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PUBLIC HEALTH GUIDANCE

Recommendations for preparedness planning for public health threats

Learning from recent public health crises: March 2025

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Abbreviations

AAR	After-action review
CDTR	Communicable Disease Threat Reports
COVID-19	Coronavirus disease 2019
EC	European Commission
EEA	European Economic Area
EU	European Union
GPMB	Global Preparedness Monitoring Board
HSC	Health Security Committee
IDHC	Infectious diseases of high consequence
IHR	International Health Regulation (2005)
JEE	Joint External Evaluation
NAPHS	National Action Plan for Health Security
NIH	National Institutes of Health
NPI	Non-pharmaceutical interventions
PHSM	Public Health and Social Measures
PoE	Point of Entry
PPE	Personal protective equipment
PRET	Preparedness and Resilience for Emerging Threats
RCCE-IM	Risk Communication, Community Engagement and Infodemic Management
SARS	Severe acute respiratory syndrome
SCBTH	Serious cross-border threats to health
SOP	Standard operating procedure
SPAR	States Parties Self-Assessment Annual Report
WHO	World Health Organization

Glossary

All-hazard approach in preparedness	An approach in which different hazards (outbreaks, cyberthreats, terrorism, extreme weather events etc) call for a similar health system response, and can therefore be addressed in a single preparedness and response plan [1].
After-action review	The process to review actions undertaken during the response to an event of public health concern by objectively observing, analysing gaps and/or best practices and identifying areas for improvement in preparedness and response activities [2].
Capacity	In the context of the self-assessment questionnaire for EU/EEA countries under EU Regulation 2022/2371 for serious cross-border threats to health, capacity is intended as an area of work within health preparedness. It encompasses prevention, preparedness and response planning as determined at national and, where appropriate, cross-border interregional level for the health sector. Seventeen such capacities are assessed in the EU questionnaire every three years.
Community engagement	Community engagement is the process of developing relationships and structures that engage communities as equal partners in the creation of emergency response solutions that are acceptable and workable for those impacted by them. The goal of community engagement is to empower communities to confidently share the leadership, planning and implementation of initiatives throughout the health emergency response cycle. [3]
Disinformation	False information disseminated with the deliberate intent to deceive or harm, usually for political, financial, or ideological gain [4].
Emergency plan	Documents that describe how an organisation will address an emergency. The term is sometimes used interchangeably with preparedness or operational plan, but there are some differences. They typically include components on mitigation or prevention, preparation, response management and recovery [5].
Epidemic intelligence	The process of detecting, verifying, analysing, assessing and investigating public health events that may represent a threat to public health. Providing early warning signals is a main objective of public health surveillance systems.
Event-based surveillance	The organised and rapid capture of information about events that are a potential risk to public health. Information can include rumours and other ad hoc reports transmitted through formal channels (i.e. established routine reporting systems) and informal channels (i.e. media, health workers and reports from non-governmental organisations) [6].
Governance	Overseeing the control and direction of something [7].
Hazard	Anything with the potential to cause harm, particularly to humans or animals. The presence of a hazard does not automatically imply a threat.
In-action review	In-action reviews refer to a real-time evaluation process that takes place during the implementation of a programme or intervention. It involves continuous assessment and learning while activities are ongoing allowing for timely adjustments and improvements.
Incident management system	Emergency management structure and set of protocols that provides an approach to work in a coordinated manner primarily to respond to and mitigate the effects of all types of emergencies, also called incident command system and it can be used to support recovery.

Indicator-based surveillance	The objective-driven periodic reporting of structured data on communicable disease cases and pathogen isolates. Indicator-based and event-based surveillance systems (see above) complement each other, enabling effective trend monitoring, planning and monitoring of prevention programmes, detection of multinational outbreaks, and timely and coordinated response.
Infection control measures	Measures practiced by healthcare workers in healthcare settings to limit the introduction, transmission and acquisition of infectious agents in healthcare settings (e.g. proper hand hygiene, scrupulous work practices and the use of personal protective equipment, such as masks or particulate respirators, gloves, gowns and eye protection). Infection control measures are based on how an infectious agent is transmitted and include standard, contact, droplet and airborne precautions.
Infectious diseases of high consequence	Also known as High Consequence Infectious Diseases (HCID), they constitute serious human health threats. Patients with such diseases typically develop severe symptoms and require a high level of care. The case-fatality rates can be high. [8].
Infodemic	An overabundance of information, both online and offline. It includes deliberate attempts to disseminate wrong information to undermine the public health response and advance alternative agendas of groups or individuals.
Misinformation	Incorrect or misleading information, different from disinformation in that it is not shared with a deliberate intent to deceive or harm [9].
National Action Plan for Health Security	A strategic plan developed by countries to enhance their ability to prepare for and respond to health emergencies, usually in response to recommendations provided by an assessment.
National Action Plan	A strategic document outlining the actions to be taken by a country in a specific area such as health security or recovery.
National Preparedness and Response Plan	Comprehensive guidelines and strategies developed by national governments to prepare for and respond to infectious disease outbreaks and other health emergencies. Many countries choose to make these all-hazard preparedness and response plans, addressing all types of crises (man-made, natural etc).
One Health approach	A multi-sectoral approach that recognises the interconnectedness of human health, animal health and the environment emphasising the need for collaboration among these sectors to address health threats [1].
Operational plan	An operational plan describes the way a preparedness or emergency plan is implemented, with timeline and benchmarks or indicators, if available, resources and roles and responsibilities of staff involved. A national preparedness and response plan may require more than one implementing operational plans.
Point of entry (PoE)	Passage for international entry or exit of travellers, baggage, cargo, containers, conveyances, goods and postal parcels as well as agencies and areas providing services to them on entry or exit.
Preparedness	The knowledge and capacities developed by government, professional response and recovery organisations, communities and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent or current crisis [10].
Public health and social measures	Decisions or actions aimed at preventing, monitoring or controlling the spread of diseases or contamination as well as combating severe health risks or mitigating their impact on public health. The term has replaced 'non-pharmaceutical intervention'.
Public health threat	The occurrence of a hazard that can pose a risk to human health.

Public health workforce	Those who work for public health agencies at all levels of government, community-based and voluntary organizations with a health promotion focus and who identify public health as being the primary part of their role [11].
Recovery	According to UNDP, it is the process of restoring livelihoods, health, economy, physical, social and cultural environments assets of a disaster-affected community according to the principles of sustainability and 'build back better' to avoid or reduce future disaster risk [12].
Resilience	In the context of health system recovery, resilience is the ability of the system to absorb, adapt to and recover from disruptions. It involves the capacity to withstand shocks, maintain essential functions during crises and bounce back to a state of normalcy efficiently.
Response	Measures aimed at mitigating the public health impact resulting from the occurrence of an event.
Risk assessment	The overall process of risk identification, risk analysis and risk evaluation.
Risk communication	The interactive transmission and exchange of information with people who are faced with a health risk or threat. Its purpose is to enable everyone at risk to take informed decisions for protective and preventive action. It includes a mix of communication and engagement strategies through dedicated resources to support public communication, media communication, social media communication, social mobilisation, health promotion, health education, community engagement and operational research, before, during and after health emergencies
Simulation exercise	A training activity that simulates real-life scenarios allowing participants to practice and refine their response to health emergencies. According to WHO, a simulation exercise is a form of practice, training, monitoring or evaluation of capabilities involving the description or simulation of an emergency, to which a described or simulated response is made [13].
Standard operating procedure	Documents that prescribe the operational steps to be followed in relation to processes or policies, so that they are performed in the same way every time to guarantee the outcome.
Validation	Confirming the authenticity of an event or incident when reported by an informal source (professional communication, media blogs). Formal communication from national authorities is considered as already validated.
Whole-of-government approach	An approach that involves all government agencies and sectors working in a coordinated manner to address health emergencies.

Executive summary

This document aims to provide public health authorities in European Union and European Economic Area (EU/EEA) countries with guidance for improved preparedness planning taking the lessons that have been identified through various activities in the context of recent public health crises (e.g. COVID-19 pandemic, mpox multi-country outbreak 2022–23) and translating them to concrete advice.

This document, together with the ECDC recommendations on the implementation of public health and social measures (PHSMs) for health emergencies and pandemics published in 2024, form a package of concrete recommendations for preparedness planning for the EU/EEA countries.

Lessons learned primarily from the response to the COVID-19 pandemic, but also from the response to the multi-country mpox outbreak in 2022–23, were collected through various activities from Member States, the European Commission, the World Health Organization (WHO) and the WHO Regional Office from Europe. We have then presented these in the form of specific recommendations for planners within each phase of the continuous cycle of preparedness (Anticipation, Response and Recovery), following a prototype structure of a preparedness and response plan. In each section, we have presented a relevant example from a Member State or international organisation to illustrate their practice or attempt to implement lessons after COVID-19 or the mpox outbreak. These examples were identified either through literature review or communication with representatives of the countries within ECDC's network for Preparedness and Response.

Annex 1 includes an overview of the main lessons for the public health sector and Annex 2 includes a compiled catalogue of documents, tools and other resources for public health preparedness planning.

Scope of this document

This document aims to provide public health authorities in the European Union/European Economic Area (EU/EEA) with guidance when they are revising or developing their preparedness plans to respond to public health threats. Its main aim is to translate the lessons that have been identified through various activities in the context of multiple recent public health crises (e.g. the COVID-19 pandemic, the mpox multi-country outbreak 2022–23) to concrete advice.

This document, together with ECDC's recommendations on the implementation of public health and social measures (PHSMs) for health emergencies and pandemics published in 2024, form a package of concrete recommendations for preparedness planning for EU/EEA countries.

These ECDC documents are parallel and complimentary to the Preparedness and Resilience for Emerging Threats (PRET) documents and the PHSM resources developed by WHO [14-16], and the Strategy and action plan on health emergency preparedness, response and resilience in the WHO European Region (Preparedness 2.0). However, our focus is on the EU/EEA countries and the EU legislation, as well as attempting to provide more concrete tips for planning in the area of public health, learning from our past responses and avoiding repeating the mistakes of the past.

An inherent limitation is that EU/EEA countries' public health sectors are differently structured from each other, meaning that advice will need to be adapted to local contexts. In many countries, it may be difficult to separate out the components of the public health sector dealing with infectious diseases from those dealing with public health in general or healthcare. We therefore include some basic advice derived from the lessons identified until now on healthcare preparedness focused on its application to responding to large outbreaks or pandemics. Although ECDC focuses on infectious disease threats, countries should consider this document relevant to addressing multiple types of threats in their preparedness plans in an all-hazard approach.

Target audience

The primary audience for this guidance is public health and other health stakeholders in EU/EEA countries collaborating in the revision or development of preparedness plans at regional or national levels.

Background

ECDC has described preparedness as a continuous cycle of planning process, identification and prioritisation of risks, training and simulation exercises (SIMEX), after-action reviews (AAR), evaluation of lessons learned, and implementation of the required organisational actions and changes. As a concept, defined by the WHO Global Preparedness Monitoring Board (GPMB), preparedness is having the knowledge, capacities and systems in place to reduce vulnerability and enhance resilience in a society [17].

The COVID-19 pandemic presented a unique example of a severe public health crisis, where coordinated public health and health system response was an absolute need and where existing preparedness plans, healthcare, and public health system capacities in EU/EEA countries and globally were challenged to their maximum. The pandemic also showed clearly that preparedness planning is an intersectoral exercise which should be both bottom up (particularly as regards risk communication, community engagement and infodemic management (RCCE-IM)), and top-down (e.g. description of roles and responsibilities, standard operating procedure (SOPs), etc.).

Public health crises like large cross-border outbreaks and pandemics have shown the need for preparedness to ensure as much as possible that countries can indeed manage health crises sufficiently and protect their population, and that the role of the public health sector should be established in the crisis management of such threats. The 2003 SARS-CoV outbreak led to the review of the International Health Regulations (IHR) and the introduction of both an annual self-assessment exercise (States Parties Self-Assessment Annual Report, SPAR) and the voluntary Joint External Evaluation (JEE) process for all WHO member states. In the EU, the same outbreak led to the founding of ECDC [18].

Similarly, the COVID-19 pandemic led to the adoption of a number of new pieces of EU legislation, including the Commission decision on establishing the Health Emergency Preparedness and Response Authority (HERA) 2021C/393 [19], Regulation 2022/123 reinforcing the mandate of the European Medicines Agency (EMA) in crisis preparedness and management of medicinal products [20], Regulation 2022/2370 strengthening ECDC's mandate including among other new tasks the organisation of country assessments and the EU Health Task Force, as well as providing non-binding recommendations to EU Member states [21]. Finally, EU Regulation2022/2371 on serious cross-border threats to health (SCBTH) [22] was also adopted, which aims to strengthen preparedness and response to health threats and improve the coordination between EU/EEA countries and EU mechanisms and structures. This regulation includes the requirement for EU/EEA Member States to

complete a self-assessment questionnaire on prevention, preparedness and response planning every three years. Capacities related to these areas in the questionnaire will be assessed by ECDC in coordination with other EU relevant agencies and bodies during this period; the first three-year cycle of country assessments runs between 2024 and 2026 [23].

In addition, in June 2024 the World Health Assembly agreed on a set of amendments of the International Heath Regulations (IHR), including the introduction of the definition of a pandemic emergency, a commitment of solidarity and equity for access to medical products and financing, the creation of National IHR Authorities to improve coordination at the national level and the establishment of the States Parties Committee to facilitate the effective implementation of the amended Regulations [24].

In conclusion, preparedness involves multiple levels and sectors, and it is not only about processes but also about people, i.e. it relies on well-functioning teams and good leadership. This is what we try to convey in this document, along the lines of Dr Anthony Fauci's words: 'Emerging infectious diseases are a perpetual challenge […] The only way to be prepared for the perpetual challenge is by being perpetually prepared.' [25]

Lessons for the public health sector from the COVID-19 pandemic

From the beginning of the COVID-19 pandemic, when its full impact and consequences were still unfolding, until the years after the emergency was over [26], international and national organisations have been undertaking reviews, audits and after-action reviews (AARs) and convened committees of experts to identify lessons from the response to this event. A compilation of lessons from the European Commission, ECDC and EU/EEA countries, as well as WHO, focusing mostly on the European region, is presented in Annex 1 of this document. Taken as a whole, these sources present several common lessons:

- Invest in and sustainably support preparedness activities including systematic updating and testing of plans.
- Good governance and leadership with a defined role for the public health sector, along with intersectoral and international cooperation, are needed in public health crises.
- Health systems and societies need to become more resilient, able to recover from various crises.
- Long-term investments in healthcare and public health workforce are needed, including on surge capacity solutions.
- Investment in surveillance systems and laboratory capacity, including for genome sequencing, are crucial for the response to public health crises. This includes planning for surge capacity solutions for surveillance and laboratory capacities.
- Implementation of public health and social measures (PHSMs) needs to be coordinated, guided by data and monitored closely.
- Investments in risk communication, community engagement and infodemic management capacities are needed to support the response to crises and also work to build trust in institutions and science.

These lessons form the basis of the following recommendations for public health preparedness planning, as we tried to convert them into advice and tips to help preparedness planners.

Methods

Individual lessons were collected from several activities by ECDC, including internal focus groups (100 ECDC experts), three EU/EEA meetings with approximately 70-120 participants each from the national level who are experts in the areas of public health preparedness, behaviour sciences, modelling and communication. In addition, ECDC staff participated in multiple after-action reviews focusing on different aspects of the response to the COVID-19 pandemic in several EU/EEA countries in 2022 (6), 2023 (5) and 2024 (2). ECDC also received 22 documents from 12 EU/EEA countries on lessons identified from the pandemic after a general call to Member States in 2022. Finally, in the context of a scoping literature review (see Annex 1) a further 47 peer-reviewed articles and 11 grey literature documents were identified focusing on lessons from the COVID-19 pandemic.

A limitation to identifying lessons may result from the fact that not all countries or regions undertake or publish relevant after-action reviews or other types of evaluation, and ECDC received documents from 12 Member States. This means that there may be more lessons that have not been identified, but we tried to balance this limitation by including more activities.

Comments and lessons from all the activities were included in an Excel file under nine thematic areas: collection and analysis of data and evidence, international coordination/collaboration and preparedness planning, enhancing the response capacity in the EU, governance and decision-making processes, risk communication, behavioural and social science insights, health system issues (including public health system). They were also mapped on the corresponding phase of the ECDC Preparedness cycle. Following that, they were included in the

description of the relevant section of the cycle in this document as advice for preparedness planning modifying the text accordingly and including references as available.

Examples of practices presented in the boxes in each section are included to showcase relevant activities. They are derived from the literature review findings and/or ECDC and reviewer expert opinion and advice. These are by no means the only ones, and more examples of practices certainly exist at the country level.

Specifically, for the RCCE-IM section, some examples were drawn from the response to the multi-country mpox clade II outbreak 2022-23, as civil society organisations took an active role in engaging with the affected communities to assist in controlling the outbreak and spreading the messages of self-protection and vaccination.

Recommendations for public health preparedness planning

Starting the planning process

While pandemics are inherently unpredictable, appropriate preparation and planning can aid in their effective management and mitigation. Investments and improvements in preparedness planning and mitigation measures should be accompanied by a whole-of-government and whole-of-society multidisciplinary approach. This will strengthen and improve the resilience of the health systems as well as the society as a whole, when responding to health crises such as future pandemics.

Most Member States identified having an updated preparedness plan as being essential. When elaborating further on the qualities of the national emergency plan for health threats, public health experts mentioned that it should in principle be generic and all-hazard, but flexible and scalable, so as to cover crises of different scale and/or duration.

As mentioned above, the planning process is continuous (Figure 1). After the identification and prioritisation of risks, and the finalisation of the preparedness plan (see Overview of Preparedness Plan section below), training and simulation exercises should be organised to familiarise all involved staff with the new plan and verify that it is working. After-action reviews and evaluation of lessons learned can be used after each activation of the plan for any reason or after a simulation exercise to implement the required organisational actions and changes. And the cycle starts again.

Specific recommendations for planners

- Before starting the development/update process for the preparedness plan, ensure that this process is supported by the appropriate people, both at the strategic level and at the operational level within the responsible authority or organisation (e.g. Ministry of Health, public health institute, etc).
- Consider introducing a legal obligation for the regular updating of emergency preparedness plans.
- Ensure sufficient resources for this task are available by defining a timeframe for the development/update of the plan, as well as the necessary person/time required from the staff and the estimated costs. Ensure that the time needed for consultation with other experts, training of stakeholders and simulation exercises is factored in.
- Set up an intersectoral working group for the development or revision of the plan, ensuring appropriate administrative support. Members of the group should be officially nominated to ensure their commitment to the activities of the group. While this is a necessary step for effective operational plans - where representatives of different sectors contribute actively to define and implement the parts of the plan that are under their responsibility – it could be less relevant for strategic plans in which one sector takes responsibility for developing it and other sectors are consulted thereafter.
- Competencies should be distributed among multiple individuals to ensure continuity and knowledge/responsibility sharing in case of staff turnover.

Review and adapt the response framework

Legal framework

Several countries reported that existing legislation governing the response to large communicable disease outbreaks, or a pandemic, were outdated or non-existent. Many countries discovered that the public health authorities had no power to implement certain measures or that the existing legislation prevented them from acting fast enough.

Countries had to develop or update their legislation governing communicable diseases during the COVID-19 pandemic, and this added significant pressure to the public health staff that was already responding to the health crisis. Moreover, such legislative changes usually take long to come into force or have to be enforced via emergency procedures, which may have affected negatively the public's perception and response or acceptance.

In addition, the use of PHSMs during the COVID-19 pandemic generated new evidence on their effectiveness, applicability and impact, thus allowing public health authorities to employ more refined and targeted PHSMs in

future crises. However, in order to maximise the advantages of such lessons learned, it is important integrate them in relevant legislative frameworks, enabling public health to advice on the use of specific PHSMs when needed [27].

In this direction, the revision of existing legislation and the enactment of new laws to address the specific challenges of a pandemic were considered essential for internal country coordination [28-30].

Specific recommendations for planners

- Map existing legal basis and update or adapt it for governing the control of communicable diseases in different phases of a crisis. This legislation should support emergency plans while taking into consideration human rights, ethics, and data protection issues. The legislation should also be aligned with the IHR and with Regulation (EU) 2022/2371.
- Establish broader governance capacities and capabilities to manage emergency response considering all administration levels based on the national constitutional framework;
- Explore if there are gaps in legislation or other administrative tools hampering the establishment of preparedness plans (and their update) at all administration levels.
- The legal framework should include a requirement for hospitals to develop their own emergency response plans.
- Data protection issues related to the need for the collection of new sets of epidemiological or other data for the monitoring of the epidemiological situation and/or the monitoring of the implementation, impact and effectiveness of PHSMs should be clarified in legislation during peace time, and training on data sharing requirements for public health should be provided to data providers;
- Prepare legal and financial mechanisms to ensure the accessibility to surge capacities and resources (human, financial and material) that are needed for a comprehensive response;
- Train and inform new employees in the public health sector about the existing legislation governing public health actions, its potential limitations and the processes in place when responding to a crisis.

The following example on rapid legislation changes comes from Germany, although all countries in the EU/EEA had to develop and update decrees and other legislative tools many times to implement measures and facilitate their response to the COVID-19 pandemic.

Box 1. Example of rapid legislation changes: Germany [31]

During the pandemic, Germany promptly enacted emergency laws to facilitate coordinated governance and response across various sectors, while also empowering governments to undertake necessary actions. For instance, on March 25, 2020, the parliament passed the COVID-19 Hospital Relief Act. This legislation encompassed provisions aimed at ensuring hospital funding and maintaining their financial stability. The associated costs of these measures are covered by the Central Reallocation Pool, funded through Social Security contributions and taxation. The primary objectives of the law were to bolster hospital capacity by offsetting revenue loss, offering financial aid, enhancing efficiency in COVID-19 incident management, and reducing administrative burdens.

Furthermore, on 28 March 2020, the Federal Parliament passed the first Act for the protection of the population in case of a pandemic of national importance. Subsequently, on 14 May 2020, a second law, extending the provisions of the first law, was enacted. These laws included a comprehensive package of measures addressing testing, reporting obligations for test results, the role of health and long-term care professionals, and their financing. Moreover, special regulations for private health insurance were established to safeguard the insurance status of patients.

Additionally, in February 2021, the Federal Government announced measures to provide financial support for health professionals. Collaboratively, with intensive care physicians, the Federal Government and the Länder were responsible for transferring COVID-19 intensive care patients from heavily affected regions to hospitals in less severely affected areas.

Governance and collaboration

Governance and intersectoral collaboration at the national level

From the lessons identified during the COVID-19 pandemic, country-level coordination and strong governance structures stand out as essential elements of an effective response.

Decisive public health leadership at national and sub-national levels is deemed important to face a crisis. Both a central administrative authority within the healthcare sector and the government, that can implement rapid and effective decisions and an efficient collaboration and coordination among regions and lower administration levels are key aspects.

Furthermore, the COVID-19 pandemic has highlighted the fact that health sits at the intersection of multiple sectors (economy, education, trade etc) and that a stronger intersectoral collaboration contributes to a better public health response. However, the role of public health in national crisis management has often not been formalised in legislation, as well as the recognition that working relationships and collaborations need to be built and maintained in peacetime to also function during crises.

The experience of PHSM implementation in the COVID-19 pandemic also shows the need for close intersectoral collaboration at the local, regional, and national/federal levels, as public health measures were implemented widely in a variety of sectors e.g. in public transport, education, borders, entertainment and many other sectors [27,32].

Specific recommendations for planners

On governance:

- Describe clear decision-making processes for crisis management, i.e. defining which authority is responsible for what and at what level. ECDC has produced a report on decision-making based on evidence during public health emergencies [33].
- Multiple meetings may be needed for clarifying the mandate of each sector in operational plans, and later for updating processes and/or standard operating procedures (SOPs). Reviewing cycles for the whole plan can be agreed in advance or may be dictated by legislation.
- Organise after-action reviews (AARs) with stakeholders from other sectors for the review of the response to any outbreak or public health emergency in the country to gather information about what went well and what needs to be changed/updated in the plan.
- Organise simulation exercises involving multiple sectors to test new or updated plans.
- In some countries, national emergency plans need to be co-signed by multiple Ministries or be adopted by the parliament. These processes need to be clarified and accounted in the timeline.

On intersectoral collaboration:

- At national level, promote cooperation among regions/municipalities and better integrate them into preparedness efforts. Multi-disciplinary expert advisory groups play a significant role in advising both the operational and strategic levels in a crisis, e.g. Pandemic Advisory Committee.
- Initiate and coordinate interaction mechanisms among regions/municipalities such as collaborative networks, regular collaboration meetings to enhance coordination and information sharing.
- Platforms, forums and procedures for sharing/collecting data should be developed in peacetime before any next public health emergency [27].
- Officially nominating an intersectoral working group for the development or revision of operational plans may facilitate participation of other sectors. Pre-established partnerships (e.g. those established during the response to COVID-19), if maintained, can enhance the speed in crises decision-making. [27,34];
- Maintain the links to all involved sectors, preferably at all administrative levels (contact lists, etc) during 'peacetime'.
  - A good practice resulting from AARs is to maintain working groups with sectors that are particularly involved or affected. Examples include but are not limited to animal health and One Health perspective response, points of entry (PoE), education facilities, civil protection, etc.
  - For the future implementation of PHSMs it may also be important to identify and maintain links to the appropriate collaborating sectors and ministries, as well as identify the focal persons in each one.

The following example of an attempt to create an intersectoral crisis unit during the crisis comes from France and is mentioned in the OECD report 'First lessons from the COVID-19 pandemic' to illustrate the need for commitment from hierarchy and the right level of seniority in the representatives to enable decision-making [35].

Box 2. Example of an attempt for intersectoral collaboration during the crisis: France [36]

In March 2020, the French government established an Inter-ministerial Crisis Unit to effectively coordinate the efforts of various ministries in addressing the pandemic. However, despite its inter-ministerial composition, the Unit was perceived to be under the auspices of the Ministry of Interior. As a result, several ministries either abstained from participating in the Unit's meetings or opted to delegate 'junior' representatives who lacked the authority to commit on behalf of their respective ministries.

The assessment conducted by the French 'Mission on the quality control of the management of the health crisis' recommended the active engagement of all ministries at a senior level to facilitate enhanced inter-agency collaboration within the Inter-ministerial Crisis Unit.

International collaboration

International collaboration is essential when dealing with a large public health crisis to agree on cross-border measures, coordinate response, discuss measures potentially affecting travel and import/export of goods, share new knowledge and capacities, coordinate research activities and provide assistance to heavily affected regions and countries.

At the EU level, the Health Security Committee (HSC) coordinated by DG SANTE is the main operational country-representative forum which plays an important role in the coordination of prevention, preparedness and response planning for SCBTH.

At the political level, the Integrated Political Crisis Response (IPCR) mechanism is a tool for the management of crises which comprises government representatives from the member states and enables the presidency of the Council of the European Union to coordinate the political response to major cross sectoral and complex crises by bringing together EU institutions, affected member states and other key stakeholders [37].

ECDC plays a pivotal role in coordinating surveillance networks (in some cases in collaboration with WHO Regional Office for Europe) for the different diseases, including the EU and national reference public health laboratories. ECDC is coordinating the newly established network of EU Reference Laboratories for public health, which were first mandated under the Regulation 2022/2371 on serious cross-border health threats. Their aim is to support national reference laboratories and coordinate work on reference testing methods and protocols, reference material resources, external quality assessments, scientific advice, research, alert notifications and support outbreak response as well as training [38]. These networks are essential pillars of the pandemic response, providing timely data, monitoring trends, and ensuring a rapid and coordinated reaction across Member States.

In addition, in 2021 the European Commission (EC) established as a Commission service the Health Emergency Preparedness and Response Authority (HERA) to increase the effectiveness of the preparedness for and response to SCBTH. DG HERA cooperates as needed with the HSC, ECDC, EMA and other Union services to provide medical countermeasures and equipment as needed using available EC instruments like joint procurements for medical countermeasures and/or medical equipment or PPE [39].

Finally, Regulation 2022/2371 on serious cross-border health threats requires in Article 5 the development of a Union prevention, preparedness and response plan. This plan aims to promote an effective and coordinated response to cross-border threats to health at the EU level. It should establish cooperation of the European Commission with other agencies and the member states promoting synergies, especially in the areas of early warning, risk assessment, risk and crisis communication, medical countermeasures, emergency research and continuity of healthcare services. The Commission foresees this plan to be a living document working under the principles of solidarity, subsidiarity, complementarity, all-hazard and one health, involving whole-of-government and whole-of-society. The Union plan is foreseen to be completed in 2025.

In December 2021, the World Health Assembly decided to embark on negotiations among the member states, and with international organizations and civil society representatives on a pandemic prevention, preparedness and response accord. Negotiations are challenging and are still ongoing [40]. In June 2024, WHO Health Assembly approved amendments to the IHR(2005) and states are called to implement them in the coming years.

Specific recommendations for planners

- Active participation in the meetings, activities and initiatives in the ECDC networks to strengthen collaboration and maintain preparedness. Participation at the European Commission level for decision-making activities is needed by all Member States, particularly when response measures are decided.
- Prepare at the national level the necessary procedures to participate in EU joint procurements or multi-centre clinical trials by making the necessary connections between public health, advisory committees and national drug agencies.
- Active participation is needed by the Member States at the WHO global health level discussions (e.g. at the World Health Assembly meetings) to formulate the global coordination framework in potential future pandemics.
- Particularly important would be to form agreements and collaborations between border regions and countries for the response to outbreaks (e.g. on exchanging data, movement of patients etc).

The following example comes from one of the most important international collaboration activities decided during the crisis in the EU, which was the joint EU-COVID-19 vaccine procurement, and in particular from the EU auditors report on this activity.

Box 3. Example of international collaboration: EU COVID-19 vaccine procurement [41,42]

According to a 2023 study by the European Parliament's Special Committee on the COVID-19 pandemic:

'The EU vaccines strategy built on the use of APAs [advanced purchase agreements] with vaccine producers to secure the availability of vaccines in the EU in a short timeframe, in a sufficient quantity, and at an affordable price. The negotiation of APAs was the first step in the implementation of the EU vaccines strategy. The APAs ensured a united EU approach to the procurement of vaccines with the aim of promoting efficiency, equality, and solidarity among the Member States.' Negotiations were undertaken by DG SANTE, 'together with a joint negotiation team formed by representatives from seven EU Member States (Spain, France, Sweden, Germany, the Netherlands, Italy, and Poland) appointed by a Steering Committee in which all EU Member States were represented.' [41]

According to the EU audit report on EU COVID-19 vaccine procurement:

'The EU launched its vaccine procurement strategy in June 2020. By the end of 2021, it had signed €71 billion worth of contracts securing up to 4.6 billion doses. We conclude that the EU secured a diversified vaccine portfolio for Member States, though it started procurement later than the UK and the US…

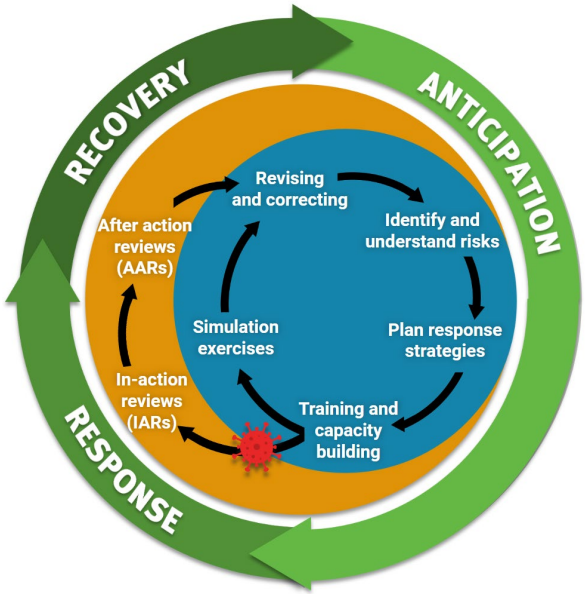
The EU's negotiators were better able to secure the EU's procurement objectives in the later contracts it signed with vaccine manufacturers […] The terms of the contracts evolved over time and those signed in 2021 have stronger provisions on key issues such as delivery schedules and production location than those signed in 2020 […] We found that the Commission had limited leverage to overcome supply challenges and the size of its impact on the ramp-up of vaccine production was unclear [42].'

Main components of a public health preparedness and response plan

Figure 1 below presents the ECDC model of preparedness and stresses that planning is a continuum from anticipation, where most of the planning takes place, to response to a crisis using existing structures and mechanisms, and finally recovery, where the updating of the preparedness plan should take place. This is valid for all administrative, regional, national, and international levels.

We tried to plot the lessons that were identified in recent public health crises in the three phases of the preparedness model (Anticipation, Response and Recovery), while at the same time outlining a simple prototype preparedness plan structure. Our hope is that planners in the different countries can use this document as their aid-memoir when going through their plan's structure and by reading the lesson points, they will avoid older practices and improve their response. WHO Preparedness and Resilience for Emerging Threats (PRET) initiative provides tools to develop plans and trainings focusing on pandemic preparedness from respiratory pathogens. It is another set of documents and tools that planners can use to develop their plans.

Figure 1. The preparedness cycle



Source: ECDC

Preparedness and response plans usually follow a generic structure, which was modified to follow the preparedness cycle, although the terminology may differ from country to country or even by sector, depending mostly on local practices. Here we include the advice as derived from the identified lessons for every phase of the cycle. The focus is mostly on the public health sector planning for responding to infectious disease emergencies, following the ECDC preparedness phases to maintain the consistency of messages.

Anticipation phase:

- **Mapping of capacities and capabilities**, represents essentially what does the plan refer to and what it covers. In the case of health threats, most relevant capacities include the public health and healthcare systems, including laboratory diagnostic capabilities.
- **Risk prioritisation** is a process that enables countries to identify the most relevant risks for their context to assist preparedness planning.
- **Key assumptions and/or planning scenarios,** these usually cover the diseases and/or other hazards addressed in the plan as per the risk ranking above. For each pathogen known transmission routes, data on the basic reproductive number R0, treatment modalities, unknowns etc should be addressed. Planning scenarios can be used as a complimentary tool to address unknown qualities or characteristics of the disease(s), and present possibilities forth evolution of a potential outbreak, e.g. a low, medium or high impact scenario for a new pandemic influenza virus.

Response phase:

- Alert mechanism and collection/analysis of surveillance data
- Response mechanisms
  - Coordination structures, these include usually an operational and a strategic level with a central focal point such as an Emergency Operations Centre (EOC).
  - Emergency response
- **Risk Communication**, Community Engagement and Infodemic Management (RCCE-IM)

Recovery phase:

- Identify lessons.
- Validate lessons.
- Action plan to incorporate changes to the preparedness plan, so that the cycle starts again.

Anticipation

Anticipation as such is not usually included as a separate section in the preparedness plans, although the following sections of mapping capabilities, risk prioritisation and key planning scenarios are, as they describe the background for which the plan is developed and is expected to function.

Mapping of capacities and capabilities

The focus here is mainly on mapping the capacities and capabilities of the health system as we outline preparedness planning for health crises. In national emergency planning several more capacities and capabilities need to be taken into consideration, e.g. national critical infrastructures, vulnerability of the supply chain including the supply of pharmaceuticals, military capacities for emergency care or other evacuation needs, large equipment for use in disaster response, chemical detection laboratories etc. These are assessed in a yearly cycle by WHO globally under IHR with the Self-Assessment Annual Report (SPAR) [43] and in a three-year cycle by the European Commission for EU/EEA countries under the Regulation 2022/2371 [22].

Health workforce

Investment in the recruitment, retention and training of healthcare and public health professionals including public health laboratory personnel was highlighted in lessons from the COVID-19 pandemic from various perspectives. A well-functioning resilient health system can respond to a variety of emerging health threats. In many EU/EEA countries, both the healthcare and the public health workforce at federal, regional and local levels were depleted starting from the years of the EU financial crisis (2008-2014) and in the years that followed. The COVID-19 pandemic exacerbated an already critical situation.

During the pandemic various strategies were adopted to scale up staff capacity to provide healthcare, as well as for the public health response (e.g. contact tracing, surveillance etc) and to meet the increased testing needs as laboratory personnel. Countries employed multiple approaches by recruiting medical and nursing students, transitioning part-time workers to full-time roles, modifying work schedules, cancelling leaves of absence, and bringing back inactive or retired healthcare professionals and using volunteers. Some countries also sought assistance from the military and private sector.

Many of these positions have unfortunately not been retained due to budgets returning to the pre-pandemic levels of financing. In addition, burnout due to increased pressure and long working hours in a prolonged crisis environment, has further impacted the numbers of active public health professionals in the EU/EEA. Countries reported a lack of resources at all administrative levels, and this will have an impact on future planning activities.

Specific recommendations for planners

- Map the existing public health, laboratory and healthcare workforce and forecast needs;
- Invest in the recruitment and retention of an adequately skilled public health workforce, including laboratory staff;
- Build an agile and strong public health workforce which is trained on all-hazards preparedness and are up-to-date in the use of new systems and methodologies (e.g. use of molecular epidemiology and mapping tools, new statistical analysis tools), with continuous enhancement of their knowledge, expertise and competences;
- Plan regular simulation exercises for the staff (including ancillary and support staff) and organise training for the areas in need of improvement;
- Provide incentives to attract young professionals to the field of public health and to medical specialties in the front line (e.g. emergency medicine, critical care, infectious diseases). Incentives can be a defined carrier path in public health, improved working conditions and continuous education/training opportunities, recognition of their work and specialty, as well as better monetary compensation;
- Foster collaborations during peace time with academia to enhance the research capacity during crises for outbreak related research;
- Define emergency procedures for surge capacity of staff, e.g. how to de-prioritise non urgent care, how to redistribute and repurpose existing workforce in case of an emergency, how to recruit and employ new staff in emergencies; include in the planning the possibility of providing international collaboration and support to other countries in need [44,45];
- Develop already in peacetime introductory training for responding to public health crises and develop an induction course that can be used for new staff recruited in crises;
- Implement programmes and allocate resources to protect the mental health and well-being of staff; keep up to date schedules and reports showing comparative workloads to prevent burnout and work exhaustion.

The following example comes from Iceland and a WHO report on health workforce [46].

Box 4. Example of initiative to retain the health workforce: Iceland

In May 2021, Iceland's Minister of Health established a national council to address staffing and educational challenges within the healthcare system. This council serves as a consultative body, offering guidance on education and employment priorities for healthcare workers, with involvement from various government entities and stakeholders. Representatives from ministries, national healthcare institutions, primary healthcare, universities, the Icelandic Association of Local Authorities, and the Directorate of Health compose the council. Its primary objective is to enhance the alignment between healthcare workers' education/training and employment needs.

Key objectives include strengthening the healthcare workers' education system, particularly specialist and postgraduate training programs; promoting task-sharing among healthcare professions to foster collaboration; enhancing system self-sufficiency; ensuring adequate staffing in rural areas; and conducting workforce profiling and future needs assessments. Operational for over a year, the council remains dedicated to expanding the healthcare workforce and improving productivity within the system through educational advancements and strategic workforce planning.

Health system

Health systems, including public health, have developed very differently in EU/EEA countries. Some are more centralised, and some are highly de-centralised. The COVID-19 pandemic revealed several weaknesses in all of them. Ensuring preparedness and health system readiness for future emergencies should happen both in the healthcare area and in the public health sector.

At the society level, the COVID-19 pandemic brought health inequalities in the spotlight, exacerbated them and underlined in particular the importance of access to health services and healthcare for all during an infectious disease emergency [47].

Preparedness and management of the healthcare sector is a national responsibility, and the EU legislation has a limited remit in that area. However, drawing from the lessons learned, two key aspects are involved: optimising healthcare facility staffing and readiness and having an adequate supply of personal protective equipment (PPE) and essential medical equipment.

The need to invest in better collaboration between public health and primary healthcare and health promotion has also been identified as a significant lesson. Primary care health professionals can maintain access and continuity of health services in their communities, can triage patients and assist their early diagnosis, can address mental health concerns due to PHSMs and finally can assist with risk communication and community engagement.

For the public health sector, it is of utmost importance to strengthen and update the epidemiologic surveillance capacities, laboratory testing capabilities and sequencing, improve contact tracing and strengthen outbreak related research capacity. The collection and interpretation of data was central to monitoring the evolution of the pandemic and formed the basis of decision-making. Several lessons were identified in relation to the systems, processes and analysis of data for all activities.

Specific recommendations for planners

- As public health professionals, advocate for a 'Health-in-all-policies' approach and the prioritisation of adequate budget for the health system in national spending. Advocate for the alignment of resource allocation with equity and efficiency goals. Finally, advocate for the need to identify and address inequalities in affected communities in the context of responding to an infectious disease emergency;
- For healthcare systems responding to communicable disease threats, and drawing from the lessons identified so far:
  - Require all healthcare facilities to develop their own emergency response plans including for the priority health threats at national level; advocate for the necessary legislative amendments, if needed;
  - Designate referral hospitals/facilities for high consequence infectious diseases and implement necessary training and continuous education for all teams involved;
  - Define procedures for surge capacity for healthcare staff, particularly in referral hospitals;
  - Establish flexible pandemic response infrastructures, with designated alternative care sites and optimised patient workflows, and explore innovative service delivery models in healthcare;
  - Define procurement procedures for emergencies during peace time as regards personal protective equipment (PPE), including the coordination for the importation and licensing of different PPE types/components;

  - Define procedures and criteria for postponing elective medical encounters and surgeries in the various phases of the crisis; consult with ethics and health services experts to maintain continuity of care for chronic diseases, as well as immunisation programmes;
  - Define procedures to transfer services from acute facilities to community-based settings when needed, allowing for more accessible and localised care;
  - Build capacity by training healthcare workers both on the plan and SOPs, as well as on the management of high consequence infectious diseases, emerging threats and public health issues
  - Build capacity to implement telemedicine to enable remote healthcare services, facilitate consultations, diagnoses, and monitoring of patients, renewal of prescriptions and continuity of care;
  - Shift towards patient-centred health promotion, community health support, and targeted health information interventions that cater to the specific health literacy needs of individuals with co-morbidities.
- For the public health sector preparing to respond to communicable disease threats:
  - The public health sector should be required to develop their own emergency response plan for the priority health threats that have been identified at national level;
  - Define procedures for surge capacity for public health staff, including laboratory staff and supporting staff for investigations or contact tracing activities;
  - Digitalisation is the way forward: invest in electronic surveillance systems with automated data collection for all diseases with direct links to laboratory, and if possible, clinical records;
  - Invest in built-in redundancies in the data collection systems to allow for the management of large amounts of data; surveillance systems should be robust but flexible and scalable;
  - Develop protocols for data protection, security standards and data governance when building new systems and in all transfers of public health data;
  - Invest in the interface of surveillance systems with national registries (e.g. cause of death registers, immunisation registries);
  - Invest in strengthening the analysis, interpretation and presentation of epidemiological data; identify needs and tailor the reports to the needs of policy-makers and the public;
  - Invest in building intersectoral procedures and standards for uniform data collection across different institutions/regions to harmonise and ease data analysis;
  - Build capacity by continuous training public health professionals both on the preparedness plan and SOPs, as well as on the response to high consequence infectious diseases and emerging threats according to risk prioritisation (see risk ranking section);
  - Strengthen data collection processes and health information systems for contact tracing; develop new or maintain existing technological solutions for contact tracing, including anonymised and decentralised contact tracing apps.
- For the laboratory sector preparing to respond to communicable disease threats:
  - Invest in maintaining and improving the capacity for laboratory testing of high consequence infectious diseases, including molecular epidemiology and whole genome sequencing (WGS) capacity by providing continuous training to staff and improving laboratory infrastructure and biosafety standards;
  - As with surveillance systems, digital laboratory information management systems are needed and should be integrated with the national surveillance systems. Establish rapid communication protocols between laboratories and public health authorities by developing standardised protocols for timely data sharing.
  - Encourage networking of laboratories and collaboration at regional and national levels.
  - Require public health laboratories to develop and maintain emergency response plans
  - Encourage regular participation in ECDC's EQA programs to validate and enhance laboratory capabilities in detecting and characterising high-consequence pathogens, ensuring consistent diagnostic accuracy
  - Define procurement and financing procedures for emergencies during peace time as regards reagents and other laboratory equipment to enable increased testing capacity;
- Strengthen the capacity to analyse and follow up the fast-emerging scientific literature during an emergency.

Risk prioritisation

Risk prioritisation of infectious disease threats involves assessing and ranking the likelihood and potential impact of various infectious disease threats. It is a qualitative, sometimes subjective, estimation of likelihoods and consequences. Risk ranking is used to inform strategic planning, qualify preparedness options, and guide the effective resource allocation for public health emergencies preparedness and response efforts and is integral part of the emergency preparedness cycle.

For the purposes of emergency preparedness, assessments of current and emerging risks that consider threat trajectories and current capabilities to respond to the threat. ECDC aims to resume threat prioritisation exercises on a regular basis.

Specific recommendations for planners

- There are numerous approaches to prioritising infectious disease threats. A multisectoral approach including e.g. animal health experts, multiple medical specialties and sectors such as climate through consultation with various means (e.g. Delphi surveys, focus groups and their combinations) is advised.
- ECDC is reviewing a threat prioritisation approach based upon multi-criteria decision analysis (MCDA) with the intention of enabling prioritisation of health threats for preparedness at the national and EU levels.
- Prioritisation lists can differ depending on the purpose they are created for (e.g. mandatory notification of cases or outbreaks, priority threats for vaccine production, etc).

The following example on risk prioritisation comes from Finland, although other countries also embark on this type of national prioritisation exercises to provide a risk list for planning to the different sectors of the government and the regional and local levels of administration.

Box 5. Example of national risk prioritisation driving preparedness planning: Finland [48]

The national preparedness framework in Finland, including for the health sector, follows the National Risk Assessment, which is updated every five years. All ministries participate in this process by identifying and proposing threat scenarios to an intersectoral high-level committee at the Ministry of Interior. A final risk list is developed and published, following public consultation. This list defines the risks that the different administrative branches and other stakeholders must be prepared for and is addressed by all preparedness plans at all administrative levels of the country.

Key assumptions and planning scenarios

This part of the plan can include the key assumptions for the pathogens addressed by the preparedness plan. These may include the main properties of each pathogen or pathogen group (transmission routes, known R0, information on therapeutics and their effectiveness etc). These properties will underpin the main response strategies e.g. control and elimination or mitigation.

For countries following an all-hazard approach this part can include all other prioritised hazards (e.g. natural disasters, earthquake, technological disasters etc) with the relevant planning assumptions.

Modelling can help in this phase of planning but also provide outputs to help answer different questions in the present, past or future of an outbreak. Situational analysis combining the epidemiological data with modelling, and forecasting models were frequently used during the COVID-19 pandemic, as well as retrospective analysis of the effectiveness of measures. Modelling can provide input to addressing various questions, e.g. assessing vaccination strategies, impact of a new variant, behaviour modelling or longer-term scenarios for the coming years.

Specific recommendations for planners

- One of the lessons from the COVID-19 pandemic was that planning should not be limited to one scenario only, but rather include various scenarios, and even worst-case scenario(s) [49,50]. In this respect, strengthening the capability to perform mathematical modelling to assist decision-making was identified as significant lesson.
- Modelling teams have also published their own lessons from the COVID-19 pandemic, which are centred around fostering a working relationship between academic modelling teams and policy-makers or public health authorities during peace time to better understand their needs and knowledge gaps, so as to be able to help during a crisis. In addition, they identified that better communication of the modelling results is needed, particularly towards policy-makers [49,50].

The following examples show the collaboration of modelling teams with public health authorities to assist in designing or validating measures.

Box 6. Examples of use of modelling tools during the COVID-19 pandemic: Greece, Italy and Spain

Greece [51]
An artificial intelligence learning system (Eva) was used to inform border policies in Greece through real-time estimates of COVID-19 prevalence in incoming travellers in summer 2020. According to performance testing, Eva identified 1.85 times as many asymptomatic infected travellers as random surveillance testing, and 1.25–1.45 times as many asymptomatic infected travellers as testing policies that utilise only epidemiological criteria.

Italy [52]
Retrospective modelling was used to evaluate the effectiveness of the gradual lifting of the lockdown measures in 2020 compared to alternative scenarios. Modelling confirmed that the gradual opening of sectors did not significantly affect the R0 of COVID-19 and underlined the importance of opening when both R0 and incidence are low.

Spain [53]
Retrospective modelling analysis of the implemented NPIs was performed to assess which significantly impacted the reproduction number (Rt) in seven Spanish provinces in the period August 2020 to January 2021. The effectiveness of measures varied considerably. The only NPIs with a significant effect were mandatory closing times for non-essential businesses, limited gatherings, and restricted outdoor seating capacities (contributed negatively to the virus's transmission) as well as curfews (positive effect on transmission). Regional mobility restrictions and limited indoor seating capacity showed no effect.

Response

Response activities are multiple and may be quite complex in a crisis. For the purposes of public health threats and preparedness these usually involve the systems which detect and evaluate signals from various communicable diseases, the crisis coordination mechanisms, and emergency response with criteria for escalation and de-escalation of its levels depending on the scale, velocity of evolution and complexity of an event, as well as the existing capacity/-ies to respond.

Alert mechanism, collection and analysis of surveillance data

Monitoring of health threats can be done with various tools, but it has been traditionally performed through the indicator-based surveillance systems for communicable diseases in place in all EU/EEA countries and at the EU level [54], combined with the event-based surveillance and epidemic intelligence tools, which have been developed in the last 25 years. Various types of surveillance systems facilitate the collection and analysis of epidemiological data, are crucial for the alerting of public health authorities on an emerging public health threat and provide valuable data to allow proper risk assessment of such threats.

ECDC works in indicator-based surveillance by collecting and analysing data from EU/EEA and pre-accession countries as well as working to harmonise case definitions, collection and reporting of data, and capacity building in the member states (e.g. support for molecular epidemiology systems and whole genome sequencing activities). ECDC also works on epidemic intelligence using scanning tools for open sources (e.g. EIOS [55]), developing and supporting EpiPulse for the exchange of information among member state representatives, public health stakeholders and international organisations (e.g. WHO Regional Office for Europe) [56]. ECDC produces daily and weekly Communicable Disease Threat Reports (CDTR) summarising the health threats under monitoring, our assessment about them and the relevant recommendations for the EU public health authorities [57].

Some of the most important lessons from the response to the COVID-19 pandemic are focused in this area of early alert, collection and analysis of data to inform action by policy- and decision-makers [58].

Specific recommendations for planners

- Strengthen epidemic intelligence and early-warning systems providing alert signals to public health. Actively participate in the exchange of information at the EU level through the EWRS and the EpiPulse platforms, as needed;
- Establish procedures and systems, where possible, to efficiently exchange information across healthcare and across regional, national and international levels to allow proper assessment of the emerging threat; leverage health information for immediate action;
- Build surveillance systems to provide an assessment of disease severity through integrated population-based primary and secondary care based systems;
- Ensure the capacity and legal requirements to turn on additional data sources, as needed and as feasible in the country's system and infrastructure, such as hospitalisations or new admissions (regular and ICU), emergency department visits, primary care visits; bed capacity (regular and ICU), contact tracing data;

- Provide frequent situation reports depending on the evolution of the situation and provide analysis with the necessary interpretation of findings;
- Trigger frequent risk assessments depending on the evolution of the situation and the availability of new evidence, with an outline of limitations and gaps of knowledge;
- Tailor report language and presentation of findings to the needs of decision-makers and the public;
- Plan ahead for the data collection and analysis (e.g. define emergency resources, prepare study protocols, fast-track ethical approvals, data protection provisions, data collection tools etc) for providing answers to operational research questions for the early assessment of infectious disease threats – e.g. transmissibility, transmission routes, risk factors of severity, secondary attack rates, and monitoring of the effectiveness and impact of public health interventions; plan for potential international collaboration on these studies.

The following example comes from Italy through a peer-reviewed publication. A lot of countries developed and followed similar indicators in order to decide on implementation or lifting of measures during the pandemic.

Box 7. Example of use of epidemiological indicators during the COVID-19 pandemic: Italy [59]

The Italian COVID-19 monitoring group adapted the ECDC rapid risk assessment tool by including quantitative and qualitative indicators from existing national surveillance systems. Results were included in weekly risk assessments during the COVID-19 pandemic and an overall categorisation of the risk of an uncontrolled and unsustainable SARS-CoV-2 outbreak in each of the 21 Italian regions and autonomous provinces. This tool included measures of probability (evidence of increased transmission), impact (evidence of burden on the health system), and resilience (public health able to maintain core functions like testing and contact tracing). The team used a total of 19 mostly quantitative indicators from the national surveillance systems to assign a risk level for each region based on last week's reported data.

These weekly risk assessments supported decision-making in Italy about implemented PHSM measures and required substantial communication with health officials across administrative levels.

Coordination structures

Active engagement from all stakeholders during a crisis is essential for continuous data gathering, evaluation, and interpretation, alongside risk assessments and prioritization of interventions. Furthermore, fostering collaboration aids in identifying research gaps, advancing scientific understanding, and implementing effective public health measures tailored to evolving contexts.

Coordination structures are needed to ensure the interaction between the technical scientific and the decision-making political and risk management level. Response to a crisis is usually organised at different levels: a front-line/field level, an operational/technical level and a strategic/decision-making level. These may have different names in the different countries, and they may be limited or cross administrative levels (local, regional, national/federal) (see also section Emergency Response). In addition, plans usually include expert advisory groups (e.g. National Pandemic Committee) providing advice to the operational and/or strategic levels.

Preparedness plans should outline clearly how information is communicated between the different administrative and response levels and how they are connected (e.g. liaison functions). Public Health Emergency Operation Centres (PHEOC or EOC) play a significant role in this coordination, as they can bring together the different capacities and expertise needed for a coordinated response. EOCs provide the technological support and the tools for this coordination and potentially the support staff, meeting rooms, joint working spaces etc. [60].

Specific recommendations on coordination structures for planners

- The preparedness plan should establish a clear structure of country-level coordination among regions and the national level with clear leadership and decision-making rules.
- Establish a centralised emergency response management unit/centre or establish localised response units and allow regions/municipalities to tailor their pandemic response measures according to the specific epidemiological situation at the local level. This improves the response as well as the engagement with the local community [61].
- Ensure that the EOC can receive communications, data or other information needed from the different stakeholders and that has the capacity to present an overview for situation awareness.
- Employ a mechanism to log working group and committee decisions during the crisis and register position statements on specific issues for timeline and continuity purposes.
- Foster multi-sectoral/multi-partner coordination in peace time between healthcare and other sectors to enable intersectoral work during crises. (see also the section on Intersectoral collaboration and governance at the national level).
- Plan regular simulation exercises with the participation of the EOC and other sectors and organise common trainings for the areas that need to be improved.
- Review frequently and keep EOC equipment, dashboard capabilities and situation awareness tools up to date.

The following example comes from Slovenia, which also undertook a AAR with the participation of ECDC [62], and it was directly communicated to ECDC.

Box 8. Example of an initiative to develop a public health Emergency Operations Centre: Slovenia

The Emergency Operations Centre (EOC) for public health operations in Slovenia was set up at the National Institute for Public Health (NIPH) Slovenia, in the department of infectious disease preparedness and threats response, as a result of the lessons from responding to the COVID-19 pandemic, which accelerated and reinforced the need to organise the EOC.

The EOC ensures the collection and analysis of the data, the preparation of risk assessments for public health and disseminating information about risks to human health, sudden events and crisis situations that exceed the daily available response capacities of the NIPH. It also provides organisational, infrastructural and professional support to all those at NIPH who actively participate in the management of public health risks. The EOC represents a key player in the response to the future public health challenges and emergencies, as it ensures interdisciplinary coordination and coordination of response to crisis situations, which exceed the capabilities of the individual NIPH centre. The coordination of the activities of many stakeholders from a single point ensures greater efficiency and alignment of stakeholders.

The Slovenian PHEOC was developed and set up according to the WHO framework for a Public Health Operations Centre [60].

Emergency response

Emergency response refers to the core activities when responding to an emergency, usually with assigned levels of emergency depending on the severity and/or other criteria e.g. velocity of evolution, complexity, resources needed to respond.

Work performed before and after this section aims at improving the response to the emergency.

Emergency response in the preparedness and response plans is usually graded in levels from Level 0–Level 3 or from 1–3 or other terminology. The aim of these levels is to give an indication of the resources needed to respond in conjunction with the extent, severity, complexity and velocity of the ongoing emergency.

A PHEOC is a critical part of the response and plays important role in the coordination of the stakeholders in the phases of response, but it depends on the system/culture of each country how response is eventually organised (see also section Coordination structures).

Specific recommendations on emergency response planning

- Situation awareness is critical in crises. Develop dashboards (or other relevant modalities) in peacetime to provide an accurate situation overview to risk managers and policy-/decision-makers; ensure that the surveillance and monitoring systems provide comparable data for the unbiased monitoring of trends and connect seamlessly with the dashboard tool;
- Turn on other data sources according to intersectoral agreements to complement classic epidemiological data, if not already done; registries, hospitalisations/new admissions (regular and ICU); bed capacity (regular and ICU), contact tracing data, work or school absence data, mobility data etc. Ensure that the systems can seamlessly connect with the PHEOC dashboards or other situation awareness tools.
- Plan and design the structure of daily/weekly reports during peacetime and automate their production.
- Provide frequent situation reports depending on the evolution of the situation (daily or weekly etc) including analysis with the necessary interpretation of findings; tailor the language towards the needs of decision-makers and the public (see also section on risk communication).
- Describe thresholds that trigger alerts and technical and scientific capacities that need to be engaged, as escalation criteria (potentially along administration levels, e.g. from a regional to a national level crisis) and potentially escalation to a national emergency as well as the respective de-escalation criteria.
- Have a clear scheme/way of indicating the current level of response.
- Each emergency response level should include clear roles and responsibilities, including the following:
  - different capacities for public health activities;
  - day-to-day risk management structure;
  - processes for requesting expertise from all relevant fields/sectors;
  - intersectoral all-government involvement and coordination meetings;
  - decision-making processes with the established role of public health;
  - procedures for communication, with decision-makers and particularly with the public.
- Emergency response levels should also describe the relevant strategies for the preferred or proposed response to the public health threat e.g. total control vs. mitigation of effects, and the necessary criteria for change of strategy (e.g. epidemiological situation, R0 of pathogen involved, health system pressure, risk groups etc).

- Mechanisms should be defined on how external resources can be integrated in national response mechanisms, e.g. support by the EU Health Task Force or another member state.
- The response levels should also address issues around testing strategy, and the necessary escalation criteria to activate backup laboratory networks. These criteria should align with the overall emergency response levels and be based on indicators like test positivity rates, sample volume, or turnaround times.
- Additional available response measures including their implementation as PHSMs should be preferably described in each response levels. This should be based upon factors such as the phase of the response/crisis and the expected effectiveness of each PHSM in the national socio-economic and political context. Behavioural insights, socio-economic impacts, and levels of uncertainty should be included. PHSMs need to be well described with all involved stakeholders and their respective monitoring mechanisms. If possible, decision-making tools should be explored/developed to assist monitoring systems and capacities for PHSMs should be designed to evaluate their societal impact, particularly on the most vulnerable population groups [27].
- Response levels should also describe the processes to achieving surge capacity for core public health activities e.g. case/field investigations, contact tracing, or testing.
- Response according to the lessons identified, should be flexible and scalable, as available scientific research and investigations may bring new pieces of information daily. If scenarios and/or models are used to guide action, these may need to be modified/adapted according to the incoming new information. This constant change and uncertainty should be clearly and frequently communicated to decision-makers and the public. (See also Risk communication section);
- If a national stockpile exists, describe the processes related to deployment of stockpiles of personal protective equipment (PPE), pharmaceuticals, testing and other equipment; otherwise describe the processes for requesting assistance from the EU level;
- Provide frequent risk assessments depending on the evolution of the situation and the availability of new evidence, with an outline of limitations and gaps of knowledge.
- The plan should also take into account the de-escalation phases and how these will be achieved for all areas in the health sector (healthcare, public health and laboratory), ensuring however, that there might be need to escalate again for potential resurgence of the threat. Same as with escalation, de-escalation should be guided for example by epidemiological data, declining pressure to the health system and other criteria according to the local/national context.

Risk Communication, Community Engagement and Infodemic Management (RCCE-IM)

RCCE-IM is key to the success of many areas of public health work during response, from adherence to public recommendations regarding preventive/protective measures (including vaccination), testing, treatment, contact tracing or isolation requirements. Successful implementation of all the above is dependent on support from affected individuals and communities. [63] RCCE-IM activities have been consistently identified as the weakest point and/or the most significant challenge for countries responding to the COVID-19 pandemic [58,62]. Risk communication specifically has also been consistently identified as an area for improvement since the last influenza pandemic in 2009–2010 and following several simulation exercises carried out in recent years in the EU [64,65].

An overarching lesson from the COVID-19 pandemic was that the public health workforce of every country should include a cadre of trained and resourced social and behavioural scientists who can support RCCE-IM efforts. In autumn 2024, ECDC launched a Prevention Community of Practice for all EU/EEA countries, with the aim of building social and behavioural science capacity. Participants will have the opportunity to network, exchange lessons learned and experiences, attend webinars and other trainings. Training and discussion on RCCE-IM will be included in many of the activities that will be conducted within the Community of Practice. Interested professionals – from the public health authorities, universities and research institutions, and civil society or community-based organisations – can register their interest in joining the Community of Practice here.

RCCE-IM are currently frequently grouped together; however, it should be noted that each one is a specialised area of work, and ideally a multi-disciplinary team of professionals should be included in the overall communications team to address these issues (e.g. journalists, social scientists, anthropologists etc).

Planning for RCCE-IM in health emergencies should be an integral part of the preparedness activities during peacetime. An RCCE-IM plan can either form part of the national preparedness and response plan or it can be a separate plan addressing RCCE-IM strategy and operations when responding to health emergencies.

Risk communication

Risk communication is an inter-disciplinary field of work aiming to provide actionable information to people and communities facing a health threat to enable them to take appropriate preventive or protective measures [3]. Risk communication professionals work together with a wide variety of experts (e.g. epidemiologists, Infection Prevention and Control specialists, clinicians, behavioural scientists etc.) to produce accurate information and actionable advice to affected communities.

Key lessons from the COVID-19 pandemic and other recent public health crises (e.g. the multi-country mpox outbreak 2022–23) included the need to build trust in public health authorities and the need to tailor messages to the needs of different audiences (e.g. policy-makers, healthcare workers, affected communities). Another key lesson was the difficulty of dealing with uncertainty, the many unknowns of an emerging pathogen and a new disease and the constantly evolving evidence. On multiple occasions, these led to confusion and conflicting messages from the various scientific groups.

Specific recommendations on risk communication

- Dedicated resources in the form of communication specialists are needed in public health authorities to assist in formulating the risk communication strategy and the relevant plan and undertake risk communication during crises.
- The risk communication plan should address leadership in communication and a mechanism to be activated during the crisis for the coordination of production and dissemination of messages among the various stakeholders. Coordination of messages is usually the response of the authority leading the response, but this may differ in the different countries.
- Important to follow the rule of 'speaking with one voice' and ensuring consistency in the messages. However, it is always important to be transparent as regards what is known and what forms the base of each new measure. In addition, communication with empathy and adapting to the needs of the population groups potentially affected is important (ethnic minorities, specific categories at risk, etc.)
- A procedure should be included for a multi-disciplinary team (including e.g. epidemiologists, communication specialists, behaviour scientists, clinicians) to develop the messaging and adapt to the target audience and the communication channel used. Multi-disciplinary teams can better clarify uncertainties and the evolving situation.
- During the anticipation phase, ensure that public health professionals are trained in risk communication and a subset also receive media training.
- In a crisis, social listening mechanisms (online and offline) for a better understanding of what the community is concerned about, what are the fears, expectations, perceptions of risks, information gaps are useful to inform risk communication. These listening mechanisms can be two-way and facilitate dissemination of messages.
- Communication experts can assist in tailoring and presenting data and key messages according to the target audience.
- Improve the capacity of communication teams to use multiple available technologies to communicate (e.g. radio, TV, short videos, pictograms, infographics, timelines of crisis events, social media messaging, multi-lingual material, etc.).
- The risk communication plan should also account for the need to coordinate messages at EU level, therefore relevant processes and liaisons with EC and other member state stakeholders.

The following example on risk communication comes from the collaboration between ECDC and the WHO Regional Office for Europe during the response to the multi-country outbreak of mpox clade IIb affecting mainly the community of men who have sex with men (MSM). Several examples also exist from the COVID-19 pandemic, where most of the countries were holding frequent press conferences with public health and other scientists along with political hierarchy to explain the measures proposed and/or implemented.

Box 9. Example of initiative on risk communication, joint effort of ECDC and WHO Regional Office for Europe in the mpox outbreak

ECDC–WHO Regional Office for Europe [66]

After the notification of the first mpox cases in men who have sex with men (MSM) in Portugal, the United Kingdom (UK) and Spain in spring 2022, ECDC raised its Public Health Emergency level to PHE 2 in order to respond to the increased needs of the multi-country outbreak. Besides the development of risk assessments and other guidance documents for primary care and contact tracing, a lot of work was performed jointly with the WHO Regional Office for Europe to produce risk communication and community engagement materials. Communication material was produced in collaboration with civil society representatives from the MSM community: fliers, posters, and ready-to-use material for communication in social media. A survey was run through the date application Grindr with significant success in all EU/EEA countries, and civil society representatives were called to provide feedback to response options included in the risk assessments and other documents as well as present their activities in weekly informative webinars for clinicians and sexual health stakeholders.

Guidance documents for public health authorities and event organisers were produced providing examples of ongoing RCCE activities in the EU/EEA countries. In addition, a complete toolkit was created for event organisers and civil society organisations to reach out to people at-risk attending the events of summer 2022.

Community engagement

Community engagement activities should be maintained and fostered during all phases of preparedness and demand continuous efforts to establish a robust network with community leaders, local actors, and civil society representatives who are involved with the particular communities.

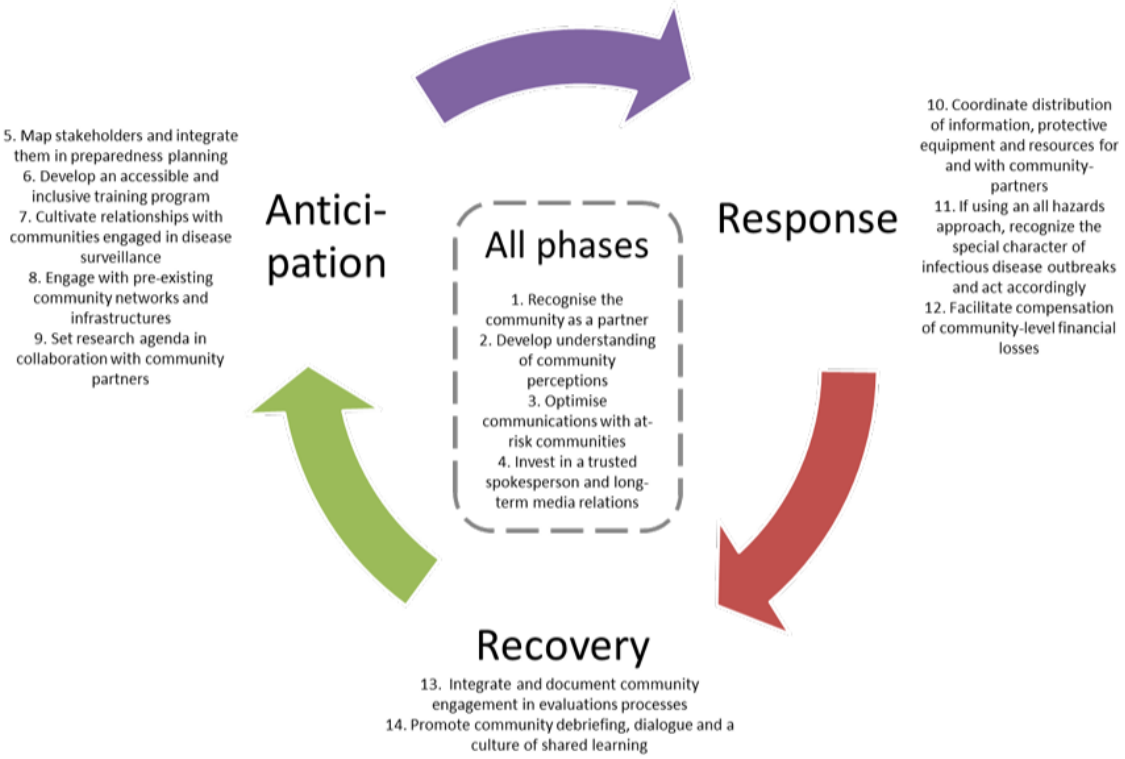
During peacetime, but particularly during times of crisis building and establishing trust with the affected community/-ies is extremely important for the acceptance and uptake of measures. Trust is essential for the success of public health response, but it is a complex issue shaped by years of different historical, cultural, societal experiences in every country or community. It takes years to build and can be destroyed very quickly [4].

Many studies have noted the political aspects of distrust, but research during the COVID-19 pandemic in eight countries (Denmark, France, Germany, Hungary, Italy, Sweden, the United Kingdom, and the United States) showed that behavioural differences are not only related to political beliefs but rather is a matter of personality: some people have a greater tendency to trust authorities. Therefore, in times of crisis it is important to appeal to people of all political persuasions and people distrustful of 'the system' [67].

ECDC has developed guidance on community engagement for public health events combining the findings of a literature review, four country case studies on public health crises and an expert consultation on community engagement in public health emergency situations [68].

Figure 2 below presents the overview of ECDC guidance on community preparedness as it relates to the preparedness cycle.

Figure 2. Outline of ECDC's guidance on community preparedness mapped in the preparedness cycle [68]



Source: ECDC

Specific recommendations on community engagement for planners

- Recognise the community as a partner in preparedness, in setting the research agenda and in decision-making during the crisis. The use of multi-disciplinary scientific advisory boards including community representatives should be considered in the preparedness plans.
- Map stakeholders including hard-to-reach ethnic minorities, migrant communities, persons with special needs etc., and integrate them into preparedness planning, including a training programme for the plan.
- Develop an understanding of community perceptions.
- Optimise communications with at-risk communities using multiple available channels.
- Engage with pre-existing community networks and infrastructures to identify existing resources e.g. individual leaders, faith-based organisations, civil society etc. In times of crisis, they can help coordinate distribution of information, protective equipment and other resources for and with community partners, and design and implement community-based solutions to address health emergencies.
- Include behavioural and social science input in public health guidance documents, and when developing, implementing and evaluating public health interventions.
- Facilitate resolving of possible issues with community-level financial losses.
- Integrate and document community engagement in evaluation processes.
- Promote community debriefing after a crisis, dialogue and a culture of shared learning to improve preparedness.

The following examples of community engagement activities refer to the experience of two minority communities in two different EU countries during the COVID-19 pandemic.

Box 10. Examples of community engagement during the COVID-19 pandemic: Belgium and Ireland

Belgium [69]

In Antwerp, Belgium, a qualitative study of the experience of the Orthodox Jewish communities (est. 25 000 members) during the COVID-19 pandemic showed that existing community resources were rapidly mobilised to facilitate adherence to national measures. An example was a pre-existing community Crisis Management Team (CMT), a volunteer-based group including religious leaders, which worked with local authorities and set up a strong communication network to share important information and updates about COVID-19 and government advice. The CMT ran a special telephone hotline staffed by volunteers, providing a direct way for community members to ask questions and receive guidance.

Community family physicians were instrumental to bridge the community with the outside world. Engagement of religious leaders was particularly important to mitigate feelings of mistrust towards the government, as well as communicate the measures in a culturally appropriate way. The study concludes that gaps remain in involving sustainably communities and their leaders in decision-making at the local level to help understand better the needs of minority populations and avoid stigmatisation.

Ireland [70]

A COVID-19 Traveller and Roma Response Team was formed in early March 2020 by the HSE Ireland National Social Inclusion Office to support health access to a number of vulnerable groups. This group included several stakeholders working with these groups and managed the designation of Traveller and Roma people as 'vulnerable to COVID-19', therefore achieving their prioritisation for testing in the context of the testing strategy in place at the time in Ireland and securing a facility for their isolation when positive. In addition, a Traveller COVID-19 Helpline was operated to provide information and connect Travellers to community services, GP and hospital appointments.

Two more examples of community engagement are presented here from the response to the outbreak of mpox, which was first detected in May 2022 but quickly spread throughout EU/EEA countries affecting mainly the community of men who have sex with men (MSM). Multiple examples of such activities exist from the period 2022–2023, the ones showcased here were discussed in ECDC multidisciplinary webinars on mpox.

Box 11. Examples of community engagement during the multi-country mpox outbreak of 2022–23: Portugal and Ireland

Portugal [71]

Portugal was one of the first countries detecting cases in the multi-country outbreak of mpox affecting MSM in 2022–23. The first cases were diagnosed in May 2022, while in June major events were planned around the Portuguese Pride. The Directorate-General of Health (DGS) in Portugal created guidance on key messages to be disseminated and advised on procedures during the events, aiming to increase awareness but avoid stigmatisation. Online meetings and sessions providing information about the infection were used to coordinate with stakeholders. DGS established a direct collaboration with the organisers of the event and with civil society organisations such as Grupo de Ativistas em Tratamentos (GAT) a Portuguese NGO working with people living with HIV. Information material in printed form and for electronic screens was developed and in collaboration with a mobile unit was used for HIV testing and the dissemination of information. The design for the mpox key messages used no pictures of the mpox rash but instead presented a 'pepino' (pickled cucumber) image. Information was provided in pocket-sized cards in Portuguese and English, outlining the most common symptoms, what to do, and who to call for more information.

Ireland [66,72,73]

In Ireland, an NGO already working with the community of MSM to reduce HIV and other sexually transmitted diseases was involved from the beginning in designing interventions to control mpox.

According to Adam Shanley, Programme Manager of MPOWER, 'When the first cases were notified in the UK and in Portugal (May 2022), a national crisis management team was convened in Ireland, which included stakeholders from across the health service, including epidemiologists, national and regional public health teams, clinical leads for sexual health and the National Immunization Office. MPOWER was included from the get-go because of its close links to the affected communities, our ability to develop meaningful engagement, and for being able to steer the response from a community perspective.' MPOWER organised outreach activities in bars and sex-on-premises venues, as well as during the pride month in Dublin. When vaccines became available, MPOWER adjusted their campaign aiming to promote vaccination for those at most risk. As the outbreak receded in 2023 and people had become more complacent with the disease, Adam warned that 'From a community perspective, it's really, really important that we don't leave anybody behind in our mpox response, particularly as a resurgence of the disease isn't something beyond the realms of possibility. We also need to be thinking about younger people under the age of 18, and using different channels of communication from those traditionally used for public health messaging.' [73]

Infodemic management

In times of public health crisis such as a pandemic, receiving or finding accurate information is crucial for people to adjust their behaviour and safeguard themselves, their families, and communities. An infodemic, characterised by an excess of information, including misinformation and disinformation, complicates the search for reliable guidance. The term became more widely used during the COVID-19 pandemic, although infodemics had accompanied outbreaks in the past (e.g. Ebola in West Africa), when spread of both accurate and inaccurate information about anything related to the pathogen, the measures implemented, the therapeutic measures and the vaccines against COVID-19 flooded the media and internet [74,75].

The infodemic during the COVID-19 pandemic led to polarisation online and offline, particularly in relation to specific measures (e.g. masks, school closures) and vaccination. Polarisation was connected to political beliefs in many countries, and this was gradually reflected to decreased trust towards public health and science overall. [76,77].

Infodemic management is an evolving field of operational public health, which is quite complex to manage and requires multidisciplinary collaboration. However, one of the key lessons from the COVID-19 pandemic is the need for preparedness as any new public health crisis or pandemic will be accompanied by an infodemic [4].

Specific recommendations on infodemic management for planners

- Advocate for resources, capacity and capabilities, as well as training on infodemic management, for the communications team involved in the response to public health crises.
- Ensure that the risk communication plan includes strategies and methods to address rumours, misinformation and disinformation [27].
- Some of the proposed strategies include listening to community concerns (social listening), communicating and translating science via improved access to appropriate health information, building strategic partnerships (e.g. media and social media, academia, fact-checking organisations, etc.) and engaging the healthcare workers, promoting resilience to mis- and disinformation (i.e. preventing people from being persuaded to believe misinformation) [4,78].
- The plan should also include the necessary processes to inform policy-makers, health authorities, field staff, and partners involved in infodemic management activities so that they can deliver the messages needed before mis- and disinformation dominate the narratives that are circulating during an outbreak [79,80].

The following examples come from Norway as they communicated to ECDC their experience during the COVID-19 pandemic and the European Commission. They showcase the variety, complexity and resource intensiveness of activities to address an infodemic.

Box 12. Example of initiative on infodemic management: Norway and the European Commission

Norway

During the COVID-19 pandemic, the social media team of the communication department at the Norwegian Institute of Public Health (NIPH) was strengthened with relevant professional groups (such as vaccine experts, testing experts, epidemiologists, virologists, etc). NIPH saw social media as a useful channel for capturing what people were concerned about and how they reacted to our recommendations and advice. The social media also provided an arena for seeing and responding to misinformation. The team prepared informative posts about what people were curious and anxious about, mainly various issues related to vaccines and infection control. Examples include symptoms and the testing system, the infection tracking application Smittestopp, the corona certificate and travel restrictions. .

During the pandemic, the NIPH moderated 50 000 comments. The team had day, evening, and weekend shifts to monitor and control the comment sections. The comments were a nice mix of relevant and good questions, rumours with misinformation, and sheer false/conspiracy information. Additionally, the institute received a lot of supportive comments. The team still functions – but on a smaller scale as the level of engagement is not as high as it was during the pandemic.

An overall annual survey measuring trust in the population, put the NIPH in first place among 94 public agencies in 2021 with a positive score of 85 (out of 100 points). The NIPH was closely followed by the Meteorological Institute in 2021. For the following years, the two have switched places, and the NIPH still in 2024 remained one of the top two trustworthy authorities in Norway. This might be partially due to the transparent and proactive communication to the public during the last few years.

European Commission, European External Action Service (EEAS) – EUvsDisinfo [81]

EUvsDisinfo was established in 2015 in the EEAS and is led by a team of experts with a background mainly in communications, journalism, social sciences and Russian studies. Its core objective is to increase public awareness and understanding of the Kremlin's disinformation operations, and to help citizens in Europe and beyond develop resistance to digital information and media manipulation.

Using data analysis and media monitoring services in 15 languages, EUvsDisinfo identifies, compiles, and exposes disinformation cases that are spread across the EU and Eastern Partnership countries. More than 17 000 such cases are included in their searchable database, the only such open source repository of its kind.

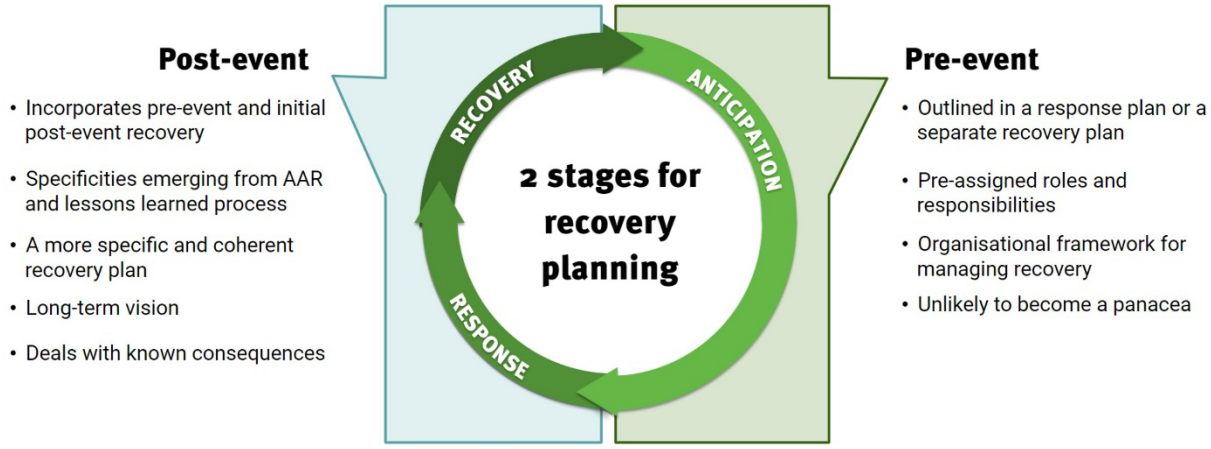
Recovery

This phase of the preparedness cycle includes the coordinated activities that usually start immediately after the end of the emergency phase of a crisis with the aim at returning operations to normal. Recovery is the process that should lead to the identification of lessons and ultimately to the updating and improvement of the preparedness plan. The recovery phase does not necessarily always follow a crisis; it can also follow a simulation exercise to implement lessons.

AARs are one of the important tools used to identify lessons to improve during and after an outbreak or other public health crisis [2,82-84]. AARs should not be used to point fingers or assign blame but serve to identify what went well and what did not in order to find areas where improvements can be made. Crises lead to many changes afterwards and people who were actively involved in the response may change position, leave organisations etc, therefore memories fade quickly. Therefore, the ideal time to perform an after-action review is either while the crisis is ongoing or one to two months after its resolution. Other tools include qualitative research such as focus groups and interviews of key response staff.

Following these activities an action plan should be developed outlining the key lessons, how these will be implemented in the planning and the expected process (who is responsible, timelines etc) [85].

Figure 3. Overview of the recovery stages for planning: pre- and post-event [85]



Source: ECDC

Specific recommendations on planning for recovery

- Include specific planning for the recovery phase in the preparedness and response plan with roles and responsibilities; otherwise, recovery may be forgotten, and mistakes will be repeated in the next crisis.
- Organise IARs, and consider requesting support from the EU Health Task Force, if the crisis is protracted to identify lessons that can already be implemented to improve response.
- Organise AARs with multiple stakeholders as soon as possible after the emergency phase of the crisis has passed- plan them carefully so as not to assign blame (e.g. neutral venue, consultant facilitator, if possible, agree on timeline and main objectives/questions to be discussed ahead of time).
- Do not forget the impact of a crisis (particularly a protracted one) on the mental health of public health and other response personnel.
- Identifying the lessons from the response is a significant step, however the objective of the recovery is closing the cycle of preparedness, i.e. implementing the lessons to amend preparedness plans. An action plan with agreed timelines should be developed after IAR/AAR identifying who and how will make the necessary amendments.

Box 13. Example of restructuring the emergency response plan in the recovery phase: ECDC Public Health Emergency Plan

ECDC remained in Public Health Emergency (PHE) status for more than 1 000 days for the response to the COVID-19 pandemic. Strategic evaluator reports during the COVID-19 pandemic identified the need for revision of ECDC's PHE plan. In 2022, an inter-unit team undertook the task, and the new PHE plan came into force in August 2023.

The updated plan includes a more comprehensive approach, integrating the need for long-term crisis management and the impact of a crisis on ECDC's work plan, as well as a de-prioritisation process. Five criteria are used to assess a PHE (scale, velocity, complexity, capacity and external impact). ECDC's new PHE plan now includes four levels (0, PHE1, PHE2 and PHE3) and each activation level can be declared as protracted if the crisis is ongoing for an extended period of time. The possibility to have protracted PHE activation was a clear lesson from the response to the COVID-19 pandemic.

During a PHE activation, the response is structured in three layers (strategy, coordination, response) and the last one is supported by an Operational Support, a Technical and a Communications Group. In the protracted phase of PHE activation, the response is again three layered with a strategic team, a Protracted Task Force Lead and a Protracted Task Force of experts, and a Coordination group.

The amended PHE plan was activated for the first time in August 2024, when the outbreaks of mpox clade I in Africa were declared a Public Health Emergency of International Concern (PHEIC), with the potential to spread further across countries in Africa and possibly outside the continent [86]. ECDC activated its PHE plan for 35 days, between 20 August and 23 September 2024. An evaluation report showed that there are still areas for improvement, and an AAR is planned in April 2025 to review the experience of this activation at ECDC.

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Annex 1. Lessons from the COVID-19 pandemic for the public health sector

This annex presents an overview of the lessons identified by the European Commission, ECDC and WHO (Regional Office for Europe and WHO Headquarters) from the response of the public health sector to the COVID-19 pandemic and focusing on European countries.

European Commission

In June 2021, while still in the emergency phase, the European Commission (EC) published early lessons from the COVID-19 pandemic [87]. This communication document included ten lessons for public health policy, in addition to some conclusions about the first response to the pandemic and planned EC actions to address them. These lessons were the following:

Lesson 1

Faster detection and response depend on stronger global surveillance and more comparable and complete data. The pandemic highlighted both the use and the limitations of surveillance systems in Europe and globally and the need for more feeding systems and better coordination amongst them.

Lesson 2

Clear and coordinated scientific advice facilitates policy decisions and public communication. There is a need to bridge the gap between science and policymaking, and for an authoritative EU scientific voice to communicate directly to the public.

Lesson 3

Preparedness needs constant investment, scrutiny and review. Preparedness and planning was not as robust, financed or as comprehensive as it needed to be; a new, systemic approach to preparedness is needed to learn the lesson from this pandemic, which starts with stepping up investment.

Lesson 4

Emergency tools need to be ready, faster and easier to activate. The pandemic highlighted the importance to have fast, functioning and flexible temporary and exceptional measures ready to be activated, to allow the EU to react as quickly as it is needed, e.g. in launching joint procurement procedures or funding mechanisms to support necessary research or clinical trials.

Lesson 5

Coordinated measures should become a reflex for Europe. The coordination of measures needs to improve along with strengthening of the inter-institutional cooperation.

Lesson 6

Reinforced public-private partnerships and stronger supply chains are needed for critical equipment and medicines. The pandemic highlighted also the need for resilience and safeguarding of supply chains, particularly of critical products necessary for the response to a health threat, e.g. masks, ventilators, reagents, pharmaceuticals etc. In addition, mapping of the gaps and manufacturing capabilities in the EU Member states is needed in case of a public health crisis.

Lesson 7

A pan-European approach is essential to make clinical research faster, broader and more effective. There is clear need to boost the capacity for common multi-centre clinical trials and more flexible instruments to assist research in crisis.

Lesson 8

Capacity to cope in a pandemic depends on continuous and increased investment in health systems. The pandemic exposed lack f surge capacity in healthcare systems, and structural weaknesses. Investment in the capacity and effectiveness of health systems, including investment in better working conditions and attractiveness of the health and care professions.

Lesson 9

Pandemic preparedness and response is a global priority for Europe. Work with neighbourhood and international partners to help improve exchange of information and best practice, ensure common approaches to preparedness and response and ensure coordinated action in a crisis.

Lesson 10

A more coordinated and sophisticated approach to misinformation and disinformation should be developed. Since the beginning of the pandemic, misinformation and disinformation spread dangerous information, fuelling vaccine hesitancy and contributing to general anxiety and polarisation. The pandemic highlighted also the threat of foreign interference. Strategic communication capacities are needed to address misinformation and disinformation campaigns at local, national and European level.

Lesson identifying activities by ECDC

During the first phase of the COVID-19 pandemic until vaccines became available, ECDC undertook an analysis focusing on testing and surveillance, healthcare sector coordination, and emergency risk communication in five countries (Croatia, Finland, Germany, Italy, and Spain) [88]. The analysis was focusing on how existing systems of measuring preparedness had performed in the pandemic for future use. The following issues were identified:

- The COVID-19 pandemic required EU Member States to develop new strategies, approaches and policies related to public health preparedness under pressure. These also had to be reviewed and revised as the pandemic evolved.
- In general, existing measurement tools for preparedness:
  - are not consistent with a country's internal hierarchical structure of public health, healthcare, and other entities that influence emergency responses;
  - do not reflect the required coordination among different sections of the healthcare system, particularly at the hospital and community-based levels; and
  - do not allow for adequate flexibility and resilience required to address the challenges of scaling up a country's pandemic response.

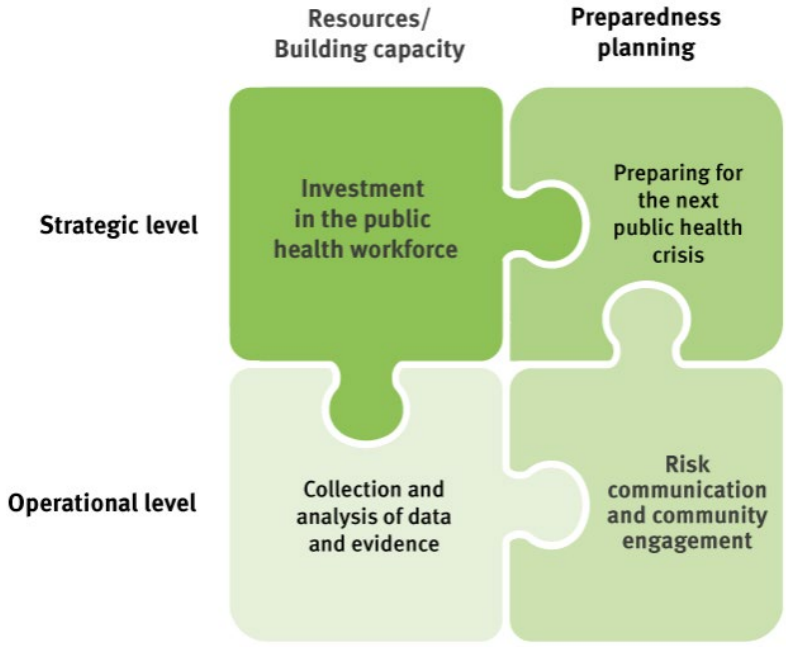
ECDC undertook also activities specifically to collect lessons from the response of the public health sector to the COVID-19 pandemic in 2021 and 2022, using qualitative and quantitative methods. Lessons were identified through activities including an internal exercise with ECDC experts; country visits to discuss lessons; a review of country lessons reports sent to ECDC after a general call to member states; discussions with the Member States during annual meetings and two member state consultation meetings: an expert consultation on the evaluation and implementation of non-pharmaceutical interventions (NPIs), now referred to as PHSMs, and an expert meeting on lessons learned from the COVID-19 pandemic [58].

Main findings from these activities were mapped systematically, initially under nine thematic areas. The information was then further collated into four lesson areas, each one representing a critical component of the response to a health threat:

- Lesson Area 1: Need for investment in the public health workforce, as Member States lacked trained staff.
- Lesson Area 2: Preparing for the next public health crisis.
- Lesson Area 3: Risk communication and community engagement.
- Lesson Area 4: Collection and analysis of data and evidence.

Findings are described in more detail in ECDC's technical report Lessons from the COVID-19 pandemic and are depicted in the following Figure 4, as an interconnected puzzle of the public health response to a health threat. Each one of these four areas represents a critical component of the response, but at the same time has an independent role in the every-day function of public health systems.

Figure 1A. Lesson areas identified by ECDC from the COVID-19 pandemic



Source: ECDC

Lessons for the public health workforce stressed the need for sufficient trained staff and resources for all administrative levels in a crisis, however it was noted that although public health budgets had been boosted during the COVID-19 pandemic, they were already being reduced to pre-pandemic levels.

Preparing for the next public health crisis is something that all countries identified as a priority area, including the need for flexible, scalable, more generic preparedness plan, even if it addresses only infectious disease threats. Plans should address more intersectoral collaboration, and cycles of updating them should be established.

Risk communication and community engagement activities are critical during the response to outbreaks or pandemics and public health professionals stressed the need to strengthen their capacity to communicate and engage with the affected communities or society in general in a large crisis. Cultivating trust in governments and institutions during peace and crisis times has been recognised as an important factor influencing the success of response measures. Managing mis- and dis-information circulating during the pandemic added a new challenge to public health institutions, for which they lacked expertise. The need to include behaviour science in shaping decisions and measures was also stressed as an area where countries lack experience.

Moreover, the collection and analysis of data and evidence by public health authorities needs to be improved, become digitalised and tailored to the needs of various audiences and stakeholders involved in responding to a pandemic. Surveillance systems reached their limits in the COVID-19 pandemic and the need to have access to multiple sources of data in a crisis was also stressed. Scaling up epidemiological and laboratory capacity were also some of the major challenges of the pandemic. Ensuring an adequate supply of reagents, developing protocols and fostering the collaboration between clinical, public health, and research laboratories, including development of genomic capacity. Finally, the ability to conduct operational research during an outbreak or other public health crisis was identified as a significant weakness, both at ECDC and at Member State level, mainly due to a lack of resources.

In addition to the above activities, ECDC outsourced a scoping literature review to identify published lessons from COVID-19 focusing on public health including the grey literature collected by ECDC. The literature review included 47 articles published between January 2020 and March 2024, and 33 grey literature reports from EU/EEA, the UK and Switzerland that were publicly available.

This activity provided lessons for the public health and healthcare sectors as outlined below, which are in general aligned with the above:

Organisation and planning of response

- Governance and clear effective leadership at all levels of response with clear decision-making processes
- Country level and international coordination were highlighted.
- Balancing centralised decision-making and decentralised work is a critical factor, as measures and response should be tailored according to regional needs, which allows for better use of local knowledge and engagement.
- Adequate resource and emergency budget allocation to the response to a public health crisis needs effective and fast procedures not adding workload to staff and agencies at the front line.
- Adaptive financing policies to facilitate emergency budget transfers.

For the healthcare part

- Ensuring health system readiness for future emergencies involves healthcare facility readiness, adequate staff and supply of PPE and essential medical equipment. As in other areas, the ability to scale up specific treatment capacities (e.g. critical care) was considered crucial.
- Healthcare facilities should prioritise digitisation efforts by providing Wi-Fi, computers, and tablets for documentation and communication among staff.
- Plans and policies to de-prioritise non urgent care and ensure continuity of care are needed.

For the public health part

- Surveillance systems were indispensable tools during the pandemic, but they need continued resources, development of new agile systems, connection with laboratories and digitisation.
- Effective data communication and sharing was proven very useful, e.g. new interactive dashboards, open data access, etc.
- A laboratory testing system capable of rapid testing and reporting of results following national testing guidance.
- Lessons stressed the importance of having a sequencing programme to better understand changes in epidemiology and inform response measures.
- Ability to scale up both for systems as well as laboratory capacities.
- Contact tracing is one of the core public health response tasks and proved particularly challenging during the pandemic due to the large number of cases. Coordination of contact tracing with local actors and the ability to quickly scale up and scale down capacities were identified as particular lessons.

- To implement large (national) vaccination campaigns, existing primary care structures, intersectoral collaboration, robust digital and physical infrastructure were important for their success.
- Implementation of PHSMs needs to be closely monitored together with societal acceptance, effectiveness and effects on society.
- Risk communication presented particular challenges throughout the COVID-19 pandemic; a trusted consistent voice to communicate on the crisis is critical, able to reach diverse audiences; the use of multimodal and multimedia communication channels is needed, as well as consistent fight against misinformation.
- Finally, an important lesson was recognising the significant psychological impact that large public health crises and pandemics have on response healthcare and public health staff as well as the society in general.

Lesson identifying activities by WHO

In August 2021, the Pan-European Commission on Health and Sustainable Development convened by the WHO Regional Office for Europe released its first report [89] with seven key objectives, including to:

- Operationalise the concept of One Health at all levels.
- Take action at all levels of societies to heal the divisions exacerbated by the pandemic.
- Support innovation for better One Health.
- Invest in strong, resilient and inclusive national health systems.
- Create an enabling environment to promote investment in health.
- Improve health governance at the global level.
- Improve health governance in the pan-European region.

This report was closely followed by one from the same Commission reviewing the evidence from the response to the pandemic [90] and collating the following lessons:

- Lesson 1. **Decisive leadership is essential**: countries that took decisive action early were able to reduce the spread of infection and thus the burden of severe disease and premature death. International leadership was also weak.
- Lesson 2. **We need a plan**: a pandemic response requires whole of government and whole of society responses.
- Lesson 3. **An early warning system linked to effective governance mechanism is essential**.
- Lesson 4. **A trained, motivated and equipped workforce is essential**.
- Lesson 5. **A strong society underpins a strong pandemic response**: The pandemic has shone a light on the weaknesses in many societies.

In addition, this report on evidence mentions one more set of lessons by The Independent Panel for Pandemic Preparedness and Response convened by the WHO Director and their main report, 'COVID-19: Make it the Last Pandemic' [91]. Their global lessons include the following, largely along the same lines:

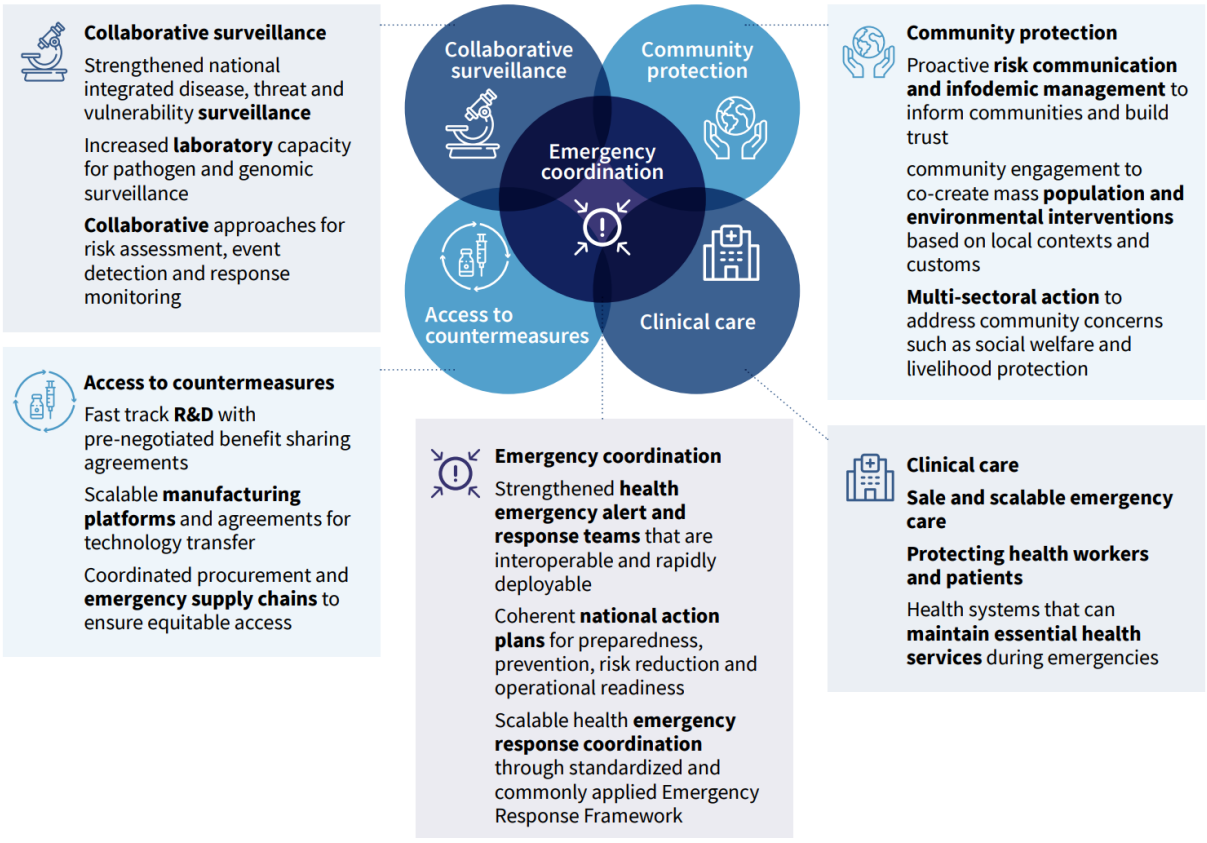
- The public health measures that would curb the pandemic need to be applied comprehensively.
- The pandemic response has deepened inequalities both between and within countries.
- The global pandemic preparedness and alert systems are not fit for purpose.
- There has been a failure to take seriously the already known existential risks posed by pandemic threat.
- WHO has been underpowered to do the job expected of it. The Panel believes that the COVID-19 pandemic must be a catalyst for fundamental and systemic change in preparedness for future such events, from the local community right through to the highest international levels.

Finally, WHO, together with the Johns Hopkins Center for Health Security, also embarked on a scoping review to inform future preparedness and response to respiratory pathogen pandemics, addressing the needs of the whole framework of health emergency preparedness and not only the public health sector [92]. Their review is distilled to nine lessons in five areas, largely coinciding with all the above-mentioned lessons and shown in Figure 5:

- Collaborative surveillance
  - Lesson 1: **Stronger surveillance and laboratory capacities are essential** for early detection of emerging respiratory threats.
- Emergency Coordination
  - Lesson 2: **Strengthening operational capacities can prepare public health** and other sectors – especially One Health institutions – to prevent outbreaks and respond quickly and early to emerging respiratory threats.
- Clinical care
  - Lesson 3: **Robust surge capacities are critical components of protecting health systems**, health workforces and communities.
  - Lesson 4: **Close partnerships** between governmental and non-governmental entities can improve health response, and continuity of health services.
- Access to countermeasures

  - Lesson 5: **Expediting the development, production and authorization of emergency medical countermeasures** (MCMs) and bolstering manufacturing capacities is a critical tenet of respiratory pandemic preparedness and response.
- Community protection
  - 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.
  - Lesson 7: **Strong social safety net policies and programmes** are needed to mitigate the social and economic impacts of pandemics on vulnerable populations.
  - Lesson 8: **Stronger mechanisms for international cooperation and coordination** are essential to implementing robust and equitable responses to pandemic threats.
- Collaborative learning and accountability
  - Lesson 9: **Policy-makers, practitioners, and researchers must proactively identify and learn from past successes and failures**, taking steps to institutionalize best practices in pandemic response.

Figure 2A. Overview of lesson areas identified by WHO from the COVID-19 pandemic [92]



Source: World Health Organization (WHO). Respiratory pathogen pandemic preparedness: lessons identified from the global response to COVID-19. Geneva: WHO; 2023. Licence: CC BY-NC-SA 3.0 IGO.

Annex 2. Catalogue of resources for public health preparedness planning

Identifying lessons, main documents

Publisher	Year	Title	Link
ECDC	2023	ECDC presents lessons learned from the COVID-19 pandemic	https://www.ecdc.europa.eu/en/news-events/ecdc-presents-lessons-learned-covid-19-pandemic
European Commission	2021	Emerging stronger from the pandemic: acting on the early lessons learnt	https://ec.europa.eu/commission/presscorner/detail/en/ip_21_2989
European Parliament	2023	European Parliament resolution of 12 July 2023 on the COVID-19 pandemic: lessons learned and recommendations for the future	https://www.europarl.europa.eu/doceo/document/TA-9-2023-0282_EN.html
WHO Regional Office for Europe	2021	Response to the COVID-19 pandemic: lessons learned to date from the WHO European Region	https://iris.who.int/bitstream/handle/10665/343157/71wd06e-rev1-PR-Response-LessonsLearned-210693.pdf
	2021	Drawing light from the pandemic: A new strategy for health and sustainable development	https://www.who.int/europe/publications/m/item/drawing-light-from-the-pandemic--a-new-strategy-for-health-and-sustainable-development
	2021	Drawing light from the pandemic: a new strategy for health and sustainable development - A review of the evidence	https://www.who.int/europe/publications/i/item/9789289051798
WHO	2024	Learnings from COVID-19 for future respiratory pathogen pandemic preparedness: a summary of the literature	https://www.who.int/publications/i/item/9789240086531
OECD	2022	First lessons from government evaluations of COVID-19 responses: A synthesis. OECD Policy Responses to Coronavirus (COVID-19)	https://doi.org/10.1787/483507d6-en
UK	2023	Responding to mpox: Communities, Communication and Infrastructure	https://theippo.co.uk/mpox-report/

Planning and response

Publisher	Year	Title	Link
ECDC	2025	Coordinated One Health investigation and management of outbreaks in humans and animals caused by zoonotic avian influenza viruses	https://www.ecdc.europa.eu/en/publications-data/avian-influenza-coordinated-one-health-investigation-outbreaks
	2024	Public health and social measures for health emergencies and pandemics in the EU/EEA: recommendations for strengthening preparedness planning	https://www.ecdc.europa.eu/en/publications-data/public-health-and-social-measures-health-emergencies-and-pandemics
	2023	Investigation protocol of human cases of avian influenza virus infections in EU/EEA	https://www.ecdc.europa.eu/en/publications-data/avian-influenza-investigation-protocol-human-cases
	2023	Survey report on laboratory capacity for molecular diagnosis and characterisation of zoonotic influenza viruses in human specimens in EU/EEA and the Western Balkans	https://www.ecdc.europa.eu/en/publications-data/avian-influenza-survey-report-laboratory-capacity
	2023	The EU Health Task Force (EUHTF) responds to specific requests coming from countries, from the European Commission or other international partners, including requests for emergency response, investigation of outbreaks, operational research, rapid identification of gaps in preparedness, expert advice, guidance, or simulation exercises.	How to request support
	2023	EU Laboratory Capacity assessment	https://www.ecdc.europa.eu/sites/default/files/documents/EULabCap-report-on-2021-survey-capabilities-and-capacities.pdf
	2022	Simulation exercises in public health settings - Step-by-step exercise design	https://www.ecdc.europa.eu/en/publications-data/simulation-exercises-public-health-settings-step-step-exercise-design
	2022	ECDC Considerations for the use of face masks in the community in the context of the SARS-CoV-2 Omicron variant of concern	https://www.ecdc.europa.eu/en/publications-data/using-face-masks-community-reducing-covid-19-transmission
	2022	Operational considerations for respiratory virus surveillance in Europe	https://www.ecdc.europa.eu/en/publications-data/operational-considerations-respiratory-virus-surveillance-europe
	2021	Protocol for a focused after-action review on evidence-based decision-making for selected COVID-19 response measures	https://www.ecdc.europa.eu/en/publications-data/protocol-focused-after-action-review-evidence-based-decision-making-covid-19-response
	2019	The use of evidence in decision making during public health emergencies	https://www.ecdc.europa.eu/en/publications-data/use-evidence-decision-making-during-public-health-emergencies
	2019	Health emergency preparedness for imported cases of high-consequence infectious diseases	https://www.ecdc.europa.eu/en/publications-data/health-emergency-preparedness-imported-cases-high-consequence-infectious-diseases
	2019	Operational tool on rapid risk assessment methodology	https://www.ecdc.europa.eu/en/publications-data/operational-tool-rapid-risk-assessment-methodology-ecdc-2019

Publisher	Year	Title	Link
	2017	Guide to revision of national pandemic influenza preparedness plans: Lessons learned from the 2009 A(H1N1) pandemic	https://www.ecdc.europa.eu/en/publications-data/guide-revision-national-pandemic-influenza-preparedness-plans-lessons-learned
	2014	Handbook on simulation exercises in EU public health settings	https://www.ecdc.europa.eu/en/publications-data/handbook-simulation-exercises-eu-public-health-settings
ECDC Learning Portal		Simulation Exercise Library	https://learning.ecdc.europa.eu/totara/catalog/index.php?cfp_menu_contenttypecont_f2b90[]=Simulation%20exercise&orderbykey=featured&itemstyle=narrow
		Step-by-step exercise design: How to design a Functional Exercise e-learning course	https://learning.ecdc.europa.eu/enrol/index.php?id=495
		Step-by-step exercise design: How to design a Table-top exercise e-learning	https://learning.ecdc.europa.eu/enrol/index.php?id=494
WHO	2024	Outbreak Toolkit, Providing the tools to investigate disease outbreaks, collect data and guide response activities	Outbreak toolkit
	2024	Technical consultation on public health and social measures for mitigating the risk and impact of epidemic and pandemic influenza to update the 2019 WHO guidance	https://www.who.int/publications/i/item/B09045
	2024	Conceptual framework for public health and social measures in the context of infectious disease transmission	https://cdn.who.int/media/docs/default-source/documents/epp/phsm/phsm-concept-framework_brochure_final.pdf
	2024	Preparedness and Resilience for Emerging Threats (PRET)	https://www.who.int/initiatives/preparedness-and-resilience-for-emerging-threats
	2024	Risk Assessment Tool	Video presentation: https://youtu.be/2OGPOitKdII
	2023	WHO benchmarks for strengthening health emergency capacities	https://www.who.int/publications/i/item/9789241515429
	2022	R&D Blueprint for Epidemics Updating the WHO list of pathogens with epidemic and PHEIC potential	https://cdn.who.int/media/docs/default-source/blue-print/rd-blueprint_prioritization-2022_concept-note_v.1.pdf
	2021	Strategic toolkit for assessing risks: a comprehensive toolkit for all-hazards health emergency risk assessment	https://www.who.int/publications/i/item/9789240036086
	2015	Framework for a Public Health Emergency Operations Centre	https://www.who.int/publications/i/item/framework-for-a-public-health-emergency-operations-centre
	2011	Pandemic Influenza Preparedness (PIP) Framework	https://www.who.int/initiatives/pandemic-influenza-preparedness-framework
		Facilitate planning and implementation. for health security preparedness. Strengthening health emergency capacities	ihrbenchmark.who.int
		Strategic Partnership for Health Security and Emergency Preparedness (SPH) Portal	https://extranet.who.int/sph

Publisher	Year	Title	Link
WHO Regional Office for Europe	2024	Strengthening hospital preparedness, catalogue of resources	https://www.who.int/europe/publications/m/item/strengthening-hospital-preparedness-and-resilience-to-respond-to-emergencies-catalogue
OpenWHO courses		Use of Epidemic Intelligence Systems with a Particular Focus on Event-Based Surveillance for Pandemic Preparedness	https://openwho.org/emergencymgmt/501093/Epidemic+intelligence
		Pandemic planning: getting 'PRET' for the new pandemic	https://openwho.org/emergencymgmt/536083/Pandemic+planning%3A+Getting+%27PRET%27+for+the+next+pandemic
AfricaCDC	2022	Risk Ranking and Prioritization of Epidemic-Prone Diseases	https://africacdc.org/download/risk-ranking-and-prioritization-of-epidemic-prone-diseases
Joint Action Terror	2021–2024	Strengthened preparedness and response to biological and chemical attacks – 202	Deliverables of the Joint Action are available here: https://www.jaterror.eu/deliverables
Joint Action SHARP	2019–2023	Strengthened International Health Regulations and Preparedness in the EU	Deliverables of the Joint Action are available here: https://thl.fi/en/research-and-development/research-and-projects/joint-action-on-strengthened-international-health-regulations-and-preparedness-in-the-eu-sharp-ja-
Dutch Societal Impact Team (Maatschappelijk Impact Team)	2024	Joining forces to be prepared for the next pandemic	https://www.government.nl/binaries/government/documenten/publications/2024/07/31/societal-impact-team/MIT+Joing+forces+to+be+prepared+for+the+next+pandemic.pdf
	2024	Assessment framework for pandemics	https://www.government.nl/binaries/government/documenten/publications/2024/07/31/societal-impact-team/MIT+Poster+Assesment+framework+for+pandemics.pdf
The Royal Society, UK	2023	COVID-19: examining the effectiveness of non-pharmaceutical interventions	https://royalsociety.org/news-resources/projects/impact-non-pharmaceutical-interventions-on-covid-19-transmission/
CapacityPlus (USAID)	2013	Human Resources Management Assessment Approach	https://www.intrahealth.org/sites/default/files/attachment-files/hrm-assessment-approach.pdf
Peer-reviewed articles based on ECDC literature reviews (open access)	2024	The effects of public health and social measures (PHSM) implemented during the COVID-19 pandemic: An overview of systematic reviews	https://onlinelibrary.wiley.com/doi/10.1002/cesm.12055
	2024	Development of a workforce self-assessment tool for public health emergency preparedness	https://academic.oup.com/eurpub/article/34/3/482/7638812
	2023	Cost of the COVID-19 pandemic versus the cost-effectiveness of mitigation strategies in EU/UK/OECD: a systematic review	https://bmjopen.bmj.com/content/13/10/e077602
	2023	Systematic review of outbreaks of COVID-19 within households in the European region when the child is the index case	https://bmjpaedsopen.bmj.com/content/7/1/e001718

Recovery

Publisher	Year	Title	Link
ECDC	2023	Conducting after-action reviews of the public health response to COVID-19: update	https://www.ecdc.europa.eu/en/publications-data/conducting-after-action-reviews-public-health-response-covid-19-update-0
	2021	Protocol for a focused after-action review on evidence-based decision-making for selected COVID-19 response measures	https://www.ecdc.europa.eu/en/publications-data/protocol-focused-after-action-review-evidence-based-decision-making-covid-19-response
	2019	Best-practices framework for undertaking an after-action review (AAR)	https://www.ecdc.europa.eu/en/publications-data/best-practices-framework-undertaking-after-action-review-aar
ECDC Learning Portal		Recovery from infectious disease outbreaks: From lessons identified to lessons learned	https://learning.ecdc.europa.eu/enrol/index.php?id=937
		Post-pandemic public health workforce: a few words on burnout	https://learning.ecdc.europa.eu/course/view.php?id=939
WHO	2025	National Action Plan for Health Security (NAPHS)	https://www.who.int/emergencies/operations/international-health-regulations-monitoring-evaluation-framework/national-action-plan-for-health-security
	2019	Guidance for after-action review (AAR)	https://www.who.int/publications/i/item/WHO-WHE-CPI-2019.4
WHO Regional Office for Europe		The National Action Plan for Health Security (NAPHS) tool	https://www.who.int/europe/tools-and-toolkits/naphs-tool
WHO Regional Office for the Eastern Mediterranean	2020	Implementation guide for health systems recovery in emergencies: transforming challenges into opportunities	https://iris.who.int/handle/10665/336472
OpenWHO course		After-action review	https://openwho.org/emergencymgmt/496674/After+Action+Review
Peer-reviewed articles		West Nile virus in Europe: after-action reviews of preparedness and response to the 2018 transmission season in Italy, Slovenia, Serbia and Greece- the article presents the methodology for AARs	https://link.springer.com/article/10.1186/s12992-020-00568-1

RCCE-IM reports and guidance documents

Publisher	Year	Title	Link
ECDC	2020	Guidance on community engagement for public health events caused by communicable disease threats in the EU/EEA	https://www.ecdc.europa.eu/en/publications-data/guidance-community-engagement-public-health-events-caused-communicable-disease
ECDC and WHO Regional Office for Europe	2022	Risk communication and community engagement (RCCE) resources for mpox	https://www.ecdc.europa.eu/en/infectious-disease-topics/z-disease-list/monkeypox/monkeypox-multi-country-outbreak/risk-communication
ECDC Learning Portal		Addressing Online Vaccination Misinformation e-Learning	https://learning.ecdc.europa.eu/enrol/index.php?id=659
WHO	2025	Interim guidance on strengthening community detection and response during the mpox outbreak	https://www.who.int/publications/i/item/B09313
	2022	EPI-WIN: WHO Information Network for Epidemics	https://www.who.int/teams/epi-win
	2019	WHO outbreak communication planning guide	https://www.who.int/publications/i/item/9789241597449
	2018	Communicating risk in public health emergencies: a WHO guideline for emergency risk communication (ERC) policy and practice	https://www.who.int/publications/i/item/9789241550208
		RCCE-IM Plan Creator	https://rcceimplanner.who.int/welcome
WHO Regional Office for Europe	2024	Communicating in an outbreak	https://www.who.int/europe/publications/i/item/WHO-EURO-2024-8271-48043-71198
OpenWHO courses		Risk communication and community engagement	https://openwho.org/emergencymgmt/501691/Risk+communication+and+community+engagement
		Infodemic management	http://openwho.org/emergencymgmt/499738/Infodemic+management
US CDC	2024	Crisis & Emergency Risk Communication (CERC)	https://www.cdc.gov/cerc/php/about/index.html
Open-access eBook	2023	Managing Infodemics in the 21st Century; Addressing New Public Health Challenges in the Information Ecosystem	https://link.springer.com/book/10.1007/978-3-031-27789-4

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