clinical and laboratory information has enabled decision-making to respond to the COVID-19 pandemic.

Before the onset of COVID-19, the country had 18 sentinel establishments to actively monitor SARI and ILI activities, with all samples being processed exclusively by the NIC. Within the context of the COVID-19 response, influenza and COVID-19 testing was decentralized to take advantage of the CCSS laboratories. This incorporation of CCSS laboratories augmented the capacities of the laboratory network and enabled influenza and COVID-19 screening at multiple at-risk locations in the country. This generated surveillance data and facilitated the monitoring of epidemiological trends as well as a comprehensive assessment of the severity of diseases.

Costa Rica has been utilizing the PAHO Flu system to analyze clinical, epidemiological and laboratory data for influenza and COVID-19 and to report to international systems (FluNet and FluID). Further, with the decentralization of influenza detection, INCIENSA established a diagnostic confirmation process that evaluates the laboratory network's performance through an external third-party source. Finally, the NIC/INCIENSA has developed genomic sequencing capacity for SARS-CoV-2. It is expected that this new capacity will be used for influenza, allowing for more efficient detection of future influenza viruses with pandemic potential.

Challenges

During the COVID-19 pandemic, Costa Rica faced challenges with consolidating reporting of high-quality data into a single digital health record that could be included in the PAHO-Flu system; continuous evaluation and training of sentinel sites; and identifying accurate indicators to monitor the severity of future pandemics

Country approaches

Costa Rica was able to overcome the aforementioned challenges with support from WHO Regional Office for the Americas/Pan American Health Organization and strong collaboration with the Ministry of Health, INCIENSA and the CCSS. Key successes included Costa Rica's addition of SARS-CoV-2 surveillance data, including variants and vaccination indicators, into the PAHO Flu system. In addition, Costa Rica analysed the case definition of ILI and SARI for COVID-19, obtaining adequate results for specificity- and sensitivity-strengthened case identification/recording using WHO ILI and SARI case definitions and increased sample collection of ILI and SARI cases. The sentinel surveillance sample processing capacity was strengthened through the decentralization of laboratory tests in the laboratories of the CCSS. Using molecular-based respiratory panels, samples from sentinel units and sites are tested for SARS-CoV-2, influenza and ORVs simultaneously. All influenza-positive samples must be referred to the INCIENSA, which serves as the reference laboratory. Samples are then shared with the United States Centers for Disease Control and Prevention (US CDC), the WHO CC in Atlanta.

[1] Ministry of Health, San José, Costa Rica; [2] National Influenza Centre, Inciensa, Cartago, Costa Rica.
[3] Social Security Fund, San José, Costa Rica.

The country continues to report weekly aggregated sentinel and national surveillance for influenza, ORV and SARS-CoV-2 to FluNet and FluID. Although sentinel site performance indicators are routinely obtained, the last sentinel site evaluation was done two years ago. In 2022, it is expected that the performance of COVID-19 surveillance sites will be evaluated.

INCIENSA is also in charge of specialized laboratory surveillance, such as genomic surveillance. For genomic surveillance, the laboratories that test for SARS-CoV-2 must send to the NIC a proportion of positive samples that fit pre-defined criteria, including for viral load and, geographical and severity representation of the behaviour of COVID-19 in the country, taking into consideration some epidemiological criteria, such as vaccinated patients and sites with an increase in case incidence. As of week 36 of 2021, Costa Rica had uploaded more than 1000 genomes to GISAID. This provides critical information on the dynamics and diversity of the viruses circulating in Costa Rica, thus supporting the national and global genomic surveillance response to the pandemic.

Lessons learned

Having a technical group of experts develop surveillance guidelines early on in the COVID-19 pandemic and continue to review and update them was helpful. In addition, the expansion of the SARS-CoV-2 diagnostic capacity in the CCSS laboratory network supported: a) early identification of cases and b) detection and monitoring of SARS-CoV-2 variants. In this way, Costa Rica has been able to obtain timely surveillance indicators for decision-making.

3.3. Laboratory actions to respond to the COVID-19 pandemic in Mexico

Authors: C. Gisela Barrera Badillo[1] and Irma López Martínez[1]

Background

The Institute for Epidemiological Diagnosis and Reference (InDRE), recognized by WHO as the NIC of Mexico since 1951, contributes to global influenza surveillance. InDRE has a national network of laboratories made up of 37 members, 32 state public health laboratories distributed in each of the states and 5 support laboratories in Mexico City that carry out epidemiological surveillance of influenza and ORVs (e.g. SARS, MERS-CoV and SARS-CoV-2). Since the influenza A(H1N1)pdm09 pandemic, the National Laboratory Network has conducted annual training and biannual external evaluations to strengthen its technical performance, the reliability of its results and its preparation for pandemics or other health contingencies. During 2020 and 2021, InDRE authorized 179 laboratories to contribute to the epidemiological surveillance of SARS-CoV-2.

Country approaches

Mexico was the first country in the WHO Region of the Americas to implement diagnostic testing for SARS-CoV-2 using an in-house, endpoint RT-PCR designed from the genetic sequences available in GISAID (Global Initiative on Sharing All Influenza Data). On advice from PAHO/WHO, InDRE then started using the standardized Berlin Protocol *(5)* to provide the National Epidemiological Surveillance System (made up of 472 Health Units Monitoring Respiratory Disease and the 37 member laboratories of the National Network) with guidelines for sample collection, packaging, shipment and diagnostic algorithms.

Mexico hosted workshops on the diagnosis and detection for specialists from the InDRE laboratory network and other laboratories, as well as the international NICs of Belize, Costa Rica, Cuba, El Salvador, Guatemala, Honduras, Nicaragua and the Dominican Republic. In the workshop, primers, probes, enzymes and positive control for 200 reactions were given to each participant for the implementation of the Berlin Protocol in their laboratories.

In addition, Mexico held trainings for private clinical diagnostic laboratories on the diagnosis of SARS-CoV-2, quality control and supervision of results. At the end of July 2021, there were 179 laboratories authorized to carry out the diagnosis of SARS-CoV-2 in Mexico. In addition, Mexico made available to laboratories that were not able to attend the trainings commercial kits that had been evaluated and authorized by InDRE, provided that they complied with biosafety standards and the minimum required infrastructure.

As the COVID-19 pandemic progressed, Mexico adapted its SARS-CoV-2 diagnostic practices and guidelines to correspond with global guidance and available detection kits. In addition, Mexico anticipated the surge in SARS-CoV-2 testing needs and planned for the InDRE to support with processing of these additional samples. As the influenza season began, Mexico introduced duplex molecular kits to detect influenza and SARS-CoV-2 simultaneously and SARS-CoV-2 rapid antigen tests to separate COVID-19 cases from other hospitalized patients. Mexico was the first country in the WHO Region of the Americas to incorporate rapid antigen tests for the detection of SARS-CoV-2 in the COVID-19 strategy for primary health care.

[1] National Influenza Center, Reference Laboratory for COVID-19 in the Region of the Americas, Institute for Epidemiological Diagnosis and Reference, Mexico City, Mexico.

Mexico was honoured to become a WHO Reference Laboratory for COVID-19 and to participate in the regional network for genomic surveillance of COVID-19. In addition, InDRE was invited to join the New Initiative of the Ibero-American Program of Science and Technology for Development (CYTED). This PAHO/WHO programme brought together National Institutes and Laboratories of Public Health working on surveillance and response to COVID-19 to share experiences. InDRE also organized Mexico's participation in WHO's external quality assessment panels to ensure reliability of results of public and private laboratories. InDRE and the 58 other laboratories that participated obtained 100% agreement with the WHO results.

In addition, InDRE in collaboration with other laboratories with sequencing capabilities, has been monitoring the evolution of SARS-CoV-2 through sequencing studies, identifying "variants of concern", "variants of interest" and variants of reinforced surveillance. These studies are carried out with the objective of guiding the global response to the COVID-19 pandemic as all the sequences obtained are deposited in GISAID. As of 9 September 2021, Mexico had contributed approximately 25 521 sequences to GISAID. From the end of 2020 to 14 September 2021, four variants of concern, four variants of interest and four variants of reinforced surveillance had been identified in Mexico.

Lessons learned

InDRE served a critical role in strengthening the network of laboratories responsible for epidemiological surveillance of SARS-CoV-2 and ORVs. InDRE evaluated and authorized the use of diagnostic testing kits, provided training and supported laboratories in diagnosing SARS-CoV-2.

SARS-CoV-2 surveillance would not be possible without the establishment of guidelines that set out who, how, when and where laboratory surveillance will be carried out. InDRE has been focused on ensuring appropriate criteria and updated guidance for the collection, packaging and shipment of samples; diagnostic algorithms; molecular kits to be used; use of PPE; and genomic surveillance. InDRE provides these recommendations through the Standardized Guidelines for the Epidemiological and Laboratory Surveillance of Viral Respiratory Disease (*6*).

The epidemiological surveillance information generated by InDRE and each of its members supported decision-making in public health policies for COVID-19 and supported the global surveillance of SARS-CoV-2 and influenza.

3.4. Regional Office for the Americas/Pan American Health Organization: integration of SARS-CoV-2 into ILI and SARI surveillance through PAHO Flu system

Epidemiology and laboratory national focal points from Bolivia, Cayman Islands, Chile, Costa Rica, Dominica, Guatemala, Honduras, Jamaica, Saint Lucia and Suriname as well as from the Pan American Health Organization (Angel Rodriguez, Rosa Ramirez, Carlos Fernandez, Jose Antonio Mendez Mancio, Paula Couto, Juliana Leite and Andrea Vicari)

Background

The PAHO Flu system is specialized online software developed by the influenza team at the Pan American Health Organization based on the standards of the PAHO/WHO Operational Guidelines for Sentinel ILI and SARI Surveillance. The purpose of the system is to strengthen surveillance of ILI and SARI by integrating epidemiological, laboratory and clinical components through the platform to allow for centralized information, easily generated surveillance reports, information searches and georeferenced displays.

The PAHO Flu system collects two types of data: nominal data input from ILI and SARI surveillance record forms and aggregate data collected from the weekly surveillance form, which is used to enter denominator data (e.g. total hospitalizations for all causes).

The PAHO Flu system integrates data from national laboratory systems with clinical and epidemiological case data to facilitate the entry of cases, denominators, and completion of a record. With the data entered into the system, PAHO/WHO epidemiological surveillance reports (FluID) and virological reports (FluNet) can be generated among others. Similarly, the system automatically generates a monitoring and evaluation dashboard for ILI and SARI surveillance systems at the national level.

With collaboration of PAHO's regional and country offices, PAHO Flu supports Member States to respond to the COVID-19 pandemic. In the Americas, the PAHO Flu system has integrated the SARS-CoV-2 surveillance since the initial stages of the COVID-19 emergency. Nine countries and one territory (Bolivia, Cayman Islands, Chile, Costa Rica, Dominica, Guatemala, Honduras, Jamaica, Saint Lucia and Suriname) have implemented PAHO Flu for the surveillance of ILI and SARI.

Country approaches

PAHO held virtual meetings at the regional and national levels to develop a workplan for PAHO held virtual meetings at the regional and national levels to develop a workplan for integrating SARS-CoV-2 into PAHO Flu. PAHO and national colleagues analysed the variables, designed the interface, tested the modifications, adjusted the system, updated the user and system manuals and shared updates. With the modified system, PAHO Flu included epidemiological and clinical variables for SARS-CoV-2 for laboratory and case reporting, which allowed the system to generate surveillance reports that included SARS-CoV-2. The PAHO Flu indicators followed WHO standards for influenza and SARS-CoV-2 indicators and reported to the global systems for influenza and COVID-19. Using the newly available data, PAHO Flu provided reports, graphs, and tables that included SARS-CoV-2.

The indicators were updated as needed. For example, PAHO Flu added the ability to report COVID-19 vaccination up to the third dose. These data are part of the count for the REVELAC report (a report used by the countries for the effectiveness of the influenza vaccine and COVID-19 vaccine) generated in the PAHO Flu system. In addition, RT-PCR and rapid COVID-19 antigen tests were integrated into the registration process in establishments, and the flow of information between the case registry and the laboratory information entry was improved.

The reporting of negative results by type of virus was included and in 2021, sequencing data was also integrated into the laboratory part of the system, allowing the SARS-CoV-2 variants to be entered in the case record.

Notably, the software tools used for the original and modified system were the same (e.g. Net tools, C shart with SQL Server, open source support libraries such as bootstrap, knockout, mapchart and others for the web environment). The development environment is a Windows dot net using Windows framework technology. This allowed for the system to be rapidly modified and maintained its familiarity for users.

Lessons learned

The incorporation of SARS-CoV-2 surveillance into ILI and SARI syndromic surveillance allowed countries to obtain quality information in a timely manner for decision-making in response to the COVID-19 pandemic and to meet the objectives of respiratory disease and event surveillance.

The development of automatic reports helped countries generate and disseminate surveillance standards to the entire national network. These reports could be disaggregated by site, region and national level, and they complied with regional and global submission of FluNet, FluID, COVID-19 line list and COVID-19 aggregated reports.

Importantly, integrating SARS-CoV-2 into PAHO Flu facilitated the maintenance of quality and standard surveillance for influenza and ORVs in the countries that use it.

4. South-East Asia Region

4.1. Bangladesh: approaches for integrated influenza and SARS-CoV-2 sentinel surveillance systems

Author: Tahmina Shirin[1]

Background

The Institute of Epidemiology, Disease Control and Research (IEDCR) has been conducting influenza surveillance with support from the US CDC since 2007. The first cooperative agreement with US CDC helped IEDCR to develop its laboratory capacity for detection of influenza virus and initial preparedness for pandemic influenza and included training of rapid response teams, setting up of surveillance at district level and conducting outbreak investigations related to respiratory illness. IEDCR was designated as a NIC by WHO in 2007 and has been supported by WHO ever since. The NIC conducts influenza surveillance through the following platforms.

- Hospital-based influenza surveillance (HBIS) (May 2007 – ongoing) which performs surveillance for influenza and severe respiratory disease at nine hospitals across Bangladesh. Samples from SARI cases are collected and tested for influenza.
- National Influenza Surveillance (May 2010 – ongoing) which performs surveillance for influenza and severe respiratory disease at 10 sentinel sites (eight district hospitals across Bangladesh and two tertiary hospitals). Samples of ILI and SARI cases are collected and tested for influenza.

Challenges

In the initial phase of the COVID-19 pandemic, the NIC was unable to upload influenza data in GISRS due to technical difficulties in the FluNet and FluID systems. Training could not be done where physical presence was required. In addition, resource persons were engaged with COVID-19 activities, and personnel at surveillance sentinel sites were assigned to COVID-19-dedicated work, which hampered influenza sample collection. Laboratory resources were exhausted due to heavy use for COVID-19 case detection activities. Finally, restrictions in inter-city movement impacted the ability of samples to be transported from sentinel sites during holidays and the pandemic lockdown.

Country approaches

The challenges posed by the COVID-19 pandemic led to the integration of influenza and SARS-CoV-2 sentinel surveillance systems.

For this integrated approach, sentinel sites activities are carried out by surveillance site teams consisting of surveillance physicians, senior staff nurses and medical technologists. The teams are responsible for case identification, data collection, sample collection, storage and transportation. Regular visits to sentinel sites support the teams by providing sensitization and supportive supervision. In addition, Bangladesh organized meetings with all sentinel sites to discuss the situation and overcome identified constraints. Bangladesh also provided training for the physician in the sentinel sites to strengthen the quality of surveillance systems and training on specimen collection, storage and safe transportation for the sentinel site personnel.

Specimens received at IEDCR are aliquoted into four. Three of the aliquots are stored at -[minus]70 °C for future activities. One aliquot is used for nucleic acid extraction followed by RT-PCR testing using a multiplex for diagnosis of influenza and SARS-CoV-2. This algorithm using multiplex influenza and SARS-CoV-2 testing was adopted in July 2021 (Figure 2). Previously, IEDCR used the RT-PCR for influenza and FTD-33 to identify other respiratory pathogens in ILI and SARI samples collected from sentinel sites.

[1] Institute of Epidemiology, Disease Control and Research, Dhaka, Bangladesh.

If the sample is positive for SARS-CoV-2, it is reported as COVID-19 positive. If the sample is positive for influenza A, subtyping (AH1, PA, AH3) is done. If the sample is positive with any of the subtypes, it is reported. If a result is negative for subtype AH1, PA, AH3, subtyping (H5, H7, H9) is performed. If the sample is positive for influenza B, determination of lineage such as Victoria or Yamgata is done. If the sample is positive for any of the subtypes, it is reported.

IEDCR has the capacity to perform influenza genomic sequencing. In addition, ILI and SARI samples of SARS-CoV-2 positive with CT value <27 are selected for next generation sequencing (NGS). The sequencing data are uploaded to GISAID on a real-time basis. Bangladesh also shares influenza samples with WHO CCs at regular intervals and participates in WHO's EQAP every year.

Data are collected in structured case reporting form. Surveillance data are monitored, cleaned, and analysed regularly after receipt from the sentinel sites. IEDCR maintains a central database that is integrated for influenza and SARS-CoV-2 surveillance.

Surveillance data are analysed regularly in Bangladesh to monitor the trend of infection, identify circulating influenza strains and identify any outbreak of severe respiratory illness syndrome. Bangladesh disseminates monthly updates from the acquired integrated influenza and SARS-CoV-2 surveillance data. These monthly reports are also posted on the IEDCR website. Weekly data are uploaded to WHO's FluMart system, and the NIC disseminates the data to national and international stakeholders annually.

Lessons learned

Influenza surveillance supports Bangladesh in characterizing the diversity of circulating influenza strains, identifying novel influenza strains, understanding the proportion of influenza patient from ILI patients and SARI patients, sharing specimens for selection of vaccine strain, giving early warnings during epidemics and pandemics, supporting decision-making and using trained staff from the influenza platform to support case detection and sample collection for SARS-CoV-2.

4.2. Integrating SARS-CoV-2 with influenza surveillance in the Democratic People's Republic of Korea

Authors: Ministry of Public Health[1], Jon Songhui[2] and Anupurba Roy Chowdhury[2]

Background

In the Democratic People's Republic of Korea, the Ministry of Public Health is responsible for developing and maintaining systems to monitor communicable disease activity domestically and internationally and for communicating relevant information. Working together with subnational public health bureaus, the Central Hygiene and Anti-Epidemic Institute (CHAEI) analyses and assesses the risk of potential pandemic threats, suggests appropriate actions and provides global epidemic situation to the Ministry of Public Health. CHAEI plays a key role in surveillance activities, including sentinel surveillance and influenza virus subtyping and characterization. The provincial, city, and county HAEIs are responsible for collecting influenza surveillance data to contribute to the national picture and to inform the local public health response. They also monitor surveillance data to identify when seasonal or pandemic influenza has the potential to overwhelm the capacity of local systems to manage the response.

During the COVID-19 pandemic, there has been a steady decline in the number of ILI and SARI cases because stringent infection control measures have been practiced, including campaigns organized to create awareness on hand hygiene and cough etiquette. An integrated approach of surveillance – which includes testing ILI and SARI cases for SARS-CoV-2 – has been also adopted.

Challenges

The global health crisis imposed by COVID-19 pandemic has caused procurement delays and impacts the ability of the Democratic People's Republic of Korea to share samples for genomic sequencing.

The laboratory is currently conducting RT-PCR confirmation tests for COVID-19 depending on the specific primers, probes and reagents and using multiplex kits provided from government resources. However, resources are not sufficient.

Country approaches

During 2020, the Democratic People's Republic of Korea maintained influenza surveillance and continuously monitored and tested ILI and SARI cases. There are 48 ILI surveillance sites and 68 SARI surveillance sites. Sentinel sites are used as collection sites. RT-PCR is considered the gold standard. All SARS-CoV-2 samples are tested by RT-PCR at the national level. The ILI and SARI samples are collected from sentinel sites and tested and sub-typed at the National Laboratory.

In addition, continuous surveillance for COVID-19 is ongoing using the influenza surveillance system. The country has the laboratory capacity (biosafety class II) for confirmatory diagnostic tests of SARS-CoV-2 in the CHAEI, which is a national designated lab for diagnosis of COVID-19. Initially RT-PCR devices were deployed by the government to perform testing at 13 provincial laboratories, which included two at border provinces. At the time of submission, samples are sent to the National laboratory to perform PCR testing.

Democratic People's Republic of Korea has reported these data to the WHO Regional Office for South-East Asia in a timely manner, despite the COVID-19 pandemic. The Democratic People's Republic of Korea has also been regularly reporting epidemiological and laboratory data to FluMart. The pandemic has not affected the regularity in the reporting mechanism.

[1] Ministry of Public Health, Pyongyang, Democratic People's Republic of Korea.
[2] WHO Country Office for the Democratic People's Republic of Korea, Pyongyang, Democratic People's Republic of Korea.

Quality assurance is performed by following internal quality control using internal samples and sample processing control provided in the kit. In 2019, the CHAEI was certified for the detection of influenza viruses by rRT-PCR after receiving a full score from WHO's External Quality Assessment Programme. In 2019, some Democratic People's Republic of Korea laboratory experts participated in training on vaccine-preventable disease laboratory diagnosis and surveillance including influenza in the Centre for Health Protection, Department of Health, Hong Kong Special Administrative Region, China with WHO support.

In 2020, many technical trainings were conducted for laboratory specialists on COVID-19 testing, sample collection and transportation. WHO supported the procurement of 1000 kits of reagents, six rRT-PCR machines, two biosafety cabinets and PPE. The United Nations Children's Fund (UNICEF) also supported the procurement of PPE and one rRT-PCR machine.

Lessons learned

The expansion of the laboratory network to include SARS-CoV-2 testing centres has benefited influenza surveillance by ensuring a more regular supply of resources for testing samples for influenza. The data generated from integrated surveillance have been used to detect cases of both influenza and COVID-19 in the community, to monitor trends in both viruses and to provide epidemiological information in support of timely prevention and containment measures.

4.3. Evolving testing criteria for COVID-19 cases and maintaining influenza surveillance in India

Authors: Varsha A Potdar[1] and Sumit Bhardwaj[1]

Background

Soon after the identification of SARS-CoV-2 and after receipt of the first two protocols from WHO, NIC India took a front-line role in diagnosing COVID-19. Within a few weeks, 13 laboratories located near to international airports were conducting diagnostic testing. Most of the sentinel sites for influenza surveillance were converted to COVID-19 centres, and samples were sent to the NIC for SARS-CoV-2 testing. The NIC took this opportunity to screen representative cases from sentinel and non-sentinel sites to sustain influenza surveillance.

Challenges

In the initial phase of the COVID-19 pandemic, the sample selection for influenza testing was a major issue as more focus was placed on contact tracing and samples were taken from asymptomatic individuals. In addition, laboratory staff were overwhelmed with huge numbers of samples referred for SARS CoV-2 testing. Timely procurement and distribution of testing reagents as well as maintenance and availability of testing equipment such as RT-PCR were also a challenge.

Country approaches

In the initial phase of pandemic screening, SARS-CoV-2 testing was restricted to overseas returnees at major ports. Testing included asymptomatic international travellers, symptomatic contacts of laboratory-confirmed COVID-19 cases and symptomatic health workers with severe respiratory distress. Later, different risk groups such as asymptomatic, direct and high-risk contacts of confirmed cases, all symptomatic patients hospitalized for ILI/SARI, and migrant and overseas returnees were included for testing.

To maintain influenza surveillance, the NIC tested 10 to 15 samples per week for influenza from the referred samples from sentinel and non-sentinel sites for SARS-CoV-2 testing. The samples for influenza testing were chosen if they fulfilled either the ILI or SARI case definition. Using this integrated approach, the NIC could maintain surveillance of influenza in both sentinel and non-sentinel sites.

Later in the pandemic, the NIC developed the one tube multiplex assay for COVID-19 and influenza testing. The test contained the ORF gene for SARS CoV-2, Matrix gene for influenza A and NS gene for Type B, including beta actin as housekeeping gene to assess the sample quality. The assay was well validated by four viral diagnostic centres (VRDL) and found 98–100% sensitive and 100% specific. The limit of detection of each target was as follows: ORF1ab detects 2.18 copies, influenza A 34 copies, influenza A(H1N1)pdm09 10 copies, influenza A(H3N2) 10 copies and influenza B detects 20 copies. Testing of the kit using WHO EQAS panel showed 100% concordant results.

With this multiplex assay, the NIC started testing both SARS-CoV-2 and influenza simultaneously. The simultaneous testing proved to be effective in reducing the turnaround time for testing and reporting and allowed the NIC to provide comprehensive reports for SARS-CoV-2 and influenza.

Further efforts were made to implement this protocol nationwide in 22 VRDLs spread across the country and representing different geographical area. The NIC is collating the data from these VRDLs and reporting to WHO through FluNet.

As the COVID-19 pandemic evolved, the recommended testing criteria, case definition and strategy were regularly updated.

[1] National Influenza Centre, Indian Council of Medical Research, National Institute of Virology, Pune, India.

Lessons learned

Using the regularly updated case definitions and categorization of cases, the NIC could observe evolution of the COVID-19 pandemic among different risk groups, transmission in the community and positivity among hospitalized cases and differences in positivity in areas where public health and social measures were in place. The integrated approach allowed the NIC to maintain influenza sentinel and non-sentinel surveillance without additional effort.

4.4. Integrated influenza and SARS-CoV-2 surveillance in Nepal during the COVID-19 pandemic 2020-2021

Authors: Runa Jha[1], Lok Bandhu Chaudhary[1], Saugat Shrestha[2], Subash Neupane[2], Nirajan Bhusal[2] and Arun Kumar Govindakarnavar[2]

Background

COVID-19 affected influenza surveillance in the context of a nationwide lockdown, which hampered transport of samples. In addition, hospitals were offering only emergency services, and most sentinel hospitals were converted into COVID-19 hospitals. The National Public Health Laboratory (NPHL) functioned as a COVID-19 laboratory and was overwhelmed with samples to be tested for SARS-CoV-2. As a result, testing was rapidly expanded throughout the country, initially in laboratories with some molecular testing capacity, veterinary laboratories, Provincial Public Health Laboratories (PPHLs) and other equipped tertiary hospital laboratories. Later, private hospitals and laboratories started testing as well.

Country approaches

Nepal maintained influenza surveillance during the COVID-19 pandemic by retrospectively testing and entering data to FLUMART and prospectively integrating influenza and SARS-CoV-2 surveillance. Because influenza surveillance was interrupted during COVID-19 pandemic, Nepal tested selected SARS-CoV-2 RT- PCR negative samples for influenza and investigated non-COVID-19 respiratory illness outbreaks.

During early 2020, Nepal tested samples collected by sentinel sites, which were stored because they could not be tested immediately due to the repurposing of NIC for COVID-19 testing. However, when the NIC could spare laboratory space for influenza testing, the stored sentinel samples were tested and the results were entered retrospectively into the FLUMART of GISRIS. This allowed Nepal to capture influenza surveillance data retrospectively. Once all the sentinel hospitals were repurposed as COVID-19 hospitals and the national lockdown was in place, Nepal used selected COVID-19 -negative SARI samples for influenza testing to maintain influenza surveillance. Nepal used convenience sampling to select the first 50–100 samples collected from SARS-CoV-2 RT-PCR-negative SARI cases each week. The number of samples tested varied, since it depended on the availability of the influenza PCR reagents. Nepal also included COVID-19 -negative ARI outbreak samples received by the NIC during this period. The samples included both designated sentinel and non-sentinel sites. Nepal used US CDC's influenza RT-PCR assay for influenza testing and approved SARS-CoV-2 RT-PCR assays for COVID-19 testing. Nepal also piloted the US CDC Influenza-SARS-CoV-2 multiplex assay, which is used for integrated surveillance of influenza and COVID-19.

Nepal has integrated influenza and SARS-CoV-2 testing for all samples received by the NIC for influenza surveillance or diagnosis since epidemiological week 14. Integrated testing allowed Nepal to detect COVID-19 cases among suspected influenza cases. For example, the first case of COVID-19 in Nepal was detected by the NIC after it was initially sent for influenza testing from the sentinel hospital. Moreover, testing of COVID-19 negative samples for influenza allowed Nepal to detect outbreaks of influenza A(H3N2) and influenza B (Victoria), including a rare case of influenza A (H3N2) subclade 3C.2a1b.2a.

The sample of influenza A(H3N2) subclade 3C.2a1b.2a could not be sequenced using the CDC influenza assay. However, the WHO CC in Japan was able to isolate the virus and sequence it to identify the subclade.

[1] National Influenza Centre, National Public Health Laboratory, Kathmandu, Nepal.
[2] WHO Country Office for Nepal, Kathmandu, Nepal.

To support the candidate vaccine virus (CVV) selection process, influenza-positive samples were shipped in September 2020 and February in 2021 to the WHO CC in Japan. In September 2021, Nepal shipped influenza-positive clinical samples to the WHO CC in Japan and Australia.

As of December 2021, Nepal had uploaded approximately 393 SARS-CoV-2 full genome sequences in GISAID and 66 genome sequences of influenza viruses, which included 40 influenza A(H3N2), 12 influenza A(H1N1)pdm09, and 14 influenza B.

Lessons learned

Despite the ongoing pandemic, Nepal was able to perform influenza surveillance through the adoption of the integrated surveillance approach.

4.5. Integration of influenza and COVID-19 surveillance and testing in Timor-Leste

Authors: Endang da Silva[1], Carlito Freitas[2] and Filipe de Neri Machado[2]

Background

Timor-Leste's focus on influenza pandemic preparedness in previous years paved the way for an effective COVID-19 pandemic response. In 2019, WHO supported the development of the country's Influenza Pandemic Preparedness Plan (IPPP) and integrated it with the National Action Plan for Health Security. This helped place Timor-Leste in a strong position to prepare for all health security situations in the medium to long term, map multisectoral health security resources and take action around COVID-19.

Challenges

The COVID-19 pandemic has disrupted the routine influenza surveillance activities in Timor-Leste. Quarterly review meetings and coordination, on-the-job training, supportive supervision and monitoring missions were suspended.

Timor-Leste also experienced challenges with surges at health facilities and laboratories due to COVID-19 pandemic response activities. Laboratories were under-staffed, and processing of samples for influenza detection was delayed as was data analysis, because of the expansion of surveillance sites. Delays in routine supply of reagents and consumables for influenza testing due to the lockdown and limited freight flights affected availability of supplies and equipment.

Country approaches

The integration of influenza and SARS-CoV-2 surveillance was discussed beginning in May 2020 and adopted in August 2020 in Timor-Leste. Guidelines and reporting formats were shared, and samples were collected from the sentinel sites.

Sentinel sites

During the COVID-19 pandemic there was an expansion of ILI and SARI sites to implement integrated SARS-COV-2 and influenza surveillance. SARI sites were expanded to all referral hospitals, and ILI sites were expanded to include all Community Health Centres (CHCs, focusing on Dili and three bordering municipalities).

Sample collection and transport

Samples were collected from patients that met ILI and SARI case definitions from all the referral hospitals and CHCs. The samples are collected from the sentinel sites and transported with proper packaging according to the global standard. With WHO support (the organization provided four vehicles), the National Health Laboratory (NHL) has maintained a functional sample transport system for COVID-19 samples and other routine services between the CHCs in Dili and the referral hospitals.

Testing

ILI and SARI samples were also tested for COVID-19. Real-time reverse transcription PCR (rRT-PCR) was performed using a laboratory diagnostic method from the NHL. The national laboratory also receives reagents and kits through the International Reagent Resource (IRR) of the influenza WHO CC at US CDC.

[1] National Health Laboratory, Dili, Timor-Leste; [2] Ministry of Health, Dili, Timor-Leste.

Timor-Leste also received multiple kits kit from the IRR to detect influenza and SARS-CoV-2 viruses. The use of multiplex assays for the identification of more than one pathogen in the same PCR reaction allows for a more efficient use of reagents, consumables and hands-on time. The multiplex kit received from IRR helps in detection of influenza A and B viruses as well as SARS-COV-2. The cartridge-based PCR is another multiplex platform to perform tests for SARS-COV-2 as well as influenza used in the national laboratory.

In collaboration with WHO and the Menzies School of Health Research, NHL has recruited qualified laboratory staff who are now performing laboratory testing and providing regular training to the peripheral laboratory staff when needed. Through the deployment and training of new staff, Timor-Leste was able to clear the backlog of samples for influenza testing.

With the continued circulation of SARS-CoV-2, Timor-Leste usually sends influenza and SARS-COV-2 positive samples to the WHO CC in Australia for sequencing and external quality assurance.

Data reporting

The data collected are consolidated and sent weekly to FluNet. This includes laboratory data by source (sentinel vs non-sentinel) for both influenza and SARS-CoV-2. In addition to influenza data, the number of specimens processed and the number of positive and negative specimens have been included for SARS-CoV-2.

Lessons learned

Timor-Leste found that building from a national surveillance system governed by national health authorities enabled strengthening of the surveillance system. The laboratory network was expanded to include SARS-CoV-2 testing centres, which has benefited influenza surveillance by ensuring a more regular supply of resources for testing samples for influenza. The availability of multiplex PCR kits to test influenza, as well as SARS-COV-2, as helpful. The data generated from integrated surveillance have been used to detect cases of both influenza and COVID-19 in the community, to monitor trends in both viruses and to provide epidemiological information in support of timely prevention and containment measures. Results of integrated epidemiological and virological surveillance are published in the weekly COVID-19 integrated influenza view and are being shared to relevant stakeholders, including the COVID-19 task force, for evidence-based decision-making within the country and globally.

There is a continued need for financial resources for capacity-building to conduct refresher training and evaluation meetings at municipality where sentinel sites were expanded. There is also a need to support municipalities with specimen transportation from CHCs to the municipality level because some areas are difficult to reach.

Moving forward

Timor-Leste is revising the national guidelines for integrated COVID-19 and SARI/ILI surveillance to improve usability for health workers and will continue with the integrated approach to surveillance for SARI/ARI/ILI and SARS-CoV-2. Timor-Leste plans to have quarterly evaluation meetings for surveillance sites with increased site monitoring and supervision. In addition, Timor-Leste would like to intensify training and refresher training for focal points at sentinel sites. Previously planned activities such as training at the WHO CC in Australia, the finalization of the Influenza Pandemic Preparedness Planning and simulation exercises may soon resume if the COVID-19 situation allows.

5. European Region

5.1. SARI and ILI surveillance in Armenia

Author: Romella Abovyan[1]

Background

In Armenia, epidemiological surveillance of ILI and SARI is carried out in 13 medical centres (five polyclinics and eight hospitals). Armenia uses the WHO standard case definitions. For each medical centre, both WHO and CDC specialists of the Ministry of Health have developed SOPs. According to the standard practice of each medical centre, samples are sent to the reference laboratory centre to be tested for influenza, SARS-CoV-2 and ORVs.

Country approaches

Surveillance data are collected in accordance with WHO's proposed algorithm for influenza, other respiratory infections and SARS-CoV-2. Each week, the coordinator of the case medical centre enters data into the electronic influenza epidemiological system for ILI and SARI cases. These data are summarized and provided in the appropriate format for the European Surveillance System (TESSy). The data are also analysed and reported in a weekly newsletter.

Lessons learned

The introduction of the new algorithm during the COVID-19 pandemic provides better understanding about the clinical course of COVID-19, the frequency of co-infection and additional helpful information for response.

[1] National Centre for Disease Control and Prevention, Ministry of Health, Yerevan, Armenia.

5.2. Belgium: Use of multiplexing RT-qPCR to detect influenza viruses, SARS-CoV-2 and ORVs in sentinel ILI and SARI surveillance samples

Authors: Isabelle Thomas[1], Nathalie Bossuyt[1], Sarah Denayer[1] and Cyril Barbezange[1]

Background

The Belgian NIC implemented testing of sentinel ILI and SARI surveillance samples for non-influenza respiratory viruses during the 2015-2016 season. In February 2020, the Belgian NIC included testing for SARS-CoV-2 to support the National Reference Centre for Coronaviruses with early diagnosis, as needed. This integrated approach allowed for detection of parainfluenza virus type 3 and respiratory syncytial virus epidemics in children with SARI in 2021.

Challenges

By the end of March 2020, the sentinel surveillance was disrupted as lockdown and other public health and social measures were imposed. Teleconsultation was implemented to avoid patients having to visit their general practitioner in person, which interrupted the virological part of ILI surveillance. Hospitals faced a surge in COVID-19 patients, and SARI surveillance was not sustainable during Belgium's first wave of COVID-19.

Country approaches

The Belgian NIC's testing of SARS-CoV-2 evolved as new methods became available. When the Corman et al methodology (5) was published in January 2020, the NIC ordered the primers, probes and reference materials to validate the assay using SuperScript III Platinum One-Step qRT-PCR kit (ref 11732-088), the kit used for all other tests performed at the NIC.

Later, the Institut Pasteur Paris' protocol targeting the RdRp gene was also implemented as an alternative methodology and adapted into an in-house triplex PCR that included RNaseP as an extraction/inhibition control. In June 2020, the E gene target of the Corman's protocol was introduced into the methodology to create a quadriplex PCR assay for influenza A, Influenza B, SARS-CoV-2 E gene and RNAseP. The idea was to have a first-line assay that included all the important targets for the testing of the sentinel samples collected through the ILI and SARI sentinel surveillance networks during the 2020-2021 season. The US CDC multiplex influenza + SARS-CoV-2 kits became available later in the summer of 2020, and the NIC implemented the assay after validation with the same Invitrogen kit. This offered Belgium two options for multiplex testing. SARI surveillance was resumed in February 2021 but with an adapted approach for some hospitals.

Lessons learned

Testing of sentinel samples for SARS-CoV-2 from February 2020 allowed Belgium to detect the first positive case in SARI samples collected the same week that the first officially confirmed case without travel or contact history was reported by the National Reference Centre for Coronaviruses.

The third wave (January-April 2021) of SARS-CoV-2 was captured by the SARI sentinel surveillance, with COVID-19 affecting almost exclusively adults. In children hospitalized for SARI, SARS-CoV-2 was almost never detected. However, more than 20% of SARI samples from children were positive for PIV-3 between weeks 9 and 12, and Respiratory syncytial virus (RSV) was detected from week 10, reaching more than 60% positivity during weeks 18 to 21. The results of the SARI surveillance are presented in weekly bulletin (*7*).

As expected, the sentinel SARI surveillance system proved to be a very useful tool for the surveillance of respiratory viruses. The information on the patient and any complications collected during hospitalization allowed for better evaluation of respiratory viruses' burden and severity.

This system will remain important to follow the evolution of SARS-CoV-2 and ORVs in the future. This system will remain important to follow SARS-CoV-2 and other respiratory viruses' evolution in the future.

[1] Sciensano, Belgian institute for health, Brussels, Belgium.

5.3. Germany: Integrating COVID-19 in syndromic surveillance of ARI and SARI

Authors: Kristin Tolksdorf[1], Luise Goerlitz[1], Walter Haas[1] and Silke Buda[1]

Background

In Germany, there are two International Classification of Diseases 10th revision (ICD-10)-based sentinels for syndromic surveillance of ARI. One is at the primary care level (since 2006) and the other on the secondary care level (since 2015). Both sentinels use ICD-10 codes that are routinely entered by physicians in practices and hospitals. From these systems, anonymized case-based data are sent in an automated process to the Robert Koch-Institute (RKI) weekly. RKI monitors ARI and SARI weekly, using ICD-10 codes to define ARI and SARI cases.

Country approaches

During the COVID-19 pandemic, Germany integrated COVID-19 into these syndromic surveillance systems to estimate the burden and severity of disease. This allowed for timely estimation of COVID-19 rates while preserving standardized case definitions on ARI and SARI, enabling comparisons to historical baselines. The assessment using the COVID-19 SARI case definition gave valuable insights in the seriousness of COVID-19.

For all ARI (ICD-10 codes J00 - J22, B34.9, J44.0) and SARI cases (ICD-10 codes J09 - J22), additional diagnoses of laboratory-confirmed COVID-19 were used to define COVID-19 cases with ARI (COVID-ARI) and with SARI (COVID-SARI). Germany estimated the burden of COVID-ARI and COVID-SARI and from that, calculated a weekly proportion of COVID-19 among ARI and SARI cases as a proxy to a positivity rate and assessed disease burden and seriousness of COVID-19 ARI and SARI cases.

Lessons learned

Within a very short period of time, COVID-19 surveillance in primary and secondary care was possible by using existing surveillance systems. This allowed for a fast and timely estimation of COVID-19 rates among ARI and SARI cases. Germany preserved its standardized case definitions on ARI and SARI, which enabled comparisons to historical baselines, which serve as stable and established reference values for weekly calculated proportions and rates. Moreover, the syndromic COVID-ARI diagnosis using ICD-10 codes is more sensitive as an ILI case definition.

The case definitions of COVID-ARI and COVID-SARI were very stable throughout changes in testing measures and testing behaviour of the population, as only symptomatic cases were captured. The assessment using the COVID-SARI case definition gave early valuable insights in the seriousness of COVID-19, especially as previous influenza waves could be used as reference due to the integrated approach.

[1] Respiratory Infections Unit, Robert Koch Institute, Berlin, Germany.

5.4. Integrating influenza and SARS-CoV-2 sentinel surveillance in Italy

Authors: Antonino Bella[1], Simona Puzelli[1], Flavia Riccardo[1], Angela Di Martino[1], Francesco Maraglino[2], Anna Caraglia[2], Patrizio Pezzotti[1], Paola Stefanelli[1], Giovanni Rezza[2] and Anna Teresa Palamara[1]. Acknowledgement to the InFluNet Network of epidemiology experts and reference regional laboratories

Background

The Italian sentinel surveillance system for influenza (InFluNet) has been active since 1999. InFluNet is coordinated by the Istiuto Superiore di Santà (ISS), Department of Infectious Diseases. It integrates seasonal epidemiological monitoring of ILI with virological surveillance of circulating influenza strains through a secure web-based platform.

The surveillance is based on a sentinel network of GPs reporting the number of patients with an ILI (as per European Union definition) on a weekly basis. A sub-set of the GPs also collects respiratory specimens from November to April (i.e., from week 46 to week 17 of the following year). Virological surveillance activities are coordinated and carried out by the NIC at ISS in collaboration with a network of regional influenza laboratories scattered across the country. Preliminary analyses on the collected clinical specimens are performed at regional level, and a representative subset of influenza virus-positive samples and virus isolates is sent to the NIC for further antigenic and genetic analyses.

The samples are subsequently shared with the WHO CC in London, United Kingdom, to participate in the vaccine composition update. The surveillance team publishes weekly integrated epidemiological and virological reports that are widely used by public health experts and journalists during the autumn/winter seasons.

Country approaches

In the context of the SARS-CoV-2 pandemic and in line with WHO/European Centre for Disease Prevention and Control recommendations, Italy enhanced its influenza sentinel surveillance system to capture and provide differential diagnoses and virological characterization of both influenza and SARS-CoV-2 infections. The objectives of the integrated surveillance system were to estimate the start, duration and intensity of ILI in Italy; monitor cases, viral circulation and evolution of influenza and SARS-CoV-2; and identify any emerging virus variants.

During the 2020/2021 influenza season, Italy implemented an integrated influenza and SARS-CoV-2 sentinel surveillance system by enhancing the existing influenza sentinel surveillance systems' epidemiological and virological components. The revision of the integrated sentinel surveillance protocol included the expansion of the number of GPs enrolled in the surveillance system. The objective was to capture at least 4% of the Italian population through sentinel surveillance sites. This process aimed to strengthen the sensitivity and representativeness of the samples. All specimens collected by sentinel GPs were simultaneously tested for SARS-CoV-2 and influenza using multiplex assays.

Moreover, in a subset of Italian regions virological surveillance activities were extended to the summer months to allow for a continued integrated surveillance. To allow this enhancement, the InFluNet team revised the surveillance protocol in 2020, which was reviewed and accepted by both regional epidemiological contact points and regional reference laboratories. The protocol was subsequently reviewed and funded by the Italian Ministry of Health for long-term implementation.

In Italy, genomic surveillance of SARS-CoV-2 is also in place to rapidly identify new variants and follow the expansion of already known variants of concern. The system will continue in the post-pandemic phase on selected positive samples of COVID-19 to estimate the prevalence of variants with important impact on public health.

[1] Infectious Disease Department, Istituto Superiore di Sanità, Rome, Italy; [2] Ministry of Health, Rome, Italy.

The main limitations encountered in the 2020/2021 season were the very low ILI notification rate and the fact that the COVID-19 security measures did not allow GPs to collect samples in all Italian regions.

This newly enhanced system will be better refined in the 2021/2022 season to increase its ability to meet all WHO recommendations, including improved sample collection from sentinel sites and expanded use of multiplex assays in all the regional reference laboratories of the InFluNet network.

Lessons learned

The added value of this integrated approach was that it kept the influenza network together, supporting the procurement of influenza diagnostic kits and the maintenance of a regular influenza sentinel surveillance, at a time when all attention was diverted to SARS-CoV-2. This enhancement increased the sensitivity and representativeness of the sentinel surveillance system as a whole while integrating SARS-CoV-2 monitoring and will be essential to manage SARS-CoV-2 in the event the virus becomes endemic.

5.5. Adaption of sentinel general practitioner surveillance of ILI to COVID-19 surveillance in the Netherlands (Kingdom of the)

Authors: Birgit van Benthem[1], Adam Meijer[1], Mariette Hooiveld[2] and Rianne van Gageldonk-Lafeber[2]

Background

The Netherlands Institute for Health Services Research (NIVEL) manages the monitoring and information services for primary care, called 'Nivel Primary Care Database.' This database holds longitudinal data recorded in electronic medical files by GPs and other primary health care providers. A proportion of the GPs participating in Nivel Primary Care Database takes part in sentinel influenza surveillance. These GPs actively report on the number of patients who consult them for ILI. From a subset of patients with ILI or ARI, they collect a throat swab and nose swab and send it to the National Institute for Public Health and the Environment (RIVM) for virological laboratory diagnostics on influenza, RSV, rhinovirus and enterovirus. The population of these sentinel GPs in about 40 practices covers approximately 0.9% of the Dutch population and is representative for age, sex, regional distribution and population density.

Country approaches

In early 2020, NIVEL rapidly adapted the primary care influenza sentinel surveillance network to integrate COVID-19 surveillance. This rapid adaption could take place because of the established network of primary care providers, highly qualified testing laboratories and stakeholder commitment.

In February 2020, SARS-CoV-2 diagnostic testing was added to the virological laboratory diagnostics on sentinel samples performed at RIVM. In January 2021, parainfluenza viruses types 1-3, human metapneumovirus (hMPV)and human seasonal coronaviruses diagnostic testing were also included.

During the COVID-19 pandemic, patient pathways changed with initially GPs forming conglomerates, reducing the number of GPs seeing patients with COVID-19-like symptoms each day, and isolating these patients from others. Sentinel GPs were only allowed to take swabs for surveillance from their own patients when accompanied.

Since June 2020, testing for SARS-CoV-2 by municipal health services of all symptomatic individuals was intensified. This has redirected patients away from primary care testing and decreased the number of samples from GP sentinel surveillance. The sentinel surveillance will be strengthened in 2022 by increasing the number of participating GPs from about 40 to about 140 to improve national coverage.

Lessons learned

Lessons learned included flexibility to establish new routines and including new laboratory testing. To enable simultaneous sentinel surveillance of influenza and COVID-19, it is pivotal to take stock of the sentinel sites and testing infrastructure experiences.

[1] National Institute for Public Health and the Environment, Utrecht, Netherlands (Kingdom of the).
[2] Netherlands Institute for Health Services Research, Utrecht, Netherlands (Kingdom of the).

5.6. Unified data collection tool in the Russian Federation

Authors: National Influenza Centre, Smorodintsev Research Institute of Influenza, St. Petersburg, Russian Federation

Background

Over the past 10 years, the National Influenza Centre of Russia in Saint Petersburg implemented an electronic system to collect data from all the responsible organizations and sentinel sites located in 61 cities across the country. It is a web-based system that can be installed on publicly accessible server and is based on an engine (UEISS) that was developed during the implementation of the Pandemic Influenza Preparedness Framework (PIP framework) task on improving data management. The main purpose of developing this electronic system was improving data quality and timeliness of data collection.

Along with data collection, this electronic system can automatically calculate rates and generate graphs and other outputs that can be used for rapid assessment of the situation in the country. This helps epidemiologists focus on the assessment of the situation, reducing the time spent on calculations and the risk of error generation. In addition, in its latest update, the flexible management of content was implemented with the main advantage that almost all content, including data collection forms and reports, can be created and modified though the system interface. This new feature allows for quick adaptation of the system, for new data collection and for generation of new outputs without the need for IT support

Country approaches

This electronic system has shown high efficiency in data collection and processing during the time when the situation was changing dramatically due to the COVID-19 pandemic. In 2020, the system was quickly and smoothly adapted for COVID-19 data collection along with data already collected for influenza and other ARI. Using this flexible system, the NIC in Saint Petersburg was able to add new data collection forms for COVID-19 and modify existing forms in the shortest possible time and avoid disruption of surveillance. This approach made it possible for the Russian Federation to introduce new parameters and to make quick updates to the data collection forms, data flows and reports generated from the new data.

Lessons learned

Using electronic information systems permitted the Russian Federation to swiftly adapt its system to the emerging situation and to have timely data collection for SARS-CoV-2. This electronic system allowed epidemiologists to assess the situation and informed decision-makers.

The NIC in Saint Petersburg is eager to share this experience with countries that need a data management application easy to use for data collection. This application should comply with the following characteristics: the system works on mobile phones; can be used offline; is flexible but contains forms and reports; does not require IT staff for any component; and simplifies reporting to FluNet/FluID/TESSy.

5.7. Implementation of a sentinel surveillance system for SARI in Spain

Authors: Amparo Larrauri Mazagatos[1], Jesús Oliva Mazagatos[1], Concepción Delgado-Sanz Mazagatos[1], Clara Mazagatos[1] and Francisco Pozo[2]

Background

Influenza surveillance in Spain includes information systems and sources that make it possible to offer a broad understanding of the disease and of circulating influenza viruses in each autonomous region and at the national level. The onset of the COVID-19 pandemic disrupted these surveillance systems, both the sentinel surveillance networks in primary care and influenza surveillance in the hospital settings. These disruptions deeply affected the surveillance system operations in all autonomous regions, which made it necessary to rethink and adapt influenza surveillance.

Following the international recommendations of the European Centre for Disease Prevention and Control (ECDC) and WHO, sentinel surveillance systems are being implemented in primary care and hospitals based on the experience gained within the framework of the influenza surveillance system in Spain.

The main objective was to monitor influenza and COVID-19 together in the current season and that these systems remain the surveillance systems for mild and severe acute respiratory infections over time. These systems will allow Spain to monitor influenza, COVID-19 and ORVs that emerge in the future.

In this report, we present the experience of setting up a surveillance system for SARI in the hospital setting in Spain. This sentinel surveillance system will be complemented with sentinel surveillance of ARI in primary care.

The SARI surveillance system aims to achieve the following objectives:

- monitor the evolution of the incidence of SARI by geographical area and, by sex and age group, throughout the year;
- describe the seasonality of the diseases, including the periods of circulation of the agents;
- estimate the percentage of positivity for SARS-CoV-2 and influenza among SARI cases hospitalized in Spain, by sex and age group;
- establish threshold activity levels that serve in the future as a reference to evaluate the impact and severity of each agent in each season;
- obtain clinical and epidemiological information on cases to identify risk factors for serious disease;
- estimate the effectiveness and impact of preventive measures, such as vaccination, against severe forms of COVID-19 and influenza (and ORVs in the future) that require hospitalization;
- genetic characterization and sequencing of the different variants of SARS-CoV-2 and influenza clades and study of the epidemiological and clinical characteristics of these variants and clades.

Country approaches

Our methodological approach is described step-by-step as follows:

Participating sentinel hospitals

- At least one referral hospital designated by each autonomous region was invited to participate in the sentinel surveillance system for hospitalized cases of SARI.

[1] National Centre for Epidemiology, CIBERESP, Carlos III Health Institute, Spain.
[2] National Centre for Microbiology, CIBERESP, Carlos III Health Institute, Spain.

- The microbiology and preventive medicine services of each centre were involved. The public health authorities of each autonomous region coordinate weekly information sharing from these centres to the central level (National Centre for Epidemiology-NCE) through a web application. Information on sequencing is also sent to the National Centre of Microbiology (NCM) from autonomous regions with sequencing capacity. Otherwise, samples are sent for sequencing at central (national) level.

Population under surveillance

- Each sentinel hospital provides the populations of its reference area, by age group (<5, 5-14, 15-44, 45-64, 65-79,> 79) and by sex. This makes it possible to have denominators for calculating the incidence rates of SARI at the national level, by autonomous region and by age group and sex.

Surveillance period

- Surveillance started in October 2020 and continues into the present. The participating hospitals are expected to carry out surveillance activities throughout the year.

Case definitions

- SARI case definitions are based on the WHO SARI case definition.

Case identification

- All patients admitted to any of the sentinel hospital units or services, including the emergency department and intensive care units (ICU) and meet the SARI case definition are included in surveillance. The persons in charge of surveillance in the sentinel hospital access the admission lists to identify hospitalized patients with SARI. For hospitals that use the International Classification of Diseases (ICD) for admitting diagnosis code, cases are identified by the following ICD codes: R06.0; J80; R06.9; R50.9; J00-J06; J09-J18; J20-J22; J40-J42; J44.x; J45.x; J96.x; Z20.828; U07.1. For hospitals that do not use the ICD for admitting diagnosis code, a list of all admitted patients with one of the following keywords among the first three diagnostic impressions at the time of admission is generated: pneumonia, asthma, chronic obstructive pulmonary disease, fever, respiratory infection and respiratory failure.
- Patients with SARI of nosocomial origin are excluded because the objective of this surveillance is to estimate the incidence of hospitalized SARI cases from the community.

Data collection and files for surveillance

- Hospital admissions data: The number of patients hospitalized with SARI aggregated by sex and age group or case-based data with the variables of sex and age is sent on a weekly basis.
- Sampling and epidemiological data: From the databases obtained from the hospital's microbiology laboratory, the number of patients who have had a respiratory sample taken for virological confirmation (RT-PCR or antigen test) is provided. An epidemiological survey will be completed only for those patients with a sample collected. It includes identification codes (RA, hospital and patient); epidemiological and clinical data (age, sex, symptoms, date of onset of symptoms, date of sampling, date of admission and discharge, risk factors, complications, invasive mechanical ventilation, admission to ICU, death, etc.); and laboratory information (diagnosis of SARS-CoV-2, influenza or ORVs, date of diagnosis, type of technique used).

Sampling

- Any patient admitted with SARI is considered to have suspected COVID-19, and a respiratory sample is recommended for virological confirmation. Sampling must be done before day 10 from the onset of symptoms to adequately detect SARS-CoV-2 and influenza viruses. If an antigen test is used for COVID-19 or influenza is positive, it is considered as valid; but if the test is negative, it is necessary to confirm the negative result with RT-PCR.
- A representative number of positive samples will be sequenced at a regional level or sent to the NCM for their genetic characterization and sequencing.

Key points and data transmission circuit

- The notification route from the hospital and public health units of each autonomous region to the NCE has been used for ten consecutive influenza seasons since the 2009 pandemic. Each autonomous region obtains information on individuals with SARI who have been hospitalized in sentinel hospitals (one or more) in its territory. The information on SARI cases in each autonomous region is integrated into the weekly notification files and sent to the NCE through a web application. The hospital laboratory sends an aliquot of the respiratory samples positive for influenza and SARS-CoV-2 to the NCM to proceed with the isolation and characterization of the detected viruses. Regional laboratories with sequencing capacity send to the NCE/NCM the sequences uploaded to GISAID.
- Representative influenza isolated viruses are also shared with WHO CCs to be used as potential candidates to reformulate vaccines.

Outcomes

Since October 2020, nine autonomous regions in Spain (Andalusia, Aragon, Balearic Islands, Castilla y León, Catalonia, Galicia, Madrid, Murcia and La Rioja), have joined the SARI surveillance system, representing a total of 13 participating hospitals (between one and three per autonomous region).

The system has provided SARI incidence rates throughout the entire period, thus responding to one of the main objectives set in its implementation.

Of the 8264 SARI patients identified since the beginning of the season, a respiratory sample was taken from 6323 (77%). Among these, 3738 were positive for SARS-CoV-2 (59% positivity), one for influenza A virus (0.02%) and 139 for RSV.

Challenges

The greatest challenge for the implementation of this new system has been, and still is, its coexistence with exhaustive COVID-19 surveillance, at a time when both primary care and hospital services, as well as public health personnel in autonomous regions and at the central level were overwhelmed. Convincing all actors involved in the system to maintain parallel notification to the universal system and the sentinel system has been a challenge. However, the idea that at some point the sentinel system, sooner or later, will replace universal surveillance has begun to resonate with stakeholders.

Another important challenge is to ensure every sample is tested not only for SARS-CoV-2 but also for influenza and RSV. So far, laboratory information on these two viruses was shared, but a clear denominator to estimate the positivity rate compared to influenza and RSV is missing. Nevertheless, during the 2021-22 season, several autonomous regions have continued to provide non sentinel information on influenza and RSV, which informed the circulation of this virus in Spain.

Integration of sequencing SARS-CoV-2 data into epidemiological information has been difficult. Nonetheless, NCE and NCM are currently working to integrate this data.

Lessons learned

Since its implementation, this SARI sentinel system has run in parallel with the universal surveillance of COVID-19 cases in Spain, and It has been possible to use this system as a "gold standard" for evaluating results. The weekly incidence rates of SARI show incidence peaks that coincide with those of the second, third and fourth pandemic waves of COVID-19 in Spain, or immediately after them. Likewise, the minimum incidence rates coincide with the turning points of the cumulative incidence of COVID-19 between the second and third, third and fourth; and fourth and fifth waves, respectively. Thus, the SARI surveillance system has been able to detect and illustrate the evolution of the COVID-19 pandemic in Spain.

5.8. Adaptation of influenza and other non-SARS-CoV-2 respiratory virus surveillance during the COVID-19 pandemic in Scotland, United Kingdom

Authors: A-Lan Banks[1], Shivani Karanwal[1], Josie Murray[1] and Jim McMenamin[1]

Background

Before the COVID-19 pandemic, influenza surveillance in Scotland consisted of (a) a GP sentinel swabbing scheme; (b) GP ILI consultation rates; (c) National Health Service (NHS) 24-syndromic surveillance; and (d) monitoring of influenza intensive care unit (ICU) cases. This was supplemented by sequencing of influenza samples. Throughout 2020/21, Public Health Scotland (PHS) continued to monitor and report on GP ILI consultation rates, NHS 24 respiratory calls and influenza cases in ICU.

The COVID-19 pandemic has had major impacts on the primary care. The GP sentinel swabbing scheme for patients presenting with ILI was suspended. A modified pathway was created to account for patients with respiratory symptoms no longer being seen in practices. As with the rest of the United Kingdom, for the purposes of contact tracing, the primary testing pathway for people meeting the case definition for COVID-19 has been via the Lighthouse laboratories pathway. In addition, each NHS board in Scotland set up COVID-19 hubs and assessment centres or GP red pathways.

People with symptoms of COVID-19 can call the NHS24 service or their general practice, where they are provided with appropriate advice. Those callers who require further specialist COVID-19 advice are triaged onto NHS board COVID-19 Hubs, where they have a telephone consultation with a primary care health professional. Those callers who need further assessment are then given appointments at the NHS board COVID-19 Assessment Centre (CAC) or GP red pathway, where they have a face-to-face consultation with a primary care health professional. The Scottish Government instructed NHS boards to test all patients attending CAC, GP red pathways or receiving home visits for face-to-face assessment of COVID-19 symptoms. As of a result of the monumental impact on previous surveillance of respiratory pathogens, it was important to ensure that the new system could be adapted to ensure, for example, that influenza infections were not missed.

At the beginning of the 2020 winter, laboratories were encouraged to test some but not all of the samples from symptomatic individuals in the community obtained for SARS-CoV-2 testing for influenza and RSV and a selected panel of ORVs. In the hospital setting, all symptomatic patients are tested for SARS-COV-2, influenza and RSV at minimum, with certain NHS diagnostic laboratories also carrying out further testing.

The main specific challenges were the change in patient pathway away from GPs and the capacity of laboratories to undertake wider respiratory testing due to the increased SARS-COV-2 testing.

The main surveillance objectives include:

- provide early warning of changes in flu-like activity in the community (which in turn trigger further detailed investigation);
- monitor the trend of influenza-like and acute respiratory illness (predominantly during the winter months);
- detect potential clusters/outbreaks of illness;
- determine the nature, type, extent and severity of pathogens causing influenza illness and distribution within the population;

[1] Public Health Scotland, Glasgow, Scotland, United Kingdom.

- identify key risk factors for infection and in particular severe illness and death;
- monitor, characterize and identify changes in circulating virus strains;
- examine the impact of influenza vaccination (and other public health interventions such as antivirals);
- gain information on the management and treatment of cases;
- understand the combined impact of COVID-19 and influenza on health services.

Country approaches

General Practitioners consultation for ILI

Since 2009/10 the Scottish Influenza Surveillance Reporting Scheme (SISRS) has provided aggregate level data on GP consultation for ILI, based on automated software extracts from 98% of Scottish GP practices. These data are now used for routine surveillance of ILI in Scotland. PHS regularly reports consultation rates for ILI in primary care. This is the key measure of influenza activity in the community and is used to gauge the severity of influenza seasons in Scotland each winter. It is also used for comparison of influenza activity across the United Kingdom and Europe. PHS has continued to monitor numbers of GP consultations for ILI. However, compared to previous seasons, the ILI rate shows a marked decrease.

This decline may be due to changes in routine health seeking behaviour and also changes in the way GP consultations have been taking place during the ongoing pandemic. Due to COVID-19, health care services are functioning differently now compared to previous influenza seasons, so the consultation rates are not directly comparable to historical data.

Modified primary care pathway

Under the new arrangements, if an individual has COVID-19 like symptoms and calls NHS 24, they may be referred for a telephone consultation with a healthcare professional. If that healthcare professional feels that the individual requires a face-to-face assessment, they will be sent to the COVID-19 primary care clinical assessment centre. If they were not sent for further onward referral to hospital or assessment centre, they will be recommended to self-isolate at home and might be eligible for inclusion in the surveillance self-swabbing scheme. A subset of patients tested through this pathway for COVID-19 are also tested for influenza A/B and RSV at minimum, with some NHS laboratories carrying out a full panel of tests including rhinovirus, adenovirus, parainfluenza, human metapneumovirus, non-SARS-CoV-2 coronavirus and Mycoplasma pneumoniae. There are currently around 500 samples per week captured via this modified primary care pathway. Laboratory confirmed cases and trends are monitored, with sequencing of SARS-CoV-2 and influenza available.

The Moving Epidemic Method thresholds are used to detect when activity is higher than levels expected for the time of year based on activity in previous seasons. The PHS publishes a weekly respiratory report (*8*). Alerts for any significant events (e.g. unseasonal increases in RSV) are also distributed to colleagues throughout Scotland. The protocol for the enhanced community surveillance details the patient flows and patient recruitment for the current process (under revision).

Lessons learned

PHS has been able to maintain a good level of respiratory pathogen surveillance in these unprecedented times and has provided early warning of rising infection rates (e.g. in rhinovirus, parainfluenza and RSV) with a view to prevent morbidity and mortality at a population level.

NHS colleagues are provided with regular updates on the situation in Scotland via our weekly report, supplemented by public health alerts as necessary.

Moving forward

An evaluation of the current patient pathways has indicated that GPs will start to see respiratory patients again, and there is discussion about standing down the CACs currently operating. PHS is therefore working to re-establish the GP sentinel surveillance system, which will be supplemented by those CACs that continue to operate, to create a fully integrated surveillance system for influenza and COVID-19. The planned sentinel community surveillance programmme will involve around 40 GP practices from across Scotland. The objective will be to collect up to 1000 samples per week from the combination of GPs and CACs. Any samples collected under the new sentinel scheme will be also tested for wider panel of respiratory pathogens as detailed above. A subset of influenza, SARS-CoV-2 and RSV samples will also be sequenced. SARI surveillance using a sentinel approach is also planned for Scotland but has not yet been implemented.

6. Eastern Mediterranean Region

6.1 Influenza surveillance in Afghanistan

Author: Hafizullah Safi[1] and Momin Khan Murad[2]

Background

In Afghanistan, an NIC was designated by the Ministry of Health and recognized by WHO in March 2009 with the technical support of NAMRU-3 project. When the NAMRU-3 support ended, the NIC discontinued performing influenza virus isolation. In September 2015, with the technical and financial support of WHO under the PIP framework, the NIC resumed influenza virus isolation and began sending the isolated samples to the WHO CC in Atlanta (US CDC). From January 2016 to April 2021, Afghanistan shared 13 batches of influenza samples to the US CDC. The shipments included 332 specimens.

Currently there are nine SARI and ILI sentinel sites for influenza surveillance, selected based on the geographical locations and population density in Afghanistan. Each site has a trained influenza assistant to collect the epidemiological data from SARI and ILI patients, and all data is entered to the GISRS online platform on regular basis.

Challenges

Afghanistan is experiencing challenges related to delays in the testing of SARI and ILI samples because the NIC is primarily focused on COVID-19 sample testing. In addition, due to the interruption of international flights, the NIC has not been able to send influenza samples to a WHO CC. Afghanistan has finalized the surveillance protocol and data collection tools but has not yet been able to perform an evaluation of its influenza surveillance system. Initially, data collection was challenging due to insecurity in some provinces. However, this particular challenge has been resolved recently.

Country approaches

In Afghanistan, the influenza sentinel system acted as an asset in the battle against SARS-CoV-2. The very first COVID-19 case in the country was detected in one of the SARI sentinel sites, and the specimen was collected and sent to the NIC for testing. The NIC, with the support provided under PIP framework, has been able to conduct PCR testing and confirm the first COVID-19 case in the country and later act as the national COVID-19 laboratory up to the time of this writing. This would have not been possible without the infrastructure built and maintained at the laboratory through the support of the PIP framework. This infrastructure can be summarized by two main components: enhanced technical capacity for the team at the NIC through trainings; and the provision of PCR machines, kits, and reagents.

On another note, the response to the pandemic would not have been efficient if it weren't for the well-trained influenza focal points at the sentinel sites. These focal points acted as a shield to the country, taking the risk of collecting specimens of the very few suspected COVID-19 cases and later training more national teams on proper usage of PPE (donning and doffing) and on nasopharyngeal specimen collection. Last but not least, Afghanistan was among the very few countries in the region testing and reporting on both influenza and SARS-CoV2 within the sentinel network, highlighting the integrated surveillance approach that is widely promoted by GISRS.

Lessons learned

The influenza programme provides critical information for pandemic preparedness planning and response. In Afghanistan, the influenza and COVID-19 surveillance and response improved response to the COVID-19 pandemic systems through integrated and coordinated activities. Such an approach could be used for other epidemic-prone diseases in Afghanistan or in similar contexts.

[1] WHO Country Office for Afghanistan, Kabul, Afghanistan; [2] National Influenza Centre, Ministry of public health, Kabul, Afghanistan.

6.2. Oman: Integrated influenza, MERS-CoV, COVID-19 and other viruses' surveillance

Authors: Hanan Alkindi[1]

Background

In 2017, a policy for national acute respiratory infection (NARI) surveillance was launched. This policy integrates influenza, MERS-CoV, atypical bacteria, and other emerging viral infection surveillance.

In 2020, the backbone of the NARI system was used for COVID-19 case surveillance. The NIC integrated COVID-19 testing for hospitalized cases in the existing NARI testing algorithm during the first few months of the pandemic before local introduction and community circulation. The national surveillance coordinator is responsible for monitoring the implementation of surveillance, data management, epidemiological analysis and preparation of national reports.

After community circulation started, SARS-CoV-2 was tested locally at each hospital site, and the NIC continued testing some SARI and ILI cases. The influenza case definitions for SARI and ILI were used to integrate testing for both viruses at sentinel sites. Subsequently, ILI sentinel surveillance was extended to every districts, and the number of sites was increased from two to 13. In Oman, all inpatients admitted that meet the COVID-19 case definition are tested for SARS-CoV-2 by PCR. From mid-February until July 2020, all outpatients presenting with fever and cough were tested for SARS-CoV-2 at the NIC. Subsequently, the NIC started to test for influenza and SARS-CoV-2 primarily samples from the 13 sentinel sites.

Implementation actors and financing of the NARI policy

Oman has only one NIC that tests diagnostic and surveillance samples. The NIC tests for influenza and SARS-CoV-2 using multiplex tests and commercial kits from different suppliers. The NIC also conducts genomic sequencing. At least twice yearly, the NIC shares clinical influenza samples (with or without isolates) to WHO CCs. The NIC shares virologic data with FluNet (FluMart), and the surveillance team shares epidemiological data with EMFLU (WHO Eastern Mediterranean regional platform).

The Ministry of Health purchases the commercial reagents and pays for local sample sharing and transport. WHO provides inhouse primers through the US CDC and covers the cost of influenza sample sharing with the WHO CC.

Outside NARI surveillance, the treating physician may also collect samples and order diagnostic tests for any patient presenting with respiratory infection (mild, moderate or severe) and a clinical or one with suspected MERS, COVID-19 and/or influenza disease based on local epidemiology.

Integrated respiratory virus surveillance before the COVID-19 pandemic

SARI surveillance for admitted cases

a. Intensified surveillance SARI (SARI-IS):
   - all hospitals ICU beds;
   - severe cases (Box 2: case definition of SARI-IS);
   - samples tested at NIC for MERS-CoV (PCR) and influenza and ORVs (multiplex PCR). If the sample is positive for influenza A or B, it will be further subtyped. When indicated, atypical bacteria PCR is also performed.

[1] National Influenza Centre, Central Public Health Laboratory, Muscat, Oman.

b. Sentinel sites SARI (SARI-SS):
   - three sentinel hospitals;
   - patients admitted with influenza cases definition;
   - samples tested at NIC for influenza A/B/pdm H1N1 with typing. 10% of SARI-SS samples will be tested for MERS-CoV.

ILI surveillance for outpatient cases

- two health centres;
- patients meeting ILI case definition;
- samples tested at NIC for influenza (PCR and typing).

Integrated respiratory virus surveillance since COVID-19 pandemic

NARI systems were maintained during COVID-19 pandemic with few changes that affected other virus surveillance. The changes for each category are described below.

SARI surveillance for admitted cases

a. Intensified sites SARI (SARI-IS):
   - all hospital ICU beds;
   - all patients meeting case definitions of SARI-IS and COVID-19;
   - hospital laboratories testing samples on site for SARS-CoV2 and influenza;
   - samples referred to NIC:
     - samples requiring MERS-CoV PCR (SARI-IS);
     - samples requiring multiplex PCR test for influenza and ORVs;
     - samples with atypical bacteria;
     - all positive influenza samples for typing;
     - a subset of COVID-19 positive samples for sequencing.

b. Sentinel sites SARI (SARI-SS):
   - three sentinel hospitals;
   - patients admitted with symptoms meeting the case definitions of SARI-SS and COVID-19;
   - hospital laboratories testing samples on site for SARS-CoV2, influenza and RSV;
   - samples referred to NIC:
     - samples requiring MERS-CoV PCR (SARI-IS);
     - all positive influenza samples for typing;
     - a subset of COVID-19 positive samples for sequencing.

ILI surveillance for outpatient cases

- 13 health centres (since August 2020).
- All patients meeting case definitions of ILI or COVID-19.
- Samples tested at NIC for influenza and SARS-CoV-2 using US CDC multiplex assays.

Challenges

The COVID-19 pandemic initially caused disruptions to the system.

- For the first three to four months, the NIC was overwhelmed, carrying out all molecular testing of both outpatients and admitted cases.
- The need to perform reflex testing (for other viral infections including MERS-CoV
- and for influenza typing) and sample shipment constrained SARI-SS sentinel sites.
- Data sharing with FluID and EMFLU for SARI-IS and SARI-SS for influenza and COVID-19 was also suboptimal.
- The financial impact of NARI testing for influenza, SARS-CoV-2, and MERS-CoV was significant.

Country approaches

- With time, decentralization of respiratory sample testing for SARS-CoV-2 was achieved. Currently, more than 44 laboratories are conducting RT-PCR for SARS COV-2 in the country which helps timely control and management of cases.
- The use of multiplex tests for influenza, RSV, and SARS-CoV-2 at SARI-SS sites solved difficulties caused by the need to perform reflex testing and sample shipment constrains.
- Increasing the awareness among clinicians, laboratory staff and epidemiologists on the importance of sustaining testing and reporting for non-COVID-19 viruses is ongoing with the aim of overcoming gaps in the surveillance system during the pandemic.
- There is government commitment to sustain the NARI surveillance programme.
- Feedback in form of weekly reports, virtual meeting or webinars is crucial to maintain the engagement of the end user in the system.
- Utilize data such as vaccination uptake and expansion of hospital capacity to assess the disease burden.

Lessons learned

An integrated approach to respiratory virus surveillance requires strong communication between testing sites, clinicians, epidemiologist and the NIC. The practice is expensive and requires strong financial support. However, it can be simplified by centralizing testing, using more inhouse testing methodologies and concentrating on priorities that are important to the region like influenza, COVID-19 and RSV. MERS-CoV testing should be added to geographical area with maintained virus circulation. Continued feedback to the end user will improve awareness and engagement in the process.

Box 2: Oman SARI intensified surveillance (SARI-IS) Case Definition (2017)

All admitted patients with the acute respiratory symptoms, i.e. fever >38C° and new onset of (or exacerbation of chronic) cough or breathing difficulties, and one or more of the following triggers:

(1) Evidence of severe illness progression, i.e. either radiographic evidence of infiltrates consistent with pneumonia or a diagnosis of acute respiratory distress syndrome or severe ILI which may also include complications such as encephalitis, myocarditis or other severe and life-threatening complications.

(2) The patient needs admission to the ICU or another area of the hospital where critically ill patients are cared for with or without mechanical ventilation.

(3) No alternate diagnosis within 72 hours of hospitalization, i.e. results of preliminary clinical and or laboratory investigations, within 72 hours of hospitalization, cannot ascertain a diagnosis that reasonably explains the illness.

(4) One or more of the following exposures/conditions:

- *(a) A high risk group (pregnant, immunocompromised, chronic condition viz. diabetes mellitus and hypertension.*
- *(b) Close contact with a confirmed case with emerging/re-emerging pathogens within 10 days prior to onset of symptoms.*
- *(c) Residence in or recent travel within History of exposure involving direct health care, laboratory, animal exposure.*
- *(d) Part of cluster with similar respiratory symptom.*

ICU: Intensive Care Unit; ILI: influenza-like-illness

6.3. Syrian Arab Republic: Building influenza sentinel surveillance system during the COVID-19 pandemic

Authors: Rasmieh Allahham[1]

Background

The influenza sentinel surveillance system in the Syrian Arab Republic was successfully reactivated during the COVID-19 pandemic by leveraging some of the resources purposed for the response to the pandemic. These resources were used to strengthen influenza surveillance infrastructure at the national level using an integrated surveillance approach for testing influenza, SARS-CoV-2 and ORVs.

The influenza surveillance system in the Syrian Arab Republic was established in 2009 in response to the influenza A(H1N1) pandemic. SARI case definitions were adopted, and all SARI cases in the ICUs of all hospitals in the Syrian Arab Republic were reported. The Central Public Health Laboratory (CPHL), Emerging Disease laboratory in Damascus was designated as the NIC in 2009. The lab is equipped with two RT-PCR machines supported by WHO. The NIC performs the following activities:

- influenza virus typing and sub-typing using molecular methods (RT-PCR);
- referral of un-subtyped specimens to a designated WHO CC;
- receiving and storing original specimens of influenza;
- participating in WHO External Quality Assessment for the molecular detection of influenza viruses;
- providing refresher trainings to sentinel sites on specimens' collection, storage, and transport.

Challenges

The humanitarian crisis in the Syrian Arab Republic, combined with the challenges brought on by the COVID-19 pandemic and its economic impact, has severely affected the health system in the Syrian Arab Republic and increased the risk of potential infectious diseases outbreaks. Since the onset of conflict in 2011, the country has suffered from deterioration of living conditions and environmental conditions, collapse of the health system and decrease in the health workforce and inadequate surveillance.

Due to COVID-19 pandemic, the Syrian Arab Republic's NIC has faced many challenges. Staff are overwhelmed with the number of COVID-19 specimens to be tested and reported; there are logistical problems with acquiring reagents, sourcing consumables and reagents, and procuring/using equipment. Additionally, there is a high turnover rate of laboratory staff and exodus of skilled personnel from the country. Specimens are collected with incomplete data about the patient, and the paper-based reporting system does not have an electronic linkage between the laboratory and surveillance sites, with no clear data flow mechanism. There are difficulties in sharing viruses with WHO CCs due to ongoing sanctions. In addition, challenges such as insufficient human resources and operation/logistic difficulties (internet and electricity) are affecting the timeliness and completeness of data sharing.

[1] WHO Country Office for the Syrian Arab Republic, Damascus, Syrian Arab Republic.

Country approaches

In 2020, based on the recommendations of WHO Regional Office for the Eastern Mediterranean Region to re-establish a sentinel influenza surveillance system in the Syrian Arab Republic, a sentinel hospital in Damascus was selected. Starting from October 2020, all SARI cases admitted to this sentinel hospital were tested for both influenza and SARS-CoV-2 at the NIC. In 2021, following a mission assessment from the WHO Regional Office for the Eastern Mediterranean Region mission assessment, the Syrian Arab Republic expanded the sentinel network to increase geographical representativeness with the goal of improving detection and monitoring of influenza and SARS-CoV-2. Accordingly, the Ministry of Health expanded the SARI sentinel surveillance network to include four sites in three governorates (two in Damascus, one in Aleppo, and one in Rural Damascus). As of 31 October 2021, approximately 1100 SARI samples had been collected from the four sentinel hospitals and tested for both influenza and SARS-CoV-2.

The Syrian Ministry of Health is sharing this data through the EMFLU platform on a semi-regular basis. Syria is coordinating with WHO Regional Office for the Eastern Mediterranean to implement the regional WHO electronic data sharing platform (EMFLU) and training is planned for the second quarter of 2022.

Lessons learned

Despite all the above-mentioned challenges, the Syrian Arab Republic has been able to successfully establish the sentinel influenza surveillance system and adopt the integrated surveillance approach from the very beginning of the COVID-19 pandemic to detect and monitor influenza viruses, SARS-CoV-2, and ORVs with pandemic potential.

These achievements were made possible because of the commitment of the government and its concerns about the potential for emerging influenza viruses with pandemic potential, as well as the dedication of available national staff at the Ministry of Health, sentinel sites and the NIC. This achievement would not have been feasible without the continuous support provided by WHO Country Office for the Syrian Arab Republic and WHO Regional Office for the Eastern Mediterranean under the PIP framework.

7. Western Pacific Region

7.1. Lao People's Democratic Republic: the health laboratory network is a key to supporting surge testing

Authors: Phonepadith Xangsayarath[1]

Background

The National Centre for Laboratory and Epidemiology (NCLE) is the NIC and national public health laboratory in the country. The NCLE plays a key role in communicating with provincial and reference laboratories as well as at the international level. NCLE is a hub for specimens at the central and peripheral levels to test for emerging diseases and diagnose pathogens of public health importance such as SARS-CoV-2, seasonal and novel influenza viruses, measles and rubella, dengue and others. NCLE has molecular testing capacity through the establishment of influenza surveillance. ILI and SARI samples are collected one day per week and tested for influenza at the NCLE.

Until mid-April 2021, Lao People's Democratic Republic had only reported 58 COVID-19 cases; however, imported cases led to a surge of local cases amplified by transmission in close-contact settings from the initial cases. Between 20 April and 21 September 2021, 17 713 cases were reported, bringing to the cumulative count of 17 762 confirmed COVID-19 cases and 16 deaths since March 2020. The surge in cases led to an influx of specimens to the laboratories nationwide. Initially, COVID-19 testing capacity was limited to Vientiane, and this lead to the delay in responding to the outbreak.

Country approaches

The NCLE has supported the country by rapidly expanding COVID-19 testing capacity at central and provincial levels using RT-PCR, portable PCR and cartridge-based PCR for rapid diagnosis of COVID-19. Provincial hospitals with existing influenza sentinel surveillance sites with a skilled workforce in laboratory, epidemiology, and data management already in place were prioritized. They are the Champasak, Savannakhet, Oudomxay and Luangprabang provincial hospitals.

The NCLE has been communicating with all laboratories on the process for sharing samples following the Health Laboratory Network Guidelines that they endorsed in 2015. This increased testing capacity expedited laboratory results for suspected COVID-19 cases.

A representative sample of positive specimens from all provinces are shipped to the NCLE, which selects up to 16 samples each week for transfer to the Institute Pasteur Laos (IPL). The IPL was designated for performing the sequencing of SARS-CoV-2 for the country. Relevant focal points (health ministries at central and provincial level) are informed of the sequencing results. Sequencing data are also submitted to GISAID.

Lessons learned

Lao PDR has a national laboratory network mechanism to diagnose pathogens of public health importance. The NCLE plays a key role in communicating with other laboratories and serving as the hub for specimens from central and peripheral labs.

The national testing capacity has increased. RT-PCR testing was expanded to sentinel laboratories, which now have capacity to conduct SARS-CoV-2 testing. This method can be further expanded to testing other emerging diseases, if needed.

[1] National Influenza Center, National Centre for Laboratory and Epidemiology, Vientiane, Lao People's Democratic Republic.

7.2. Incorporating COVID-19 surveillance into influenza sentinel surveillance in Mongolia

Author: National Influenza Centre, National Centre for Communicable Diseases, Ministry of Health, Ulaanbataar, Mongolia

Background

The Mongolian NIC had been participating in GISRS and using influenza surveillance data as robust evidence to inform decision-makers for many years. Mongolia had 152 sentinel surveillance sites (1st category 78 sites, 2nd category 64 sites) at the national level. In 2018, Mongolia also developed pandemic influenza severity assessment capacity with the support of WHO.

On 10 November 2020, the first domestic transmission of COVID-19 was reported in Mongolia. However, Mongolia had not enough human resources either for laboratory testing or for the transportation of samples and real-time evidence generation. In addition, the laboratory used the traditional Sanger sequencing method, which requires considerable time to generate results. In response to these challenges, stakeholders and decision-makers highlighted the importance of increasing influenza sentinel surveillance at the national level and testing all cases that met ILI and SARI case definitions. In addition, sentinel and non-sentinel samples were tested for SARS-CoV-2 and other respiratory diseases.

Currently, Mongolia is working to establish next-generation-sequencing (NGS) capacity in a virology laboratory with support from the WHO and the WHO CC in Japan. The goal is to conduct COVID-19 variant of concern analyses based on the sentinel surveillance platform that exists at the national level. However, challenges may arise due to inexperience in next-generation-sequencing and bioinformatics.

Country approaches

On 11 December 2020, the Mongolian Ministry of Health issued order A/583 *Incorporating COVID-19 surveillance into Influenza sentinel surveillance interim guidance*, which expanded the number of influenza sentinel surveillance sites nationally. A total of 21 additional sentinel site were established and distributed as follows: three maternal hospitals, four reference centres, nine provincial sites and 14 point of entry sites. Moreover, all provinces established COVID-19 testing capacity.

To cope with the shortage of human resources, health graduate students and retired health workers were mobilized to support activities at sentinel sites. Capacity building included the initial procurement and preparation of spaces and human resources. Once these terms were established, virology laboratory and surveillance specialists conducted on-site and online trainings. Newly expanded sites were given access to the national influenza system for reporting.

Human resource trainings were conducted on multiple subjects (epidemiology, laboratory, clinical management, contact tracing, rapid response, information flow and multi-sectoral collaboration) to further strengthen national capacity.

Mongolia has focused on multi-sectoral collaboration from the start of the COVID-19 pandemic. With this approach, Mongolia has been sharing timely updated guidelines that align with WHO and international collaborators' recommendations and guidelines. In addition, Mongolia is conducting studies for evidence generation as part of the WHO Unity Studies.

Mongolia has also developed national-level electronic contact tracing and case reporting tools to reduce the workload of public health officials.

Lessons learned

The Mongolian NIC continuous experience in influenza surveillance, contributed to the smooth integration of COVID-19 surveillance. In particular, influenza experience facilitated SARS-CoV-2 data collection, evidence processing and sample collection, transportation and storage.

Mongolia has enhanced community and multi-sectoral knowledge and practice for preventing respiratory illness and provided evidence to decision-makers, which helped with vaccine deployment.

The expanded ILI networks helped to monitor the COVID-19 situation at points of entry and maternal hospitals as well as in the community. By expanding the ILI network, decision-makers were informed of e COVID-19 situation reports, and experts were better able to support contact tracing, case management, and relevant activities.

The COVID-19 pandemic experience has helped Mongolia to develop its next generation sequencing capacity building support and variant surveillance planning.

7.3. Strengthening laboratory capacity of the Philippine National Influenza Center

Authors: Mayan U. Lumandas[1] and Vina Lea F. Arguelles[1]

Background

Since 2005, the Philippines has been part of the Global Influenza Surveillance Network (GISN), with the Research Institute for Tropical Medicine (RITM) as the National Influenza Center, with US CDC, and WHO as its partners. Currently, the Philippines has national ILI and SARI surveillance systems that collect samples from ILI/SARI cases from the five subnational laboratories (SNLs) and 17 ILI sites. The Philippine NIC and corresponding SNLs perform virus isolation and PCR detection. The NIC also regularly contributes data to the GISRS.

Between 2005 and 2012, RITM-NIC conducted virologic surveillance using virus isolation procedures. The turn-around time for the release of laboratory results was between 21 and 28 days from receipt of specimens in the laboratory. This resulted in untimely provision of un-subtypable specimens to a WHO CC, which is vital in the identification of viruses with pandemic potential and also for contribution to annual influenza vaccine composition.

When pandemic influenza A(H1N1) occurred in 2009, the National Reference Laboratory for influenza and ORVs housed in RITM was overwhelmed by more than 10 000 specimens for molecular testing. As a solution, five SNLs were established with the support of the Health Facility Development Bureau (HFDB) of the Department of Health. The SNLs were tasked with performing real-time PCR testing of influenza to augment the testing capacity of RITM. However, after the 2009 pandemic, no more specimens were referred to SNLs for molecular testing because the roles and responsibilities were not clear. The COVID-19 pandemic further strained the health system in the Philippines, which experienced a wave of cases in 2020.

Country approaches

Creating a framework

When pandemic influenza A(H1N1) occurred in 2009, the Department of Health – with the support of RITM/NIC–created a Department Personnel Order (DPO) for the establishment of SNLs and of a technical working group. This DPO specified that certain hospitals be upgraded with equipment for molecular testing and identified personnel responsible for laboratory assessments, laboratory upgrading, finalization of specifications and procurement of laboratory equipment. It also included training of staff at subnational level for the laboratory diagnosis of influenza A(H1N1) pdm09, the use of PPE and infection control of influenza A(H1N1)pdm09 virus.

Maintaining proficiency

Following the 2009 pandemic, in order to maintain the proficiency of the SNL staff, RITM-NIC has been regularly providing proficiency test panels and refresher courses for molecular testing. In addition, RITM-NIC has provided trainings to SNL staff on molecular diagnosis of avian influenza, MERS-CoV and Ebola virus and multiplex assays to detect 21 ORVs (FTD 21 KIT). This initiative supported familiarity with laboratory testing of other emerging and re-emerging viruses. Regular monitoring visits to sentinel sites were done to address issues and concerns related to surveillance activities. Visits to SNLs assessed overall readiness to conduct SARI surveillance. Annual feedback meetings with stakeholders were conducted.

[1] National Influenza Center, Research Institute for Tropical Medicine, Alabang, Muntinlupa, Philippines.

Shifting of laboratory procedures
In response to the GISRS recommendations to use rapid and sensitive methods for influenza detection and to improve turnaround time of laboratory results, the Philippines shifted the testing algorithm from virus isolation to molecular testing. This improved the speed with which results could be received. In addition, the Philippines provides clinical samples and isolates to WHO CCs in Australia and Atlanta to help inform vaccine composition every year.

Addressing sustainability
In 2013, NIC also drafted a legal document for the revised terms of reference of the NIC, SNLs and other stakeholders. This administrative order defined operationalization and sustainability of the NIC, including logistical and funding support mechanisms of the Department of Health to RITM-NIC to ensure sustainability of operations of ILI and SARI surveillance. Following consultation with stakeholders, the administrative order was approved and released in the following year.

Integrating ILI, SARI and SARS-CoV-2 surveillance
In 2020, the NIC drafted interim guidelines for enhanced ILI and SARI surveillance. The emergence of SARS-CoV-2 across the country highlighted the need for additional sentinel sites and establishment of genomic surveillance of ILI and SARI specimens. The aim was to move beyond influenza virus detection and include detection and genomic characterization for both influenza and SARS-CoV-2. A series of meetings were organized to finalize the guidelines of the enhanced surveillance and terms of reference of the stakeholders.

Lessons learned

The existing GISRS influenza surveillance systems have become the primary platforms for responding to respiratory outbreaks and pandemics. In the Philippines, the existing national ILI and SARI surveillance system acts as a support mechanism for monitoring possible outbreaks and pandemics. Through the establishment of the SNLs, a framework was built for improved preparedness and response during outbreaks and pandemics. These activities augmented RITM's surge capacity during previous outbreaks as well as on the ongoing COVID-19 pandemic. In particular, through this ongoing surveillance system, there was an ease of referral of samples during the 2009 influenza and COVID-19 pandemics. In addition, establishment of PCR laboratories in several regions to augment the testing capacity of RITM during the 2009 pandemic served as the framework for augmented response to MERS-CoV.

Several trainings were provided by WHO and other collaborators on virus isolation, antiviral susceptibility, RT-PCR tests, sequencing, and bioinformatics that honed the skills of the RITM-NIC staff. In addition, the training of SNL staff on molecular detection of avian influenza, MERS-CoV, and multiplex detection of respiratory viruses prepared them for rapid deployment of SARS-CoV-2 RT-PCR. These trainings had an ancillary benefit because the SNL staff then served as trainers for the expansion of the COVID-19 laboratory network, hosting trainees in the SNLs.

Fast and reliable laboratory surveillance results were provided to stakeholders since the shift of the testing algorithm from virus isolation to RT-PCR testing. This enabled the provision of appropriate response as well as weekly provision of data to FluNet and to sentinel sites and the Epidemiology Bureau of the Department of Health.

In addition, the Philippines is now taking steps to align with the GISRS direction by incorporating genomic sequencing for SARS-CoV-2 into the existing ILI and SARI surveillance of the Philippine National Influenza Centre.

8. References

1. Interpreting influenza surveillance data in the context of the COVID-19 pandemic. WHO Weekly epidemiological record. No 35, 2020, 95, 409–416. Geneva: World Health Organization; 2020 (https://apps.who.int/iris/bitstream/handle/10665/334024/WER9535-eng-fre.pdf?sequence=1&isAllowed=y, accessed 19 December 2022).

2. Global Influenza Surveillance and Response System (GISRS). Geneva: World Health Organization (https://www.who.int/initiatives/global-influenza-surveillance-and-response-system, accessed 19 December 2022).

3. Maintaining surveillance of influenza and monitoring SARS-CoV-2 – adapting Global Influenza surveillance and Response System (GISRS) and sentinel systems during the COVID-19 pandemic: interim guidance. Geneva: World Health Organization; 2020 (WHO/2019-nCoV/ Adapting_GISRS/2020.1). Licence: CC BY-NC-SA 3.0 IGO (https://apps.who.int/iris/rest/bitstreams/1316069/retrieve, accessed 19 December 2022).

4. Operational considerations to expedite genomic sequencing component of GISRS surveillance of SARS-CoV-2. Geneva: World Health Organization; 2021 (WHO/2019-nCoV/ genomic_sequencing/GISRS/2021.1). Licence: CC BY-NC-SA 3.0 IGO. (https://apps.who.int/iris/rest/bitstreams/1332762/retrieve, accessed 19 December 2022).

5. Corman VM, Landt O, Kaiser M, Molenkamp R, Meijer A, Chu DKW, et al. Detection of 2019 novel coronavirus (2019-nCoV) by real-time RT-PCR. Euro Surveill. 2020;25(3):pii=2000045 (https://doi.org/10.2807/1560-7917.ES.2020.25.3.2000045, accessed 19 December 2022).

6. Lineamiento Estandarizado para la Vigilancia Epidemiológica y por Laboratorio de la enfermedad respiratoria viral. Dirección General de Epidemiología, Gobierno de Mexico (https://www.gob.mx/cms/uploads/attachment/file/715444/Lineamiento_VE_y_Lab_Enf_Viral_05042022.pdf, accessed 19 December 2022).

7. Weekly bulletin acute respiratory infections. Sciensano, Brussels, Belgium (https://www.sciensano.be/en/node/464, accessed 19 December 2022).

8. Weekly national seasonal respiratory report. Public Health Scotland, Glasgow, Scotland, United Kingdom (https://publichealthscotland.scot/publications/weekly-national-seasonal-respiratory-report/weekly-national-seasonal-respiratory-report-week-36-2021/, accessed 19 December 2022).

9. Selected further readings

Argentina

- Consenso sobre el uso de pruebas diagnósticas para SARS-Cov-2. Banco de Recursos de Comunicación del Ministerio de Salud de la Nación. Ministerio de Salud Argentina (**https://bancos.salud.gob.ar/recurso/consenso-sobre-el-uso-de-pruebas-diagnosticas-para-sars-cov-2**, accessed 19 December 2022).
- Guía para equipos de salud para la vigilancia de infecciones respiratorias agudas en el contexto de la pandemia por COVID-19. Banco de Recursos de Comunicación del Ministerio de Salud de la Nación. Ministerio de Salud Argentina (**https://bancos.salud.gob.ar/recurso/guia-para-equipos-de-salud-para-la-vigilancia-de-infecciones-respiratorias-agudas-en-el**, accessed 19 December 2022).
- Integración de la vigilancia genómica de SARS-CoV-2 a la vigilancia de COVID-19 a través del sistema nacional de vigilancia de la salud. Versión 1. 04/2021. Ministerio de Salud Argentina (**https://bancos.salud.gob.ar/sites/default/files/2021-04/SNVS_integracion-de-la-vigilancia-genomica_de_SARS-CoV-2.pdf**, accessed 19 December 2022).

Italy

- InfluNet weekly bulletin. Istituto Superiore di Sanità, Rome, Italy (**https://w3.iss.it/site/RMI/influnet/pagine/rapportoInflunet.aspx**, accessed 19 December 2022).
- Puzelli S, Di Martino A, Facchini M, Fabiani C, Calzoletti L, Di Mario G, et al. Co-circulation of the two influenza B lineages during 13 consecutive influenza surveillance seasons in Italy, 2004–2017. BMC Infect Dis 19, 990 (2019). (**https://doi.org/10.1186/s12879-019-4621-z**, accessed 19 December 2022).
- Sorveglianza virologica dell'influenza (Rete InfluNet). Istituto Superiore di Sanità, Rome, Italy (**https://www.iss.it/sorveglianza-virologica-dell-influenza-influnet**, accessed 19 December 2022).

Philippines

- Leang SK, Deng YM, Shaw R, Caldwell N, Iannello P, Komadina N, et al. Influenza antiviral resistance in the Asia-Pacific region during 2011. Antiviral Research 97(2013) 206–210. (**https://doi.org/10.1016/j.antiviral.2012.12.016**, accessed 19 December 2022).
- Lucero MG, Inobaya MT, Nillos LT, Tan AG, Arguelles VLF, Dureza JCJ, et al. National Influenza Surveillance in the Philippines from 2006 to 2012: seasonality and circulating strains. BMC Infect Dis 16, 762 (2016). (**https://doi.org/10.1186/s12879-016-2087-9**, accessed 19 December 2022).
- Members of the Western Pacific Region Global Influenza Surveillance Response System; Dwyer D, Barr I, Hurt A, Kelso A, Reading P, Sullivan S, et al. Seasonal influenza vaccine policies, recommendations and use in the World Health Organization's Western Pacific Region. Western Pac Surveill Response J. 2013 Mar 3;4(3):51-9. (**https://doi.org/10.5365/wpsar.2013.4.1.009**, accessed 19 December 2022).

- Pamaran RR, Kamigaki T, Hewe TT, Flores KM, Mercado ES, Alday PP, et al. Epidemiological characterization of influenza A(H1N1)pdm09 cases from 2009 to 2010 in Baguio City, the Philippines. PLoS One. 2013 Nov 11;8(11):e79916. (https://doi.org/10.1371/journal.pone.0079916, accessed 19 December 2022).
- Tallo VL, Kamigaki T, Tan AG, Pamaran RR, Alday PP, Mercado ES, et al. Estimating influenza outpatients' and inpatients' incidences from 2009 to 2011 in a tropical urban setting in the Philippines. Influenza Other Respir Viruses. 2014 Mar;8(2):159-68. doi: 10.1111/irv.12223. (https://doi.org/10.1111/irv.12223, accessed 19 December 2022).
- Western Pacific Region Global Influenza Surveillance and Response System. Epidemiological and Virological Characteristics of Influenza in the Western Pacific Region of the World Health Organization, 2006–2010. PLoS One. 2012;7(5):e37568. (https://doi.org/10.1371/journal.pone.0037568, accessed 19 December 2022).

Spain

- Sistema de Vigilancia de la Gripe y otros virus respiratorios en España. Instituto de Salud Carlos III, Madrid, Spain. (https://vgripe.isciii.es/inicio.do;jsessionid=6D1EE8B4B08ADD2FD0E229E219DF536C, accessed 19 December 2022).
- Weekly report on the ARI and SARI surveillance in Spain. Instituto de Salud Carlos III, Madrid, Spain. (https://www.isciii.es/QueHacemos/Servicios/VigilanciaSaludPublicaRENAVE/EnfermedadesTransmisibles/Paginas/Temporada_Gripe_2010-21.aspx, accessed 19 December 2022).

Global Influenza Programme
World Health Organization

Avenue Appia 20
1211 Geneva 27
Switzerland
www.who.int
influenza@who.int

9789240056701