

Preparedness and resilience for emerging threats

Module 1: planning for
respiratory pathogen
pandemics. Version 1.0



PRET
Preparedness and Resilience
for Emerging Threats



World Health
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Foreword

Nearly a decade apart, the COVID-19 and influenza A(H1N1)pdm09 pandemics have highlighted the severe threat posed by respiratory pathogens and revealed serious gaps in the world's defences against epidemics, pandemics, and other health emergencies. We know that the future will bring other respiratory pathogen pandemics and large-scale health emergencies.

While the COVID-19 pandemic caused many challenges for national and global systems, the response experiences have generated valuable learnings. A key success throughout the pandemic was countries' ability to rapidly respond by leveraging existing pandemic preparedness plans and systems. These adaptations have prompted many countries to consider how they can streamline preparedness efforts across known and novel pathogens.

Past pandemics have demonstrated the need for all countries to expect the unexpected. Member States' vision for a pandemic accord and a pandemic fund provides a much-needed framework for enhancing a shared response to shared threats, placing equity and global solidarity at the heart of preparedness planning and response. In addition, refining the architecture for health emergency preparedness, response, and resilience (HEPR) helps introduce new ways of thinking and implementation.

As the world moves forward, a new way of approaching pandemic preparedness is called for. Using a mode of transmission approach can help countries to prepare more effectively and efficiently for future events. The *Preparedness and Resilience for Emerging Threats: Module 1 – Planning for Respiratory Pandemics* navigates countries through key actions they can take to get ready for the next respiratory pandemic.

This module operationalizes a critical part of pandemic preparedness and response systems, and supports Member States to rapidly close critical gaps in implementing the International Health Regulations (2005) core capacities globally, regionally, and nationally.

WHO is committed to building a healthier, safer, and fairer future for all people of the world.

Dr Michael Ryan, Executive Director,
WHO Health Emergencies Programme



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The Preparedness and Resilience for Emerging Threats (PRET) internal Steering Committee, composed of headquarters, regional, and country office focal points in all six regions, collaborated extensively to craft the module's scope, structure, and content. The Steering Committee served an essential role in providing direction throughout the document's drafting and revision processes.

The core development group for the module was composed of five Epidemic and Pandemic Preparedness and Prevention units at WHO headquarters: the Pandemic Preparedness Global Platform, the Global Influenza Programme, the Pandemic Influenza Preparedness Framework, Emerging Zoonotic Diseases and High Impact Events Preparedness teams. In addition, numerous other WHO headquarters departments shared knowledge and experiences to support the module's development. These include: Access to Medicines and Health Products; Acute Events Epidemiology; Antimicrobial Resistance: Surveillance Prevention and Control; Communications: News, Emergencies, and Crisis; Country Readiness Strengthening; Global Tuberculosis Programme; Health Emergency Interventions; Health and Technical Logistics; Health Security Preparedness; Health Workforce; Immunization, Vaccines and Biologicals; Integrated Health Services; One Health Initiative; Quality Assurance of Norms and Standards; Regulation and Prequalification; Special Programme on Primary Health Care; Strategic Planning and Partnerships; Surveillance Systems: Strategy and Guidelines.

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Abbreviations

AAR	after action review
FAO	Food and Agriculture Organization of the United Nations
HCW	health and care workers
HEPR	health emergency preparedness, response and resilience
IAQ	indoor air quality
IHR (2005)	International Health Regulations (2005)
IRPs	infectious respiratory particles
IPC	Infection prevention and control
JEE	joint external evaluation
NAPHS	national action plan for health security
NDVP	national deployment and vaccination plan
PHSM	public health and social measures
POC	point of care
PPE	personal protective equipment
PRET	Preparedness and Resilience for Emerging Threats
R & D	research and development
R-PEF	Respiratory Pathogens Partners Engagement Forum
SPAR	State Party Self - Assessment Annual Report
UHPR	Universal Health Preparedness Review
UN	United Nations
WHO	World Health Organization
WOAH	World Organisation for Animal Health

Glossary

Access to countermeasures: ensuring equitable access to countermeasures through fast-tracked and prioritized research and development with pre-negotiated benefit-sharing agreements, scalable manufacturing platforms and agreements for technology transfer, and coordinated procurement and emergency supply chains (1).

Capacity: combination of all the strengths, attributes and resources available within an organization, community or society to manage (2).

Clinical care: providing lifesaving and scalable clinical care, protection of health and care workers and patients, and health systems that can maintain essential health services (1).

Coherence: ensuring synergy between institutional capabilities for systems strengthening and financing, reducing fragmentation, competition, and duplication, and aligning with international instruments (1).

Collaborative surveillance: strengthening national integrated disease, threat and vulnerability surveillance, increased laboratory capacity for pathogen and genomic surveillance and collaborative approaches for risk assessment, event detection and response monitoring (1).

Community protection: proactively building trust with communities through risk communication and infodemic management, community engagement to help design and implement public health and social measures (PHSM), and multisectoral action to address community concerns (1).

Community transmission: the appearance of cases with no known exposures to suspected putative sources.

Contingency planning: a management process that analyses risks and establishes arrangements in advance to enable timely, effective and appropriate response (2).

Critical infrastructure: the physical structures, facilities, networks and other assets which provide services that are essential to the social and economic functioning of a community or society (2).

Disability: individuals with impairment in body structure or function, or mental functioning (such as loss of a limb, loss of vision or memory loss), activity limitation (such as difficulty seeing, hearing, walking, or problem solving), or participation restrictions in normal daily activities (such as working, engaging in social and recreational activities, and obtaining health care and preventive services) (3).

Disseminated community transmission: the occurrence of sustained community transmission in multiple geographic regions.

Emergency: A type of event or imminent threat that produces or has the potential to produce a range of consequences, and which requires coordinated action, usually urgent and often non-routine (2).

Emergency coordination: developing coherent national action plans for preparedness, prevention, risk reduction and operational readiness and scalable health emergency response coordination through a standardized and commonly applied emergency response framework (1).

Epidemic: the occurrence, in a community or region, of cases of an illness, specific health-related behaviour, or other health-related events clearly in excess of normal expectancy (2).

Equity: the absence of unfair, avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically or by other dimensions of inequality such as sex, gender, ethnicity, disability, or sexual orientation. In the context of preparedness, equity means ensuring fair distribution and implementation of health and public health interventions, driven by the public health needs of the various population groups affected by an epidemic or pandemic.

Gender: the socially constructed roles and differences between males and females, and the relationships between these groups. Gender changes over time, within and between cultures, and is dependent on both context and time. Gender and other diversity factors, such as sexual orientation, age group, disability, and socioeconomic status, among others, *determine daily responsibilities, access to resources, and power dynamics* (4).

Inclusivity: providing all countries an equal voice, engaging whole-of-government and whole-of-society, having collaborative networks of multisectoral and multidisciplinary partners (1).

One Health: having an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes that the health of humans, domestic and wild animals, plants and the wider environment including ecosystems are linked (5).

Outbreak: used synonymously with “epidemic”, usually to indicate localized as opposed to a generalized epidemic (2).

Pandemic: recognizing that various definitions exist, the following definitions facilitate preparedness planning in the context of this module:

- i) When a new pathogen has been shown to cause several outbreaks in at least one country, and to have spread to other countries, with consistent disease patterns indicating that serious morbidity and mortality is likely in at least one segment of the population (6).
- ii) Worldwide spread of a new disease. Pandemics occur when a new (novel) pathogen emerges against which people have little or no immunity, and spreads around the world (7).

Pathogen agnostic: not specific to one pathogen.

Preparedness: having the knowledge, capacities, and systems that work to reduce vulnerability and enhance resilience (8).

Readiness: taking actions to delay or reduce the risk of an emergency including the introduction of a respiratory pathogen with pandemic potential.

Resilience: The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management (9).

Response: any public health action triggered by the detection of a public health risk.

Surge: Sudden demand for services where additional capacities in terms of the amount of personnel, specialized expertise, equipment or supplies are required.

Surge capacity: Ability of institutions (such as clinics, hospitals, or public health laboratories) to respond to increased demand for their services during an emergency.

Sustained community transmission: the persistent appearance of cases with no known exposures to suspected putative sources.

Vulnerability: The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of a hazard.

Whole-of-government: having a collaborative effort by different government ministries and agencies to public service delivery.

Whole-of-society: having a collaborative effort by different various government ministries and agencies, businesses and civil society.

DRAFT

Executive summary

Public health importance

The two pandemics in the 21st century have exposed the significant health and socio-economic risks posed by respiratory pathogens.

Four key lessons learned from COVID-19 are:

1. Preparedness works
2. Health is everyone's business
3. No one is safe until everyone is safe
4. Response must be agile and adaptive.

As similar systems and capacities can be used to prevent, prepare for and respond to different respiratory pathogens, integrated respiratory pathogen pandemic planning is efficient because:

1. It establishes a unifying approach for preparedness covering both novel pathogens and those known to have pandemic potential.
2. Pathogen-specific elements, such as therapeutics in clinical care, can be elaborated in line with the unifying approach to minimize duplication or fragmentation.
3. It can be coherently embedded into broader plans for disaster risk management and national action plans for health security.

Module objectives

This module is intended for use by cross-sectoral stakeholders, both at country and regional/global levels, involved in preparedness and response planning for respiratory pathogen pandemics. The module has three objectives:

1. To guide countries and partners in developing or updating their integrated approach to respiratory pathogen pandemic preparedness for equitable and robust response.
2. To focus attention on the actions needed to strengthen respiratory pathogen pandemic preparedness functionally, in line with the International Health Regulations (IHR, 2005) core capacities.
3. To provide an organizing framework, pragmatic steps and an outline to structure pandemic preparedness and response planning.

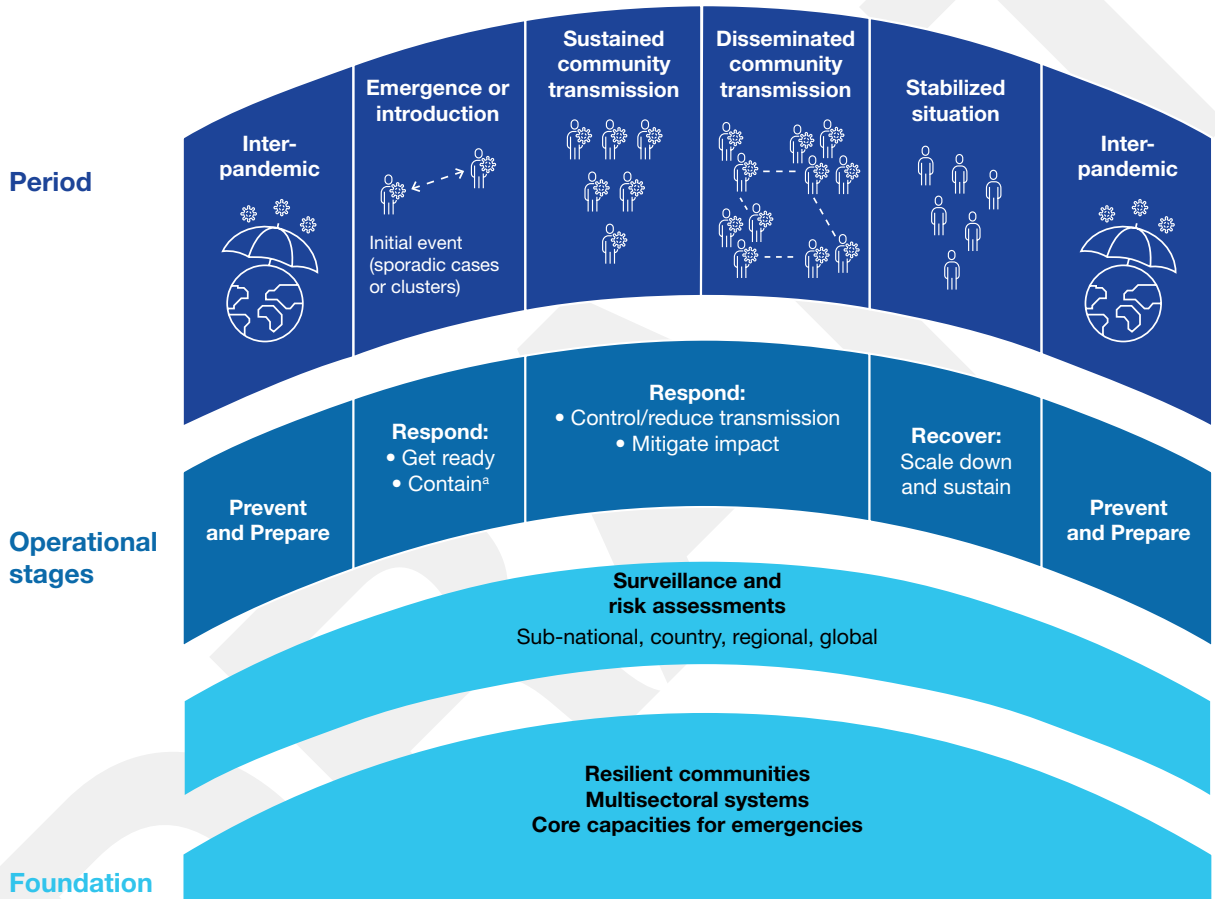
“ This module is intended for use by cross-sectoral stakeholders, both at country and regional/global levels, involved in preparedness and response planning for respiratory pathogen pandemics. ”

Organizing framework

An organizing framework helps decision-makers determine what needs to be done when, so that attention is given to the systems and capacities

needed for operations before, during and after a pandemic. Note that response and recovery plans will need to be tailored at the time of an event.

Organizing framework for respiratory pathogen pandemic planning



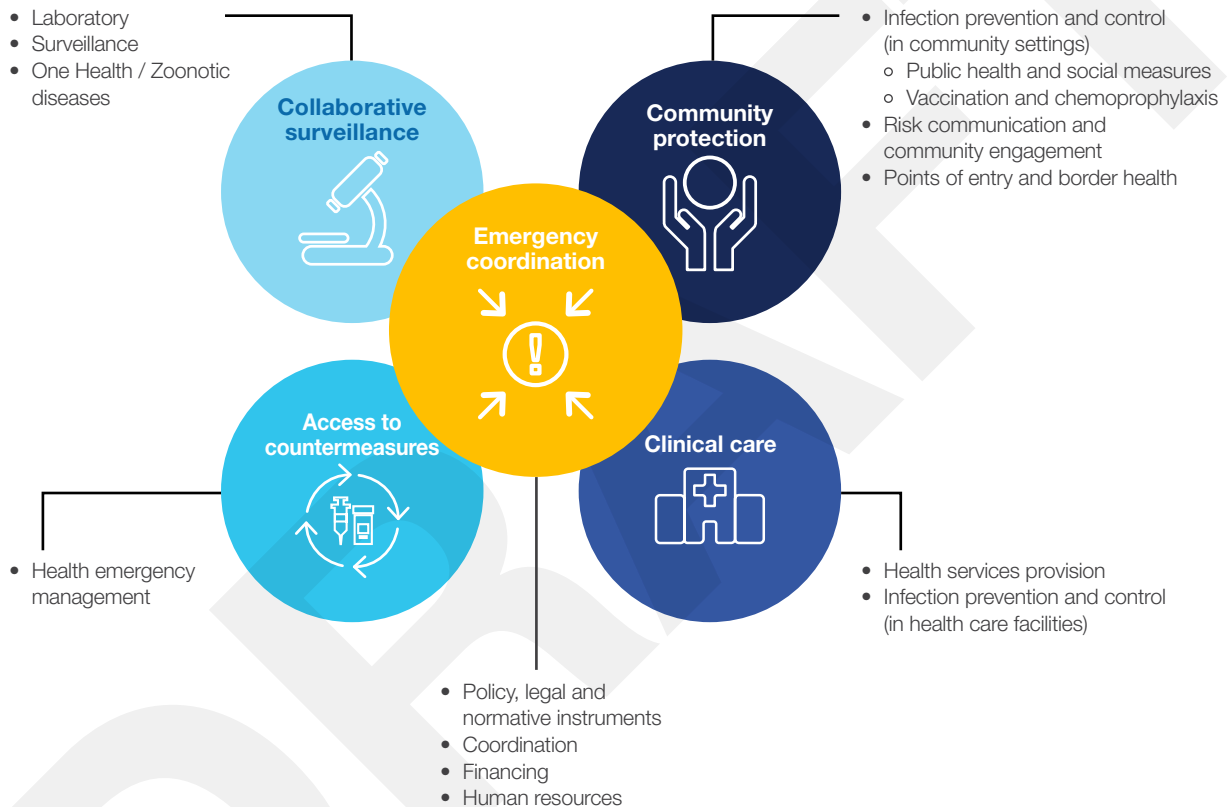
^a Containment aims to stop transmission by reducing the effective reproduction number (R) to below one. This requires highly stringent application of measures, is resource intensive and time sensitive. Containment measures may halt, delay or reduce the spread and overall impact of the pandemic and may be considered as part of a country's national preparedness plan. Operational decisions need to be based on risk assessments that account for pathogen, exposure and contextual factors including health and socio-economic capacities and vulnerabilities.

Capacities needed

Twelve core capacities, in line with the IHR (2005), are needed for respiratory pathogen pandemic preparedness, and specific actions can be taken to strengthen preparedness for each.

To simplify planning and to align with global planning instruments, the 12 IHR (2005) core capacities can be organized according to five components for health emergency preparedness, response and resilience.

Five components for health emergency preparedness, response and resilience



Strengthening preparedness

Strengthening preparedness involves articulating the actions needed during each pandemic preparedness and response period to (a) prevent and prepare (b) respond and (c) recover. This requires:

1. Knowing the actions needed to strengthen preparedness and addressing gaps by

leveraging capacities that exist in both cross-cutting and hazard-specific systems.

2. Embedding respiratory pathogen pandemic preparedness in a foundation of resilient communities, multisectoral systems and core capacities for emergencies.
3. Accounting for the guiding principles and multisectoral interdependencies.

Monitoring preparedness

Monitor preparedness using two approaches and use findings to continuously improve planning and preparedness:

1. Tools for monitoring implementation of the IHR (2005) core capacities
2. Specific respiratory pathogen pandemic planning measures.

Developing a plan

The four essential steps for building an integrated respiratory pathogen pandemic preparedness plan:

1. Prepare, analyse the situation and engage stakeholders
2. Draft the plan
3. Evaluate, finalize, and disseminate the plan
4. Implement, monitor and continuously improve the plan.

Use the suggested outline to guide planning discussions and to steer the overall process to develop a plan. The outline includes an approach for documenting context and objectives, planning considerations and assumptions, country systems and capacities, plan activation and triggers for shifting between operational stages, and actions needed during each operational stage.

How to use this document

This module presents key themes and planning considerations in order to guide stakeholders in their approach to strengthening respiratory pathogen pandemic preparedness.

Fig. 1. Illustrates how the module is structured. Chapters 1-3 present the objectives, rationale and context – the ‘why’ – of respiratory pathogen pandemic preparedness. Chapters 4-5 focus on

the ‘what’ by providing an organizing framework for pandemic planning as well as describing the systems components and core capacities needed. Chapters 6-10 present the ‘how’ by providing guidance on implementing, monitoring, researching and continuously improving respiratory pathogen pandemic preparedness, as well as steps and suggested outline for planning.



Throughout this module this symbol indicates recommended actions to strengthen preparedness.

The module is designed to be used in conjunction with other documents that elaborate on pathogen-agnostic and pathogen-specific preparedness.



This symbol is used where readers are signposted to related documents.



Click on the arrows throughout this document to navigate across sections.



**COMMUNITY
MOBILIZER**

Fig. 1: Organization of this module



**Chapters 1-3
and Annex 1 & 2**

present the objectives, rationale and context – the ‘why’ – of respiratory pathogen pandemic preparedness.



**Chapters 4-5 and
Annex 2, 3 & 4**

focus on the ‘what’ by providing an organizing framework for pandemic planning as well as describing the systems components and core capacities needed.



**Chapters 6-10 and
Annex 2, 5 & 6**

present the ‘how’ by providing guidance on implementing, monitoring and continuously improving respiratory pathogen pandemic preparedness, as well as steps and suggested outline for planning.

The Why

Chapter 1: Introduction



Chapter 2: Lessons from COVID-19 for future respiratory pathogen pandemic preparedness



Chapter 3: Context for respiratory pathogen pandemic preparedness



Annex 1 

Methods for developing this module

Annex 2 

Examples of critical interdependencies between health and other sectors for respiratory pathogen pandemic preparedness

1. Introduction

1.1 “PRET” – a global initiative

The Preparedness and Resilience for Emerging Threats (PRET) initiative is an innovative, hazards-based approach to improving pandemic preparedness that recognizes that the same systems, capacities, knowledge and tools can be leveraged and applied for groups of pathogens based on their mode of transmission (respiratory, arboviruses, foodborne etc.). This document presents the first module of the PRET approach.

PRET builds on current momentum to strengthen the global architecture for health security (prevention, preparedness, response and resilience) and to operationalize the vision set by the World Health Organization’s (WHO) Member States for a more equitable and robust response to future pandemics, saving lives and protecting livelihoods. It leverages the latest tools and approaches for shared learning and collective action established during the COVID-19 pandemic and other recent public health emergencies. PRET aims to bring together countries and diverse stakeholders, including those across all relevant sectors, to work together on pandemic planning.

PRET works by drawing on lessons from previous events to identify gaps and opportunities to

strengthen capacities. It develops mode of transmission-based resource packs that include pathogen-agnostic and pathogen-specific items, where relevant. PRET brings together stakeholders to engage in the next iteration of pandemic preparedness by building a community of practice where countries and partners can learn from each other. PRET aims to strengthen health security components to be ready for surge during future pandemics by providing a mode of transmission specificity to complement an all-hazards approach.

This document is therefore intended to be an evolving document that will gradually incorporate the improvements and lessons learned from the implementation.

1.2 Respiratory pathogen pandemics

The two pandemics since the start of the 21st century have exposed the significant health, social and economic risks posed by respiratory pathogens.

Integrated respiratory pathogen pandemic planning is efficient because similar systems can be used to prevent, prepare for and respond to different respiratory pathogens – including in emergency coordination, laboratory and surveillance, clinical care and community protection. Integrated planning helps stakeholders to:

- a) set up a unified approach for pandemic preparedness that covers both novel respiratory pathogens and those known to have pandemic potential,
- b) embed pandemic preparedness as a critical element of acute respiratory disease control programmes no matter the causative agent,
- c) strengthen and promote integrated systems and capacities for respiratory pathogens to avoid duplication, and
- d) have a common approach to address pathogen-specific elements and to interface with cross-cutting systems.

This module supports countries and stakeholders to develop and implement a plan that addresses both preparedness and response planning needs; this is also commonly referred to as contingency planning. Once an emerging respiratory pathogen threat is detected, a pathogen-specific preparedness and response plan would need to be developed; this would account for both the context at the time of the event and pathogen-related parameters such as transmissibility and clinical severity.

WHO is committed to supporting countries with pandemic preparedness planning. World Health Assembly resolutions WHA58.5 (10) and WHA74.7 (11) provide the mandate for WHO's provision of updated technical guidance and

assistance to support pandemic preparedness. In addition, the International Health Regulations (IHR 2005) Emergency Committee for COVID-19 noted the need for guidance and technical support from WHO for respiratory pathogen pandemic preparedness (12).

This module was developed in a multi-step process involving a review of the literature, key informant interviews, stakeholder consultations and a review of good practices through case studies. It incorporates learnings from past respiratory pathogen pandemics and accounts for the evolving landscape of public health systems, capacities and operations. See Annex 1 for the module's development process.

1.3 Purpose of this module

The three objectives of this module are to:

1. Guide countries and partners in developing or updating their integrated approach to respiratory pathogen pandemic preparedness for equitable and robust response
2. Focus attention on the actions needed to strengthen respiratory pathogen pandemic preparedness functionally, in line with the IHR (2005) core capacities, and
3. Provide an organizing framework, pragmatic steps and an outline to structure pandemic preparedness and response planning.

“ This module supports countries and stakeholders to develop and implement a plan that addresses both preparedness and response planning needs.”



1.4 What's new in this module?

This PRET module:

- Uses a mode of transmission approach to support countries and partners in navigating the new era of pandemic preparedness. The hazard-based model helps countries to prepare for pathogens with similar transmission patterns, including an unknown “Disease X”, rather than developing a multitude of pathogen specific plans.
- Provides a refreshed look at pandemic preparedness that places equity, inclusivity, and coherence at the forefront. To support harmonization, this module interlaces the Global Architecture for Health Emergencies Preparedness, Response, and Resilience (HEPR) with the relevant IHR (2005) core capacities. By incorporating these existing global health mechanisms, the module provides key recommended actions relevant for respiratory pathogens that complement and provide nuance to the all-hazards approaches such as the National Action Plans for Health Security (NAPHS).
- Includes an organizing framework with operational stages, triggers and assumptions that countries can use to structure plans.
- Documents specific lessons from COVID-19 as the most recent respiratory pathogen pandemic and highlights ways to build on capacities gained, including in multisectoral preparedness, community engagement and infodemic management, and collaborative surveillance and research.
- Outlines ways to monitor respiratory pathogen pandemic preparedness and provides a stepwise approach as well as an outline to facilitate planning.
- Incorporates innovations and innovative approaches such as waste water surveillance, genomic sequencing, and infodemic management.

1.5 Who should use this document

This module is intended to be used by all key stakeholders involved in respiratory pathogen

pandemic preparedness and response, at country and international level (see Table 1).

Table 1: List of target audiences for this module

Level	Audiences
Country	<ul style="list-style-type: none"> Ministry of health and national public health institutes (where relevant) that lead technically in the development, testing and activation of the plan, and are responsible for health sector preparedness. National emergency and disaster risk management authorities that lead contingency planning and interface with political leadership including the office of the head of state and parliamentarians. Ministry of agriculture or other ministries responsible for animal health that focus on preventing and controlling zoonotic pathogens. Other ministries and institutions from sectors involved in disease emergency preparedness and response. Other health authorities at national and subnational levels that interface with other stakeholders such as health care facilities, community leaders, health and care workers (HCW), and animal health workers, nongovernmental organizations, civil society organizations, philanthropic institutions, private for-profit sector and academia.
Regional and global	<ul style="list-style-type: none"> WHO and other United Nations organizations. International and intergovernmental agencies involved in pandemic preparedness and response. Regional economic integration organizations. International health professional organizations and associations. Non-governmental organizations, civil society organizations, philanthropic institutions, private for-profit sector and academia involved in pandemic preparedness and response. Funding institutions including donor governments and multilateral agencies.

2. Lessons from COVID-19 for future respiratory pathogen pandemic preparedness

The COVID-19 pandemic shed light on critical gaps and challenges in existing systems for preventing, detecting, responding and recovering from respiratory pathogen pandemics. The key messages and lessons below distil and focus on opportunities to enhance collective preparedness for future equitable and robust pandemic response. Annex 1 describes how these lessons were identified.

2.1 Key messages

1. Preparedness works.

Investing in functional capacities, interoperable systems, and critical infrastructure makes the world better equipped to respond to emergencies.

2. Health is everyone's business.

Pandemic preparedness and response rely on whole-of-government and whole-of-society action. Political leadership, community engagement, and collaboration across institutions, sectors, and borders is essential.

3. No one is safe until everyone is safe.

In an interconnected world, what happens in one community or country affects others. Public health and scientific literacy facilitate acceptance and adoption of life-saving interventions. Vulnerable populations must be prioritized globally.

4. Response must be agile and adaptive.

As pandemics progress, response systems must monitor new developments, consider contingencies, adapt to evolving circumstances, and operationalize lessons learned along the way.

2.2 Lessons learned

- Lesson 1:** **Strengthening operational capacities can prepare public health and other sectors, especially One Health institutions, to prevent and respond quickly – and early – to emerging respiratory threats.** Bolstering the capacities of rapid responders and investing in emergency response infrastructure can prevent or slow outbreaks before they escalate into pandemics.
- Lesson 2:** **Stronger surveillance and laboratory capacities are essential for early detection and response to emerging respiratory threats.** Alert and enabled health and care workers (HCWs) are key to detecting and rapidly responding to an event. Enhanced disease surveillance and laboratory capacities can help public health practitioners to routinely assess public health risks and the impact of different measures on different population groups. Having real-time analytic epidemiology, ideally using case-based data, provides modellers with robust parameters to generate near- and long-term estimates on disease incidence, morbidity and mortality associated with different interventions.
- Lesson 3:** **Robust surge capacities are critical components of protecting health systems, health workforces, and communities.** Strengthening these capacities can prepare health care facilities to meet increased demands for emergency care during respiratory pandemics, while minimizing disruptions to routine care provision, protecting clinical workforces, and mitigating community transmission risk by effective infection prevention and control measures.
- Lesson 4:** **Expediting the development, production and authorization of emergency medical countermeasures and bolstering manufacturing and supply chain capacities is a critical tenet of equitable respiratory pandemic preparedness and response.** Implementing measures to accelerate medical countermeasure development and production – especially in resource-constrained settings – can save lives, protect at-risk populations, and prevent undue strain on health systems.
- Lesson 5:** **Close partnerships between government and nongovernmental entities can improve health response delivery as well as the continuity of essential services and industries.** Aligning priorities in these areas within and across countries – as well as between entities across the public sector, private sector, and civil society – enables coordinated responses to emerging threats.
- Lesson 6:** **Long-term, sustainable investments in routine public health and primary care services are essential to building resilient health systems and communities, which are better equipped to safeguard populations from future respiratory disease pandemics.** Investing in robust systems of public health and primary care establishes healthy and resilient communities. Resilient communities, in turn, are better prepared to withstand and rapidly respond to pandemics, such as by scaling up emergency care, maintaining routine health service provision, and adapting surveillance systems.

Lesson 7:**Strong social safety net policies and programmes are needed to mitigate the social and economic impacts of pandemics on vulnerable populations.**

These help to protect vulnerable populations, who bear a disproportionate share of disease, disability, and death stemming from pandemics. Vulnerable populations also shoulder disproportionate health, social and economic burdens from the very mitigation measures needed to protect the public's health, including loss of income, educational disruptions, and barriers to accessing health care and other needed social services.

Lesson 8:**Stronger mechanisms for international cooperation and coordination are essential to implementing robust and equitable responses to pandemic threats.**

These need to be considered within the health sector as well as other critical infrastructure sectors – such as transportation, manufacturing, food and agriculture – to ensure that pandemic response is consistently enabled at country, regional and global levels.

Lesson 9:**Policymakers, practitioners and researchers must proactively identify and learn from past successes and failures, taking steps to institutionalize best practices in pandemic response.**

Although the COVID-19 pandemic illuminated flaws in existing systems and practices, it also highlighted governments and health systems ability to evolve and adapt existing policies, capabilities, and programmes to enhance preparedness and response. Iteratively documenting and sharing these lessons and opportunities could improve institutional learning and enhance readiness for future pandemics.

3. Context for respiratory pathogen pandemic preparedness

This chapter presents the guiding principles, the multisectoral and health context, the challenges associated with respiratory pathogens and their technical implications for pandemic planning. These facilitate whole-of-society and whole-of-government respiratory pathogen pandemic preparedness.

3.1 Guiding principles

Previous respiratory pathogen pandemics have demonstrated – including in the lessons from COVID-19 noted in the previous chapter – the criticality of ensuring timely and equitable access to medical and other essential products during the emergency.

Experience has also highlighted the importance of communities being 'at the heart' of the response for action to be effective, and the need for coherent whole-of-government and whole-of-society response that adapts to the evolving needs.

Accordingly, the following guiding principles underpin respiratory pathogen pandemic preparedness planning and serve as the foundation for rapid and effective response.

- **Equity based on public health needs:** both between and within countries to make sure that no one is left behind and that at-risk groups are protected.
- **Inclusiveness:** engagement and ownership from whole-of-government and whole-of-society, taking a community- and person-centered approach.
- **Coherence:** reduce fragmentation and competition to maximize trust and agility in decision-making through coordination, cooperation and collaboration.
- **Equality and non-discrimination:** preventing discrimination of any kind based on race, colour, sex, language, religion, political, or other opinion, national or social origin, property, birth or other status such as disability, age, marital and family status, sexual orientation and gender identity, health status, place of residence, economic and social situation (see Box 1 for gender as an example).
- **Evidence-informed decision-making:** using available data to inform policies, recommendations and operational decisions while recognizing existing uncertainties and addressing misconceptions and errors.
- **Forward-looking and transparent:** placing importance on looking ahead and being proactively prepared, while sharing the process for arriving at decisions and recommendations to build and maintain trust.
- **Technical and financial sustainability:** applying policies, resources and programmes that have a lasting impact on a country's emergency preparedness and response systems.
- **Continuous learning for improvement:** use lessons learned from research and past experiences, and monitor and evaluate progress to continually strengthen preparedness and response planning.

Box 1. Ensuring pandemic planning advances gender, equity and human rights

Unequal societies exacerbate the effects of a respiratory pathogen pandemic for at-risk groups – gender exemplifies this. Gender inequities have deepened since the COVID-19 pandemic began: for example, seven in ten women say they think that verbal or physical abuse by a partner became more common (13) and by 2021 there were 19.7 million fewer jobs for women, compared to 10.2 million fewer for men, than before the pandemic (13).

Addressing these inequities requires data, investments and policy innovations. Analyses of the nearly 5000 measures from 226 countries and territories monitored through the United Nations Development Programme (UNDP) and UN Women COVID-19 Global Gender Response Tracker found that, overall, government responses did not pay enough

attention to gender dynamics and often failed to mitigate the negative impact of the pandemic on women and girls (13); eighty-two per cent of COVID-19 task forces across 130 countries were dominated by men (13).

However, policy innovations and learning took place even amid constraints. Countries with powerful feminist movements, stronger democracies or higher women's representation adopted an average of five more gender-sensitive measures than countries without those features (13). More than 100 countries used digital tools to adapt support to survivors of violence against women and girls (13). Nine out of ten gender-sensitive cash transfers were implemented in the Global South (13).



Learn more about these findings in *Government responses to COVID-19: lessons on gender equality for a world in turmoil* (13).



Learning from COVID-19: opportunities to enhance equity

Think about ways to operationalize the guiding principles: how can we build on the lessons learned from the different experiences, including the gender example shared here? Take steps to mitigate and prevent disproportionate impact in future pandemics based on key inequality dimensions – including income, sex, age, race, ethnicity, migration status, disability and geographic location, among others.

Box 1. (cont.)

Determine

who was left behind and why, by analysing data and assessing barriers to improve health outcomes during the COVID-19 pandemic

Develop

approaches and implement initiatives to address barriers and build back better

Build

in accountability and monitor progress

Conduct

research to assess inequities and to identify effective programmes or remedial actions

Strengthen

technical and operational capacity across the intersectoral pandemic planning workforce so that they have the know-how to deliver quality programmes

Dedicate

resources specifically to promote whole-of-government and whole-of-society programmes that focus on equality, equity and human rights

Engage


communities especially through civil society from the outset to maximize trust, co-design and co-achieve.



For more information, see WHO's Innov8 (14) Approach for Reviewing National Health Programmes to Leave No One Behind.

3.2 Multisectoral interdependencies

Health exists in the broader socioeconomic context. Given the interdependencies between different sectors, preparing for and responding to a pandemic requires multilevel and multisectoral collaboration across society, under the leadership of governments and in coherence with supra-national bodies. While it is ministries of health that enact health policies and plans, including priorities for emergencies, countries are also likely to have National Emergency and Disaster Risk Management strategies and policies, which are typically administered by the office of the head of state, ministry of the interior or national disaster management authority. Respiratory pathogen pandemic preparedness planning needs to be integrated into intersectoral policies, strategies, planning and budgeting for greatest impact.

 **Ministries of health** and other stakeholders should integrate respiratory pathogen pandemic preparedness into national planning for emergency and disaster risk management. Clarify the key roles and responsibilities of different stakeholders and ensure that actions are underpinned by science and latest evidence. This will facilitate whole-of-government and whole-of-society action.

Many actors play a role in preventing disease emergence and spread, protecting health, minimizing the socioeconomic impact, and managing the response in different contexts including fragile, conflict and vulnerable settings. In many countries, national and international civil

society and community-based organizations have a key role in providing community-based services to meet the needs of vulnerable populations. Community-based organizations can also translate and contextualize scientific and government messages and recommendations, which otherwise may be met with mistrust or scepticism by parts of society. Community leaders can build public confidence, increase community ownership of ways to protect health, disseminate timely information and identify people at risk.

 **Governments should involve** civil society and local communities in the development of respiratory pathogen pandemic preparedness plans.

Governments should also work with local and international humanitarian agencies and organizations, including the United Nations system, to identify how the basic needs of vulnerable populations will be met in a pandemic. The adoption of this whole-of-society approach will clarify responsibilities, identify gaps and avoid duplication in planning and implementation.

Box 2 outlines the sectors relevant to multilevel and multisectoral preparedness, recognizing the varying contexts and diversity in governance and operational structures (15).

Box 2. Sectors relevant for respiratory pathogen pandemic preparedness

Engaging the right sectors, and their relevant public, private and humanitarian entities, in respiratory pathogen pandemic preparedness will save lives, protect livelihoods, and speed up recovery at the time of the emergency.

Relevant sectors may include:



Early in the planning process, make it a priority to:

1. **List** the sectors critical in the context of a respiratory pathogen pandemic
2. **Develop** jointly a better understanding of critical interdependencies
3. **Establish** routine coordination with the critical sectors to advance planning
4. **Co-create** a respiratory pathogen pandemic preparedness plan outlining the role and actions of each sector during each operational stage
5. **Encourage and incentivize** engagement of different critical sector stakeholders (public, private and humanitarian) in pandemic planning and preparedness actions including financing
6. **Enhance** knowledge and build capacity among sector stakeholders on respiratory pathogen pandemic preparedness
7. **Co-monitor** implementation of actions to strengthen preparedness

For some examples of the critical interdependencies between health and other sectors refer to **Annex 2**

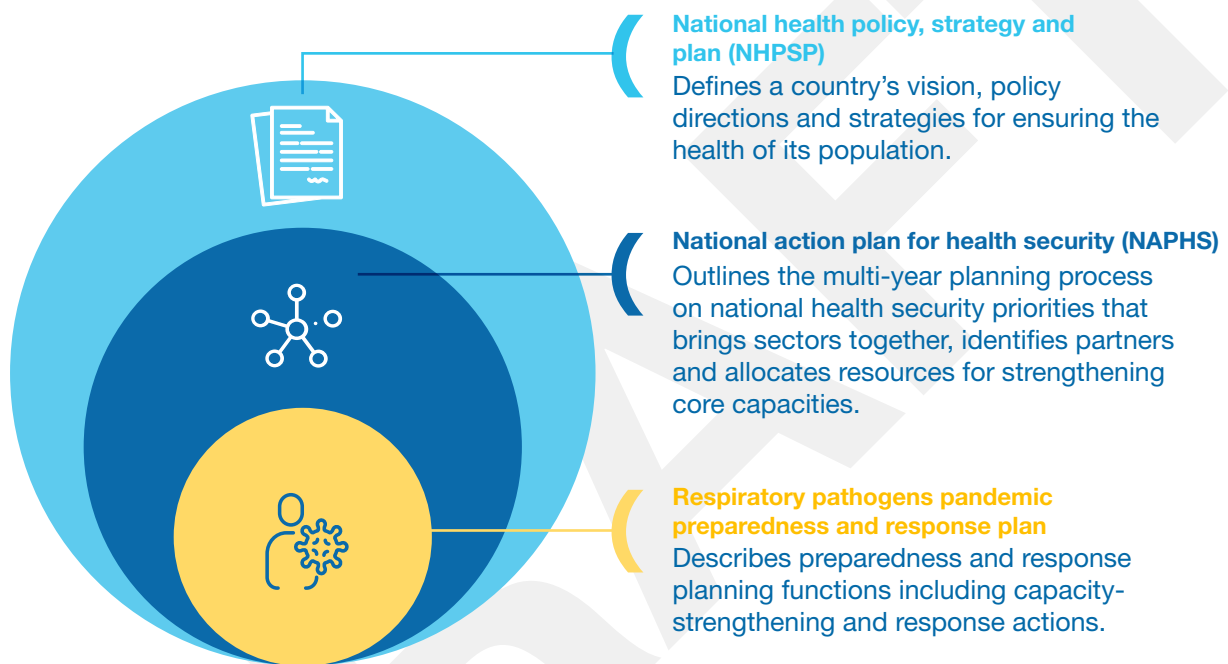


3.3 Health policy and planning context

Respiratory pathogen pandemic preparedness plans need to align with and be integrated into national policies, planning processes and budget

cycles for health sector capacity development, emergency preparedness and contingency planning (see Fig. 2) (16).

Fig. 2: National planning processes for emergency preparedness and response



Respiratory pathogen pandemic preparedness planning should be reflected in broader strategies, policies and plans commonly available at country level, such as the National Health Policy, Strategy & Plan (NHPSP) and the NAPHS.

Respiratory pathogen pandemic preparedness plans should also incorporate and build on any pre-existing hazard-specific plans, such as those for pandemic influenza preparedness or COVID-19 response, so that there is coherent integrated planning for respiratory pathogens with pandemic potential.

This will maximize coherence, ensure national funding, and facilitate countries to meet their core capacity obligations as outlined in the IHR (2005) (12). Given that the range and scope of health and cross-sectoral plans at country level depend on the context, the overall aim should be to have policy and operational clarity for respiratory pathogen pandemic preparedness within:

- a) national priorities to address preparedness and response gaps,
- b) resources required to accelerate implementation and maintain relevant IHR (2005) core capacities, and
- c) response actions during emergencies including roles and responsibilities of different stakeholders.

For low- and middle-income countries, the newly established Pandemic Fund hosted by the World Bank offers additional avenues for resourcing, where financing will be linked to frameworks such as the IHR (2005) for pandemic prevention, preparedness, and response (17).



For WHO guidance to facilitate coherence see:

the National Health Planning Toolkit (18), Guidance on Preparing for National Response to Health Emergencies and Disaster (19), the Health Sector Multi Hazard Response Framework (20), and Health Systems for Health Security (21).

“ Respiratory pathogen pandemic preparedness planning should be reflected in broader strategies and plans, and build on the foundation of routine systems.”



3.4 Challenges posed by respiratory pathogens

3.4.1 Respiratory pathogens

A range of bacterial, fungal and viral pathogens target the human respiratory tract and result in a broad spectrum of clinical manifestations including life-threatening illness. The clinical presentation of respiratory pathogens is often non-specific, leading to the potential for misdiagnosis.

If early cases of a newly emerged or re-emerged respiratory pathogen are not identified, the pathogen can spread quickly. This highlights the critical value of alert clinicians, strong laboratory networks and various surveillance systems including at the human-animal interface to consistently monitor and detect emerging threats to trigger response actions (22).

Respiratory viruses are of particular concern as they typically have short incubation periods and a

tendency for symptomatic, asymptomatic, or pre-symptomatic spread, which can lead to individuals spreading the virus rapidly and without knowledge. Respiratory virus groups are also prone to high rates of virus evolution, which can impact disease severity and the development of effective medical countermeasures.

While for some respiratory pathogens – such as a novel influenza virus – there is the potential for vaccines to be developed within months of onset, for others vaccines or therapeutics may not become available for an extended period of time. Even when vaccines and therapeutics become available, high mutation rates observed among some viruses can reduce the effectiveness of medical countermeasures. Table 2 shows virus groups with characteristics most consistent with respiratory pandemic pathogens (22).

Table 2. Examples of known virus groups with epidemic and pandemic potential

Virus Family	Known Pathogens	Relevance
Adenovirus	Grouped A-F, 47 types known to infect humans	Respiratory and conjunctival disease and can cause pneumonia. No therapeutics; vaccines are under development.
Coronavirus	SARS-CoV-1, SARS-CoV-2, MERS-CoV	<p>Have caused pandemic COVID-19 (SARS-CoV-2) and large epidemics SARS (SARS-CoV-1) and Middle East Respiratory Syndrome Coronavirus (MERS-CoV).</p> <p>SARS-CoV-2 is capable of asymptomatic and pre-symptomatic transmission, particularly in closed settings and/or settings with poor ventilation; high rate of virus evolution. Vaccines and therapeutics available.</p> <p>MERS-CoV is a zoonotic virus with repeated introduction into human populations; limited human-to-human spread observed including nosocomial transmission; high fatality rate. No vaccines or therapeutics are currently available.</p>
Enterovirus	EV-D68, EV-A71	Range of severity of illness. In addition to respiratory secretions, EV-A71 is also found in stool and in skin blisters of symptomatic cases. No vaccines or therapeutics are currently available.
Henipavirus	Nipah	Zoonotic origin with limited human-to-human spread, but very high mortality. Virus also known to transmit through exposure to food products that have been contaminated by infected animals, and direct contact with infected animals or their body fluids. No vaccines or therapeutics are currently available.
Orthomyxovirus	Influenza	Most common pathogen historically known to cause a pandemic, including four in the 20 th and 21 st centuries A(H1N1) in 1918, A(H2N2) in 1957, A(H3N2) in 1968 and A(H1N1)pdm09 in 2009. Contagious during incubation period; demonstrated pandemic capacity; high mutability associated with reassortments of genetic material including from influenza viruses from multiple animal species. Vaccines and therapeutics available.
Orthopoxvirus	Variola	Eradicated. Preparedness is required in case of natural re-emergence, accidental or deliberate release of the live virus, or created through synthetic biology. Highly contagious with high mortality. Vaccines available.
Paramyxovirus	Respiratory syncytial virus (RSV), human metapneumovirus	Highly contagious with a range of severity of illness. No vaccines or therapeutics are currently available. RSV vaccines are under development.
Respirovirus	Human parainfluenza viruses 1 and 3	
Rhinovirus	Human rhinovirus C	Highly contagious with a range of severity of illness. No vaccines or therapeutics are currently available.
Rubulavirus	Human parainfluenza viruses 2 and 4	

3.4.2 Modes of transmission

The modes of transmission of respiratory pathogens give them epidemic- and pandemic-potential. Understanding the modes of transmission and quantifying the risk of transmission associated with a respiratory pathogen is necessary to inform risk reduction measures, such as increasing indoor ventilation and controlling the occupancy in residential, public and health care settings, as well as to be able to communicate the risk, assess benefit of interventions and enable informed decisions.

The mechanisms of infection transmission are complex, with the risk of disease determined by numerous factors that have considerable and uncertain variability, with variables including the characteristics of the pathogen concerned, the infectiousness of the host, the media in which it is passed from the source to new hosts and the immune response of the exposed host (23-25). Transmission through the air complicates this further, by adding other influencing factors (30) such as the dispersion and distribution of infectious respiratory particles (IRPs) on a continuum of sizes, and the effect of temperature, relative humidity and ultraviolet radiation on the survival of the pathogen (22).

At the time of writing, the issue of respiratory transmission is under review by a WHO-convened global technical consultation group. Pending the conclusions of the expert group regarding consensus terminology relating to modes of transmission, the current proposal is to recognize that respiratory pathogens can spread through three major modes of transmission:

1. Inhalation: The process whereby smaller aerosolized IRPs (generally $\leq 100 \mu\text{m}$ in size) are inhaled and enter the respiratory

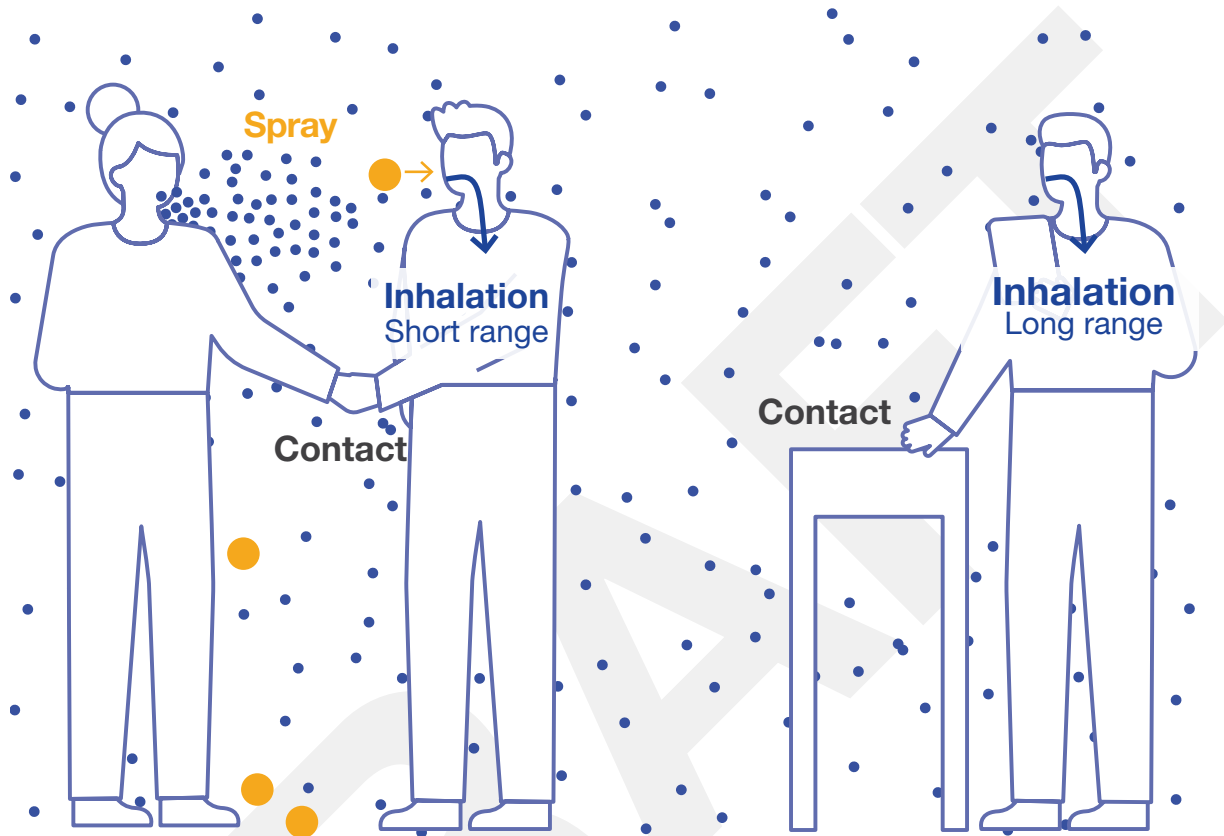
tract of a susceptible person, move through the upper and then lower parts of the respiratory tract, and can be deposited on the tissue at any point along the tract, potentially even reaching the distal alveolar region. This mode of transmission can occur when IRPs have travelled either a short or a long distance (range) after emission from an infected person and the sum of both short- and long-range contributions defines the inhalation mode.

2. Spray: The process whereby larger IRPs (generally $>100 \mu\text{m}$ in size) are directly deposited onto the mucous membranes of the upper respiratory tract of a susceptible person, having followed a projectile motion after emission from the infected person. This mode of transmission only occurs at short range, or what can be described as at a “conversational distance”.

3. Contact: The process whereby IRPs, of any size, either settle on a surface at any distance from the source following emission, or are transferred directly from (usually) the hands of an infected person (by the infected person touching their own eyes, nose or mouth); and then transferred to the mucosal membrane of a susceptible person when that person either touches the contaminated surface or the hand of the infected person followed by touching their own eyes, nose or mouth. The former (that is, transmission via touching contaminated surface) is often referred to as indirect contact transmission and the latter (that is, transmission via touching the hand of infected person) as direct contact transmission.

Transmission through IRPs is illustrated in Fig. 3.

Fig. 3: Transmission through infectious respiratory particles, adapted from (23)



Key:

- Small infectious respiratory particles
- Larger infectious respiratory particles

3.4.3 Vulnerable groups

Which groups are particularly vulnerable to the risk of exposure or effects of the disease during a pandemic depend on the pathogen, the immunity of the host and context. Box 3 presents examples

of potentially vulnerable groups during a respiratory pandemic (15). The range of potentially at-risk populations makes planning more complex, yet taking such groups into account is critical to maximize and ensure a robust response.

Box 3. Groups that may be particularly vulnerable during a respiratory pathogen pandemic

1. People with a weak immune system:

- Children (especially young children)
- Older persons
- People with immunosuppression, including HIV
- Pregnant women

2. People with underlying medical conditions

- E.g. cardiovascular diseases for COVID-19 and Influenza

3. People living/working in crowded, confined places

- People living and working in institutions such as long-term care facilities, prisons, nursing, retirement or residential homes for older people, or children's homes
- People experiencing homelessness or inadequate/overcrowded housing conditions
- Refugees, migrants, internally displaced persons

4. Vulnerable groups needing special support during crisis

- People with disabilities
- People living in informal settlements or slums

- People without access to health services or who cannot afford health services
- Socially or geographically marginalized and isolated groups
- People with language limitations or other barriers to information People with mental health conditions and/or in need of psychosocial support
- Indigenous communities

5. People at higher risk of becoming infected due to greater exposure to sick people

- All categories of health workers
- Home care givers
- Women and girls, who often take caregiving roles which expose them further to disease

6. Groups essential to economies and social cohesiveness during crisis

- People who are essential for business continuity to deliver essential products or services
- People dependent on the informal economy

3.4.4 Transmission dynamics and epidemiological parameters

Respiratory pathogens have the potential to spread easily and rapidly between people, which means that they can spread quickly – in particular in poorly ventilated or crowded indoor spaces, and at mass gatherings, and so can lead to superspreading events. As various population groups may be vulnerable to severe outcomes, this can result in high morbidity and mortality and have the potential to overwhelm health care systems, mortuary services and disrupting societies at large (22). Therefore, upon detecting a new respiratory pathogen, it is critical to investigate its transmission dynamics, clinical presentation and impact on the health care system to inform response actions. Table 3 provides a non-exhaustive list of questions and parameters that can facilitate decision making.

Epidemiological investigations and specialized studies will be required to gather the information that can be used to inform surveillance and public health response actions, including infection prevention public health and social

measures (PHSM). The information can be used to decide on:

- i) case definitions, including for contacts,
- ii) the length of case isolation and contact quarantine,
- iii) the need for transmission-based precautions, and
- iv) forecasts for workforce and medical supply requirements.

The data can also help forecast disease trends, evaluate the effectiveness of control measures and explore different scenarios for more robust pandemic risk management. Importantly, the transmission dynamics and epidemiological parameters need to be assessed repeatedly as the situation evolves. This will ensure that the latest estimates inform public health decisions. A pandemic event affects all countries; therefore, in addition to national data collection, it is important to ensure a certain level of international standardization of data so that it can be compared across regions and lead to a global assessment of the situation.



See Chapter 8 for more on research preparedness, including in existing regional and global initiatives focusing on operational research.

Table 3. Examples of questions to ask about a new respiratory pathogen and the epidemiological parameters and considerations that need to be assessed to inform response actions

Question	Epidemiological parameters and considerations
How does it transmit?	Modes of transmission <ul style="list-style-type: none"> • Is there a mode of transmission that can surely be excluded? • What's the pathogen entry mechanism? • What's the surface receptor on the target cell membrane? • How does the pathogen replicate?
When does it transmit?	Latency period, duration of pathogen shedding, incubation period <ul style="list-style-type: none"> • Is there presymptomatic, asymptomatic or symptomatic transmission?
How transmissible is it?	Effective reproduction number (R), incubation period, serial interval, secondary attack rates, underlying population immunity <ul style="list-style-type: none"> • How does this vary across different contexts and settings? • What is the duration of immunity post-infection and post-vaccination?
How quickly does it evolve?	Genomic and phenotypic characteristics <ul style="list-style-type: none"> • What are the molecular markers for changed pathogenicity or transmissibility? • Is there geographic variation in the molecular epidemiology?
What disease does it cause?	Range and frequency of clinical symptoms and syndromes, clinical attack rates, duration of symptoms <ul style="list-style-type: none"> • Does this differ across population sub-groups?
Who is at risk of severe disease?	Range and frequency of underlying medical conditions, population demographic characteristics, infection fatality ratio, proportion of cases (a) hospitalized (b) admitted to intensive care units (ICU) (c) on mechanical ventilation, (d) die <ul style="list-style-type: none"> • What secondary infections are observed among cases?
What is the burden on health care facilities?	Median number of days from symptom onset to hospitalization Median number of hospitalization days among those not admitted to ICU Median number of days of hospitalization among those admitted to ICU Percentage of patients admitted to ICU among those hospitalized Percentage of patients on mechanical ventilation among those hospitalized (includes both non-ICU and ICU admissions) Percentage of patients who die among those hospitalized (includes both non-ICU & ICU admissions) Median number of days on mechanical ventilation Median number of days from symptom onset to death (for fatal cases)

3.4.5 Disease severity and impact of the pandemic

Respiratory pathogens affect health systems, disrupt essential services, and negatively impact societies and economies. The impact of pandemics depends on disease severity as well as social, economic and political factors. Respiratory pathogen pandemics have the potential to be mild, moderate, or severe. Initially, it will be difficult to have a full understanding of the disease severity as the first cases are typically identified through hospitalizations and deaths.

Disease severity reflects three dimensions:

1. The transmissibility of the pathogen

Transmissibility is affected by several factors: the ability of the pathogen to spread from person to person, the dynamics of the spread including modes of transmission, and the susceptibility of the exposed population. Transmissibility is influenced by social and climatic factors.

2. The clinical seriousness of those infected

Clinical seriousness reflects the clinical spectrum of disease and the frequency of clinical symptoms, complications of illness and outcomes following infection.

3. How the health system is coping

Impact on the health system reflects the level of health care use (hospitalization and intensive-care unit admissions), the availability of health workforce and excess mortality resulting from the pandemic.

Conducting disease severity assessment throughout the course of the pandemic can help calibrate the scope and scale of the response needed. As noted in both recent respiratory pathogen pandemics, understanding disease severity is a challenge. Multiple well-coordinated systems are often needed to reliably provide data during inter-pandemic periods to establish baselines and these systems can be disrupted at the time of an emergency. This highlights the need to strengthen the resilience of systems so that they can provide data to support severity assessments to inform scale up or scale down response measures. Building system and decision-making agility are critical to anticipate and navigate challenges.

Social, economic and political factors also affect the trajectory and impact of respiratory pathogen pandemics. As observed from recent pandemics, factors that bear a negative effect include poverty, crowding, work insecurity, racial/ethnic disparities and discrimination, gender-based violence, low levels of education, poor nutrition, limited access to quality care, high prevalence of comorbidities, an infodemic, concurrent crises including conflict, armed violence and population movement. Community resilience, trust in government institutions, the presence of social and economic safety nets, agility in adjusting and communicating response measures can help to mitigate negative effects.

3.5 Technical implications for pandemic planning

The following considerations assist pandemic planners to navigate the challenges described above.

- 1. As the characteristics of the next pandemic pathogen are not known, a precautionary approach to infection prevention early in the event will save lives.** Be ready to apply stringent PHSM, but for a limited time period in order to minimize associated unintended health, livelihood and other socio-economic

consequences. This will give time to learn about the disease (including transmission dynamics, disease severity and impact on the health care system) and to trigger the development and roll-out of medical countermeasures such as vaccines and therapeutics. As knowledge is gained, conduct iterative risk assessments to drive evidence-informed decisions and better-tailored infection prevention and other response actions.

2. **Respiratory pathogens can spread rapidly in the community resulting in overwhelming demand for health services.** The speed of spread depends on the pathogen. However, densely populated areas such as urban settings can experience thousands of cases per week. Be ready to diagnose (including use of point of care tests) and manage mild and moderate cases in the community and through home-based care. This will allow health care facilities to focus resources on those with severe illness and to maintain other essential health services.
3. **Interrupting transmission chains of a respiratory pathogen that is spreading in the community is challenging.** A suite of measures will likely be needed to cut transmission chains including extensive testing, case isolation, contact tracing and quarantining of exposed individuals. Apply risk-based approaches to review and adjust the use of these measures to local circumstances and disease epidemiology, population immunity, health system capacities including the availability of other measures such as vaccines and therapeutics, and risk tolerance over time.
4. **Combinations of PHSM can reduce transmission and spread of respiratory pathogens and minimize public health impact.** PHSM includes personal protective measures (such as physical distancing, avoiding crowded settings, hand hygiene, respiratory etiquette, mask-wearing); environmental measures (such as cleaning, disinfection, indoor ventilation); surveillance and response measures (such as testing, genetic sequencing, contact tracing, isolation, and quarantine); physical distancing measures (such as regulating the number and flow of people attending gatherings, maintaining distance in public places, schools or workplaces, domestic movement restrictions); and international travel-related measures. Engage communities to own and participate in the measures. Use information collected through social listening systems to identify bottlenecks and use two-way communication to discuss community actions and solutions including through community networks and influencers.
5. **Respiratory pathogens, especially viruses, can have high mutation rates producing variants that may (a) circumvent natural or vaccine-induced immunity, or (b) reduce the effectiveness of countermeasures including therapeutics and diagnostics.** Encourage and facilitate HCWs to detect and report unusual cases/clusters or other signals indicating unusual disease patterns. Participate in global genomic surveillance and molecular epidemiology risk assessments to rapidly detect emerging variants of concern, and to trigger relevant measures to contain the variant or update countermeasures.
6. **Respiratory pathogen pandemics are protracted events likely to have multiple waves of transmission.** Define and ensure the continuity of essential health and other sector services throughout the pandemic. Forecast essential commodity supply requirements, consider the need for national medical stockpiles or local manufacturing of products such as masks, and prepare supply chain control and management systems including quality assurance, stockpiling, storage, security, transportation and distribution arrangements for medical and other essential supplies.
7. **Community resilience is critical for respiratory pathogen pandemic preparedness and response.** Even before a pandemic, empower and engage with communities to manage their own exposure and response to respiratory pathogens. Message about: respiratory pathogen disease trends, personal protective and physical distancing measures, modes of disease transmission, signs and symptoms, when to seek health care, and access to support and advice including mental health services.
8. **High-quality operational research about the modes of transmission of different respiratory pathogens is needed to drive infection prevention, preparedness and response actions.** Promote research that brings medical professionals, evolutionary biologists, occupational hygienists, engineering, aerosol scientists, behavioral and social scientists and other stakeholders

together to understand the relative importance of different transmission routes of respiratory pathogens; the dose required for transmission to occur; the settings and risk factors for superspreading events; the minimum ventilation rate needed to mitigate

the risk; and the extent of asymptomatic and pre-symptomatic transmission as well as the related, culturally and socially acceptable solutions to reduce transmission. See Box 4 for a spotlight on modes of transmission risk assessment.

Box 4. Modes of transmission risk assessment as part of respiratory pathogen pandemic prevention, preparedness, response and resilience

The COVID-19 pandemic has shed light on the important role indoor ventilation has in infectious disease transmission. WHO, in collaboration with CERN (the European Organization for Nuclear Research), has developed a model to quantify the risk of SARS-CoV-2 inhalation transmission in residential, public buildings and health care settings. Building managers and other stakeholders can now assess the risk to drive both acute and long-term risk reduction measures including engineering controls (for example, mechanical or natural ventilation, passive and active filtration, air cleaning and controlled indoor airflow patterns) and non-engineering controls (for example, limiting occupancy, exposure time, screening and masking).

Although a wide range of variables are used in the model to arrive at a risk profile, only six of these are specific to the pathogen. This presents a key opportunity in the context of

future pandemic prevention, preparedness, response and resilience:

- a) For new emerging respiratory pathogens, promote and support studies to rapidly enumerate the pathogen-specific variables so that the model can be tailored and quickly applied as part of pandemic preparedness and response.
- b) For respiratory pathogens with known pandemic and epidemic potential, gather relevant data for the pathogen-specific variables so that the model can be tailored and applied to better control disease transmission.

This work can also inform national and international initiatives aimed at improving indoor air quality. It can drive a new era of pandemic-resilient buildings, environmental sustainability with proactive disease control, and rational use of indoor ventilation, filtration and other scalable interventions.

The What

Chapter 4: Organizing framework for respiratory pathogen pandemic planning →

Chapter 5: System components for respiratory pathogen pandemic preparedness →

Annex 2 →

Examples of critical interdependencies between health and other sectors for respiratory pathogen pandemic preparedness

Annex 3 →

Case studies and technical resources to support implementation of respiratory pathogen pandemic preparedness planning

Annex 4 →

Data commonly available by local administrative offices that can support respiratory pathogen pandemic preparedness

4. Organizing framework for respiratory pathogen pandemic planning

This chapter provides an organizing framework for pandemic planning, including operational stages for each pandemic preparedness and response period. An organizing framework helps to provide clarity as to what needs to be done when, so that attention is given to the systems and capacities that need to be strengthened for operations before, during and after a pandemic.

4.1 Foundation for pandemic preparedness and response

Respiratory pathogen pandemic preparedness and response needs to be underpinned by a foundation of resilient communities, multisectoral systems and core capacities for emergencies (Fig. 4). In this context, resilience refers to the ability of

communities, systems and capacities to adapt to and recover from a pandemic. These need to be in an ongoing state of readiness for rapid and appropriate transition between operational stages to be effective.

4.2 Pandemic surveillance and risk assessments

Surveillance and risk assessments inform pandemic preparedness and response operations at the country, regional and global levels. Surveillance generates critical evidence to detect a respiratory pathogen with pandemic potential; assess and monitor its epidemiology, disease severity and broader societal impact; and inform the development and monitor the effectiveness of different interventions. Surveillance data and other science-based evidence on the pathogen, exposure and context needs to be accessible, timely and relevant to assess risk and inform policy-making and operations. Recognizing that the actions in one country affect other countries, sharing available evidence and risk assessments and coordinating operations across countries will maximize global coherence, effectiveness and equity.

Countries are strongly encouraged to conduct regular risk assessments, based on local contexts and cognizant of global or regional assessments, to identify actions that should be taken and to adjust them over time (25, 26). Actions should reflect

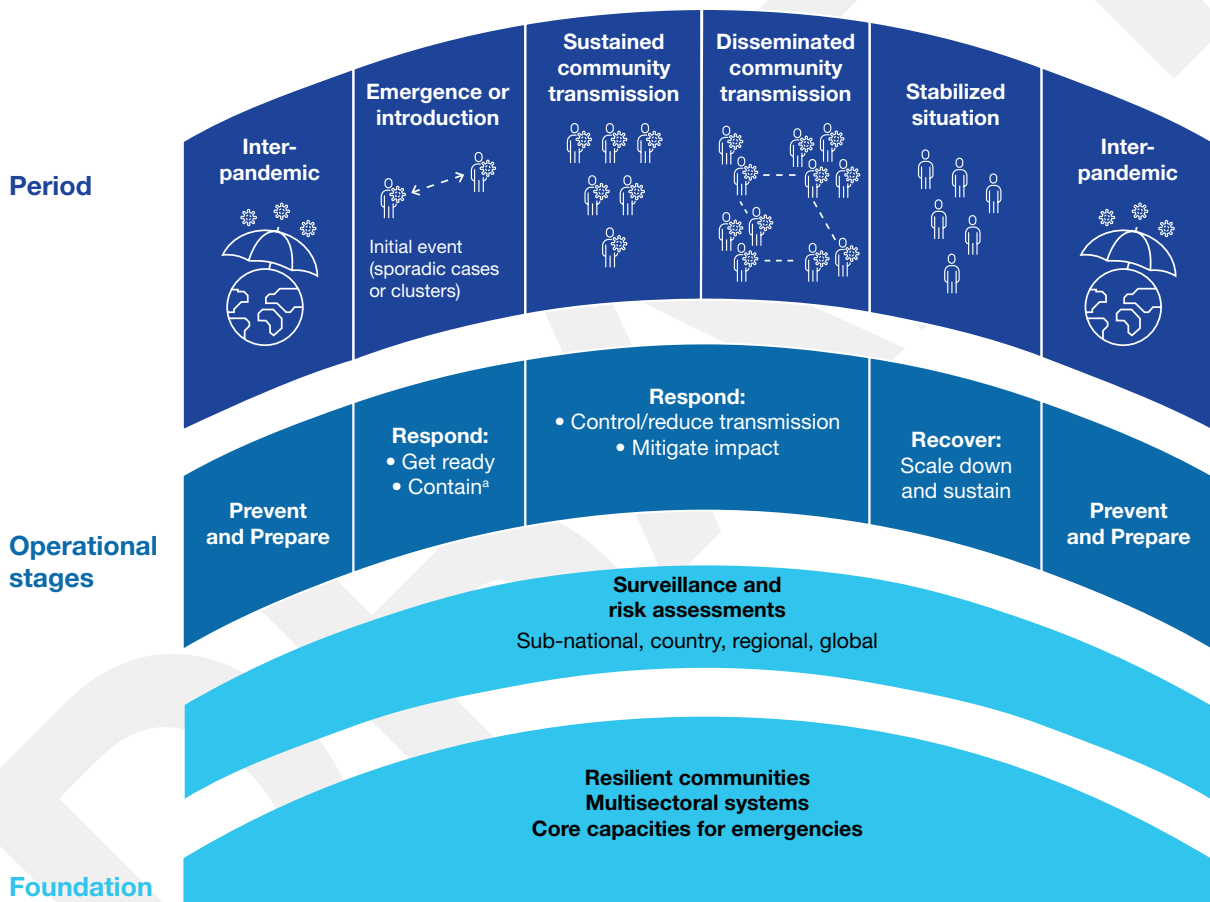
the situation at the country level as well as at the sub-national administrative level where operations are implemented. Agility needs to be built in to assess and manage risks as the situation unfolds while accounting for uncertainty. Actions taken during each operational stage should be clearly communicated with the accompanying rationale, knowns and unknowns to support the population's trust and engagement. In accordance with the IHR (2005), countries are required to share information with WHO to inform regional and global risk assessments and to facilitate actions at each level.

Regional and global risk assessments, by definition, will not represent the situation in individual countries, but should be used by countries to inform their own assessments as well as the timing and scale of operations. WHO's global operations will be informed by global risk assessments that take into consideration the evolving international situation and recognizing that different countries and regions face different risks at different times.

WHO uses risk assessments as part of the process for determining a Public Health Emergency of International Concern (PHEIC) under the IHR (2005), which leads to the communication of temporary recommendations. Based on risk assessment and appropriate to the situation, the WHO Director-General may declare the event as a

pandemic. Determination of a PHEIC or declaration of a pandemic can be used for communicating the need for collective global action, or by regulatory bodies and/or for triggering legal or contractual agreements, should they be based on a determination of a PHEIC or a pandemic declaration.

Fig. 4. Organizing framework for respiratory pathogen pandemic planning



^a Containment aims to stop transmission by reducing the effective reproduction number (R) to below one. This requires highly stringent application of measures, is resource intensive and time sensitive. Containment measures may halt, delay or reduce the spread and overall impact of the pandemic and may be considered as part of a country's national preparedness plan. Operational decisions need to be based on risk assessments that account for pathogen, exposure and contextual factors including health and socio-economic capacities and vulnerabilities.

4.3 Operational stages

Recognizing that each respiratory pathogen will have its own pattern of transmission as well as health and societal impact, response and recovery plans will need to be tailored specifically at the time of an event.

1. In the **inter-pandemic period**, the aim is to prevent emergence or introduction, and to prepare to respond to an event. Once a respiratory pathogen with pandemic potential is detected, operations shift to response mode.
2. For the **initial event** when sporadic cases or clusters of the respiratory pathogen are detected, the focus is to get ready and contain the outbreak by cutting transmission chains. Containment aims to stop transmission and halt the event by reducing the effective reproduction number (R) to below one. This necessitates case isolation, extensive testing, contact tracing, quarantining of exposed individuals, and potentially other measures such as chemoprophylaxis (if available) or limiting gatherings and population movement.

All countries, including those unaffected by the initial event should raise the alert, strengthen operational readiness in anticipation of cases, rapidly review pandemic plans to consider and take actions accounting for the latest outbreak information available, and in solidarity, support global efforts to contain the event. More should be learned about the clinical, epidemiological and microbiological characteristics of the pathogen. This includes (a) investigation of animal source, origin and potential reservoirs for the pathogen, (b) better understanding modes of transmission, transmissibility, the spectrum of clinical illness, risk factors for infection and severe outcomes, and (c) effective preventive and curative countermeasures.

3. When **sustained human to human transmission is detected in the community** and cases can no longer be linked to clearly defined transmission chains, risk assessments that account for pathogen, exposure and contextual factors including capacities and vulnerabilities,

“ Slowing transmission decreases pressure on the health system which enables people vulnerable to severe outcomes to access clinical care, and allows whole-of-society and whole-of-government systems to sustain essential services.”

need to guide operational decisions on continuing containment efforts. Continuing containment will require highly stringent and coordinated application of measures at the population level, which is both resource intensive and time sensitive. Nevertheless, slowing transmission is key, whether by reducing the effective reproduction number (R) to below one to contain or by reducing it to as close to one as possible to control community transmission and mitigate health and socioeconomic impact.

Slowing transmission provides all countries, including communities that were initially affected, with more time to enhance emergency response systems, to identify and implement effective public health and social measures, to increase the capacity to detect cases and care for patients, and to roll out countermeasures and socioeconomic interventions that save lives and safeguard livelihoods. Recognizing that community transmission levels may vary within a country, sub-national risk assessments should define the control and mitigation (or containment) actions needed at the lowest administrative level.

4. With **disseminated community transmission** in a country or across other countries, control and mitigation efforts need to continue. Continuing containment may also be considered based on risk assessments. Slowing transmission

decreases pressure on the health system which enables people vulnerable to severe outcomes to access clinical care, and allows whole-of-society and whole-of-government systems to sustain essential services.

Pandemics are protracted evolving emergencies that impact communities differently over time. Various scenarios need to be anticipated to effectively control and mitigate impact, and response actions need to be adjusted and scaled up or down as the pandemic unfolds. There may be multiple waves of transmission with differing levels of severity. The pathogen may evolve producing variants that result in a resurgence of transmission or that render existing countermeasures ineffective. Health and multisectoral systems may lose coping capacity or may be stretched if faced with concurrent emergencies. Public trust and adherence to control measures may wane due to pandemic fatigue as well as mounting socioeconomic pressures.

Therefore, the intensity of transmission, the coping capacity of health and other sector systems to provide essential services, and the overall health and socioeconomic well-being of communities should be routinely assessed to adjust the control and mitigation (or containment) actions at the country and sub-national levels. Containment measures may be applied during the course of the pandemic to control outbreaks in closed/semi-closed settings (for example aged care facilities,

hospitals, military camps, correctional facilities) or to stop transmission of newly detected variants/strains of concern. Risk-based approaches help inform both short-term response priorities and longer-term preparedness needs.

5. Response actions should continue to be applied until the **situation stabilizes** throughout the country and risk assessments indicate that response systems can cope under routine non-emergency arrangements. Operationally, this leads to the country scaling down the response while sustaining longer-term disease control and impact mitigation measures. The scenarios ending the acute response actions vary and may include situations where there is eradication or elimination of the pathogen, reduced levels of transmission, endemicity or periodic epidemics. Alternate scenarios are also plausible such as the continued evolution of the pathogen leading to variants with greater severity and societal impact over time. Therefore, scaling down the response must be coupled with continued vigilance. Additionally, depending on the pandemic context locally and globally, some response actions may need to continue in the longer term.

After the situation stabilizes and emergency operations have scaled down, there is a **return to the inter-pandemic period**. Building on lessons learned, operations again focus on preventing and preparing for future respiratory pathogen threats.

5. System components for respiratory pathogen pandemic preparedness

This chapter describes the core capacities needed to prepare for a respiratory pathogen pandemic. The content is organized according to the five components outlined in the health emergency preparedness, response and resilience (HEPR) architecture (1) (Fig. 5).

The five components rely on a foundation of resilient communities, multisectoral systems and core capacities for emergencies. The five components describe the ability to prevent, prepare, and respond effectively to health emergencies. Importantly, the five components are interconnected, and some activities may be relevant to more than one component.

Figure 5 maps the five components to the IHR (2005) core capacities (27) relevant for respiratory pathogen pandemic preparedness. Even though the IHR (2005) core capacities may apply to more

than one component, they are mapped once where feasible to streamline and simplify planning.

For each of the five components, the sections below outline the relevant IHR (2005) core capacities and the recommended actions to strengthen respiratory pathogen pandemic preparedness (28). Links to technical resources and case studies to support the implementation of each component are presented in Annex 3. Country, regional and global case studies of good practices cover both pathogen-agnostic and pathogen-specific initiatives.

“ The five components rely on a foundation of resilient communities, multisectoral systems and core capacities for emergencies.”



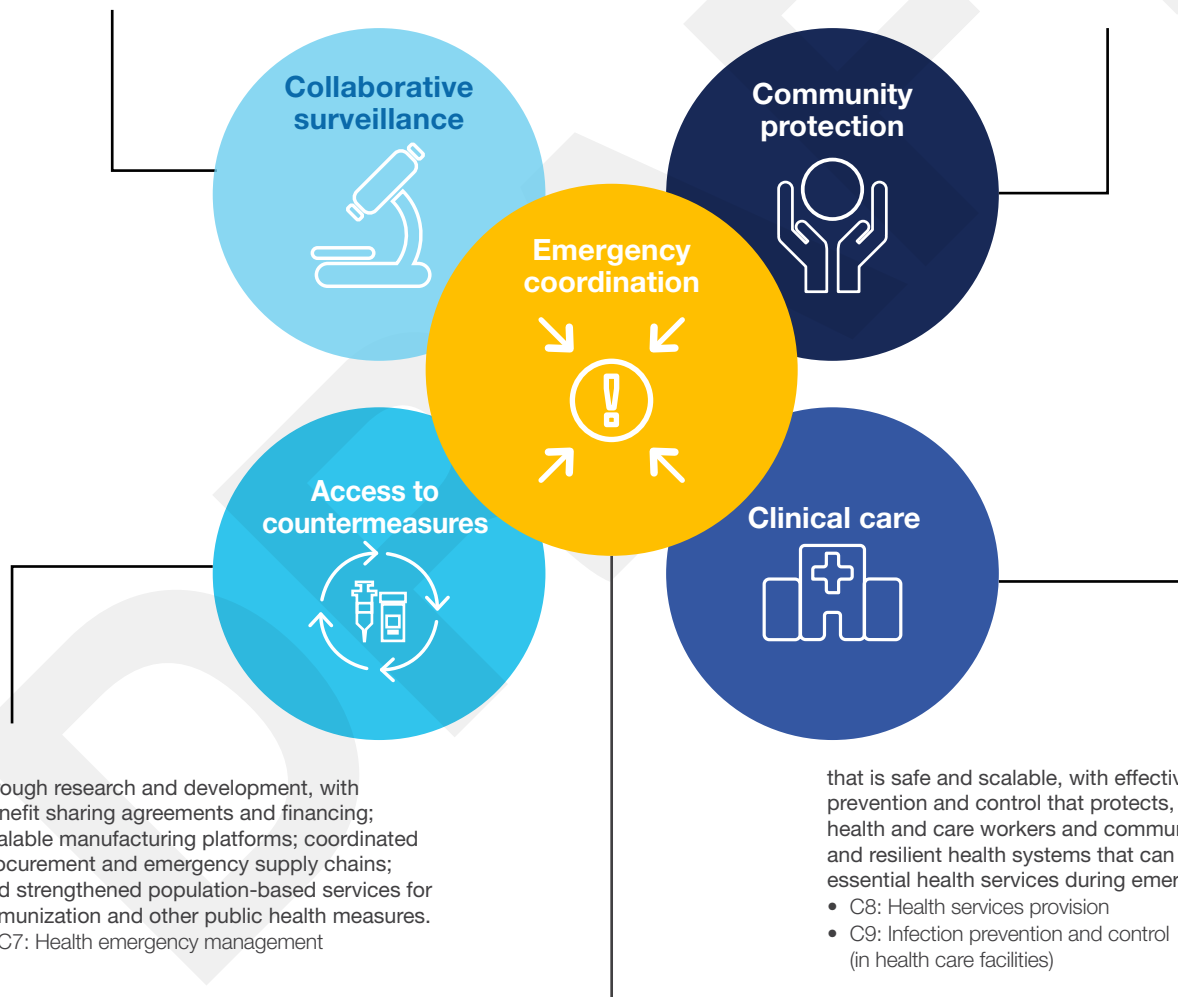
Fig. 5 Five components for health emergency preparedness, response and resilience mapped to International Health Regulations (2005) core capacities as relevant for respiratory pathogen pandemic preparedness

through strengthened multisectoral disease, threat and vulnerability surveillance; increased laboratory capacity for pathogen and genomic surveillance; and collaborative approaches for risk assessment, event detection and response monitoring.

- C4: Laboratory
- C5: Surveillance
- C12: One Health / Zoonotic diseases

through two-way information sharing; community engagement to create public health and social measures; a multisectoral approach to social welfare and livelihood protection, and mechanisms to ensure the protection of individuals.

- C9: Infection prevention and control (in community settings)
 - Public health and social measures
 - Vaccination and chemoprophylaxis
- C10: Risk communication and community engagement
- C11: Points of entry and border health



through research and development, with benefit sharing agreements and financing; scalable manufacturing platforms; coordinated procurement and emergency supply chains; and strengthened population-based services for immunization and other public health measures.

- C7: Health emergency management

that is safe and scalable, with effective infection prevention and control that protects, patients, health and care workers and communities; and resilient health systems that can maintain essential health services during emergencies.

- C8: Health services provision
- C9: Infection prevention and control (in health care facilities)

with a trained workforce that is scalable and ready to rapidly deploy; coherent national action plans; operational readiness through risk assessment and prioritization of critical functions; and application of a standardized emergency response framework.

- C1: Policy, legal and normative instruments
- C2: Coordination
- C3: Financing
- C6: Human resources

5.1 Emergency coordination

Preparedness for respiratory pathogen pandemics is grounded in robust planning, dedicated coordination, sustainable financing and a strong health workforce. Countries should consider how to include the broad range of stakeholders in respiratory pathogen preparedness planning, from the highest levels of government to community stakeholders. Countries are advised to consider how policy, legal and normative instruments, coordination and financing can be strengthened for respiratory pathogen preparedness, which can be guided by tools to strengthen these IHR (2005) core capacities.



IHR (2005) core capacities relevant for respiratory pathogen pandemic preparedness

Policy, legal and normative instruments: Countries should have adequate legal frameworks and policies to cover respiratory pathogen pandemic preparedness and response, addressing both known and unknown threats. Legislation may be used to facilitate coordination among the different entities involved in respiratory pathogen preparedness and response activities, and mandate the responsible agencies legally required to lead and/or coordinate a response to a respiratory pathogen pandemic. It should also include aspects such as the legal basis for public health and social measures, liability for adverse events attributed to medical countermeasures, and regulatory pathways for importation and licensing of medical countermeasures, including vaccines, diagnostics, therapeutics, medical devices, personal protective equipment (PPE) and other interventions.



Recommended actions to strengthen preparedness for policy, legal and normative instruments

- Consider a review of policy, legal and normative instruments to ensure their suitability for effective respiratory pathogen pandemic preparedness and response. The policies, legal, and normative instruments should include provisions to operationalize equity and other guiding principles, and should take into consideration the different sectors and different levels involved in pandemic preparedness and response. These include policies for data sharing and decision making. Government may need legal mechanisms in place to rapidly import, license, and deploy A) medical countermeasures such as vaccines and therapeutics, and to implement B) public health and social measures, such as quarantine, school closures and contact tracing. Contact tracing may be most useful during the early stages of an outbreak when there are traceable transmission chains and during periods where containment is deemed feasible. Raise awareness about these instruments widely to facilitate timely and effective implementation of measures at the time of an emergency. During a pandemic, plan to monitor implementation of such instruments and update them as required.
- Identify responsible actors for different aspects of the response including the role of political leadership. Appoint dedicated focal points (national pandemic coordinators) who are accountable, and who have a mandate to drive whole-of government and multi-level coordination for pandemic preparedness and response. Clarify roles and sharing of responsibilities and resources among different levels of governments at national and sub-national levels. The public health leadership should be empowered by heads of state to act and lead health-related incident management structures during the pandemic period.
- Engage with other countries and international entities on preparedness planning. This includes cross-sharing experiences and identifying opportunities to strengthen regional or global cooperation and clarity in expectations at the political, governance and technical levels.

Coordination: Knowing who will do what and when is critical. There should be clarity on the entity/entities responsible for plan development, approval, implementation and review. Roles and responsibilities of all involved need to be clearly articulated, and a key priority is to engage political leadership at the highest level. A whole-of-society and whole-of-government approach is built on a foundation of agile leadership, partnership, collaboration, and coordination. Fundamental to this multisectoral approach is both the recognition that risks to human health can emerge from various sources, such as zoonotic spillover, laboratory accidents and deliberate events, and that the impact of a respiratory pathogen pandemic spreads beyond the health sector to all facets of society, the economy, and governance. Therefore, the capacity to prevent, detect, report and respond to events or public health risks should exist within all relevant sectors. In addition to multisectoral planning, data and information need to be shared to analyse risks and coping capacities comprehensively. Emergency response architectures should be developed to articulate chains of command, mapping of existing resources and capacities, reporting lines, pathways to incorporate findings from technical risk assessments and emerging scientific evidence, and management structures for both operational and strategic response. Technical advisory committees may be needed to support government decision making and action. Advanced planning will help minimize disruptions to essential services during a pandemic, such as transport, sanitation services, education, food supply chains, and other critical infrastructure needs.



Recommended actions to strengthen preparedness for coordination

- Conduct a landscape analysis of capabilities and capacities, as well as mapping of key national/sub-national actors, partners, and stakeholders to identify who should be involved in preparedness planning process. Prepare for a range of potential scenarios and their impacts on different population groups by involving stakeholders from diverse sectors (Box 2).
- Consider maintaining a database of multidisciplinary professionals and surge human resources to be activated in emergency situations. Include national bodies, sub-national stakeholders (e.g., community and faith-based leaders), donors, multilateral agencies, and other partners in their preparedness planning process, and ensure that all actors are aware of their roles during a pandemic. The terms of reference for technical advisory groups should be defined and membership kept current according to context and preparedness and response needs.
- Use preparedness checklists, joint risk assessments, and simulation exercises to engage all relevant stakeholders in the process of respiratory pandemic preparedness planning. Reviews of national capacities and learning from exercises such as Joint External Evaluations, intra-action reviews, and after-action reviews can build the relationship between sectors and provide insight on additional stakeholders who should be included in preparedness efforts.
- Encourage non-health sectors to develop sector specific contingency plans to clarify their roles and responsibilities during a respiratory pathogen pandemic. Sector specific contingency plans should align with the national respiratory pandemic preparedness plan.

Financing: Adequate funding for the implementation of respiratory pathogen pandemic preparedness and response activities is necessary. For preparedness, this includes both a multi-year budget and sustainable financing. The budget is an itemized financial plan over a specified period, whereas financing refers to financial resources which a government or organization provides for a particular purpose. In other words, budget is what is planned for, and financing is what is provided. This can be considered within a broader national plan, such as a NAPHS. Critically, it should allow for action in various sectors and include efforts to prevent the emergence of respiratory pathogens such as at the human-animal interface. For response, access to emergency funds needs to be secured and available for use quickly. Countries should have mechanisms in place to rapidly access funds at the beginning of the emergency including operational procedures for their use at local to national level.



Recommended actions to strengthen preparedness for financing

- Invest in preparedness with sustainable financing resources to prevent and mitigate the next crisis. Establish a national contingency fund to be used for small and quick spending on the emergency response. This should not substitute having dedicated funding available for preparedness efforts which can ideally be rapidly repurposed for response during an event. Preparedness funding should be a multiyear commitment that is incorporated into the medium-term expenditure framework. A longer-term horizon of approximately 10 years is easier to build into national financial planning and can have more of a positive impact than short one-to-two year investments.
- Ensure mechanisms are in place for rapid dispersion of funds during health emergencies, including in a pandemic context. This requires staff to be familiar with the domestic public financial management, processes, and emergency structures. Clarity and tests of these procedures will enable more flexible and timely use of funds during emergency events while avoiding extra budgetary processes or risk of misuse.

Human Resources: A multisectoral and scalable workforce needs to be available and trained to enable early detection, prevention, preparedness and response to potential events of international concern at all levels of health systems, as required by the IHR (2005). The availability and accessibility of a trained and resourced health workforce is critical to improve community health, build trust in the health system, and to strengthen health service continuity. This health workforce should have the capacity to deliver on the essential public health functions, including a strong focus on emergency preparedness and response, and be able to support surge requirements through redeployment, optimization of roles, and temporary relaxation of regulations and scale-up (29). The health workforce may be particularly vulnerable during the pandemic (both directly as a result of infection and death, and indirectly through unmanageable workload, mental health issues, deteriorating working conditions, industrial action and strikes). Countries should have an adequate health workforce to start with and put in place mechanisms and procedures to rapidly activate response mechanisms that can ensure its protection and safeguarding, as well as redeployment and mobilization of surge capacity, during a pandemic.



Recommended actions to strengthen preparedness for human resources

- Invest in HCW training and professional development programmes to increase the quantity, availability and capability of the health workforce to respond to an emergency when needed. This includes the clinical, allied health and public health workforce which is needed to rapidly respond once a respiratory pathogen with pandemic potential is detected. Capacity building programmes should include recruitment, pre-service education, supervision and continuous learning that increase the pool of competent HCWs who could be deployed for emergencies and ensure continuity of service to meet increased health needs during a respiratory pathogen pandemic. Additional workers could be recruited through temporary hiring, mobilization of retirees and private sector workforces, redeployment, optimization of roles, or temporary relaxation of certain workforce certification and regulatory requirements. International networks such as for Emergency Medical Teams (EMT) and the Global Alert and Outbreak Response Network (GOARN) are key for supporting surge needs.
- Provide adequate working conditions, including manageable workloads, occupational health and safety, psychosocial, mental health and other supportive services and protection for HCWs, including appropriate infection prevention and control practices and adequate PPE, to enable their active engagement and well-being during pandemic events.
- Assess, revise or put in place regulatory measures to support HCWs to deliver services at the highest level based on their competency, training and certification. This includes ensuring mechanisms for timely payment of salaries, overtime, sick leave, and incentives or hazard pay, including for temporary, surge and community workers.

“ Preparedness for respiratory pathogen pandemics is grounded in robust planning, dedicated coordination, sustainable financing and a strong health workforce.”

5.2 Collaborative surveillance

Local to global systems and capacities for collaborative surveillance, laboratory services and risk assessment rely on multiple sources of information including multisector data that can provide contextual information. Additionally, One Health approaches to facilitate the prevention, preparation, detection and response to emerging respiratory pathogens need to be incorporated. For an emerging respiratory pathogen, information provided by laboratory and surveillance systems can rapidly contribute key information for the development of effective countermeasures.



IHR (2005) core capacities relevant for respiratory pathogen pandemic preparedness

Surveillance systems not only detect and monitor pathogens, but support evidence-informed operational decision making, and transparent sharing of information routinely, before and during respiratory pandemics. The basic, primary roles for which surveillance systems are generally designed are usually event/outbreak detection or monitoring trends in transmission, however, there are many special situations in which systems will be modified or adapted to provide more detailed information on risk groups, transmission dynamics, disease burden, provide material for producing testing and treatment methods or vaccines, or to dig deeper and answer specific questions about transmission dynamics. It is impossible to address the many complex needs of respiratory pathogen surveillance with a single surveillance system. Multiple systems and associated stand-alone pandemic investigations and studies must each be fit-for-purpose to specific high priority objectives, and only together may they provide all needed information to policymakers. In essence each surveillance system or study fit together as “tiles in a mosaic” that allow one to see the full picture of respiratory pathogens and the impact of associated illnesses and interventions in a country. Effective and timely respiratory pathogen preparedness and response are thus dependent on a mosaic of surveillance systems within the health sector and beyond.



Recommended actions to strengthen preparedness for surveillance

- Articulate the priority surveillance objectives and map the sources of information and influences that affect risk assessment and decision making. Examples of core surveillance approaches are outlined in the mosaic framework (WHO, *Crafting the mosaic: A framework for resilient surveillance for respiratory viruses of pandemic potential: Draft guidance*, 2022). The mosaic framework relates high priority objectives to the systems that are most fit-for-purpose to address those objectives to ensure that the information needed to make the best decision at a given time is available in a timely manner. The mosaic framework also considers that the information needs of surveillance vary, requiring coordinated and complementary systems to meet all needs (e.g. no single system can meet all needs). These needs include (i) detection and investigation of unusual events through event based surveillance and rapid investigation teams, (ii) monitoring disease spread, severity and intensity through sentinel surveillance, other forms of notifiable disease and hospital or community-based surveillance, and (iii) monitoring impact of the disease and the countermeasures. Not all the necessary information can be obtained through ongoing surveillance, and it is necessary to add specific studies with pre-defined protocols. Contextual data are essential and come from various sectors, stakeholders and levels. See Annex 4 for examples of multi-sector data commonly available at local level.
- Review and strengthen existing surveillance systems for respiratory pathogens, especially the integration of multi-pathogen laboratory testing within sentinel Influenza-Like Illness (ILI)/Acute Respiratory Infection (ARI) and Severe

Acute Respiratory Infection (SARI) case-based surveillance systems. Additional approaches, such as targeted population surveillance, comprehensive case finding or environmental surveillance, may also be helpful during the early stages of a response to understand disease spread. Ensure that surveillance for different priority pathogens is sustained during a pandemic.

- Require training for responsible staff on how and when to conduct sampling, the types of sampling required, and how to appropriately and safely collect, package, and store samples. Ensure that there are clearly articulated objectives, proper application of case definitions, and good quality samples. Specimen collection should be consistent and standardized.
- Invest in coordinated data management by developing data structures that allow for sharing, integration and centralization of information from different subnational and national data sources, including different sectors during the inter-pandemic period. Build in technological advances that enable data linkage and analysis. An online integrated platform should be considered where resources allow, and contingency plans are needed to ensure these systems remain operational during a pandemic.
- Explore the feasibility of scaling up surveillance systems during future emergencies. Map data collection and management requirements, financial and human resource implications and the expected value-add under different scenarios.

Laboratory capacity facilitates event detection, investigation, and response. Countries should have sustainable mechanisms in place to: collect and manage specimens; ship specimens to appropriate laboratories domestically or internationally; perform reliable and timely sample testing; characterize pathogens and conduct molecular risk assessments that link microbiological data to other types of information including clinical, environmental or epidemiological; and share results with relevant international entities such as WHO, the World Organisation for Animal Health (WOAH), and the Food and Agriculture Organization of the United Nations (FAO). Public health laboratories are a cornerstone of the alert and response mechanisms before, during and after health emergencies, providing both diagnostic services and the surveillance data required to detect, confirm and monitor pandemic prone pathogens. Country participation in the Global Influenza Surveillance and Response System is key to support national objectives and coordinate in an interconnected world. As technologies evolve and access increases, laboratory systems can decentralize, have more capacities such as genomic sequencing and bioinformatics, and build in approaches that account for increasing options for self-testing at community level.



Recommended actions to strengthen preparedness for laboratory capacity

- Sustain molecular and genomic sequencing capacities established or enhanced for SARS-CoV-2 at national and sub-national levels for respiratory pathogen monitoring.
- Consider the longer-term use and integration of self-testing and point of care (POC) diagnostics data into routine surveillance of respiratory pathogens. Future deployment of POC tests should have robust oversight including end user training, data management and integration into clinical care pathways.
- Use events such as seasonal influenza epidemics or outbreaks of zoonotic respiratory infections to maintain and enhance laboratory capacity (human resources, relevant skillsets, equipment, etc).
- Conduct quality assurance of national and sub-national laboratories in the framework of a Quality Management System. An important way to do this is to participate in WHO's global mechanisms for external quality assurance, accreditation and licensing, as relevant.
- Strengthen the national public health laboratory system including networks with national and international reference laboratories. Consider the roles and responsibilities of different laboratories in terms of clinical diagnostics and public health surveillance functions, including timely data flow. Develop plans for engaging laboratories from other sectors, such as veterinary laboratories to support surge needs.

One Health / Zoonotic diseases capacity includes preparedness planning, surveillance, and joint response for respiratory pathogens in human populations and in animal populations (including wildlife, domestic species and livestock), at the animal human interface, and in environments where humans and animals co-exist. These capacities include the ability to prepare for and prevent outbreaks, identify novel pathogens, conduct risk assessments, and report health concerns at the human–animal interface. This can include diseases that may not currently be considered zoonoses, such as investigation of the epidemiology and origin of a newly identified disease in humans to identify animal origins or reservoirs.



Recommended actions to strengthen preparedness for one health/zoonotic diseases

- Include animal health, environmental, wildlife, human health, and food system experts in the respiratory pathogen preparedness planning process and apply existing operational tools (30). Articulate and practice actions expected during each operational stage (Fig. 4) such as event investigation, data sharing, joint risk assessments and outbreak containment measures. The waste water surveillance used during COVID-19 in certain urban settings seems to be a promising additional element for the monitoring of virus spread in human population.
- Consider the types of respiratory pathogens that may cause a future pandemic as well as potential scenarios for their origins, transmission patterns, and levels of severity. As no two pandemics are alike, countries are advised to think broadly about the range of possibilities and how these may impact national/sub-national preparedness efforts.
- Maximize the consistent and timely sharing of One Health data and information arising from preparedness and response systems to support rapid identification of emerging respiratory pathogens.

5.3 Community protection

Community protection involves meaningfully engaging with people to co-create interventions to prevent and control infection. Emphasis should be placed on high-risk groups and populations with underlying vulnerabilities to ensure that their needs are served. Community protection consists of proactive risk communication and infodemic management. Evidence-based public health and social measures (PHSM), as well as preventive medical countermeasures need to be applied appropriately and monitored to ensure effectiveness. Health and other sector actions need to be based on local contexts and customs, ensure that community concerns are addressed, and that livelihoods and social welfare are protected.



For respiratory pandemics, community engagement can enable success across many aspects of emergency response where trust and engagement with public health responders is critical: from surveillance and contact tracing to provision of samples for testing, to limiting transmission and spread of the virus, and to vaccinations and clinical care.

IHR (2005) core capacities relevant for respiratory pathogen pandemic preparedness

Infection prevention and control (IPC) in community settings, covering:

A) Public health and social measures are non-pharmaceutical interventions that reduce transmission and spread of the virus and the disease. For respiratory pathogens, the adequate measures contribute to lowering community transmission, hospitalization rates and deaths, which can reduce pressure on the health care system enabling it to maintain essential health services, buy time to develop and roll out medical countermeasures such as vaccines or therapeutics, and offer increased individual and community protection. PHSM should be based on findings from epidemiological investigations, informed by regular risk assessments and the operational response stage (Fig. 4), and weighed against the potential impacts these measures have on the wellbeing of societies and individuals. Considerations include—but are not limited to—impact on health systems, security, economy, mental health and psychosocial well-being, and socioeconomic disparities. PHSM are used to complement vaccines and therapeutics, including in situations when these countermeasures are not able to prevent transmission.



Recommended actions to strengthen preparedness for public health and social measures

- Systematically integrate PHSM into health emergency management plans, policies, and financing, and establish and strengthen dedicated leadership and governance for PHSM in all relevant sectors at all levels. Account for different cultural and geographical contexts, enablers, and barriers to promote effective uptake. Identify evidence-informed measures relevant for different scenarios and known pathogens in advance of an event. This includes developing a framework for surveillance potentially including disease modelling to monitor and assess the effectiveness and wider societal and economic impacts of different measures.
- Develop procedures and protocols to support the implementation and adjustment (scale up or scale down) of PHSM while considering commonalities and specificities of various respiratory pathogens. During an emergency, adjust (scale up or scale down) PHSM measures using multisource information, including risk/benefit assessments that consider the epidemiological characteristics, the health system's capacity to respond, other contextual considerations, and the overall strategic approach. Protecting vulnerable populations (Box 3) should be central in the decision to implement, maintain or lift a measure.

- Engage multisectoral stakeholders to develop mitigation measures including strengthening of social safety nets to reduce the unintended negative consequences and ensure equitable implementation of PHSM. Social protection measures include provision of cash transfers, basic income support, rent protection, support for furloughed workers, provision of housing and food, added support to health systems at different levels of care, universal health coverage and any other measures introduced and/or extended to ensure equitable social protection and access to health care.
- Invest in and implement improved indoor air quality (IAQ) to reduce the risk of disease transmission in indoor spaces while ensuring environmental sustainability – be it in health facilities, public spaces or households. Develop IAQ minimum requirements and establish through building standards and codes, educate the public regarding the importance of healthy air, incentivize system upgrades among businesses and building developers and managers, create a consistent labeling method for building IAQ, operationalize existing and emerging technologies to help monitor and enhance IAQ, and improve our understanding of climate change's impact on the indoor environment.

B) Vaccination and chemoprophylaxis: vaccination plays a key role in controlling and mitigating pandemic impact. Vaccination can reduce transmission and/or the seriousness of illness. A national vaccine delivery system needs to be in place that is 'emergency ready' – with nationwide reach, effective distribution through mass or targeted campaigns, adequate cold chain, ongoing quality control, and access to priority groups including those among marginalized populations. Vaccination planning needs to account for challenges including inadequate vaccine supplies, timelines for availability, use of multiple vaccine products with different characteristics, the size of priority group populations and their diversity. In addition to vaccination, consideration should be given to chemoprophylaxis, both pre- and post-exposure (and including both drug and antibody products), in case it is available during the pandemic and its use is aligned with public health goals. See the section below 'Access to Countermeasures' for upstream preparedness actions relevant for vaccination and therapeutics including research and development, regulatory measures, manufacturing and supply chains.



Recommended actions to strengthen preparedness for vaccination and chemoprophylaxis

- Update or develop national deployment and vaccination plans (NDVPs) to incorporate lessons learned from COVID-19 and other emergency vaccine introduction experiences. When updating NDVPs, countries are advised to consider the bottlenecks for pandemic vaccine deployment during A(H1N1)pdm09 and COVID-19 pandemics and identify actions that can be taken at the sub-national, national, regional, and global levels to streamline the process of vaccine receipt for future respiratory pathogen pandemics. These plans should be regularly tested to not only ensure their applicability but also enable maintenance of stakeholders' capacities to implement these plans.
- Assess how existing routine immunization programmes across the life course can be leveraged for pandemic vaccine deployment. Using or adapting existing systems, processes, and structures can support rapid surge capacity during the pandemic, including of the health workforce. For example, countries can use annual seasonal influenza vaccination campaigns to strengthen health workforce vaccination programmes during the inter-pandemic periods. Studies demonstrated vaccinating HCWs against seasonal influenza has benefits for both epidemic and pandemic preparedness: those vaccinated had less absenteeism during seasonal epidemics as well as increased acceptance and demand of pandemic vaccines during both the A(H1N1)pdm09 and COVID-19 pandemics (31-33).
- Develop scenario-based plans for chemoprophylaxis detailing target populations and roll out during different operational stages, including to contain a respiratory pathogen with pandemic potential, and to control transmission and mitigate impact when there is community transmission.

Risk communication and community engagement with the increased use of internet and the development of social media platform, the information eco-system in which we are living is drastically different from the time when the IHR (2005) was adopted. The way health information is produced, transmitted amplified and analysed has changed significantly. More than half of the global population and especially young generations has access to internet and this phenomenon is likely to increase. People have now access to an enormous amount of information (which increases during crisis) from many different sources, traditional or digital, including for instance online platform offering pre-print access to scientific articles. Health institutions are not anymore, the only provider of information. This new information ecosystem has generated a new “Health Threat” that accompanies epidemics and pandemics, called infodemic. Infodemic is the overabundance of information -accurate or not- which makes it difficult for individuals to adopt behaviours that will protect their health and the health of their families and communities. The infodemic can directly impact health, hamper the implementation of public health countermeasures and undermine trust and social cohesiveness.

Infodemic cannot be eliminated it can only be managed. This is why WHO and partners have developed the approach of infodemic management which encompasses Risk Communication and Community Engagement adding additional tools and approaches to manage it more efficiently in the 21st century.

Four main interventions are recommended for infodemic management:

1. Listen to concerns
2. Communicate risk & translate science
3. Promote resilience to potentially harmful elements of an infodemic (such as misinformation and disinformation)
4. Engage and empower communities

New tools and approaches for social listening have been developed using new technologies such as artificial intelligence to listen to population concerns on social media (such as the Platform EARS developed by WHO (34)). Effective risk communication needs to adapt to the digital world while maintaining approaches and principles that were effective in the former information eco-system (35). While scientific information is broadly available and accessible, not everyone is able to make sense of it. Hence the need to ensure that scientific knowledge is synthesized, shared and applied by communities, decision makers, and other stakeholders in a way that is accessible, understandable and meaningful to everyone, in order to strengthen evidence-informed policies and decisions to protect lives and promote health during public health emergencies (36). A number of technical guidance have been and are being developed with partners to facilitate infodemic management at local regional and global levels to address more effectively this rapidly evolving area including the threat posed by misinformation and disinformation that are spreading faster and further.

Community engagement involves partnering with communities to foster their engagement and ownership in the design, implementation, and evaluation of respiratory pathogen preparedness and response measures to achieve positive health impact and outcomes (37). Communities refer to groups of people that may or may not be spatially connected, but who share common interests, concerns or identities. These communities could be local, national or international, with specific or broad interests (38). This includes sector-specific stakeholder engagement, which aims to build and maintain partnerships with actors that represent communities or networks convened around a common history, values, objectives or interests, such as faith and youth. These sector-specific stakeholder groups (communities/networks) are connected at the global, regional, national and local levels. Each group brings a unique contribution to health systems and health emergency preparedness and response.



Recommended actions to strengthen preparedness for risk communication and community engagement

- Invest in risk communication capacities and systems that include two-way communication channels, use of both digital and community listening mechanisms, and technologies used by communities. WHO has issued an infodemic manager competency framework to build the workforce needed to address the infodemic in the context of epidemics and pandemics.
- Establish and invest in resources for social listening surveillance systems and capacities to identify concerns as well as rumors and misinformation. To build trust, it's important to be responsive to needs and concerns, to relay timely information, and to train leaders and HCWs in risk communications principles and encourage their application. Communication should be tailored to the community of interest, focusing on and prioritizing vulnerable groups.
- Develop and implement communication and behaviour change strategies based on infodemic insights, and test them during acute respiratory events including seasonal influenza. This includes implementing infodemic management across sectors, and having a coordinated approach with other actors, including academia, civil society, and international agencies.
- As respiratory pathogen pandemics unfold and more knowledge is gained about the disease and its impact, repeatedly and consistently communicate the evolution of science and the rationale for scientific recommendations to explain changes in messaging and advice to prevent confusion of the public.
- Establish mechanisms or platforms to involve community leaders, faith-based leaders, youth, occupational groups, and vulnerable populations (Box 3) routinely into preparedness planning at all levels to inform development and ensure communications messages are accessible and responsive to community needs and perspectives. This includes identifying personnel from different sectors who can co-create and deliver information as a trusted voice.
- Integrate health communications strategies and leverage insights from social listening data to support the collection, analysis, and use of information on how to develop effective respiratory pathogen public health interventions. Institutionalize and apply these routinely in acute respiratory events or seasonal epidemics such as for influenza.
- Convene and engage sector-specific stakeholder networks at all stages of respiratory pathogen preparedness and response to ensure information is adequately exchanged, understood and representative of communities' needs, interests and concerns. Roles and responsibilities including decision making across sectors need to be well-defined, and engagement strategies should consider the needs of vulnerable populations.
- Strengthen scientific literacy and people's understanding of evidence about respiratory pathogens and pandemics through community dialogue, integration into educational curricula, and utilizing networks, media, social media and other appropriate technology. This includes training public health, medical, IPC, biomedical engineers, urban planners and other specialists in decision-making processes and communication with non-specialist audiences.
- Invest in peer-exchange platforms such as Science Translation networks, that enable exchange of experience and learnings among academia, researchers, media, health professionals and decision makers. Build trust in these networks by having them share knowledge and engage in community dialogue on seasonal respiratory pathogen transmission dynamics and control measures so that there is awareness about respiratory disease epidemics and pandemics.

Points of entry and border health: ports, airports and ground crossings are integral parts of both the surveillance and response system for biological hazards including respiratory pathogens. These systems

should be engaged in both preparedness and response actions as they can impact the pandemic pathogen's spread and societal impacts.



Recommended actions to strengthen preparedness for points of entry and border health

- Build on plans and procedures established during COVID-19 for key risk mitigation measures such as public health advice to travelers, surveillance and case management at points of entry and onboard conveyances.
- Update risk assessment and risk management procedures for cross-border travel during future respiratory pathogen pandemics.
- Prepare contingency plans that allow for maintenance of essential travel such as humanitarian corridors, essential personnel, repatriations and cargo transport for essential supplies, in case travel restrictions are considered. Contingency plans should include a risk assessment framework for other measures that could be implemented if necessary, such as exit/entry screening for signs and symptoms, targeted testing and quarantine of travelers, while ensuring that their application respects dignity, human rights and fundamental freedoms.
- If vaccination certification is considered, introduce digital documentation in line with WHO recommendations and guidance (39). Policies related to border entry/exit should consider the accessibility of vaccines to ensure that travel does not exacerbate vaccine inequity.

5.4 Clinical care

The ability and flexibility to surge to meet increased demands during health emergencies, while maintaining essential services and protecting HCW and patients, is crucial in a safe and resilient health system. Respiratory pathogen preparedness requires targeted attention to long-term investment in health system strengthening to detect, prevent and respond to health emergencies. Resilient health systems ensure equitable access to care and may need to reorganize and redeploy resources to reduce morbidity and mortality and to reduce socioeconomic disruptions. Clinical care in respiratory pathogen preparedness includes lifesaving and scalable clinical care, the protection of HCW and patients, and health systems' maintenance of essential health services.



IHR (2005) core capacities relevant for respiratory pathogen pandemic preparedness

Health service provision: Resilient national health systems and high-quality health service delivery at the intermediate and local level for both individual- and population-based services are essential for countries to prevent, detect, respond to and recover from public health events while maintaining the core functions of the health system. Health services and systems should include a governance structure, and ensure capacities for event-related case management, including surveillance, contact tracing, data collection and community engagement, in addition to the provision of routine health services in all contexts. This includes consideration of monitoring the capacity and delivery of these facilities and services to provide mapping of resources for respiratory pathogens such as beds, respirators and skilled staff.



Recommended actions to strengthen preparedness for health service provision

- Review systems for ensuring and continually improving quality of care and service delivery (clinical governance), including how guidance can be rapidly developed, rolled out, implemented and updated in real-time during an event. Processes should be in place to disseminate information, standard operating procedures, and updates in an accessible and timely manner.
- Support access to diagnostic services, including point of care (POC) tests where appropriate to enable timely and quality clinical management of respiratory pathogens. To ensure that diagnostic services for clinical care do not disrupt laboratory-based public health surveillance systems, report results into surveillance systems if feasible. The use of POC diagnostics does not replace the need for submitting samples and associated metadata to national laboratories to meet surveillance objectives.
- Optimize service delivery including for patients with long-term symptoms or post-infection syndromes, and where appropriate, plan to shift health encounters to community-based health care, outreach services, or alternative remote health care services. If digital and telemedicine platforms are used, ensure access to essential medications and supplies. Promote home care for patients with mild disease so that health facilities focus on patients with moderate and severe disease. Decisions for service delivery should consider equitable access for all and should be based on an operational monitoring plan that includes indicators for coping and surge capacity, such as number of hospital beds and trained workforce.
- Encourage health facilities to conduct operational planning for surge response, considering the need to maintain essential health services. Health facilities should develop

or adapt existing standard procedures and trainings to enable surge capacity based on relevant guidance. Operational planning should prioritize access to necessary quality assured therapies, equipment, and supplies to provide quality and safe care. Where resources are available within the private health sector, options should be explored during the inter-pandemic

period to map these resources and to agree to their use during a pandemic.

- Establish mechanisms to enable health facilities to participate in clinical research and data analyses, including death cases, to inform treatment, processes, standard of care, and develop innovative interventions during the response.

Infection prevention and control in health care facilities: Allows safe health care and essential services, as well as control of disease spread throughout the health system. Countries need to have minimum requirements for a strong and effective IPC programme in place at both the national and facility levels and to gradually progress to the full achievement of all requirements within WHO's IPC core components recommendations. Quality IPC builds community trust in the health system and can minimize the burden on facilities during a respiratory pathogen pandemic.



Recommended actions to strengthen preparedness for infection prevention and control in health care facilities

- Build or strengthen a national IPC programme with a strong primary health care foundation to support implementation, reduce the vulnerability of the IPC core components, and build resilience of communities and the health system to deal with everyday stressors and cases of respiratory diseases. This includes investment in the essential public health functions and focus on preventative, population-based health interventions and services.
- Routinely convene a national IPC taskforce on respiratory pathogens comprised of IPC specialists, engineers, architects, biologists, environmental scientists, clinicians, regulators and other expertise to revise, adapt and disseminate IPC-related information across all levels of the health care system. The IPC taskforce should be responsible for developing national IPC standards related to infrastructure (ventilation, airflow, air filtration, isolation rooms etc.), IPC measures (including screening, triage, source control measures training, environmental cleaning and disinfection, provision of adequate supply and quality of PPE and training on use according to risk) and support the national government in identifying surge supply plans and resources needs to protect patients and HCWs. Apply learnings from recent pandemics as well as from acute respiratory events during the interpandemic period to strengthen IPC procedure application.

5.5 Access to countermeasures

Equitable access to countermeasures requires prioritised and fast-tracked research and development processes with pre-negotiated agreements on benefit-sharing and technology transfer, scalable manufacturing platforms, and coordinated procurement and emergency supply chains. The countermeasures chain needs seamless, concerted and coordinated efforts across every step. National, multi-country, regional and global approaches are needed to advance and ensure equitable global access to countermeasures at the time of the next respiratory pathogen pandemic.



IHR (2005) core capacities relevant for respiratory pathogen pandemic preparedness

Health emergency response: This capacity focuses on the overall national health emergency framework and system for enabling countries to be prepared and operationally ready for response to any public health event, including respiratory pathogen pandemics, in line with the IHR 2005. This includes having an incident management system, a supply chain management mechanism, relevant regulations and procedures that enable research, development and roll out of countermeasures during a pandemic. Business continuity plans need to describe procedures, roles, responsibilities and requirements.



Recommended actions to strengthen preparedness for health emergency response

- Maintain technical and operational readiness of incident management teams including emergency operations centres for respiratory pathogen pandemics through standard operating procedures and periodic exercises. Designate focal point(s) to be responsible for liaising with national and/or international partners to ensure timely access to countermeasures.
- Strengthen and streamline regulatory systems for therapeutics, vaccines, diagnostics and medical devices including ventilators and PPE. Follow WHO's guidelines on regulatory preparedness for the provision of marketing authorization of emergency products. Countries need to have both the legal provisions as well as national staff expertise in using the emergency provisions to enable efficient registration of pandemic products and potentially WHO prequalification.
- Streamline access to and use of therapeutics, vaccines, diagnostics and medical devices by monitoring, identifying and resolving bottlenecks. Examples of pressure points include at point of procurement, licensing, supply volumes, demand generation, distribution logistics, safety monitoring, cold chain capacity, and issues related to the liability and indemnification of products. Where possible, countries can consider stockpiling essential products, establishing manufacturing capacity, or arranging multiple contracts with suppliers to mitigate the risk of stockouts. Emergency supply chain procedures need to consider commodity planning, people and processes, and logistics and transport mechanisms according to context and demand.
- Strengthen capacity for post market oversight of medical countermeasures including pharmacovigilance systems during the inter-pandemic period to increase familiarity with, and improvement of systems before the onset of the next pandemic.

(The How)

Chapter 6: Implementing respiratory pathogen pandemic preparedness →

Chapter 7: Monitoring in respiratory pathogen pandemic preparedness →

Chapter 8: Research in respiratory pathogen pandemic preparedness →

Chapter 9: Steps for respiratory pathogen pandemic planning →

Chapter 10: Suggested outline for a national respiratory pathogen pandemic preparedness plan →

Annex 2 →

Examples of critical interdependencies between health and other sectors for respiratory pathogen pandemic preparedness

Annex 5 →

Examples of assumptions in the national planning process

Annex 6 →

Examples of triggers for transitioning between operational stages for pandemic preparedness and response



6. Implementing respiratory pathogen pandemic preparedness

Thus far, this PRET module has outlined why respiratory pathogen pandemic preparedness is important (Chapters 1-3), provided an organizing framework for pandemic planning (Chapter 4), and described what core capacities need to be in place to be better prepared (Chapter 5). This chapter moves into the 'how'. Putting together the pandemic planning organizing framework and the core capacities needed, this chapter elaborates on the approaches to strengthen preparedness and the actions needed during each operational stage.

6.1 Approaches to strengthen preparedness

To strengthen preparedness, countries are encouraged to leverage what exists and to take two mutually reinforcing approaches: a cross-cutting all-hazards approach and a vertical hazard (mode of transmission) approach (Fig. 6). The cross-cutting approach can improve the underlying systems and capacities common for managing the risks and responses to different types of emergencies. It is also an efficient approach for strengthening the resilience of

communities to be ready to respond to any emergency. The vertical approach provides technical specificity to manage the risks and responses for hazards including pathogens of interest and their associated subtypes and variants. The two approaches are complementary and align with how ministries of health typically structure public health programming by having both cross-cutting and disease specific departments/units.

Fig. 6 Two mutually reinforcing approaches to strengthen respiratory pathogen pandemic preparedness



For respiratory pathogens, countries are encouraged to build on capacities that exist in both cross-cutting and hazard specific systems. This includes building on what exists for acute respiratory diseases, pneumonia and zoonoses control; specific respiratory pathogens such as for influenza and COVID-19; other diseases especially those that surged during COVID-19 such as HIV, tuberculosis, and vaccine preventable diseases; and cross-cutting surveillance systems, incident management systems, health promotion, and risk communication and community engagement.

Broader health systems and multisectoral capacities and infrastructure provide a critical foundation for respiratory pathogen pandemic preparedness and need to be continuously strengthened (Fig. 6). Collaboration with health system actors will better prepare systems for an emergency, such as information management systems, supply chains, management of health/medical services and devices, health promotion services, and the health workforce. Effective coordination and engagement with different sectors (Box 2) will improve preparedness, response and overall resilience (Annex 2).

6.2 What to do when: the focus of actions during different pandemic periods



Prevent and prepare

In the prevent and prepare phase, focus on:

- **Activities to prevent the emergence of respiratory pathogens such as from zoonotic spillover, laboratory accidents or deliberate events.**
 - Multisectoral and multi-level risk assessments and agreed actions are needed to address the control points such as in the food chain or laboratory systems.
 - To reduce the risk of zoonoses, apply a One Health approach that brings together the sectors and stakeholders engaged in human, terrestrial and aquatic animal and plant health, food and feed production and the environment to design and implement sustainable programmes, policies, legislation and research.
 - Develop and implement national codes of practice for the safe handling of biological agents in laboratories, using a risk assessment framework to set and implement biosafety and biosecurity policies and practices (40).
- Recognizing that the responsibilities to prevent deliberate events lies with other sectors, coordinate with relevant stakeholders including transport, customs, law enforcement and civil protection, as well as other countries to share expertise, supplies and resources to rapidly contain a deliberate respiratory pathogen event (41).
- **Actions to reduce the risk of respiratory pathogen emergence and transmission in other sectors.**
 - Map existing indoor ventilation in healthcare facilities, residential and non-residential buildings in order to enable more accurate risk assessment and inform future urban planning interventions, assess health system structural capacities and prioritize actions to strengthen building resilience and enhance engineer and environmental control measures to maximize structural flexibility and improve IAQ.

- **Collaborative planning with communities, building trust, increasing community health, science and digital literacy, and tightening collaboration among multi-level and whole-of-society stakeholders.**
 - o Raise public awareness of and embed education on respiratory pathogen prevention and control measures including respiratory hygiene, handwashing, vaccines and therapeutics.
 - o Seasonal epidemics of respiratory pathogens provide an opportunity to increase community engagement, knowledge, and practices relevant for respiratory disease prevention and management.
- **Overall system strengthening for preparedness.**
 - o Develop, update and test plans, provide training and capacity building, and consolidate multisectoral partnerships.
 - o Prepare supply chain systems to secure essential commodities for emergency response and plan to ensure timely access to medical countermeasures in the event of a pandemic.
 - o Conduct operational research to support future response measures, and strengthen existing surveillance and clinical networks.



Respond

Once a respiratory pathogen with pandemic potential has been detected, the priority is to get ready to respond: enhance surveillance, implement measures that reduce the risk or delay introduction/amplifications, and prepare to implement actions that contain the event.

- Scale up health care system capacities, increase awareness of communities that a potential response may be needed and listen to their views. Engage other sectors to be ready to activate their own measures. Provide support to countries already affected, as feasible.
- To contain an initial event, focus on detecting, isolating and caring for the initial cases and clusters in the affected communities.
- To reduce transmission risk, conduct outbreak investigations, engage affected communities in case detection, undertake contact tracing, and dialogue to empower the community and responders to manage their exposure risk based on known PHSM.
- Prepare to scale up the national response, including ways to safeguard essential services across different sectors, intensify surveillance and monitoring systems, and support other sectors with the latest data and guidance that can help them to maintain services to minimize societal impact.
- Actions also include supporting learning about the novel pathogen to identify best practices for all aspects of the response.
- As the magnitude of the event grows with sustained community transmission, whole-of-society measures should be scaled up to slow the spread of disease, while also accounting for the challenges and operational constraints experienced. Actions by all sectors (see Box 2) need to account for disease transmission patterns and ensure equitable access to response measures, especially for high-risk groups (see Box 1). More needs to be learned about the characteristics of the pathogen and its epidemiology.
- To strengthen the public's ability to protect themselves – and to manage misinformation – communicate meaningful information based on science through relevant channels, including media and community leaders. Include communication of unknowns and uncertainties about

the pathogen. Communities need to be included in the decision making for all stages of response.

- Consider the resources required for the different measures so that limited supplies or resources can be maximized for public health benefit.
- With disseminated community transmission in different parts of the same country or in different countries around the world, the application of medical countermeasures, public health and social measures and other

intersectoral actions need to be scaled up or down to control transmission and mitigate health and socioeconomic impact over time.

- Recognizing that the pathogen may evolve, systems need to be alert and ready to modify response actions in case new variants or strains emerge that impact the effectiveness of existing measures. Throughout the response, and accounting for different waves of transmission, conduct Intra-Action Reviews (IARs) and other analyses to continuously improve and tailor the response to emerging issues, gaps and needs.



Recover

Once the situation stabilizes, scale down actions from emergency response and sustain the necessary long-term disease control measures.

- Monitor the pathogen over time, including for antimicrobial resistance or reduced efficacy of different countermeasures. This includes antivirals used to prevent and treat respiratory viruses.
- Focus on restoring services interrupted during the pandemic and well-being of the population, with a particular emphasis on

vulnerable and affected groups, and for the responders across different sectors and different levels.

- Evaluate the systems and processes used during the pandemic, such as through After-Action Review (AARs) to identify strengths, weaknesses, opportunities, and threats that can be used to enhance preparedness, emergency response procedures and health systems for future responses.

7. Monitoring in respiratory pathogen pandemic preparedness

7.1 Monitoring relevant International Health Regulations (2005) core capacities

Quality respiratory pathogen pandemic preparedness is heightened through robust monitoring, evaluation, advocacy and engagement. Working with Member States and partners, WHO has developed and updated several resources within the IHR (2005) Monitoring and Evaluation Framework that can be used to assess national core capacities for public health emergencies encompassing preparedness for respiratory pathogen pandemics.

The IHR Monitoring and Evaluation Framework consists of four complementary components: one mandatory; the State Party Self-Assessment Annual Report (SPAR), and three voluntary: joint external evaluation (JEE), after-action reviews, and simulation exercises. The electronic SPAR (12, 27) and JEE (42), are based on quantitative measures, and can be regarded as a prerequisite of functional core capacities. AARs (43) and simulation exercises (44), are based on qualitative measures, and are aimed at gauging the functional status of core capacities and should be used when and where needed.

Considering the yearly periodicity and consistency of SPAR reporting, indicators will be monitored over time. A key indicator for respiratory pathogen pandemic preparedness with the SPAR is C7.1 Planning for Health Emergencies which monitors the presence of health emergency plans being implemented, tested and regularly reviewed.

To complement and draw on JEE and SPAR, a WHO Member State-driven intergovernmental consultative process is being undertaken to develop the Universal Health and Preparedness Review (UHPR). The UHPR aims to provide a

holistic view of preparedness considering health systems and whole-of-government components. UHPRs are intended to promote country ownership, commitment and accountability, and build mutual trust between countries (45).

Additional tools support the implementation and monitoring of capacities required by the IHR (2005), such as existing tools developed jointly with the FAO and WOAHP for zoonotic diseases, enabling a concomitant review of gaps in the public health and veterinary sector and the development of roadmaps to improve coordination at the human-animal-environment interface (46). Future quadripartite (working additionally with the UN Environment Programme) operational tools targeting some of the most challenging areas in this coordination will complement the planning process.

Additional monitoring and evaluation tools from pathogen-agnostic and pathogen-specific programmes can be used to track specific systems and capacities. Examples include the Global Influenza Strategy (47), the Global Genomic Surveillance Strategy for Pathogens with Pandemic and Epidemic Potential (48), and the Pandemic Influenza Preparedness Framework (49, 50).

7.2 Monitoring functional respiratory pathogen pandemic preparedness planning

Specific measures to monitor functional respiratory pathogen pandemic preparedness and planning are needed to support countries, partners and WHO to monitor progress, identify gaps and

undertake necessary course corrections. A number of measures are outlined in Table 5 that aim at stimulating continuous improvements in planning and preparedness.

Table 5: Indicators to monitor functional capacities for respiratory pathogen pandemic preparedness and planning

Component	Measure
Emergency coordination	<ul style="list-style-type: none"> • Presence of a respiratory pathogen pandemic preparedness plan • Presence of a multisectoral group for respiratory pathogen pandemic preparedness • Exercises conducted to test, review and update respiratory pathogen pandemic preparedness plans
Collaborative surveillance	<ul style="list-style-type: none"> • Consistent and timely reporting to the Global Influenza Surveillance and Response System • Participation in Pandemic Investigations and Studies (“Unity Studies”) network • Local capability, or access to, timely genomic sequencing for pathogens with pandemic and epidemic potential
Community protection	<ul style="list-style-type: none"> • Presence of trained infodemic manager/s in ministries of health • Evidence of risk communication or community engagement during acute respiratory disease events including MERS-CoV, seasonal and zoonotic influenza • Presence of emergency vaccination plans, with a focus on risk groups as needed, during a respiratory pathogen pandemic
Clinical care	<ul style="list-style-type: none"> • Participation in WHO’s Global Clinical Platform • Presence of national guidance on clinical management of severe acute respiratory infections
Access to countermeasures	<ul style="list-style-type: none"> • Presence of a National Vaccination and Deployment Plan that addresses actions needed during a respiratory pathogen pandemic • Implementation of a defined regulatory approach that enables timely approval for use of pandemic products

8. Research in respiratory pathogen pandemic preparedness

Research preparedness is critical for a more robust and equitable response to a future respiratory pathogen pandemic. This chapter describes the research systems needed to identify and implement effective PHSM and medical countermeasures, and to support decision-making in all five components: emergency coordination, collaborative surveillance, community protection, clinical care, and access to countermeasures.

Research capacities, networks, funding, prioritized research agendas, and collaborations enable (a) quality basic, translational, clinical and operational research, as well as (b) a coherent and rapid pandemic research response.

A strong foundation for basic research is needed. This includes research in pathogen biology, pathogenesis, host immunity, structure-function studies and animal models. Without basic research, medical countermeasures will not be developed in a timely way during the pandemic. Translational and clinical research including clinical trials in diagnostics, therapeutics and vaccines are essential to make life-saving medical countermeasures available. This needs to leverage different platforms, technologies and infrastructure including in manufacturing capacity and regulatory science. The need for a strong research ecosystem was recognized by the World Health Assembly in resolution WHA75.8. The resolution set out priorities for countries, partners and WHO to strengthen systems and facilitate synergies among stakeholders throughout the continuum of research to utilization of clinical trial data in clinical practice.

In the inter-pandemic period, countries and other stakeholders need to strengthen collective research preparedness, continue to innovate and develop medical countermeasures/candidate products for (a) respiratory pathogens known to have pandemic potential such as influenza, and (b) unknown respiratory pathogen 'X' by selecting prototype-pathogens from pathogen families known to infect humans. This approach will more

A strong foundation for basic research is needed. This includes research in pathogen biology, pathogenesis, host immunity, structure-function studies and animal models. Without basic research, medical countermeasures will not be developed in a timely way during the pandemic.”

comprehensively prepare the world for the next pandemic by providing baseline knowledge on various pathogens and potentially speed up the movement of candidate products into clinical trials. Various country, regional and global initiatives including WHO's Research and Development (R&D) Blueprint facilitate these research preparedness priorities.

Recognizing that PHSM played a critical role in preventing transmission during the COVID-19 pandemic but that some came with adverse and unintended effects (intervention burden), more robust research systems are needed to measure the effectiveness and social, health and economic impact of PHSM. A framework for evaluating and monitoring PHSM and a global research agenda are being developed by WHO in collaboration with

countries and partners. Countries can advance their PHSM research systems and capacities by applying them during respiratory pathogen outbreaks and seasonal epidemics. This will also increase knowledge about the effectiveness and impact of different measures aimed at controlling respiratory pathogens in advance of the next pandemic.

Throughout the course of a pandemic, operational research is needed to support decision-making based on near and long-term disease incidence, morbidity and mortality estimates associated with different interventions. It helps inform decisions to optimize clinical care pathways, health care network configuration, workforce and resource allocation, health facility operations, prioritization and continuation of health and multisectoral services, and supplies of medical countermeasures including PPE and medical devices. National, regional and global expert groups in analytic epidemiology and modeling are critical for such research across different response pillars. All countries should consider how to incorporate operational research and learning into their pandemic preparedness and response planning, including in the humanitarian sector.

“ Throughout the course of a pandemic, operational research is needed to support decision-making based on near and long-term disease incidence, morbidity and mortality estimates associated with different interventions. ”

The COVID-19 pandemic showed the value of pre-existing research networks and platforms for emerging and re-emerging diseases. This includes the R&D Blueprint which was activated to accelerate diagnostics, vaccines and therapeutics, the Global Research Collaboration for Infectious Diseases Preparedness (GLoPID-R) which helped identify priority areas for research and

facilitated rapid funding, and the Pandemic Special Investigations & Studies rebranded as ‘The WHO Unity Studies’ which focused on seroepidemiologic studies including the first few cases, household transmission, and population-based serosurvey.

Leveraging existing research networks and platforms improves preparedness as there is familiarity with research methods, pre-established processes and protocols, and greater equitable research opportunities. An external evaluation of the WHO Unity Studies found that the initiative helped connect expertise globally, provided resources for implementation where it was needed, and that the standardized approach facilitated rapid study implementation. Limitations experienced by countries participating in the WHO Unity Studies included variations in study methods, communicating study findings, and the length of time taken for ethical clearance, receipt of standardized laboratory assays from WHO and approval to share results. These barriers can be overcome through planning during the inter-pandemic period as part of country, regional and global efforts to strengthen research preparedness.

Collective efforts help deliver stronger pandemic research preparedness and response.

Initiatives such as ISIDORe, which is a large-scale multidisciplinary consortium involving 32 European countries and 154 research entities and organizations, advances research on pandemic- and epidemic-prone respiratory pathogens focusing on basic research, medical countermeasures, social sciences and epidemic management. Similarly, the Coalition for Epidemic Preparedness Innovation (CEPI), a global partnership working to accelerate the development of vaccines against epidemic and pandemic threats, has set the ambitious goal of responding to and defusing the next pathogen with pandemic potential with a new vaccine in 100 days.

At the heart of research preparedness is national investment in an enabling R&D ecosystem, even if supplemented by external public and private funding. All countries can establish an enabling environment for research and discovery by

cooperating and co-developing global research agenda; participating in global or regional research efforts including clinical trials that apply standard protocols; investing in a research workforce; having clear national procedures for sample/data sharing, safety and ethics; pre-negotiating access

and benefit-sharing agreements; and having the requisite policies in line with the national context for accelerated emergency research and development of countermeasures. A national respiratory pathogen pandemic preparedness plan needs to consider research preparedness.



“ The COVID-19 pandemic showed the value of pre-existing research networks and platforms for emerging and re-emerging diseases.”

9. Steps for respiratory pathogen pandemic planning

This chapter describes the four essential steps for developing or updating a respiratory pathogen pandemic preparedness plan (Fig. 7). Where available, build on plans such as an influenza pandemic preparedness plan or COVID-19 preparedness and response plan. Aim to have plans that are practical, feasible, and as simple as possible so that they can be operationalized easily. Plans should be regularly tested, monitored and updated (51).

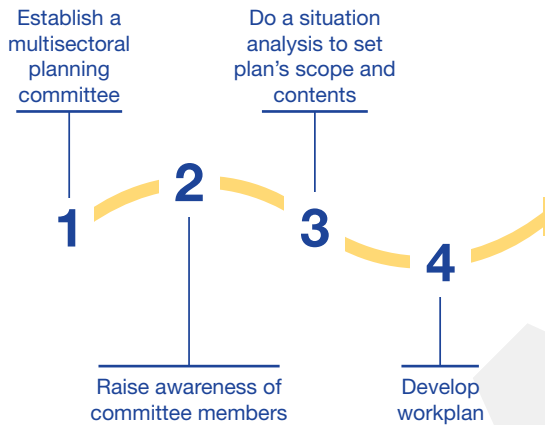
“ Use plans to trigger action. Strengthen routine systems as the foundation for pandemic preparedness and fill gaps in capacities.”



Fig. 7 Essential steps in pandemic planning

Step I

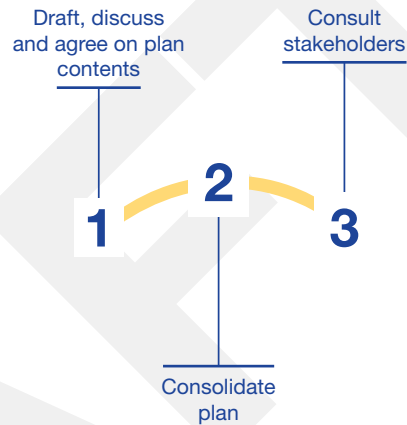
Prepare, analyze the situation and engage stakeholders



- Conduct a stakeholder analysis to identify all sectors relevant to prevention, preparedness, and response to a respiratory pathogen pandemic.
- Convene a multisectoral planning committee reflecting whole-of-government and whole-of-society representation. Include experts in respiratory pathogens (e.g., clinicians, epidemiologists, microbiologists etc) or identify relevant technical advisory bodies/groups that provide relevant scientific inputs and guidance.
- Identify lessons learned from past events and scope the core content of the new/ updated respiratory pathogen pandemic preparedness plan.
- Develop a workplan with a budget and assign tasks.

Step II

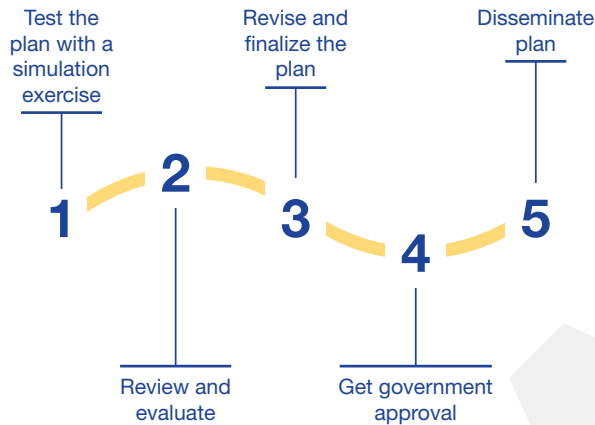
Draft the plan



- Assign specialists from each sector to develop or update the plan with actions needed during each operational stage.
- Collate and consolidate the different sectoral inputs into a cohesive document. Check the logic flow and the list of planned actions to ensure feasibility of implementation.
- Seek inputs from stakeholders including users who implement preparedness and response activities. This can be done through targeted consultations, workshops or focus groups.
- Update the draft plan following stakeholder engagement

Step III

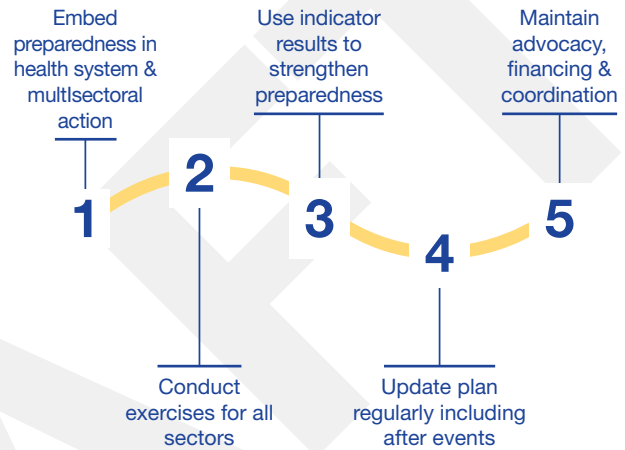
Evaluate, finalize, and disseminate the plan



- Test the draft plan by conducting simulation exercises, evaluate its fitness-for-purpose and incorporate any learnings. The multisectoral planning committee needs to oversee this process including its contextualization in broader emergency and disaster risk management.
- Revise and finalize the plan, and seek approval from the relevant government authorities.
- Disseminate the approved plan broadly through the multisectoral committee and other whole-of-society and whole-of-government channels to stakeholders including the public.

Step IV

Implement, monitor and continuously improve the plan



- Implement the actions outlined in the plan to strengthen preparedness at the national and subnational levels, and accounting for different contexts and population needs.
- Establish a schedule to exercise different aspects of the plan, including multisectoral aspects.
- At least yearly, gather the multisectoral planning committee to monitor progress, especially measures in line with the IHR (2005) core capacities and specific functional capacities for respiratory pathogen pandemic preparedness (Chapter 7).
- Use the routine monitoring and exercises to identify gaps and to continually update the plan and drive improvements in functional multisectoral and multi-level preparedness.

10. Suggested outline for a national respiratory pathogen pandemic preparedness plan

This chapter provides a suggested outline for a national respiratory pathogen pandemic preparedness plan. Member States may find the outline useful to guide planning discussions and steer the overall process to develop a plan or update their existing preparedness plan.

The outline provides an adaptable structure and includes an approach for documenting context and objectives (**Part A**), planning considerations and assumptions (**Part B**), country systems and capacities (**Part C**), plan activation and triggers

for shifting between operational stages (**Part D**), and actions needed during each operational stage (**Part E**). The list of considerations in each part of the outline are therefore indicative and non-exhaustive.



National Respiratory pathogen pandemic preparedness plan: suggested outline



**a****Country context**

- i.** Country overview including population demographics, disaster risk profile
- ii.** Disaster risk management structures
- iii.** Acute respiratory disease surveillance and management in the country including prevention:
 - Summarize the status of respiratory pathogen immunization programmes
 - Laboratory biosafety and biosecurity measures
 - Measures/standards to improve indoor air quality to minimize respiratory pathogen transmission in health facilities, residential and non-residential settings
 - Health promotion and clinical care programmes for respiratory disease control

b**Purpose and scope of document (can include the following)**

- i.** Outlines the existing systems and capacities relevant for respiratory pathogen pandemic preparedness
- ii.** Describes the operational actions and roles and responsibilities of different stakeholders during the different pandemic periods
- iii.** Serves as an advocacy, fund-raising and monitoring tool to strengthen preparedness

c**Objectives of the plan (can include the following)**

- i.** Minimize the risk of a respiratory pathogen pandemic including the transmission, morbidity and mortality, and socioeconomic impacts
- ii.** Enable appropriate and timely actions for emergency coordination, collaborative surveillance, community protection, clinical care and access to countermeasures during each operational stage
- iii.** Inform, engage and empower the public to maximize community resilience

d**Target audience**

(see Table 1 for inputs)

e**Risk of respiratory pathogen pandemics**

(see Chapter 3 section 3.4)

(Part B)

Planning considerations and assumptions

-
- a**
Principles and ethical considerations for respiratory pathogen pandemic preparedness:
- i.** Consider equity, gender, and human rights, inclusiveness, coherence, and others, according to the country context
 - ii.** Describe the purpose of principles and ethical considerations. This can include (a) balancing rights, interests and values, (b) setting priorities, (c) implementing PHSM, and (d) having equitable access to life-saving measures if scarce
-
- b**
Legal and policy considerations
- i.** Legislative framework for health emergency preparedness and response/respiratory pathogen preparedness and response, including coordinating frameworks between sectors and legal basis for PHSM
 - ii.** Roles and responsibilities in pandemic preparedness and response, including those that are legally mandated and those for technical advisory groups
 - iii.** Compliance with obligations under the International Health Regulations (2005) and any other international agreements
 - iv.** Policies for data sharing and decision making
 - v.** Policies for research and innovation including participation in regional/global platforms focused on research during public health emergencies
-
- c**
Methods for plan development
- i.** Planning committee terms of reference
 - ii.** Multisector and multi-level consultations (see Box 2)
 - iii.** Analysis of existing in-country and external systems, capacities and capabilities
-
- d**
Approach for planning (can include the following)
- i.** Needs-based and scalable
 - ii.** Integrated across society
 - iii.** Leveraging existing systems and capacities
 - iv.** Regular updating of plan based on preparedness and response needs
 - v.** Indicators and milestones for preparedness including for the planning process
 - vi.** Others, as indicated by country context
-
- e**
Pandemic preparedness and response periods and operational stages
- (see Chapter 4)
-

f

(see Annex 5 for inputs)

Planning assumptions

g

Funding for multisector
preparedness and
response

h

Other national
or subnational
considerations

(Part
C)

Country systems and
capacities relevant
for respiratory
pathogen pandemics

a

Emergency
coordination:
describe systems and
procedures

- i. How does this plan fit with other emergency response operations plans
 - Describe the roles and responsibilities at national, subnational and local levels during a respiratory pathogen pandemic
 - Describe the command-and-control structures including if there is an Emergency Operations Centre
 - Describe the frameworks for multi-agency and multi-sector coordination
- ii. Describe emergency funding triggers, mechanisms and measures to streamline funds utilization
- iii. Describe plans for exercising emergency coordination across sectors, across levels and with other stakeholders (communities, international partners etc)
- iv. How will human resources be surged
 - What methods are used to address skills shortages if they exist
 - How will emergency medical teams (national and international) be used
- v. Other national or sub-national considerations

b

Collaborative surveillance: describe systems and procedures

- i.** What One Health surveillance and coordination mechanisms are in place nationally and internationally, and how will they support pandemic preparedness and response
- ii.** How will signals be verified and investigated
- iii.** What is the role of health emergency alert and response teams
 - Functions, standards and deployment criteria
 - Support for and coordination of team deployments
 - Involvement of and access to global or regional networks/teams
- iv.** How will data be promptly synthesized, assessed and used to inform action
- v.** What triggers and how will risk assessments be done and by whom
- vi.** What surveillance approaches will be put in place for
 - Coordination and information sharing concerning pathogens circulating in animals prior to emergence among humans
 - Rapid detection and assessment of an emerging or re-emerging (including new variant or sub-type) respiratory pathogen
 - Monitoring epidemiological characteristics of respiratory pathogens with sustained circulation in human populations (pandemic surveillance)
 - Monitoring epidemiological characteristics of respiratory pathogens in the inter-pandemic period
 - Monitoring the effectiveness of human health interventions
- vii.** How access to laboratory services will be ensured, such as
 - What sub-national, national and international networks and reference laboratories for respiratory pathogens exist and how these will enable sharing of biological samples and genetic data
 - How other laboratories may be co-opted if there is a surge in demand
 - How specimens will be transported or shipped to referral laboratories nationally or internationally
 - How will quality and biosafety be ensured
 - How will laboratory data be integrated with other data (e.g., clinical)
- viii.** How will multi-source data from the health system and other sectors be used to comprehensively inform risk assessment and response actions, including
 - Hospital and other health care facility capacity monitoring
 - Supply chain system monitoring
 - Infodemic monitoring and insights generation
 - Urban and disaster risk management data
 - Humanitarian assistance monitoring systems
- ix.** Other national or sub-national considerations on surveillance

c

**Community protection:
describe systems and
procedures**

- i.** What mechanisms will be used to deliver respiratory pathogen infection prevention interventions (medical countermeasures and PHSM) in alignment with local contexts and customs
 - PHSM to interrupt or control chains of transmission
 - Vaccination (presence of a National Deployment and Vaccination Plan), therapeutics (including for chemoprophylaxis), and PPE
 - Social welfare and protection measures including for marginalized or at-risk groups requiring greater support
 - Livelihood and economic safety nets and food security to minimize poverty, civil unrest and harm
 - Measures for the continuation of education and learning, and to sustain other essential services
- ii.** How will PHSM be considered
 - How will evidence of PHSM effectiveness be gathered (including research)
 - How will adjustments to PHSM be explained
- iii.** What two-way communications mechanisms will be used
 - How will community insights and sentiments be monitored and analysed
 - What processes will be used to develop health/other messages as the situation evolves
 - How will messages be adapted to community context/customs
 - What community networks/influencers will be engaged to ensure community inclusion and consistency of outreach
 - How will media groups (e.g., social media, radio, print etc) be engaged
 - Who is responsible to coordinate messaging and set the frequency of communication
 - What languages will be used in which communities, if appropriate
- iv.** How will misinformation and disinformation be monitored and addressed
 - What processes will be used to empower and strengthen community resilience against misinformation and disinformation
 - How will scientific literacy be strengthened
- v.** How will travel and trade be maintained
 - How will risk communication and risk mitigation measures be designed and delivered to travellers
 - How will surveillance and case management at points of entry and onboard conveyances be conducted when these measures are indicated
 - How will essential travel such as humanitarian corridors or cargo transport of critical supplies be managed when these measures are indicated
 - How will decisions on targeted screening, testing or quarantine be made and how will they be operationalized
- vi.** Other national or sub-national considerations on protecting the community

d**Clinical care:
describe systems and
procedures**

- i.** How will facilities be scaled up, including for
 - Clinical care pathways that account for patient flow, triage and isolation
 - Point of care diagnostic tests
 - Severe acute respiratory infection case management
 - Use of tele-medicine and use of private sector facilities, if applicable
 - Management of burials with safe and dignified practices
 - Waste management
- ii.** How will the availability of supplies and equipment be sustained at facilities
 - Systems to report shortages or stock-outs
 - Security measures to safeguard stocks
- iii.** How will essential individual and population-based services be maintained
 - Define the priorities of essential health services and mechanisms
 - Identify trained health workforce and staff from other sectors to supplement in case of workforce shortages
 - Procedures and platforms to monitor disruptions and trigger corrective actions to essential services
 - Approaches and procedures to facilitate the recovery of services after the emergency
- iv.** How will health and care workers, patients and communities be protected
 - Access to infection, prevention and control methods, materials and training including water, sanitation and hygiene capacities, as well as occupational health
 - Adequate WASH services in health facilities
 - Mechanisms to monitor and mitigate attacks on health and care workers
- v.** What are the roles of different sectors, different levels, private sector, and civil- and non-governmental organizations in the above interventions
- vi.** How will research support the above processes and what research networks/platforms enable these efforts
- vii.** Other national or sub-national considerations to provide clinical care

e

**Access to countermeasures:
describe systems and
procedures**

- i.** Is there a pre-defined list of essential supplies including diagnostics and therapeutics for managing different categories of respiratory pathogens
 - ii.** Are there supply and manufacturing nationally or regionally platforms that can scale rapidly, including for essential items such as PPE, therapeutics and vaccines
 - iii.** Will a national stockpile or access to an international stockpile be implemented to support emergency response needs
 - iv.** How will access to countermeasures be maximized through global, regional or country level pre-negotiated agreements
 - v.** What are the regulatory frameworks and procedures for new countermeasures at the time of an emergency
 - vi.** How will liability and indemnification be managed for emergency medical countermeasures
 - vii.** How will linkages to upstream (global and regional) supply chains and delivery be ensured
 - viii.** How will systems for downstream (in-country) supply chains and delivery be ensured
 - ix.** How will an enabling environment for research and development be ensured
 - x.** Other national or sub-national considerations for having access to life-saving countermeasures
-

**(Part
D)**
**Plan activation
including triggers
for shifting between
operational stages**

a

Activation of plan

- i. What body makes decisions to escalate and de-escalate between the operational stages in the plan
- ii. What are the roles and responsibilities of different stakeholders including technical advisory groups in this process
- iii. How and who communicates the escalation and de-escalation

b

Triggers for shifting between operational stages: escalation and de-escalation

(see Annex 6 for examples of triggers and a format for layout)

c

Procedures for assessing and adjusting response measures at the country and sub-national levels.

- i. What body will conduct the situational assessments that may lead to adjustment of response measures
- ii. What systems and data points will be used in the assessments to account for the intensity of transmission, the coping capacity of health and other sector systems to provide essential services, and the overall health and socioeconomic well-being of communities.

(Part E)
Actions during each operational stage

a

Actions for each operational stage explaining what needs to happen when. The example table below can be used to document key information. Separate tables should be created for each operational stage.

Prevent and prepare stage				
Component	Actions	Sector	Responsible agency	Budget estimate
Emergency coordination				
Collaborative surveillance				
Community protection				
Clinical care				
Access to countermeasures				

(Part F)
Annexes

- Develop pathogen-agnostic annexes as needed.
- For respiratory pathogens known to have pandemic potential such as influenza, link to pathogen-specific documents or develop pathogen-specific annexes. Such documentation may relate to specific clinical management requirements and preventive measures such as vaccines or evidence based PHSM.

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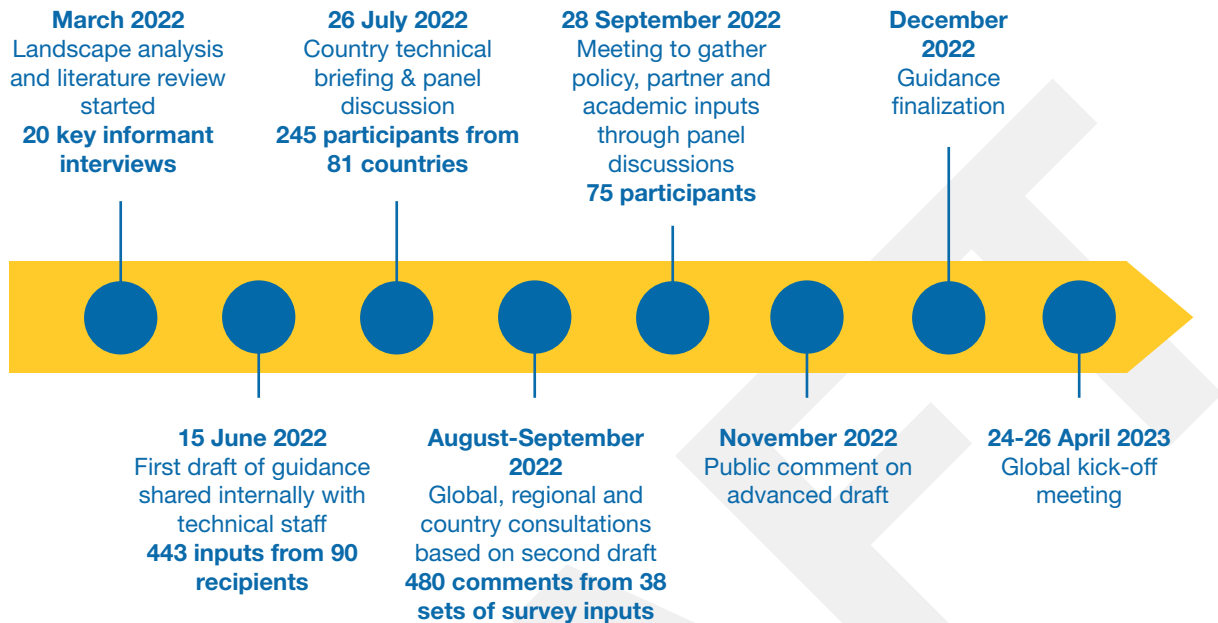
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Annexes

Annex 1: Methods for developing this module

In developing this module, the World Health Organization (WHO) undertook a number of steps to assess gaps and needs, identify priorities, gather inputs and develop the document. Staying consistent with the direction set by the World Health Assembly in Resolution 74.7 and the development of a pandemic accord, an iterative process, building on responses from key stakeholders and lessons learned from previous experiences and research, was undertaken as outlined below (Fig. A1.1):

1. Internal committee comprised of WHO staff from country, regional and headquarters offices established to steer guidance development and implementation (February – ongoing)
2. External partner engagement forum on respiratory pathogen pandemic preparedness established to discuss activities, opportunities and advancements (April 2022 – ongoing)
3. Lessons arising from international and country level assessments of recent pandemics were reviewed (March – October 2022)
4. Review of the literature on lessons from COVID-19 for future respiratory pathogen pandemic preparedness was commissioned (August to September 2022)
5. Country technical briefing with panel discussions conducted to gather inputs (27 July 2022)
6. Consultations undertaken with countries and partners on the draft guidance (August to September 2022)
7. A meeting with policy makers and private sector stakeholders including academia, industry and philanthropy held on the side-lines of an international respiratory diseases conference to discuss perspectives on preparedness priorities including monitoring and research (28 September 2022)
8. Public comment on advanced draft and revision to finalize the module (November - December 2022)
9. Global kick-off meeting with countries and partners (April 2023).

Fig. A1.1: Steps in the module development process that engaged stakeholders

Step 1: Landscape analysis and literature review

Experiences of Member States, international reviews as well as key learnings from pandemic preparedness and response in recent years have guided the development of this document through both document review and consultation. Interviews were conducted with 20 internal key informants at WHO Headquarters in the initial phase of the module development. Documents reviewed include global assessments such as those from: committees reviewing the functioning of the IHR (2005) during pandemics; the Independent Panel on Pandemic Preparedness and Response; the Global Preparedness Monitoring Board; the Lancet Commission; working papers from the International Monetary Fund; and policy briefs by theme and population groups from the United Nations System (1-9).

At country level, the module drew on actions that reflect successes, address challenges, and areas for improvement as identified in the COVID-19 Intra Action Reviews which covered over 90 countries (10). A variety of case studies from countries, partners and WHO also helped identify good practices for preparing and responding to respiratory pathogen pandemics and epidemics, and these were incorporated in the module.

For chapter 2 (COVID-19 lessons learned), WHO contracted the John Hopkins Center for Health Security to perform a scoping review of the English-language peer-reviewed and grey literature published between December 2019 and July 2022. Data were analysed thematically based on the five components for health emergency preparedness, response and resilience: emergency coordination, collaborative surveillance, community protection, clinical care and access to countermeasures. These findings were supplemented by input from World Health Organization (WHO) experts, including representatives from WHO country offices, and members of other communities of practice involved in outbreak response, health security, and health systems strengthening.

Step 2: First draft of module shared

A first draft of the module was shared on 15 June 2022 with 90 internal WHO staff at headquarters, regional offices, and country offices. This step generated 443 comments which led to the development of the second draft.

Step 3: Country technical briefing

A virtual country technical briefing was held on 26 July 2022. The invitation was shared and circulated widely to countries as well as external partners engaged in pandemic preparedness and response. The briefing was attended by 245 participants from 81 countries from all six WHO regions. WHO shared plans and progress to develop the module. Two panel discussions focused on (i) lessons learned from the COVID-19 pandemic to inform future preparedness, and (ii) good practices for respiratory pathogen pandemic preparedness planning. The inputs received from the briefing were incorporated into the second draft of the document.

Step 4: Global, regional, and country consultations

An online survey was developed to solicit regional, country and partner inputs on the draft module. The survey link was shared along with the second draft on 7 August 2022. Summary versions of the module and the survey were also translated and shared in Spanish, Portuguese, and Russian as relevant. Consultations with countries were undertaken by regional focal points from 7 August to 30 September 2022. Approaches to gather inputs are presented below by WHO region.

- **WHO African Region:** the document and survey were shared with all 14 National Influenza Centres (NICs), and national focal points for consultation with Ministries of Health. Inputs were provided through the online survey.
- **WHO Eastern Mediterranean Region:** a regional webinar was held on 15 September 2022 engaging all 21 Member States and one Territory in the region. Inputs were collected through panel discussions and subsequently collated according to the survey prompts.
- **WHO European Region:** the document was shared with national focal points, academic experts, and regional teams with a request for general feedback. Inputs were collated by regional focal points and submitted through the online survey.
- **WHO Region of the Americas:** the document and survey were shared with national focal points and national authorities within the region. Stakeholders directly submitted inputs through the online survey.
- **WHO South-East Asia Region:** the document was shared with national focal points in all 11 Member States for consultation with relevant stakeholders. Inputs were collated and submitted by regional focal points according to survey prompts.
- **WHO Western Pacific Region:** the document and survey were shared with national focal points for consultation with relevant stakeholders, requesting inputs through the online survey. In addition, regional focal points undertook in-depth discussions with national focal points to solicit and collate inputs according to survey prompts.

In parallel to the country consultations conducted through WHO regional offices, the draft module and survey were shared with external partners who are members of the Partners Engagement Forum for Respiratory Pathogens Pandemic Preparedness Planning (R-PEF).

This step generated 480 individual comments pooled through 38 survey responses. Surveys were received from 18 Ministries of Health and other Ministries, 12 from WHO country and regional offices, 3 from academia, one inter-governmental agency, one UN agency, and three inputs from other agencies covering donors, philanthropies and non-governmental agencies. Inputs were incorporated into the third draft of the module.

Step 5: Meeting to discuss research and monitoring priorities with partners

Following on from the regional consultations, WHO hosted a meeting to discuss research priorities and key measures of success in respiratory pathogen pandemic preparedness planning. The in-person meeting was conducted on 28 September 2022 in Belfast, United Kingdom of Great Britain and Northern Ireland. There were 75 meeting participants representing country respiratory disease control managers, pandemic planning and policy makers, academia, pharmaceutical industry manufacturers and associations, philanthropic organizations and international capacity building partners involved in pandemic planning. WHO provided an overview about the module, and two moderated panel discussion sessions took place to solicit inputs on (i) research priorities in respiratory pathogen pandemic preparedness, and (ii) key measures of success, monitoring and evaluation. This helped raise awareness about the module among various stakeholder groups.

Step 6: Public comment

The third draft of the module along with a link to an online survey was posted for public comment on the WHO website on 1 December 2022 for three weeks. This generated 72 completed survey responses from ministries of health and agriculture (n=15), national non-governmental agencies (n=19) and citizens (n=5), academic institutions and referral hospitals (n=15), international civil society (n=6) and non-governmental organizations (n=4), and WHO/FAO staff (n=8). The call for comments also generated seven written responses from WHO's Strategic and Technical Advisory Group on Infectious Hazards with Pandemic and Epidemic Potential (STAG-IH) which provides independent advice and analysis to WHO on the infectious hazards that may pose a potential threat to global health security. All inputs received were taken into consideration to finalize the document.

Step 7: Global kick-off meeting







To launch the respiratory module and co-develop the way forward for PRET and mode of transmission pandemic planning, a global meeting was organized in Geneva Switzerland on 24-26 April 2023. Participants included Member States, partner agencies involved in different aspect of respiratory pathogen pandemic preparedness including academia, civil society and non-governmental organizations and members of the R-PEF.






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Annex 2: Examples of critical interdependencies between health and other sectors for respiratory pathogen pandemic preparedness

Respiratory pathogen pandemic preparedness is a joint effort between health and other sectors, in which each sector plays its part. Some examples are listed below.

Sector	Interdependencies
 <p>Food and agriculture</p>  <p>Environment</p>	<ul style="list-style-type: none"> Mitigate the risk of zoonotic diseases associated with wildlife, climate change, livestock breeding systems or animal trade such as at live animal markets and slaughterhouses Minimize risk to livelihoods and supply chains associated with agriculture and food supply during a pandemic Conduct regular data reviews and risk assessments on zoonotic respiratory pathogens of pandemic potential circulating in animal and human populations Develop joint outbreak management mechanisms for effective multisectoral response to zoonotic respiratory pathogens.
 <p>Transport, logistic, travel and tourism</p>  <p>Law and order</p>  <p>Critical manufacturing</p>	<ul style="list-style-type: none"> Prioritize safe movement of essential workers and supplies and other persons travelling for essential reasons Mitigate respiratory disease spread associated with travel including at points of entry and public transport Limit transmission across borders and enable safe population mobility without unwarranted travel and trade restrictions, and Identify approaches to prepare and sustain international and domestic supply chains for essential commodities during the acute stages of a pandemic.
 <p>Information, communication and technology (ICT)</p>	<ul style="list-style-type: none"> Promote mechanisms for community engagement and risk communication that can deliver clear and accurate information that meet the diverse and heterogenous subpopulations in urban, rural and vulnerable settings Have mechanisms for social listening Prepare advance media messaging materials on respiratory disease management and countermeasures, and Improve digital workflows and the automation needed to sustain businesses and enable e-services during acute stages of the pandemic.

Sector	Interdependencies	
 <p>Critical manufacturing</p>	<ul style="list-style-type: none"> Identify essential commodities during a respiratory pathogen pandemic, and 	<ul style="list-style-type: none"> Develop business continuity plans that protect the critical workforce and that ensure sustained sourcing of raw materials, safe production, delivery of essential commodities and management of associated waste.
 <p>Education</p>	<ul style="list-style-type: none"> Promote public health literacy and safe learning environments Identify approaches and prepare to sustain education through different distance learning modalities during the acute stages of a pandemic, and 	<ul style="list-style-type: none"> Support health workforce needs.
 <p>Social welfare</p>  <p>Housing and public works</p>	<ul style="list-style-type: none"> Identify vulnerable groups who are likely to be more affected in an emergency and develop social safety measures through community engagement Promote standards that maximize ventilation to reduce respiratory pathogen transmission Promote infrastructure, public buildings and open spaces that reduce crowding and maximize ventilation 	<ul style="list-style-type: none"> Increase availability of public and green and blue spaces that are accessible to all for ventilation and to mitigate the mental health impacts of a pandemic, and Make arrangements to safely manage the acute accumulation of waste during a pandemic including that associated with medical products such as PPE.
 <p>Water</p>	<ul style="list-style-type: none"> Improve access to facilities such as hand hygiene capacity that reduce respiratory disease spread especially in informal settlements, and 	<ul style="list-style-type: none"> Initiate campaigns during seasonal or epidemic respiratory disease events on disease reduction measures such as hand hygiene and respiratory hygiene.

Sector	Interdependencies
 <p>Social welfare</p>  <p>Law and order</p>	<ul style="list-style-type: none"> Identify and mitigate risk of violence during pandemics including for domestic violence and gender-based violence.
 <p>Finance</p>	<ul style="list-style-type: none"> Develop, advocate and implement an investment case for long-term public and private financing to strengthen respiratory pathogen pandemic preparedness as part of health security Identify and engage in innovative financing models to prepare for and mitigate future respiratory pathogen pandemics, and (c) identify mechanisms to continue minimum financial services including deposit and lending services that reduce socio-economic disruption during a pandemic.
 <p>Defence and security</p>  <p>Critical manufacturing</p>	<ul style="list-style-type: none"> Identify surge capacities for supply chain management, stockpiling and distribution and Identify medical surge capacities including physical infrastructures such as military hospitals and medical personnel.
 <p>Energy</p>  <p>Dams</p>  <p>Water</p>	<ul style="list-style-type: none"> Identify approaches to sustain energy provision and water supplies including irrigation for food production during a pandemic.

Annex 3: Case studies and technical resources to support implementation of respiratory pathogen pandemic preparedness planning

Component	Case studies and technical resources (use hyperlinks available online)
Emergency Coordination	<p>Case Studies</p> <ul style="list-style-type: none"> Islamic Republic of Iran: Effective multisectoral and multi-level coordination to develop a preparedness plan (1). Viet Nam: Early, strong actions and whole-of-society approach to control COVID-19 (2) (see page 116-122) <p>Resources</p> <ul style="list-style-type: none"> Good Emergency Management Practices: The essentials. A guide to preparing for animal health emergencies (3) Framework for a Public Health Emergency Operations Centre (4) Multisectoral Preparedness Coordination Framework (5) Financial Sector Assessment (6)
Collaborative Surveillance	<p>Case Studies</p> <ul style="list-style-type: none"> Nigeria: Scaling up genomic sequencing (7). Region of the Americas: Strategy to scale up genomic surveillance (8) <p>Resources</p> <ul style="list-style-type: none"> Tripartite zoonoses guide (9)
Community Protection	<p>Case Studies</p> <ul style="list-style-type: none"> COVINFORM: Supporting decision makers to protect vulnerable populations (10) Germany: Facilitating evidence-based risk communication using fact boxes on COVID-19 mRNA vaccines (11) Puerto Rico: Preparing for the infodemic (12) <p>Resources</p> <ul style="list-style-type: none"> Collective Service for risk communication and community engagement (13) Early AI-supported response with social listening (EARS) (14) Emergency risk communication training (15) EPI-WIN: WHO Information Network for Epidemics (16) SocialNet: Social and behavioural insights COVID-19 collection tool (17) Taxonomy and Glossary of Public Health and Social Measures that may be Implemented to Limit the Spread of COVID-19 (18) WHO strategy for engaging religious leaders, faith-based organizations and faith communities in health emergencies (19) WHO training on infodemic management (20)

Component	Case studies and technical resources (use hyperlinks available online)
Clinical Care	<p>Case Studies</p> <ul style="list-style-type: none"> Caribbean sub-region of the Americas: Capacity boosting of nurses to respond to COVID-19 (21) Pakistan: Maintaining TB health services during the COVID-19 pandemic (22) Uzbekistan: Strengthening clinical management practices (23) <p>Resources</p> <ul style="list-style-type: none"> Caring for those who care: guide for the development and implementation of occupational health and safety programmes for health workers (24) Core components for infection prevention and control programmes (25) Framework and toolkit for infection prevention and control in outbreak preparedness, readiness and response at the national level (26) Guidelines for the clinical management of severe illness from influenza virus infections (27) Health workforce policy and management in the context of the COVID-19 pandemic response (28) Infection prevention and control of epidemic- and pandemic-prone acute respiratory infections in health care (29) National workforce capacity to implement the essential public health functions including a focus on emergency preparedness and response (30) Planning considerations for human and financial resources for COVID-19 vaccination (31) The role of community health workers in COVID-19 vaccination: implementation support guide (32)
Access to Countermeasures	<p>Case Studies</p> <ul style="list-style-type: none"> C-TAP and Biotech Africa: Improving access to COVID-19 testing technologies (33) Somalia: COVID-19 Vaccine Delivery Partnership (CoVDP) to reach high priority groups (34) (see page 8) <p>Resources</p> <ul style="list-style-type: none"> COVID-19 vaccine introduction toolkit (35) International Clinical Trials Registry Platform (36) International Coordinating Group on Vaccine Provision (37) OpenWHO course: Pandemic Influenza Vaccines: National Deployment and Vaccination Plans (38) Pandemic Influenza Preparedness Framework (39) R&D Blueprint (40) The mRNA vaccine technology transfer hub (41).

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Annex 4: Data commonly available by local administrative offices that can support respiratory pathogen pandemic preparedness

Data commonly available from local administrative offices that can support respiratory pathogen pandemic preparedness includes the following.

Urban settlement data, such as:

- Demographics
- Informal settlements and other vulnerable communities
- Housing and zoning
- Transport networks and usage
- Public and private facilities and resources.

Emergency, disaster and risk management data, such as:

- Emergency resources available
- Evacuation routes
- Supply chains
- Information on current and future hazards
- Vulnerabilities
- Health and care workforce geographic distribution
- Capacities and scenarios
- Population demographics.

Annex 5: Examples of assumptions in the national planning process

Assumptions made in the national planning process may include:

- **Inevitability but unpredictability of the next respiratory pathogen pandemic.** The time, origin, and type of respiratory pathogen for the next pandemic are unknown and require countries to think of a broad range of potential scenarios that may occur.
- **Severity of the pandemic:** Pandemics may be mild, moderate, and severe in terms of morbidity and mortality. During the early stages of the pandemic, it may be difficult to identify the severity of the pandemic. National, regional, and global pandemic investigations and studies and research efforts can support increased awareness of the pathogen, its transmission patterns, and the severity of its impact.
- **Immunity** Most people will have little or no immunity to a novel respiratory pathogen. Susceptibility will be different among different population groups and may affect require countries to consider how they will adjust their response measures based on sub-population susceptibility (for example, if children and/or young people are most affected; if older adults are most affected, and so on).
- **Pandemic course:** Multiple global pandemic waves are likely to occur. Countries should be prepared for multiple surges and reductions in cases, hospitalizations, and deaths over the course of the pandemic period.
- **Demand for health care, medicine and supplies:** Demand for health services, medical countermeasures, personal protective equipment, and other supplies are likely to outstrip supply especially early on. Stockpiles of products such as personal protective equipment, ventilators, medicines and other supplies may be considered. When supply is constrained, responders should recall the key principle of equity in access to life-saving products and other essential supplies.
- **Potential for social unrest:** Pandemics are extreme situations. The disruption of normal life, fear, and shortage of supplies including potentially food, fuel, and other everyday items may cause concern among populations and may lead to panic. Countries should actively engage in community protection measures, risk communication and community engagement to empower and enable ownership of actions that protect health and maintain socioeconomic well-being.
- **Absenteeism:** Workplace and school absenteeism will depend on the attack rate and the severity of the pandemic. Absenteeism may disrupt essential services (for example. transport, education, health system). Countries should have (multisector, multi-level, whole-of-society) business contingency plans to prepare for a range of absenteeism levels.
- **Whole-of-society impact:** Pandemics are likely to negatively impact all aspects of society including social, economic and political aspects. Critical infrastructure sectors, including public, private and humanitarian providers, need to have the capacity to surge to minimize disruption.

Annex 6: Examples of triggers for transitioning between operational stages for pandemic preparedness and response

Operational stage	Operational sub-stage	Triggers for moving between stages and sub-stages
Prevent & prepare	Respond	<p>Get ready</p> <ul style="list-style-type: none"> Information received from XXXXX of a novel respiratory pathogen outbreak outside national borders; or an alert received at national level from WHO; or an indication from a national surveillance body of a trend in acute respiratory infections which may overwhelm health systems; or declaration by WHO of a Public Health Emergency of International Concern.
		<p>Contain</p> <ul style="list-style-type: none"> First case/s or clusters have been detected in-country; or alerts/reports received from a sub-national unit seeking assistance to manage events such as atypical trends or severity associated with known respiratory pathogens; or a request for assistance from a sub-national level associated with the event.
		<p>Control and mitigate</p> <ul style="list-style-type: none"> Amplification and disseminated spread of the respiratory pathogen in-country; or disseminated spread of the respiratory pathogen in other countries in different parts of the world. <p>During this operational sub-stage, there may be scale up or scale down of response measures depending on the following and while considering broader socioeconomic impacts:</p> <ul style="list-style-type: none"> cases, deaths and hospitalizations reported in-country or globally; or vaccination coverage and its effect on transmission; or health system capacity to cope with the patient load; or availability and effective of therapeutic options to minimize health impact; or levels of population immunity in different sub-populations.
Recover	Scale down and sustain	<ul style="list-style-type: none"> Sustained global reduction in cases, deaths, or hospitalizations; or advice that the pandemic has reached a level where it can be managed under more routine arrangements; or termination of the Public Health Emergency of International Concern by the WHO Director General.

