Strategic Framework for Action for
Strengthening Surveillance, Risk
Assessment and Field Epidemiology
for Health Security Threats
in the WHO South-East Asia Region
Strategic Framework for Action for Strengthening Surveillance, Risk Assessment and Field Epidemiology for Health Security Threats in the WHO South-East Asia Region

November 2023
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Foreword

Strengthening health emergency preparedness and response has been an important health priority in the WHO South-East Asia Region. Emergency risk management was identified as a Regional Flagship Priority Programme in 2014. Honourable Ministers of Health of the Member States in the Region had endorsed the Delhi Declaration - Emergency Preparedness in the South-East Asia Region at the Seventy-second session of the WHO Regional Committee for South-East Asia in 2019.

COVID-19 pandemic caused enormous negative consequences on health, society and economy. While managing the COVID-19 pandemic and other emergencies and disasters, countries in the Region learned lessons and identified areas that require further improvements. WHO Regional Office for South-East Asia had the honour to work with Member States to review the lessons from the COVID-19 pandemic and other emergencies, and to develop the Regional Strategic Roadmap for Health Security and health System Resilience for Emergencies 2023–2027, which was endorsed by the Member States at the Seventy-fifth session of the WHO Regional Committee for South-East Asia in 2022.

Key components of country and regional health security systems include the system and capacities for surveillance, risk assessment and field epidemiology, which can provide early warning and guide decision-making for public health actions. This necessitates connecting various surveillance systems and stakeholders across sectors to share and synthesize multiple information sources, generated by traditional and non-traditional approaches. As such, this document Strategic Framework for Action for Strengthening Surveillance, Risk Assessment and Field Epidemiology for Health Security Threats in the WHO South-East Asia Region proposes a multisource collaborative surveillance approach as a key framework to advance collaborative efforts for surveillance, risk assessment and field investigations.

This document proposes a set of priority actions to further advance surveillance, risk assessment and field epidemiology. The document was developed through active consultations with Member States and partners and aligned to emerging global frameworks, such as the Collaborative Surveillance framework. I believe important lessons learnt from the Member States are reflected in the framework. Public health surveillance systems should be further strengthened by combining traditional and non-traditional approaches. Risk assessment should be conducted in a systematic manner, and the results should be informing decision-making. The framework also calls for national planning and sustained investment to strengthen field epidemiology capacities.

Additionally, the framework advocates for enhancing regional cooperation and information-sharing to provide a timely alert and to inform countries’ risk assessment and readiness actions. This will require advancing implementation of International Health Regulations (2005) as well as enhancing regional and cross-border mechanisms, learning and trust.

I hope this document provides a useful guide for Member States on planning the priority actions to further strengthen surveillance, risk assessment and field epidemiology. The systems and capability need to be strengthened from a local level to national and regional levels. By implementing these collective actions, we will make progress towards a safer and more secure WHO South-East Asia Region.

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## List of acronyms and abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AI</td>
<td>Artificial intelligence</td>
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<tr>
<td>COVID-19</td>
<td>Coronavirus disease 2019</td>
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<td>CRVS</td>
<td>Civil registration and vital statistics</td>
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<td>EBS</td>
<td>Event-based surveillance</td>
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<td>EIOS</td>
<td>Epidemic intelligence from open sources</td>
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<td>EWAR</td>
<td>Early warning, alert and response</td>
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<td>EWARS</td>
<td>Early warning, alert and response system</td>
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<tr>
<td>FAO</td>
<td>United Nations Food and Agricultural Organization</td>
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<td>FETP</td>
<td>Field epidemiology training programme</td>
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<td>FHIR</td>
<td>Fast Healthcare Interoperability Resources</td>
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<tr>
<td>GI-AI4H</td>
<td>Global Initiative on AI for Health</td>
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<td>GOARN</td>
<td>Global Outbreak Alert and Response Network</td>
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<tr>
<td>HEPR</td>
<td>(global architecture for) health emergency preparedness, response, and resilience</td>
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<td>HL7</td>
<td>Health Level Seven International (health-care standards organization)</td>
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<tr>
<td>IBS</td>
<td>Indicator-based surveillance</td>
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<td>ICU</td>
<td>Intensive care unit</td>
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<td>IHR (2005)</td>
<td>International Health Regulations 2005</td>
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<tr>
<td>IHR NFP</td>
<td>National IHR Focal Point</td>
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<tr>
<td>INB</td>
<td>Intergovernmental Negotiating Body</td>
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<tr>
<td>ITU</td>
<td>International Telecommunication Union</td>
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<tr>
<td>PISA</td>
<td>Pandemic influenza severity assessment</td>
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<tr>
<td>SEARO</td>
<td>Regional Office for South-East Asia (of the World Health Organization)</td>
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<tr>
<td>SOP</td>
<td>Standard Operating Procedure</td>
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<tr>
<td>WIPO</td>
<td>World Intellectual Property Organization</td>
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<td>WHO</td>
<td>World Health Organization</td>
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<td>WOAH</td>
<td>World Organization of Animal Health</td>
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<td>WGIHR</td>
<td>Working Group on Amendments to the International Health Regulations</td>
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Executive Summary

WHO South-East Asia Region continuously faces increasingly complex health emergencies from various hazards. While countries in the Region have made considerable progress in strengthening health security systems, recent severe emergencies, including the COVID-19 pandemic, posed unprecedented challenges. At the same time, the countries in the Region have learned critical lessons in managing health security threats. Those lessons were synthesized in a regional meeting that took place in October 2021, based on which the Regional Strategic Roadmap for Health Security and Health System Resilience for Emergencies 2023–2027 (Regional Strategic Roadmap) was developed and adopted at the Seventy-fifth session of the WHO Regional Committee for South-East Asia in 2022.

To identify priority actions to implement the Regional Strategic Roadmap in the areas of surveillance, risk assessment and field epidemiology, a Regional consultation Strengthening public health surveillance and risk assessment for health security threats (2) was organized in September 2022 (Bangkok, Thailand). The contribution of the participants from Member States and partners during this meeting formed the foundation of this document Strategic Framework for Action for Strengthening Surveillance, Risk Assessment and Field Epidemiology for Health Security Threats in the WHO South-East Asia Region. Furthermore, the document incorporated strategic direction of the emerging global framework, particularly the Collaborative Surveillance (3).

The framework proposes multisource collaborative surveillance as the overarching framework. In making critical decisions during complex emergencies, the framework highlights the importance of using multiple information sources. Collaborative arrangement for surveillance and risk assessment should be enhanced at all levels, while overall surveillance systems should be reviewed and optimized, guided by surveillance objectives to address fragmentation and duplication. Mechanisms to monitor risks at the human-animal-environmental interface require further strengthening through coordination among relevant sectors. Regional and cross-border collaboration also needs to be advanced.

The framework summarizes identified priority actions for countries to strengthen surveillance, risk assessment and field epidemiology.

- Continued efforts should be made to strengthen core surveillance functions, especially to provide early warning and information to guide timely decision-making. Additional surveillance approaches may further benefit risk assessment and decision-making, and they should be considered, introduced or strengthened for priority hazards – such as genomic surveillance, waste-water surveillance, environmental monitoring and behavioural surveillance.
- Risk assessment for acute public health events should be systematically conducted, and analysis of data should be strengthened at national, subnational and local levels to effectively inform public health actions.
- The framework encourages all the countries to have a national plan to strengthen field epidemiology workforce with adequate competencies at different administrative levels, and to gradually institutionalize the training programme. Field investigation and epidemiological studies should be further strengthened to guide interventions and policies.
- Cross-cutting enablers, including governance and coordination, legal instruments, sustainable financing, information systems, new technology and monitoring and evaluation, provide foundation for surveillance, risk assessment and field epidemiology, and require continued investment.
Priority actions are also proposed to **strengthen the regional systems**. Regional public health intelligence activities should continue to be strengthened to ensure timely alert function in the Region. This also requires collective efforts to further advance timely and effective event communication following International Health Regulations (IHR) (2005) (4) obligations. Regional mechanisms and cross-border arrangements for sharing the health emergency information should be enhanced. It is proposed that regional learning and innovation should be fostered for surveillance and epidemiology.
1. Background

Advancing health security systems in WHO South-East Asia Region

Strengthening health emergency preparedness and response has been an important health priority in the WHO South-East Asia Region. Emergency risk management was identified as a Regional Flagship Priority Programme in 2014 (5). Honourable Ministers of Health of the Member States endorsed the Delhi Declaration on Emergency Preparedness in the South-East Asia Region at the Seventy-second session of the WHO Regional Committee for South-East Asia in 2019 (6).

Member States in the Region have made considerable progress in advancing core capacities mandated by the International Health Regulations (IHR) (2005) for health emergency preparedness and response (1). However, the COVID-19 pandemic has posed unprecedented challenges for every country. At the same time, the pandemic provided opportunities for countries to learn critical lessons and to identify areas that require further improvements. As such, the seventy-fourth session of WHO Regional Committee for South-East Asia (September 2021) recommended “Member States and WHO must work together to synthesize lessons from the COVID-19 pandemic, identify common priorities, and develop a regional roadmap to advance health security systems” (7).

Responding to these recommendations, the WHO Regional Office for South-East Asia organized meetings with Member States, experts and partners in October 2021 (8, 9). These consultations provided important insights on what has worked and what should be prioritized for our efforts and investment in better preparing for future pandemics and emergencies. Informed by these lessons, the Regional Strategic Roadmap for Health Security and Health System Resilience for Emergencies 2023–2027 (Regional Strategic Roadmap) was developed, through full consultation with the Member States, and was adopted at the Seventy-fifth session of the Regional Committee for South-East Asia in September 2022 (1). The Regional Strategic Roadmap provides high-level strategic direction to strengthen the health security and health system resilience in the next five years (2023–2027) in the WHO South-East Asia Region.

Efforts to strengthen global health security framework following the COVID-19 pandemic

Various global bodies, committee and panels undertook the review of COVID-19 pandemic and response, such as the IHR review committee (10), the Independent Panel on Pandemic Preparedness and Response (11), the Global Pandemic Monitoring Board (12), and the Independent Oversight and Advisory Committee (13), along with others. WHO secretariat has summarized the recommendations from those global reviews (14).

Informed by these reviews and recommendations, at the Seventy-fifth World Health Assembly in May 2022, WHO set out a harmonizing framework to strengthen the global architecture for health emergency preparedness, response, and resilience (HEPR) (15, 16). Recognizing the need for a stronger, inclusive, equitable and coherent health-security architecture, the recommendations were grouped by three main pillars – governance, financing and systems.

For the governance pillar, the Member-State-driven processes have been initiated (16). The first of these efforts is the work of the Intergovernmental Negotiating Body (INB) to draft and negotiate a WHO convention, agreement or other international instrument on pandemic prevention, preparedness and response (WHO CA+). In addition to the INB process, WHO Member States are also engaged in the process of considering targeted amendments to the IHR (2005), through the Working Group on Amendments to the International Health Regulations (2005) (WGIHR).
For the finance pillar, new mechanisms to secure sustainable financing for health emergency preparedness and response, such as the Pandemic Fund, have been launched.

For the systems, HEPR calls for strengthening five core health emergency components, as named five Cs - collaborative surveillance; community protection; safe and scalable care; access to countermeasures; and emergency coordination (16).

**Strengthening surveillance, risk assessment and field epidemiology in the evolving context**

The Regional Strategic Roadmap (1) provides high level strategic direction for the country’s core health security systems and response plan, and for regional health security systems. At the same time, it was necessary to identify concrete actions required to achieve the proposed goals and objectives of the roadmap for each of the system components.

The regional consultation *Strengthening public health surveillance and risk assessment for health security threats in the WHO South-East Asia Region* was organized to translate the Regional Strategic Roadmap into concrete priority actions (2). Through this regional meeting, the participants identified common priority actions on surveillance, risk assessment and field epidemiology. The contribution of the Participants from Member States and partners during the meeting formed the foundation of this document *Strategic Framework for Action for Strengthening Surveillance, Risk Assessment and Field Epidemiology for Health Security Threats in the WHO South-East Asia Region*.

Alongside the initiatives in the Region, new global frameworks have been proposed to further strengthen surveillance systems, such as Collaborative Surveillance and the Mosaic Respiratory Surveillance Framework (3,17).

Collaborative surveillance (3) is proposed as one of the five core components of HEPR systems, and is defined as the systematic strengthening of capacity and collaboration among diverse stakeholders, both within and beyond the health sector, with the ultimate goal of enhancing public health intelligence and improving evidence for decision-making. Learning from the complex challenges highlighted by the COVID-19 pandemic and other emergencies, the collaborative surveillance concept emphasizes collaboration itself as a key capability – building intentional collaboration across diseases and threat-surveillance systems, sectors, geographic levels, and emergency cycles.

The Mosaic Respiratory Surveillance Framework (17) also promotes a collaborative approach to surveillance, with particular focus on respiratory viruses such as influenza, SARS-CoV-2, and respiratory syncytial virus. It is impossible to address the many complex needs of respiratory-virus surveillance with a single system, and as such, multiple surveillance systems and complementary studies must fit together as tiles in a mosaic to provide a complete picture of the risk, transmission, severity, and impact of respiratory viruses of epidemic and pandemic potential.

Building on contribution from the Regional consultation, this document was finalized incorporating the strategic direction of those emerging global frameworks.
2. Objectives and structure of the proposed framework

This action framework aims to contribute to the implementation of the Regional Strategic Roadmap (1). As such, the framework aims to move towards the strategic vision, goal and strategic objectives of the Regional Strategic Roadmap (Box).

**Box. Vision, goal and objectives of the Regional Strategic Roadmap for Health Security and Health System Resilience for Emergencies 2023–2027 (1)**

**Strategic vision**
People and economies in the WHO South-East Asia Region are protected from the impact of public health emergencies.

**Goal**
To strengthen national and regional health security and health system resilience, to anticipate, prevent and manage health emergencies while maintaining essential health services, through enhanced health systems, governance and collaboration within and across the countries of the Region.

**Strategic objectives**

1. Strengthen the whole-of-government and whole-of-society approaches to enable more effective public health emergency preparedness, readiness and response.
2. Strengthen the country’s health security systems to reduce risks, anticipate, detect early, prevent, and respond to public health emergencies, and recover from their impact.
3. Strengthen governance, financing and enabling functions and health system resilience for emergency preparedness and surge response.
4. Strengthen health system resilience to enable continuity of essential health services.
5. Strengthen regional alert, preparedness, and response systems, through improved regional collaboration.

This action framework especially aims to propose priority actions related to the “5.A.2 information, surveillance and intelligence” section of the country core health security systems (5.A), and part of the “5.C regional and global initiatives and linkages” section of the Regional Strategic Roadmap (1). Based on those sections of the roadmap, this framework proposes the following specific objectives.

**Specific objectives for the framework**

1. Ensure surveillance systems are able to provide effective early warning and information to guide risk assessment and timely decision-making in the evolving situation of health emergencies
2. Strengthen systematic risk assessment and data analysis through synthesizing multiple information sources, ensuring the results are informing decision to manage health security threats
3. Advance the programme to strengthen field epidemiology capacities at all levels and to strengthen field investigations and epidemiological studies to inform public health actions
4. Strengthen regional mechanisms for public health intelligence, alert, information-sharing and capacity-strengthening
5. Advance collaborative approaches for surveillance, risk assessment, and field investigations across systems, stakeholders, sectors and countries

Structure of the framework
This framework proposes the following structure to guide actions towards the above specific objectives (Figure 1). Multisource collaborative surveillance is proposed as overarching framework. The actions are grouped into two components – actions to strengthen country systems and actions to strengthen regional systems. The actions to strengthen country systems are composed of three technical pillars – namely, surveillance, risk assessment and data analysis, and field epidemiology – as well as cross-cutting resources and capacities.

Figure 1. Strategic framework for action to strengthen surveillance, risk assessment and field epidemiology in the WHO South-East Asia Region
3. Multisource collaborative surveillance

During emergencies, decision-makers need to make critical decisions continuously to manage health security threats despite many uncertainties. Use of multiple sources of information often helps to improve decision-making, especially in large-scale and complex health emergencies. Information required for decision-making and their relative contribution evolves over the phases of emergencies (Figure 2). Synthesizing multiple sources of information for surveillance and risk assessment requires collaborative arrangement of various systems, stakeholders, sectors and administrative levels. Recent regional and global guidance calls for collaborative approaches to enable multisource surveillance for risk assessment and decision-making (3, 17, 18).

Figure 2. Illustrative presentation showing information sources and their relative importance for decision-making may evolve during emergencies

A multisource collaborative surveillance approach is expected to produce benefits in various scenarios:

- Early warning and alert – Event-reporting from health-care workers or media articles often provides signals of acute public health events, while a surveillance based on indicators may contribute by detecting changes in an epidemiological situation. Signals are often verified through field investigations, involving local stakeholders. Intelligence from One Health partners may provide important insights.
- Improved epidemiological understanding – Each surveillance system has biases and limitations. The triangulation of various information sources improves interpretation of an ongoing epidemiological situation, by addressing biases and limitations of each surveillance system (19).
- Contextual intelligence – Broader contextual information often provides critical information for risk assessment and decision-making. The contextual information includes, for example, population immunity, vector density, environmental conditions, people’ movements and social mixing, system capacities, and vulnerabilities.
Collaborative Surveillance (3, 20) encourages all countries and partners to strengthen surveillance capacities and collaboration and to strive towards a common goal of optimized decisions for coordinated action. Actions proposed in this framework are expected to support operationalization of a collaborative approach. Here, three processes are particularly highlighted as important factors to enable multisource collaborative surveillance.

**System design and performance:** Surveillance objectives should be clarified for the priority hazards, and surveillance approaches and information sources should be reviewed and optimized. Standardized procedures and harmonized tools should be in place, and an integrated platform may be established where appropriate. Coordinated digitalized information systems should be gradually strengthened to facilitate reporting and analysis, with increased interoperability to enable connectivity across the systems.

**Governance and coordination:** Intentional efforts are needed in connecting surveillance stakeholders across systems, platforms and sectors. Coordinated arrangements across systems, stakeholders and sectors, supported by appropriate governance structure and legislation, are needed to address fragmentation and duplication, and to establish procedures and platform for information sharing.

**Workforce:** Continued efforts are needed for workforce development for collecting, managing and analysing data at all levels, particularly at the subnational and local levels. Capacities to triangulate and interpret the epidemiological data and other information, as well as capacities to coordinate various stakeholders to strengthen collaborative approach should be strengthened.
4. Country systems

This section summarizes proposed priority actions to strengthen surveillance, risk assessment and field epidemiology as part of national health security systems (Figure 3). While countries have made considerable progress, continued efforts and investments are needed to cope with increasingly complex health emergencies. Cross-cutting enabling factors have also been identified to enhance effectiveness and sustainability of the systems.

Figure 3. Proposed components of country systems
4a. Surveillance for health security threats

IHR (2005) defines surveillance as the systematic ongoing collection, collation and analysis of data for public health purposes and the timely dissemination of public health information for assessment and public health response as necessary (4). A surveillance system to manage health security threats should be able to provide early warning and alert, as well as timely and relevant information for risk assessment and decision-making for public health actions. The systems need to be adaptable to evolving information needs over different phases of outbreaks and health emergencies, while ensuring the efficient use of the resources. Optimizing system design and improving performance of public health surveillance are critical foundations for multisource collaborative surveillance.

4a.1 Strengthen core surveillance functions to manage health security threats

Continue to strengthen event-based surveillance (EBS) using relevant information sources. All the countries in the Region have established event-based surveillance, although the functionality, procedures and information sources vary. Detected signals should be triaged and timely verified.

- First, systems and procedures should be established for health-care workers and laboratory staff to immediately report unusual events and observations, both from public and private health facilities (health facility EBS).
- Second, systematic screening of formal and informal media from open sources on the internet should be implemented at appropriate levels (including at the subnational level as appropriate). Epidemic intelligence from open sources (EIOS) (21) may be considered as an option (media EBS).
- Third, countries may consider receiving reports from communities, such as from non-governmental organizations, community leaders, community health-care workers, and other community organizations through mechanisms such as call centres or hotlines. Community reports may play especially important roles among vulnerable populations and humanitarian settings (community EBS).

Review, optimize and strengthen routine indicator-based surveillance (IBS). IBS systems will continue to serve as backbone in monitoring epidemiological situations and detecting the changes in the epidemiological situation of health hazards. Guided by surveillance objectives, appropriate surveillance approaches should be selected (for example, disease notification, sentinel surveillance, syndromic surveillance, laboratory-based surveillance, community-based surveillance). The systems should be regularly reviewed and adjusted to ensure that they are efficient and adaptable to evolving information needs. Timeliness is especially important for acute public health events that may evolve rapidly, requiring timely public health actions. Private health-care services should be engaged in relevant IBS systems.

Strengthen systems for early warning, alert and response (EWAR). Mechanisms and practice should be established to synthesize information from various surveillance systems, including EBS and IBS, to rapidly detect and verify the signals, and timely respond to acute public health events. To ensure effective EWAR functions, information should be sought not only from traditional disease-based or syndromic surveillance, but also from additional information sources, such as waste-water surveillance, vector surveillance, climatic data, and behavioural information, depending on the hazard and context.

Ensure surveillance systems are supported by effective public health laboratory networks. Continue to strengthen laboratories to identify infectious and non-infectious hazards rapidly, accurately and
safely adopting a One Health approach, by improving multisectoral collaboration and partnerships, as guided by the WHO South-East Asia regional roadmap for diagnostic preparedness, integrated laboratory networking and genomic surveillance (2023–2027) (22). This will include ensuring access to laboratory diagnosis through national and regional laboratory networks. In addition, laboratory-based surveillance systems for priority pathogens and antimicrobial resistance are expected to play increasingly important roles in the national surveillance systems to address health security threats.

**Strengthen genomic surveillance systems using One Health approach.** COVID-19 pandemic has highlighted the critical importance of timely detecting and monitoring virus evolution to guide adequate response measures. Continue to invest in genomic surveillance systems with adequate sampling approach. This may include ensuring agreement and procedures for timely referral of specimens to international laboratory networks. Collaborate with One Health partners to monitor and exchange the sequences of priority pathogens emerging or circulating in humans, animals and environment. The WHO South-East Asia regional roadmap for diagnostic preparedness, integrated laboratory networking and genomic surveillance (2023–2027) (22) provides strategic framework and priority actions to strengthen the genomic surveillance.

**Continue to enhance multisectoral mechanism to monitor public health hazards at the human-animal-environment interface,** ensuring timely and effective information sharing across surveillance systems managed by different One Health stakeholders on humans, animals, wildlife and environment. These efforts should be built on the countries’ initiatives to advance One Health coordination mechanisms to address zoonotic diseases, foodborne and waterborne diseases, as well as antimicrobial resistance. Enhance use of existing data sources that may contribute to understanding risks at the interface, such as database on veterinary science and antimicrobial resistance.

**Enhance integrated platform for relevant diseases.** Countries are encouraged to explore benefits of integrated approaches for disease surveillance and promote such approaches where appropriate. Having an integrated or harmonized platform streamlines the surveillance systems and may contribute to improving their performance and efficiency. The use of integrated platform is especially beneficial for diseases with similar symptoms or transmission routes, such as, respiratory or Aedes-borne arboviral diseases.

**4a.2 Strengthen non-traditional approaches and information sources to enhance surveillance**

**Establish and maintain waste-water surveillance for priority pathogens.** Monitoring of wastewater from communities or facilities can provide additional evidence on circulation of the pathogen of interest among the population, including pathogen presence or absence, early warning of increasing or decreasing trends, and information on evolution of pathogens. As properly planned, and if resource permits, waste-water surveillance has the potential to provide effective early warning and readiness actions.

**Promote use of environmental data through One Health collaboration.** Data shared from other sectors through One Health coordination may provide important information to monitor the risks and provide early warning signals. This includes, for example, data on rainfalls, temperatures, vectors, wildlife, and water quality. Partnership and mechanisms should be established to enable use of such information for early warning, risk assessment and decision-making for public health actions for priority diseases and health hazards.
Establish systems to monitor the level of hospitalization and admission to intensive care unit (ICU). The level of hospitalization and ICU admission serves as a potential indicator to assess disease severity at a population level. It is also important to monitor the strain on health-care services, for example, through occupancies of acute and critical care beds, and the use of ambulances – those indicators may be used to adjust public health and social measures to prevent overwhelming strains on health-care services. Indicators on hospitalization have also been used for pandemic influenza severity assessment (PISA) (23). Monitoring of such indicators requires effective coordination of health-care and public health systems. Countries are encouraged to establish mechanisms that enables public health units to monitor those health-care system-based indicators.

Participatory surveillance. Participatory surveillance of public health involves engagement of communities and individuals in actively monitoring and reporting health-related information. An advantage of participatory surveillance is that information can be reported from individuals with the disease who do not seek health care, and such method has been applied for diseases such as influenza and COVID-19 as complementary information to other surveillance data. Participatory surveillance approach also has the potential to collect community-based information on suspected occurrence or risk of emergence of disease in human populations.

Engage academic and private sectors to enhance surveillance efforts. Partnership with academia and private sectors should be explored as potential information sources to supplement public health surveillance data. For example, research studies by academia and genomic sequencing carried out by private laboratories, if available, may provide useful additional information to better understand the characteristics and circulation of pathogens and hazards.

Strengthen surveillance for cross-border public health risks. Border areas may bear public health risks associated with importation of pathogens and other health hazards from neighbouring countries. Points-of-entry may play roles in implementing additional health measures, as guided by IHR(2005). Mechanisms and plans should be in place, as part of national surveillance systems, to monitor public health risks associated with international travel and trade, and cross-border movement of people and animals. This may include regular sharing of data between public health authorities in neighbouring countries. Surveillance approaches and health measures at point-of-entry should be adjusted through risk-based approach, informed by risk assessment in the evolving situation of the health hazards of public health concern (see the Section 4b.1).

Capitalize on the efforts to strengthen civil registration and vital statistics (CRVS) and mortality surveillance. It is important for countries to understand the impact of epidemics, pandemics and other emergencies, through having adequate estimates of deaths and their causes. When the system is functional, the data from CRVS may help estimate and monitor the impact of the emergency. However, it takes years to establish well-functioning civil registration systems; in such case, there are interim measures that countries can use to gather information, such as sample registration, verbal autopsy and mortality surveillance.

Enhance contextual knowledge of vulnerabilities. A multisectoral understanding of vulnerabilities – demographic, environmental, social and economic drivers of health risks based on local contexts – should be enhanced to better analyse the risks and to inform public health readiness and response. Such knowledge may also be used to inform design of surveillance, to interpret surveillance findings and to better inform risk assessment.

Explore the value of social and behavioural data. Social and behavioural data are increasingly used to better understand the drivers of epidemics and pandemics and the effectiveness of interventions.
This may include monitoring patterns and volume of people’s mobility and social mixing, sales of certain medicines at pharmacies, compliance to public health and social measures, hesitancy to take vaccines and various cultural practices and behaviours that have public health implications.

**Surveillance during humanitarian settings and natural disasters.** When routine surveillance is disrupted or rendered ineffective during humanitarian emergencies or natural disasters, it becomes crucial to address the unique surveillance requirements of vulnerable populations and the heightened risk of infectious disease transmission. Countries must maintain capabilities of early warning and surveillance, even in challenging settings. In such situations, special early warning, alert, and response systems such as WHO’s EWARS in a box can play a vital role in rapidly establishing early warning surveillance, primarily adopting syndromic approaches and incorporating event-based surveillance (24). Once the emergency passes, the system can be reintegrated into the national routine surveillance system.
4b. Risk assessment and data analysis for acute public health events

During health emergencies, the authorities are required to make decisions for public health response, often with a high level of uncertainty. Public health response should be mobilized in proportion to the level of risk, avoiding excessive interference on social and economic activities. Systematic risk assessment will help guide defensible decision-making and provide foundation for appropriate response measures (25). Risk assessment is an integral part of overall risk management of public health events, and it informs risk mitigation measures and risk communication activities. Analysis and visualization of surveillance data are often critical steps in informing risk assessment and decision-making. It helps characterize health hazards, better grasp the epidemiological situation, estimate and forecast the trend, and communicate the rationale of the public health response. Both risk assessment and data analysis require organizing and synthesizing multiple information sources to guide decision-making.

4b.1 Strengthen risk assessment and risk-based approach

Strengthen systematic risk assessment for acute public health events. To manage acute public health events, methods and processes of systematic risk assessment help guide defensible decision-making and inform proportional and appropriate public health response measures, as well as operational and risk communication activities (25). Systemic risk assessment may help allocate and focus resources rationally to higher-risk public health events. While most countries in the Region have already been conducting risk assessment formally or informally, many countries also expressed a need to introduce more systematic approaches for risk assessment. Standard procedures should be established for an initial risk assessment that can be routinely conducted and for a formalized risk assessment that can be conducted for the major events when required. The relevant workforce should be trained in procedures to ensure the quality of risk assessment.

Strengthen mechanisms to use and communicate risk assessment results to decision-makers and stakeholders. It is also important to sensitize the decision-makers and risk communication teams to effectively use the results of risk assessment. Risk assessment results should also be communicated to the public and other stakeholders so that the rationale for public health decisions is understood and trust in the response is maintained. It is also important to communicate the uncertainty related to the risk assessment. Media can also be engaged and trained to communicate the risk assessment results.

Strengthen a risk-based approach for public health response. A risk-based approach aims to implement and adjust public health measures proportional to the level of risk, and thus to target control efforts and resources to higher-risk events and areas, while minimizing unnecessary interference on socioeconomic activities. The COVID-19 pandemic reiterated the critical importance of using a risk-based approach. While stringent restrictive measures helped to control transmission of the virus, they were accompanied by considerable negative impact on social and economic activities. A risk-based approach should be guided by sound risk assessment. In the context where frequent situation assessment and adjustment of response measures are required for different subnational areas, practical approaches are needed to stratify risk levels using a set of quantitative and qualitative indicators (26, 27). Based on the stratification of risk levels, countries have also introduced risk mapping of different subnational and local areas. Countries may review and develop methods and tools to strengthen a risk-based approach for priority diseases and for preparation for future emerging health security threats.
Establish mechanism and practice of joint risk assessment. Joint risk assessment engaging multiple sectors is especially beneficial when the concerned hazard requires coordinated assessment and response of different sectors and stakeholders. In particular, mechanism and practice of joint risk assessment using a One Health approach should be established to address the complex health threats at a human-animal-environment interface, including for zoonosis, foodborne and waterborne diseases, antimicrobial resistance, and vector-borne diseases. Operational tools developed by Food and Agriculture Organization of the United Nations (FAO), WHO, and World Organization of Animal Health (WOAH) provide suggested procedures for joint risk assessment (28).

4b.2 Strengthen data analytics for health emergency readiness and response

Collected data should be analysed to better inform risk assessment and public health response. Proper data analysis will be instrumental in comprehending the epidemiological characteristics, risk factors and drivers of the health hazards and informing appropriate control measures.

Strengthen data analysis at subnational and local levels. In many countries in the Region, one of the priorities is to enhance basic analytical capacities of the public health workforce at the subnational and local levels. Competencies and culture of conducting basic data analysis will likely empower local workforce to more effectively guide local response and contribute to overall national response actions. Training local health workforce may be undertaken through front-line field epidemiology training programme (FETP) (see the Section 4c.1) or other capacity-building activities.

Enhance advanced analytics to better inform response strategies. Advanced analysis may help identify risk factors of the concerned health hazards, determinants of transmission, and characterization of health hazards. This may include rapidly analysing transmission patterns, disease severity, and impact of emerging pathogens and variants. Findings from such analyses will inform risk assessment and identification of appropriate response strategy. Additionally, the use of data science methods for analysing and visualizing large datasets, as well as geographical information systems for mapping, can contribute to designing interventions and monitoring the impact of response actions.

Develop capacities to conduct forecasting and modelling analysis. Forecasting of epidemiological situation and response needs provides critical foundation for readiness planning for health security threats. Mathematical modelling will generate inference and help estimate potential impact of different policy options. Consider investing in developing capacities for forecasting and modelling, as well as capacities for communicating their results. This may require partnership with relevant national and international expertise.
4c. Field epidemiology

Field epidemiology generally refers to the use of epidemiological tools to investigate urgent public health problems and recommend actions to control or prevent them (29). During the COVID-19 and other emergencies, many countries in the Region noted that there was not a sufficient number of adequately trained epidemiologists to ensure performance of surveillance, investigation, and risk assessment, especially at subnational levels. While countries in the Region are at different stages in strengthening field epidemiology workforce, there appears to be common challenges – the number of trained epidemiologists, training approaches, and regards for field epidemiologists (2, 30). Field investigation and special studies play a critical role in informing evidence-based public health actions and policies, as integral components of multisource collaborative surveillance. It is important that countries enhance and maintain readiness and capacities to carry out rapid response investigations and epidemiological studies.

4c.1 Strengthen field epidemiology capacities

Invest in and implement a field epidemiology training programme (FETP). All the countries are encouraged to have a formal programme to build capacities in field epidemiology in a systematic manner, tailored to countries’ needs and priorities, and guided by a multi-year plan.

Develop national plan to strengthen field epidemiology capacities. Strengthening field epidemiology workforce in countries requires long-term vision, leadership and sustainable funding. In this regard, the development of a multi-year national action plan for field epidemiology is encouraged (aligned to the national action plan for health security, and the national plan on human resources for health). Such plan can facilitate shared understanding and concerted efforts among stakeholders, prioritize activities, clarify responsibilities, and support advocacy for sustainable domestic financing. The plan should be developed informed by local assessment and through consultation of relevant stakeholders. The planning should involve setting the targets for training field epidemiologists, determining programme structure, and identifying steps to enhance institutionalization of the programme.

Respond to emerging needs for a specialized programme. Countries are seeing emerging needs for specialized programmes of FETP, such as for noncommunicable diseases, veterinary, One Health, outbreaks in hospitals, antimicrobial resistance and the use of data science methods. As the demand for evidence-based public health policies and interventions will continue to increase, countries may need to respond to emerging health priorities in their respective country settings.

Strengthening faculty and mentorship. To effectively build field epidemiology capacity requires facilitators of learning, such as trainers, supervisors, and mentors. The training participants need be engaged through effective supervision, training, and mentoring. Investment in facilitators is expected to promote contextualization of training approaches, engagement of the fellows, and improved institutionalization. The facilitators of learning need opportunities to learn about training, mentoring, and supervising, and they will benefit from connecting with other facilitators to share and learn from one another in networks that gather regularly. Countries can also host a resource centre where facilitators can share and access training tools and materials.

Advance institutionalization of FETP and establish a career path for field epidemiologists. Despite critical contribution made by field epidemiologists in responses to the COVID-19 pandemic and other emergencies, regards and recognition for field epidemiology is not always high in many countries. This results in limited budget allocated for FETP, no clear career path being established for field
epidemiologists, and the FETP being not fully institutionalized in the national systems. Continued efforts and advocacy are needed to enhance domestic funding and institutionalization of FETP, and to strengthen career paths of FETP graduates. Documenting case studies describing how field epidemiologists contributed to the pandemic response and other emergencies, or a joint programme review of FETP may provide the basis for advocacy efforts in countries.

**Invest in regional cooperation to build a field epidemiology workforce.** It may not be feasible or efficient to establish an advanced training programme for countries with a relatively small population. In such situation, one option is to enrol fellows in international FETP courses that accommodate people from other countries. For example, FETP of India and Thailand routinely offer international or regional FETP courses. Countries may also seek technical support and cooperation from other countries and partners, including from WHO collaborating centres and through global and regional network for FETP, if required.

4c.2 Strengthen field investigations and epidemiological studies

**Strengthen field investigations to verify and manage public health events.** Field investigations are critical activities in managing health security threats by informing evidence-based response measures. Field investigations are conducted to verify the signals, describe the epidemiological situation, understand drivers and risk factors, and inform risk assessment. As such, field investigation is a critical element of rapid response activities and may be conducted jointly with other stakeholders such as One Health partners. Continued efforts should be made to ensure timeliness and quality of field investigations, including in remote areas and among vulnerable populations.

**Conduct special studies to inform interventions and policies.** Special epidemiological or operational studies may provide important evidence to inform risk assessment and decision-making. The studies should be designed to provide insights to inform interventions and policies, for example, to generate evidence on characteristics of pathogens (such as mode of transmission, transmissibility, clinical presentation and severity, serial interval, and infectivity over time), consequences of exposure to biological, environmental, and chemical hazards, as well as impact of interventions (such as effectiveness of vaccines, therapeutics, and public health and social measures). Countries may actively explore collaboration with research institutions and international partners for financial resources and technical assistance as needed. Furthermore, studies of social and behavioural science may provide important insights on the drivers of epidemics and pandemics, as well as factors influencing uptake and effectiveness of interventions (31).
4d. Enablers

In continuing our efforts to strengthen surveillance, risk assessment and field epidemiology, and to enhance collaborative approaches to use multiple information sources for decision-making, the success will be facilitated by various enabling factors (Figure 4). Here, six such enablers are discussed, including governance and coordination, legal instruments, sustainable financing, information systems, new technology, as well as monitoring and evaluation.

Figure 4. Enabling factors for surveillance, risk assessment and field epidemiology

Ensure effective governance and coordination, including One Health arrangement.

Leadership and governance play critical roles in strengthening countries’ surveillance, risk assessment and field epidemiology. Proactive coordination of relevant stakeholders is essential to promote a multisource collaborative approach across the systems, sectors and administrative levels in order to build effective and efficient information-sharing systems. Depending on the context of each country, it is important to clarify the responsibilities of stakeholders through a legal or policy framework, identify or establish a national steering or coordinating body, and foster a culture of trust that facilitates a collaborative approach and information sharing. Strengthening of field epidemiology also requires national leadership to invest in future public health workforce in the country.

A multisectoral, One Health approach is paramount to address complex health threats at the human-animal-environment interface. Zoonotic diseases, antimicrobial resistance and food safety events require coordinated assessment and actions engaging multiple sectors. While efforts have been made to strengthen One Health approaches in all the countries, risks at the human-animal-environment interface pose increasingly complex challenges. Further efforts are needed to strengthen One Health approaches – identifying common priorities, improving information sharing, strengthening joint investigation and risk assessment, facilitating a coordinated response and risk reduction, and developing an epidemiologist workforce. The exchange of genomic sequencing data across humans, animals and environment should also be strengthened.
**Review and ensure adequate legal instruments for public health surveillance, investigations and epidemiology workforce**

Legal instruments enable the authorities to exercise essential health security functions, including public health surveillance, investigations and response. The law defines the responsibilities for relevant actors (such as health-care workers) in reporting notifiable diseases. The legal instruments can also clarify the roles and responsibilities of relevant sectors in preparing for and responding to health emergencies. While all the countries in the Region have a law that governs the management of infectious diseases or health security threats, those laws may be outdated and contain elements that are inconsistent with current context and approaches to public health. Based on lessons from the COVID-19 pandemic and other health emergencies, countries are encouraged to review the legal framework and identify whether any amendments are needed to strengthen future public health surveillance, investigation and response, as well as to advance implementation of the IHR (2005). The legal framework should also be reviewed from perspectives of information and pathogen sharing within the country and internationally in the context of convention of biological diversity, as well as data protection of individual data. A legal instrument on human resource for health may define roles of epidemiologists and public health professionals, which may help strengthen the career path for epidemiologists as a profession. At the same time, it is important to raise awareness of legal obligations among relevant stakeholders.

**Mobilize and ensure sustainable financing**

Building countries’ health security systems requires sustainable financing, combined with long-term vision and leadership. The momentum has been generated through the regional governing body of WHO. In 2019, Honourable Ministers of Health of the Member States endorsed the Delhi Declaration on Emergency Preparedness in the South-East Asia Region at the Seventy-second session of the WHO Regional Committee for South-East Asia in 2019 (6). At the Seventy-fifth Session in 2023, the Member States adopted the *Regional Strategic Roadmap on Health Security and Health System Resilience for Emergencies 2023–2027*. It is expected such commitment be translated into progressive and adequate funding to advance health security systems and health system resilience.

One of the priorities is to ensure that the national action plan for health security and related subplans, including those to strengthen surveillance, risk assessment and field epidemiology is costed, and that high-level endorsement is obtained. The plans should be developed in participatory manner engaging all relevant stakeholders. In this process, it is also important that activities are prioritized on the basis of lessons learnt from COVID-19 and other emergencies. Countries may consider developing an investment plan, estimating the returns for investment, as basis for advocacy.

The budget should be predictable, flexible and distributed in a timely manner at the national, intermediate and local levels in all relevant ministries or sectors, with monitoring and accountability mechanisms in place. The public financial resources mechanism for responding to public health emergencies should also be in place at the national, intermediate and primary levels, and it should allow for the timely distribution and execution of funds by relevant sectors during a public health emergency.
Optimize and advance information systems and their digitalization

Surveillance should be supported by functional information systems that facilitate effective, timely and efficient reporting, information management and sharing, and data analysis. Recent global reviews of health security systems recommended the more effective use of digital technologies for surveillance and information systems to manage health security threats (10, 11). Countries in the Region are at different stages of their digital health transformation as a whole and in digitalizing their information platform for reporting, surveillance and data management. Building an adequately designed electronic information system brings benefits to countries’ surveillance systems by improving efficiency and timeliness and by helping the shift towards real-time surveillance.

While digitalization provides opportunity to strengthen surveillance, it also poses challenges. If various initiatives are not coordinated, the national information systems will be fragmented, which will impede collaborative approaches in surveillance and may pose additional burden to the reporting health services. National policy frameworks, governance mechanisms and standards should be established to guide a coherent, effective and efficient national digital enterprise architecture. Interoperable systems and registries require the adoption of agreed international interoperability standards (such as the structural interoperability standards HL7 FHIR) (32). It is also important to ensure ethical standards and data security so that the privacy and confidentiality are protected (33). As such, countries require effective leadership to ensure coordinated planning and implementation to advance use of digitalized information systems.

Promote optimal use of innovation and new technology

Emerging new technology has catalysed dramatic improvement in diagnosis, communication, as well as processing, analysis and visualization of information. In the course of implementing this action framework, further new technologies are expected to be available, and guided by public health objectives, countries are encouraged to proactively consider incorporating such innovations. At the same time, those technologies should be carefully evaluated, and optimal use should be explored taking into consideration the international recommendations and best practices.

One of such innovations may be the enhanced use of artificial intelligence for public health purposes; for example, for public health intelligence, analytics, early warning and alert. Artificial intelligence may help improve surveillance and assessment of health security threats. Currently, there is growing interest among countries for support with guidance around governance, regulation, implementation, and evaluation of AI-based solutions for health and improved stakeholder collaboration. Steered by WHO, International Telecommunication Union (ITU) and World Intellectual Property Organization (WIPO), the Global Initiative on AI for Health (GI-AI4H) (34), has a five-year activity structured around three key functions: 1) enable normative technical guidance, policies and standards on AI for health; 2) facilitate resource and knowledge sharing through a global network on AI for health; and 3) implement AI for health through technical support and building sustainable, responsible models.

Review, monitor and evaluate progress

A monitoring and evaluation framework should be in place to monitor the progress in surveillance, risk assessment and field epidemiology, to facilitate learning and continuous improvements, and to ensure accountability – this may be done through the larger framework of the Regional Strategic Roadmap (1), or focused on the technical areas of interest. In addition to monitoring performance and
outcome indicators, intra-action and after-action reviews of the major public health events and simulation exercises should be considered to assess functionality of the systems, identify remaining gaps, and to inform priority actions.
5. Regional systems

The Regional Strategic Roadmap (1) calls for critically advancing regional cooperation to manage health security threats and emergencies more effectively. In the areas of surveillance, risk assessment and field epidemiology, this includes improving collaborative approaches for surveillance and risk assessment for collective public health intelligence, effective IHR event communication, and improved regional information sharing platforms (Figure 5). It also aims to foster regional learning, catalyse innovation, and strengthen surge capacities for surveillance and field epidemiology.

Figure 5. Proposed components of regional systems

<table>
<thead>
<tr>
<th>Regional public health intelligence</th>
<th>IHR event communication</th>
<th>Information sharing platform</th>
<th>Regional network &amp; learning</th>
<th>Regional surge capacity</th>
</tr>
</thead>
</table>

Continue to strengthen collaborative public health intelligence for regional alert

Public health intelligence or epidemic intelligence refer to activities that involve collection, synthesis and analysis of information from multiple sources to guide decision-making for public health response. Based on the Article 5.4 of IHR (2005), WHO Regional Office for South-East Asia carries out regional event-based surveillance to identify signals of acute public health events in the Region, aiming to provide timely alert to Member States. Applying EIOS (21), WHO Regional Office screens a number of media articles on daily basis, triages the signals, and facilitates verification working with the national IHR focal points (IHR NFP), and WHO country offices. For substantiated events of public health importance, rapid risk assessments that inform risk-based response measures and readiness planning will be carried out. As such, regional public health intelligence work requires collaborative efforts between countries and WHO. The WHO Regional Office for South-East Asia is expected to facilitate strengthening of regional public health intelligence work in consultation with the Member States.

Ensure timely and effective IHR event communication

IHR event communication is a cornerstone for the timely sharing of information on health security threats across the countries, carried out by the IHR NFPs, and WHO IHR contact points at the WHO regional offices. One of the key recommendations from global reviews (such as from the IHR review committee) was further strengthening of the function of IHR NFPs (10). The role of IHR NFPs should be clearly defined in the national legal framework and granted sufficient authority to fulfil their functions under IHR (2005). Countries are expected to strengthen IHR event communication in cooperation with WHO. WHO Regional Office for South-East Asia may collaborate with countries through various means. This collaboration may include organizing a regional simulation exercise on IHR event communication “SAPHIRE” on annual basis. The WHO Regional Office may also provide a forum to facilitate collective learning and improvement for the IHR event communication, including through setting standard operational procedures, as well as production of information products.
Advance regional platform and cross-border arrangement for sharing the health emergency information

As pathogens and health hazards may easily affect other countries beyond the borders, countries have expressed a need for a more effective and timely sharing of information of health security threats across countries (2, 8, 9). This can be done through various means, such as creating regional epidemiological bulletins, dashboards, or regional communities, supported by information technologies where appropriate. In addition, cross-border arrangement may also be explored or strengthened between the subnational areas across the borders, through a Memorandum of Understanding or similar mechanism and in consultation with the national authorities. However, information on acute public health events is generally considered sensitive. Member States will be further consulted on appropriate options for sharing of health emergency information in the WHO South-East Asia Region, taking into consideration experiences of other WHO Regions, as well as advancement in global agreement, including the targeted amendment of IHR (2005).

Foster regional network and learning for surveillance and epidemiology

Strengthening of health security systems, including surveillance and field epidemiology, require continuous improvement through learning and innovations. Regional learning opportunities should be fostered through various means, facilitated by WHO in cooperation with Member States, WHO collaborating centres, and other partners. First, countries’ good practices and lessons should be shared through regional meetings, regional publications and country exchange opportunities. Second, regional trainings and fellowship will be promoted, including field epidemiology training through regional FETP programmes and public health intelligence training at WHO Regional Office for South-East Asia. Third, regional network or community may be established or strengthened; for examples, among the IHR NFP or users of EIOS. Fourth, WHO and partners should facilitate the introduction of innovations for surveillance, information systems, public health intelligence, and use of digital technology and artificial intelligence in the Region, through technical assistance and regional webinars and meetings.

Strengthen regional surge capacity for surveillance and epidemiology

For a timely and effective response to health security threats, surge capacities for surveillance and epidemiology may be needed in certain situations. The region should be prepared to deploy surge capacities, especially in complex and high-risk situations, upon request of affected countries and areas. This may require strengthening of regional mechanisms and networks in deploying epidemiologists across the countries, as well as capitalizing on existing network such as Global Outbreak Alert and Response Network (GOARN).
References


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### Annex. Proposed benchmark to guide phased implementation of priority actions

**Surveillance**

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<tr>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
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<tbody>
<tr>
<td><strong>Core surveillance functions to manage health security threats</strong></td>
<td>• Priority disease and hazards are identified for public health surveillance.</td>
<td>• National strategy, guidelines and/or SOPs for public health surveillance are implemented, with reporting made in a timely manner from most subnational areas, with all relevant workforce at all levels receiving adequate training.</td>
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<td></td>
<td>• National strategy, guidelines and/or Standard Operating Procedures (SOPs) for public health surveillance are in place, combining core indicator-based surveillance (IBS) and event-based surveillance (EBS).</td>
<td>• The surveillance systems are providing timely data, enabling early warning functions.</td>
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<td></td>
<td>• Some, but not all relevant workforce, are trained in national strategy, guidelines and/or SOPs for public health surveillance.</td>
<td>• The surveillance systems are routinely analysed and used to guide decision-making for readiness and response.</td>
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<td></td>
<td>• Clear procedures are developed for health-care workers, services, and laboratories to immediately report unusual health events (health-care-based EBS).</td>
<td>• The surveillance data are disseminated to public in timely manner (e.g. through epidemiological bulletin, dashboard).</td>
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<td>• Some samples are selected in an ad hoc manner and shipped for serotyping or genomic sequencing for priority pathogens.</td>
<td>• The surveillance systems are regularly evaluated, and the findings are used to improve the systems.</td>
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<td></td>
<td>• Adequate financial and human resources are allocated to implement the surveillance activities at all levels, and a realistic plan for surge capacity is in place to cope with emergencies.</td>
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<td></td>
<td></td>
<td>• Genomic surveillance is routinely conducted for selected priority pathogens adopting strategic sampling of specimens, and sequencing data are shared across One Health partners.</td>
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</tbody>
</table>
| Non-traditional approaches for enhanced surveillance | • Data on hospitalization and hospital bed occupancy are available, but not in timely or systematic manner.  
• Data on environment (e.g. temperature, rainfall, water quality) are not used, or used in ad hoc manner, to assess the public health risks of relevant priority diseases. | • Waste-water surveillance established for at least one pathogen.  
• Mechanisms established to routinely monitor hospitalization, intensive care unit (ICU) admission and bed occupancy due to priority diseases, for assessment of clinical severity and response capacities of the health system.  
• Some data on environment are being used to monitor the public health risks of relevant priority diseases.  
• Vulnerabilities are assessed, mapped, and available to inform risk assessment and public health actions.  
• CRVS systems are not functional, but efforts are being made to estimate mortality, using some interim method. | • Waste-water surveillance is established for multiple priority pathogens.  
• Data on environment (e.g. climate, rainfall, water quality) are routinely used to assess risks of relevant diseases and hazards, and informing public health actions.  
• Mechanisms for cross-border surveillance, such as at points-of-entry, and regular sharing of data and information between public health authorities in neighbouring countries are established.  
• Functional CRVS system is available, which enables monitoring the level of all-cause mortality.  
• Private and academic sectors are actively engaged and provide relevant information to supplement public health surveillance data. |
### Risk assessment and data analysis

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<tr>
<th>Stage 1</th>
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<tr>
<td><strong>Risk assessment</strong></td>
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</table>
| - National SOP on rapid risk assessment for acute public health events is developed, and the national team is trained on the SOP.  
- Rapid risk assessment is carried out for selected events at the national level, but not in systematic manner. | - Rapid risk assessment is conducted for key public health events in a systematic manner at the national level.  
- SOP for initial risk assessment is developed, and relevant workforce are trained on the SOP.  
- Some subnational areas may be routinely conducting initial risk assessment.  
- Joint risk assessment using One Health approach is introduced, and training is provided to relevant workforce of One Health partners. | - Initial risk assessment is routinely conducted at national and subnational levels, with the methods regularly reviewed and optimized.  
- Rapid risk assessments are systematically conducted for key public health events, and results are effectively used by decision-makers for decision-making on public health actions.  
- Joint risk assessment is conducted to address priority risks at human-animal-environment interface, including for zoonotic diseases, antimicrobial resistance, and climate-sensitive diseases. |
| **Data analysis** | | |
| - Surveillance data are received regularly and analysed on some priority diseases (but some delay may happen).  
- Some health staff in sub-national level have basic (descriptive) analytical capacities, but sub-national and district level teams usually do not conduct data analysis. | - Surveillance data are received and analysed regularly for priority diseases, and disseminated (e.g. through epidemiological bulletins).  
- Data analysis is conducted in majority of sub-national surveillance units, and informing public health actions.  
- Data are analysed to identify risk factors and determinants of health security threats, and to characterize emerging pathogens.  
- Geographical information systems are regularly used for mapping the epidemiological situation. | - Data analysis is routinely conducted at all the levels, and the results are informing local public health action.  
- Data science methods are utilized for analysing and visualizing large datasets.  
- Capacities and/or network for modelling analysis are in place to develop inferences and forecasts, and results are informing risk assessment and decision-making.  
- The results of analysis are shared across sectors and internationally on a regular basis. |
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<tr>
<th>Stage 1</th>
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<tr>
<td><strong>Field epidemiology capacity-strengthening</strong></td>
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<tr>
<td>• Front-line (basic) field epidemiology training programme (FETP) courses, that involve substantial field assignment, are organized on regular basis.</td>
<td>• Two levels of FETP courses (front-line, intermediate or advanced) are organized on regular basis.</td>
<td>• The FETP is well institutionalized, with robust management structure and majority of funds provided by domestic financial sources.</td>
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<tr>
<td>• A multi-year national action plan to strengthen field epidemiology capacities, including the national targets, is developed.</td>
<td>• Continuing education and support mechanisms for facilitators and mentors, as well as active network of FETP alumni, are in place.</td>
<td>• Career path of field epidemiologists is established on the basis of national policy framework.</td>
</tr>
<tr>
<td>• Capacities to triangulate multiple information sources are developed at national level.</td>
<td>• The programmes to train field epidemiology workforce from multiple sectors, based on the One Health approach, are organized on regular basis.</td>
<td>• Field epidemiologists are trained for capacities to coordinate surveillance stakeholders at national and subnational levels.</td>
</tr>
<tr>
<td></td>
<td>• Capacities to triangulate multiple information sources are developed at national and subnational levels.</td>
<td>• Support is provided to other countries for their efforts to strengthen field epidemiology workforce.</td>
</tr>
<tr>
<td>• A monitoring and evaluation scheme is implemented to facilitate continuous improvement of FETP.</td>
<td>• A monitoring and evaluation scheme is implemented to facilitate continuous improvement of FETP.</td>
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</table>

| Field investigation and epidemiological studies | | |
| • Rapid response teams are trained for verifying and investigating detected events, but there are issues in quality and/or timeliness of investigation in some subnational areas. | • Outbreak investigations are conducted by trained national, sub-national or local teams, engaging relevant sectors and timely generating information to guide risk assessment and decision-making on public health action. | • Coordinated epidemiological studies involving relevant sectors are conducted to generate evidence to inform policy and public health measures to manage health security threats, involving trained personnel. |
| • Field epidemiological studies are conducted to generate data on risk factors of health hazards, or characteristics of pathogens (e.g. transmissibility, severity and vaccine effectiveness). | | |

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## Enablers

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<th>Governance and Coordination</th>
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<th>Stage 2</th>
<th>Stage 3</th>
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</thead>
<tbody>
<tr>
<td>• There is no clear focal point and arrangement to coordinate surveillance stakeholders.</td>
<td>• Some surveillance data are shared or synthesized across the systems at national and subnational levels.</td>
<td>• Relevant information is being shared and synthesized across the agencies and sectors (including One Health partners) to inform risk assessment and decision-making, supported by legal instrument or formalized agreement.</td>
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<tr>
<td>• Sharing of surveillance data across systems, agencies and sectors is limited.</td>
<td>• Surveillance objectives are clarified, and a set of appropriate surveillance approaches for priority hazards and pathogens is agreed among surveillance stakeholders.</td>
<td>• Coordinated surveillance activities are implemented at national, intermediate and local levels, guided by surveillance objectives and addressing major duplication and fragmentation.</td>
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<tr>
<td>• Stakeholders of public health surveillance are mapped.</td>
<td>• Coordinated arrangements of surveillance stakeholders for priority health hazards are in place, with responsibilities of each stakeholder clarified.</td>
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<tr>
<td>• Some surveillance data are shared or synthesized across the systems at national and subnational levels.</td>
<td>• A multisectoral arrangement is formalized to detect, verify, and manage events and threats at the animal-human-environmental interface, ensuring exchange of information and joint assessment of risks.</td>
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### Legal instruments

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<tbody>
<tr>
<td>• The country has conducted a legal mapping of relevant legal instruments that cover surveillance, investigation and public health workforce (this could be as part of legal mapping for implementation of IHR(2005)).</td>
<td>• The country has identified issues or gaps in legal instrument in relation to surveillance, investigation and public health workforce through a legal analysis in health and other relevant sectors.</td>
<td>• The country has identified issues or gaps in legal instrument in relation to surveillance, investigation and public health workforce through a legal analysis in health and other relevant sectors at national and subnational levels, and has developed and/or revised legal instruments to address the identified gaps.</td>
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<td><strong>Sustainable financing</strong></td>
<td>• Limited financial resources are allocated to implement and strengthen surveillance, risk assessment, and field epidemiology, with limited financial planning with or without dedicated budget line.</td>
<td>• Predictable budgetary allocation (combining domestic and external sources) is available to implement and strengthen surveillance, risk assessment, and field epidemiology in the health sector. Financial planning is based on estimated resource needs.</td>
<td>• Sufficient, sustainable and predictable budgetary allocation (primarily based on domestic sources) is available to implement and strengthen surveillance, risk assessment, and field epidemiology in the health sector and other relevant sectors at national, subnational, and local levels. The budget is flexible and disbursed in timely manner. Financial planning is aligned with national priorities.</td>
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<tr>
<td><strong>Information systems</strong></td>
<td>• Basic electronic information system is introduced, facilitating efficient reporting and basic analytics.</td>
<td>• Standards are established to enable interoperable information system for surveillance.</td>
<td>• Interoperable and digitalized information systems are established that facilitate timely sharing of relevant information across the systems, agencies, and sectors to inform decision-making (including among One Health partners).</td>
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<tr>
<td><strong>New technology</strong></td>
<td>• Limited new technologies are applied with a small scale, and in an ad hoc manner, and not producing systematic benefits.</td>
<td>• Some efforts are made to introduce new technology for public health surveillance, but without systematic evaluation.</td>
<td>• Mechanisms are established to evaluate new technologies. Operational research studies are conducted to inform new approaches (e.g., surveillance, reporting, public health intelligence, artificial intelligence, point-of-case diagnostics).</td>
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<tr>
<td><strong>Monitoring and evaluation</strong></td>
<td>• Limited efforts are documented to monitor and evaluate the progress, and to learn from real public health events.</td>
<td>• Monitoring and evaluation framework, methods, and indicators are in place to monitor the progress in strengthening surveillance, risk assessment, and field epidemiology. • Intra-action and after reviews are conducted for selected public health events.</td>
<td>• Simulation exercise and/or intra-action and after reviews, as well as programme evaluations, are conducted, gaps are identified, lessons are documented, and used to further strengthen systems and capacities.</td>
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# Regional system strengthening

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<td>• Regional event-based surveillance runs on daily basis, providing timely alert on acute public health events of regional importance.</td>
<td>• Regional simulation exercise on IHR event communication “SAPHIRE” conducted annually.</td>
<td>• All the State Parties comply with IHR (2005) obligations on event communication, including timely responses for verification requests.</td>
<td>• Information on health security threats is shared with Member States in timely manner.</td>
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<td>• Regional network of National IHR Focal Points is established and hold meetings on regular basis.</td>
<td>• Regional community of users of epidemic intelligence from open sources (EIOS) provides forum for sharing information and learning.</td>
<td>• Regional network for surveillance and field epidemiology actively facilitates collective learning and experience sharing.</td>
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<td>• Regional information sharing mechanisms (e.g. epidemiological bulletin, dashboard) are established and are routinely providing updates, based on contribution by Member States.</td>
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<td>• Regional fellowship for public health intelligence is established, inviting fellows from Member States to gain experiences of regional activities.</td>
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