

# Defining collaborative surveillance

A core concept for strengthening the global  
architecture for health emergency preparedness,  
response, and resilience (HEPR)



Agile · Equitable · Sustainable

**HEPR**

Health Emergency Preparedness,  
Response and Resilience



**World Health  
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*Defining collaborative surveillance: a core concept for strengthening the global architecture for health emergency preparedness, response, and resilience (HEPR)*

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# Foreword

The world remains extremely vulnerable to major health emergencies. These emergencies begin and end in communities, and our best defence is resilient communities backed by strong local health systems and public health authorities. Establishing local oversight and understanding of local risks must be at the forefront of driving timely local decisions and local actions. These decisions and actions reinforce national health security and, in turn, strengthen global health security.

Effective national surveillance is a cornerstone of a strong global architecture for health emergency preparedness, response, and resilience (HEPR). Every public health action – from the administration of a routine vaccine to the international mobilization of response teams – relies on ensuring that decision-makers at all levels have access to timely and robust intelligence. Although the COVID-19 pandemic exposed stark weaknesses in national, regional, and global surveillance capabilities, it also brought many opportunities to strengthen surveillance systems and introduce innovative approaches at unprecedented scales.

The collaborative surveillance concept outlined here takes advantage of these opportunities. It establishes an approach to surveillance that moves beyond programme and resource silos towards the systematic application of the collective capabilities of multiple systems and sources, leveraging the best of vertical, specialized, and integrated surveillance approaches.

All stakeholders must view collaboration as a fundamental capability to be nurtured. Collaboration must be continuously reinforced – across disease and threat surveillance systems, sectors, the emergency cycle, and geographic levels – to generate and integrate insights from diverse sources, to contextualize and better interpret data, and to comprehensively address the diverse hazards and threats faced the world over. Implementation of the collaborative surveillance concept will ultimately connect decision-makers to the evidence needed to inform decisions and actions that protect our communities and global public health security.

I implore all surveillance stakeholders to reflect on their capabilities against the collaborative surveillance concept defined here, to set local priorities for strengthening these areas based on local risks, and to make strategic investments in both surveillance capacity and collaboration to build a stronger architecture for HEPR together.



A black ink signature of Dr Chikwe Ihekweazu, written in a stylized cursive script.

**Dr Chikwe Ihekweazu**

Assistant Director-General, Division of Health  
Emergency Intelligence and Surveillance Systems,  
incorporating the WHO Hub for Pandemic and Epidemic  
Intelligence, WHO Health Emergencies Programme



A blue ink signature of Dr Michael Ryan, written in a stylized cursive script.

**Dr Michael Ryan**

Executive Director, WHO Health Emergencies  
Programme

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# Glossary

**All-hazards approach:** An approach to the management of the entire spectrum of emergency risks and events based on the recognition that there are common elements and common capacities required in the management of these risks, including in the responses to virtually all emergencies (1).

**Collaborative surveillance:** 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.

**Global public health security:** The activities required, both proactive and reactive, to minimize the danger and impact of acute public health events that endanger people's health across geographical regions and international boundaries (1,2).

**Hazard:** A process, phenomenon, or human activity that may cause loss of life, injury, or other health impacts; property damage; social and economic disruption; or environmental degradation (1). Hazards may be single, sequential, or combined in their origin and effects and, under the WHO classification of hazards, include natural hazards (biological, extraterrestrial, geophysical, hydro-meteorological), human-induced hazards (technological, societal), and environmental hazards (environmental degradation) (3). Further descriptions and classifications of hazards have been defined by the United Nations Office for Disaster Risk Reduction (4).

**One Health:** An integrated, unifying approach that aims to sustainably balance and optimize the health of humans, animals, plants, and ecosystems. It recognizes that the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent. The approach mobilizes multiple sectors, disciplines, and communities at different levels of society to work together to foster well-being and tackle threats to health and ecosystems while addressing the collective need for clean water, energy, and air and safe and nutritious food, taking action on climate change, and contributing to sustainable development (5,6).

**Public health intelligence:** A core public health function responsible for identifying, collecting, connecting, synthesizing, analysing, assessing, interpreting, and generating a wide range of information for actionable insights and disseminating these for informed and effective decision-making to protect and improve the health of populations (7).

**Public health and social measures:** A broad array of nonpharmaceutical interventions implemented by individuals, communities, and governments to reduce the risk and scale of transmission of epidemic- and pandemic-prone infectious diseases. They range from surveillance, contact tracing, mask-wearing, and physical distancing to social measures such as restricting mass gatherings and modifying school and business openings and closures. Public health and social measures play an immediate and critical role throughout the different stages of health emergencies and contribute to decreasing the burden on health systems so that essential services can continue, effective vaccines and therapeutics can be developed and deployed, and their effects can be maximized to protect the health of communities (8,9).

**Risk:** The potential loss of life, injury, or destroyed or damaged assets that could occur to a system, society, or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability, and capacity (1,10).

**Risk assessment:** A continuous, systematic process of gathering, assessing, and documenting information to assign a level of risk to human health to an event based upon three components: hazard assessment, exposure assessment, and context assessment (including vulnerability and coping capacity). A risk assessment provides the basis to inform the actions to reduce the negative consequences of public health events through preparedness and response activities (11).

**Surveillance (public health surveillance):**

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 (1,12).

**Threat:** A person, place, thing, or development, or a combination of these, that can harm health security, either as a real or perceived danger (13). Examples include antimicrobial resistance or environmental threats such as climate change. Threats can also refer to deliberate events such as an intent to release a hazardous substance to cause harm (14). See also Hazard.

**Vulnerability:** The characteristics and circumstances (physical, social, economic, and environmental factors or processes) of an individual, community, system, or asset that make it susceptible to the effects of a hazard (10,15).

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# Executive summary

Public health emergencies are occurring with increasing frequency and complexity, exposing weaknesses in our current surveillance efforts for informing decision-making at all levels. Effective national surveillance is the foundation of global public health security, as all activities to prevent and mitigate the impact of epidemics, pandemics, and other emergencies depend on our surveillance capabilities. The complex challenges highlighted by the COVID-19 pandemic and other emergencies emphasize the need to rethink our approach to surveillance while building upon the momentum of recent substantive investments in public health capacity.

**Collaborative surveillance is 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.**

This concept builds upon the foundations of robust public health surveillance, health service monitoring, and laboratory surveillance, drawing insights from other data sources and applying advanced data and analytical approaches to enable the generation of contextualized intelligence. Collaborative surveillance emphasizes collaboration itself as a key capability – **building intentional collaboration across diseases and threat surveillance systems, sectors, geographic levels, and emergency cycles.**

Collaborative surveillance involves three critical objectives targeting the development of:

- strong national integrated disease, threat, and vulnerability surveillance
- effective diagnostics and laboratory capacity for pathogen and genomic surveillance
- collaborative approaches for event detection, risk assessment, and response monitoring.

In addition to systematically applying cross-cutting principles of equity, inclusivity, and coherence, the specific capabilities required to meet these objectives must be underpinned by:

- clear institutional arrangements, responsibilities, and accountabilities, with strong **governance** and legislation;
- **sustainable funding** for the establishment and maintenance of surveillance capabilities that can adjust to evolving priorities and technology and pivot to support contingencies;
- a **culture of trust** maintained through systematic feedback, transparency, and strong data governance, with a disposition towards the exchange of data, information, and intelligence for mutual benefit; and a well-resourced and effective **workforce** with the ability to scale up and with established expertise and mechanisms for collaboration across all required disciplines.

This concept paper proposes an ambitious set of capabilities for strengthening evidence for public health decision-making. However, countries' starting points will differ not only with respect to **surveillance capacity** but also with respect to the **strength of collaboration**. The steps countries will need to take will vary based on their respective starting points, contexts, and resources available. Adoption, prioritization, and resourcing of capabilities must therefore be country-driven and collaboratively pursued. Countries and supporting partners must ultimately work towards a common goal of **optimized decisions for coordinated action**.



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# 1 Introduction

## 1.1 Background

At the 75th World Health Assembly in May 2022, the WHO Director-General presented a harmonizing framework to strengthen the global architecture for health emergency preparedness, response, and resilience (HEPR) (16), under the aegis of a new WHO convention, agreement, or other international instrument on pandemic prevention, preparedness, and response. This framework builds upon more than 300 recommendations from various independent reviews of the global response to COVID-19 and reports on previous outbreaks as well as the views of Member States and ongoing multilateral consultation processes. Under the proposed global architecture, the ability to effectively prevent, prepare for, detect, respond to, and recover from health emergencies at subnational, national, regional, and global levels depends on operational readiness and capacities in five interconnected components:

- C1. Collaborative surveillance**
- C2. Community protection**
- C3. Safe and scalable clinical care**
- C4. Access to countermeasures**
- C5. Emergency coordination.**

## 1.2 Scope

Collaborative surveillance builds upon the successes of investments to advance surveillance as a core capacity of the International Health Regulations (IHR 2005) (12) and multi-hazard early warning systems as part of the Sendai Framework for Disaster Risk Reduction 2015–2030 (17).

Collaborative surveillance is intended to reinforce frameworks and strategies for strengthening surveillance, risk assessment, and response to emergencies, such as Integrated Disease Surveillance (IDS) in the Eastern Mediterranean Region (18), the Integrated Disease and Response (IDSR) Framework in the African Region (19), the Asia Pacific Strategy for Emerging Diseases and Public Health Emergencies (APSED III) (20), and the Strategic Plan of the Pan American Health Organization 2020–2025 (21,22). Collaborative surveillance complements regional and global surveillance frameworks and strategies for disease prevention and control, such as in the African (23) and European (24) unions, and specialized programmes (e.g., for antimicrobial resistance, HIV, TB, malaria, polio, influenza and other respiratory viruses, and other vaccine-preventable diseases) (25–32).

This document defines collaborative surveillance and proposes key objectives and concrete capabilities for how countries, with the support of WHO and partners, can further advance their surveillance capabilities and address fragmented and insufficient capacity. This document proposes a conceptual model of an ideal set of capabilities and dimensions across which collaboration should occur, which together make up effective collaborative surveillance. Recognizing that Member States will have different starting points and different needs, the principles described aim to inform the development of surveillance systems and assist countries in assessing implementation priorities, operational readiness, and critical next steps.

The scope of collaborative surveillance extends to all surveillance systems, but the primary focus of this document is to strengthen those aspects related to emergencies. Because routine surveillance and data generated by other sectors and entities are essential to address emergencies comprehensively, these stakeholders may also benefit from what is described here.

Forthcoming materials and associated tools will focus on supporting implementation of collaborative surveillance and the broader HEPR architecture.

### 1.3 Target audience

The collaborative surveillance concept was developed to support all stakeholders working on surveillance. It is primarily intended to be used to guide national health authorities (including ministries of health, national public health agencies, and emergency management authorities) responsible for public health surveillance, laboratories, and emergency preparedness and response, as well as partners and other stakeholders supporting these activities. It may likewise support donor agencies, academia, the private sector, and other partners to focus technical and financial resources on essential surveillance needs.

### 1.4 Development

The collaborative surveillance concept was defined through an extensive landscape analysis, with initiatives, strategies, and frameworks reviewed to identify key shifts in surveillance activities and critical gaps, building on the lessons of major emergencies. WHO technical working groups developed the concept over a series of working sessions, drawing input from Member States, partners, and WHO surveillance and laboratory experts at regional and headquarters levels within and beyond the Health Emergencies Programme.

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## 2 A need to drive change in surveillance for global health security

The last three decades have been marked by concurrent epidemics, pandemics, disasters, conflicts, and other major emergencies occurring with increasing frequency, magnitude, and complexity (33). COVID-19 is part of a pattern of increasing infectious disease outbreaks driven by globalization, urbanization, and climate change, among other factors. The probability of experiencing another novel pandemic (or Disease X) in the coming decades remains very high, with a persistent risk that such a pathogen could traverse the world in less than 36 hours (34). Disasters and extreme weather events are also becoming increasingly frequent and causing more damage, with records highlighting, on average, one disaster occurring every day over the past 50 years (35). In 2023, global estimates of people needing humanitarian assistance reached a record 339 million people, with more than 103 million people forcibly displaced owing to disasters, violent conflicts, food crises, and other humanitarian emergencies (36). These emergencies, in addition to the continuing burden of other diseases that disproportionately affect vulnerable populations, have all stressed health systems, caused increased morbidity and mortality, and negatively affected all aspects of society with lasting effects.

The COVID-19 pandemic, recurring Ebola virus disease outbreaks, and other recent public health emergencies of international concern have each highlighted limitations in national, regional, and global public health surveillance capacities across sectors. Recommendations arising from intergovernmental committees and independent expert bodies during the pandemic have all, without exception, urged Member States, WHO, and partners to redouble efforts to strengthen surveillance capabilities as a critical measure to protect the world against future epidemics and pandemics (37,38). COVID-19 has provided opportunities to innovate and accelerate strengthening of several health systems components, with unprecedented investments in surveillance, laboratory capacities, and emergency management structures. We must be bold to apply these lessons to build more robust surveillance capabilities.

**Effective national surveillance is the foundation of global public health security.** All activities to prevent and mitigate the impact of epidemics, pandemics, and other major emergencies are dependent on surveillance. Public health and policy decisions rely on timely and accurate information on hazards, context, vulnerability of the local community and health systems, and local capacity. Once a public health event is detected and verified, enhanced surveillance, investigations, and continuous risk assessment are needed to understand how the event is unfolding and to define and target countermeasures. These activities must leverage many different data sources to inform decisions throughout the course of events. Further, these decisions cannot be made in isolation; greater efforts are needed to facilitate multisectoral systems thinking, especially at the animal-human-environmental interface.

Interconnected capabilities for the generation and linkage of relevant data and the application of intelligence at all levels of decision-making can revolutionize our ability to detect emerging events, communicate information quickly, rapidly initiate responses, and continue to inform actions throughout emergency cycles. This vision has motivated the inclusion of the collaborative surveillance concept as a core component of the framework for strengthening global architecture for HEPR (16). Moreover, at the 152nd WHO Executive Board in 2023, Member States supported efforts towards establishing a collaborative surveillance ecosystem, emphasizing the need to put accurate, timely information into the hands of decision-makers. Achieving these goals will mean strengthening capacities and combating fragmentation at national, regional, and global levels through enhanced mechanisms for coordination, collaboration, and innovation among traditional and new stakeholders, including One Health partners (39).

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## 3 Collaborative surveillance – a working definition

**Collaborative surveillance is 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.**

The collaborative surveillance concept builds upon robust routine public health surveillance, health systems monitoring, and laboratory surveillance, while drawing insights from other data sources and applying advanced data and analytical approaches to enable the generation of contextualized insights on hazards, threats and risks, populations affected, and their contexts.

The concept emphasizes collaboration itself as a key capability. The need for collaboration as a critical component of surveillance is not new and is reflected in foundational global and regional public health strategies. A collaborative approach to surveillance has proven to enable the triangulation of diverse sources to generate contextualized intelligence (17,40), warranting renewed attention.

By ensuring this intelligence is communicated to decision-makers (e.g., policy-makers, public health officials, communities, and individuals) at all levels, better actions and policies can reduce risks, and enhance emergency prevention, preparedness, response, and recovery. In this way, mortality, morbidity, and societal impacts will be minimized, and national health security will be strengthened, benefiting global public health security.

### 3.1 A modern vision of disease surveillance integration and collaboration

Surveillance supports many different objectives. On a routine basis, surveillance supports, for example, monitoring and assessing endemic disease trends, public health threats (e.g., antimicrobial resistance), health service provision, resource use, and the uptake of prevention measures (e.g., vaccines). Before, during, and after public health emergencies, surveillance objectives extend to prediction and early detection of acute events; tracing groups affected; assessing epidemiological characteristics (e.g., trends, severity, risks, magnitude, impacts), community perceptions, and other factors; and informing interventions (e.g., use, uptake, and impact of public health and social measures and medical countermeasures), among others. These differing needs have resulted in the creation of a range of surveillance systems, each designed to address a specific and sometimes narrow set of questions (31).

Vertical and specialized surveillance programmes (e.g., such as for HIV, influenza, TB, malaria, polio, and other vaccine-preventable diseases) have fostered in-depth and specialist understanding of the epidemiology of many public health hazards, with associated investment in interventions at a scale necessary for achieving global goals for improvement (26–30,32). The prevention and control of many diseases would arguably not have been achieved in the absence of this specialized focus. Further, continued investment is needed to achieve shared objectives, such as the elimination or eradication of certain diseases.

The separation of surveillance activities into silos (between hazards and sectors) has largely been driven by financing priorities, with 60% of current funding for surveillance coming from disease-specific programmes and disease-focused funders (41). An unintended consequence has been fragmentation of the overall surveillance infrastructure, making it difficult for decision-makers to have a comprehensive situational overview or to repurpose capacities from one part of the system to another need. For example, assets such as laboratory equipment purchased for disease-specific programmes are often not permitted to be used for other diseases despite their broad functionality. Resulting inefficiencies, along with parallel reporting and analysis structures, increase vulnerability to new threats. The impact of fragmentation becomes especially apparent during health emergencies, where speed, flexibility, and a comprehensive view are critical.

IDS and similar horizontal initiatives to harmonize routine health information systems, take a multi-hazard/all-hazards approach, and extend community engagement in surveillance (e.g., through participatory surveillance systems) have been progressively introduced to address fragmentation in specific contexts (17–19,42). However, there have been many barriers to the implementation of these strategies over the past two decades. These barriers include resistance to integration where vertical surveillance systems are already well established or where integrated systems fall short of addressing all desired objectives and information needs, requiring the continuation of specialized surveillance programmes in parallel.

Nevertheless, IDS can develop and strengthen surveillance and response mechanisms for priority diseases on a scale that may otherwise not be achievable through scattered investments. Moreover, grouping pathogens with similar routes of transmission or similar methods of specimen collection may save time and resources by applying common surveillance and diagnostic platforms. Likewise, well-established vertical programmes and investments provide opportunities to address broader threats, as was demonstrated through the modification of individual disease surveillance infrastructure and capabilities to address COVID-19. Building on a population-based surveillance foundation while applying full civil registration and vital statistics or a sample registration system will enable vertical programmes to efficiently use accurate common denominators to foster more integrated surveillance and actions (38).

There is no one right answer for every context; tailored solutions with built-in agility must be devised. No single surveillance system can meet all public health objectives. The resilience and flexibility of individual systems can be improved only if this is anticipated in their design and incentivized in their implementation. Both vertical and integrated approaches address different needs as well as the underlying complexity of local health systems and the diverse public health risks communities face.

Collaborative surveillance does not seek to disrupt IDS or vertical programmes. In contrast, it builds upon the successes of programme-specific capacity investments through collaboration, embracing contemporary modalities of integration (**Box 1**) which may be differentially practiced but achieve a common outcome of enhancing collaboration between systems and stakeholders. Collaborative surveillance fully recognizes the need for continued investment in integrated, vertical, and other specialized surveillance programmes while increasing the ability of each of these to respond to evolving risks to public health. It aims to address the intersection of these approaches while incorporating other data sources not otherwise systematically captured by these current models (**Fig. 1**).

Vertical and horizontal surveillance approaches must continue to adapt to evolving public health threats resulting from demographic, societal, and epidemiological transitions. Further, these approaches must evolve to meet added demands of existential threats such as climate change, conflicts, and changes in the impacts of countermeasures (e.g., vaccines and antimicrobials). Finally, these approaches must leverage technologies that offer new ways to improve how hazards are detected and diagnosed (e.g., point-of-care diagnostics); how data are collected, managed, analysed, and shared (e.g., electronic data collection and real-time visualization tools); and how countermeasures are implemented (e.g., applying digital tools for contact tracing and case management) to better inform decision-making and public health action.

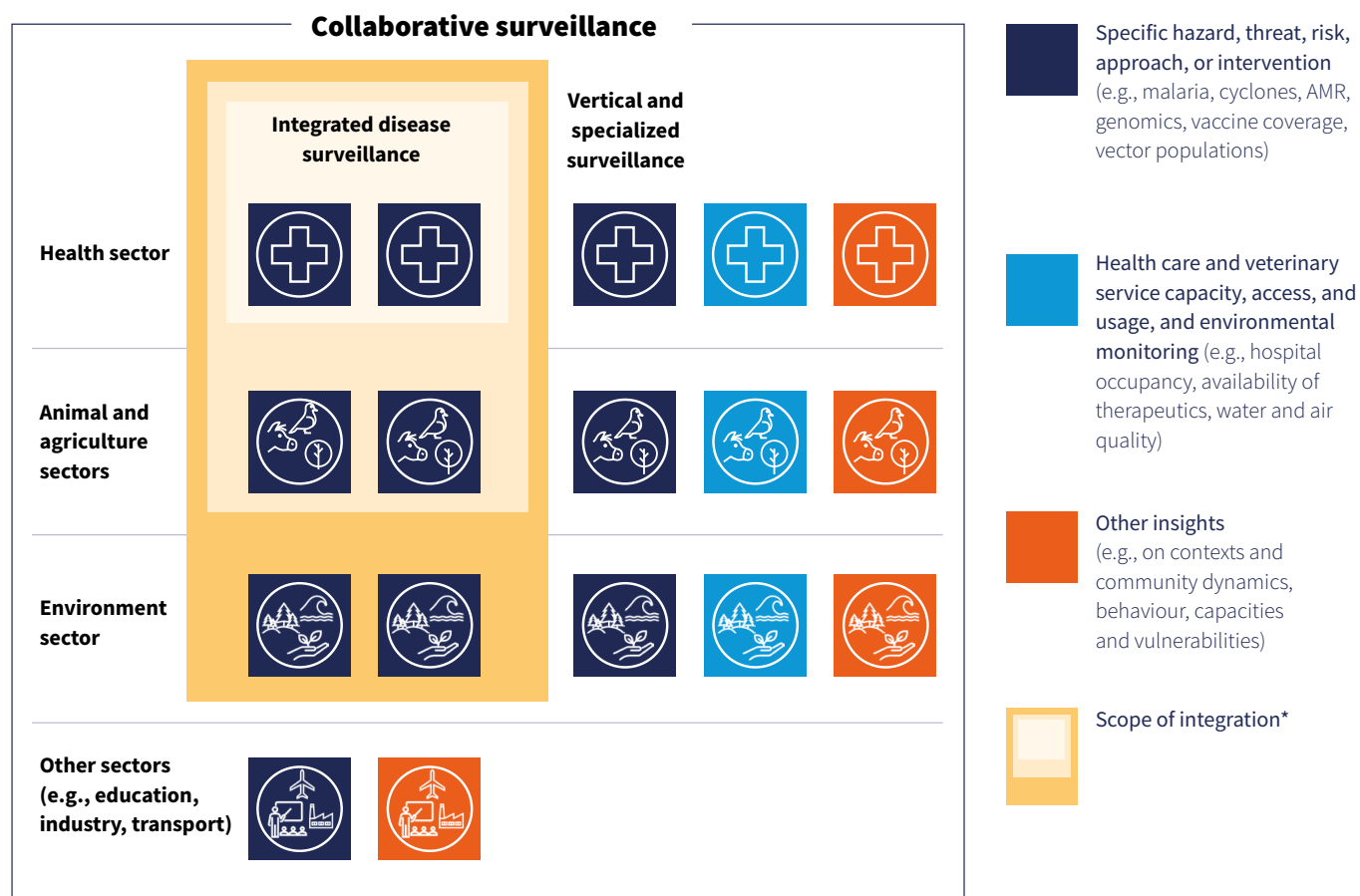
#### Box 1.

##### Modalities of integration

As part of the implementation of collaborative surveillance, integration may encompass:

- **consolidation of surveillance activities**, establishing common, interoperable systems to address multiple hazards, where appropriate;
- **data and information sharing across systems** that operate together to address the full range of surveillance objectives, linked to decision-making based on a comprehensive view and analysis;
- **sharing and integration of capacities**, ensuring that resources (workforce, systems, infrastructure) and investments synergistically strengthen surveillance beyond individual disease objectives and can be effectively leveraged to address new and emerging threats; and
- **open communication of surveillance findings** at all levels where appropriate, with systems and feedback loops to enable the exchange of intelligence generated by others, driven by use cases aimed at informing decisions and driving action.

**Fig. 1.** Intersection and application of insights generated through IDS, vertical and specialized surveillance programmes, health service monitoring, and other data sources as part of the collaborative surveillance concept



\* The scope of IDS varies by country and context and may include, for example, multi-source surveillance for prioritized (notifiable) human conditions only; prioritized conditions among human and animal populations (e.g., zoonoses); or integrated surveillance across One Health partners, and in some contexts beyond these sectors. Likewise, under the collaborative surveillance concept, the scope of collaboration across surveillance systems, surveys, field investigations, sectors, and providers of other insights will vary by hazard, event, and underlying objective and must be tailored over time and to local needs. Multiple surveillance activities across sectors, whether integrated or vertical/specialized, can contribute meaningfully to One Health intelligence and joint multisectoral risk assessment.

## 3.2 Dimensions of collaboration

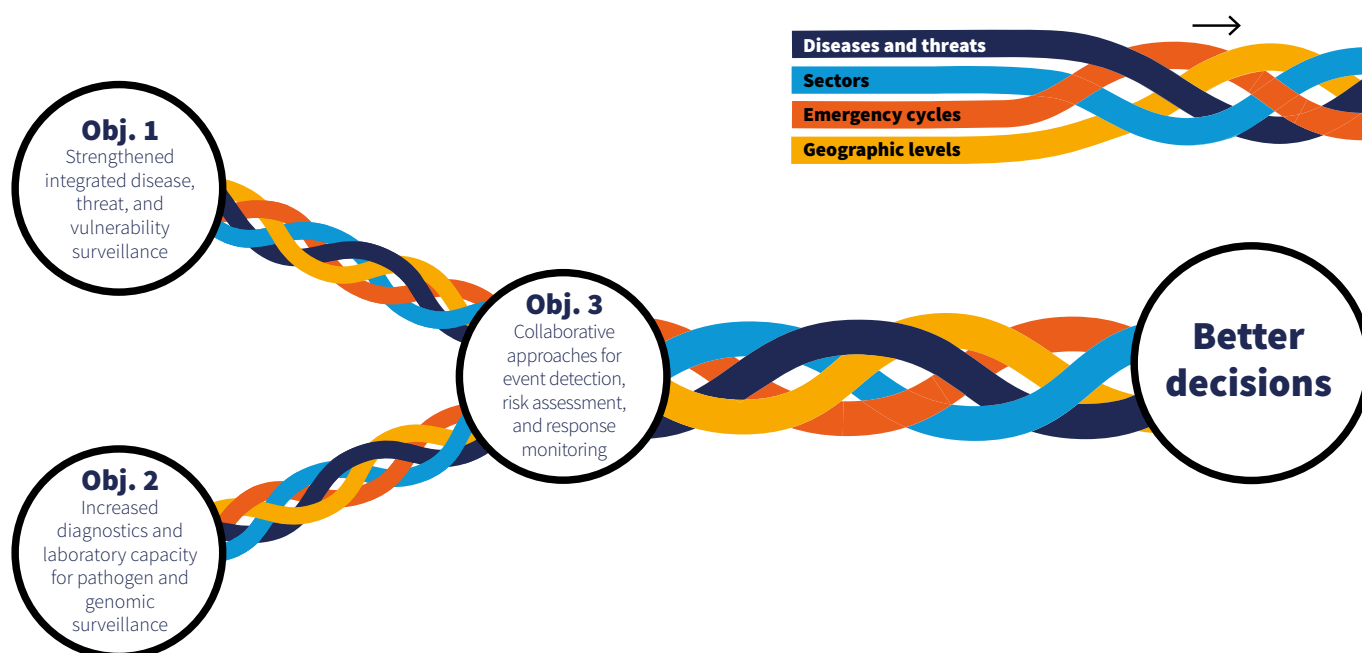
Bridging vertical and horizontal surveillance approaches requires continuous collaboration, which in turn will foster trust among stakeholders. Collaborative surveillance requires capacity and collaboration across four key dimensions (**Fig. 2**).

- **Disease and threat surveillance systems:** Enabling a comprehensive understanding of the epidemiological situation across systems for monitoring hazards, threats, and vulnerabilities, with the ability to mobilize disease and threat-specific capabilities to respond to emerging events.
- **Sectors:** Building multisectoral contextual understanding and operationalizing collaboration across sectors, organizations, fields of expertise, and disciplines.

- **Emergency cycles:** Addressing both routine monitoring and emergency surveillance objectives throughout the cycle of prevention, preparedness, response, and recovery.
- **Geographic levels:** Ensuring local capacities to respond to local events and the flow of relevant data, information and intelligence across subnational, national, cross-border, regional, and global administrative levels.

Applying the modalities of integration (as described above), collaboration should be designed and incentivized to satisfy mutual needs. This may include, for example, sharing data and information; sharing workforce capacities and skill sets; applying interoperable data platforms and standards; conducting joint risk assessments, investigations, and interventions; or strategic alignment of priorities and plans. Collaboration must occur in a meaningful way to achieve the desired goals without overloading systems.

**Fig. 2.** Convergence of objectives across four key dimensions of collaboration to strengthen decision-making



The specific dimensions, stakeholders, and modalities of collaboration will vary widely between local contexts, hazards and threats prioritized, and evolving evidence needs. Nonetheless, key steps for enabling collaboration must be established to enable access to diverse insights, ideally before they are needed. These steps may include mapping and rationalizing systems and sources, and establishing networks, governance structures, and capacity to appropriately manage and analyse shared data, information, and intelligence. In common across all dimensions of collaboration is the need to address diverse and evolving demands, which necessitate collaboration between multiple surveillance systems as well as the systematic organization of multi-source information to inform decisions (20,40,43).

### 3.2.1 Collaboration across disease and threat surveillance systems

Collaborative surveillance builds on the need to assess different, prioritized hazards in an integrated way to better inform public health decisions. Routine and enhanced surveillance during emergencies, through vertical programmes, IDS, or specialized investigations, must be viewed as collective capacities; each system provides unique insights into diseases, threats, and risks as well as an understanding of the contexts in which they occur and the vulnerabilities of local populations and the supporting health system. Each system contributes towards specific objectives, which, when coordinated and acting in synergy, can enable a comprehensive understanding of the epidemiological situation. Modalities of collaboration across diseases and threat surveillance systems may vary:

- **For a specific prioritized hazard, threat, or risk, applying a multi-source surveillance approach to enable the triangulation of data to inform decision-making (20,40,43).** For example, linking agencies and institutes, as well as departments and teams within the same organization, responsible for complementary surveillance activities (e.g., aggregate data; case-based, event-based, sentinel, syndromic, laboratory, and genomic surveillance; health service usage data; population health surveys) to obtain a comprehensive overview.
- **For multiple hazards, threats, or risks, developing shared systems and approaches.** For example:
  - implementing IDS, IDSR, and multi-hazard early warning and disaster risk information and assessment systems (e.g., the Global Disaster Alert and Coordination System) (17–19,44);
  - collaborating with well-established surveillance programmes (e.g., HIV, TB, influenza, malaria, polio, and other vaccine-preventable diseases) to align infrastructure, platforms and tools, other resources, and data sources; and
  - leveraging capacities strengthened during emergencies, such as reinforcing mechanisms developed during the COVID-19 pandemic (e.g., PCR testing, genomic surveillance) to address a wider range of hazards (e.g., groups of respiratory pathogens).

All surveillance systems should ideally be designed for use across programmes at the outset. Designing for flexibility provides governments and partners the opportunity to mobilize these capacities to respond to emergencies when they occur. Emergency readiness may be strengthened by, for example, increasing and sharing workforce capacity across programmes and, where possible, applying an integrative and whole systems approach to surveillance infrastructure and resources.

### 3.2.2 Collaboration across sectors

Multisectoral collaboration is needed to better detect and assess public health hazards, threats, risks, and vulnerabilities. This includes intentional collaboration across sectors, types of organizations, fields of expertise, and disciplines, requiring openness, strong sustainable partnerships, and a shared vision among sector leaders. There are many points of potential collaboration across sectors.

- Joint risk assessments, cross-border and targeted surveillance, and data and information sharing **between One Health partners** will enable the triangulation of intelligence for the timely detection and mitigation of threats to health security at the human-animal-environment interface.
- Collaboration **across other sectors** (e.g., education, energy, forestry, immigration, maritime and transport, security, tourism, economy, etc.) can further inform assessment of emerging risks and potential countermeasures.
- Collaborations with **industry and technology sectors** experienced in complex data collection, management, integration, analysis, visualization, access, and sharing can expedite the development and implementation of advanced surveillance tools and methods.
- Insights from **other fields and disciplines** can serve to better contextualize and improve the quality of decisions. These may include, for example, insights from social, behavioural, cultural, political, and data sciences; communications; economics; administrative data; civil registration and vital statistics; and other demographic statistics.
- Collaboration across **public and private sector entities, security sector entities, academia, nongovernmental organizations, and civil society organizations** to ensure that all affected populations are reached through surveillance approaches built upon best practices while continuing to develop, test, and operationalize innovations.

It is the responsibility of health organizations and governments to nurture these collaborations for threats to public health security. Points of cross-sectoral collaboration must be carefully selected based on local contexts, risks, and governance structures and designed and incentivized to satisfy mutual needs without overloading systems. This must take into consideration the accessibility and confidentiality of data and information generated by the other sector. Steps must be taken to engage all relevant

stakeholders and sensitize them to the benefits of collaboration while integrating an understanding of the needs and drivers of other sectors.

### 3.2.3 Collaboration across emergency cycles

Decision-makers rely on accurate, timely surveillance throughout the emergency cycle (or phases of events) to inform prevention, preparedness, response, and recovery. As a result of evolving objectives, the relative importance of different information sources used for risk assessment and decision-making varies during these different phases (20,45,46). Collaboration between systems is critical to meet evolving information demands.

- **Prevention, risk mitigation, and preparedness (pre-event phase):** Developing a comprehensive understanding and prioritization of local risks (e.g., through strategic assessments of health emergency risks), reinforcing routine surveillance for prioritized risks (e.g., notifiable disease and sentinel surveillance), and applying other insights (e.g., climatological, population mobility, animal health) towards predicting hazards, controlling endemic disease, prompting preventive and mitigative actions before the first cases, and preparing to manage events.
- **Response:**
  - **Alert phase:** Maintaining capacity to rapidly detect potential public health events through routine surveillance and networks (e.g., through event-based surveillance and syndromic surveillance) connected to capacities to continuously triage, validate, manage, and risk assess signals, events, and alerts and mount an immediate response.
  - **Event phase:** Once an event is detected, adapting and scaling systems, workforce, and physical infrastructure to identify cases (e.g., enhanced case finding, contact tracing, points of entry monitoring), to accurately characterize the event and changes in risks (e.g., through monitoring test positivity, burden on hospitals, genomic evolution), and to address evolving information needs to continuously inform countermeasures.

- **Recovery (transition/post-event phase):** After the response phase, supporting ongoing information needs to facilitate recovery of affected populations and the health system and to prevent or mitigate risks from newly established or re-emerging hazards (e.g., monitoring endemic disease trends through sentinel surveillance, active follow-up of potential sources of pathogen resurgence).

Both routine and emergency surveillance capabilities must be strengthened. Routine surveillance capabilities should ideally be designed with the ability to surge during emergencies, and where possible, without the need for contingency tools or parallel surveillance systems. Emergency response actors must actively seek to engage routine surveillance systems and capacities through all stages of events and avoid disruptions to these critical functions. Finally, investments in surveillance during emergencies should be made so as to create a lasting benefit, with strengthened systems, workforce, and capacity reintegrated into health systems.

### 3.2.4 Collaboration across geographic levels

Collaborative surveillance seeks to facilitate the availability of timely and robust information at all administrative levels where decisions are made. This extends from individuals and communities, through levels of government, to regional networks and international organizations.

Foremost is ensuring that local, subnational, and national public health capacities are equitably established, with appropriately mandated institutions, to undertake surveillance for locally prioritized hazards, informing local decision-making and timely action. Surveillance and collaboration across larger areas and jurisdictions should be designed so as to first prioritize local/

national objectives and local users by creating greater sensitivity to the detection and ongoing monitoring of threats (e.g., through cross-border surveillance), adding capacities (e.g., through complementary surveillance activities and shared analytics or diagnostics), and providing greater insights from differing perspectives on variance, equity considerations, evolving risks, and response options. Further, surveillance and collaboration should embrace geographic variability in the hazards and risks faced within countries (e.g., across urban and rural/remote settings or in specific vulnerable communities), applying the best approaches to track these hazards and competitive advantages of geographically targeted approaches, as appropriate.

Achieving an unimpeded, bidirectional flow of data, information, and intelligence, as well as specimens and pathogens for laboratory investigations across geographies, will require the continued development and implementation of systems, information technology tools, baseline architectures (e.g., data standards and technical requirements), formal and informal networks, legislation, and agreements, with defined roles and responsibilities at each level. All of these may be facilitated by a greater understanding of different contexts and user needs.

Equitable approaches to acknowledging and encouraging reporting, accessing data, and sharing information and intelligence for mutual benefit must be continuously reinforced to engender trust and participation, starting at the point of data collection and extending throughout systems and networks. Routine feedback loops must be ensured and extended to facilitating other incentives (e.g., capacity development) and countering disincentives (e.g., unwarranted penalties against entities detecting events).

### 3.3 Enablers of collaborative surveillance

Principles of equity, inclusivity, and coherence are the heart of the global architecture for HEPR (16) and create the foundation of engendering trust among communities and between stakeholders.

- **Equity** protects the most vulnerable, with no one left behind.
- **Inclusivity** requires engagement and ownership by all countries, communities, and stakeholders, including One Health partners.
- **Coherence** reduces fragmentation, competition, and duplication of efforts and prompts alignment with international instruments for collaboration (e.g., IHR 2005 [12], Sendai Framework for Disaster Risk Reduction [17], Pandemic Influenza Preparedness Framework [47], and Nagoya Protocol [48]).

All stakeholders must routinely practice these principles and embrace diversity in surveillance design, operations, and leadership by ensuring engagement and representation of all communities regardless of gender, race, ethnicity, sexual orientation, age, socioeconomic background or nationality. Moreover, the success of collaborative surveillance depends the following enabling factors.

#### 3.3.1 Governance

To effectively implement collaborative surveillance, clear institutional arrangements, responsibilities, accountability and transparency mechanisms, and strong governance structures – supported by legislation – are critical at all levels. Empowered national authorities (such as national public health agencies/institutes, national public health/reference laboratories, and emergency management authorities) should be designated to coordinate, set priorities for surveillance, evaluate and rationalize surveillance systems and activities, facilitate information synthesis and evidence-based decision-making, foster collaboration, and enable interlinkages with the global architecture. These authorities must be supported by leadership and governance structures across all dimensions of collaboration.

Sustainability in governance structures may be further supported through the institutionalization of surveillance systems and functions and systematic collaboration across sectors and other stakeholders so as to become routine, standard practice. This may include, for example, the development of joint operating procedures, establishment of standing committees, conduct of joint risk assessment and joint decision-making, and issuance of joint recommendations.

#### 3.3.2 Sustainable funding

Although funding needs are context-dependent, there are some commonalities across all countries. Routine surveillance systems require sustainable domestic funding with enough flexibility to adjust according to evolving priorities and technology and to pivot to support contingency measures during emergencies. Financing for routine and emergency surveillance workforce, infrastructure, tools, and collaboration capabilities must be considered part of the national health financing policy. One estimate puts the appropriate national investment in disease surveillance at US\$ 1–4 per capita per year (38).

Many countries require partnerships with external financing entities to support collaborative surveillance, including bilateral and multilateral donors, development banks, philanthropies, and the private sector. Financing mechanisms should be explored to support programme implementation as well as capacity-building and innovation. Such partnerships and investments should be designed to ultimately incorporate new approaches into routine systems once they are proven to maximize their utility and long-term sustainability.

### 3.3.3 A culture of trust

Collaborative surveillance requires the development of trustworthiness and reliability in the outputs generated, decisions made, and actions taken by all stakeholders involved. This begins with reinforcing the HEPR principles described above while ensuring systematic feedback and transparency throughout systems and routinely engaging local communities and stakeholders in activities, decisions, planning, and actions.

Maintaining strong data governance by upholding core data principles provides a foundation of trust in surveillance across all stakeholders. This should include, for example, upholding data as a public good through clear guidance and transparency; maintaining secure data storage, processing, and sharing; applying international data standards across systems; and maintaining ethics in data use and sharing practices and research (49). It is essential to ensure quality in the surveillance and laboratory methods applied and in the data, information, and intelligence generated.

Collaborative surveillance requires a disposition towards the exchange of data, information, knowledge, and intelligence for mutual benefit, enabling open communication and incentivizing (not punishing) countries and other reporting entities. Efforts to enable safe and seamless communication of surveillance findings (e.g., establishing interoperable systems, regional and global networks, and open reporting) can support the continued development of trust and overcome barriers among local communities, national entities, and across international borders. Moreover, data, information, and sample/pathogen sharing must support a global multilateral benefit-sharing mechanism (50), ensuring that all stakeholders derive benefits (e.g., knowledge; direct involvement in research and development; and access to countermeasures, reagents, services, and other products) (51) to build and sustain a culture of trust.

### 3.3.4 Workforce

Collaborative surveillance relies on a diverse, effective, highly skilled public health workforce embedded at all administrative levels, focused on aspects of surveillance every day. This workforce should ideally fall within an appropriately mandated institutional framework and be able to scale up during emergencies.

This workforce includes a strong frontline health workforce as well as an empowered local public health workforce with skills to support all aspects of surveillance. Stakeholders should consider establishing both in-house capabilities and additional multidisciplinary collaboration mechanisms (shared capacity) across epidemiology, One Health, social sciences, data sciences, clinical sciences, laboratory sciences, information technology, and other expertise across sectors (e.g., meteorology, agriculture, animal health, environment, etc.).

Diversity and equity in the surveillance workforce are critical at all levels to ensure that systems and processes consider all affected communities and systematically address barriers and surveillance biases faced by marginalized groups.

Finally, the surveillance workforce must be supported with continuous capacity development through cross-cutting and disease-specific learning and training opportunities, other opportunities to build and share best practices, and initiatives to encourage retention of skilled staff.

## 4 Meeting country surveillance systems where they are

The collaborative surveillance concept acknowledges that countries have different starting points and different needs. While this concept proposes ideal capabilities (see Section 5), in practice, the steps countries need to take will vary significantly based on:

- **Context:** the disease control objectives, locally prioritized hazards and threats, known vulnerabilities, and setting-specific concerns (e.g., in fragile, conflict-affected, and vulnerable settings);
- **Starting point:** the capabilities and design of their existing surveillance systems; and
- **Means:** the resources at their disposal.

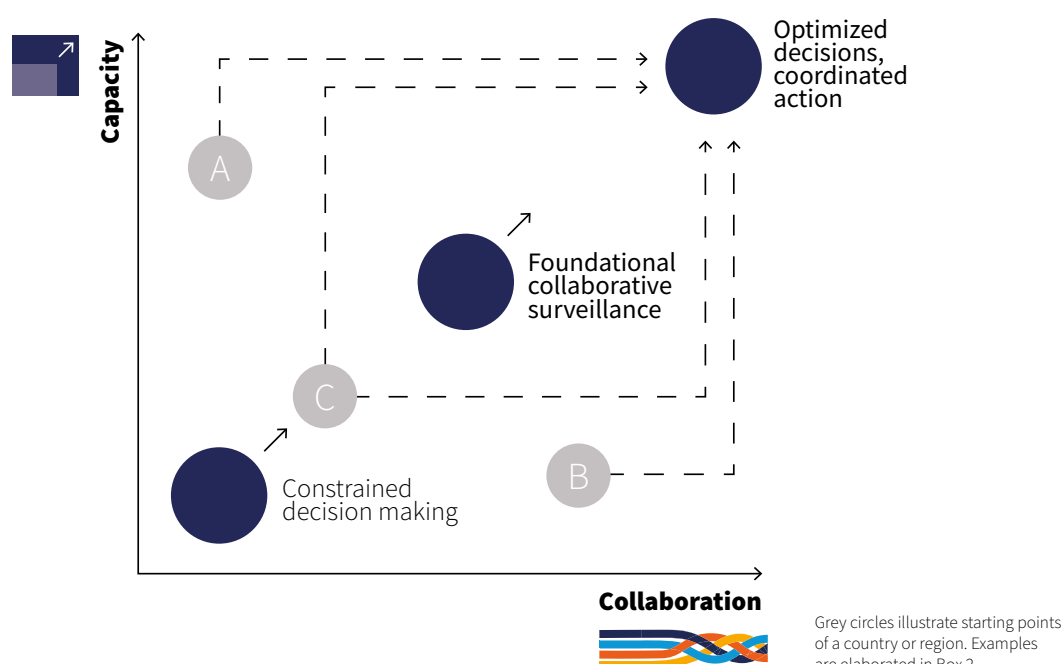
These factors shape the priorities for implementing this concept. Countries' starting points will differ not only with respect to surveillance capacity but also with respect to the strength of collaboration. Recognizing these as distinct is critical to success.

Collaborative surveillance is best considered as an increasing constellation of capabilities rather than a linear, prescriptive progression. Adoption,

prioritization, and resourcing of strategic objectives must be country-driven and collaboratively pursued, grounded in a critical assessment of capabilities and the level of collaboration. Although the path will differ for each country (**Fig. 3 and Box 2**), all countries and partners should first target initiatives towards achieving foundational capacities and collaboration and ultimately strive towards a common goal of **optimized decisions for coordinated action**.

Ongoing monitoring and periodic evaluations are critical for tracking efforts to strengthen collaborative surveillance capacities and to make course corrections when necessary. This can be done in concert with routine reviews of IHR 2005 core public health capacities, such as State Party Self-Assessment Annual Reporting (SPAR) and Joint External Evaluations (JEE) (52); other review mechanisms such as the Universal Health and Preparedness Reviews (UHPR) (53), and intra- and after-action reviews of successive acute public health events; and simulation exercises. Sharing of lessons learned during these processes will further improve collaboration.

**Fig. 3.** Model illustrating the differing starting points and paths countries and regions may take towards increasing capacity and strengthening collaboration for decision-making and coordinated action



**Box 2.**

**Hypothetical examples of collaborative surveillance approaches across differing country starting points and needs**

**1 High surveillance capacity but low levels of collaboration**

- Well-functioning health system and integrated surveillance infrastructure
- Measured national surveillance and laboratory capacities are high (e.g., SPAR/JEE level 4–5)
- Four dimensions of collaboration are not implemented or demonstrated ad hoc
- Examples of potential first steps: assess and prioritize local public health risks, map systems, and stakeholders; review surveillance coverage among marginalized groups; and develop a shared vision that prioritizes collaboration.

**2 Low surveillance capacity but high levels of collaboration**

- Underdeveloped health system but strong relationships with neighbouring countries and other bilateral investment ties
- Measured national surveillance and laboratory capacities are low (e.g., SPAR/JEE level 1–2)
- Four dimensions of collaboration are fully implemented

- Examples of potential first steps: assess and prioritize local public health risks, evaluate local surveillance systems against these risks, and prioritize systems strengthening initiatives that offer the greatest gains in capacity while leveraging international relationships to develop or strengthen common approaches and shared resources.

**3 Low–moderate surveillance capacity and collaboration**

- Moderately functioning health system but substantive recognized gaps
- Measured national surveillance and laboratory capacities are low to moderate (e.g., SPAR/JEE level 2–3)
- Four dimensions of collaboration are ad hoc or only partially implemented
- Examples of potential first steps: assess and prioritize local public health risks, evaluate local surveillance systems against these risks, and assess most resource-effective path to maturity in the absence of the ability to build all capabilities in tandem.

## 5 Building blocks of collaborative surveillance

The HEPR framework describes three objectives, targeting the development of:

- strong national integrated disease, threat, and vulnerability surveillance
- effective diagnostics and laboratory capacity for pathogen and genomic surveillance
- collaborative approaches to event detection, risk assessment, and response monitoring.

While the first two objectives address capacity development and collaboration across core public health surveillance sources, the third seeks to maximize the application of these and other sources through innovative and multidisciplinary capabilities and public health intelligence processes, which collectively generate actionable insights. These insights, built through collaboration across dimensions, inform the ultimate aim of collaborative surveillance: better decisions for action (**Fig. 1 above**).

Each objective is underpinned by a set of ideal capabilities and sub-capabilities, which are described here and summarized in the **Annex**.

### 5.1 Strong national integrated disease, threat, and vulnerability surveillance

The first objective is to strengthen the capabilities required for public health surveillance in tandem with health service capacity, access, and usage monitoring to ensure that all surveillance objectives are addressed. Moreover, that insights on contexts, vulnerabilities of communities affected, One Health partnerships, and other diverse data sources are systematically integrated. Strong governance, innovation, and integration are necessary to ensure collaboration across these systems and insights and across the four dimensions (**Fig. 4**).

**Fig. 4.** Capabilities for developing strong national integrated disease, threat, and vulnerability surveillance



### **5.1.1 Strong public health surveillance**

Informed decision-making for action first requires timely and appropriate routine public health surveillance, including analytical and communications capacities. Building on a foundation of robust population denominator and mortality data, routine capacities and data flows should be integrated across disease- and threat-specific verticals and interconnected with response mechanisms, with the flexibility to respond to early warning signals as well as to surge with enhanced surveillance capabilities during emergencies (e.g., case finding, epidemiological investigations, contact tracing). Limitations in routine surveillance capacity should be understood, adjusted where possible, and contingency tools built in to fill anticipated gaps.

### **5.1.2 Health service capacity, access, and usage monitoring**

In addition to primary routine monitoring, facility management and service provision objectives, health service monitoring provides a critical complement to public health surveillance activities for emergency preparedness and response, providing a dynamic picture of the resilience of health care systems to assess risks and inform adjustments to response activities. This may include, for example, local capacities to mitigate morbidity and mortality from emergencies, barriers to utilization of clinical services, individual risk factors, direct and indirect or collateral effects on human health, areas of potentially heightened risks, positioning and allocation of medical countermeasures, and the impact of control measures.

In many contexts, these data are collected but not consistently accessible to decision-makers. These monitoring systems must therefore be interconnected with public health response mechanisms, with the flexibility to adapt to all types of emergencies. The establishment of contingency capabilities will also aid in the rapid assessment of the effects of major disasters and other emergencies on the availability of health services and the accessibility of these services by all affected communities.

### 5.1.3 Contextual, community, and One Health insights

Advanced public health practice requires the use of multiple surveillance systems and other health and non-health data sources to comprehensively assess and understand risk. This includes the integration of insights into the context in which events are occurring and the vulnerabilities of local communities (e.g., applying civil registration and vital statistics data, conflict analysis, population mobility mapping, or various indices of risks [54,55]). Insights are generated through collaboration to identify and assess risks at the intersection of animals, humans, and the environment. This requires the continuous exchange of information between One Health and other partners, thereby enabling joint risk assessments, investigations, and response to high-risk situations and the operationalization of multisectoral activities under existing plans and frameworks (6,17).

A multisectoral understanding of vulnerabilities – demographic, environmental, social, and economic drivers of health risks based on local contexts – should be locally established and applied towards the design of surveillance (e.g., prioritization of hazards and vulnerable populations) as well as the interpretation of surveillance findings. Communities play a central role in this. Communities and individuals must be engaged at all stages and empowered to take an active role in their health and participate in surveillance systems and decisions that affect them.

### 5.1.4 Collaboration: governance, innovation, and integration

Surveillance approaches must be coordinated to meet the full range of routine surveillance and emergency-related objectives and be designed for flexibility to address shifting needs. This requires well-defined governance structures that systematically undertake routine monitoring and systematic evaluations of the constellation (“the mosaic”) (31) of surveillance systems, with findings compared across emergencies and lessons shared to inform strategic investments in capacity. The establishment of shared priorities and coordination and collaboration mechanisms (e.g., policies, standards, and protocols for data sharing) as part of routine practice may facilitate collaboration between stakeholders during emergencies.

Operational research should be fostered through collaboration with academia, the private sector, and other stakeholders to establish best practices in surveillance methods, systems, and tools for enhancing surveillance activities while continuing to drive innovation. The application of best practices in diverse contexts, including multisystem economic analyses, will support optimization across surveillance approaches and points of collaboration.

Surveillance data and processes should be digitized, prioritizing integrated, interoperable, and flexible solutions. Where appropriate, prioritize the point of data collection in digitization efforts while strengthening capacities across all levels and decentralizing analytic capabilities to empower local decision-making. This will require joint efforts to solve cross-cutting challenges, such as the need to strengthen digital connectivity for continuous communication. Funders of vertical programmes must include incentives for the platforms they support to be flexible to the needs of other diseases and allow for interoperability from the design stage.

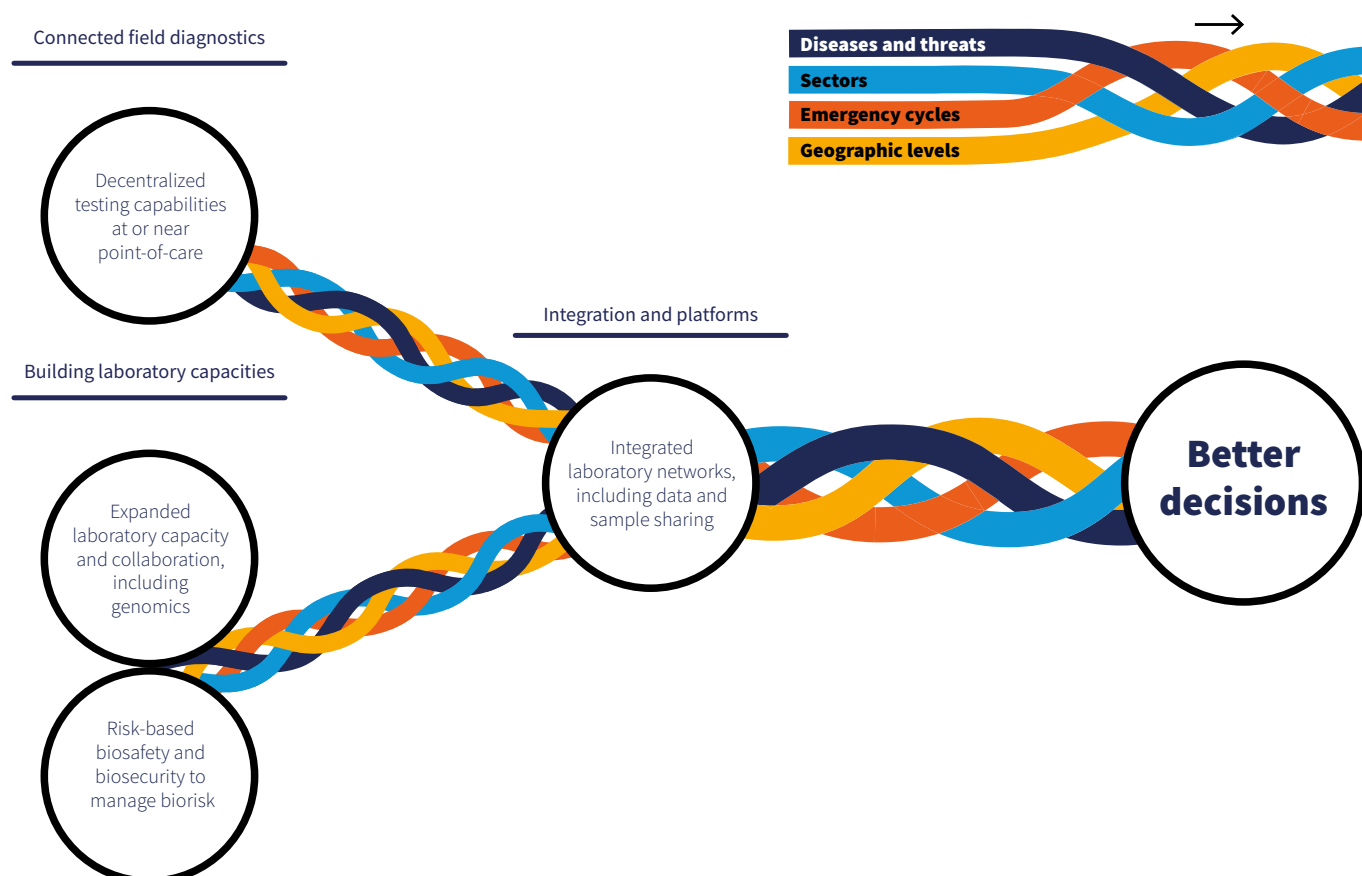
## 5.2 Effective diagnostics and laboratory capacity for pathogen and genomic surveillance

With increased diagnostic and laboratory capacity, collaborative surveillance aims for the early detection and verification of signals to provide insights at all levels while limiting biorisks. This means developing decentralized testing capabilities at or near the point of care, better equipping laboratory systems, ensuring timely sharing of data and biological material across networks, and promoting sound biosafety and biosecurity practices (**Fig. 5**).

### 5.2.1 Decentralized testing capabilities at or near the point of care

Access to diagnostics and laboratory services is often limited at the peripheral level, particularly for hard-to-reach areas and populations. To leverage decentralized testing opportunities, national distribution plans for point-of-care diagnostics should be developed and aligned with public health surveillance and clinical care strategies and guidelines, with clearly outlined responsibilities at each appropriate subnational level. This will require routinely maintaining central registers of public and private diagnostic capacity, stock management systems (linked to replenishment mechanisms), and quality management systems for point-of-care testing. Finally, point-of-care diagnostics for priority diseases should be expanded and results integrated into national surveillance systems.

**Fig. 5.** Capabilities for building effective diagnostics and laboratory capacity for pathogen and genomic surveillance



### **5.2.2 Expanded laboratory capacity and collaboration, including genomics**

Robust diagnostics and laboratory capacity must be established and maintained, with the ability to surge to respond to emergencies, leveraging all sectors as part of a One Health approach. This will require maintaining accountability for laboratory testing through appropriately resourced quality management systems, including accurate quality indicators. As part of implementing the global genomic surveillance strategy for pathogens with pandemic and epidemic potential (56), genomics and phenotypic characterization of pathogens should be accessible either in-country or abroad, with data integrated into surveillance and risk assessment activities. Facilitating innovation and research to respond to local, national, and global needs for affordable and scalable technologies and sustainably implementing these technologies where contextually appropriate will further enhance laboratory systems.

### **5.2.3 Risk-based biosafety and biosecurity practices to manage biorisks**

Ensuring biosafety and biosecurity begins with agreed pathogen-control measures, including standards for inventory, containment, equipment operation and maintenance, personal protective equipment, operational handling, and proper management of high-consequence research. Guidelines and protocols must be implemented, observed, and underpinned by workforce competencies and governance. This should include risk-based biosafety guidelines, standards, and regulations for safe and secure national and global specimen, reagent, pathogen, material, and genetic sequence data sharing. Rigorous incident reporting, response, and monitoring must also be incorporated into all activities involving high-consequence pathogens, both inside and outside safe and secure facilities.

### **5.2.4 Integrated laboratory networks, including data and sample sharing**

Tiered national laboratory and diagnostics networks, connected to networks of international partners, must be established to generate, report, and share high-quality data from subnational facilities to public health and reference laboratories. Coupling laboratory data with clinical and epidemiological information will enable more meaningful analysis, which, when linked to timely communication and feedback mechanisms (including to clinicians), will allow for more comprehensive risk assessments and evidence-based management of individual cases and events. Moreover, the standardization of data management systems, wherever possible, will enable greater sharing and interoperability. National and international systems, governance frameworks, and rapid transportation capacities need to be in place for all stakeholders to access and benefit from the storing and sharing of biological materials.

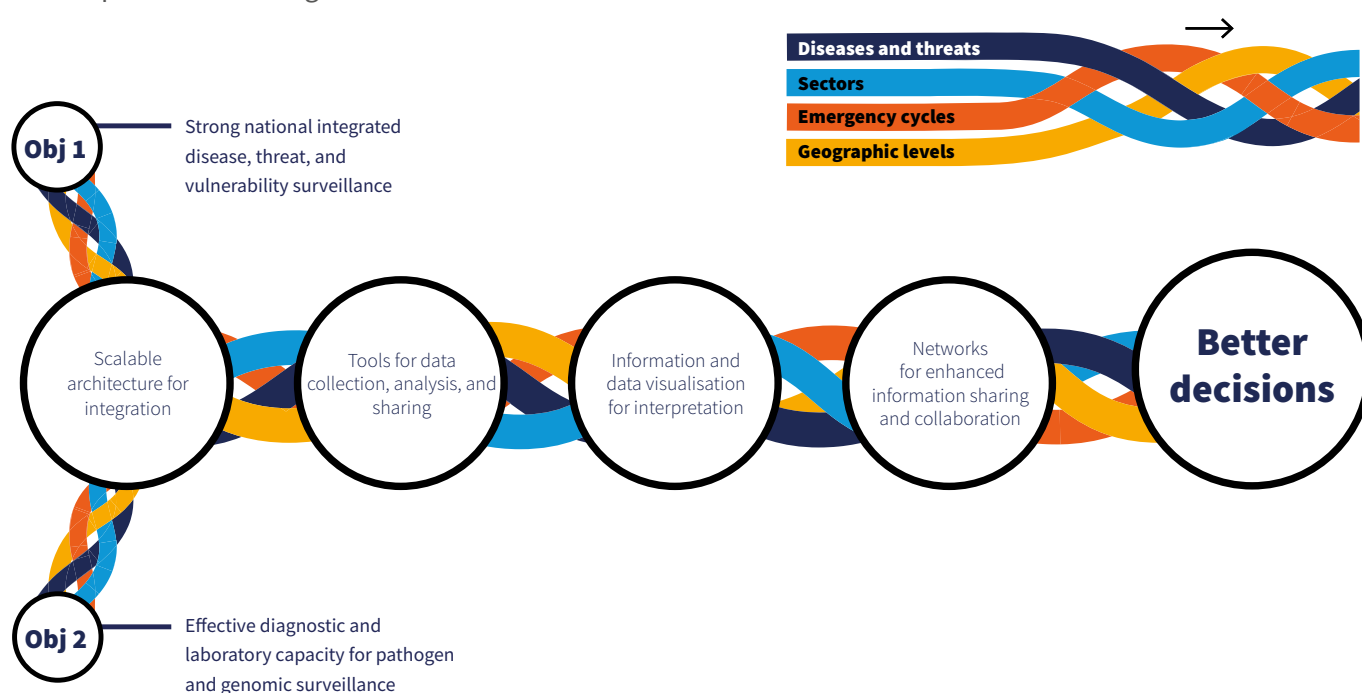
## 5.3 Collaborative approaches to event detection, risk assessment, and response monitoring

Collaboration requires mechanisms that draw upon the key surveillance dimensions to generate actionable intelligence for decision-makers. These surveillance mechanisms are powered by innovative and multidisciplinary capabilities at national and subnational levels to forecast, detect, and assess risks and monitor risk-informed response actions. By understanding risks and potential health consequences, countries can apply evidence to inform their plans and prioritize key actions to prepare for emergencies, scale up anticipatory actions, and mitigate the impacts of events. The capabilities required to enable this collaborative approach include a scalable architecture for the integration of surveillance data and other insights; contextually adaptable tools for data collection, analysis, and sharing; information and data visualization for interpretation; and networks for information sharing and collaboration (**Fig. 6**).

### 5.3.1 Scalable architecture for integration

Integration and collaboration will benefit from establishing modern infrastructure across national public health delivery bodies (e.g., national surveillance hubs managed by national public health agencies or equivalent entities) and in other sectors. Scalable, distributed, evolving mechanisms and networks are needed for secure data linkage, integration, and intelligence sharing. Norms and standards for data quality must also be established and routinely applied, with clearly derived benefits for all levels so as to become standard practice. This may be supported by developing focal points for intelligence sharing across multisectoral partners to triangulate findings from different data sources as events unfold. This should also be extended to cross-border collaboration for health risk management.

**Fig. 6.** Capabilities for facilitating collaborative approaches for event detection, risk assessment, and response monitoring



### **5.3.2 Tools for data collection, analysis, and sharing**

A global collaborative agenda should be established to continuously inform the development of data collection, management, analysis and modelling tools based upon national and local needs. This may be complemented by a global “marketplace” of tools available to countries to adapt to various contexts as well as technical support for countries to use advanced analytical tools. These tools should follow governance policies and data standards to maximize interoperability between systems and enable secure data management, analysis, and sharing.

### **5.3.3 Information and data visualization for interpretation**

Robust risk assessment for decision-making requires strong and well-sourced analytical capacities, which must integrate contextual insights from statistical analyses and modelling. Intelligence generated, including community and behavioural insights, should be shared and fed back through appropriate mechanisms. Real-time, data-driven interfaces and dashboards, incorporating insights drawn from collaboration, should be leveraged for decision-making. Policy-makers and the public should have access to multisectoral data sources, tailored to target audiences, with accompanying guidance on interpretation. A culture of open communication should be maintained, with surveillance outputs systematically fed back and disseminated to relevant stakeholders, and wherever appropriate, routinely published and made accessible to the public. This should be complemented by mechanisms to leverage intelligence for mutual benefit and coordinated action.

### **5.3.4 Networks for enhanced information sharing and collaboration**

National networks across partners, sectors, organizations, and fields of expertise are needed to build relationships and establish protocols for enabling secure access to data; sharing information, intelligence, and capacities in a timely manner; and leveraging synergies. Cross-border, regional, and global platforms should define longer-term objectives and a shared agenda for global surveillance networks while supporting knowledge exchange and building trust within the community.

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## 6 Conclusion

Collaborative surveillance offers health authorities and partners the opportunity to rethink our approach to surveillance to address the complex challenges highlighted by public health emergencies. This concept calls for all stakeholders to apply more contemporary integration practices that leverage the best of surveillance frameworks – embracing vertical, specialized, integrated, and multi-source approaches. Moreover, by building in flexibility to share capacities to prevent, prepare for, respond and recovery from emergencies, more resilient surveillance systems can be developed. Collaborative surveillance calls for developing capabilities and collaboration to generate, share, and apply insights that will provide decision-makers with contextualized intelligence to inform public health actions.

Forthcoming materials will focus on supporting implementation of the collaborative surveillance concept as a core component for strengthening HEPR at all levels. Implementation must take into consideration that successful improvement in collaborative surveillance does not lend itself to traditional global health paradigms of target-driven resource mobilization, given that the success of collaborative surveillance will be defined by a complex mix of prevention, risk assessment, detection, and response activities. Whatever the starting point, scaling surveillance capacities and collaboration to meet the hazards and threats of the 21st century will require a step change in the resources devoted to it and sustained political prioritization.

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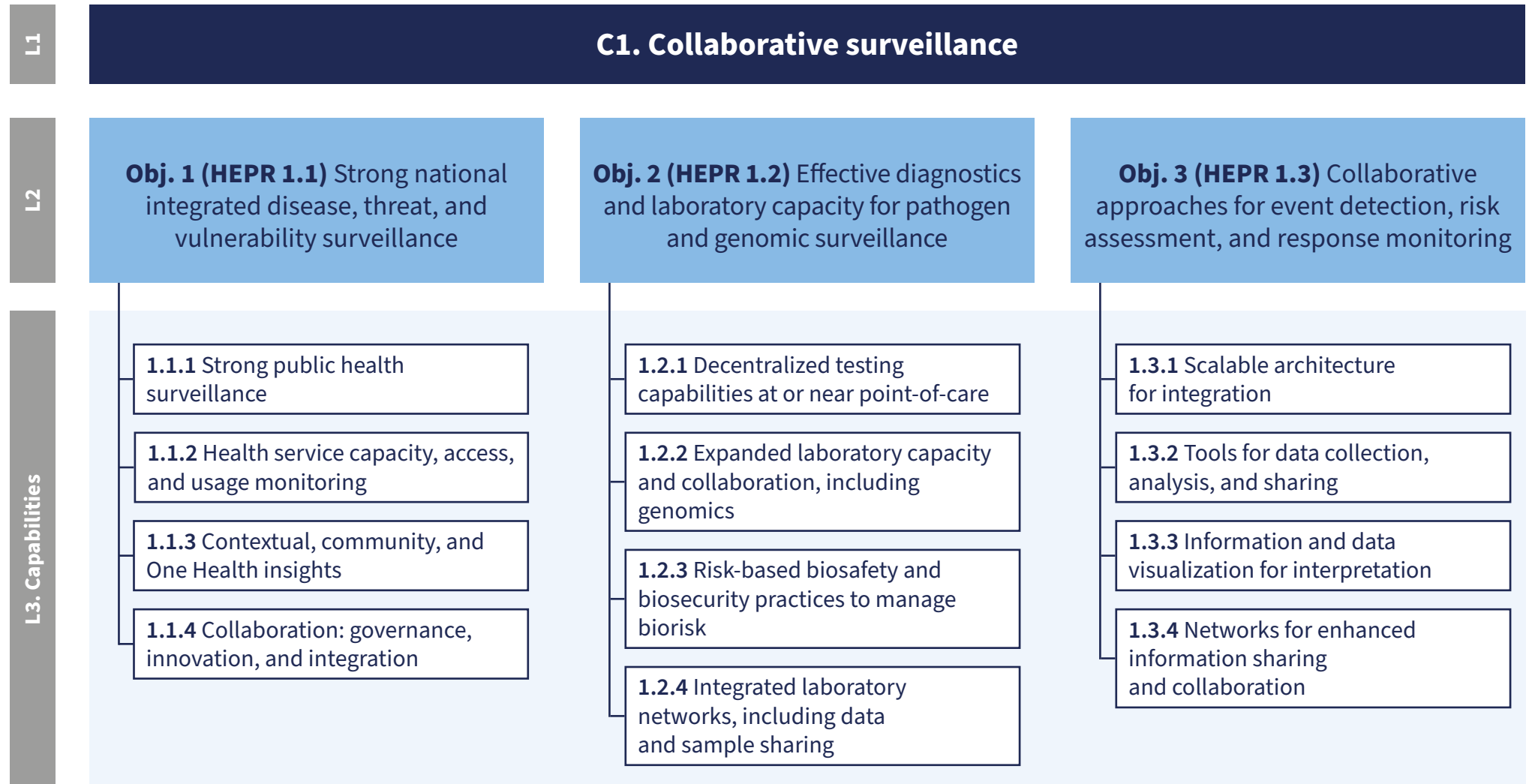
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# Annex. Summary of collaborative surveillance objectives and capabilities





L2

## 1.2 Effective diagnostics and laboratory capacity for pathogen and genomic surveillance

L3. Capabilities

### 1.2.1 Decentralized testing capabilities at or near point-of-care

### 1.2.2 Expanded laboratory capacity and collaboration, including genomics

### 1.2.3 Risk-based biosafety and biosecurity practices to manage biorisk

### 1.2.4 Integrated laboratory networks, including data and sample sharing

L4. Sub-capabilities

**1.2.1.1.** National distribution plans for point-of-care diagnostics developed and aligned with public health surveillance and clinical care strategies and guidelines, with clearly outlined responsibilities at each appropriate subnational level

**1.2.1.2.** Routinely updated and validated central register of public and private diagnostic capacity, and a stock management system linked to replenishment mechanisms

**1.2.1.3.** Quality management systems for point-of-care testing

**1.2.1.4.** Integration of point-of-care diagnostic results into national surveillance systems for priority diseases

**1.2.2.1.** Sufficient, fit-for-purpose laboratory capacity with the ability to surge, leveraging all sectors across One Health dimensions

**1.2.2.2.** Quality management systems for laboratory testing

**1.2.2.3.** Access to genomic and phenotypic characterization of pathogens, either in-country or aboard, with findings integrated into surveillance and risk assessments activities

**1.2.2.4.** Innovation and research ecosystem that responds to local, national, and global needs for affordable, scalable technologies which laboratory systems sustainably implement as contextually appropriate

**1.2.3.1.** Agreed pathogen control measures, including standards for inventory, containment, equipment operation and maintenance, operational handling, and proper management of high consequence research

**1.2.3.2.** Implementation and observance of guidelines and protocols, underpinned by workforce competencies and governance

**1.2.3.3.** Risk-based biosafety guidelines, standards, and regulation for safe and secure national and global specimen, reagent, pathogen, material, and genetic sequence data sharing

**1.2.3.4.** Rigorous incident reporting, response and monitoring in activities involving high-consequence pathogens, both inside and outside safe and secure facilities

**1.2.4.1.** Tiered national laboratory and diagnostics networks established to generate, report, and share data from subnational facilities to high-quality public health and reference laboratories, connected to networks of international partners

**1.2.4.2.** National and international systems for access and benefit sharing of biological materials, supported by rapid transportation capacity

## L2

# 1.3 Collaborative approaches for event detection, risk assessment, and response monitoring

## L3. Capabilities

### 1.3.1 Scalable architecture for integration

### 1.3.2 Tools for data collection, analysis, and sharing

### 1.3.3 Information and data visualization for interpretation

### 1.3.4 Networks for enhanced information sharing and collaboration

## L4. Sub-capabilities

**1.3.1.1.** Integrated modern infrastructure across national public health delivery bodies

**1.3.1.2.** Scalable, distributed, and evolving technical interfaces for secure data linkage, integration, and intelligence sharing between systems

**1.3.1.3.** Established norms and standards on data quality that are routinely applied with clearly derived benefits for all levels (becoming standard practice)

**1.3.1.4.** Developed focal points (nodes) for intelligence sharing between multisectoral partners to triangulate findings from different data sources as emergencies unfold

**1.3.2.1.** A global collaborative agenda to continuously inform the development of data collection, management, analysis, and modelling tools based upon national and local needs

**1.3.2.2.** A global ‘marketplace’ of tools available to countries and adaptable to various contexts

**1.3.2.3.** Technical support for countries to build, customize or adapt, and use advanced analytical tools

**1.3.3.1.** Analytics capacity, integrating contextual understanding and insights from modelling for strengthened risk assessment, with resources and intelligence shared and feedback mechanisms

**1.3.3.2.** Real-time interfaces and dashboards, incorporating insights drawn from collaboration, leveraged for decision making

**1.3.3.3.** Access for policy makers and public to multisectoral data sources, tailored to target audiences and the national or local context, to generate actionable insights

**1.3.3.4.** Open communication with surveillance outputs routinely published, complemented by mechanisms established to leverage intelligence for mutual benefit and coordinated action

**1.3.4.1.** National network across sectors, organizations, and fields of expertise to build strong relationships, establish necessary protocols to share data, information, intelligence and capacities in a timely manner, and leverage synergies

**1.3.4.2.** Regional and global platforms to define longer-term objectives and a shared agenda for global surveillance networks, supporting knowledge exchange, and building trust within the community

**WHO Health Emergencies Programme**

World Health Organization  
20 Avenue Appia  
1211 Geneva 27  
Switzerland  
[www.who.int](http://www.who.int)

