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Containment and mitigation strategies for pandemics

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Containment and mitigation strategies are the only viable measures to counter a pandemic before effective pharmaceutical interventions are available. These measures require a variety of societal capacities and resources, delivered in a harmonised manner, to achieve the best outcomes and minimise unintended consequences. This chapter reviews the core capacities traditionally emphasised in preparedness for public health emergencies, and summarises actions taken by OECD countries to combat the COVID-19 pandemic. Based on global experiences and national lessons learnt from the crisis response, this chapter investigates gaps between preparedness and actual response. Drawing on these findings, it outlines what capacities need to be strengthened, and how these efforts can be supported, to better prepare for the next pandemic and, more broadly, to improve resilience in national health systems.

Key findings

Most OECD countries had pandemic preparedness plans because of lessons learnt from previous pandemics. The plans typically covered containment and mitigation measures which, in the absence of any effective vaccines or treatments, include non-pharmaceutical interventions such as enhanced hygiene, limitations on people gathering (“physical distancing”) and the closure of public places.

However, COVID-19 revealed that other issues are crucial for successful containment and mitigation beyond these public health measures. Most of the plans lacked certain capacities or strategies that were revealed to be essential for an effective whole-of-society response to the pandemic. These strategies include:

- psychological support for populations – especially vulnerable groups and young people
- social and financial support for people and businesses affected by restrictive interventions
- civil society engagement, to secure buy-in for measures
- management of privacy or ethical issues, such as issues related to enforcing mask wearing
- research and development into pharmaceutical and non-pharmaceutical interventions.

Speed is key. During the COVID-19 pandemic, many countries struggled to implement containment measures in a timely manner, although they had previously been assessed as well-prepared for a pandemic scenario. This proved that “planning well”, alone, is insufficient to respond effectively to threats such as pandemics. Stronger focus should be placed on practical readiness to deploy core capacities, including mobilising physical and human resources to be at the right place at the right time. The failure to implement containment measures proactively led to use of more stringent mitigation measures – such as lockdowns – early in the pandemic, with consequent negative socio-economic impacts.

Broader societal involvement is warranted when designing and implementing non-pharmaceutical interventions, such as limiting economic activity, closing schools and public places, and instigating lockdowns. Hence, implementing a mitigation strategy should not depend solely on the nature and timing of interventions. Careful consideration should also be given to economic and social aspects, such as trust in institutions, public tolerance of specific interventions, social cohesion and how best to support those who are vulnerable. Co-operation within government and among diverse sectors is crucial, as is engaging civil society, when designing and implementing containment and mitigation measures.

More resilient and effective pandemic preparedness and response constitutes:

- continuous investment in physical and human **resources**
- integrated **information** systems and research support
- proactive political **leadership**
- ensuring citizen **participation**.

OECD countries are encouraged to engage actively to enhance international co-operation in pandemic preparedness and response. Active engagement will help sustain political momentum for collective action and will shape better containment and mitigation strategies for the future, contributing to efforts to make health systems, economies and societies ready for the next crisis.

4.1. Containment and mitigation strategies are essential to combat pandemics

Containment and mitigation strategies are responses at a national or regional/sub-national scale against the threat of a pandemic caused by a newly emerging infectious disease. Infectious diseases have been on the rise in recent decades and have had significant negative economic impacts. These economic impacts have ranged from USD 40 billion to USD 55 billion: USD 40 billion for the severe acute respiratory syndrome (SARS) in 2003, USD 45-55 billion for H1N1 influenza in 2009 and USD 53 billion for the West African Ebola outbreak in 2014-16 (Global Preparedness Monitoring Board, 2019^[1]).

To block or minimise transmission of infectious diseases in the community, timely and concerted implementation of containment and mitigation strategies is essential. Each type of strategy is distinct (Table 4.1). In practice, however, they are often implemented simultaneously to achieve the common goal of preventing health system capacity from being overloaded.

Table 4.1. Definitions of containment and mitigation strategies

Containment	Containment strategies primarily aim to prevent the spread of infection by limiting transmission within a certain group or community. They use interventions such as active case detection with various test techniques and/or investigation, tracking and tracing of possible infected or exposed cases, and isolation of cases with appropriate treatment when required. These strategies are predominantly applicable in the initial phases of a pandemic, when the transmission is still on a scale that is containable.
Mitigation	Mitigation strategies primarily aim to minimise the negative impacts on society by alleviating the intensity of the shock on the socio-economic system. They focus on decreasing the transmission rate and flattening the peak so that it falls below the capacity of the health system. Examples of mitigation strategies range from the individual to social levels, including enhancing personal and/or environmental hygiene, wearing masks in public places, and physical distancing including limits on gatherings, public closures and full society-scale lockdowns.

Source: Adapted from OECD (2020^[2]), "Flattening the COVID-19 peak: Containment and mitigation policies", <https://doi.org/10.1787/e96a4226-en>.

The actual measures employed in each strategy can vary widely – from individual case detection and isolation to campaigning for personal hygiene enhancement, enforcement of specific protective actions or activities and large-scale physical distancing in society. The range extends further based on the degrees of scale and stringency, which depend on factors such as the number of infected cases, the affected area, the emergence of variants, policy objectives and the political setting (USAID, 2011^[3]). Implementing such measures in the right place and at the right time requires continuous efforts to enhance and maintain relevant core capacities and infrastructure. These mainly consist of surveillance and risk assessment systems, case-tracing and contact-tracking workforces, laboratory and reporting networks, and communication in the period before and during the pandemic (WHO, 2005^[4]).

The response to a shock, such as a pandemic, comprises four stages (see the chapter on key findings and recommendations). These stages are prepare, absorb, recover and adapt. *Prepare* includes the steps taken to prepare critical functions to avoid and mitigate shocks. This occurs prior to the disruption. *Absorb* occurs after the shock commences, comprising the capability of the health system to maintain core functions and absorb the consequences without collapse. Thus, limiting the extent of the disruption and minimising the morbidity and mortality impact. *Recover* involves regaining the disrupted functions as quickly and efficiently as possible. *Adapt* is the capacity of the health system to “learn” and improve its capacity to absorb and recover from shocks, reducing the impact of similar threats in the future.

The primary aim of this chapter is to highlight the core capacities that should be prioritised when implementing timely and effective containment and mitigation strategies against future shocks. This chapter looks back at major pandemic preparedness paradigms and key capacities suggested prior to the COVID-19 pandemic, and analyses interventions taken during the absorb and recovery stages of the pandemic. Through reviews of recent research and major discussions, it highlights the importance of resources, information, leadership and citizen participation for more resilient and effective pandemic preparedness and response in the future.

4.2. Pandemic preparedness was insufficient to combat the COVID-19 pandemic

4.2.1. The H1N1 pandemic enabled countries to review preparedness for future public health emergencies

Containment and mitigation strategies require various capacities and abundant resources, alongside an effective co-ordinating mechanism at all levels of the response system – including at national, regional and international scales. Establishment of a preparedness plan and the accompanying response system is the first milestone in enabling this multi-faceted strategy to operate during a pandemic.

Based on experience during the SARS outbreak of 2003, the International Health Regulations (IHR) were revised to reinstitute the concept of their coverage to any public health emergency of international concern. They called on State Parties to equip and strengthen capacities to detect, assess, report and respond to future emergencies (WHO, 2016^[5]). Despite the enforcement of the IHR 2005, the 2009/2010 H1N1 pandemic revealed that the world was insufficiently prepared for such threats; similar observations were made during the 2014-16 West African Ebola outbreak (WHO, 2016^[6]). Notwithstanding, the H1N1 pandemic provided an opportunity to re-emphasise the importance of a planned approach, and the 2014-16 West African Ebola outbreak developed the perception of epidemics as an issue of national health security (Heymann et al., 2015^[7]).

4.2.2. Efforts were made to evaluate preparedness before the COVID-19 pandemic

Various efforts were made to establish an effective framework for public health emergency preparedness (PHEP) before the COVID-19 pandemic. These include the World Health Organization (WHO) emergency preparedness frameworks, the United Nations Sendai and Hyogo Frameworks, and the United States Centers for Disease Control and Prevention Public Health Emergency Preparedness and Response Capabilities (Box 4.1).

However, the lack of consistency and limited consideration of PHEP plans within the crisis response strategies to COVID-19 hampered their application (Khan et al., 2018^[8]). Furthermore, efforts to evaluate PHEP plans focused more on the presence of capacities and resources and less on capabilities that reflect a country's actual ability to intervene in the event of a health emergency (Chiossi, Tsolova and Ciotti, 2021^[9]). Studies have revealed that none of the pandemic preparedness assessment tools – including the Global Health Security Index and Joint External Evaluation – successfully predicted the relative performance of countries in their COVID-19 pandemic response (COVID-19 National Preparedness Collaborators, 2022^[10]). However, other researchers have suggested associations between low levels of national preparedness and increased national caseloads and mortality (Chaudhry et al., 2020^[11]). A greater extent of readiness was also observed in countries with extensive experience of managing epidemics – especially at the beginning of the pandemic, supported by the findings of a shorter time to first COVID-19 case detection in countries with a higher risk of importation (Haider et al., 2020^[12]).

Box 4.1. Public health emergency preparedness frameworks and capacity evaluation efforts

The WHO Strategic Framework for Emergency Preparedness is an example of a public health emergency preparedness (PHEP) framework. It focuses on setting up policy objectives and priorities and identifies the core capacities that need to be strengthened for PHEP at the national level. It identifies 12 core capacities across three areas of governance, capacities and resources: 1) national legislation; 2) plans for emergency preparedness, response and recovery; 3) co-ordination mechanisms; 4) risk assessment; 5) surveillance and early warning system; 6) access to diagnostic services; 7) basic and safe health and emergency services; 8) risk communications; 9) research, development and evaluation; 10) financial resources; 11) essential supplies; and 12) human resources. The framework highlights that PHEP should be achieved at all levels of society and needs to be co-ordinated via multi-sectoral action with supportive investment (WHO, 2017^[13]).

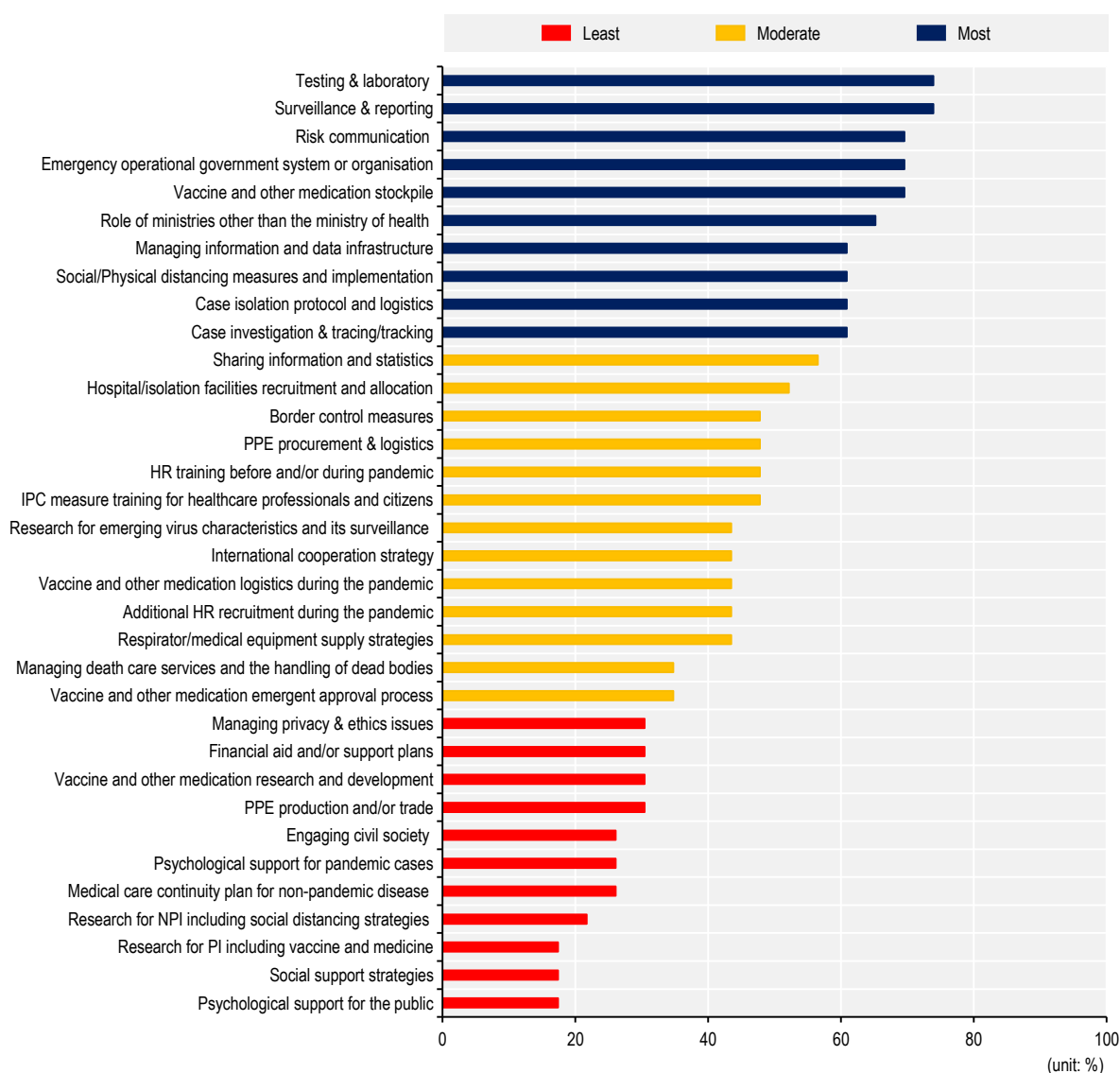
Two examples of capacity evaluation efforts follow:

- The Joint External Evaluation (JEE) is a voluntary external assessment tool developed to assess in detail the core capacities relevant to the IHR, alongside the State Party self-assessment Annual Report, which is an annual national internal assessment required by the IHR. Four main pillars – prevent, detect, respond, and IHR-related hazards and points of entry – are assessed on a scale of one to five across 19 technical areas (WHO, 2018^[14]). However, owing to the voluntary nature of the assessment, only 12 OECD countries (32%) participated in JEE assessment between 2016 and 2018 (WHO, 2022^[15]).
- The Global Health Security (GHS) Index is a biannual open-source information-based assessment established in 2019, consisting of 34 indicators across six categories – prevention, detection and reporting, rapid response, health system, compliance with international norms, and risk environment. The GHS Index emphasises the role of the health system in national security and assesses both capacity and utilisation of that capacity (Cameron, 2019^[16]).

4.2.3. Preparedness plans lacked capacities that proved crucial during the pandemic

OECD countries had prepared pandemic preparedness plans (PPPs) in varying degrees for the potential risk of a pandemic. In the OECD Resilience of Health Systems Questionnaire 2022 (answered by 23 countries), 91% of respondents stated that they had a national PPP. The primary reason given for the initiation of most PPPs was WHO requirements (70%). Other reasons given were a national/political drive (61%), the domestic experience of the 2009 H1N1 pandemic (61%), the domestic experience of an emerging infectious diseases (30%), and experience of emerging infectious disease in neighbouring countries (13%).

Figure 4.1. Capacities included in national pandemic preparedness plans among OECD countries



Note: Most = the 10 most commonly included capacities in the PPPs of OECD countries. Moderate = the remaining capabilities that were not among the 10 most or 11 least commonly included. Least = the 11 least commonly included capacities in the PPPs of OECD countries' (11 capacities are ranked as least due to a tie in the components least included).

Source: OECD (2022^[17]), Resilience of Health Systems Questionnaire, 2022.

In national PPPs, as shown above in Figure 4.1, the ten most commonly included capacities – included by more than 60% of responding countries – were testing and laboratory preparedness; surveillance and reporting; risk communication (Box 4.2); emergency operational government system or organisation; vaccine and other medication stockpiles; role of ministries other than the ministry of health; managing information and data infrastructure; physical distancing measures and implementation; case isolation protocol and logistics; and case investigation and tracing/tracking.

Conversely, other capacities – shown to be crucial after the COVID-19 pandemic began and emphasised in prior PHEP frameworks – were delineated in less than a third of OECD countries' preparedness plans. These included psychological support for the public; social support strategies; research for non-pharmaceutical interventions (NPI); medical care continuity plan for non-pandemic diseases; psychological

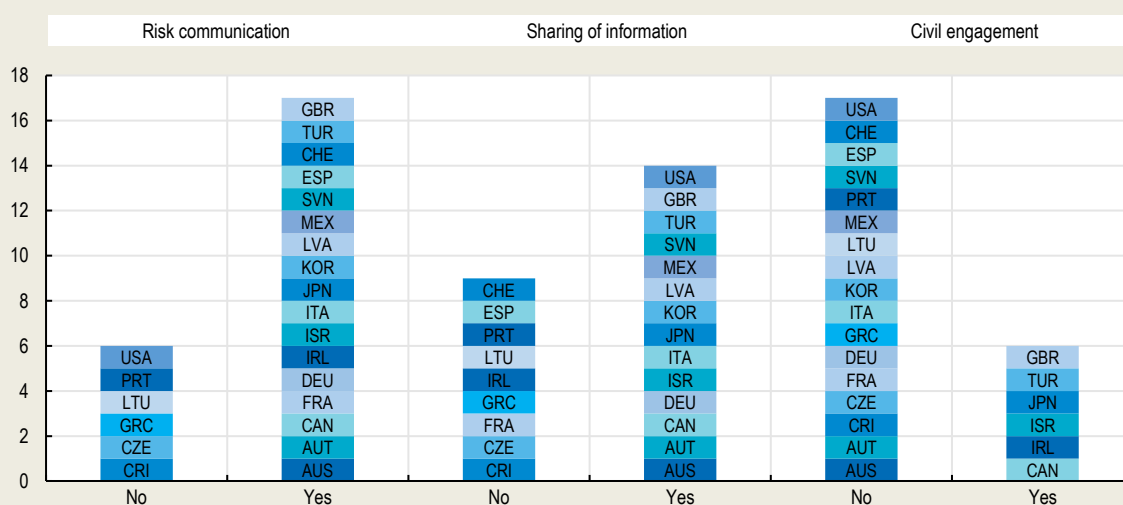
support for pandemic cases; engaging civil society; PPE production and/or trade; research and development for pharmaceutical interventions (PI); financial aid and/or support plans; and managing privacy and ethical issues.

Despite the presence of a national PPP, several countries stated that they faced difficulties in applying plans that did not fit well with the COVID-19 pandemic situation. Other respondents reported that the plans were not flexible enough; the plans were aimed more at disasters or natural hazards; or the plans did not anticipate certain characteristics of COVID-19, such as asymptomatic transmission (OECD, 2022^[17]).

Box 4.2. Crisis communication strategies among OECD countries before the pandemic

Strategies for risk communication were set out in most PPPs. However, the COVID-19 pandemic focused attention on the crucial role of effective communication to the public. Among responding countries with pandemic plans, the majority (17 of 21) reported that these plans included strategies to address risk communication, while 14 had also included strategies to promote sharing of information and statistics during a pandemic (Figure 4.2). Far fewer (6 of 21) reported that their PPPs included strategies for engaging civil society, despite its potential to act as an important bridge between high-level government policy and people's daily lives and its ability to reach populations that might otherwise be difficult to reach via traditional communication means.

Figure 4.2. Countries that included selected core capacities in national pandemic preparedness plans



Note: "No" includes countries that responded "no" and countries that left the answer blank.

Source: OECD (2022^[17]), Resilience of Health Systems Questionnaire, 2022.

The majority of responding countries reported that crisis communication strategies had already been established and were used during the pandemic. Several countries had communication strategies that had been developed in response to or in anticipation of pandemic influenza, which was modified or adapted to meet the needs of the new emergency response. During the COVID-19 pandemic, many countries reported communication strategies that targeted health authorities and ministries of health. Other countries reported that cross-governmental crisis communication approaches were co-ordinated by external ministries or centres of government, including the Ministry of the Interior in Austria and the Federal Chancellery in Switzerland.

4.3. Containment and mitigation were critical to absorbing the COVID-19 pandemic

4.3.1. Containment strategies have been shown to be effective

The success of a containment strategy is largely dependent on the capacities of strong surveillance and reporting systems, accompanied by rapid identification and isolation/quarantine of cases and their potential contacts. The effectiveness of containment using the 4T Strategy (testing, tracing, tracking, treatment and isolation) implemented in a timely manner has been proved by multiple studies (Hellewell et al., 2020^[18]). Each measure – contact tracing, screening, and isolation/quarantine – was independently effective at various levels, and effectiveness was increased with earlier intervention, broader coverage and integration of multiple measures (Girum et al., 2020^[19]). An economic-epidemiological modelling study comparing the intensive 4T Strategy and a lockdown strategy suggested that aggressive but successful containment strategies aiming to contain small outbreaks by severely restricting a target high-risk group are significantly more effective in flattening the curve, and exert significantly less severe impacts on GDP, than restricting an entire population. These effects were seen more dramatically among low-skilled workers and self-employed groups (Aum, Lee and Shin, 2021^[20]).

4.3.2. Proactive implementation of a containment strategy is not easy

To initiate containment strategies rapidly and effectively from an early phase, various capacities should be in place before a pandemic occurs. These capacities include: monitoring the occurrence of emerging infectious diseases at both regional and national levels; risk assessment of potential risks; governance and legislation that allow rapid design and implementation of policy interventions even in settings of limited information and evidence (Chung et al., 2021^[21]); well-trained and dedicated health care professionals and administrative/logistics staff; essential equipment and tools for tracing/tracking activities (such as PPE); resource management systems including recruiting additional health care workers and hospital beds; and case isolation/quarantine facilities and their staff (Rajan, 2020^[22]).

During the COVID-19 pandemic, only 13 OECD countries managed to implement comprehensive contact tracing within a month of the declaration of a public health emergency of international concern (Hale et al., 2021^[23]). This resulted from a mixture of complex reasons, including underequipped capacities, delayed hiring of sufficient and trained contact tracers, difficulties with scaling up testing capacity to meet demand – including shortages of testing reagent supplies (see the chapter on securing supply chains) – and lack of procurement of facilities and systems for surveillance of isolation (Lewis, 2020^[24]). Box 4.3 gives examples of some early containment strategies implemented by OECD countries.

Box 4.3. Examples of containment strategies in OECD countries during the COVID-19 pandemic

During the initial phase of the COVID-19 pandemic, countries implemented various kinds of containment strategies in line with their different national contexts, health care capacities and public health response systems. The core elements of success were similar: rapid and proactive responses with evidence-based policy making and implementation.

- In Germany, despite the disadvantages of bordering nine other countries, with high interconnectedness as an EU Member State, robust public health fundamentals – including expert scientific institutions (such as the Robert Koch Institute) – formed a strong foundation for the early response. Germany was one of the first countries to establish COVID-19 testing methods (on 16 January 2020) together with accompanying technical guidelines for testing, case finding, contact tracing and hygiene and disease management. As a result, the country quickly scaled up capacity to cover the escalating demand (1.1 million tests per week at the end of 2020), with a high proportion from decentralised private laboratories equipped with expertise and instruments to conduct reverse transcriptase-polymerase chain reaction (RT-PCR) diagnostics. This was accelerated by mandating full insurance coverage of COVID-19 tests for symptomatic patients. The country aimed to trace every confirmed case, despite the hindrance caused by a significant lack of human resources; this was later reinforced by hiring “containment scouts” to support local authorities in tracing contacts (Wieler, Rexroth and Gottschalk, 2021^[25]).
- New Zealand chose a different strategy from most other countries, which resulted in remarkable results in the containment of the COVID-19 pandemic. At the end of 2022, New Zealand had maintained one of the lowest case fatality ratios (Johns Hopkins University & Medicine, 2022^[26]). The country’s response focused on rapid and aggressive lockdown measures, accompanied by consistent and clear communication and strong political leadership. Within one month of the first detected case, on 28 February 2020, the country closed its borders and chose an elimination strategy via a Level 4 lockdown (interaction limited to within the household). This lasted for about a month and successfully brought down the case number to zero (Bremmer, 2021^[27]). The border closure continued for about two years. During this time, the country showed high political trust and compliance among its citizens, with ministers cutting 20% of their wages and supporting tax reforms to ensure the housing of people who had lost their jobs (Taylor, 2020^[28]).
- Korea’s response strategy, initially known as the 3T Strategy (testing, tracing, and treatment with isolation) was recognised as an exemplary response to a strong containment strategy (Lim et al., 2021^[29]). Korea strongly enhanced its capacities for rapid and robust containment strategies after its experience with outbreaks of SARS in 2003 and Middle East Respiratory Syndrome in 2015. The country executed regular tabletop exercises before the pandemic; based on analysis of these, a new testing process was developed rapidly before the first case was detected (Kim et al., 2020^[30]). Through public-private partnerships, Korea established a nationwide testing system within two weeks. The Korea Disease Prevention and Control Agency was at the centre of strategic planning and implementation, including the deployment of its epidemic intelligence service officers to track and trace cases. All confirmed cases were isolated in the designated hospitals or newly established “residential treatment centres”, based on the severity of the case at triage (Yang, Kim and Hwang, 2020^[31]). Possible exposed contacts were isolated at home and closely monitored with regular mobile communication and smartphone apps. Korea was also noted for adapting innovative digital technology, such as comprehensive data collection and tracing/tracking supporting systems and the use of QR codes for entry regulations to indoor places (Kim et al., 2021^[32]).

4.3.3. Comprehensive implementation of non-pharmaceutical interventions is key to their effectiveness

NPIs played a significant role in the response to the COVID-19 pandemic in almost all countries, particularly in the most affected countries – including OECD member countries. Until safe and effective vaccines and medication were available, NPIs (together with the 4T Strategy) continued to be the main countermeasures against the pandemic.

Despite their crucial role in counteracting the COVID-19 pandemic, concerns about the NPIs were raised in the early phases of the pandemic, especially because of unintended negative consequences such as economic loss due to closings, learning loss due to school closures, etc, that accompanied their implementation. Limited data availability led to increased dependency on modelling studies, which concluded that the implementation of comprehensive packages of NPIs could effectively suppress the transmission of COVID-19. Table 4.2 lists NPIs used at different levels to minimise transmission.

Table 4.2. Examples of non-pharmaceutical intervention policies implemented by OECD countries

Level	Policy
Individual	Physical distancing (indoors and outdoors) Respiratory and hand hygiene Face masks PPE (including face shields and gloves)
Environmental	Environmental cleaning and ventilation
Population	Limiting close physical interpersonal interactions Isolation of symptomatic cases not requiring hospitalisation Quarantining of contacts Shielding medically and socially vulnerable populations Recommending “social bubbles” Specific recommendations for detention centres: long-term care facilities, prisons, migrant and refugee centres Limiting the size of gatherings Measures in the workplace, including teleworking Closure of non-essential businesses School closures Stay-at-home measures Travel-related measures International and domestic travel restrictions and border closures Measures on conveyances and travel hubs Travel advice Screening at points of entry at national borders (including mandatory testing) Quarantine of passengers

Source: Adapted from ECDC (2020_[33]), “Guidelines for the implementation of non-pharmaceutical interventions against COVID-19”, <https://www.ecdc.europa.eu/sites/default/files/documents/covid-19-guidelines-non-pharmaceutical-interventions-september-2020.pdf>.

While no individual intervention is sufficient to contain the COVID-19 pandemic on its own (ECDC, 2020_[33]), NPIs are most effective when conducted comprehensively in a layered approach (implementing several at once) and sustained for a sufficiently long period. Box 4.4 gives examples of studies that reported a comprehensive set of NPIs implemented by countries during the pandemic, mostly examining their contributions to the suppression of the “reproduction number” (the number of people infected by one infected person). The impact of interventions seemed to have a cumulative nature: impacts were limited in the early days of implementation, but more significant impacts were seen about 1-3 weeks after both implementing and lifting interventions (Li et al., 2020_[34]).

Box 4.4. The expected impact of non-pharmaceutical interventions

Understanding the relative impact of different NPIs is of great interest to policy makers, as it provides a basis for calibrating the public health response throughout different stages of a shock such as a pandemic.

Studies use advanced modelling and statistical techniques to evaluate the relative contribution of NPIs to containing the spread of COVID-19. However, such analyses are difficult for technical reasons – for example, the simultaneous implementation of multiple measures makes it difficult to disentangle the relative contribution of each. Other significant issues include delays in the impacts of policies and implementation of relatively similar interventions at different levels of stringency or adherence, making a comparison across countries difficult. Despite these technical difficulties, the notable body of evidence made the following findings.

- Haug et al. (2020^[35]) found that the most effective NPIs consisted of both stringent restrictive measures (including curfews, lockdowns, closing and restricting places of large/small gatherings for a specific amount of time – such as work-at-home measures – and closure of schools/universities) and less restrictive measures (such as government support for vulnerable populations, risk communication strategies and land border restrictions). Environmental measures to disinfect surfaces in public and semi-public places were found to be ineffective.
- Bo et al. (2021^[36]) studied COVID-19 transmission in 190 countries during the first wave, and found that mandating face masks in public (11.4%), isolation/quarantine (15.1%), physical distancing (42.9%) and traffic restrictions (9.3%) were all associated with a reduction in the reproduction number. Studies have also found that simultaneous implementation of two or more types of NPI seemed to be associated with a greater reduction in the reproduction number.
- Liu et al. (CMMID COVID-19 Working Group, 2021^[37]) found that school closures and internal movement restrictions had a strong association with a reduction in the reproduction number, which intensified under increased stringency. Workplace closures, income support and debt relief showed effectiveness at the initiation of the interventions, while public event cancellations and restrictions on gatherings only showed effectiveness when implemented at maximum capacity. Stay-at-home requirements, on the other hand, were found to be inconsistent and inconclusive on the reproduction number.

4.3.4. Careful planning is an asset in implementing non-pharmaceutical interventions

The implementation and transition of effective NPIs require careful planning and consideration of various factors. Experience during the COVID-19 pandemic highlighted several practical and social elements that should be considered by policy makers, as outlined below.

- Individual adherence to and compliance with NPIs are essential to their success. This may be affected by various factors, including trust in the implemented measures, perceived level of personal and local community risk, availability of resources and information, and socio-economic status (Seyd and Bu, 2022^[38]). Hence, to enhance knowledge, understanding and trust in governments among the public, it is crucial to promote communication that outlines the rationale for using the NPIs. These tools might include mass media campaigns to circulate practical information and guidance, peer-to-peer motivation, community engagement and legislative action supported by adequate funding (Seale et al., 2020^[39]). Compulsory enforcement can be implemented in compelling situations. However, strong physical distancing ordinances associated with the enforcement of compulsory use of PPE (such as face masks) triggered a discussion about civil rights and, in some cases, violence in communities. Clear recommendations through timely and transparent communication are desirable in these challenging situations (Box 4.5).

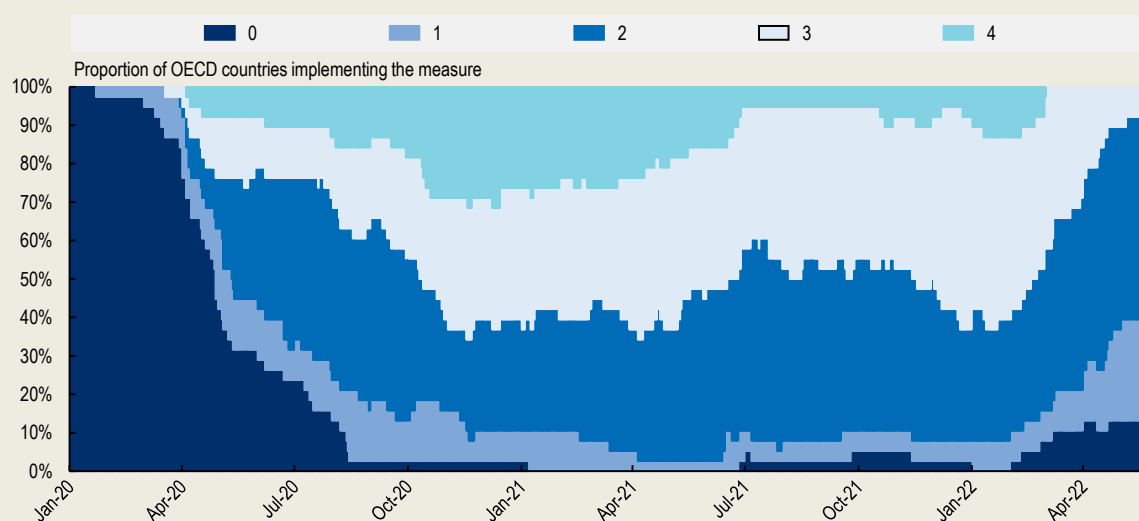
Box 4.5. Mask-wearing mandates: the necessity of public compliance

Appropriate use of a face mask reduces COVID-19 transmission by preventing the release of respiratory droplets from infected individuals. This NPI is most effective when it attracts high compliance, with adequate mask types (Eikenberry et al., 2020^[40]). Many studies have shown the effectiveness of this mask-wearing, and multiple guidelines officially recommend its implementation (Cheng et al., 2021^[41]; ECDC, 2022^[42]).

However, mandates to wear face masks triggered a strong backlash, especially in European societies (Zhao and Knobel, 2021^[43]), for reasons including inconvenience, stigma and shortages (Li et al., 2022^[44]). Despite the resistance, studies have shown that policies mandating face masks increased actual compliance despite moderate acceptance, which correlated positively with other protective behaviours. Further research has suggested that, compared to mandates, recommendations led to decreased compliance, were perceived as less fair, and intensified stigmatisation (Betsch et al., 2020^[45]).

Many OECD countries implemented stringent face coverage mandates – mostly from the middle/end phases of the first wave of the COVID-19 pandemic. In May 2020, 50% of OECD countries had implemented some degree of face coverage mandate; the rate exceeded 80% in August 2020, and the high level was maintained until the end of 2021 (Figure 4.3). Alongside mandates, countries implemented various penalties to increase compliance and achieve higher effectiveness – most commonly fines (as in Germany, the Netherlands, and the United States).

Figure 4.3. Changes in face coverage policy stringency among OECD countries over time



Note: 0: No policy; 1: Recommended; 2: Required in some specified shared/public spaces outside the home with other people present, or some situations when physical distancing is not possible; 3: Required in all shared/public spaces outside the home with other people present or all situations when physical distancing is not possible; 4: Required outside of the home at all times regardless of location or presence of other people.

Source: Created by authors using data from Our World in Data, Hale et al. (2021^[23]), "A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker)", <https://doi.org/10.1038/s41562-021-01079-8>.

- The timing of NPI implementation is crucial in the context of effectiveness (Lai et al., 2020^[46]), and in minimising the burden on relevant stakeholders (such as educational institutions, logistics systems, resource manufacturers and health facilities). While large differences exist across settings and time, studies suggest that in the absence of NPIs the number of COVID-19 cases can double in as little as three days (Lurie et al., 2020^[47]). However, NPIs take at least a week – and often more – to produce any impact after implementation (Li et al., 2020^[34]), accentuating the importance of proactive implementation before the impact of a pandemic exceeds health system capacity. At the same time, however, NPIs should not be implemented too early, given the practical aspects of implementation.
- Effective surveillance systems and close monitoring with regular situational analysis and forecasting should support decision making. Strong surveillance systems are necessary at every stage of a pandemic: before and during the implementation of NPIs and after the lifting of interventions (Leung and Wu, 2020^[48]). It has therefore been suggested that relaxing or adjusting the implementation of NPIs should be gradual, and should go together with continuous monitoring of the situation and risk assessment (WHO, 2020^[49]).
- NPIs are usually implemented in an amalgamated manner with containment strategies. However, with limited resources available to be mobilised and constrained political vitality, the absence of strategic prioritisation in allocating resources can result in the ineffective implementation of both strategies. This can lead to the early exhaustion of trust and acceptability before effective pharmaceutical interventions are developed. Box 4.6 outlines the transition of priorities in NPI implementation.

Box 4.6. Shifts in policy priorities with the progression of pandemic phases

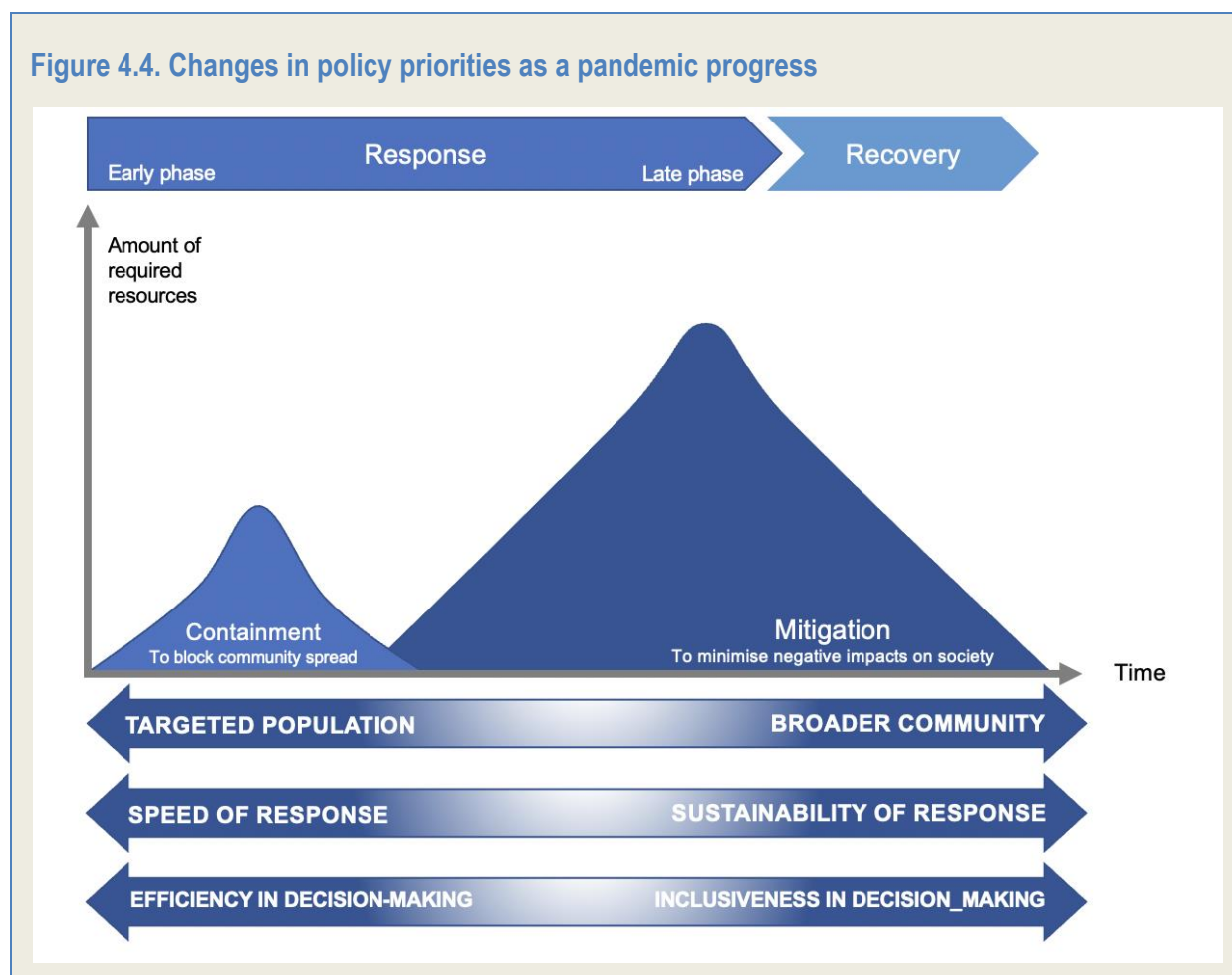
As the pandemic progresses and the response transitions from a “containment strategy dominant” phase to a “mitigation strategy dominant” phase, governments may change their policy priorities. This transition is an appropriate course of policy implementation to respond to escalating or de-escalating situations, shifts in resource levels, and evolving socio-economic and political circumstances.

In the early phase of a pandemic, the majority of resources are generally dedicated to controlling the target population – infected cases and their contacts – through containment strategies. Resources and capacities should be in place before the pandemic and available to react as swiftly as possible to initial outbreak cases. Despite limited situational information and scarce evidence, prompt decisions should be made at the highest levels for the rapid mobilisation of resources from various sectors at every level of government and communities (Figure 4.4).

As the outbreaks spread out and a pandemic evolves, dominant strategies to counter the epidemic shift to mitigating measures – including physical distancing, affecting the whole of society. This means that the target group shifts from a relatively small group to the whole population. In this phase, accountability and acceptability among the public should be the top priority in planning and implementing policy measures, to ensure the mitigation strategy is sustainable.

As was experienced in the COVID-19 pandemic, social/physical distancing policies may widen the socio-economic gap (Palomino, Rodríguez and Sebastian, 2020^[50]). Inclusiveness should not be overlooked, alongside the efficacy and efficiency of policies, when making decisions to achieve the goal of controlling the epidemic while protecting social solidarity and preserving the socio-economic potential of people to recover and adapt during and after the crisis.

Figure 4.4. Changes in policy priorities as a pandemic progresses



The impact of NPIs may vary across settings. An NPI that showed excellent effectiveness in one country is not guaranteed to have the same effectiveness elsewhere. The impact of interventions such as physical distancing measures and travel restrictions, for example, has been shown to vary significantly depending on the country of implementation (Haug et al., 2020^[35]). Consequently, building up a mitigation strategy should be based on the national context and societal setting, especially to garner legitimacy.

The predictability of a measure should also be considered before its implementation, as this is connected to its acceptability, sustainability and eventual effectiveness. Unlike mitigation strategies, the impact of containment strategies such as case identification, contact tracing and health care measures seems to be less dependent on the setting. Additional evidence is needed; however, preliminary analyses suggest that country-specific characteristics – such as social, cultural, economic, and technical circumstances – may play a significant role in explaining the differences (Haug et al., 2020^[35]).

4.3.5. Negative consequences of non-pharmaceutical interventions should be considered

Despite their high effectiveness in containing and mitigating the pandemic, NPIs may also create negative consequences – particularly in terms of economic and social impacts. NPIs implemented at extensive scales or stringent levels, such as lockdowns, have been shown to have the greatest impacts on all outcomes related to the COVID-19 pandemic, including the transmission of the infection, the incidence of severe cases requiring hospitalisation and fatalities (Flaxman et al., 2020^[51]). However, these interventions

have also been shown to have a detrimental impact on the functioning of society and the economy, with unequal impacts observed across different sectors.

A study that estimated the effect of social inequalities of NPIs found that wealthier areas experienced smaller outbreaks and lower burdens than poorer areas (Gozzi et al., 2021^[52]). School closures were a NPI that led to many social controversies. School closures raised concerns and marked the beginning of a policy debate to identify a suitable balance between effective control of the epidemic, economic prosperity and ensuring equity (Kaplan, Moll and Violante, 2020^[53]).

4.3.6. A risk-based approach in international travel restrictions is crucial, though it was not easy to achieve

International travel restrictions refer to any kind of measures to restrict inbound (and sometimes outbound) travel to a defined country, region or territory. They range from reporting designated symptoms to closing borders. The restrictions are imposed to minimise the influx of infected cases and are especially effective in the early periods of an epidemic (Grépin et al., 2021^[54]), as they allow time to establish a domestic public health response system. However, the efficacy and feasibility of international travel restrictions are controversial because of difficulties in establishing appropriate timing, as well as the accompanying high economic and social costs. Moreover, once a variant is widespread within the country, continued international travel restrictions have been shown to make an extremely limited contribution to local epidemic control (Kucharski et al., 2022^[55]), and some studies suggest a reduction of only about 3% in the incidence rate in the long term (Mateus et al., 2014^[56]).

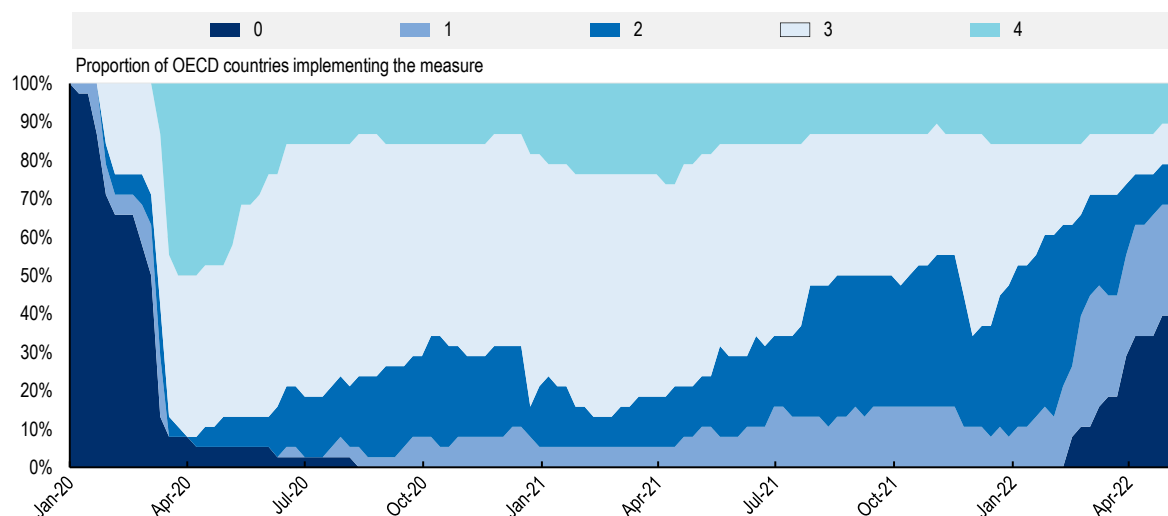
Despite their limited epidemiological effect, most countries imposed travel restrictions during almost the entire COVID-19 pandemic, initiated in part by political and economic motives in a situation of limited alternatives (Neumayer, Plümper and Shaikh, 2021^[57]).

The stringency and type of international travel restrictions fluctuated depending on the international and national COVID-19 situation. Until mid-March 2020, fewer than 30% of OECD countries had implemented travel restrictions. However, following the WHO's characterisation of COVID-19 as a pandemic, 90% of OECD countries increased their restrictions. Marked patterns were observed following the emergence of new variants and seasonal changes. For example, a rapid increase in stringency was observed when the Delta variant emerged (July-November 2021). Similarly, in the December 2021-February 2022 period, a steep increase in stringency was followed by a rapid lifting of restrictions, in response to the emergence of the Omicron variant. This was a less virulent yet much more infectious variant that infected the highest number of people around the world (Figure 4.5).

Travel restrictions included: closures of border entries; suspension of all/some flights; destination-specific travel restrictions; requests for immediate quarantine or self-isolation of travellers for a specified period; suspension of the visa-issuing process; medical certificate requirements – such as pre-departure or additional post-departure negative test certificates, with RT-PCR or antigen tests or vaccination certificates; and mandatory reports of travel itineraries via passenger locator form submission before travel (UNWTO, 2020^[58]). These led to reductions in the number of international travellers by 73% in 2020 and 71% in 2021 compared with 2019 (OECD/UNWTO, 2022^[59]).

However, in a setting like New Zealand, border closures could be relatively cost-effective and cost-saving when implemented in a timely manner (Boyd et al., 2018^[60]). Several island areas – including Australia, Chinese Taipei and New Zealand – showed notable results in minimising incidence and fatality rates in the early/middle phases of the COVID-19 pandemic by using their geographical advantages alongside proactive decision-making.

Figure 4.5. Changes in international travel measure stringency among OECD countries over time



Note: 0: No measures; 1: Screening; 2: Quarantine of arrivals from high-risk regions; 3: Ban on arrivals from high-risk regions; 4: Total border closure.

Source: Created by the authors using data from Our World in Data, Hale et al. (2021^[23]), "A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker)", <https://doi.org/10.1038/s41562-021-01079-8>.

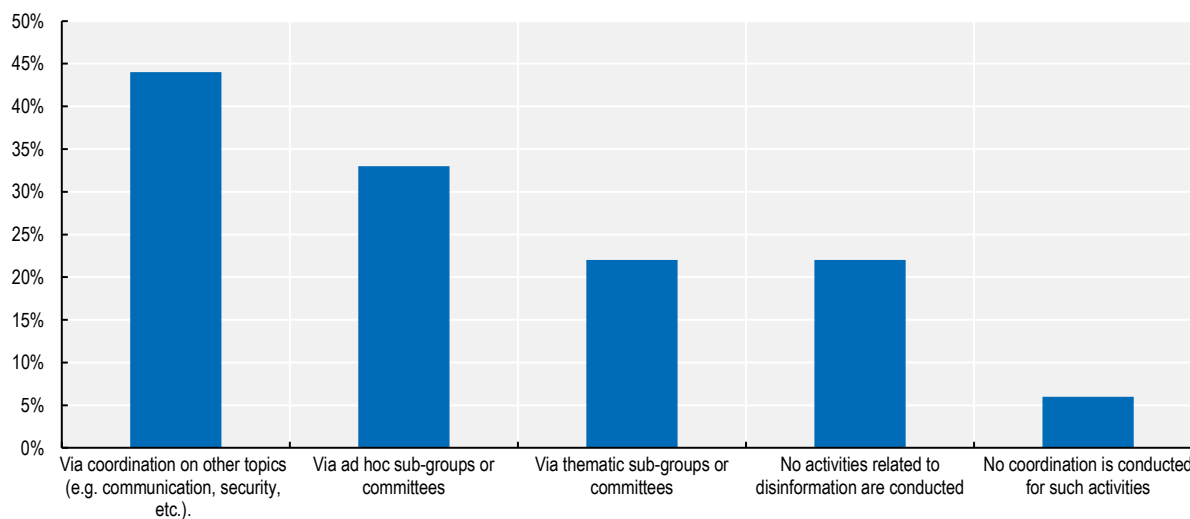
4.3.7. Countries sought to confront the "infodemic" of mis- and disinformation that accompanied the pandemic

Countering disinformation (the deliberate spread of false or misleading information with the intent to deceive) and misinformation (the spread of false information, regardless of an intent to deceive) is key to effective crisis communication within society and trust in governments and experts, including scientists. The OECD has launched a set of principles to help governments use public communication functions to respond to mis- and disinformation. Responses should be transparent, responsive, public interest-driven, evidence-based, aimed at prevention, inclusive, involving whole-of-society collaboration, institutionalised, timely and future-proof (OECD, 2022^[61]).

Before the COVID-19 pandemic, very few OECD countries (2 of 18 responding countries) reported that they had developed government strategies, plans or other guiding documents to inform health ministries about how to respond to disinformation (OECD, 2020^[62]).

After the so-called "infodemic" of COVID-19 related news, however, most countries reported they had some mechanisms in place to confront mis- and disinformation (OECD, 2020^[63]). Nonetheless, more than one-fifth of respondents to the 2020 OECD Understanding Public Communication Survey reported that no activities related to countering disinformation were in place (Figure 4.6). Furthermore, despite the potential for civil society to be an important partner in countering mis- and disinformation narratives, the majority of responding countries reported that their health ministries did not consult civil society groups on countering disinformation, and just one (Türkiye) reported that consultation happened on more than an ad hoc basis.

Figure 4.6. Approaches by health ministries to co-ordinate activities related to disinformation



Source: OECD (2020^[62]), Understanding Public Communication survey, <https://www.oecd.org/gov/open-government/oecd-report-on-public-communication-22f8031c-en.htm>.

Nevertheless, mis- and disinformation efforts intensified after the initial absorb stage of the COVID-19 pandemic. As part of countries' efforts to co-ordinate public communications and promote trusted information, nearly all (19 of 23 responding countries) reported that they had directly engaged with social media and/or news media to combat COVID-19 related mis- and disinformation. Many countries (including Australia, Austria, Germany, Greece, Israel, Italy, Latvia, Mexico, Portugal, Türkiye, the United Kingdom and the United States) highlighted that these engaging efforts with social media companies were unprecedentedly promoted during the COVID-19 pandemic (OECD, 2022^[17]).

For example, Korea established a mis-/disinformation monitoring system and an inter-ministerial co-operative response system for correcting false information. The government worked closely with news media and operated a social media hotline for daily briefings aiming to eliminate information gaps, provide new materials and meet information demand (OECD, 2022^[17]). In the United Kingdom, the government established various mediums, including the Rapid Response Unit to deliver a unified effort in monitoring and response, a RESIST counter-disinformation toolkit to help professionals address and communicate about disinformation, and training courses to actively counter mis- and disinformation (OECD, 2021^[64]).

4.4. Recovery saw restrictions lift as COVID-19 vaccination became available

Once the vaccines against COVID-19 were authorised, along with a few promising results in treatments to prevent patients from becoming severely ill, countries began to lift stringent NPI strategies, including travel restrictions. However, the implementation of vaccination programmes was impeded. Challenges include shortages of vaccine supply, uneven and inequitable distribution, constantly evolving variants, difficulty in establishing an appropriate delivery system (including cold chain), the emergence of vaccine side-effects, and vaccination hesitancy (Alam et al., 2021^[65]). As a result, countries struggled to establish efficient, reliable and predictable policies to maximise vaccination rates.

To maximise vaccination, many OECD countries required mandatory COVID-19 certificates to access high-risk facilities such as crowded indoor areas. However, the stringency of the certificates varied among countries. For example, some applied the so-called "2G" certificate, which required vaccination or proof of recovery, while some required the "3G" certificate, which added the requirement for a recent negative test

to the 2G certificate. Starting with Israel, followed by Denmark and Austria, 28 countries had adopted COVID-19 certificates by the end of 2021, including EU countries with the launch of the EU digital COVID-19 certificate on 1 July 2021 (adopted by France in July 2021 and Germany in August 2021) (Woloszko, 2022^[66]). A study showed that this policy led to a 6.2-13.0% increase in the vaccination rate by motivating certain population groups (Oliu-Barton et al., 2022^[67]), despite strong resistance, which plateaued the vaccination rate at around 80-90% (Ward et al., 2022^[68]).

With an increasing vaccination rate and a less virulent variant, there was a decrease in demand for health care resources within countries' existing health care capacities. In turn, many countries recalibrated their stringent domestic NPIs based on the assessed situational risk.

For example, the Government of Canada (2022^[69]) published guidance outlining indicators (of COVID-19 epidemiology, health care and public health capacity) and other factors (such as vaccine coverage and community vulnerabilities) that public health authorities should consider when adjusting individual- and community-level NPIs in their jurisdictions. Earlier in the pandemic, a set of criteria/indicators to assess readiness for the lifting of measures had included: control of COVID-19 transmission; sufficient public health capacity in place to test, trace and isolate all cases; expanded health care capacity, with incidence maintained below the capacity of the health system; support in place for vulnerable groups; establishment of workplace preventive measures; monitoring of international travel-related cases to avoid the risk of importation of cases; and engagement with and support for communities to adjust through communication.

The United Kingdom also established a plan for lifting measures from March 2021 as the vaccines started to roll out. Step 1 consisted of allowing outdoor gatherings of a maximum of six people or two households, and reopening educational institutions including universities, with the condition of testing students and staff. Step 2 allowed the reopening of public spaces such as shops and libraries. Step 3 enabled outdoor gatherings of up to 30 people, indoor activities with a maximum of six people or two households, and further opening of indoor and outdoor activities. Step 4 entailed lifting all remaining measures, which was planned for the end of June 2021. However, the government delayed the date of Step 4 by a month to enable the vaccination of a much larger number of people compared to the original date (GOV. UK, 2021^[70]; 2021^[71]).

International travel restrictions were frequently readjusted during the absorb stage of the pandemic, but gradual and constant lifting was observed with the increase of vaccination coverage worldwide. Many countries introduced risk assessment criteria to classify the risk of inbound travellers and apply different restrictions accordingly. Risks associated with the departing countries were often assessed based on the number of cases per 100 000 people in the last 7-28 days, and travellers from low-risk countries were obliged to follow fewer restrictions – for example, requirements for negative RT-PCR tests were replaced with negative rapid antigen tests for exemption from mandatory quarantine – while stricter restrictions were applied to travellers from higher-risk countries (Uthman et al., 2022^[72]). The vaccination status of the travellers was also considered. Stricter requirements were requested for unvaccinated travellers such as more recent COVID-19 tests before departure, additional tests after arrival or quarantine measures (NAFSA, 2022^[73]).

For example, the EU published a weekly report that classified EU and European Economic Area countries into four colours (green, orange, red and grey) according to a risk assessment based on three indicators: 14-day cumulative COVID-19 case notification rate per 100 000 population; test positivity rate; and testing rate per 100 000 population. Later, with the development of the vaccines, the 14-day notification rate was weighted according to the vaccine uptake rate in the region, and countries were classified into six colours. These classifications complied with the European Council's recommendation of a co-ordinated approach to the restriction of free movement, which Member States could refer to in implementing travel restrictions (ECDC, 2022^[74]).

Switzerland also had a risk assessment system that differentiated high-risk countries/regions from others. During January-June 2021, the four criteria for high-risk countries or regions consisted of the presence of variants of concern; a higher (more than 60 new infections per 100 000 population) infection rate than Switzerland; unreliable data; and repeated instances of infections from the country/region. As the situation changed, from June 2021 to March 2022, the criteria were eased to consist only of countries or regions with variants of concern. Furthermore, different obligations and regulations were applied to groups depending on factors such as the method of travel (aircraft, rail, road or ship), the profession of the passenger – including passenger transport operators and essential workers of Switzerland – and vaccination status. Differentiation was mostly applied to the requirements for RT-PCR testing and quarantine (The Swiss Federal Council, 2021^[75]; 2021^[76]).

4.5. Building a more resilient health emergency response system

4.5.1. Lessons learnt from the COVID-19 pandemic were not new

Research studies and reports have suggested how capacities and functions might be redesigned before the next pandemic (Box 4.7). The importance of classic public health emergency response capacities – such as surveillance, risk assessment, testing, tracing and tracking, case management, and procuring and stockpiling essential resources – has been re-emphasised. Furthermore, suggestions have highlighted the significance of proactive political decisions based on strong situational analysis and up-to-date scientific evidence, to ensure a timely response. Seamless co-ordination of all relevant parties and sectors, including rapid logistics and recruiting additional resources, have also been revealed as critical capabilities in preparing for and responding to a pandemic. Public acceptability of restrictive interventions, such as social/physical distancing policies, should never be overlooked and should be reinforced by transparent and strategic communications to foster community awareness and engagement in decision making.

Box 4.7. Preparing for the next pandemic

- Many eminent leaders, researchers, study groups and institutions have suggested how to strengthen pandemic preparedness and response systems. These recommendations are not limited to public health measures but expand to consider whole of society responses, consistent with this report (see the chapter on key findings and recommendations).
- The European Observatory on Health Systems and Policies (2021^[77]) systematically analyses the core capabilities required to establish resilience in the health system, based on the COVID-19 experience. It highlights the following five capacities: leading and governing, at both an international and national level with relevant stakeholders; a flexible and sufficient financing system; mobility and support in the health workforce; strengthening of public health interventions such as NPIs and pharmaceutical interventions, including containment strategies and vaccination programmes; and continuity of health care services for both pandemic-related and non-pandemic-related health care needs through scaling up, repurposing and adaptation.
- The WHO (2021^[78]) position paper on building resilience for universal health coverage and health security describes these as complementary goals. This paper calls on countries to act on its recommendations of: leveraging the current response to strengthen both pandemic preparedness and health systems; investing in essential public health functions, including those needed for all-hazards emergency risk management; building a strong primary health care foundation; investing in institutionalised mechanisms for whole-of-society engagement; creating and promoting enabling environments for research, innovation and learning; increasing domestic and global investment in health system foundations and all-hazards emergency risk management; and addressing pre-existing inequities and the disproportionate impact of COVID-19 on marginalised and vulnerable populations.

- The Independent Panel for Pandemic Preparedness and Response main report, presented to the World Health Assembly in May 2021, urges countries to take immediate action to end COVID-19; elevate leadership for global health to ensure, accountable and multi-sectoral action; strengthen the independence, authority and financing of WHO; commit to immediate investment in preparedness; establish new global surveillance, validation and alert systems; establish a pre-negotiated platform for tools and supplies; implement new international financing for global public goods; and establish the highest level of national co-ordination for pandemic preparedness and response (Independent Panel, 2021^[79]).

Many country respondents to the OECD Resilience of Health Systems Questionnaire, 2022 recognised the COVID-19 pandemic has been an opportunity to test and evaluate the actual state of national pandemic preparedness, while acknowledging significant challenges, and the differences between each country's national health system and its broader socio-economic settings. It enabled countries to identify gaps and to give greater attention to a whole-of-society response for future public health emergencies (OECD, 2022^[17]). The key lessons from the pandemic can be crystallised into four areas: resource, information, leadership and participation (Table 4.3).

Table 4.3. Key lessons from the pandemic can be categorised into four areas

Areas	Key lessons
Resources	Readily available physical resources Readily available and educated/trained human resources
Information	Harmonised and inter-operable data and information Accelerated research and development support
Leadership	Proactive and trustworthy political leadership Multi-sectoral co-operation and co-ordination
Participation	Transparent and strategic crisis communication Guaranteed civil society engagement in decision making

4.5.2. Continued investment is needed to enhance human and physical resources

In this context, **resources** refer to people, infrastructure, equipment, and supplies required to execute a pandemic response, including surveillance, testing, tracing/tracking, and case management (see the chapters on workforce, securing supply chains and investing in resilience).

Targeted investment in pandemic preparedness and response has been urged continually by the international community, but, overall, countries' investment was insufficient before the COVID-19 pandemic and uneven after it began (Cameron, 2019^[16]; Bell and Nuzzo, 2021^[80]).

- Notable allocations of funding have been made by several countries. For example, the United States included USD 88.2 billion in funding in the 2023 President's Budget for national and international pandemic preparedness, allocated to enhance capabilities to prevent, detect and respond to potential infectious disease threats (White House, 2022^[81]). Australia allocated AUD 29.9 billion to invest in the National Medical Stockpile over two years. The budget involves a long-term capability enhancement through investment in research, consultation and planning for solutions for the Stockpile, and in information management systems to track inventories to and from the Stockpile (Australian Government, 2021^[82]).
- Building up and maintaining core capacities for public health emergency response should, however, be embodied in the civil protection system. It should also be secured by continuous procurement plans and financing through a similar concept of national and regional investment in firefighting and police systems (National Academies of Sciences, Engineering, and Medicine, 2016^[83]; World Bank Group, 2017^[84]).

The health workforce, long-term care professionals and other administrative and support staff played a crucial role in the COVID-19 pandemic response (Dinkin et al., 2022^[85]). Enhancements should also be made to ensure a readily available workforce in times of crisis through planning, education and training, recruitment, retention, and remuneration. For example, the Netherlands has announced a yearly investment of EUR 5 million in pandemic preparedness, which includes the establishment of a pool of health care professionals who can be readily available during a crisis. It also announced an expansion of available training places for infectious disease control doctors from 2022 (Rijksoverheid, 2021^[86]; 2022^[87]).

A stronger and more resilient workforce should be a priority in adapting systems in response to the lessons of the COVID-19 pandemic and preparing for the next threat (see the chapter on workforce).

4.5.3. Integrated information systems are crucial for situation analysis and proactive decision making

In this context, **information** refers to the transmission of knowledge, based on data about epidemic situations, allocated or available resources and implementation of containment and mitigation strategies, through an easily accessible system or channel.

As the COVID-19 pandemic demonstrated, integrated real-time information is increasingly important, particularly in situation analysis and proactive decision making. Further investment in enhancing data analysis and information systems will be an essential part of future preparedness plans, in alignment with the “classic” physical and human resource procurement.

Essential data (such as the number of infected, critical, and fatal cases), gathered at country and worldwide levels at near to real-time speed, was important for countries in planning, monitoring, and pro-actively adjusting containment and mitigation strategies (Eggers et al., 2020^[88]). Around 74% of countries (17 of 23 respondents to the OECD Resilience of Health Systems Questionnaire, 2022 reported that they actively used modelling studies as evidence to inform decisions on implementing or adjusting containment or mitigation strategies or lifting interventional policies (OECD, 2022^[17]).

Data collection occurred nationally and sub-nationally, and information was shared internationally. For example, in Germany, data about the spread of the disease were collected following the Infection Protection Act and reported to the central national public health institute – the Robert Koch Institute. Daily intensive care unit occupation data were also collected through the German Interdisciplinary Association for Intensive and Emergency Medicine (Refisch et al., 2022^[89]). Luxembourg developed the “Qlik” system, a platform displaying key indicators in real time basis, with application of the General Data Protection Regulation (GDPR) for securing data privacy. The international sharing of data and information was facilitated by several public/private institutions and organisations – including Our World in Data, the 2019 Novel Coronavirus Visual Dashboard of Johns Hopkins University, the University of Maryland Social Data Science Center Global COVID-19 Trends and Impact Survey, the Oxford COVID-19 Government Response Tracker and many more.

However, fragmented and lagged data-collecting systems were still observed at the national level, leaving significant room for improvement in preparing for the next shock (see the chapter on digital foundations).

The COVID-19 pandemic also saw a significant increase in number and breadth of COVID-19-related research and development studies. The number of new clinical trials increased by about 40% compared to the average number per month before the pandemic (Agarwal and Gaule, 2021^[90]), and the global funding mobilised for research reached approximately USD 9 billion within seven months (OECD, 2020^[91]). UK Research and Innovation invested over GBP 554 million during 2020/2021 in more than 3 300 new COVID-19-related research projects (UKRI, 2022^[92]), and Canada allocated a budget of CAD 26.3 million to research the impacts of COVID-19 on equity-seeking communities (Government of Canada, 2022^[93]; Canadian Institutes of Health Research, 2022^[94]). Despite the increase in overall investment, however, research and development has been relatively weaker in some areas. Unlike the rapid investment and

remarkable outcomes in pharmaceutical interventions for the COVID-19, research into the effectiveness and impacts of NPIs has been limited (Hirt, Janiaud and Hemkens, 2022^[95]; OECD, 2020^[91]). This is despite the influence and impact of NPIs on societies and economies, as this chapter highlights. More investment in research and development should be accelerated in all areas, including the effectiveness of NPIs, to improve resilience to future threats, such as a new infectious disease with high pandemic potential.

4.5.4. Proactive political leadership improves the resilience and efficiency of crisis responses

In this context, **leadership** includes not only the structure and processes for decision making, but also the legal framework and high-level planning of all stages of a response to a shock. Political leadership has a direct impact on the responsiveness, resourcefulness, and capacity of a country to promote resilience during a crisis (European Observatory on Health Systems and Policies, 2021^[77]). Political leadership has a significant role in preserving rule of law and setting legal foundations, financing (including employment and social support), implementing responses (such as containment and mitigation strategies), communicating decisions and the rationale for them, and ensuring public trust and acceptability (OECD, 2020^[96]). It is also vital for creating, allocating and distributing resources, especially when a shock raises the potential of overwhelming health systems (see the chapter on critical care surge).

Governing reactively in silos does not work, especially when a shock requires pro-active leadership of a whole of society response (see the chapter on key findings and recommendations). In the OECD Resilience of Health Systems Questionnaire, 2022, 87% of countries (20 of 23 respondents) reported that a “whole-of-government” approach was pursued to facilitate co-operation in the response to the COVID-19 pandemic. For example, Austria established the Statutory State Crisis and Disaster Management Committee before the pandemic to act as a co-ordinating and consultation body in response measures. Ireland formed the National Public Health Emergency Team for the health sector response and an additional inter-departmental committee to co-ordinate across all relevant government departments. Italy launched the Department of Civil Protection to co-ordinate responses (OECD, 2022^[17]). Stronger multi-sectoral co-operation in response to the pandemic was also evident; however, there is still room for improvement in the efficiency of collaborative structures and processes. How to decide the right intervention at right time in a more inclusive, human rights-respecting, evidence-based way remains an issue for the future leadership of pandemic preparedness and response.

4.5.5. Transparent communication and stronger civil society engagement is important

In this context, **participation** refers to the interactions among individuals, entities, and governments, including communication between many parties and sectors within and beyond a national health system.

The participation of people and civil society at all levels and in all areas constitutes a critical element that binds different parts of society together to respond inclusively to significant shocks, including pandemics. It entails not only a concerted emergency response but also a means for feedback on the response, including any socio-economic impacts (such as the impacts of containment and mitigation strategies). During the COVID-19 pandemic, countries that were characterised by the keywords “partner, co-ordinate, develop, and strengthen” showed relatively high performance in the response during the first year of the pandemic (Haldane et al., 2021^[97]).

Transparent and consistent crisis communication is also important in fostering societal trust. After the COVID-19 pandemic began, countries established multiple methods for effective COVID-19-related communication. At the national and sub-national level, governments established COVID-19-specific crisis communication teams, created websites and smartphone applications, and used various channels to communicate messages (including social media, dedicated telephone lines and public briefings by representative leaders).

Overall, while communication efforts were commendable, patient and civil society engagement was uneven in country-level COVID-19 pandemic responses. This is despite the potential for such engagement to reach marginalised communities (Gilmore et al., 2020^[98]). More than two-thirds of countries responding to the OECD Resilience of Health Systems Questionnaire, 2022 reported that no citizen or patient participation was included in decision-making bodies, such as COVID-19 taskforces (OECD, 2022^[17]). Despite strong patient advocacy networks across many OECD health systems, most countries did not systematically reflect patient voices in decision making related to the pandemic response.

Box 4.8 offers examples of how civil society and patient engagement could improve the effectiveness of health system responses and foster public compliance with containment and mitigation strategies.

Box 4.8. Civil society and patient engagement

Facilitating patient involvement and participation can help to strengthen the relationship between health care systems, providers, and patients. In Portugal, patients were actively involved in decision-making processes around COVID-19 vaccination campaigns, with patient representative groups involved in helping define comorbidities. In Lithuania, representatives from various public organisations were included in a working group set up to co-ordinate and provide COVID-19 related health support.

Beyond helping to connect health services with vulnerable populations, civil society can also play an important role in the active countering of mis- and disinformation narratives (Brechenmacher, Carothers and Youngs, 2020^[99]). Several countries made efforts to ensure citizen participation and reflect the voices of citizens. For example, Ireland conducted regular qualitative and quantitative research that was openly reported to reflect and respond to public concerns (OECD, 2022^[17]).

Engagement in decision-making may also help to engender community buy-in to critical policy measures. In Costa Rica, a shared management model – Costa Rica Works and Takes Care of Itself – was designed to create ownership of containment measures from the community level up. In doing so, it facilitated a sense of responsibility for following policies developed by the Ministry of Health (OECD, 2022^[17]).

4.5.6. Learning the lessons of effective pandemic preparedness and response requires significant investment

Several reports have estimated the minimum amount of annual investment required for better pandemic preparedness and response. These investments range from about USD 10 billion to USD 43 billion per year (H.E. Ellen Johnson Sirleaf, 2022^[100]) and from USD 1 to USD 5 per capita per year, depending on the targeted scopes and functions (Craven et al., 2021^[101]; World Bank Group, 2017^[84]; Clarke et al., 2022^[102]).

Despite the variation, these estimates predict that the cost of investment would be significantly lower than the cost of the negative impacts of another pandemic. The McKinsey report suggests that, assuming a pandemic comparable to COVID-19 as a 50-year event, the return on investment on pandemic preparedness and response is certain, even in conditions of the partial effectiveness of implemented measures (Craven et al., 2021^[101]).

4.6. Strong and sustained international co-operation will make a positive difference to national-level pandemic preparedness and response

Containment and mitigation strategies are the only viable options for confronting pandemics. They should be maintained until safe and efficacious pharmaceutical interventions have been developed. Effective implementation of these strategies requires both the comprehensive preparation of essential capacities and their timely mobilisation during a crisis.

The COVID-19 pandemic proved that the world – including countries that had been assessed as well prepared by indicator-based evaluations – is insufficiently prepared to combat pandemics. This highlights the need for greater attention and action to invest in these essential capacities at the national and sub-national level. These efforts will also make health systems more resilient in the face of threats that are current and emerging, beyond pandemics (see the chapter on key findings and recommendations).

While this chapter has focused on national level policies and actions, international efforts to develop a legitimate and effective and response system should also be supported. The G20 Joint Taskforce on Health and Finance has highlighted the vulnerabilities in the international community’s ability to prevent, detect and respond effectively to pandemic threats (G20 HLIP, 2021_[103]).

In December 2021, the World Health Assembly (WHA) of the WHO established an Intergovernmental Negotiating Body to draft a legally binding convention, agreement, or other international instrument on pandemic prevention, preparedness, and response. It aims to “build resilience to pandemics; support prevention, detection and responses to outbreaks with pandemic potentials; ensure equitable access to pandemic countermeasures; and support global co-ordination through WHO”. It is envisaged that this instrument will be the subject of a report at the WHA in 2023 and adopted in 2024 (WHO, 2022_[104]).

Creating, operating and maintaining a trustworthy, comprehensive analytical global surveillance network is also crucial. Developments include the WHO’s “Hub for Pandemic and Epidemic Intelligence”, the ECDC’s “EpiPulse” and the G7’s “Global Pandemic Radar” plan (Dowlen et al., 2022_[105]; ECDC, 2021_[106]). The financial sustainability of pandemic preparedness and response would also be an asset. The World Bank’s financial intermediary fund for pandemic preparedness and response (the “Pandemic Fund”), established in September 2022 with broad support from the G20 and beyond, is an important step in the right direction (World Bank Group, 2022_[107]).

OECD countries are encouraged to engage actively in initiatives to enhance international co-operation. Active engagement will help sustain political momentum for collective action and shape better containment and mitigation strategies for future pandemic preparedness and response, contributing to broader efforts to make health systems, economies, and societies ready for the next crisis.

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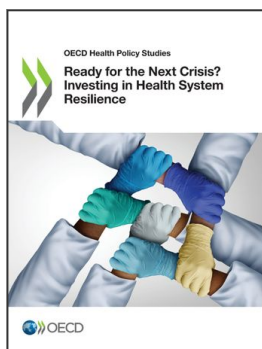
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