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EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL

OPERATIONAL SUPPORT

Integrated respiratory virus surveillance guidance for the EU/EEA

A framework for surveillance to inform public health action

Version 1.0

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Abbreviations

AAR	After-Action Review (AAR)
ARI	Acute respiratory infection
EBS	Event-based surveillance
ECDC	European Centre for Disease Prevention and Control
EEA	European Economic Area
EHDS	European Health Data Space
EHR	Electronic health record
EPIET	ECDC Fellowship programme for field epidemiology
EQA	External quality assurance (EQA)
ERVI-NET	European Respiratory Viruses Network
ERVISS	European Respiratory Virus Surveillance Summary
EU	European Union
EUPHEM	ECDC Fellowship programme for public health microbiology
EURL	European Union Reference Laboratory
EURL-RESVIR	EU Reference Laboratory for Respiratory Viruses
EWRS	EU Early Warning and Response System
GISRS	WHO's Global Influenza Surveillance and Response System
ICU	Intensive care unit
IHR	International Health Regulations
ILI	Influenza-like illness
IPC	Infection prevention and control
ISO	International Organization for Standardization
JEE	Joint External Evaluation
NAAT	Nucleic Acid Amplification Test
PPE	Personal protective equipment
PHEPA	Public Health Emergency Preparedness Assessment
PHSM	Public health and social measures
RADT	Rapid antigen detection test
RSV	Respiratory Syncytial Virus
RT-PCR	Reverse Transcription Polymerase Chain Reaction
SARI	Severe acute respiratory infection
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SNP	Single nucleotide polymorphism
SPAR	Self-Assessment Annual Report (IHR)
SUREHD	Surveillance from Electronic Health Data
VE	Vaccine effectiveness
VTM	Viral transport medium
WBS	Wastewater-based surveillance
WGS	Whole genome sequencing
WHO	World Health Organization
WHO CC	World Health Organization Collaborating Centre

Executive summary

Integrated respiratory virus surveillance combines information from multiple sources to provide a comprehensive assessment of acute respiratory illness in the population. Effective integrated surveillance should generate information to guide public health actions, such as data interpretation, reporting and communication and prevention and control measures.

This guidance supports the fulfilment of EU legislation which sets the requirements for coordinated surveillance, early warning, and response. It focuses on the routine indicator- and event-based surveillance of respiratory viruses, including influenza viruses, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and Respiratory Syncytial Virus (RSV). Although this guidance does not specifically focus on surveillance of zoonotic influenza viruses or overall pandemic preparedness, its implementation will support and strengthen both areas. The guidance defines action-oriented surveillance objectives; the mix and design of surveillance systems needed to meet them, and how the resulting data are analysed to inform action at different levels. Its development was informed by a working group of members of the European Respiratory Viruses Network (ERVI-NET). This guidance is also intended to support national and subnational public health authorities in decisions concerning the allocation of resources for surveillance.

Three overarching objectives guide integrated respiratory virus surveillance in the European Union/European Economic Area (EU/EEA):

1. Monitor epidemiological characteristics in time, person and place of acute respiratory illness due to influenza viruses, SARS-CoV-2, RSV and other respiratory pathogens to detect changes that can inform national and EU-level prevention and control measures.
2. Monitor virological changes and characteristics of circulating and emerging influenza, SARS-CoV-2 and RSV viruses to detect changes that can inform national and EU-level prevention and control measures.
3. Assess the burden of disease and the effectiveness and impact of interventions against acute respiratory illness due to influenza viruses, SARS-CoV-2, RSV and other respiratory pathogens.

Objectives 1 and 2 describe timely, continuous epidemiological monitoring and virus characterisation, which is the foundation of routine respiratory virus surveillance. Objective 3 describes key areas where surveillance data can be used for studies to contribute evidence to guide the investment and targeting of interventions. Sub-objectives provide a more complete description of the purpose and scope of each objective. The sub-objectives are broken down into the information required from surveillance to inform action.

This framework provides the foundation for identifying the most appropriate mix of surveillance systems required to fully meet the objectives. Design aspects are also outlined for systems that are fit for purpose and sustainable. National or subnational public health authorities should map the data sources available to them to understand gaps and opportunities.

Core surveillance systems should be prioritised for routine epidemiological monitoring and virus characterisation. They include surveillance in primary care and hospitals, virus characterisation, laboratory-based surveillance and event-based surveillance. When used together, core systems can complement one another to meet many of the surveillance objectives:

- Well-designed systems based on the influenza-like illness (ILI), acute respiratory infection (ARI) and severe acute respiratory infection (SARI) syndromic case definitions with integrated virological testing remain the principal approach for integrated respiratory virus surveillance.
- Hospital-based surveillance is central to understanding severity and impact and cannot be readily replaced by other systems. Surveillance that is based on the SARI syndromic case definition with integrated virological testing is preferred over laboratory-confirmed hospital surveillance since it can contribute more fully to both epidemiological and virus characterisation objectives.
- National or subnational capacity for routine genomic virus characterisation is required to meet Objective 2. Where countries do not have capacity for phenotypic characterisation, selected specimens can be sent using established supranational mechanisms.
- Case-based data, particularly for severe disease, are required at national/subnational and EU/EEA levels to facilitate the advanced analyses needed to fully meet the surveillance objectives, including estimation of risk factors, burden and evaluation of interventions. Data linkage, ideally across the clinical care spectrum, is essential to ensure completeness of key variables, and assess severity, clinical outcomes and the impact of interventions.

Supplementary surveillance systems provide additional information not captured by core systems, covering different populations and more of the surveillance pyramid. They can be selected to address weaknesses or gaps in core systems and to ensure adequate coverage across the surveillance pyramid. Examples commonly used in the EU/EEA include mortality monitoring, monitoring of outbreaks in specific settings, wastewater-based and participatory surveillance.

Complementary data sources provide information that is vital for strengthening public health decision-making but since these sources are often beyond the organisational remit of respiratory virus surveillance teams, they are considered outside of routine surveillance. They include hospital occupancy monitoring, data on vaccine coverage, drivers of vaccine hesitancy and pharmaceutical usage data.

It is important to maintain the ability to detect signals, monitor the impact on healthcare and characterise circulating viruses at any time of the year through indicator- and event-based surveillance. SARS-CoV-2 has not become a seasonal winter virus and out-of-season epidemics of RSV and influenza viruses can occur. Similarly, influenza viruses detected during the summer can support early assessments of the coming winter season and may provide a signal of zoonotic non-seasonal virus transmission. Year-round, consistent data also supports the setting of thresholds, analysis and signal detection. Where resources are limited, surveillance in the summer should, at a minimum, allow for detection, assessment and communication of epidemiological and virological signals, with the option to scale up, as required.

The optimal combination and design of surveillance systems is context-specific and can evolve over time. It may be necessary to periodically review and adapt the mix of surveillance systems, taking into consideration new technologies and developments, especially as the use of electronic health data continues to expand and emerging AI applications reshape public health surveillance. Reductions in human and financial resources available for surveillance may also affect which systems can run and how well they are maintained.

Ensuring the quality and readiness of respiratory virus surveillance is an ongoing, cyclical process to assess whether surveillance systems can continue to meet their objectives under routine conditions and in periods of increased threat. Monitoring and evaluation, preparedness planning, collaboration and exchange all support this process, ensuring that surveillance systems can adapt to changes, while maintaining robustness, comparability, and sustainability.

Priorities for effective surveillance

This guidance presents a framework for integrated respiratory virus surveillance as information for action in support of the fulfilment of Regulation (EU) 2022/2371 [1] and Commission Implementing Decision (EU) 2018/945 [2]. National or subnational surveillance that can produce timely, high-quality data is essential for each country and is the foundation of EU-level monitoring and public health action. To ensure effective surveillance, public health authorities should use this guidance to:

1. Review their surveillance objectives to ensure coherence with the EU/EEA objectives, which support the fulfilment of the EU legal framework.
2. Determine the most appropriate mix and design of surveillance systems and other data available within their context to meet the surveillance objectives, with a focus on the elements below.
    - Prioritising ILI/ARI surveillance in primary care, hospital surveillance (preferably based on SARI), genomic virus characterisation, laboratory-based and event-based surveillance. Well-designed systems based on the ILI, ARI and SARI syndromic case definitions, integrating both syndromic and virological data, remain the cornerstone of integrated respiratory virus surveillance.
    - Mapping the availability of data from other surveillance systems and complementary sources and incorporating it to cover gaps and ensure adequate coverage across the surveillance pyramid.
    - Establishing case-based data collection with data linkage to facilitate the advanced analyses (including estimation of risk factors, burden, severity assessment and evaluation of interventions such as immunisation effectiveness) needed to guide the appropriate allocation of resources and inform prevention and control measures.
    - Periodically reviewing and adapting the mix of surveillance systems, taking into consideration new technologies and emerging developments.
3. Establish, refine and document surveillance processes to ensure that surveillance data are routinely used for public health actions at the appropriate geographical level and frequency.
    - Maintain ongoing data interpretation, reporting and communication as the foundation of surveillance.
        - Routine reporting and communication from the monitoring of trends and signal detection.
        - In-depth assessment in response to relevant signals, with communication of risk and public health recommendations.
        - Regular data consolidation and analysis to contribute to scientific knowledge and improve long-term data quality.
    - Use the evidence generated above to inform prevention and control measures covering pharmaceutical interventions, public health and social measures and healthcare planning.
    - Plan time and resources for continuous monitoring of performance and periodic in-depth evaluations.
4. Maintain event-based and integrated indicator-based respiratory virus surveillance year-round for situational awareness, preparedness, and data consistency.
5. Ensure effective, targeted virological surveillance by:
    - Using multiplex Reverse Transcription (RT) Polymerase Chain Reaction (PCR) as the preferred detection method for surveillance purposes.
    - Typing and subtyping all positive influenza virus specimens from sentinel sites that swab ILI/ARI/SARI cases for surveillance. This is important for the detection of zoonotic non-seasonal influenza virus subtypes and is the first step in monitoring potential mismatches against northern hemisphere vaccine components that can be later confirmed by other data. The source of specimens for typing and subtyping can be expanded to other surveillance types in the inter-seasonal period.
    - Typing sentinel RSV specimens to monitor the epidemiology of circulating RSV viruses.
    - Maintaining capacity for routine genomic virus characterisation of influenza viruses, SARS-CoV-2 and RSV as an essential element to meet surveillance objectives. The 'right sizing' module which will be published later in 2026, includes detailed considerations concerning the most appropriate frequency, source and number of specimens for sequencing analysis.
    - Where resources for phenotypic characterisation are lacking, sending selected virus specimens for further characterisation to reference laboratories, the WHO Collaborating Centre or the European Union Reference Laboratory for Public Health on Respiratory Viruses (EURL-PH-RESVIR), depending on the specific arrangements for individual viruses.

Introduction

Background and purpose

In the EU, the surveillance of respiratory viruses is carried out within a structured legal and operational framework established by Regulation (EU) 2022/2371 on serious cross-border threats to health [1] and Commission Implementing Decision (EU) 2018/945, which defines the list of communicable diseases and related case definitions [2]. Together, they set the requirements for coordinated surveillance, early warning, and response across the EU/EEA, ensuring that national or subnational systems generate high-quality data to support national and EU-level public health action.

Building on this framework, Implementing Regulation (EU) 2025/2537 [3] establishes the operational rules for the European Union Reference Laboratories (EURLs), designated under Regulation (EU) 2022/2371. The Regulation defines the roles of EURLs in supporting Member States through harmonised laboratory methods, quality assurance schemes, confirmatory testing, and technical guidance.

The European Centre for Disease Prevention and Control (ECDC) coordinates the European Respiratory Viruses Network (ERVI-NET) of nominated experts from public health authorities in EU/EEA countries. ECDC also collaborates with the World Health Organization (WHO) Regional Office for Europe on the coordinated collection of respiratory virus surveillance data from all countries in the European region through EpiPulse Cases. These data are published weekly in the jointly developed European Respiratory Virus Surveillance Summary (ERVISS) [4].

To support surveillance within ERVI-NET and to provide the operational detail needed for fulfilment of the EU legislation, ECDC has produced this guidance for EU/EEA countries focusing on the routine integrated surveillance of respiratory viruses. This guidance replaces the 2022 ECDC/WHO Regional Office for Europe 'Operational Considerations for Respiratory Virus Surveillance in Europe' [5]. The guidance should not only inform how surveillance is implemented, but also support national and subnational public health authorities in allocating sufficient resources for surveillance.

The guidance is tailored to the EU/EEA context and coherent with the guidance published in 2024 for WHO's Global Influenza Surveillance and Response System (GISRS) [6]. It sets out action-oriented surveillance objectives. These objectives are intended to support the design, implementation and long-term continuity of integrated respiratory virus surveillance systems whose data can inform effective and timely disease prevention and control measures.

Scope

This document is the main module of a suite of documents that together comprise guidance for integrated respiratory virus surveillance in the EU/EEA. Additional modules will be published as separate, linked documents, covering individual topics in detail. Two modules are planned for later in 2026, covering 'right-sizing' of epidemiological and genomic surveillance, and the use of thresholds for surveillance data. This document may be updated to reflect new developments or when new modules are published.

We recognise the vital importance of electronic health record (EHR)-based surveillance for respiratory viruses and aim to publish preliminary guidance covering some aspects of this broad topic in 2027. A similar development may be possible for wastewater-based surveillance (WBS) of respiratory viruses in the future. Another important area requiring detailed guidance is the monitoring and assessment of seriousness, impact and burden of disease using surveillance data in the EU/EEA.

The following topics are outside the scope of this guidance:

- The surveillance of zoonotic influenza viruses, which is covered in other ECDC guidance [7]. However, implementation of the current guidance should support and strengthen zoonotic influenza virus surveillance and pandemic preparedness more broadly.
- The reporting of data to EpiPulse cases, covered in the ECDC Reporting Protocol for respiratory virus surveillance [8].

Target audience

The intended audience for this document is:

- national and subnational public health authorities and experts responsible for the design, implementation, and coordination of respiratory virus surveillance across the EU/EEA;
- other relevant European stakeholders, including the European Commission and WHO Regional Office for Europe.

Guidance development process

The guidance was informed by a working group established in April 2025 through a call for expression of interest to ERVI-NET. Three subgroups were formed to separately develop content on action-oriented surveillance objectives, 'right-sizing' and thresholds. Regular group meetings were coordinated by ECDC, with subgroup members providing written and verbal input on ECDC-drafted outputs. These outputs were used by ECDC during the drafting of the guidance. A list of working group members who focused on action-oriented surveillance objectives appears at the start of this document.

Action-oriented integrated surveillance

Integrated respiratory virus surveillance combines information from multiple sources to provide a comprehensive assessment of acute respiratory illness in the population. It brings together epidemiological and virological information to describe disease patterns across the spectrum of severity and the respiratory pathogens that drive these patterns. It can also provide data for studies to guide the appropriate allocation of resources.

Effective integrated surveillance should generate information to guide public health actions. These range from data interpretation, reporting and communication, to public health prevention and control measures, covering pharmaceutical interventions, public health and social measures (PHSM) and healthcare planning.

Surveillance objectives

Three overarching objectives for integrated respiratory virus surveillance in the EU/EEA are presented below:

1. Monitor epidemiological characteristics in time, person and place of acute respiratory illness due to influenza viruses, SARS-CoV-2, RSV and other respiratory pathogens to detect changes that can inform national and EU-level prevention and control measures.
2. Monitor virological changes and characteristics of circulating and emerging influenza, SARS-CoV-2 and RSV viruses to detect changes that can inform national and EU-level prevention and control measures.
3. Assess the burden of disease and the effectiveness and impact of interventions against acute respiratory illness due to influenza viruses, SARS-CoV-2, RSV and other respiratory pathogens.

Objectives 1 and 2 describe timely, continuous epidemiological monitoring and virus characterisation, which is the foundation of routine respiratory virus surveillance. Objective 3 describes key areas where surveillance data can be used for studies to contribute evidence in order to guide the investment and the targeting of interventions. These EU/EEA surveillance objectives are coherent with global objectives for integrated surveillance published by WHO [6] and those published by ECDC and WHO Regional Office for Europe in 2022 [5], as described in Annex 1.

Each objective is split into sub-objectives which provide a more complete description of the purpose and scope of the objective. The sub-objectives can be broken down into 'information requirements' (Table 1). These provide the basis for linking surveillance systems and other complementary sources to information for public health action, as described later in this section.

Table 1. Sub-objectives and associated information requirements for each surveillance objective

Sub-objective		Information requirement	Data*
Objective 1			
1a	Describe illness in time, person and place across the surveillance pyramid and estimate the relative contribution of different viruses.	• Syndromic and virus-specific measures of transmissibility, severity and impact. • Notifications of clusters or outbreaks in specific groups or settings. • Virological data from the testing of patients who meet a syndromic case definition. • Distribution of type, subtype and lineage.	S S S S
1b	Describe epidemic intensity, timing and seasonality with defined thresholds.	• Intensity levels for syndromic and virus-specific illness. • Epidemic onset, offset, peak and duration.	S S
1c	Determine groups/settings at highest risk of severe disease and which would benefit most from interventions.	• Risk factors for severe disease. • Prevalence or population size estimates for each target group. • Population attributable fraction by group/setting.	S C C
1d	Identify unexpected patterns of disease in time, person, place or clinical presentation.	• Clusters of unusual (time/person/place/speed of spread/clinical presentation) illness. • Changes in the distribution of symptoms. • Changes in the distribution of known risk factors in severe cases. • Changes in the distribution of vaccine status in severe cases.	S, C S S S
Objective 2			
2a	Identify emerging genetic lineages - clade, subclade, variant.	• Characterise circulating lineages from genomic surveillance.	S
2b	Determine susceptibility of circulating viruses to available antiviral drugs	• Genotypic markers associated with reduced susceptibility. • Phenotypic antiviral susceptibility.	S S
2c	Assess the evolution of viruses compared to previous seasons, including their match with immunisation products.	• Compare circulating subtype/clades to those from recent seasons. • Characterise circulating viruses for their genetic profile vs vaccine strains. • Characterise circulating viruses for their antigenic profile vs vaccine strains. • Vaccine composition meeting data.	S S S C
2d	Determine if circulating viruses are detected by available diagnostics.	• Data on effectiveness of diagnostics to circulating viruses.	S, C
2e	Assess if an emerging virus/lineage is more transmissible or virulent.	• Transmissibility and infection-severity data comparing circulating lineages. • Data on infectivity, severity, immune evasion of a new virus. • Epidemiological data from other countries to assess the possible impact of a new virus.	S C C
Objective 3			
3a	Describe the burden of disease.	• Estimates of burden based on surveillance data. • Other burden of disease estimates.	S, C C
3b	Assess the effectiveness and impact of immunisation programmes.	• Estimates of immunisation impact based on surveillance data. • Estimates of vaccine effectiveness based on surveillance data†. • Other vaccine effectiveness estimates. • Immunisation coverage data by group/setting. • Adherence and drivers of immunisation hesitancy.	S, C S C C C

** Data column indicates the main source of data to fulfil the information requirement: S = routine surveillance; C = complementary sources.*

† Estimates of vaccine effectiveness are based on surveillance data by group/setting, subtype, lineage, or time since vaccination.

Definitions: transmissibility (how many individuals become ill), severity (how ill infected individuals become), impact (effect of virus activity on the health care system or society) [6]. Time: trends and seasonal comparison, person: specific populations or groups, place: settings, regions or countries. 'Severe disease' and 'severe cases' refer mainly to hospitalised patients but could also include community-acquired pneumonia which can be used as an indicator of severity among patients presenting to primary care.

Surveillance system choices to meet the objectives

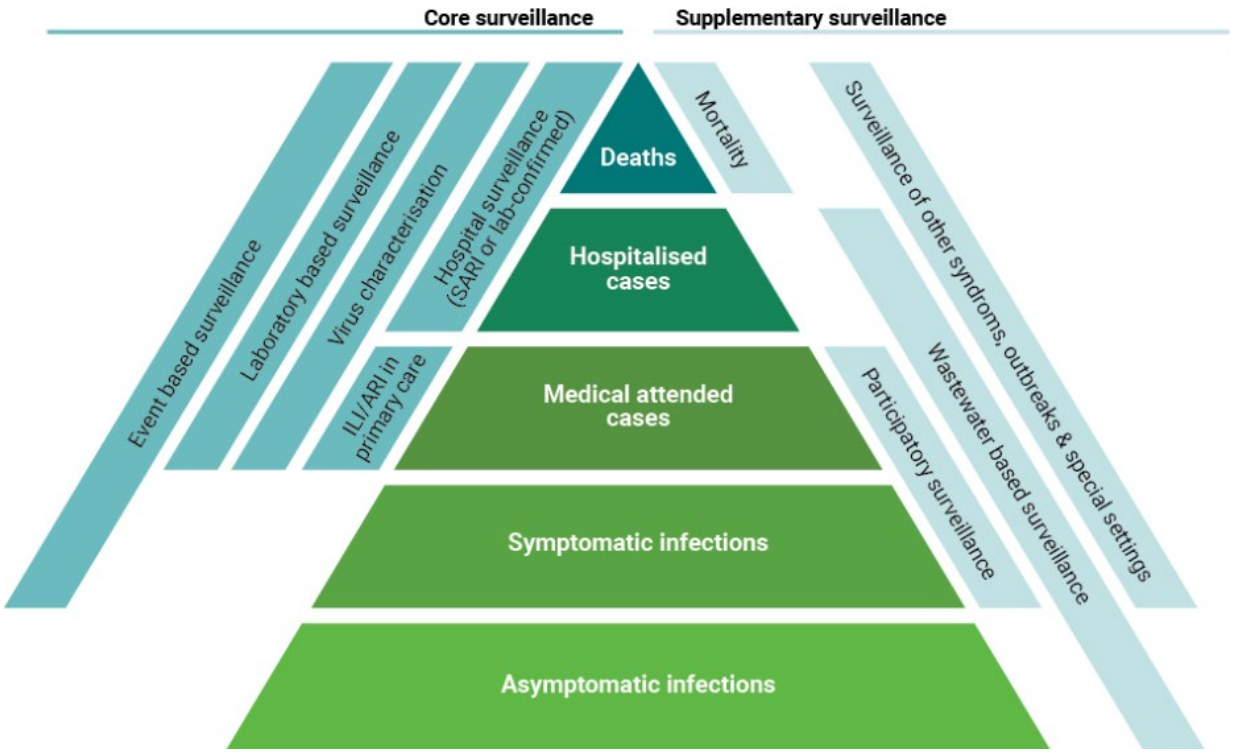
Surveillance systems can be divided into two broad groups.

Core surveillance systems should be prioritised for routine epidemiological monitoring and virus characterisation. Core indicator-based surveillance systems focus on the slice of the surveillance pyramid covering symptomatic, medically attended patients. Event-based surveillance (EBS) could cover any part of the pyramid from symptomatic infections and above (Figure 1).

Supplementary surveillance systems provide additional information not captured by core systems, covering different populations and more of the surveillance pyramid. Some of these systems may be a substitute when core systems are either not available or insufficiently sized to provide interpretable data.

The parts of the surveillance pyramid covered by core and supplementary surveillance systems are illustrated in Figure 1.

Figure 1. Surveillance pyramid with core and supplementary surveillance systems



Source: ECDC

A brief description of the main core and supplementary surveillance systems in use across the EU/EEA is provided in Table 2, with further detail provided in 'Surveillance systems and data sources'.

Table 2. Overview of respiratory virus surveillance systems

System	Key attributes
Core surveillance	
ILI/ARI surveillance in primary care	Monitors respiratory virus circulation in the community by capturing mild-to-moderate illness through syndromic ILI/ARI consultations. Population under surveillance should be well-defined and representative, allowing incidence to be estimated. A subset of cases is swabbed according to a standardised protocol and multiplex testing is used to understand the relative contribution of circulating viruses. It provides early warning of increased intensity of transmission, making it important for timely adoption of prevention and control measures. Well-established with many years of historic data in many EU/EEA countries, supporting robust calculation of epidemic and intensity thresholds.
Hospital surveillance: a. SARI (priority); and/or b. Laboratory-confirmed hospitalisations	Monitors severe respiratory illness by capturing patients admitted to hospital that meet the syndromic case definition of a severe acute respiratory infection (SARI). Severity (e.g. intensive care unit (ICU) admission) and outcome (discharge or death) should be recorded. Multiplex virological testing and a well-defined population provide similar benefits to those listed for ILI/ARI.
	Monitors patients admitted to hospital or ICU testing positive for a respiratory virus, with no syndromic component. Clinical indication for testing is usually not known. Multiplex testing may not be used.
Genomic virus characterisation	Molecular sequencing and analysis of respiratory viruses to monitor genetic diversity and identify emerging lineages.
Phenotypic virus characterisation	Laboratory-based assessment of viral phenotypic properties, such as antigenic characteristics against vaccine viruses and antiviral susceptibility.
Laboratory-based surveillance	Monitors respiratory virus activity through reporting of laboratory test results. The notification of positive results is often mandatory. Good geographical coverage, year-round in most countries. Typically provide stable, interpretable trends. The indication and setting for testing are often unknown and patient-level clinical information may be limited. Severe illness is likely to be over-represented in countries with limited routine testing in primary care.
Event-based surveillance	The systematic collection, monitoring, assessment, and interpretation of predominantly unstructured, ad hoc information from a wide range of sources to detect potential public health events or risks [9]. Valuable for signal detection due to increased timeliness and sensitivity compared to indicator-based surveillance.
Supplementary surveillance	
Mortality monitoring	Assesses the impact of respiratory viruses on mortality through cause-specific mortality data (deaths among people who recently tested positive for a respiratory virus, or via extraction from death registers) and through all-cause excess mortality monitoring (comparing observed with expected numbers of deaths due to any cause).
Syndromic surveillance in specific settings and populations	Structured syndromic surveillance (ILI/ARI/SARI or more specific syndromes such as pneumonia or bronchiolitis) at different points of entry to the healthcare system, in defined populations or specific settings (e.g. paediatric mortality surveillance, emergency department surveillance, outbreaks in long-term care facilities).
Wastewater-based surveillance (WBS)	Monitoring of respiratory virus circulation through the detection and quantification of viral genetic material in wastewater.
Participatory surveillance	Engages volunteers from the general population who routinely report and transmit health-related information, typically through digital platforms to monitor respiratory symptoms and support early detection of changes in disease activity. May also include self-sampling, allowing integration of the syndromic and virological information.

Note: registries (e.g. vaccination, administrative, or healthcare registries) are not listed in the table as standalone surveillance systems, however, they can provide essential supplementary data when linkable to individual-level data from one or more of the surveillance systems described above (see 'Surveillance system design 'for further detail).

Figure 2 maps surveillance systems to the sub-objectives and information requirements, allowing conclusions to be drawn on the role of different data sources in meeting the surveillance objectives.

When used together, core systems (surveillance in primary care and hospitals, virus characterisation, laboratory-based surveillance and EBS) can complement one another to meet most of the information requirements and sub-objectives for Objectives 1 and 2.

Well-designed systems based on the ILI, ARI and SARI syndromic case definitions with integrated virological testing remain the principal approach for integrated respiratory virus surveillance.

Hospital-based surveillance is central to understanding severity and impact and cannot be readily replaced by other systems. SARI is preferred over laboratory-confirmed hospital surveillance since the characteristics of well-designed SARI surveillance (Table 2) enable it to contribute more fully to both epidemiological and virus characterisation objectives.

Without genomic surveillance it is not possible to fully meet any of the sub-objectives for Objective 2. Phenotypic virus characterisation is necessary to fully meet sub-objectives 2b and 2c, although this is not required in all countries since supranational mechanisms exist for this (see 'Virological surveillance' below).

High quality case-based data (mainly from severe disease surveillance) are required to fully meet sub-objectives 1c, 2e and 1d. However, it is only possible to identify unexpected clinical presentations through routine indicator-based surveillance data if the system is specifically designed to do so, making EBS particularly important for 1d.

Many supplementary systems offer additional breadth and diversity compared to core systems. For example, the addition of mortality monitoring and surveillance in long-term care facilities would cover populations vulnerable to severe illness that might be missed through hospital surveillance, thus strengthening sub-objectives 1a and 1d. Supplementary systems should be selected to cover weaknesses or gaps in core systems and ensure adequate coverage across the surveillance pyramid.

Surveillance data, particularly case-based data of sufficient quality, can be used for in-depth analyses, needed to inform public health actions, and studies to estimate the burden and impact of interventions for Objective 3. The mix and design of surveillance systems will determine the scope of disease burden and impact that can be estimated. Data from supplementary systems may enhance these analyses. Analytical capacity and the way in which data are collected are also key limiting factors. Some studies can be performed using data from core surveillance settings with enhanced data collection/linkage (see 'Case-based data and data linkage'). More detailed epidemiological information or additional swabs for virological testing may be collected from dedicated surveillance sites [6] to support the estimation of vaccine effectiveness embedded within surveillance [10]. In addition to addressing sub-objectives 3a and 3b, surveillance data may also contribute to studies aimed at assessing the effectiveness and impact of PHSM and the cost-effectiveness of interventions. Monitoring and evaluation of interventions is in the primary interest of public health.

Data from routine surveillance alone are insufficient to satisfy all information requirements, as shown in the final column of Table 1 and the grey boxes in Figure 2. Complementary data sources are needed to complete the picture and provide information which is vital to strengthening situational awareness and informing public health decision-making. These sources include hospital or ICU occupancy/capacity monitoring, data on vaccine coverage, drivers of vaccine hesitancy and pharmaceutical usage data. As they are not readily available in all contexts and are often beyond the organisational remit of respiratory virus surveillance teams, they are considered to be outside of routine surveillance (see 'Surveillance systems and data sources'). National or subnational public health authorities should map the data sources available to them to understand gaps and opportunities for obtaining access.

The best overall mix of surveillance systems for a country will be context specific. It may also evolve if the contribution of individual systems changes with factors such as technological developments. Reductions in human and financial resources available for surveillance may affect which systems can run and how well they are maintained, thereby affecting sustainability and consistency (see 'Surveillance system design'). It is therefore important to routinely reassess performance against surveillance objectives and to conduct periodic in-depth surveillance system evaluations (see 'Ensuring surveillance quality and readiness').

Figure 2. Relationship between surveillance objectives, sub-objectives, information requirements and data from surveillance and complementary sources

Source: ECDC.
Notes: see 'Surveillance systems and data sources', Table 2 and definitions below Table 1. Most data collection and analysis occurs at the national or subnational level (N). Some may also be performed supranationally, in addition to, or instead of (sub)national level analyses: European (EU - e.g. ECDC, EURL or ECDC-funded projects); other supranational (e.g. WHO-Collaborating Centre (WHO-CC) (S). Assumptions for information requirements to be fully met by the associated surveillance systems: core systems are well designed (see 'Surveillance system design' below); high quality case-based data (mainly from severe disease surveillance) is available for sub-objectives 1c, 2e and 1d (for 1d this information can be obtained from event-based surveillance, but also from indicator based surveillance where these variables are routinely collected); participatory surveillance includes self-sampling and lab testing.

Informing public health action

Surveillance data should ultimately inform public health action. These actions are wide-ranging and can be broadly grouped according to:

- data interpretation, reporting and communication, which is a major task of surveillance teams and the foundation for evidence generation to inform recommendations on prevention and control;
- public health prevention and control measures, covering pharmaceutical interventions, PHSM [11] and healthcare planning.

These actions and the typical frequency and level at which they are undertaken are summarised in Table 3.

Table 3. Public health actions that use and are informed by respiratory virus surveillance data

Domain	Public health actions	Typical frequency	Relevant level
Data interpretation, reporting and communication			
1. Routine, monitoring, assessment, communication, evidence generation	A. Routine reporting and communication based on timely monitoring of trends and detection of signals.	Ongoing	(Sub)national, supranational
	B. Perform in-depth situational/risk assessment (rapid analysis and interpretation of diverse data combined with expert opinion) in response to relevant signals, communicate risk and public health recommendations.	Ongoing (in response to epidemiological or virological signals)	(Sub)national, supranational
	C. Consolidate and analyse data (summarise recent epidemics, undertake studies, generate hypotheses to set an agenda for further research), disseminate findings to contribute to scientific knowledge, improve long-term data quality.	Annual	(Sub)national, supranational
Public health prevention and control measures			
2. Immunisation by vaccines or monoclonal antibodies	A. Review and update composition of vaccines and monoclonal antibodies.	Biannual	Supranational
	B. Identify, quantify, inform and prioritise target groups and settings for immunisation campaigns.	Ad-hoc (identify, quantify, prioritise) Annual (inform)	(Sub)national, supranational
	C. Plan the frequency and timing of existing and new immunisation campaigns to ensure maximum protection and efficiency of delivery.	Annual	(Sub)national, supranational
3. Antivirals	A. Identify, quantify and prioritise target groups and settings for antiviral use.	Ad-hoc	(Sub)national, supranational
	B. Determine when and what to communicate to clinicians about antiviral use.	Ongoing, based on epidemiological situation	(Sub)national
4. PHSM	A. Identify and prioritise target groups and settings for PHSM.	Ad-hoc	(Sub)national, supranational
	B. Issue recommendations or programmes to the public, for specific target groups or settings concerning preventive behaviour to reduce the risk of infection and/or mitigate the impact of disease.	Ongoing, based on epidemiological situation	(Sub)national, supranational
5. Healthcare	A. Implement or adapt plans for winter pressures or surges in respiratory patients in healthcare settings, including the use of enhanced infection prevention and control (IPC) (e.g. isolation rooms, personal protective equipment (PPE)), testing strategies, planning human resource and bed capacity (including special respiratory wards and paediatric ICU).	Ongoing, based on epidemiological situation	(Sub)national

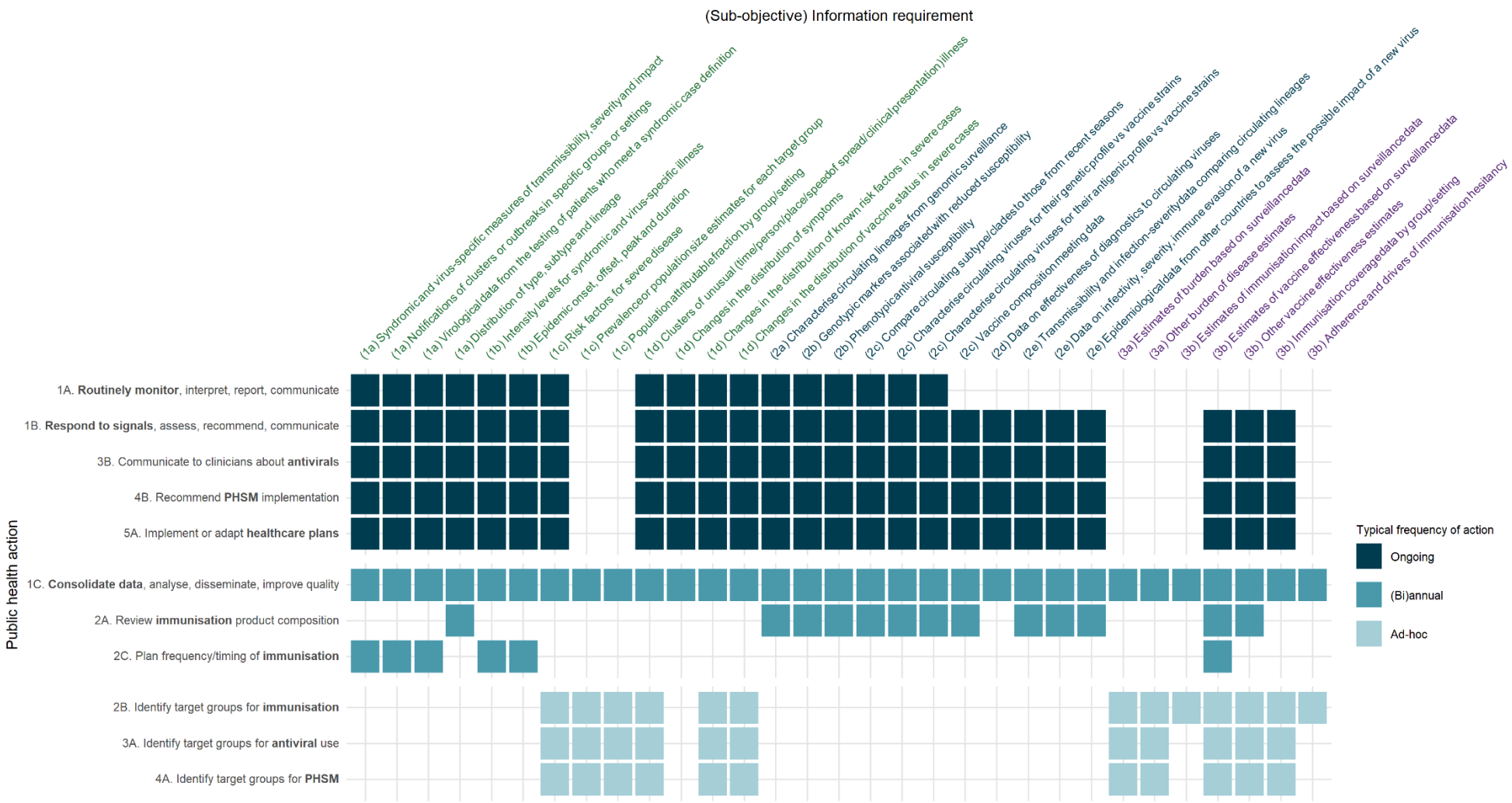
Note: PHSM include preventive behaviour for risk groups, specific settings and/or the general population, including physical distancing, hygiene/handwashing, avoiding large gatherings, or use of masks. More extreme measures that limit free movement or mixing, such as school closures or stay-at-home orders, are beyond the scope of routine seasonal surveillance. Communication of routine and ad-hoc interpretation and assessments is aimed at diverse audiences, including the media, public, health professionals and policy makers. Consolidated analyses can be disseminated via technical reports or scientific manuscripts.

The most appropriate geographical level for collection and analysis of data depends on the level at which any linked action will take place (Table 3). National or subnational-level actions usually require data collection and analysis at the same level. The role of subnational surveillance depends on how surveillance is organised in the country and the need for local recommendations (e.g. for regional hospitals). Data collected at national and/or subnational level is essential for each country and represents the foundation of EU-level surveillance, which in turn is used to inform actions to be taken at the supranational level.

Figure 3 shows how the public health actions relate to the information requirements presented previously (Table 1). Actions are grouped according to their typical frequency, as listed in Table 3. These frequencies are illustrative and should be flexible in response to the local needs and epidemiological situation. This grouping illustrates how the routine processes of data interpretation, reporting and communication precede and inform the different prevention and control measures. The ongoing monitoring of routine epidemiological and virological surveillance data (Action 1A) and assessment in response to a signal (Action 1B) can provide most of what is needed to inform measures in response to the current epidemiological situation (Actions 3B, 4B, 5A), whereas less frequent data analyses or ad-hoc studies (Action 1C) can provide evidence to inform vaccine composition (Action 2A), immunisation programmes (Action 2C) and identify/quantify target groups for intervention (Action 2B, 3A, 4A).

When taken together with the mapping of surveillance systems to the objectives in Figure 1, Figure 3 illustrates the interrelated nature of surveillance and public health decision-making. Most actions rely on information coming from the three surveillance objectives. Many information requirements are common to more than one action. The same information may need to be considered or analysed at different frequencies, depending on the action to be taken. For example, weekly trends and levels of an indicator can be used to identify epidemic onset in order to inform measures in response to the current epidemiological situation, while retrospective analysis of the same indicator across multiple seasons can describe seasonality to inform the timing of the immunisation programmes. This further highlights the need for a balanced mix of surveillance systems that together can generate information for action at the right time.

Figure 3. Public health actions and their associated information requirements and sub-objectives, grouped by typical frequency of the action



Source: ECDC

Sub-objectives are shown here by number in parentheses. They are listed in full in Table 1 and Figure 2.

Maintaining adequate surveillance year-round

Although the largest respiratory virus disease burden and impact occurs during the winter, integrated respiratory virus surveillance should remain at a level for the objectives to be met throughout the year, maintaining the ability to detect signals, monitor the impact on healthcare and characterise circulating viruses through indicator- and event-based surveillance. There are many reasons for this. At the time of writing, SARS-CoV-2 is not a seasonal winter virus, unlike influenza virus and RSV. RSV circulation and large-scale outbreaks of influenza viruses can occur outside of the traditional winter respiratory virus season. Influenza viruses detected during the summer months may give an indication, together with southern hemisphere data, of what will circulate in the coming season and support early assessment of how well circulating viruses may match vaccine antigens.

Other respiratory pathogens also circulate at different times of the year, and many countries routinely test for multiple pathogens using respiratory panels. While not currently under EU surveillance, their impact can still be detected through syndromic surveillance. They contribute to the overall burden of respiratory virus disease and may influence the seasonality of influenza viruses, SARS-CoV-2 and RSV.

It is recognised that financial and human resources are limited, and that some countries do choose to vary the intensity of indicator-based surveillance to reflect the expected seasonality and impact of respiratory virus activity during the year. However, it is important that, as a minimum, surveillance is always maintained at a level that allows for ongoing monitoring, detection, assessment and communication of epidemiological and virological signals (Action 1A, 1B). Even if some components are turned off in the summer months, it should be possible to restart them in the event of a significant signal that requires closer monitoring. The relationships between surveillance systems, objectives, information requirements and public health actions (Table 1, Figure 2 and Figure 3) can be used to assess the impact of turning off or scaling down a surveillance system during the summer in a national or subnational setting. For example, maintaining hospital surveillance should be prioritised since this is essential to meet the objectives and cannot be replaced with supplementary systems. Other important considerations are communication with and motivation of participating surveillance sites, and the impact on consistency of data, which is essential for setting thresholds, analysis and signal detection.

The added value of supranational surveillance

National and subnational surveillance needs to produce timely, high-quality data that is useful for informing specific, local priorities. Submission of national data to ECDC fulfils EU legal requirements and is the foundation of EU-level surveillance, facilitating EU-level monitoring, international comparison and an epidemiological assessment based on data from a diverse range of contexts. Indicator-based surveillance data are submitted weekly to ECDC via EpiPulse Cases and published in the European Respiratory Virus Surveillance Summary (ERVISS) [4]. EU level event-based surveillance is well-established through EWRS and EpiPulse Events and communicated via ECDC's CDTR [12].

EU/EEA countries, and subnational areas within some countries have widely different health system structures, laboratory capacities, resources and epidemiological contexts. The diversity of supplementary surveillance systems and complementary data sources across the EU/EEA is a strength in terms of coverage and signal detection but can pose a challenge for common interpretation of data. Harmonisation, particularly of core surveillance systems, is desirable to ensure consistency of data generated from individual units of surveillance, whether these are subnational, national or European. Alignment according to common standards, such as the EU case definitions [2] and reporting protocol for EU surveillance [8] facilitates aggregation, interpretation, and comparison of indicators. However, harmonised variables and indicators do not necessarily produce harmonised outputs. Differences in system design, population coverage, healthcare-seeking behaviour, testing practices, coding systems and data completeness can all influence the indicators that are reported. Surveillance outputs should therefore be interpreted as context dependent.

When done carefully and with due consideration for the many differences between countries' surveillance systems, pooled supranational analysis of surveillance data from multiple countries can be very powerful, with larger pooled sample sizes providing estimates with higher statistical precision than achievable with single country data. This can be done using centrally pooled data, or through meta-analysis of data analysed in each country according to a common protocol.

EU-level surveillance also helps fill knowledge gaps resulting from variation between countries in terms of epidemiological situation, surveillance coverage or capacity. High quality data from a small number of countries across the EU/EEA is often sufficient to make a European assessment and for communication purposes. Weekly data published in ERVISS can provide countries with an idea of how their season may unfold from what has already been experienced in other countries. Risk assessment for a novel lineage can be valuable, even if it is based only on early and incomplete information from those countries where it has been detected. Many countries do not have capacity for phenotypic virus characterisation, which is needed to fully meet the surveillance objectives. However, supranational mechanisms exist for the shipment of selected samples to reference laboratories which are able to carry out this work.

Collaboration between countries and international organisations, such as that facilitated through ERVI-NET, provides additional opportunities for exchange and support (see 'Ensuring surveillance quality and readiness').

Digitalisation

Digital transformation in healthcare is accelerating and reshaping public health surveillance. The expanding use of electronic health data and emerging applications of artificial intelligence enable data to be collected more widely, rapidly and cost-effectively. This has the potential to fundamentally change how surveillance data are generated, linked and analysed. This rapidly evolving context makes it more important than ever to ensure that developments in digital health infrastructure can be harnessed to support fulfilment of the action-oriented surveillance objectives presented in this guidance. These remain valid and should be applied to guide the design and implementation of surveillance using electronic data, rather than the other way around.

Electronic health data encompass a broad range of sources, including electronic health records (EHRs) generated through routine healthcare delivery, as well as other forms of e-health data, such as internet searches and absenteeism monitoring (see 'Surveillance systems and data sources'). EHR are particularly relevant for respiratory virus surveillance, given their routine and systematic capture of clinical and laboratory data in primary and secondary care. Well-implemented EHR-based surveillance can provide detailed information on diagnoses, healthcare utilisation, comorbidities, and outcomes, enabling analyses of transmission dynamics, severity, risk factors, healthcare burden and the impact of interventions. In the EU/EEA, many countries use EHR data within respiratory virus surveillance in primary and secondary care, with EHR-based surveillance being behind the expansion of SARI surveillance in the EU/EEA in recent years.

EHR-based surveillance offers important advantages, as it lends itself to automation with less reliance on active involvement of clinicians. Such automated systems are more likely to be resilient during periods of increased healthcare pressure, support long-term, year-round operation and the generation of consistent data with broad geographical coverage. The potential for linkage with laboratory, vaccination, and administrative data further strengthens their usefulness for studies required to meet surveillance objective 3.

However, important limitations and uncertainties remain. Questions persist regarding the validity, completeness, and comparability of EHR-derived indicators, as data are primarily collected for clinical rather than surveillance purposes and can be affected by factors such as financial reimbursement and legacy coding practices. There are also substantial differences in data access, governance frameworks, and technical infrastructure across the EU/EEA, which can limit comparability and scalability.

Legislative developments, such as Regulation (EU) 2025/327 for the European Health Data Space (EHDS) (13), will introduce stricter interoperability and technical requirements. These will influence how electronic health data can be accessed and used for public health purposes, with the potential to improve comparability and interpretability across countries. The many potential applications of artificial intelligence in health include admission triage, remote and digital consultations, natural language processing of free text in clinical records and advanced analytics across diverse data sources. This is likely to further affect surveillance in the coming years and raises many important questions related to data protection, governance, appropriate use-cases and methodological validity.

ECDC recognises the need for detailed, specific guidance on EHR-based surveillance. Until this is available, the principles outlined in this document can support the development of systems to ensure they meet surveillance objectives and effectively inform public health action. Considerations for EHR relevant to surveillance system design have also been included where appropriate in the sections below.

Surveillance system design

When designing a national surveillance system, there are multiple factors to take into consideration. Specific design choices depend on the overall mix of systems needed to meet the surveillance objectives, data needs, and context in which the system operates, including available technical, financial and human resources. The sections below highlight some aspects of particular importance to the objectives, but do not cover all possible design choices.

Case identification

EU case definitions provide the basis for harmonised surveillance across the EU/EEA through consistent case identification to meet national and EU-level surveillance objectives. Commission Implementing Decision (EU) 2018/945 [2] includes syndromic definitions for ILI and ARI within the case definition for influenza. ECDC also has an operational case definition for COVID-19 [14]. Updated EU case definitions for ILI, ARI, SARI, influenza, COVID-19 and RSV have been proposed, but not yet published.

The approach chosen for the identification of cases, together with the specific case definition used, has important implications for interpretability, sensitivity and the range of analyses that a surveillance system can support. It determines which aspects of disease burden can be measured, how impact can be assessed, and whether analyses such as vaccine effectiveness can be reliably conducted, ultimately shaping the ability of surveillance data to guide public health action. In the sections below, we outline the two main approaches for the identification of cases, syndromic and laboratory-confirmation.

Syndromic case identification

Cases are identified using a standardised syndromic case definition based on clinical presentation or an EHR-based case definition (see below). ILI/ARI surveillance in primary care and SARI surveillance in hospitals (Table 2 and 'Surveillance systems and data sources') are commonly-used core surveillance systems based on syndromic case identification. It is important that syndromic surveillance is complemented by virological testing. Such systems support:

- estimation of the incidence of medically attended acute respiratory illness where the population under surveillance is representative and well-defined;
- understanding of the contribution of circulating pathogens to medically attended acute respiratory illness in the population under surveillance;
- a wider definition of disease burden, since syndromic case definitions capture acute respiratory illness that can be caused by multiple different pathogens;
- the opportunity to understand and compare the characteristics and clinical presentation of cases who test negative for influenza viruses, SARS-CoV-2 and RSV, with those of cases who test positive. These data can also be used for in-depth analyses to estimate vaccine effectiveness (VE) and to identify and monitor risk factors for disease;
- the chance to identify unusual signals by enrolling patients based on a syndromic case definition rather than relying on pathogen confirmation.

Consistent application of syndromic case definitions is essential and requires clear guidance for all staff involved [6]. It is important to consider case definition sensitivity and specificity, as these characteristics directly influence how well surveillance can detect and distinguish respiratory pathogens [15]. In primary care, countries using ARI as the primary case definition are strongly encouraged to also collect ILI consultation counts, for example as a subset of ARI, to retain this influenza-specific indicator for monitoring activity. ARI provides a better basis for virological sampling than ILI as it captures a broader range of respiratory presentations and is less biased toward influenza virus. ARI and SARI trends tend to be less easily interpretable than ILI (which aligns well with influenza virus positivity data due to its high specificity for influenza viruses) since they can be driven by a wider range of circulating respiratory pathogens. This is an advantage for potential detection of an emerging or unusual respiratory pathogen.

Case identification through laboratory-confirmation

Cases are identified based on a positive test result for a pathogen or via EHR diagnostic codes reflecting laboratory-confirmed diagnosis, usually irrespective of clinical presentation. 'Laboratory-confirmed hospitalisations' and 'laboratory-based surveillance' (Table 2 and 'Surveillance systems and data sources') are common examples of core surveillance systems based on this approach. Such systems may be:

- timely and comprehensive, sensitive to changes in virus activity and able to show clearly interpretable trends, making them a valuable complement to virological data from ILI, ARI, or SARI surveillance;
- a source of specimens outside the period of usual respiratory virus epidemics, when the chance of detecting viruses in core systems, particularly ILI/ARI surveillance, is low;
- a source of specimens for virus characterisation, particularly for sub-objective 2a (Identify emerging genetic lineages), where it is desirable to sequence from a wide range of patients;
- able to capture coincidental respiratory virus infections (e.g. where respiratory illness is not the primary clinical presentation, as in syndromic systems) that may still contribute to the disease burden, particularly in population groups with severe preconditions (e.g. cancer patients);
- useful as a consistency and validation check, particularly during transitions or changes in syndromic data collection systems (e.g. changes in case definitions or shifts towards EHR-based surveillance).

The distinction between these two approaches for case identification may not always be clear in practice, as illustrated by systems that use registries for surveillance. Cases identified through laboratory-confirmation can be linked to, or integrated with additional data sources, such as population registries or hospital records. These may deliver similar benefits to those outlined above for syndromic case identification, including access to clinical and demographic information. However, surveillance based on laboratory data where testing is not based on a clinical case definition is sensitive to changes in testing practice.

Considerations for case identification using EHR data

In EHR-based syndromic case identification, a combination of codes (e.g. ICD-10, SNOMED-CT) is used to try to replicate the traditional ILI, ARI and SARI case definitions. Pathogen-specific and non-specific codes are often combined to generate the EHR-based case definition [16]. Differences in coding systems, selection of codes, clinical workflows and case ascertainment choices can affect timeliness and lead to variations in the captured case numbers, trends, and case profiles. Therefore, EHR-based case definitions should be validated, ideally against traditional questionnaire-based ILI, ARI and SARI case definitions.

EHR-based case definitions differ fundamentally from traditional ILI, ARI and SARI case definitions because key symptoms (e.g. fever and cough), which are central to classical syndromic definitions (and can be consistently applied by trained healthcare staff), are often not routinely or consistently captured in structured EHR data and are instead recorded in free-text clinical documentation. Some code systems, such as SNOMED CT, enable greater clinical nuancing through fine-grained concepts, however they require large code sets. The use of large language models is being explored to extract relevant clinical information from free-text patient records, potentially enhancing the validity, sensitivity and interpretability of EHR-based syndromic surveillance beyond what is achievable with coded data alone.

There is currently no formal operational guidance for implementing ILI, ARI or SARI case definitions using EHR-derived data, although the development process has been initiated with the ECDC project 'Surveillance from Electronic Health Data' (SUREHD) [16]. At the time of writing, it remains unclear if applying a single unified EHR-based case definition across the EU/EEA will yield optimal or comparable surveillance outcomes. It is however essential to continue the ongoing validation against established surveillance systems and transparent sharing of methods used in the different systems. The planned SUREHD 2.0 project, aligned with the implementation of the European Health Data Space [13] across the EU/EEA, could help address this gap by developing formal guidance for EHR-based surveillance of ILI/ARI/SARI, building on previous internal SUREHD work on generic EHR-SARI surveillance protocols.

Coverage

Coverage relates to the proportion of the national population or healthcare system covered by surveillance. There are two common designs, although some systems in the EU/EEA incorporate elements of both or sit somewhere between the definitions presented below.

Comprehensive surveillance (also called universal or exhaustive) takes data from all, or most sites within a defined geography or healthcare system. Comprehensive rarely means complete case ascertainment but instead that the system was designed to cover the entire population. Data are typically collected continuously from routine sources such as mandatory notifications, electronic health records (EHRs), or registries.

Sentinel surveillance relies on a selected sample of sites that systematically collect syndromic and/or virological data through voluntary participation by trained personnel. Sentinel networks are commonly used in ILI/ARI surveillance in primary care and SARI surveillance in hospitals. Sentinel networks of emergency departments, ICUs or laboratories are also used for surveillance in the EU/EEA. Sentinel sites often need increased resources to ensure that staff have the time and training to collect consistent, high-quality data not captured in routine medical care. Sentinel networks therefore require ongoing resources, coordination and active participation by clinicians, making them vulnerable to changes in participation, motivation of sites or healthcare pressures. The term 'sentinel surveillance' is commonly used synonymously with ILI/ARI/SARI-based surveillance with syndromic and virological components [6]. This reflects how many of these systems were historically designed and implemented. Some countries' systems comprise a mixture of sentinel and universal designs. For example, universal syndromic surveillance in primary care may be implemented using EHR to identify cases of ILI or ARI, while a representative sentinel network of sites is used for swabbing of cases to ensure quality and completeness of virological data (see 'Virological surveillance').

Representativeness

Representativeness describes the extent to which the population under surveillance represents the general population on key characteristics (such as age, geography, population density and social factors), and to which surveillance data reflect disease patterns in time, person and place that are present in the general population.

In sentinel surveillance, sites are commonly selected so that the network covers a nationally representative population, but in practice this may not always be achieved. Comprehensive surveillance has the potential to be representative as it draws on a large proportion of the population, however representativeness is not guaranteed and is influenced by factors such as access to health care and how data are generated, coded, and used. For example, certain EHR-based case definitions may introduce systematic biases, such as differential coding practices among individuals with multiple underlying conditions.

Adaptability

Surveillance systems should be able to adapt to changing needs, including updates to case definitions, legislative or regulatory changes, addition of new variables, and rapid response to emerging threats such as new pathogens or lineages.

Sustainability

Surveillance systems should be designed to operate on a routine and long-term basis. This requires consideration of financial costs, human resource capacity, technical infrastructure, and the ongoing burden placed on data providers. Systems that are largely automated or do not rely on active involvement of clinicians are more likely to be resilient in times of crisis or increased healthcare pressure [17].

Data considerations

Effective respiratory virus surveillance depends not only on surveillance system design, but also on how data are generated, structured, linked, and maintained over time. The considerations below influence the ability of systems to meet the surveillance objectives.

Case-based data and data linkage

Individual-level records with complete information on epidemiological, clinical and virological variables allow data to be used beyond monitoring trends to more detailed analysis, including assessment of severity, clinical outcome, risk factors, healthcare burden and vaccine effectiveness. For a country to fully meet the surveillance objectives (particularly sub-objectives 1c, 1d, 2e, 3a, 3b –see Table 1, Figure 2) and to inform the associated public health actions (Table 3, Figure 3) case-based data are needed at national level. The surveillance objectives place higher priority on data from severe disease surveillance (Figure 2), but to properly assess severity and the impact of interventions, case-based data are required from across the clinical care spectrum. For some analyses, the number of cases within individual countries may be insufficient to provide robust estimates. In such situations, the pooling of case-based data for analysis at supranational level can add substantial value (see 'The added value of EU and supranational surveillance').

Data linkage is vital as it enables the integration of different data sources to achieve the level of completeness of key variables required for more advanced analyses and follow-up over time. This can be very difficult to achieve in surveillance based on questionnaires where medical history obtained by a clinician may be affected by their workload, incomplete recall or be unavailable from severely ill patients who cannot provide a history. Data can be linked between epidemiological, clinical, laboratory and administrative sources - including from syndromic surveillance, primary care consultations, hospital admissions, intensive care unit data, vaccination registries,

mortality records, databases of genomic and phenotypic virus characterisation. Linkage relies on highly developed health IT infrastructure that allows patient level linkage across multiple data sources. Common methods include deterministic linkage using unique personal identifiers (such as national identification numbers or health insurance IDs), and probabilistic linkage based on combinations of variables (e.g. date of birth, sex, postcode, healthcare provider) when unique identifiers are unavailable. It is important to ensure privacy within linkage approaches (e.g. pseudonymisation and secure data environments) to comply with data protection and ethical standards.

Linkage also creates opportunities for a broader set of analyses than would normally be possible with surveillance data. Individual-based data on patients attending sentinel sites that do not meet the syndromic case definition would support assessment of ILI/ARI/SARI case definition performance. The availability of long-term clinical history, such as to identify underlying conditions and vaccination history, allows current cases to be assessed within the broader health context and supports more accurate evaluation of risk factors, severity, and outcomes. Disease registries that store patient data in a systematic and comprehensive way can be reliable sources for this type of information. Several EU/EEA countries have comprehensive registry-based data collection systems that are an asset for routine surveillance and in-depth analyses.

Consistency

Reliable long-term data enables the analysis of long-term trends in virus circulation, severity, healthcare impact and disease burden. Longitudinal datasets which are comparable (e.g. harmonised case definitions, standardised variables, consistent coding systems) make it possible to compare epidemics across time, detect gradual shifts in age distribution or vulnerability, assess the effects of changing immunity and interventions, and distinguish exceptional events from expected seasonal variation. To ensure consistency, systems and their metadata should be clearly described for use at both national and supranational levels. For example. testing strategies, describing who is tested for surveillance purposes, and denominator data (e.g. number of tests performed or population under surveillance) are essential for interpreting data. For EHR-based surveillance, extraction algorithms, code lists and mappings should be version controlled, with changes documented and assessed for their impact on trends.

Timeliness

The importance of timeliness depends on how frequently surveillance data are analysed and interpreted to inform assessment and action. As outlined in 'Informing public health action', the different measures that can be informed by surveillance require data at different frequencies. Each system should be able to deliver data at the highest frequency indicated across the different public health measures (Figure 3). For routine indicators used in weekly outputs, it is important to balance rapid availability with data completeness. The need for timely data should therefore influence system design choices, such as whether diagnoses recorded at admission or discharge are used. Data should be assessed for reporting delays which should be accounted for during interpretation or corrected for using nowcasting methods that estimate the number of cases that have occurred but not yet been reported.

Virological surveillance

Virological surveillance is an essential component that contributes information across all surveillance objectives. It includes pathogen detection, typing, subtyping and further characterisation. An overview of key considerations is provided below.

Source of specimens

The foundation of virological surveillance should be specimens obtained as part of ILI/ARI surveillance in primary care and SARI surveillance in hospitals. Swabs are collected from patients meeting a syndromic case definition when they present at dedicated surveillance sites (often sentinel sites – see 'Coverage') using a standard protocol to achieve population representativeness. Specimens are usually submitted to national reference centres for multiplex testing and virus characterisation. This should ensure a robust, representative source of specimens to be used as the basis of understanding which viruses are circulating in the population.

Surveillance based on laboratory confirmation (positive test results or diagnostic codes) can also be a source of specimens for virological surveillance (see 'Case identification through laboratory-confirmation'), however, key limitations include lack of information as to how patients were selected for tested, or whether testing was preferential for particular pathogens. In addition, detections may be reported from many different laboratories and specimens may not be consistently retained or made accessible for further virological analyses. Expansion of surveillance based on laboratory confirmation should not be a reason to reduce or replace the swabbing of syndromic cases from dedicated surveillance sites.

Testing methods

(RT-)PCR remains the standard detection method for surveillance purposes due to its reliability and the availability of specimens for subtyping and further characterisation. Multiplex PCR supports estimation of the relative contribution of different influenza viruses to respiratory illness in the population.

If using rapid antigen detection test (RADT) instead of PCR for testing in surveillance settings, measures should be in place to ensure test quality and performance, as well as adequate training of personnel. In some settings, the use of RADT for testing cases of ILI/ARI/SARI may be appealing to increase the numbers of tests performed or as an incentive for participation by clinicians and patients, since results are available at point of care, but this has implications for data interpretation and quality. If testing volumes increase and the test denominator is known, trends in test positivity are likely to become less noisy and more interpretable. However, if RADTs are used to screen patients prior to confirmatory PCR testing, this will bias results by raising the positive predictive value of the PCR test, since a positive antigen test result would more likely lead to a positive PCR test result. If RADTs completely replace PCR tests it removes a valuable source of representative specimens for (sub)typing and further characterisation.

Typing and subtyping

Understanding which influenza virus types and subtypes are circulating is important for many reasons. It can allow for detection of zoonotic non-seasonal influenza virus subtypes and may provide an initial indication of mismatch against northern hemisphere vaccine components that can be later confirmed by other data, including virus characterisation. Typing of sentinel RSV specimens can be valuable to understand the epidemiology of circulating RSV viruses but this information does not currently inform public health action.

All positive influenza virus specimens from sentinel sites that swab ILI/ARI/SARI cases for surveillance should be typed and subtyped. This should provide sufficient specimens, if systems are well-designed, to monitor subtype distributions and estimate the relative contribution of different influenza viruses to respiratory illness in the population (sub-objective 1a).

Hospital laboratories often use tests that are at typing level for influenza virus and sometimes for RSV. In the absence of SARI, or if SARI systems do not yield sufficient specimens, subtyping of laboratory confirmed influenza virus detections in hospital is important to cover the severe end of the surveillance pyramid. Similarly, in the absence of ILI/ARI surveillance, or if ILI/ARI systems do not yield sufficient specimens, subtype distributions may need to be based on specimens from other testing outside of hospital settings. In both instances, total numbers to subtype can be informed by the calculations for genomic surveillance in the forthcoming module on 'right-sizing' (to be published later in 2026) although biases due to a potential lack of representativeness need to be considered.

During the interseason period, subtyping, and further characterisation of influenza virus detections, regardless of the source, is particularly important as these may give an indication, together with data from the southern hemisphere, about the types, subtypes and strains that may circulate in the coming season.

Virus characterisation

Timely genomic, antigenic and antiviral or monoclonal antibody susceptibility monitoring should be integrated into overall respiratory virus monitoring strategies. Collecting information on the epidemiological characteristics of sequenced cases and source of specimens selected for sequencing is important to aid interpretation.

The forthcoming module on 'right sizing' includes detailed considerations concerning the most appropriate source of specimens for sequencing, the number that need to be sequenced and frequency of sequencing analysis, to meet the specific objectives of genomic surveillance.

Based on the genotypic results, further antigenic characterisation and phenotypic testing for antiviral drug or monoclonal antibody susceptibility should be carried out on a subset of specimens in the countries that have resources available. Countries, who do not have resources for phenotypic characterisation should send selected respiratory virus specimens for characterisation to the EURL-PH-RESVIR and/or WHO Collaborating Centre. For influenza viruses, selected clinical specimens, and particularly specimens and/or virus isolates of influenza A viruses that cannot be subtyped, should be shared with a national reference laboratory and then with a WHO Collaborating Centre. In addition, specimens should be shared with EURL-PH-RESVIR if resources allow. For RSV, SARS-CoV-2 and other respiratory viruses, selected specimens and/or virus isolates of circulating strains and selected specimens of SARS-CoV-2 variants under monitoring, of interest or of concern, should be shared with national reference laboratories and shipped to EURL-PH-RESVIR to perform more in-depth virus characterisation analysis and collect specimens for potential future vaccine composition.

Laboratory considerations

Specific laboratory technical considerations are listed below, including those from 'Operational Considerations for respiratory virus surveillance in Europe' (2022) [5] which remain valid:

- Frequent and regular sequencing and data-sharing is preferred over batch sequencing in irregular intervals.
- Nasopharyngeal swabs or combined nasopharyngeal and throat (oropharyngeal) swabs are considered appropriate specimens both for influenza virus and SARS-CoV-2 molecular detection; other suitable respiratory specimens are listed in WHO guidance [6].
- Specimens collected should be stored in non-inactivating viral transport medium (VTM) or dry swabs if VTM is unavailable to facilitate the sharing of specimens for subsequent virus isolation.
- Storage of clinical specimens at the site of collection and transport to the testing laboratory should follow the instructions in WHO's 'Manual for laboratory diagnosis for influenza viruses' and its 'Guidance for laboratory testing for influenza viruses and SARS-CoV-2' [18-20].
- Virus characterisation should be undertaken according to standard laboratory protocols [18-21].
- Where possible, multiplex assays are preferred as they have a reduced use of reagents, consumables, and faster turnaround time.
- Whole genome sequencing (WGS) is considered the gold standard, but amplicon sequencing and screening single nucleotide polymorphism (SNP) based NAAT assays can be used to identify and characterise strains/lineages/variants.
- Specimens with a cycle threshold (Ct) value of ≤25 are considered appropriate for good quality whole genome sequences. Samples with Ct>30 may not give WGS results but may still be appropriate to determine influenza virus subtypes/lineages and SARS-CoV-2 strains/lineages/variants.
- Participation of EU/EEA national reference laboratories for respiratory viruses is mandatory in WHO and ECDC external quality assurance (EQA) exercises and ISO accreditation for diagnostics and NAAT-based characterisation is encouraged, preferably also for genotypic and phenotypic characterisation.
- Use of laboratory-developed (in-house) tests versus commercial tests should be in relation to the requirements of the EU Regulation on in vitro diagnostic medical devices (IVDR)[1].

[1] *Regulation (EU) 2017/746 of the European Parliament and of the Council of 5 April 2017 on in vitro diagnostic medical devices and repealing Directive 98/79/EC and Commission Decision 2010/227/EU:* https://eur-lex.europa.eu/eli/reg/2017/746/oj/eng

Surveillance systems and data sources

This session provides more detail about the different surveillance systems and complementary data sources presented briefly under 'Surveillance system choices to meet the objectives' and in Table 2.

Core surveillance

ILI/ARI surveillance in primary care

Surveillance in primary care plays a central role in monitoring respiratory virus circulation in the community, as it captures early signals of seasonal activity and includes data from patients with mild and moderately severe illness that do not require hospitalisation. Primary care providers contribute data on the number of patients meeting syndromic case definitions for ILI and/or ARI. A well-defined population under surveillance allows incidence to be estimated (see 'Case identification'). Coverage may be sentinel or comprehensive (see 'Coverage'). Syndromic surveillance should be complemented by virological testing to allow estimation of the contribution of circulating pathogens to medically attended ILI or ARI in the population under surveillance. Swabs are usually taken from a subset of cases according to a defined sampling scheme; further considerations are provided in GISRS 2024 [6]. Careful system design is needed to achieve representativeness and correct sizing of the syndromic and virological components (more information will be provided in the forthcoming 'right-sizing' module). Continual support and motivation of participating practitioners is vital for the sustainability of the system.

SARI surveillance in hospitals

SARI surveillance systems systematically capture hospitalised patients meeting a syndromic SARI case definition, with laboratory testing of all or a subset of cases integrated into the system. Many of the benefits described for ILI/ARI surveillance also apply for SARI. These systems are particularly valuable for monitoring trends in severe disease and healthcare burden while remaining relatively robust to changes in testing practices over time. SARI can provide important clinical and epidemiological information for understanding of severe disease, including age distribution, underlying conditions, disease progression and outcomes.

Laboratory-confirmed hospitalisations

This type of surveillance is based exclusively on patients in hospital or ICU with a laboratory-confirmed infection, without systematic application of a syndromic case definition. These systems provide high specificity for severe disease attributable to individual pathogens but are highly dependent on testing practices, which may vary over time, by hospital, or by patient group. Changes in testing volume and diagnostic algorithms can influence observed trends and limit comparability over time. The lack of a clear clinical indication for testing can lead to coincidental infections being detected whose contribution to total detections may vary over time. Clinical information may be limited where data are reported from laboratory databases without linkage.

Surveillance of laboratory-confirmed hospitalised and/or ICU-admitted cases, which was already well established for influenza viruses before the COVID-19 pandemic, became widespread for COVID-19. Although SARI surveillance is the preferred method and target of investment for hospital surveillance in most EU/EEA countries, surveillance of laboratory-confirmed hospitalisations can be an important complement to SARI for monitoring trends and assessing the impact of respiratory disease.

Laboratory-based surveillance

This usually involves the use of information from laboratory databases on confirmed detections of respiratory pathogens, which may be mandatorily notifiable, for surveillance purposes. For some countries, data on notifiable diseases includes information on the hospitalisation status, such as admission to ICU. In others, information on clinical characteristics of patients or the clinical setting for testing is limited. Changes in testing volume and diagnostic algorithms can influence observed trends and limit comparability over time. Nevertheless, these data provide valuable insights into the transmissibility and temporal trends of specific pathogens, making them a valuable supplement to other core surveillance systems. Countries are encouraged to collect data on the number of tests performed for calculation of test positivity and establish automatic transfer of these data to public health institutes. Data linkage may be explored to enhance the use of laboratory data in combination with other clinical and epidemiological information.

Event-based surveillance

EBS is the systematic collection, monitoring, assessment, and interpretation of predominantly unstructured, ad hoc information from a wide range of sources to detect potential public health events or risks [9]. EBS should be conducted continuously at national level. It is extremely valuable for signal detection due to its increased timeliness and sensitivity compared to indicator-based surveillance.

In accordance with the International Health Regulations (2005), serious, unusual, or unexpected respiratory disease events are reported and shared through the EU Early Warning and Response System (EWRS)[2]. EWRS supports rapid information exchange and coordination among EU/EEA countries for serious cross-border threats to health, while IHR notification ensures global situational awareness and response for events that may constitute a public health emergency of international concern.

In addition, EpiPulse Events enables the sharing of confidential information on events that may be of relevance to other EU/EEA countries. ECDC strongly encourages the use of this platform to support early information sharing and efficient interaction within the surveillance network.

Supplementary surveillance

Mortality monitoring

Mortality monitoring is used to assess the impact of respiratory viruses. Cause-specific mortality per pathogen can be reported in a timely manner using deaths among people who recently tested positive to a respiratory virus. In-hospital deaths should be captured in well-designed hospital surveillance with patient follow up, such as SARI surveillance. This can be expanded to include deaths in other settings via linkage to death registers although this may be delayed depending on time taken for cause of death to be registered. All-cause excess mortality monitoring tends to be timelier than cause-specific mortality monitoring but less specific, since it uses mortality data due to any cause to compare the number of deaths observed with the number expected for a given time point or period. This monitoring can be useful for estimating the population impact of severe respiratory virus epidemics. Excess mortality estimates with different geographical and temporal resolution are published by EuroStat [22] and EuroMOMO [23].

Syndromic surveillance in specific settings and populations

This describes structured syndromic surveillance that complements core surveillance by covering specific settings or defined populations. Surveillance may be based on ILI, ARI or SARI case definitions applied in these settings, as well as on more specific syndromes or clinical presentations, including pneumonia, bronchiolitis (for RSV) or COVID-like illness. Surveillance can be achieved through reporting via clinical networks or by automated extraction of codes at different points of entry to the healthcare system, from telephone helplines to emergency departments [24]. Structured monitoring of cases or outbreaks of respiratory illness in settings such as long-term care facilities can be particularly useful to detect early respiratory virus activity in a population particularly vulnerable to severe disease that might not otherwise be covered by core surveillance systems [25].

Wastewater-based surveillance

Monitoring of respiratory virus circulation through the detection and quantification of viral genetic material in wastewater is a complementary tool that can provide valuable population level information beyond what is captured through traditional healthcare-based surveillance. The COVID-19 pandemic led to a rapid expansion of initiatives to monitor population level circulation of SARS-CoV-2 through wastewater as a complementary and early warning surveillance tool. In this context, the European Commission adopted Commission Recommendation (EU) 2021/472 of 17 March 2021, encouraging Member States to establish systematic wastewater surveillance for SARS-CoV-2 and its variants, to integrate wastewater-based surveillance into national surveillance strategies, and to promote harmonised methods and data exchange at EU level. Many countries within the EU/EEA have WBS systems in place and several countries have expanded the surveillance to include respiratory infections beyond SARS-CoV-2, notably influenza viruses and RSV. The Joint Research Centre's European Wastewater Observatory for Public Health has developed a dashboard that shows WBS data from multiple European countries [26].

[2] In line with Annex 2 of the International Health Regulations (2005) and Regulation (EU) 2022/2371 of the European Parliament and of the Council of 23 November 2022 on serious cross-border threats to health and repealing Decision No 1082/2013/EU Regulation - 2022/2371 - EN - EUR-Lex

WBS has the potential to provide an independent and complementary signal of community transmission that is not influenced by healthcare-seeking behaviour or testing practices. It is a form of supplementary surveillance, best used in combination with other data sources to address specific surveillance objectives. This reflects its limitations when used in isolation, notably the absence of individual-level information on age, clinical severity, risk factors, and lineage or subtype attribution, which are essential for risk assessment and public health decision-making.

To support the effective use of WBS for respiratory virus monitoring, several methodological and strategic issues must be addressed, including the need for standardised approaches to sample collection, processing, and analysis across the EU/EEA to improve data comparability. The location of sampling sites can affect representativenss and the contribution of environmental run-off, both of which are important for data interpretation. Improved understanding of wastewater data variability and temporal dynamics is required. Other evidence gaps include lead times relative to clinical indicators and on how changes in population-level shedding due to immunity, vaccination, or evolving variants affect signal interpretation over time. ECDC plans to further investigate the role of WBS within integrated respiratory disease surveillance, focusing on how it can best meet the surveillance objectives to add clear public health value, and on clarifying methodological, analytical, and interpretative requirements [27].

Participatory surveillance

Participatory surveillance relies on the active involvement of volunteers from the general population, who routinely report and transmit health-related information, typically through digital platforms. Data collection commonly involves structured, symptom-based questionnaires; however, in some systems these data are supplemented with virological confirmation obtained through point of care self-testing or testing of self-collected swabs [28]. By capturing information directly from the volunteers, participatory surveillance includes symptomatic individuals who may not initially seek healthcare, thereby broadening epidemiological understanding beyond what is observed in core indicator-based surveillance (Figure 4). In addition, information on healthcare seeking behaviour can also be obtained, providing context to interpret trends from primary care surveillance. Overall, participatory surveillance can complement core surveillance systems, particularly in settings where access to primary healthcare is restricted. Questions remain regarding the representativeness of participants, as engagement is voluntary and may reflect differential access to digital tools or varying levels of health awareness [29]. WHO guidance published in 2024 outlines key considerations for establishing participatory surveillance for influenza-like illness, including system design, data quality, ethical considerations, and integration with existing surveillance structures [30]. Several EU/EEA countries have already established participatory surveillance platforms, and some have integrated their data into supranational initiatives, such as Influenzanet [31].

Complementary data sources

There are numerous sources of complementary data outside of routine surveillance that provide information to strengthen public health decision-making but which may not to be readily available in all contexts. A selection of these data sources is described in Table 4.

Table 4. Overview of selected complementary data sources

Type	Description and examples
Vaccine effectiveness (VE) estimates	VE has been classed as complementary data as it is not a surveillance system, but it should be considered an integral component of surveillance where studies can be performed in core surveillance settings (e.g. ILI, ARI, SARI sentinel sites) with enhanced data collection. VE is essential for our assessment of how intense or severe a season may be, as it indicates how well vaccines perform in the real world, informing multiple public health actions. Early season estimates are particularly important when virus characterisation and immunological data suggest a poor match between the vaccine and circulating lineages.
Research	This includes, but is not limited to, estimates of burden of disease, the effectiveness of PHSM, cost-effectiveness of interventions, impact of immunisation programmes and antiviral efficacy data from randomised controlled trials.
Vaccine coverage	Routinely available in most countries, although often with considerable delay and sometimes outside of the organisational remit of the teams in public health institutions responsible for respiratory virus surveillance. Despite these limitations, vaccine coverage data are vital for identifying gaps in immunisation, particularly among underserved or hard-to-reach populations, and for informing targeted vaccination strategies and programmatic improvements.
Survey data on attitudes and drivers of hesitancy around immunisation and PHSM	Vital to guide efforts to increase immunisation uptake, particularly in underserved or hesitant populations, and to support the effective targeting, communication, and implementation of PHSM.
Hospital or ICU occupancy/capacity monitoring	Highly relevant during public health crises to assess healthcare system pressure and inform response measures. Monitoring can be difficult to sustain outside emergency periods and may fall outside the mandate of many public health institutions. In addition, it typically requires the collection of comprehensive occupancy data across all causes of admission and is not limited to respiratory infections alone.
Sero-epidemiological studies	Sero-epidemiological studies are vital for assessing population immunity but their value in predicting season severity is unclear. Very few countries in the EU/EEA carry out these studies on a routine basis.
Internet searches and social media	Increases in searches for symptoms (e.g. fever, cough, shortness of breath) or medications, as well as changes in social media posts related to illness, may signal rising transmission in the community. This may also include increased traffic to or engagement with official government and public health websites. Important to note that these signals may be non-specific and influenced by media coverage or public concern.
Absenteeism monitoring	Monitoring absenteeism from schools, workplaces, and healthcare personnel provides a complementary syndromic surveillance signal for the early detection of respiratory disease activity. Sudden or unusual increases in absenteeism may indicate increased community transmission, particularly when clinical or laboratory data are delayed or incomplete.
Pharmaceutical sales or usage data	Monitoring pharmaceutical sales or usage data, such as over-the-counter antipyretics, cough and cold medications, or antivirals, can provide an early signal of increased respiratory disease activity in the community.
Other supporting data	Examples include population data, epidemiological data from other countries in which a new lineage has been identified, and vaccine composition meeting data.

Ensuring surveillance quality and readiness

Ensuring the quality and readiness of respiratory virus surveillance is an ongoing, cyclical process that supports the ability of surveillance systems to meet their objectives under routine conditions and periods of increased threat, including reductions in the amount of money available for surveillance. As highlighted, technological developments are expected to progress rapidly over the coming decade. Surveillance systems will need to adapt to these changes, while maintaining robustness, comparability, and sustainability. The mechanisms outlined below support this continuous process of quality assurance, preparedness, and adaptation.

Routine monitoring

Routine performance monitoring supports early identification of issues and continued functionality of surveillance systems. This includes:

- Regular assessment of data quality [32], timeliness and representativeness, as these can affect the routine interpretation of surveillance data. This monitoring should be automated as much as possible.
- Periodic check-ins with data providers to address operational challenges, clarify reporting requirements, and maintain engagement.
- External quality assessments (EQAs) to ensure and maintain laboratory and analytical quality.

Periodic in-depth evaluation

Countries should conduct periodic in-depth evaluations of surveillance systems according to defined attributes [17, 32]. Given that surveillance systems are influenced by national legislation, organisational remits, stakeholders and technical capacity, the aim of evaluation is not cross-country comparison. Evaluations should assess whether a country's systems remain fit for their intended objectives, examine dependencies and complementarities between systems, and review governance, data flows, workforce capacity, and sustainability.

ECDC's 2014 handbook 'Data quality monitoring and surveillance system evaluation – A handbook of methods and applications' covers the elements to consider when planning an evaluation [32]. They may be based primarily on desk review, questionnaires and interviews, but can be strengthened through interactive, multi-stakeholder workshops based on scenarios, such as MOSAIC framework workshops [33].

Preparedness and response

As respiratory viruses cause recurrent epidemics and have pandemic potential, preparedness is essential to ensure timely and effective public health response.

- **Preparedness planning** supports timely and proportionate responses to threats, such as respiratory virus pandemics. These plans can, for example, describe how surveillance systems are adapted, including scaling up or down, in response to evolving threats.
- **Simulation exercises** support structured reflection of how well surveillance may perform in different made up, but realistic scenarios. Taking part in such exercises can help to improve coordination and communication mechanisms. Identifying gaps and challenges can lead to improvements and the strengthening of capacities [34, 35].
- **After-Action Review** (AAR) is particularly valuable following periods of pressure, such as an unusually severe influenza season, by bringing together relevant stakeholders to reflect on the timeline of the event, what worked well, the challenges, and what to improve moving forward [36].
- **Public Health Emergency Preparedness Assessments** (PHEPA) cover key aspects of public health preparedness relevant to respiratory virus diseases including surveillance systems, laboratory capacity, risk communication and community engagement, coordination and zoonotic threats [37]. PHEPA also consider countries' capacity to implement the International Health Regulations (IHR, 2005) based on responses to the **Self-Assessment Annual Report (SPAR)**. The **Joint External Evaluation (JEE)**, coordinated by WHO and complementary to SPAR, also provides an opportunity to periodically review the IHR capacities during an in-country visit [38].

Collaboration and exchange

Collaboration and exchange are essential to support continuous learning and capacity building. This can be achieved within a country by bringing together different national and regional stakeholders to improve coordination and shared understanding. Exchange between countries enables the sharing of experiences, helps avoid duplication of efforts, and supports coordinated approaches to common challenges. Collaboration and exchange can be facilitated through:

- Multi-stakeholder national forums, supported by regular meetings, workshops, and webinars.
- The European Respiratory Viruses Network (ERVI-NET) which provides structured opportunities for regular exchange.
- Twinning and bilateral exchanges to enable focused, peer-to-peer learning on complex or emerging topics.
- Training and workshops on specific topics or technological developments.
- ECDC's Fellowship training programmes for field epidemiology (EPIET) and public health microbiology (EUPHEM).
- ECDC's outsourced projects that include surveillance networks for vaccine effectiveness and mortality monitoring.

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Annex 1. Developing action-oriented objectives

Through a series of online meetings, the working group (subgroup focused on action-oriented surveillance objectives) approached the objective development process as follows:

1. Agree public health actions informed by surveillance data

The actions considered were those presented in Table 3, plus a number that were removed following further analysis or network consultation. Actions related to 'estimating needs (for masks/PPE, consumables and equipment, vaccines, monoclonal antibodies, antivirals) so adequate quantities are procured to ensure target groups in specific settings can be protected' were dropped since they were not felt to be the core business of surveillance and could be achieved if target groups were identified and quantified. 'Preparing for new immunisation programmes' was initially considered as a standalone category, but since the information requirements are the same as those for existing programmes (Actions 2B and 2C) it was decided to merge them during the analysis.

2. Identify information requirements for each action

The working group discussed the information needed to inform each public health action. The wording of the information requirements was standardised and analysed at ECDC. Information requirements that were later classified as surveillance systems were removed from the analysis. The analysis revealed that many information requirements are common to more than one public health action and that the information requirements could be grouped together under common themes to reflect the type of data they are based on.

3. Objectives based on emerging themes with alignment to other documents

It became clear that the emerging themes corresponded quite closely to the overarching themes behind the surveillance objectives in the 2022 Operational Considerations [5] and the 2024 GISRS guidance [6]. The working group agreed that maintaining close alignment and coherence with existing objectives was desirable, with modifications as required. Following this discussion, three main themes (general epidemiological, virus characterisation and assessment of interventions) were selected. These themes and their associated information requirements formed the basis for defining the surveillance objectives.

- Objective 1 merges the content of the Operational Considerations Objectives 1 and 2 and incorporates some wording from the first two primary objectives in the GISRS guidance. Some sub-objectives and associated information requirements are closely aligned with sub-objectives in the GISRS guidance.
- Objective 2 is based closely on the wording of the Operational Considerations Objective 3. The sub-objectives and information requirements have been phrased in general terms to make them pathogen-agnostic, as even if they do not currently apply equally to all viruses, we should consider that they may do in future.
- Objective 3 incorporates burden of disease into the theme of assessment of interventions, since reducing burden is a public health aim, thus merging the content of the Operational Considerations Objectives 4 and 5. It also incorporates some wording from the sub-objectives of the GISRS guidance secondary objective on special investigations.

The wording 'other respiratory pathogens' was included in the objectives, where relevant, alongside explicit naming of influenza viruses, SARS-CoV-2 and RSV. This is in line with the approach taken in the 2022 Operational Considerations and 2024 GISRS guidance. Many countries routinely use respiratory panels which allow them to understand the relative contribution of multiple pathogens, even if these data are not currently requested at EU level. The inclusion of this wording allows for any possible expansion of indicator-based surveillance in future to other viruses for which pharmaceutical interventions are developed or which contribute to the overall burden and influence the seasonality of influenza viruses, SARS-CoV-2 and RSV.

4. Determine the frequency and geographical level for the information requirements

The frequency with which information is needed to inform the different public health actions was defined using a 3-point categorical scale. Weekly was agreed as the lowest level for routine surveillance, even if daily may be appropriate for some continuous, automated systems or during emergencies. The geographical level for data collection and analysis was also assigned using three categories: national, including subnational data; European (analysis or data collection at EU/EEA including EURL or ECDC-funded projects, where some will also be relevant for collaborative activities with WHO Regional Office for Europe); other supranational (including WHO-CC or where information comes from studies/literature).

Geographical level was assigned to each information requirement while frequency varied depending on the specific action. In the final analysis, frequency was simplified so that it related to the typical frequency of each action (Figure 3).

5. Mapping of surveillance systems and complementary data sources to objectives

The assignment of systems to core and supplementary was carried out at ECDC but inspired by similar work done in the Netherlands that was shared through the working group. The working group discussed whether individual data sources should be considered as routine surveillance data. Those considered out of scope have been classified as complementary data, to show that they are not routinely available in most countries. The final step of mapping the systems and complementary data to the sub-objectives and information requirements (Figure 2) to assess their ability to meet surveillance objectives was carried out at ECDC.

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