OECD Health Policy Studies

Ready for the Next Crisis? Investing in Health System Resilience

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BETTER POLICIES FOR BETTER LIVES

Please cite this publication as:
OECD (2023), *Ready for the Next Crisis? Investing in Health System Resilience*, OECD Health Policy Studies, OECD Publishing, Paris, https://doi.org/10.1787/1e53cf80-en.

ISBN 978-92-64-79463-4 (print)
ISBN 978-92-64-83087-5 (pdf)
ISBN 978-92-64-62566-2 (HTML)
ISBN 978-92-64-96093-0 (epub)

OECD Health Policy Studies
ISSN 2074-3181 (print)
ISSN 2074-319X (online)

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Corrigenda to publications may be found on line at: www.oecd.org/about/publishing/corrigenda.htm.

Foreword

The COVID-19 pandemic proved to be the greatest health crisis in a century. It highlighted how health systems are not resilient to shocks, with consequent impact on the global economy and global community. Even the most advanced health systems in the world were not resilient enough.

It is not known what the next crisis has in store for humanity – however, it is critical to make health systems ready for future shocks. There is urgency in ensuring that health systems can withstand current and future challenges.

This report recommends policy areas and investments to improve the resilience of health systems into the future, drawing on analyses of three major vulnerabilities health systems faced during the pandemic:

- Health systems were underprepared. Pre-existing inequity and chronic diseases made the outcomes of the pandemic worse. Despite rhetoric of spending on health being an investment, not a cost, approaches had not changed significantly before the crisis. Health systems spent less than 3% of total health expenditure on prevention, leaving too many in the population vulnerable.
- Health systems were understaffed. This constrained effective responses to the pandemic and continues to do so. A sufficient and well-trained workforce in health care and long-term care is necessary to promote agility in times of crisis, as well as to address the care backlog and meet the substantial increase in mental health needs.
- Health systems suffered from underinvestment. Boosting the resilience of health systems requires investments and improved co-ordination and co-operation. This report recommends an annual targeted investment of 1.4% of GDP across OECD countries relative to expenditure in 2019, on health workforce, prevention and key infrastructure.

Beyond this investment, this report makes six recommendations to improve health systems resilience and to reduce the impact of future shocks:

- Promote population health: vulnerable populations make for vulnerable health systems
- Promote workforce retention and recruitment: people are the key to making systems resilient
- Promote data collection and use: without the right data, decision makers are flying blind
- Promote international co-operation: responses are better together than alone
- Promote supply chain resilience: getting products and services when and where they are needed
- Promote governance and trust: without trust, whole-of-society responses are less effective.

The pandemic proved that there are significant social and economic dividends from promoting health system resilience. Investing in resilience will give people better access to health services that they need, promoting their health and well-being and fostering their full participation in society.

Acknowledgements

This project on health system resilience would not have been possible without the collaborative involvement of many people both within and beyond the OECD. The report was prepared by authors from several OECD directorates and divisions: the Directorate for Employment, Labour and Social Affairs (ELS), the Trade and Agriculture Directorate (TAD), the Directorate for Science, Technology and Innovation, and the New Approaches to Economic Challenges (NAEC) team. The report was co-ordinated and edited by Philip Haywood of the Health Division in ELS.

Chapter 1 was written by Philip Haywood, Frederico Guanais, William Hynes and Francesca Colombo. Chapter 2 was written by Igor Linkov and Ben Trump. Chapter 3 was written by Chris James, Michael Muller, Tiago Cravo Oliveira Hashiguchi and Philip Haywood. Chapter 4 was written by Dongwoo Lee and Hansol Min. Chapter 5 was written by Philip Haywood. Chapter 6 was written by Caroline Berchet, Eliana Barrenho and Katherine De Bienassis. Eileen Rocard, Ana-Llena Nozal and Max Clark wrote Chapter 7. Sofia Astorga-Pinto, Emily Hewlett and Philip Haywood wrote Chapter 8. Chapter 9 was written by Luigi Siciliani (University of York), Gaétan Lafortune and Noémie Levy. Chapter 10 was written by Gaétan Lafortune and Noémie Levy. Chapter 11 was written by Sébastien Miroudot, Cemre Balaban, Ruth Lopert, Suzannah Chapman and Philip Haywood. Chapter 12 was written by Rishub Keelara and Philip Haywood. Chapter 13 was written by Ruth Lopert, Rohit Malpani, Philip Haywood, David Winickoff and Hermann Garden. Chapter 14 was written by Chris James and David Morgan. Michele Cecchini, Marion Devaux, Ece Özçelik and Sabine Vuik provided the work on risk factors and antimicrobial resistance.

Francesca Colombo, Frederico Guanais, Philip Haywood, William Hynes, Dongwoo Lee, Igor Linkov and Ben Trump conceptualised the application of a resilience framework, including the disruption cycle and the resilience matrix, to the project.

Joshua Ginnane, Luca Lindner and Sofie Norregaard interned and provided essential inputs. The authors would like to thank and acknowledge: Andrea Andrenelli, Celia Becherel and Silvia Sorescu from TAD; Craig Matasick and Karine Badr from the Public Governance Directorate; Marie-Clémence Canaud, Guillaume Dedet, Marina Dorfmuller Ciampi, Nicolás Larraín, Eric Sutherland, Elina Suzuki, Francisca Vargas Lopez, Martin Wenzl, Doron Wijker and Tom Raitzik Zonenschein from ELS for their comments and contributions. Statistical assistance was provided by Gaëlle Balestat, José Carlos Ortega Regalado and Gabriel Di Paolantonio from the Health Division. Julia Zhu (ETH Zürich) contributed to Chapter 11. Patrick Love contributed to Chapter 1. Dongwoo Lee, aided by Caroline Penn, organised an internal webinar series and we are grateful to all contributors to it, including John Crombez and Rob De Staelen (Ghent University Hospital).

The project team would like to thank and acknowledge all the country delegates and experts for their engagement. This included responses to the questionnaire, comments on the draft outputs, providing additional information and examples, and suggestions during the project, in particular during the Health Committee meetings of 28-29 June 2021 and 30 June-1 July 2022, further meetings of working parties and expert groups of the Health Committee, and the meeting of the Working Party of the Trade Committee on

12-14 October 2022. The authors also thank the companies that were interviewed and provided material for the analysis in Chapter 11.

This project and publication benefited from the preparation, guidance and review of Francesca Colombo and Frederico Guanais, Head and Deputy Head of the Health Division. We also thank Stefano Scarpetta and Mark Pearson, Director and Deputy Director of ELS for their guidance and comments.

Editorial assistance was provided by Lucy Hulett and Alastair Wood from ELS. Thanks also go to Justine Deziel, Sabina Kovacic, Sahnur Soykan and Isabelle Vallard for their administrative support. Assistance with messaging was provided by Paul Gallagher and Spencer Wilson. The report was copy-edited by Lydia Wanstall.

Acronyms and abbreviations

AI	Artificial intelligence
AMC	Advance market commitment
AMR	Antimicrobial resistance
APC	Advance purchase commitment
API	Active pharmaceutical ingredient
CARB-X	Combating Antibiotic-Resistant Bacteria Biopharmaceutical Accelerator
CDC	Centers for Disease Control and Prevention
CEPI	Coalition for Epidemic Preparedness Innovations
COVID-19	Coronavirus disease 2019
CRP	Collaboration Registration Procedure
CSR	Corporate social responsibility
CT	Computerised tomography
ECDC	European Centre for Disease Prevention and Control
ECG	Economy for the Common Good
EEA	European Economic Area
EHR	Electronic health record
EM	Excess mortality
EMR	Electronic medical record
EU	European Union
EUR	Euro
FDA	Food and Drug Administration
G20	The Group of Twenty
G7	The Group of Seven
GAD-7	7-item General Anxiety Disorder scale
GDP	Gross domestic product
GHIT	Global Health Innovative Technology Fund
GHS	Global health security
GHSI	Global Health Security Index
GP	General practitioner
GPG	Global public good
HCBM	Human-Centred Business Model
HR	Human resources
HS	Harmonised Commodity Description and Coding System
HSE	Health Service Executive
HW	Health workforce
IASC	Inter-Agency Standing Committee
ICT	Information and communication technology
ICU	Intensive care unit
IHI	Innovative Health Initiative

IHR	International Health Regulations
IP	Intellectual property
IT	Information technology
KCE	Belgian Health Care Knowledge Centre
LDC	Least developed country
LGBTIQ+	Lesbian, gay, bisexual, transgender, queer (or questioning), intersex and gender fluid populations
LGBTQ2S+	Lesbian, gay, bisexual, transgender, queer or questioning, and two-spirit
LMIC	Low or middle income country
LMWH	Low-molecular-weight heparin
LTC	Long-term care
MERS	Middle East respiratory syndrome
MPP	Medicines Patent Pool
MRI	Magnetic resonance imaging
NGO	Non-governmental organisation
NHS	National Health Service
NPI	Non-pharmaceutical intervention
NTD	Neglected tropical disease
NTM	Non-tariff measure
OECD	Organisation for Economic Co-operation and Development
PDP	Product development partnership
PHEP	Public health emergency preparedness
PHQ-9	9-item Patient Health Questionnaire
PI	Pharmaceutical intervention
PPE	Personal protective equipment
PPP	Pandemic preparedness plan (Chapter 4)
PPP	Public-private partnership (Chapter 13)
PPR	Pandemic preparedness and response
PRV	Priority review voucher
R&D	Research and development
RT-PCR	Reverse transcriptase-polymerase chain reaction
SARS	Severe acute respiratory syndrome
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2
SD	Standard deviation
SDG	Sustainable Development Goal
SME	Small or medium sized enterprise
SPS	Sanitary and phytosanitary measure
TBT	Technical barrier to trade
TER	Transferable exclusivity right
TiVA	Trade in Value Added
UHC	Universal health coverage
WHA	World Health Assembly
WHO	World Health Organization
WTO	World Trade Organization

OECD Country ISO codes

AUS	Australia
AUT	Austria
BEL	Belgium
CAN	Canada
CHL	Chile
COL	Colombia
CRI	Costa Rica
CZE	Czech Republic
DNK	Denmark
GB-ENG	England (United Kingdom)
EST	Estonia
FIN	Finland
FRA	France
DEU	Germany
GRC	Greece
HUN	Hungary
ISL	Iceland
IRL	Ireland
ISR	Israel
ITA	Italy
JPN	Japan
KOR	Korea
LVA	Latvia
LTU	Lithuania
LUX	Luxembourg
MEX	Mexico
NLD	Netherlands
NZL	New Zealand
GB-NIR	Northern Ireland (United Kingdom)
NOR	Norway
POL	Poland
PRT	Portugal
GB-SCT	Scotland (United Kingdom)
SVK	Slovak Republic
SVN	Slovenia
ESP	Spain
SWE	Sweden
CHE	Switzerland
TUR	Türkiye
GBR	United Kingdom
USA	United States
GB-WLS	Wales (United Kingdom)

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Executive summary

The COVID-19 pandemic is a tragedy. Over 6.8 million deaths due to COVID-19 were reported worldwide in January 2023. Analysis of excess mortality suggests that as many as 18 million people may have died worldwide because of the pandemic by the end of 2021. Life expectancy decreased in many OECD countries in 2020 and 2021. There was widespread disruption to society and education. GDP dropped by 4.7% in 2020 across OECD economies.

New crises beyond a further pandemic could severely test the global community: antimicrobial resistance; armed conflict; climate change; financial crisis; biological, chemical, cyber, and nuclear threats; environmental disasters; and social unrest. Chronic stressors such as ageing and demographic change challenge health systems and compound the impact of crises.

Building the resilience of our health systems has never been more urgent. Resilience entails much more than planning for a crisis. Resilience helps to absorb shocks and accelerates recovery. Importantly, health systems can enhance resilience by learning lessons which lead to better adaptation in a crisis. Doing so now is vital to facing tomorrow's threats.

The pandemic provided lessons on what worked. OECD countries implemented whole-of-society responses, including through containment and mitigation measures. Surge capacity for critical care was raised – an 8% increase in critical care beds occurred in 2020 – while other care, such as elective surgery, was deferred. Health data availability and timeliness improved. Flexibility and agility in the health care workforce facilitated new care models and increases in crucial activities such as critical care and vaccination. Telehealth was a positive transformation, with a dramatic increase in the proportion of adults who had a medical consultation online or by phone. By early 2021, almost one in two adults had consulted their physician remotely in 22 reporting OECD countries.

However, populations and health systems in many countries are struggling to recover fully as 2023 begins. Disruptions in care, COVID-19 infections and the challenge of post-COVID-19 syndrome or "long COVID" continue to burden health systems. The legacy of the pandemic could endure for decades.

Three major vulnerabilities weakened health system resilience.

Health systems were **underprepared**. Spending on prevention accounted for only 2.7% of total health spending across OECD countries in 2019. As well as age, obesity and chronic diseases such as diabetes were risk factors for serious health impacts and death from COVID-19. More than a third (35%) of the population aged over 16 years across OECD countries had longstanding illnesses or health problems prior to the pandemic. Prevalence was even higher (43%) among people on lower incomes. Multimorbid patients were also vulnerable to care disruptions, which led to severe consequences and long-term complications. Poverty, unemployment and socio-economic disadvantage were highly associated with poor health outcomes. In the first year of the pandemic, the relative risk of dying from COVID-19 doubled for those living in the most socially deprived areas and for ethnic minority populations. Symptoms of depression doubled amongst young people in several OECD countries in 2020-2021, compared to 2019.

Health systems were **understaffed**. The pandemic left front-line health care and long-term care workers overstretched and exhausted, raising concerns that this could lead to an exodus. This would compound the strain on those remaining in the sector and stretch the resources needed for high-quality care delivery, including to address the substantial increase in mental health needs. Before the pandemic there was a wide variation across the OECD in the density of doctors and nurses, ranging from less than 5 per 1 000 people to over 20 per 1 000 people with an average of 12.4 per 1 000 across the OECD in 2019. Over 11 million fewer investigations and operations were conducted in 2020 than 2019, leading to a backlog of cases. The availability of the health workforce will be a constraint in increasing activity. The impact of long COVID is a large and uncertain burden for health systems and society: estimates are that 10% or more of those infected with SARS-CoV-2 have persistent symptoms.

Health systems suffered from **underinvestment**. Smart spending will be essential to strengthen public health and prevention, boost staffing, stockpile emergency supplies, increase availability of critical care beds and use data for better decision making, surveillance and research. Many countries increased their investments in workforce, digital infrastructure and equipment in response to the pandemic, but this effort will need to be maintained. Boosting the resilience of health systems requires an annual targeted investment of 1.4% of GDP across OECD countries relative to expenditure in 2019. The major investment, approximately half, should be in the health workforce.

Below are six policy recommendations to improve health system resilience. These recommendations aim to reduce the impact of future shocks on societies and economies, not only health systems. Reforms need to be cohesive and forward looking. They should not only address current issues but also anticipate future challenges by ensuring physical resources, data, governance and financing arrangements are in place.

1. Promote health of the population: vulnerable populations make for vulnerable health systems

Maximising people's health before a crisis minimises the damage to the population, reducing the risk of death and long-term health problems. It can also reduce demand for acute health services during a shock, benefiting all. Promoting healthier lifestyles and addressing wider determinants of poor health – including poverty and unemployment – are critical to mitigating the impact of future shocks on health systems. A strong primary care system offering universal health coverage helps to improve health prior to a crisis. Including mental health considerations in crisis preparedness and response planning should be routine. Improving population health is cost-effective, and these investments will improve both the welfare of society and resilience.

2. Promote workforce retention and recruitment: staff are the key to making systems resilient

Workforce shortages pose one of the biggest threats to resilient health systems. In the context of the pandemic, workforce limitations proved to be a more binding constraint than the availability of hospital beds. A proportionally larger number of health and social care workers in an OECD country was associated with relatively better outcomes. The pandemic also highlighted the importance of valuing front-line workers – particularly nurses and care workers – to revitalise health systems. Despite record high numbers of health care workers across OECD countries, over 3 million additional health care and long-term care workers may be required to improve resilience. Increased investment in retention and recruitment will make the recovery less onerous and improve workforce flexibility to meet future shocks.

3. Promote data collection and use: without the right data, decision makers are flying blind

Although it is not known what form the next crisis will take, data will be vital to tackle it. Better use of data and the tools to convert it into actionable information is critical to surveillance of new threats and to providing a better picture of health. Prior to the pandemic, digital infrastructure was fragmented. Only 14 OECD countries were able to link data across multiple settings within health care. Key information for health system management was not available in real-time. Only two countries reported availability of weekly mortality data prior to the pandemic. Linked data and timeliness of health data improved greatly in response to the pandemic. All OECD countries reported improved data reporting, and almost all enhanced the timeliness of data to inform policy choices and to foster more efficient resource use. These gains must be consolidated and built upon to improve the response to future crises.

Investing in digital infrastructure will also improve health system performance between crises. For future crises, data will need to be collected and linked beyond the health system, taking into account the interdependencies that arise during a crisis. For example, few national statistical offices or education ministries undertook special data collections related to the COVID-19 pandemic and its effects on education (including school closures).

4. Promote international co-operation: responses will be better together than alone

Global mobility and connection have significant benefits but can magnify shocks. International decision making was challenged at the beginning of the pandemic and the speed of response was compromised. A stronger international surveillance system with continuous information gathering, risk assessment and rapid co-ordination of responses would have facilitated a quicker response.

The unparalleled success and speed of COVID-19 vaccine development saved millions of lives. Massive public sector funding was provided for research, development and manufacturing capacity, but vaccine distribution has been inequitable. The failure to complete development of vaccines against earlier coronavirus outbreaks (severe acute respiratory syndrome in 2003 and Middle East respiratory syndrome in 2015) was a missed opportunity.

Prioritising innovation through public support of research and development and exploring new incentives would help prepare the global community for a range of threats, such as antimicrobial resistance, climate change and pandemics. Internationally co-ordinated approaches are required for technology transfer and management of intellectual property for currently under-produced essential health technologies. Credible governance frameworks, enforceable commitment mechanisms, and stable long-term funding would facilitate the equitable distribution and use of essential products, such as personal protective equipment and vaccines, and global public goods such as surveillance. Global instruments are being developed for pandemics – the goals of the World Health Organization and Pandemic Fund initiatives to foster this co-operation should be supported. However, initiatives will need to go beyond pandemics to address a wider array of risks. Without progress, global challenges will result in greater disruption and inequity.

5. Promote supply chain resilience: getting products and services when and where they are needed

The supply of medical products hampered the initial response to the pandemic. Almost all OECD countries reported difficulties in obtaining personal protective equipment (92%), as well as testing materials (83%) and ventilators (68%). The lack of personal protective equipment was devastating. International trade underpinned a large increase in availability of vaccines and essential medical devices later in the pandemic, but barriers to trade hampered distribution. Difficulty in identifying supplies and countries involved in supply chains undermined the assessment of risk.

More detailed information on supplies, suppliers and countries of origin of finished products and key inputs are needed to better assess risks and prepare for crises. Having a limited number of suppliers for essential products is a key vulnerability. While countries are diversifying their supply chains for such products, risks remain. International co-operation around stockpiling and distribution of scarce products would promote more equitable and effective responses. For those technologies that are useful in a crisis, ensuring that sufficient manufacturing capacity exists should be combined with supplier commitments to ensure access where the need is greatest. Investing in more resilient supply chains will not only improve outcomes during crises but also encourage predictability and reliability between times of disruption.

6. Promote governance and trust: without trust, whole-of-society responses are less effective

Governance structures need to reflect the reality that the whole-of-society is involved in addressing large shocks. Interdependencies exist between the health sector and the rest of society. An example in the context of the pandemic was the long-term care sector, which was hit hard. One-third (34%) of all cumulative COVID-19 deaths in 25 OECD countries were among residents in long-term care facilities by April 2022. About 20% of older people who received personal care from professionals or relatives (living outside their household) regularly reported forgone or postponed care in 2021 across 23 OECD countries. Increased integration of long-term care with health and explicit inclusion in crisis planning would improve outcomes for the next shock.

Trust in institutions is necessary for whole-of-society responses. Misinformation and disinformation have the potential to undermine societal responses. It is critical to actively counter this and also promote legitimate and transparent decision making: 19 out of 23 OECD countries reported engaging with the media to combat misinformation and disinformation at the end of 2021. Involving stakeholders early and communicating the evidence for decisions is important to legitimacy. This is especially true when crisis responses involve liberty-restricting measures and altering of usual standards of health care. In these circumstances, leadership at the highest level is required for rapid decision making in the face of uncertainty.

With the outlook darkening for 2023 and multiple crises such as Russia’s war against Ukraine, inflationary pressures and energy insecurity, governments face tough policy choices. However, smart targeted investments in health system resilience will benefit societies by ensuring that the building blocks are there and ready for the next crisis. Without such investments, the costs will be larger and the impact on people greater.

1 Key findings and recommendations

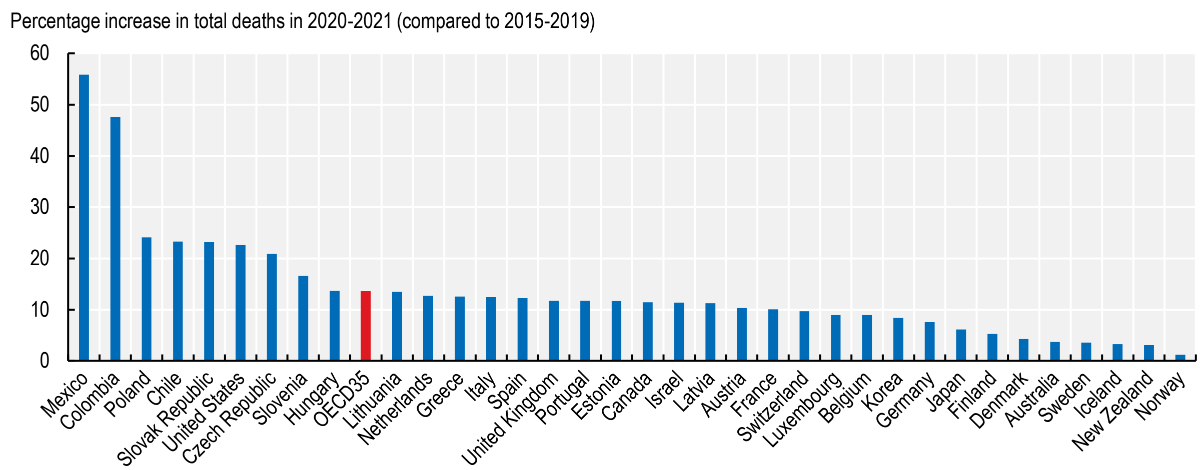
Philip Haywood, Frederico Guanais, William Hynes and Francesca Colombo

Not being sufficiently prepared for a shock like the COVID-19 pandemic results in major loss of life and well-being, and requires costly interventions that have repercussions for years to come. Health systems must also be resilient to shocks beyond pandemics. This report uses the lens of the COVID-19 pandemic and the latest evidence to analyse how ready health systems were to prepare for, absorb and recover from a crisis, and how they can be adapted to be more resilient to future challenges. This report offers recommendations in six policy areas to improve health system resilience. These policy areas relate to the health system and to its interactions with broader society. Implementing these recommendations will produce health systems that deliver high-quality care before, during and after crises.

1.1. COVID-19 showed that health systems are not resilient enough

Globally, millions of people have died, and hundreds of millions have been infected with COVID-19. Over 6.8 million deaths due to COVID-19 were reported worldwide in January 2023 (WHO, 2023[1]). Analysis of excess mortality suggests that as many as 18 million people may have died worldwide because of the pandemic by the end of 2021 (Wang et al., 2022[2]). Overall, OECD countries have reported over 3.1 million COVID-19 deaths. There is a large degree of disparity between OECD countries - by the end of 2021, the percentage of excess deaths was 20 times higher in Mexico than in Norway (Figure 1.1). The COVID-19 pandemic led to a 0.8-year reduction in life expectancy across 28 OECD countries, comparing 2019 to 2021 (OECD, 2022[3]).

Figure 1.1. Excess mortality in 2020-21 across OECD countries



Note: Excess mortality is calculated by comparing the average annual deaths in 2020-21 with the annual average for 2015-19. Data for Colombia until week 35 in 2021 are included. No mortality data are available for Costa Rica, Ireland and Türkiye for 2020-21. OECD average is unweighted. Comparator years to calculate the percentage increase in total deaths are 2015-19.
Source: OECD (2022[3]), OECD Health Statistics, https://doi.org/10.1787/health-data-en, based on Eurostat data and national data.

Health systems were not resilient enough. Resilience is understood as the ability of systems to prepare for, absorb, recover from and adapt to major shocks (OECD, 2020[4]). It is not simply about minimising risk and avoiding shocks: resilience is also about recognising that shocks *will* happen. Such shocks are defined as high-consequence events that have a major disruptive effect on society.

The pandemic revealed weaknesses in health systems and in how they respond to shocks, highlighting the need to improve their resilience. Health systems need to prepare better for shocks – not only pandemics but also antimicrobial resistance; armed conflict; climate change; biological, chemical, cyber, financial and nuclear threats; environmental disasters; and social unrest. Health systems also need to be able to absorb such disruptions, to recover as quickly as possible and with minimal cost, and to adapt by learning lessons to improve performance and manage future risks.

While the COVID-19 pandemic has been called a “once-in-a-century” health crisis (WHO, 2020[5]), there is no reason to believe that health systems worldwide are safe from further shocks. Structural factors such as increasing global mobility, interconnectedness and digitalisation create new opportunities to deliver and improve health care. These factors, however, also create new risks or exacerbate existing threats, as exemplified by the threats of energy insecurity and the cost-of-living crisis in 2022-23. Other infectious diseases such as influenza, monkeypox and respiratory syncytial virus have also complicated provision of health care in OECD countries since the pandemic began (Fairbank, 2022[6]).

1.2. A 4-stage disruption cycle emphasises interdependencies beyond the health system

Health care in OECD countries is characterised by interdependencies at every level of the health system and beyond. As the health system becomes stressed and some functions cannot be undertaken, the burden and disruption flow through the system, further worsening outcomes. The way the health system is organised may propagate these shocks.

As the COVID-19 pandemic began, a sequence of demand and supply shocks compounded the overall effect on the system. For example, a sharp rise in infections increased demand for acute care, leading to stress in the healthcare workforce, reduced stocks of essential supplies, less space in critical care facilities such as hospitals and intensive care units, and large adverse impacts on long-term care facilities. This resulted in further infections among the general population and health workforce. In turn, this put additional pressure on the workforce and essential supplies. A resilient health system interrupts and limits these vicious cycles.

These interdependencies occur at a larger scale: health systems are dependent on larger societal systems to keep functioning. For example, infectious diseases may disrupt the functioning of essential services such as schools, public utilities and transportation, which in turn affect the functioning of health care. Public information may affect health-seeking behaviours. Health systems in individual OECD countries are also linked by vulnerabilities that go beyond health care. For example, supply chains and the logistics of health systems depend on international trade, and the workforce depends on the mobility of professionals.

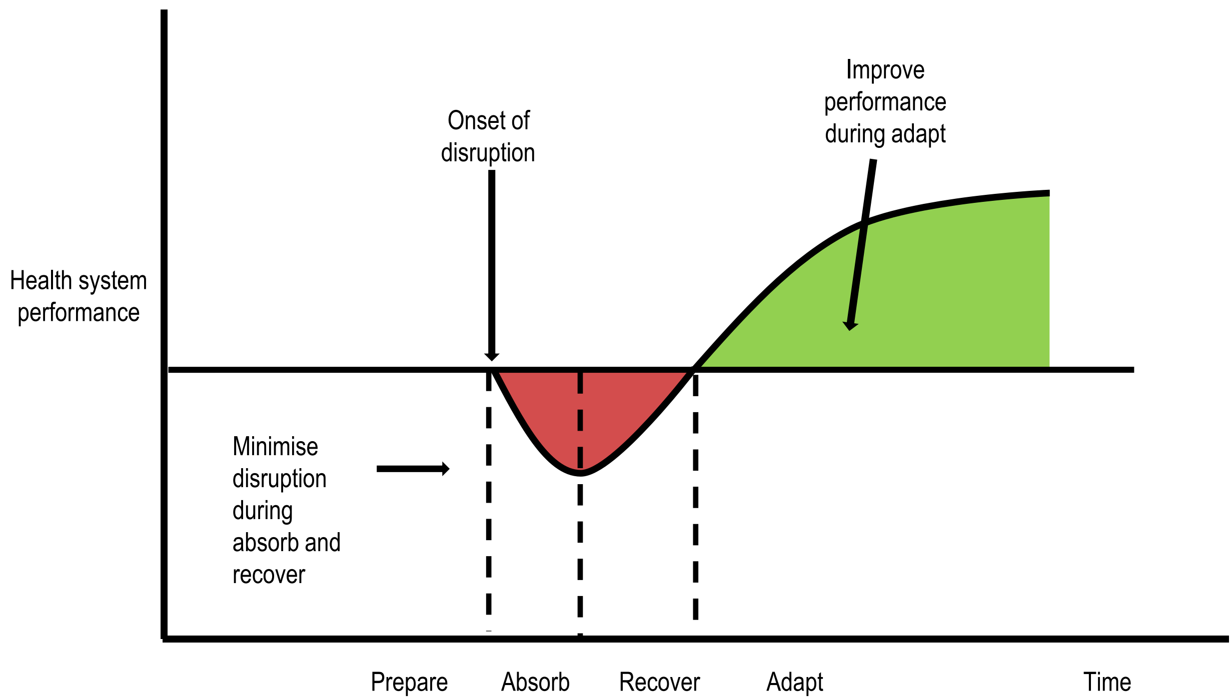
The interdependencies also occur over time. Disrupted education and the loss of other investments could lower the productive capacity of OECD economies in the future, making it more difficult to sustain health systems. Early analysis based on data from OECD countries estimated that educational disruption following the onset of the COVID-19 pandemic would produce an average reduction in GDP of 1.5% for the remainder of this century (Hanushek and Woessmann, 2020[7]).

Rather than relying solely on planning for, avoiding and absorbing shocks, a resilience approach acknowledges that some shocks will be of a size and scale that will disrupt an entire health system. In this scenario, it is important that the health system is capable of recovering and adapting for the future.

The disruption cycle comprises four stages (Figure 1.2):

- **Prepare** includes the steps taken by the health system and related institutions to plan and prepare critical functions and features to avoid and mitigate a universe of potential shocks. It occurs prior to the disruption.
- **Absorb** comprises the capability of the health system to maintain core functions and absorb the consequences of an acute shock or extended stress without collapse. It involves limiting the extent of the disruption and minimising the morbidity and mortality impact.
- **Recover** involves the health system attempting to regain lost functions as quickly and efficiently as possible. It also refers to the time and resources needed for the system to recover its functionality after the shock.
- **Adapt** relates to the capacity of the health system to "learn" and improve its capacity to absorb and recover from shocks based on past experience, reducing the impact of similar threats in the future. It informs planning and preparation for the next cycle.

Figure 1.2. The disruption cycle: the four stages of a response over time



Sources: Adapted from OECD (2019[8]), "Resilience-based Strategies and Policies to Address Systemic Risks", https://www.oecd.org/naec/averting-systemic-collapse/SG-NAEC(2019)5_Resilience_strategies.pdf, and National Research Council (2012[9]), *Disaster resilience: A national imperative*, https://doi.org/10.17226/13457.

These stages are presented in sequence but are dynamic and integrated in practice. This is illustrated by the COVID-19 context. For example, a new variant of SARS-CoV-2 that escapes immune protection from vaccination could result in a shift backwards from the recover to the absorb stage. Furthermore, decisions made in one stage of the disruption cycle may have an impact on the subsequent stages – for example, stopping elective surgery during the absorb stage of the pandemic may affect the recover stage.

Resilience involves ensuring that health system performance continues under extreme stresses (Linkov et al., 2013[10]), and across the domains that determine its performance. This relates to factors within health systems (including capacity, physical resources, workforce and information systems) and beyond them (including a view of the socio-economic determinants of health). Experiences in the health sector, including outbreaks of the Ebola virus, also demonstrate the importance of considering resilience at different levels: the individual; the local community; institutions; and the whole system (see the chapter on resilience in other sectors, including for a case study on the Ebola virus).

Analysis of approaches to resilience in other sectors can be enlightening (Box 1.1). This analysis highlights there is no single way to quantify and improve resilience, with many methods and tools the subject of sector-specific practice and academic investigation.

Box 1.1. Resilience in other sectors

Resilience has decades of application in other disciplines, beyond health. All resilience analysis requires stakeholders to adopt a perspective that recognises the connections between systems - interdependency - and the need to go beyond risk, to absorb, recover from and adapt to disruption.

Resilience is a rapidly developing field of endeavour. Many different approaches are used to analyse and improve resilience of systems, from scorecards and tabletop exercises to simulations using artificial intelligence. More advanced approaches require greater data and more sophisticated approaches to modelling the systems of interest.

Multiple sub-systems must work together for any system to be resilient. A generic conceptualisation of the sub-systems includes, but is not necessarily limited to, the following domains:

1. physical – equipment and facilities
2. information – data
3. cognitive – understanding and decision making
4. social – interactions between actors.

Resilience is a function of system performance and cannot be engineered in silos. Improving one domain without the others may not improve resilience. For example, over-relying on physical infrastructure (e.g. intensive care unit beds) and not considering social behaviour (e.g. adherence to containment and mitigation) will not produce a resilient system in response to a pandemic.

In the infrastructure sector, disruptions that place transportation networks or energy facilities offline cannot be effectively engineered against. A focus on maximum efficiency can leave systems vulnerable to disruption. This has meant that resilience efforts focus not only on mitigating risk and preparing for shocks, but on recovering and adapting to learn from them.

In the finance sector, the global financial crisis (2007-08) was the impetus for resilience thinking and implementation. Financial systems have operationalised resilience by trying to prepare for and absorb shocks through stress testing. The purpose of these tests is to identify areas of financial systems which should be bolstered. The results of these tests are published and can be brought into the public domain.

In the environmental sector, systems still require resilience, although they are formed not designed. For example, the Environmental Protection Agency of the United States has explored qualitative approaches to evaluating resilience. Resilience to the impacts of climate change is also a growing field.

Further, experiences in cybersecurity and digital systems show the potential for feedback loops and interdependencies between systems. For example, cyber attacks that disrupt the provision of essential goods and services, such as fuel, can result in hoarding behaviour, further exacerbating shortages.

The remainder of this chapter presents the key findings and recommendations of the report in parallel with the disruption cycle:

- Section 1.3 summarises some of the pre-existing major vulnerabilities that showed that health systems were not ready for a crisis, as demonstrated by the COVID-19 pandemic.
- Section 1.4 analyses the strengths and weaknesses from a resilience perspective of OECD health systems, primarily through the lens of how well these systems absorbed the impacts of the pandemic, while appreciating the array of other future threats.
- Section 1.5 recognises that a crisis often creates a legacy of policy choices, inadvertent consequences and lingering impacts, even as new crises unfold. It outlines contemporary efforts by OECD health systems to recover from the pandemic. The recover stage of the pandemic began when normal health

system functions resumed – namely, when vaccination coverage became widespread, containment and mitigation measures were reduced, and efforts began to address deferred and delayed care.

- Section 1.6 recommends policy actions, based on this report's key findings, in support of OECD countries investing in health system resilience to be ready for the next crisis. The recommendations relate not only to being ready for future pandemics but also to improving readiness to prepare for, absorb, recover from and adapt to a broader range of future challenges.
- Finally, the benefits of investing in resilience are highlighted in Section 1.7.

As well as the available literature this report draws upon multiple OECD data collections and surveys (Box 1.2), as well as case studies.

Box 1.2. Data sources, including the OECD Resilience of Health Systems Questionnaire 2022

This report draws on the regular data collections of the OECD and supplementary information. A questionnaire on resilience was used to inform both responses to the pandemic and future intentions to improve health system resilience. The questionnaire focused on several important areas including workforce, care continuity, mental health, pandemic planning and investments. It was sent to OECD countries on 3 December 2021, and responses were accepted until April 2022. The details of the questionnaire and additional material are in Annex A. A total of 26 countries participated in the OECD Resilience of Health Systems Questionnaire 2022.

Additional questionnaires and surveys that this report draws on include: the OECD Survey on Telemedicine and COVID-19 answered by 31 countries (OECD, 2023[11]); the OECD Health Data and Governance Changes during the COVID-19 Pandemic Questionnaire 2021 answered by 24 countries (de Bienassis et al., 2022[12]); the 2021 OECD Survey on Electronic Health Record System Development Use and Governance answered by 26 countries; and the 2021 OECD Questionnaire on COVID-19 in Long-Term Care answered by 26 countries.

1.3. Prepare: Health systems should be ready for a crisis

The COVID-19 pandemic demonstrated uneven efforts across OECD countries to prepare fully for health system disruption, underscoring the need for a resilience approach. It is now appreciated that national pandemic preparedness was underfunded prior to the pandemic (The Independent Panel for Pandemic Preparedness, 2021[13]). Furthermore, the pandemic revealed underlying structural weaknesses in health systems and societies: underdeveloped plans around issues such as civil engagement and procurement of supplies; social and economic inequities; vulnerabilities in population health and long-term care systems; fragmented digital infrastructure resulting in fragmented data; and some OECD countries with limited spare capacity in their workforce and a lack of other critical resources. While these weaknesses were exposed in the context of the pandemic, they reveal that more investment is needed for health systems to be ready for a broader range of future shocks.

1.3.1. Stronger mechanisms for co-ordination and co-operation were needed

Health systems need to implement policies to respond to all four stages of a disruption: prepare, absorb, recover and adapt. Preparation is necessary but not sufficient for resilience (The Independent Panel for Pandemic Preparedness, 2021[13]).

Required resources and capabilities should be anticipated during the prepare stage and made available for best use during the absorb and recover stages. For example, enhancing the capacity for surveillance, tracing/tracking and case management has been emphasised as key to effective pandemic planning and response. After the COVID-19 pandemic began, however, the available health workforce, critical care resources for COVID-19 patients and personal protective equipment (PPE) were highlighted as insufficient.

Further, fewer than one-third of countries responding to the OECD Resilience of Health Systems Questionnaire 2022, had delineated capacities/strategies in their national pandemic preparedness plans to promote societal co-operation, such as social and financial support for those affected, civil society engagement, and management of privacy or ethical issues.

Governance impacts on the trajectory of a crisis but it can be neglected in preparedness (World Bank, 2022[14]). Countries can strengthen health system resilience by improving decision making processes, creating strong health institutions, and leveraging whole-of-government and whole-of-society approaches (EU Expert Group on Health Systems Performance Assessment (HSPA), 2020[15]). Health systems require frameworks for decision making and co-ordination to be introduced prior to a shock occurring, so that these can be activated at the appropriate time during the disruption cycle. Mechanisms for facilitating multisectoral co-operation, ensuring civil engagement and sustaining public trust also cannot be created at short notice when a shock occurs. Their absence may have profound effects during the absorb and recover stages of a crisis (see the chapter on containment and mitigation).

Conversely, putting in place mechanisms for multisectoral co-operation may improve the speed of response to a shock. For example, prior to the pandemic, Korea had built an epidemiological investigation support system that integrated information from a wide range of sectors to identify cases and trace contacts quickly. Several elements of this system built on Korea's review of experience with the Middle East respiratory syndrome outbreak of 2015 (OECD, 2022[16]).

Misinformation and disinformation have the potential to undermine co-operation (Box 1.3). 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, 2021[17]). Despite the potential for civil society to act as an important partner in countering misinformation and disinformation narratives, the majority of responding countries reported that their health ministries did not consult civil society groups on countering disinformation, and only one (Türkiye) reported that consultation happened on more than an ad hoc basis.

Box 1.3. Combatting COVID-19 disinformation, including on social media

Disinformation about COVID-19 is quickly and widely disseminated across the Internet, reaching and potentially influencing many people. Data from Argentina, Germany, Korea, Spain, the United Kingdom and the United States show that about one in three people said they saw false or misleading COVID-19 information on social media. Research has also shown that COVID-19 disinformation is disseminated more widely than information about the virus from authoritative sources like the World Health Organization (WHO).

The OECD has identified four key actions to counter COVID-19 disinformation on online platforms: supporting a multiplicity of independent fact-checking organisations; ensuring that human moderators are in place to complement technological solutions; voluntarily issuing transparency reports about COVID-19 disinformation; and improving users' media, digital and health literacy skills (OECD, 2020[18]).

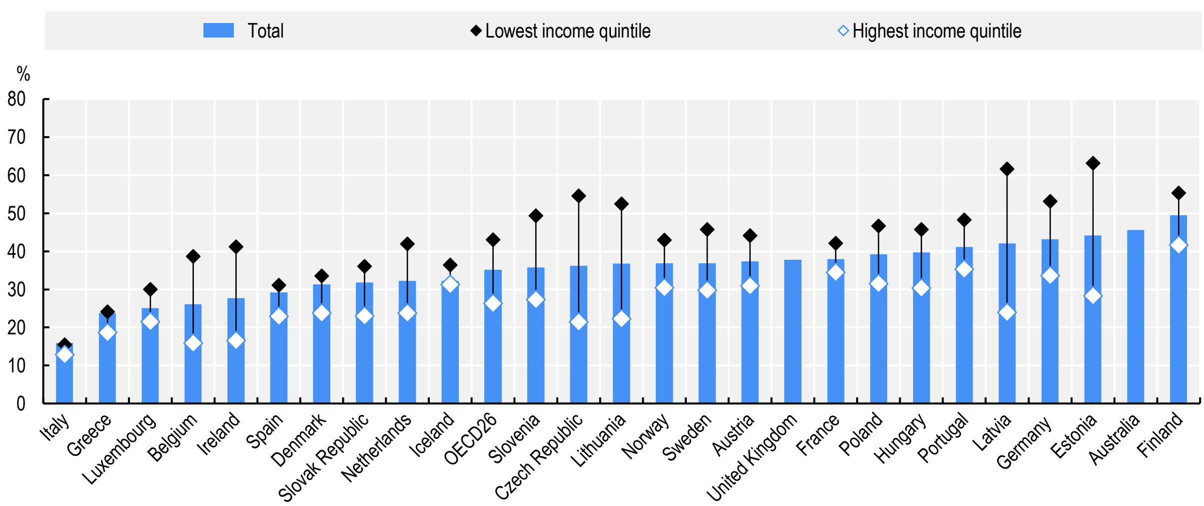
Governments would benefit from exploring a more holistic approach to the challenge of disinformation, combining initiatives to ensure that truthful and reliable information is accessible, and that the spread of dangerous content is reduced. These initiatives should rest on the open government principles of transparency, integrity, accountability and stakeholder participation. The OECD could play a role in building a global evidence base on this evolving challenge and the relative efficacy of the responses, including potential regulatory responses. Addressing disinformation with concerted action, alongside effective and authoritative public communication, is crucial to fostering public trust (Matasick, Alfonsi and Bellantoni, 2020[19]).

1.3.2. The health of populations and inequity exacerbated vulnerabilities

Improving the health of populations, strengthening primary care and its linkage with long-term care, and empowering patients improves the resilience of health systems. It does this by reducing the strain on the health system during disruptions and decreasing the probability that it will be overburdened. Recent spending on disease prevention is low, at only 2.7% of total health expenditure across OECD countries in 2019 (OECD, 2021[20]), and has been consistently low over time (OECD, 2005[21]).

Multimorbid patients are vulnerable to disruptions in care, which can lead to severe consequences and long-term complications. This group of patients has high utilisation rates of health care – often seeing multiple providers – and high rates of emergency department visits and hospital admissions. Data from just before the pandemic showed that, on average, 35% of the population across OECD countries had a longstanding illness or health problem. Prevalence was even higher for the population in the lowest income quintile, reaching 43% (Figure 1.3).

Figure 1.3. People in OECD countries reporting a longstanding illness or health problem, by income quintile



Note: Data refers to 2019 or nearest year. Data for Australia refer to people aged 18 and over living with at least one chronic condition, and refer to 2017-2018.
Source: European Union Statistics on Income and Living Conditions instrument (EU-SILC) 2021 and national health surveys, presented in OECD (2021[20]), *Health at a Glance 2021: OECD Indicators*, https://doi.org/10.1787/ae3016b9-en.

The high prevalence of chronic disease in OECD countries was a contributing factor to mortality rates during the pandemic. Obesity and chronic diseases such as diabetes were risk factors for serious health impacts and death from COVID-19 (Barron et al., 2020[22]). OECD countries where pre-pandemic treatable mortality was low experienced better health outcomes (see the chapter on COVID-19 outcomes).

Considering mental health needs and the sufficiency of mental health services before a widespread and severe shock reduces the size of the population that is vulnerable after a shock, thereby helping to mitigate its impact. Population mental health services and their provision outside the health system (for example, in schools and workplaces) are important to a multi-faceted response.

Poor co-ordination between primary care and long-term care has been a longstanding issue. In 2019, between 36% and 88% of the primary care providers in 11 OECD countries reported not co-ordinating care frequently with social care or other community care services (Doty et al., 2020[23]). Only ten

OECD countries reported having guidelines or legislation on the integration of long-term care and primary care before the pandemic.

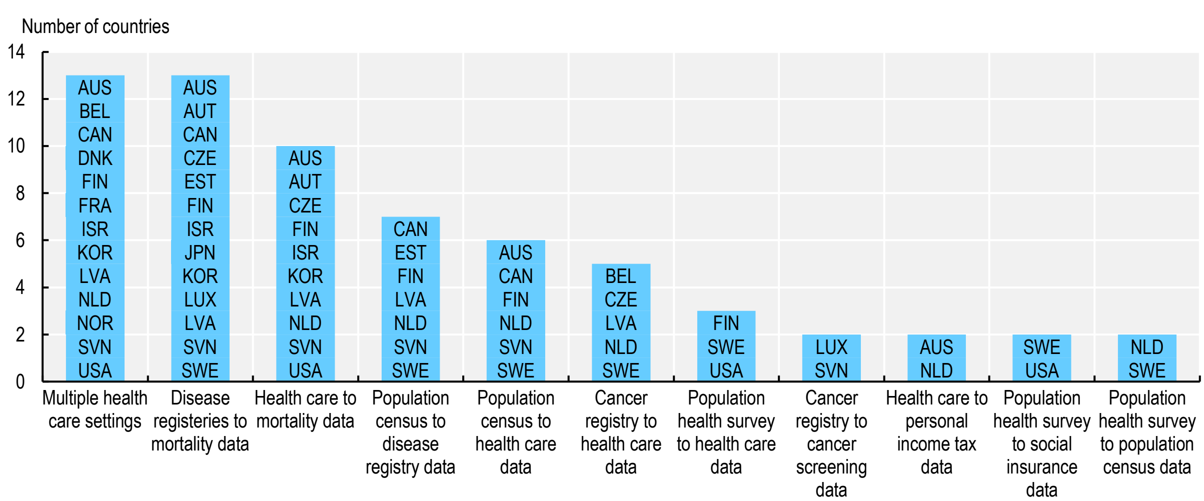
Universal health coverage, improving population health and reducing disparities in risk factors diminishes both inequities in outcomes and demand for acute services during a crisis. Undertaking these prior to a crisis occurring reduces the vulnerabilities of the population and improves the performance of health systems during the absorb stage of a shock.

1.3.3. Health data were fragmented and not available in real-time

Decision makers are flying blind unless they have access to timely data, and the tools to convert it into actionable information. Without data, threats cannot be identified; the effectiveness and unanticipated consequences of policies cannot be monitored and evaluated; and the implications of not introducing policies cannot be fully appreciated. Information is needed for all stages of the disruption cycle.

Prior to the pandemic, data infrastructure within the health system was fragmented. Only 14 OECD countries were able to link data across multiple settings within the health system (Figure 1.4). A smaller number had real-time data available for some data collections (Oderkirk, 2021[24]).

Figure 1.4. OECD countries able to link data across multiple settings before the pandemic

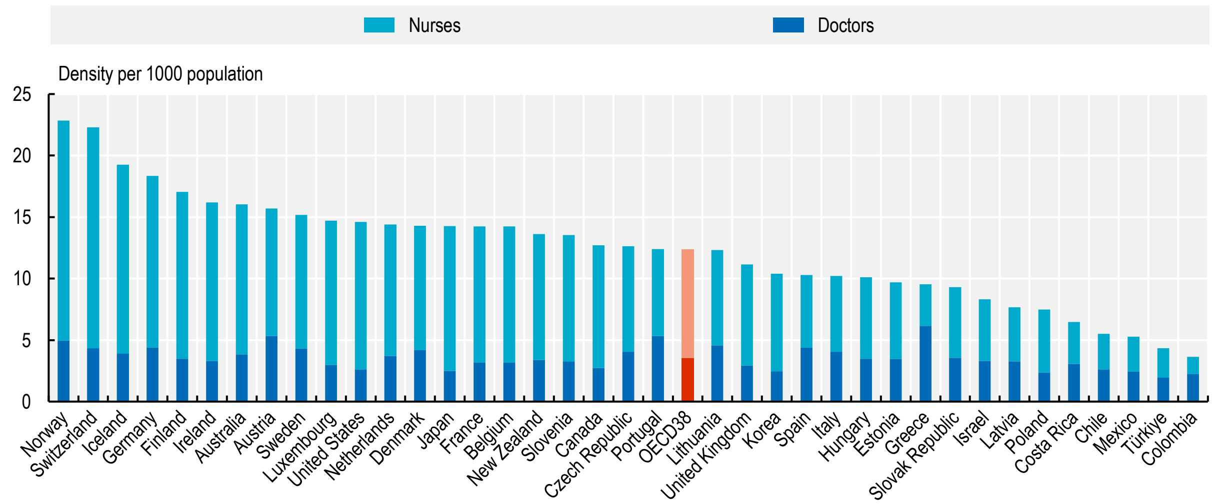


Source: Adapted from Oderkirk (2021[24]), "Survey results: National health data infrastructure and governance", https://doi.org/10.1787/55d24b5d-en.

1.3.4. Spare capacity was lacking in some OECD countries

Both the capacity and the spare capacity of health systems in key areas such as workforce and the availability of critical care resources varied greatly across OECD countries prior to the pandemic. Variation was six-fold in the number of doctors and nurses per capita across OECD countries prior to the pandemic (Figure 1.5).

Figure 1.5. Numbers of doctors and nurses across OECD countries before the pandemic, 2019



Note: In Portugal and Greece, the number of doctors refers to all doctors licensed to practice, resulting in a large overestimation of the number of practising doctors (e.g. of around 30% in Portugal). In Greece, the number of nurses is underestimated, as it includes only those working in hospitals. The data from Finland date back to 2014.
Source: OECD (2022[3]), OECD Health Statistics, https://doi.org/10.1787/health-data-en.

Prior to the pandemic, there were also indications in some OECD countries of insufficient physical infrastructure and a lack of spare capacity. For example, four countries reported an occupancy rate of around or over 90% for acute care beds in 2019, while eight countries had less than half the mean number of adult intensive care beds across OECD countries (OECD, 2021[20]).

These limitations flowed into the absorb stage of the COVID-19 pandemic, hampering some responses and making the consequences of the pandemic more significant than they might otherwise have been. Investments in population health, data and key aspects of health system capacity would help to address these challenges, bolstering health system resilience (see chapters on digital foundations and COVID-19 outcomes).

1.4. Absorb: The pandemic response was substantial but insufficient to address major vulnerabilities

The response of countries to absorb the impact of the COVID-19 pandemic was rapid and, in many cases, exceptional. During the absorb stage, countries implemented whole-of-society containment and mitigation measures, increased resources for the health system, moved resources to critical care, transitioned to different models of care such as telehealth, and changed health workforce roles and responsibilities (see chapters on containment and mitigation, critical care surge, care continuity, and the health workforce). Importantly, the stresses on populations were also partially mitigated by means other than health care – for example, by financial, employment and community support.

Additional health system resources (including to support the healthcare workforce), better information and modelling, a whole-of-society approach and flexibility in healthcare provision all played a role in mitigating the severity of the disruption in some OECD countries. They also led, however, to a reduction in regular health care and widespread cancellation of procedures (see the chapter on waiting times).

Weaknesses in the prepare stage also made it more difficult to respond to the COVID-19 pandemic during the absorb stage. Some health systems were running at capacity prior to the pandemic. Timely information was lacking, and the numbers of supplies, staff and treatment facilities relative to demand were inadequate. Supply chains of many essential goods were disrupted. Fragmentation of responses, lack of co-operation and, at times, even competition for scarce resources also hampered responses during the absorb stage (see the chapter on securing supply chains). COVID-19 magnified the impact of poor care integration in many OECD countries, and demonstrated the impact of limited co-ordination at the international level.

The COVID-19 pandemic revealed and highlighted major vulnerabilities in health systems that call for greater investment. Increased vulnerabilities meant that both the direct consequences of COVID-19 and its indirect impacts were larger than they might otherwise have been. If a health system does not have the critical resources it needs at crucial times, its functioning is inefficient and costly; further, their absence can have disastrous impacts. When resources, such as PPE, were insufficient, the COVID-19 mortality rate increased and the health workforce was infected (Verbeek et al., 2020[25]).

1.4.1. Cohesive societal responses were launched

Improving the resilience of society depends on the health system, and strengthening the resilience of the health system depends on society. Communicating risk and uncertainty requires trust in and transparency from institutions, including the media. Communication can be undermined when there is a lack of trust (Edelman, 2022[26]). Trust in institutions is especially important in absorbing shocks of a scale and severity that they affect everyone.

During 2020 – the first year of the COVID-19 pandemic – public understanding and co-operation were essential to containment and mitigation. In Ireland, for example, Amárach public opinion surveys were conducted regularly to inform communications and decisions made by the Department of Health. The results of the surveys were made publicly available and shared across government departments.

Community involvement in decision making also engendered buy-in to critical measures. In Lithuania, representatives from community organisations were included in a working group to help co-ordinate and assist in minimising the harms caused by the pandemic. In Costa Rica, a shared management model – "Costa Rica works and takes care of itself" – encouraged ownership of containment measures from the community level up and facilitated a sense of responsibility to follow public health requirements.

Nonetheless, many countries struggled to implement containment strategies in a timely manner, even though they had been evaluated as prepared by assessments such as the Global Health Security Index (Haider et al., 2020[27]). This demonstrates that while "planning well" is necessary, it is not sufficient for an effective societal response. A failure to implement containment strategies proactively led to use of more stringent containment and mitigation strategies – such as lockdowns – during the early stages of the pandemic, with negative socio-economic impacts (see the chapter on containment and mitigation).

To implement timely and effective interventions to a disruption of significant scale and severity, many parts of government need to be marshalled – budgets allocated; the co-operation of local administrations secured; essential equipment procured and delivered; and strategic communications conveyed – all in a way that complements and facilitates the health response.

Most OECD countries responding to the OECD Resilience of Health Systems 2022 (20 of 23) implemented a whole-of-government approach as part of their pandemic response. For example, Luxembourg's agility in its COVID-19 response was evaluated as partly attributable to its inter-ministerial management, aided by fiscal and social support of households and businesses (OECD, 2022[28]). Such an approach was important to the effectiveness of a range of measures, including containment and mitigation.

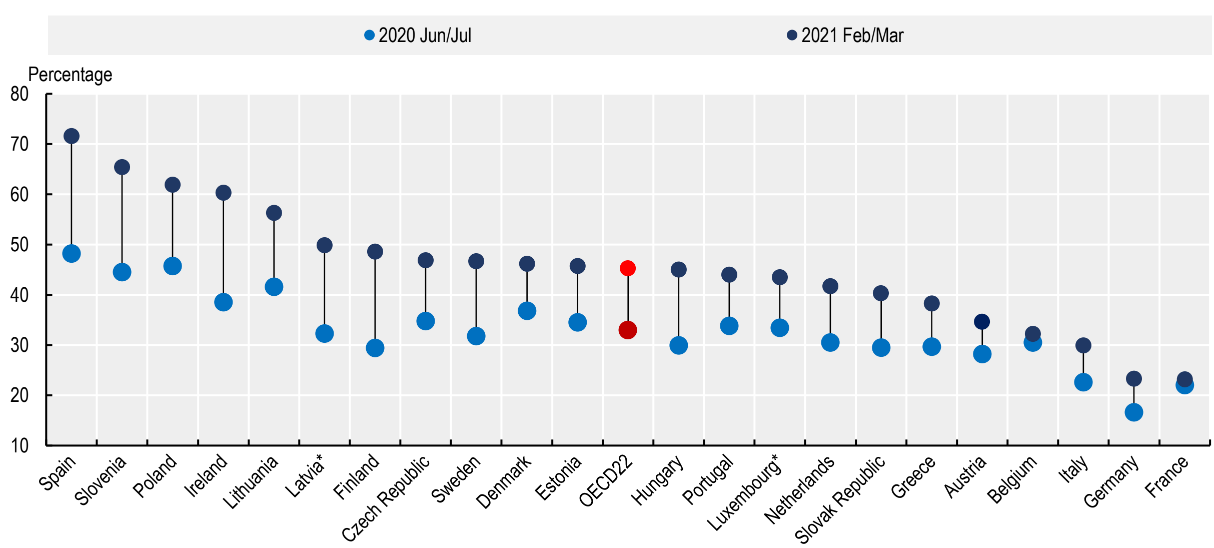
1.4.2. Flexible care delivery and improved co-ordination supported effective resource use

Collaboration and co-ordination within health systems foster resilience by reducing vulnerabilities and increasing the effectiveness of resource use. There were several positive examples of how different levels of collaboration helped OECD countries absorb the shock of the COVID-19 pandemic.

Load-balancing – using networks of intensive care units (ICUs) and sharing the burden by transferring patients to ensure that no individual ICU is overwhelmed – for critical care requires national and sub-national authorities to co-ordinate and inject resources. All OECD countries used real-time data to improve co-ordination during the critical care surge, accompanied by changes in institutional arrangements. Most OECD countries responding to the OECD Resilience of Health Systems Questionnaire 2022 (15 of 18) integrated public and private facilities into the same network, and over two-thirds (13 of 19) increased the effective size of their hospital networks. Crisis care protocols were widely used. Almost all reporting countries (20 of 21) used modelling to predict the critical care capacity required to respond to the pandemic and found modelling useful to plan resources (see the chapter on critical care surge).

Welcome transformations occurred in healthcare delivery. The need for physical distancing saw OECD countries move usual health system functions to different locations or different providers (OECD, 2021[20]). Nearly half of adults in 22 OECD European countries reported receiving medical consultations online or via telephone (Figure 1.6).

Figure 1.6. Increased use of telehealth services June 2020 to March 2021, selected European OECD countries



Note: The data show numbers of OECD country respondents in the EU27 answering “Yes” when asked “Since the pandemic began, have you received any of the following services from a doctor? Online health care: medical consultation online or by telephone”. The survey was carried out in June/July 2020 and February/March 2021. * Data for Latvia and Luxembourg are of low reliability.
Source: Eurofound Living, Working and COVID-19 Survey dataset.

OECD countries also adopted strategies to maintain continuity for ongoing care needs by delegating new roles and responsibilities to health workers. These strategies ranged from increasing the role of nurses and community health workers to provide home-based care (Slovenia, the United Kingdom and the United States) to allowing community pharmacists to prescribe or extend prescriptions for chronic conditions (Austria, France and Portugal).

Changes to service provision in response to the pandemic relied on the local-level adoption of new models of care – telemedicine was an example of this flexibility. OECD countries used multidisciplinary teams with public health and community services to proactively contact patients with underlying health needs. For example, in Australia, general medical practices – which comprise general practitioners, primary care nurses, allied health and other healthcare professionals – provided essential primary care services to their patients for chronic conditions, preventive care and mental health concerns (Desboraugh et al., 2020[29]). In Lithuania, mobile teams of primary care professionals were introduced to visit patients in their homes to provide primary care services.

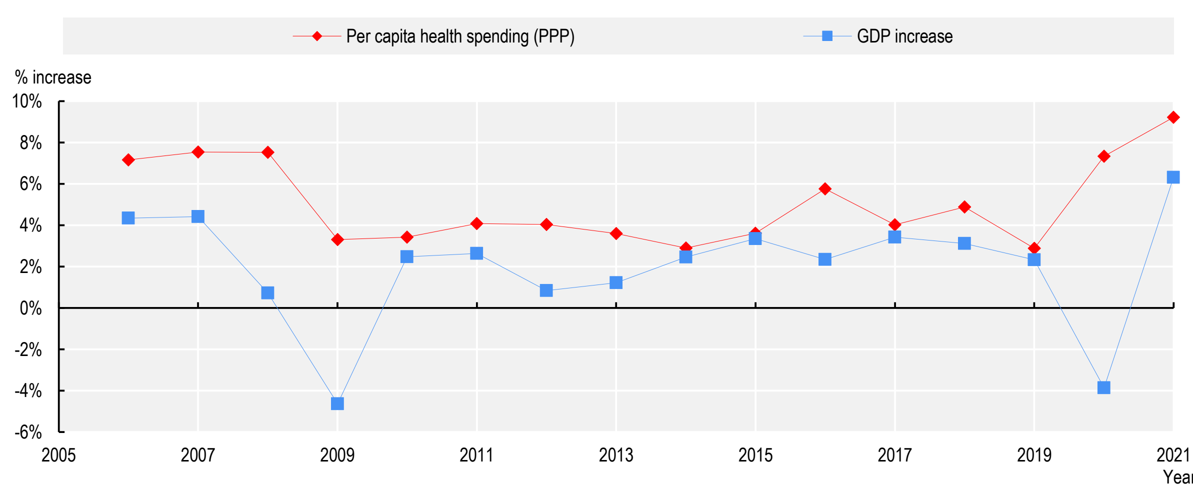
The effectiveness of testing and containment was also influenced by the extent of healthcare coverage. For example, Korea's rapid scaling up and implementation of testing, tracing and tracking was facilitated by their health coverage eliminating out-of-pocket charges for COVID-19 related diagnosis and treatment (Dongarwar and Salihu, 2021[30]). OECD countries where the entire population had health coverage for a key set of health services experienced better health outcomes (see the chapter on COVID-19 outcomes).

Flexibility in health financing supported innovation in service provision and models of care. It ensured that providers continued services (for example, by funding telehealth), delivered new services (for example, by funding vaccinations), aided containment and mitigation (for example, by ensuring coverage and low out-of-pocket charges) or avoided inappropriate incentives (for example, by moving to block funding and global budgets) (Thomas et al., 2020[31]).

1.4.3. An additional 1% of GDP was directed to health systems

The need to increase critical care surge capacity to address COVID-19 saw governments intervene to increase resources for the health system. There was a per capita increase in health spending of over 6% across OECD countries at the same time as GDP contracted in 2020 (Figure 1.7). The share of GDP allocated to health expenditure increased by approximately 1% in 2020.

Figure 1.7. Increases in health expenditure as the shock of the pandemic was absorbed in OECD countries, 2020



Note: Only OECD countries (20) with data for the complete series are included in the analysis. An unweighted average of the annual percentage increase for OECD countries was calculated. 2021 figures are provisional. Current purchasing power parity (PPP) was used for health spending increase calculations.
Source: OECD (2022[3]), OECD Health Statistics, https://doi.org/10.1787/health-data-en.

This increase in resources was accompanied by widespread cancellations of elective procedures and reprioritisation of resources – both physical and workforce – to critical care surge capacity. An 8% increase in critical care beds was reported (see the chapter on critical care surge). Without increasing the critical care surge capacity many health systems would have been even more overwhelmed, as the number of ICU patients with COVID-19 exceeded the previous capacity. Despite this, over three-quarters of countries (16 of 21) that responded to the OECD Resilience of Health Systems Questionnaire 2022 used crisis standards of care, which meant a move from supplying everyone with appropriate care to ensuring that the most lives were saved.

1.4.4. Data deficiencies were mitigated but important limitations persist

The lack of timely information was a key limitation when countries sought to absorb the impacts of the COVID-19 pandemic. Countries found that they lacked basic timely data – on hospitalisations, healthcare workforce, resources and mortality (de Bienassis et al., 2022[12]). Not having sufficient information on populations living in vulnerable and marginalised conditions was a weakness. For example, poor data measurement and evaluation of long-term care facilities hampered the response to COVID-19 during the absorb stage (Rocard, Sillitti and Llena-Nozal, 2021[32]).

As the pandemic continued, countries took steps to collect important data, either via surveys or by repurposing existing data collections. Data were collected on COVID-19 cases and mortality, population mental health symptoms, critical care resources and their use, and the well-being of the health workforce.

COVID-19 also served as a catalyst for mobilising resources to improve the use of data. All countries that responded to the 2021 OECD Survey on Health Data and Governance Changes improved mechanisms for data reporting: almost all improved the timeliness of health data; and 63% implemented regulatory changes or policy reforms to improve data availability (de Bienassis et al., 2022[12]).

Information technology improvements and adaptations accelerated (see the chapter on digital foundations). Many OECD countries (18 of 24) introduced new technologies to improve health data availability, accessibility, sharing or data privacy and security protection. Some introduced legislative reforms to facilitate data sharing to monitor COVID-19. Financial incentives were introduced in a quarter of responding OECD countries (6 of 24) (de Bienassis et al., 2022[12]).

The response to the pandemic was also facilitated by new data linkages, and by moving information to where it was needed most. This information was used by decision makers at different levels to balance the many competing resource needs. The value of information to multiple actors should be fully appreciated. It is crucial to making decisions with greater confidence, and to effective and efficient use of resources.

Nonetheless, data limitations persist. The ability to monitor unintended consequences of policies and to anticipate key failures is important for resilience. Without information about the distribution of benefits and harms across the population, pre-existing inequities can be worsened. Assessing harms and benefits across a population requires information not only about age and sex but also comorbidities, socio-economic status and other markers of vulnerability, such as homelessness and long-term care facility residency, to make fully informed decisions. Such depth of data collection is not present in most OECD countries – this may undermine an effective response to future crises.

1.4.5. Disruptions in supply chains hampered the early response

The pandemic introduced additional pressures on medical and medical device supply chains (see the chapter on securing supply chains). It led to unprecedented spikes in demand for those medicines and medical devices needed to treat COVID-19 patients and to protect the health and long-term care workforce and the population from infection risk. This included PPE, ventilators, vaccines and critical care medicines.

Other factors also contributed to extraordinary tension in procurement of essential medicines and medical devices at a time when supply chains were already vulnerable. Lockdown policies and other containment measures created disruptions in production and international transport networks. Further, some governments introduced export restrictions that exacerbated existing shortages and worsened the situation by triggering similar actions in other countries.

Significant shortages were observed globally for PPE (Gereffi, 2020[33]). Almost all countries (23 of 25) responding to the OECD Resilience of Health Systems Questionnaire 2022 had a problem with securing PPE. Most responding countries reported a problem with testing materials (19 of 23), ventilators (17 of 25), vaccines (15 of 25) and sanitiser (14 of 24). While supply chains for medicines showed relatively greater resilience, demand increased significantly for medicines used in intensive care – such as anaesthetics – creating disruptions in supply and local shortages. While two-thirds (16 of 24) of OECD countries reported supply chain difficulties during the early response to the pandemic, most also reported that the situation resolved over time.

Domestic production, supply chain diversification, regulatory changes and central co-ordination mitigated supply chain disruptions. While diversification and the requirement to increase supplies quickly raised the risk of product quality, countries invested in increased product testing and offered support to new suppliers and manufacturers to guarantee quality. Open international trade was also important. Trade of essential medical products increased in response to the shortages – for example, imports of facemasks into the United States increased by 1 000% (Andrenelli, Lopez-Gonzalez and Sorescu, 2022[34]).

Nonetheless, the months between the increase in demand for essential medicines and medical goods and the rise in supply to match it had a devastating toll. A resilient health system must be able to reduce this delay and mitigate its effect.

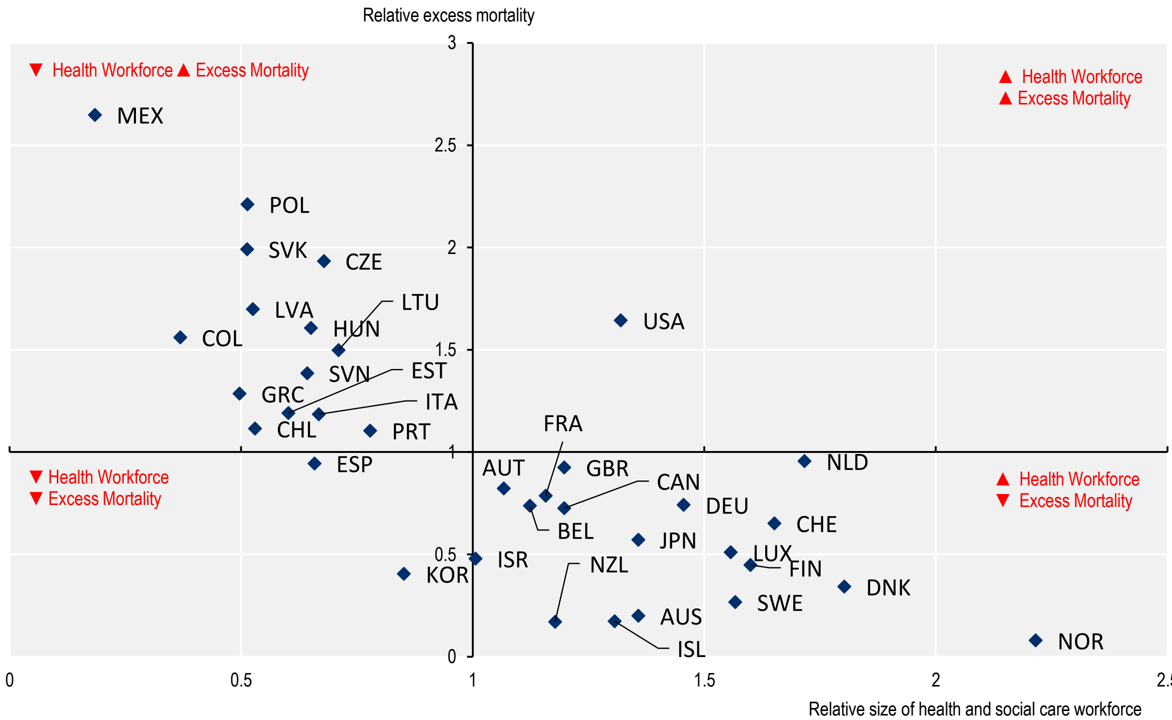
1.4.6. The healthcare workforce was pushed to its limits

The pandemic demonstrated that efforts to increase the size and skills of the health workforce are essential to improving health system resilience. Workforce limitations proved to be a more binding constraint for healthcare provision than hospital beds or equipment in absorbing the pandemic (OECD, 2021[20]).

An adequate and well-trained workforce saves lives. Public health workers were also a key part of the pandemic response (see the chapter on containment and mitigation), as they carried the burden of contact tracing, case and contact investigation, testing and eventually vaccination.

Although rapid and strong public health interventions to contain the spread of SARS-CoV-2 were important, higher numbers of health and social care providers were associated with better outcomes, such as lower mortality (Figure 1.8; and see chapters on COVID-19 outcomes and workforce). A higher staffing rate was associated with lower death rates in long-term care facilities (see the chapter on long-term care).

Figure 1.8. Higher numbers of health and social care employees associated with lower excess mortality



Note: The quadrant chart shows the association between the health and social care workforce and excess mortality. The x-axis shows how much a country is above or below the OECD average for total health and social employment in 2019 (per 1 000 population); the y-axis shows a country's distance from the OECD average excess mortality rate for 2020-21. Note that this analysis does not adjust for other factors; nor does it necessarily infer causality.
Source: OECD (2022[3]), OECD Health Statistics, https://doi.org/10.1787/health-data-en.

No country that responded to the OECD Resilience of Health Systems Questionnaire 2022 reported that workforce shortages had a low impact on their capacity to respond to the pandemic (see the chapter on workforce). There was, however, heterogeneity in responses. Nearly half of responding countries (9 of 22) reported that health workforce shortages had a high or medium-high impact on their response capacity. Canada, Japan, Latvia, the United Kingdom and the United States were among this group. Conversely, Finland, Greece, Luxembourg and Switzerland considered that health workforce shortages had a low-to-medium impact on their capacity to respond.

The lack of an appropriately skilled workforce was a key hindrance when it came to increasing critical care capacity (see the chapter on critical care surge). Most countries (17 of 22) reported that the number of nurses working in hospitals was an issue, and specifically almost all (19 of 22) reported that nurses working in ICUs were in short supply. Beyond critical care, two-thirds of countries (14 of 22) reported that a lack of healthcare assistants in nursing homes was an issue.

Another key priority in the absorb stage was to protect health (including long-term care) workers. Many health workers became infected during the first few months of the pandemic, when the shortage of PPE was a major issue (as noted above). The mental health of health workers also suffered (Aymerich et al., 2022[35]). Several OECD countries are continuing to take steps to protect the well-being of the healthcare workforce, and an increasing number are assessing healthcare worker well-being.

Many OECD countries sought to expand their workforce capacity in response to the pandemic, using a similar set of policies. These policies included increasing the efforts of the current workforce, bolstering it with clinical staff, increasing it with non-clinical staff, redeploying staff and changing worker roles and responsibilities.

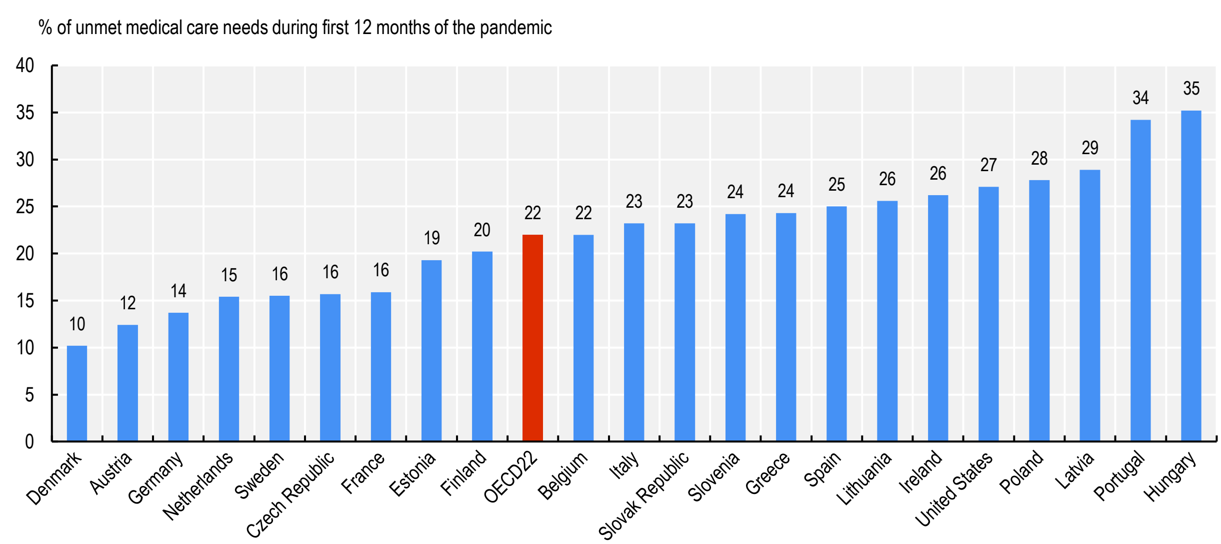
All countries that responded to the OECD Resilience of Health Systems Questionnaire 2022 mobilised additional staff in response to the pandemic. Nearly all mobilised students nearing the end of their studies in medicine, nursing and public health to staff population hotlines, support testing and contact tracing, and provide care in hospitals. Most countries also called in and reregistered retired or inactive doctors and nurses. Some countries accelerated the recognition of qualifications and registration of foreign-trained doctors and nurses (including Canada, France, Spain, the United Kingdom and the United States).

Only a few countries had put in place a reserve of health workers before the pandemic. This was the case in France where a health reserve was established in 2007 following the avian influenza pandemic. At the onset of the COVID-19 pandemic, France introduced new mechanisms to match the urgent demands from hospitals and long-term care facilities with volunteers in different regions of the country. Soon after the pandemic began, other countries set up national reserves to mobilise additional civilian or military staff (such as Belgium, Luxembourg and Norway).

1.4.7. Care was disrupted, despite substantial efforts

Reductions in healthcare utilisation were experienced from the patient perspective. Many essential services were postponed or forgone (see section 1.5.3). On average across 22 OECD countries with comparable data, more than one in five people reported having forgone a needed medical examination or treatment during the first 12 months of the pandemic (Figure 1.9; see chapters on waiting times and care continuity).

Figure 1.9. Unmet medical care needs during the first 12 months of the pandemic in selected OECD countries, 2020-21



Note: Data for Luxembourg are excluded due to low reliability.
Sources: Eurofound Living, Working and COVID-19 Survey carried out in February/March 2021, and Centers for Disease Control and Prevention Household Pulse Survey carried out between April 2020 and April 2021.

Delays in access to diagnostic services were also observed in many countries, with an average decline of over 5 percentage points in the proportion of women screened for breast cancer across 23 OECD countries. Further, an estimated 100 million cancer screening tests were not performed in Europe as a result of the pandemic, and 1 million patients living with cancer remained undiagnosed due to a backlog of screening tests. Such care disruption has come at a high cost for people and health systems.

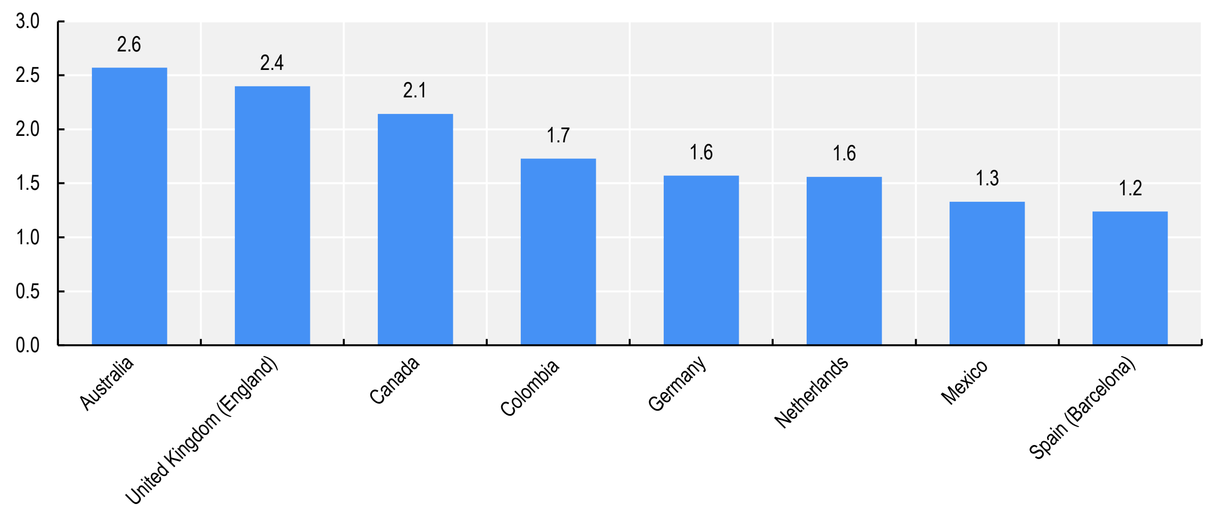
Those living with chronic health conditions were particularly affected. Among people aged 50 years and over, those with a chronic condition were, on average, over 40% more likely to report either forgoing or postponing medical care from the start of the pandemic.

1.4.8. Vulnerable populations suffered disproportionately

Mortality data from several OECD countries confirm that vulnerable populations have borne a disproportionate burden from the COVID-19 pandemic. In some countries, the rate of relative mortality doubled for those living in the most deprived areas compared to those in the least deprived (Figure 1.10). Similar relative mortality increases were found for ethnic minority populations (Office for National Statistics, 2022[36]).

Figure 1.10. Relative mortality for those in deprived areas in selected OECD countries

Rate ratio for COVID-19 mortality between people living in the most and least deprived areas



Note: Data are not directly comparable across OECD countries and regions – while the rate ratio is age-adjusted or multivariate methodology used in all countries, the timeframe of observation differs. For example, in Australia the data cover the first year of the pandemic to May 2021, while in Canada data cover the period January-August 2020.
Source: Berchet (forthcoming[37]), "Socio-economic and ethnic health inequalities in COVID-19 outcomes across OECD countries".

There are multiple reasons why vulnerable populations have suffered disproportionately. These include: increased exposure to SARS-CoV-2 through working and living conditions; a higher prevalence of health conditions and risk factors, such as diabetes, obesity and smoking; and barriers to access and use of health care. For example, a study from the United States assessing older patients with chronic health conditions found that one-quarter of Medicare patients were at high risk for delayed and missed care, which was associated with higher rates of non-COVID-19 mortality in the context of the pandemic (Smith et al., 2022[38]).

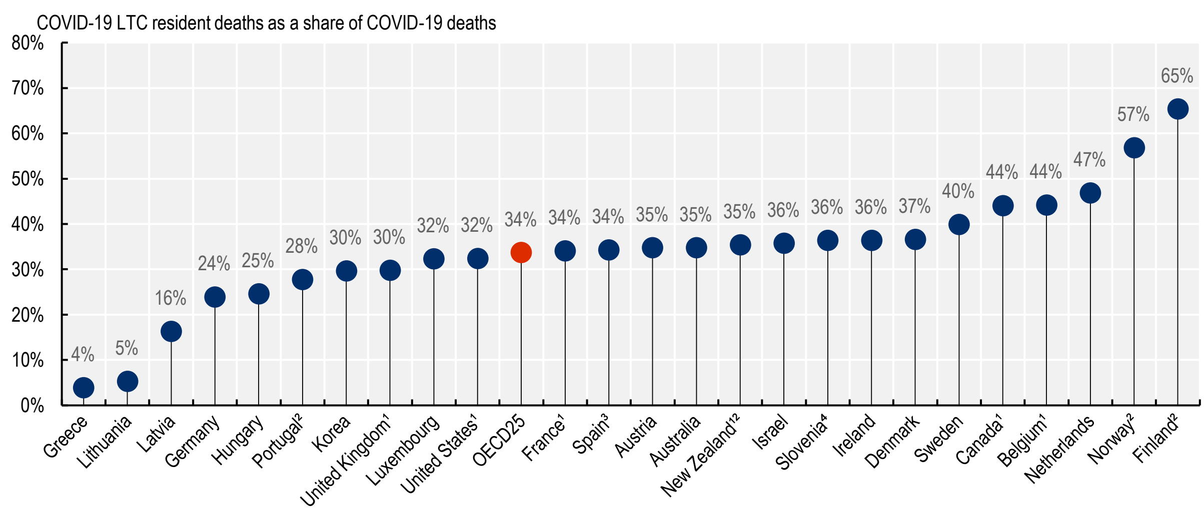
The prevalence of mental health symptoms, including anxiety and depression, during 2020 to 2022 remained heterogeneous, varying over time and between countries. Such symptoms were associated with the stringency of containment measures and the severity of the pandemic (Aknin et al., 2022[39]). The burden fell more heavily on young people and those with pre-existing vulnerabilities (see the chapter on mental health).

Three-quarters of OECD countries (20 of 26) responding to the OECD Resilience of Health Systems Questionnaire 2022 undertook mental health prevalence surveys during 2020-21. These included nationally representative surveys at several time points to collect up-to-date data on mental health issues, including anxiety and depression symptoms and psychological distress. Many of these surveys also included information about age, occupation, sex and gender, among other demographic variables relevant to understanding mental health impacts. Additionally, 19 of 26 reporting countries tracked the impact of COVID-19 on mental health service use and delivery.

All respondents (26 OECD countries) reported introducing emergency mental health support measures for the public during the pandemic. Furthermore, 25 of 26 OECD countries reported permanently increased mental health support or capacity since the pandemic began. Nonetheless, mental health in 2022 has not returned to pre-pandemic levels (see the chapter on mental health). This suggests that mental health services could not be scaled to the level required.

The long-term care (LTC) sector was hit hard by the pandemic, in terms of both the death toll and the number of people infected (workers and care recipients). The health and social costs were also substantial because of delayed or cancelled care, and because restrictions on visitation and movement generated negative mental and physical impacts for older people. Residents of LTC facilities were particularly affected in 2020 – the first year of the pandemic. Across 25 OECD countries, 34% of total COVID-19 deaths between 2020 and 2022 were among LTC residents (Figure 1.11).

Figure 1.11. Proportion of long-term care residents among all COVID-19 deaths across OECD countries



Note: Data on cumulative deaths cover different periods: data cover up to May 2022 for eight countries and up to 2021 for the remaining countries, except for Israel (2020). 1. Includes confirmed and suspected COVID-19 deaths. 2. Only includes deaths occurring within LTC facilities, not those occurring after transfer to hospitals. 3. Data come from regional governments using different methodologies, some including suspected deaths. 4. Slovenia includes deaths in nursing homes and social LTC facilities.
Source: LTC COVID website, complemented with European Centre for Disease Prevention and Control data and data from the 2021 OECD Questionnaire on COVID-19 in LTC.

Just over 50% of OECD countries had guidelines on infection control in LTC facilities. This prevented early intervention, which would have been crucial to reducing mortality. Moreover, testing and access to PPE in the initial phases of the pandemic were not sufficiently prioritised for the LTC sector. On a scale of 1 (not an issue) to 5 (extremely challenging), OECD countries defined access to PPE as 3 and access to testing as 4 for the LTC sector.

Countries have sought to remedy these deficiencies. Maintaining high vaccination rates for this priority population is very important. In this respect, 60% of the 25 OECD countries that responded to the OECD Resilience of Health Systems Questionnaire 2022 introduced mandatory vaccination for LTC workers. Most reporting countries (19 of 23) also had testing policies for LTC workers. As a result of these policies, 86% of countries reported that low vaccination rates among LTC workers were not an important concern.

Efforts have also been made to improve care co-ordination. Since the pandemic began, eight OECD countries have introduced new measures to integrate more primary care into LTC facilities. In France, a new financial scheme has been set up to incentivise primary care doctors to visit LTC residents. Italy and Luxembourg now require nursing homes to have a 24/7 medical presence to ensure follow-up care of ill LTC residents (European Observatory on Health Systems and Policies, 2020[40]).

1.5. Recover: Crises have a legacy that must be addressed

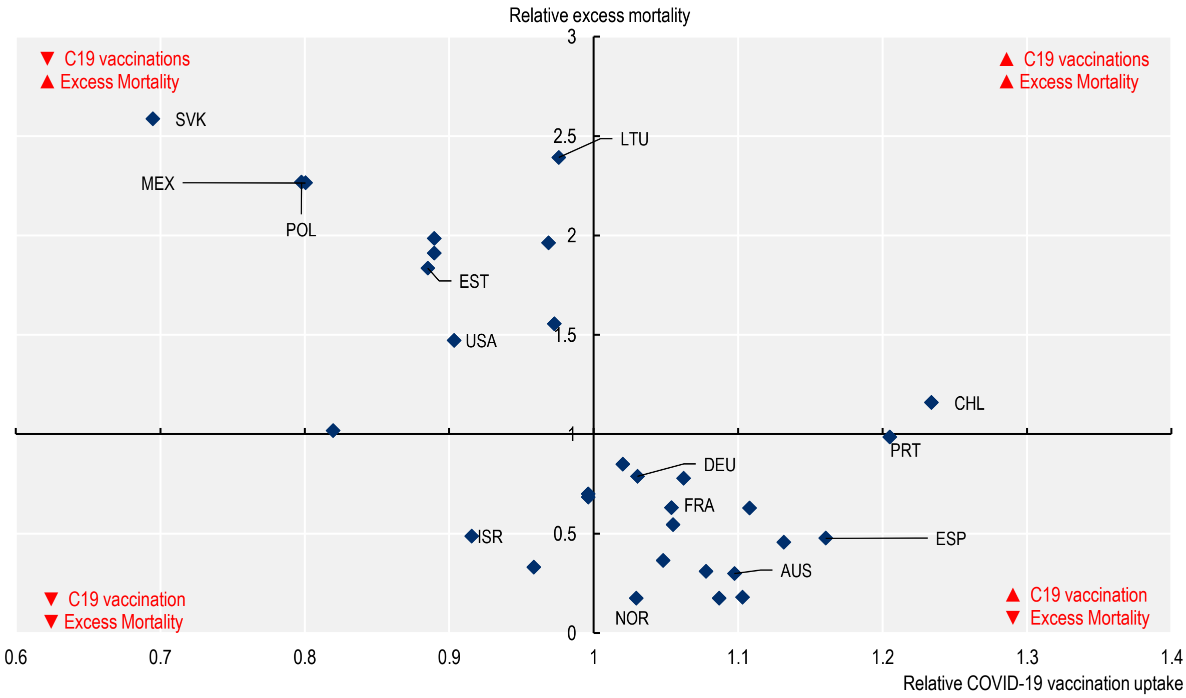
A key lesson from the pandemic is that the recover stage is less arduous when the absorb stage is less severe. Furthermore, improved resilience and performance by health systems in the absorb stage reduces the length of the recover stage.

In 2023, OECD health systems were still recovering from the legacy of the pandemic. So far, this stage has been characterised by widespread vaccination, reduced containment and mitigation measures, and a return of resources to the usual functions of the health system. Delayed and deferred care is being addressed. However, the healthcare workforce is still under pressure. The impact of post-COVID-19 syndrome or "long COVID" remains a large and uncertain burden for health systems and society.

1.5.1. COVID-19 vaccines were a scientific success but inequitably distributed

The rapid development, testing and rollout of COVID-19 vaccines was a success in transitioning to recovery for some countries. This was a game changer: increased vaccination rates were associated with decreased excess mortality through 2021 (Figure 1.12).

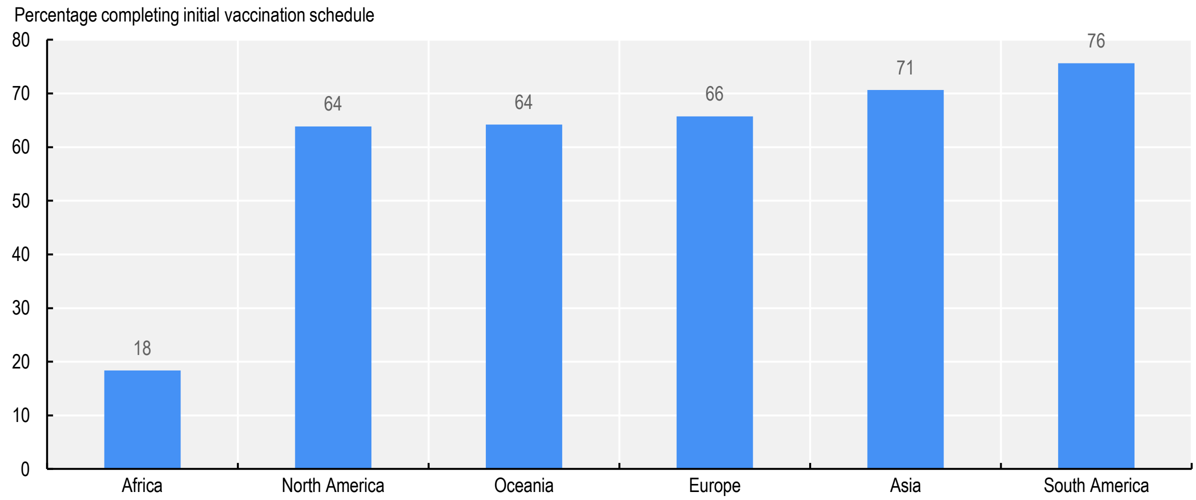
Figure 1.12. Higher vaccination rates associated with lower excess mortality



Note: The quadrant chart shows the association between vaccination rates and excess mortality. The x-axis shows how much a country is above or below the OECD average for completed initial vaccination schedules per 100 at the end of 2021; the y-axis shows a country's distance from the OECD average excess mortality rate in 2021 (OECD average normalised to 1). Note that this analysis does not adjust for other factors; nor does it necessarily infer causality. Vaccination reported as of 31 December 2021 or nearest preceding date.
Source: OECD Health Statistics 2022 and OECD analysis of Our World in Data.

On an international level, however, trade restrictions and stockpiling have meant that available resources, such as vaccines, have not always been deployed to where they might have the most benefit. Production of vaccines is highly specialised and concentrated in a limited number of countries (OECD, 2021[41]).The global distribution of vaccines is inequitable (Figure 1.13), which increases the risk of new variants developing (OECD, 2021[42]).

Figure 1.13. A four-fold difference in vaccination rates between continents



Note: Number of completed initial vaccination schedules per hundred calculated on 25 June 2022 or the nearest preceding date.
Source: Mathieu et al. (2021[43]), "A global database of COVID-19 vaccinations", https://doi.org/10.1038/s41562-021-01122-8. Dataset available at Our World in Data.

1.5.2. A lack of trust in vaccination could undermine a sustained recovery

Vaccine hesitancy and scepticism still have the potential to limit recovery from the pandemic, and to undermine the response to future outbreaks. Within OECD countries, those who have not been immunised have a more pronounced attitude against immunisation (Turner et al., 2022[44]). Enhancing public trust in COVID-19 vaccination remains important (Box 1.4).

Box 1.4. Enhancing public trust in COVID-19 vaccination

COVID-19 vaccination was an example of a large-scale societal response. The effectiveness of that response relied on trust in vaccines – especially the ability of governments to communicate the benefits of COVID-19 vaccination and to deliver safe and efficacious vaccines (Allin et al., 2022[45]). Trust in vaccines also needed to be complemented by trust in the competence and reliability of those administering vaccinations and those deciding on vaccine procurement, distribution and prioritisation.

Vaccine hesitancy is not immutable. In the OECD Resilience of Health Systems Questionnaire 2022, 19 of 23 responding countries reported engaging with the media to combat misinformation and disinformation in the context of the pandemic. For example, the United Kingdom developed a suite of approaches to counter misinformation: a rapid respond unit to co-ordinate and support departments in tracking and devising responses; a counter-disinformation toolkit to assist public sector communication; and a training programme (OECD, 2021[17]).

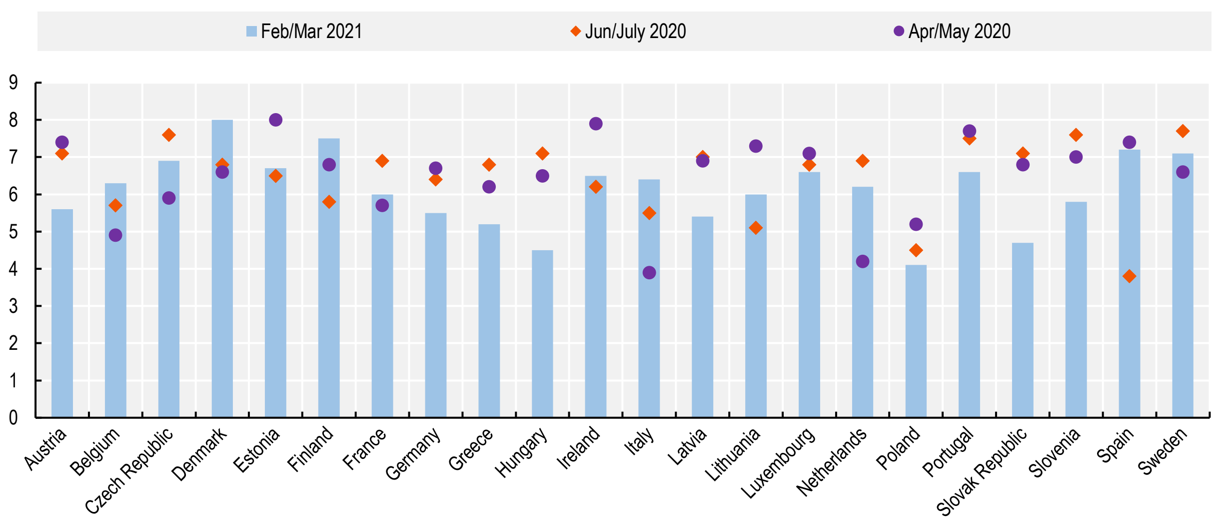
Transparency and community engagement, especially with those segments of the population most hesitant to be vaccinated, also enhanced public trust in COVID-19 vaccination. The OECD has reported examples of good practices in public communications about the pandemic and responses to it (OECD, 2021[46]). These include leveraging the use of behavioural science to increase vaccine confidence in Canada, and partnering with social media influencers in Finland and Korea to share reliable information.

In Portugal, patients were actively involved in decision making around COVID-19 vaccination campaigns through the inclusion of patient representative groups.

Communicating transparently both the risks and benefits of COVID-19 vaccination, and countering misinformation, will be important to a faster, sustained and equitable recovery from the pandemic's unfinished legacy.

Promoting trust in actors in the health system is essential, especially when widespread health interventions may be needed for societies to absorb and recover from future challenges. Concerningly, trust in the healthcare system has fallen in some countries (Figure 1.14).

Figure 1.14. Declining trust in healthcare systems, selected countries



Source: Eurofound (2022) presented in de Bienassis (2023[47]), "Advancing patient safety governance in the COVID-19 response", https://doi.org/10.1787/9b4a9484-en.

1.5.3. An exhausted workforce will make the recover stage longer

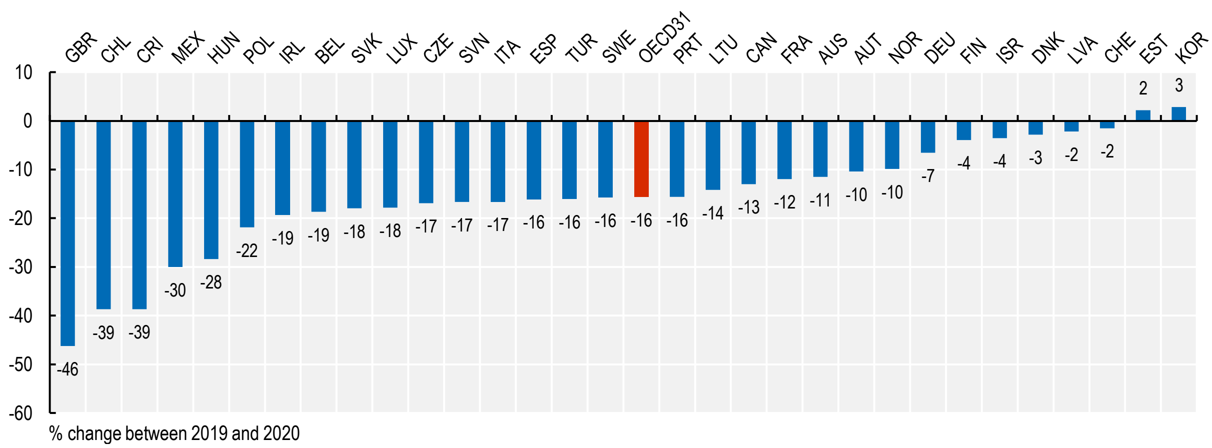
The absorb stage of the pandemic was characterised by a steep reduction in non-COVID-19 health system activity and then a rapid increase of this activity in some – but not all – countries. However, the follow-on effects from this initial reduction in non-COVID-19 activity persist. A loss of health may become permanent even with a return of healthcare activity if irreversible harm occurs or if the backlog of care is not eliminated (see chapters on waiting times and care continuity).

Across a selected set of diagnostic and surgical procedures in 31 OECD countries for which data are available there were:

- four million fewer diagnostic (magnetic resonance imaging and computerised tomography scans) procedures performed in 2020 compared with 2019
- seven million fewer elective surgical (cataract surgery, hip and knee replacement, and coronary angioplasty and bypass) procedures performed in 2020 compared with 2019.

The impact of the delayed and deferred care differed between countries, reflecting the duration and degree of disruption to health services and the speed of recovery. For example, some countries were able to maintain treatment activity for hip replacements in 2020, while others reduced activity by one-third (Figure 1.15).

Figure 1.15. Reductions in hip replacements between 2019 and 2020



Note: The OECD average is the total reduction across all OECD countries for which data are available.
Source: OECD (2022[3]), OECD Health Statistics, https://doi.org/10.1787/health-data-en.

Most countries (11 of 18) responding to the OECD Resilience of Health Systems Questionnaire 2022 reported that addressing waiting times for elective care was a high or medium-high priority. These include both countries that were hard hit by the pandemic and imposed strict confinement measures, and some other countries that were less hard hit (such as Australia and Finland). The Czech Republic, Luxembourg and the United States considered waiting times to be a low-to-medium priority issue.

A similar set of supply-side polices was introduced in most OECD countries to reduce backlogs in health care, involving additional funding, increased use of staff and resources, and the involvement of additional providers, such as private providers. Some approaches – for example, digital consultations – built on the experiences of telehealth during the absorb stage of the response to the pandemic.

Countries made efforts to improve the safety and well-being of health and long-term care workers after the pandemic began, as highlighted in section 1.4.6. The outcomes of these efforts should be reviewed, and consideration given to implementing effective programmes to promote sustained health and care worker well-being. The prevalence of mental health symptoms in the healthcare workforce is still high (Aymerich et al., 2022[35]). It represents a burden of recovery to be addressed.

Concerns remain that an exhausted health workforce could increase staff shortages. Existing shortages may result in higher numbers of resignations, exacerbating the situation. Responses to the United Kingdom's National Health Service survey (one of the largest workforce surveys) show that motivation has declined, work pressure has increased, and more staff are thinking about leaving (NHS, 2022[48]). Interrupting the potential for a vicious cycle is crucial to resilient health systems (Abbasi, 2022[49]).

1.5.4. New data challenges have emerged

Data is vital to tackle the backlog in health treatment. Adequate disaggregated data on healthcare needs, prioritisation, waiting times and healthcare delivery are required for countries to move from the absorb to the recover stage. Without such data pre-existing inequities could worsen.

Some countries have implemented approaches to co-ordinate this information. For example, in England (United Kingdom), the Clinical Prioritisation Programme has published prioritisation frameworks for surgery, diagnostics and endoscopy to help manage waiting lists, promote their accuracy and ensure that priority is based on clinical need. These frameworks outline the steps for clinicians to check a patient's condition, establish additional risk factors and understand treatment options (NHS, n.d.[50]).

New data and evidence-based insights will be needed to address the long-term implications of the pandemic, which are becoming increasingly evident. For example, information about the prevalence and consequences of long COVID is evolving. At the end of 2022, a lack of consistency in definitions of long COVID, limited national surveillance and different research approaches complicate international efforts (O'Mahoney et al., 2023[51]).The condition is defined by the WHO as a set of signs and symptoms that usually present within three months following SARS-CoV-2 infection and last for at least two months, in the absence of an alternative diagnosis (WHO, 2021[52]). Long COVID encompasses multiple adverse outcomes, with new-onset conditions including cardiovascular, thrombotic and cerebrovascular disease, type 2 diabetes, chronic fatigue syndrome, and dysautonomia. Estimates are that 10% or more of people infected with SARS-CoV-2 may have long COVID (Davis et al., 2023[53]); this would mean – on a conservative estimate – that at least 75 million individuals have long COVID based on total documented COVID-19 cases worldwide (WHO, 2023[1]). The number, however, is likely to be much higher owing to the significant number of undocumented cases.

Much as the burden of SARS-CoV-2 has been borne inequitably across the population, the risk of developing long COVID and experiencing more severe symptoms may also be distributed inequitably. For example, in a meta-analysis conducted in the United Kingdom, the odds ratio of people developing long COVID living in the most deprived area with confirmed or self-reported COVID-19 was 1.4 times as likely relative to people living in the least deprived area (OpenSAFELY Collaborative, 2022[54]).

High-quality and timely data on health, well-being and employment are key to understanding and meeting this challenge in the coming years. Future shocks, which may not take the form of another pandemic, will bring new information and data challenges. It is essential that the digital foundations of the health system (and beyond) are adaptable to generate useful information for decision making.

1.5.5. Stresses emerging from the pandemic may reduce health system performance

Increasing stresses are buffeting health systems as 2023 begins. These stresses may reduce the performance of health systems. Backlogs, delayed and deferred care (including preventive care), and an exhausted workforce are complicated by the addition of over a million new reported cases of SARS-CoV-2 a week, as at the end of 2022 (WHO, 2023[1]). The implications of long COVID are still emerging. A cost-of-living crisis complicates these stresses (Goddard, 2022[55]).

The worst-case scenario of a more deadly SARS-CoV-2 variant may not occur. Nonetheless, additional critical care surge capacity for continuing SARS-CoV-2 infections is likely to be needed. This may be especially important during winter months, when reduced physical distancing and more frequent presence in enclosed spaces with poor ventilation increases the potential for large numbers of patients infected with either influenza or SARS-CoV-2, or both. Health systems unable to generate this capacity may be at risk of failure and worse outcomes.

The morbidity impacts of long COVID are concerning - and for some people may last for years (Davis et al., 2023[53]) - but they are not known with certainty. Increasing long-term morbidity from SARS-CoV-2 infections, alongside acute infections, will increase demand for health services, reducing spare capacity in health systems and making them vulnerable.

The disruption to health services, and especially hospital care, is still reverberating. Hospitals are seeing more high acuity, in patient cases than they were prior to the COVID-19 pandemic. A lack of preventive care and disrupted care may increase the severity and prevalence of chronic diseases in the population (see the chapter on care continuity). Sicker patients, combined with workforce shortages, are reported to have resulted in increases in the average length of stay in hospitals in the United States (Kaufman Hall, 2022[56]). This situation increases demand and reduces spare capacity in the health system. If appropriate preventive and primary care cannot be scaled up, this may result in a vicious cycle where the resources required for higher-acuity patients reduce the resources for preventive and primary care.

A safe clinical environment, given SARS-CoV-2 is still present, requires additional cleaning and additional space (for physical distancing). Hospitals face more costs than before the pandemic for PPE, and other medical and safety supplies need to care for higher acuity patients (Kaufman Hall, 2021[57]). The health system will need greater resources to undertake the same level of activity. Without such resources, performance will fall, albeit improved infection control may reduce other infectious complications associated with health care.

The long-term economic implications of long COVID are uncertain but some predications are alarming (Cutler, 2022[58]). Long COVID may reduce labour participation; some estimates are that substantial numbers of individuals with long COVID are unable to return to work or to undertake their prior workload. For example, it has been estimated that more than 1 million people may be out of the United States workforce at any given time because of long COVID (Bach, 2022[59]). People out of the workforce because of long COVID disproportionately worked in service jobs, including health care and social care (Cutler, 2022[58]). Long COVID in the health workforce may result in fewer staff and a need for higher staff numbers – absent this, health system performance and efficiency will fall.

A decline in real income associated with long COVID and the cost-of-living crisis could place more pressure on health systems funded by out-of-pocket costs. For publicly funded systems, decreased labour participation and increased costs would place pressure on financing attained through taxation. Funding pressures from decreased income and taxes will reduce the sustainability of health systems.

Health system resilience requires stakeholders to deal with a different set of challenges during the recover stage than during the absorb stage of a large-scale shock. However, there are some commonalities, including: understanding the interdependencies within and beyond the health system; adequate resourcing; quality and timely data on which to make well-informed decisions; and the agility to respond effectively and as quickly as possible.

1.6. Adapt: Policies to improve health system resilience should cover the entire disruption cycle

Not being sufficiently prepared for a shock like the COVID-19 pandemic results in costly interventions when crises occur that have repercussions for years to come. With a large shock there may not be a return to normal. Shocks and the response to them leave a legacy of new challenges and impacts on resilience.

It is essential to include health system resilience as an explicit goal and to integrate the pursuit of resilience into planning. The tools to be resilient need to be given to health systems; these include not only investments but also the means to incentivise future development of key technologies, such as vaccinations and treatments (see the chapter on global public goods).

Planning health system resilience should be undertaken as a goal for societies and health systems. This needs to be operationalised within a framework, including the development of measurement tools and indicators of resilience, so that useful information can be generated to inform decision making.

The relationship between resilience and efficiency can be complicated. Some policies may improve both – for example, better use of data and elimination of low-value care improves efficiency and resilience. However, trade-offs can exist (Almeida, 2023[60]). Systems running close to capacity can improve short-term efficiency but at the expense of resilience (as with the high occupancy levels in hospitals, especially intensive care units, seen in some countries before the pandemic began). Incentives that prioritise low-cost provision of services may not make sufficient allowance for resilience (for example, supply chains incentivised by low costs and generic pharmaceuticals). The balance between resilience and efficiency should maximise societal benefit, and both should be included in health system performance frameworks and inform decision making.

While specific threats – such as pandemics – should be examined, the approach to health system resilience should be wider and cover all hazards. Multiple different shocks and threats should be considered and reviewed. For example, the OECD has issued guidance for support on climate resilience, including to encourage sector-level (such as health system-specific) approaches to identifying climate risks and ensuring that sector-specific policies and actions are climate resilient (OECD, 2021[61]). Regular review of the approaches undertaken, and testing of their effectiveness, would also be useful. Resilience testing of health systems should be considered.

Learning from the gaps and difficulties highlighted by the pandemic will be important - all countries should undertake such a process. The relationship between public health functions and the wider functions of the health system should be strengthened, based on reviews of pandemic experiences across countries.

Care should be taken to ensure that important non-health systems, such as social care and manufacturing, are regularly included in the analyses. Sufficiently large shocks necessitate a whole-of-society approach with national leadership. Reflecting the complex interdependencies and feedback loops beyond health will be required (Smaggus et al., 2021[62]). The results should be used to update governance, regulatory, investment, financing and funding decisions, including those suggested in this report.

This report recommends the promotion of six policy areas to improve health system resilience: the health of the population; workforce retention and recruitment; data collection and use; international co-operation; supply chain resilience; governance and trust. These recommendations will have the optimal impact if implemented together.

1.6.1. Promote the health of the population: vulnerable people make for vulnerable health systems

A healthier population improves health system resilience. An approach using multiple policies to increase health coverage, promote healthier lifestyles and reduce the potential for one policy failure to result in harm would be beneficial. Ensuring disease prevention through public health, reinforcing the centrality of primary care, and increasing mental health services would improve the health of the population prior to a crisis occurring. Achieving this will require additional investments in public health and primary care. Tackling the socio-economic determinants of health would improve resilience by lowering vulnerability to future shocks.

Populations with less multimorbidity may be less prone to permanent health loss associated with interrupted treatment. Increased prioritisation may be needed during times of crisis to ensure that services are allocated where they will be most effective. In this respect, better data would improve the evidence base for these allocations.

Many changes were made after the COVID-19 pandemic began to ensure continuity in services. The strengths and weaknesses of these changes need to be assessed for their contribution to efficiency, equity and resilience. Without assessment, weakness and adverse unintended consequences could be perpetuated.

At the local level, promoting the health of the population requires models of integrated care, focused on improving patient health. These models can be useful during times of crisis. Generating the flexibility to respond to evolving requirements at a local level would improve the resilience of health systems across all stages of the disruption cycle. Generating this flexibility requires many changes: physical infrastructure for different models of care (e.g. telehealth); data systems that deliver useful information and allow the data to “follow the patient”; an adaptable workforce; and incentives and governance to support co-ordination, sustainability and care integration.

Residents of LTC facilities were particularly vulnerable to the COVID-19 pandemic. This vulnerability will also be evident in response to other shocks, such as climate change. While many measures are being taken to improve the performance of the LTC sector, more needs to be done. Ensuring LTC preparedness for health emergencies requires regular, granular assessments of preparedness. Solutions need to be found for safe visits and to safeguard continuity of care. Transparent communication plans with families of LTC residents should be part of the solution. Co-ordination with primary and secondary care remain essential. Adequate staffing is important, and additional workers are required in the LTC sector.

Across the health system, resilience requires information and resources, accompanied by an appropriate governance, data and regulatory environment. Co-operation and co-ordination are required to ensure the most effective use of resources during the absorb and recover stages. The COVID-19 pandemic demonstrated that a health system must be able to react dynamically to a multitude of different challenges. Adaptability of roles and movement of resources to where they could best be used were crucial in the pandemic response. The move to telehealth, alongside changes in regulations and funding, was one example. Increasing universal health coverage and ensuring low or no user charges was important in delivering care, and giving options for the model of care delivery, in response to the pandemic. Better-performing health systems were those in which a greater portion of the population was covered by health insurance (see the chapter on COVID-19 outcomes).

Investing in population health and prevention not only improves health system resilience but is also a cost-effective way of improving health (OECD, 2019[63]).

1.6.2. Promote workforce retention and recruitment: people are the key to making systems resilient

Staff, supplies and space were limited for the critical care surge response (see chapters on critical care, workforce and securing supply chains). Existing health workforce shortages in many countries suggest that increasing efforts from these workers is not a sustainable solution except in the very short-term. Greater investments in the number of healthcare workers and in workforce flexibility are required.

Many OECD countries have begun implementing measures to increase and sustain the supply of healthcare workers. These measures include increasing training and recruitment of new staff, improving retention and redesigning service delivery. Responses to the OECD Resilience of Health Systems Questionnaire 2022 demonstrated that most countries (16 of 20) increased student intake and increased incentives to encourage more doctors to choose general practice. Most countries (12 of 20) plan to expand roles to relieve pressure on medical practitioners, and some (8 of 20) plan to introduce financial incentives to improve the geographical distribution of doctors. One-quarter of respondents reported having targeted immigration policies to attract foreign health workers. These policy changes will be beneficial in the long-term, but health systems will remain vulnerable until trainees join the workforce.

Governance, regulations, financing and training to promote an effective societal response to a large shock are necessary. This may involve anticipating how to bolster the health workforce to absorb and recover from a shock – for example, by creating a medical reserve. It may also entail the flexibility to rely upon other resources and infrastructure, such as hotels, stadiums and community spaces, to deliver health care (see the chapter on critical care surge).

The pandemic demonstrated the value of flexibility in the workforce, the ability to engage in new models of care and task shifting. One example was the use of a wide variety of healthcare professionals in vaccination. It also demonstrated that some skills may be in short supply for specific shocks – especially nursing skills in critical care and intensive care – and that increased training may need to be activated in times of crisis. Specific consideration may need to be given to skills and staffing for public health, ensuring that capacities such as contact tracing, data analysis and epidemiological investigation can be surged when required.

Improving working conditions (including remuneration), promoting well-being, increasing staff numbers and increased workforce planning will also support future resilience. OECD estimates suggest that over three million additional workers may be required in health and social care across OECD countries (see the chapter on investing in resilience).

LTC workers also need to be included. Rapid recruitment and retention of staff in the LTC sector is challenging without addressing structural issues linked to pay adequacy and job quality. Countries need to ensure sustainable and adequate funding for the sector, and a stronger focus on quality measurement and improvement. Providing training to the LTC workforce and investigating ways to deploy experts on a regular basis are likely to reduce preventable safety failures. This also requires access to information and resources, in the form of guidelines, guidance and procedures on infection prevention, to ensure that all facilities establish and follow safe routines for care.

The workforce needs protection from harm – both physical and mental – to counter future threats effectively. Resilient health systems not only invest in pandemic-related planning and training of health workers but also ensure worker protection and economic security.

Decisions about the workforce should be supported by data and evidence. Data collections started after the pandemic began should be reviewed, updated and – if fit for purpose – continued. Workforce planning should be undertaken, and should include the links between a resilient health system and the workforce.

1.6.3. Promote data collection and use: without the right data, decision makers are flying blind

Increased investment in data infrastructure is essential to improve the resilience of health systems. This needs to be accompanied by greater data linkages both within and beyond the health system. Information systems and models of care need to reduce fragmentation around patients and decision making. The benefits of these changes will be seen both during crises and between them. Stronger digital foundations will benefit the resilience, efficiency and sustainability of health systems.

The acceleration in digitalisation seen in response to the pandemic should continue, including the movement of OECD countries to more timely data collection. Care should be taken to ensure that vulnerable groups are not marginalised and are thus included in data gathering. Developing and sustaining some of these data collections, after review, may be useful to improve resilience. Extra investment would make data infrastructure more mature. This investment needs to occur not only in physical assets and software but also in the health workforce and others whose decisions are driven by data.

Availability of high-quality linked data will also help to mitigate future shocks and their impacts on the health system. Data integration can facilitate better disease management through contact tracing, and can support research into potential treatments and risk factors. Where cross-cutting high-quality data are available, and governance frameworks for sharing are in place, health systems can be more resilient and have more information available to prevent long-term consequences. This is true of the shock that was the COVID-19 pandemic, and it will be true for other shocks. For example, high-quality linked data will aid responses to climate events and other disasters. Accordingly, digital infrastructure may be required to support additional linkages to non-health data, such as meteorological information.

Governance, legal and regulatory changes should support adaptation to a digital health future without loss of protections for the public. Governments could establish and implement national health data governance frameworks to encourage the availability and use of personal health data to serve the health-related public interest, while promoting the protection of privacy, personal health data and data security.

The pandemic brought about a rapid change in the digital landscape. It is important to understand the political, technological, legal, regulatory and financial implications that result from the speed of change. Increasing digitalisation of the health system has advantages, but it may also increase the risks from some sources – malicious or otherwise. Increasing vulnerability to cyber threats must be mitigated (OECD, 2020[64]). Reliance on cloud computing and servers can result in a different set of risks; for example, heat stress resulted in cancellation of operations associated with the failure of servers during 2022 (Building Better Healthcare, 2022[65]).

Another risk is that the benefits of digitalisation may not be evenly spread across the population. Digitalisation may continue to favour advantaged groups (OECD, 2019[66]). New tools and digital solutions should be tested with a range of end users, including those living with disabilities.

In the future, health system resilience would benefit from high-quality timely data, facilitating a speedier and more agile response to shocks. Updating governance frameworks, ensuring interoperability and enhancing the use of existing data are important to improve resilience.

1.6.4. Promote international co-operation: we will do better together than alone

Many complex global health problems require international co-operation to solve. The COVID-19 pandemic demonstrated this, but it is not the only challenge – for example, climate change and antimicrobial resistance loom over the horizon. Without credible mechanisms to promote and fund international co-operation, societies and health systems will be more vulnerable to a broad array of threats.

The lack of an effective global surveillance system to identify threats rapidly and counter them makes everyone vulnerable. The speed of decision making and preparations at an international level for the pandemic were found lacking (The Independent Panel for Pandemic Preparedness, 2021[13]). A stronger international surveillance system with continuous information gathering, risk assessment and rapid co-ordination would have facilitated a quicker global response. Surveillance benefits the country performing it and other countries, conferring the advantage of lower infection risk and more preparation time.

International efforts are under way to foster collaboration and ensure long-term funding for pandemics. WHO Member States are negotiating an international instrument on pandemic prevention, preparedness and response (WHO, 2022[67]). The July 2022 draft outlined many of the issues to achieve better global co-operation and stronger systems, including sustainable and predictable financing of systems and global public goods (WHO, 2022[68]). The Pandemic Fund – a collaborative fund launched in 2022 (The World Bank, n.d.[69]) – aims to finance critical infrastructure over the long-term, with a focus on low- and middle-income countries. Ideally, the goals of these initiatives would have been achieved prior to the COVID-19 pandemic, not afterwards.

Vaccination benefits the individual and society, by reducing transmission, morbidity and death, and freeing-up health resources for other uses. The unparalleled success and speed of COVID-19 vaccine development saved millions of lives. In contrast to earlier attempts to develop coronavirus vaccines, public sector funding for research, development and manufacturing capacity was enormous for COVID-19 vaccines.

However, it is not sufficient that health technologies that are essential during times of crisis are developed and manufactured: they must be accessible and deployable. If a vaccine is not widely and equitably deployed, its value to health system resilience is limited. This requires a manufacturing base to produce these health technologies in sufficient volumes at an appropriate pace, adequate infrastructure and resilient supply chains to distribute and deliver them, and a workforce with the capacity to utilise them. The distribution of COVID-19 vaccines has been inequitable and is likely to have substantially increased the worldwide mortality from COVID-19 (Moore et al., 2022[70]). Better policies are required to foster co-operation and to develop and distribute essential health technologies more equitably.

There are many reasons for failure to develop and distribute essential health technologies (see the chapter on global public goods). Some of these relate to the structure of markets and their impact on investment. When return on investment does not adequately reflect a technology's value it will not be produced in the required volumes. Intellectual property protection is the most common mechanism for encouraging investment but may not always create the appropriate conditions. For example, if a technology is not needed until a crisis, there will be a lag before production meets the demand triggered by it. This was the case globally with COVID-19 vaccines during the first two years (2020-2021) of the pandemic (OECD, 2021[42]). In these circumstances, delinking research, manufacturing and supply from sales volumes is critical. Alternative mechanisms for financing and governance are required.

Problems can arise from poor co-ordination. Private, public and philanthropic funders would be more effective if they can co-ordinate their efforts. In turn, the research, development, manufacturing and distribution of essential health technologies also need co-ordination. Mechanisms exist to achieve this - for example blended finance, data sharing hubs, and collaborative platforms such as COVAX.

There is no single best approach to solving the development, manufacturing and distribution challenges. Multiple approaches were deployed in response to the pandemic. Various forms of push funding (e.g. direct investment in the development of vaccine candidates) and pull incentives were used during 2020-2022. Mechanisms for sharing intellectual property, such as the WHO-led COVID-19 Technology Access Pool, were launched. Many OECD countries used advance purchase contracts - commitments to buy, which are a form of pull incentive guaranteeing a return. Some mechanisms - for example, advance purchase contracts for additional COVID-19 vaccines - resulted in greater access for high-income countries (OECD, 2021[42]).

As countries look ahead, the strengths and weaknesses of existing and novel approaches to meeting the challenges described above need to be considered and reassessed. Public support will be required in many policy areas: financing; regulation; manufacturing; and even the direct provision of services. Sharing intellectual property and know-how, combined with decentralised manufacturing, could increase supply. Most importantly, public funding and support need to be in concert with efforts to ensure more equitable distribution of vaccines and treatments (including medical devices), especially during times of crisis.

1.6.5. Promote supply chain resilience: reliably getting products to where they are needed is vital

Improving the resilience of supply chains for essential medicines and medical devices is crucial for effective crisis responses, as well as for health systems between times of disruption.

In the context of the pandemic, essential medicines included COVID-19 vaccines, treatments such as dexamethasone and critical care medications, and essential devices included ventilators and PPE. Widespread shortages existed early in the pandemic. Open international trade underpinned a large increase in the availability of vaccines and essential medical devices later in the pandemic, but barriers to trade hampered distribution.

Improving supply chain resilience can involve different strategies, including transparency, diversification, capacity and co-ordination (see the chapter on securing supply chains). The characteristics of the disruption and the medical device or medicine may alter the relative usefulness of each strategy, and thus their overall impact on health system resilience.

The COVID-19 pandemic, as an extreme disruption, demonstrated some of the benefits and risks of each strategy. It also demonstrated that preparing for events that may affect the world simultaneously is important (Fabra, Motta and Peitz, 2020[71]). In response to a sufficiently large crisis, these strategies may not be enough to prevent a shortage of key medical products. In such a situation, a medicine or medical device should be used to maximum benefit, in accordance with crisis standards of care.

Difficulties in identifying the suppliers and countries involved in supply chains can undermine the assessment and mitigation of risks by governments. Greater transparency and improved reporting would promote resilience. Real-time information and co-operation between countries and manufacturers may help with anticipating and addressing issues earlier.

Diversification of supply chains aids resilience. Domestic production has been suggested as a solution. While reshoring may have some advantages, it is risky. First, unless the entire supply chain is reshored, it remains vulnerable to other links in the chain. Second, reshoring may compound geographical risks – for example, an earthquake may both increase demand and reduce supply. Third, reshoring requires sufficient demand for local production. Finally, it may require substantial investment from the country or region involved and necessitate price premiums on the products over time. For example, increases in productive capacity after the N1H1 influenza pandemic were not sustained because of reduced demand (Chen et al., 2021[72]).

Problems with capacity may be mitigated by several different mechanisms:

- stockpiles and inventories, which are useful when a rapid increase in demand or fall in capacity occurs that cannot be accommodated in the short term – for example, from an earthquake
- capacity buffering (the purchase of additional capacity for essential medicines and medical devices), although this requires some lead-time and may depend on the availability of inputs
- capability, which means expanding and altering other manufacturing processes for a medical device, such as non-traditional manufacturers producing ventilators after the pandemic began.

Governments centralised purchasing and management of essential medicines and medical devices during the first year of the pandemic. Given that supply chains tend to be international, co-ordination is essential to align stockpiling strategies across countries in response to future challenges. Widespread anticipation of shortages can prompt increased purchasing to avoid shortfalls. Decentralised and fragmented actions at an institutional or sub-national level may worsen this situation. Supra-national stockpiling strategies, where feasible, are likely to be more efficient than duplicating national stocks in several countries.

Supply chains for medical products are complex and are subject to a wide variety of risks. One reason for the magnitude of the supply chain disruptions at the onset of the pandemic is that security of supply was sacrificed for improvements in efficiency, partly because the incentives favoured lower costs (National Academies of Science Engineering and Medicine, 2022[73]). Policies that incentivise both supply chain resilience and efficiency would be beneficial to health systems – and to the health of populations.

1.6.6. Promote governance and trust: without trust, whole-of-society responses are less effective

Large-scale shocks can have a critical impact on people’s trust in government. At the same time, responding to large shocks like the COVID-19 pandemic involves everyone. This means that the health system and health system governance must interact with the wider political, economic and social context.

Governance should not be siloed, and linkages need to be developed prior to a disruption occurring. Co-operation requires commitment from leadership and a fit-for-purpose governance structure with clear mandates. For example, the quality of co-ordination among levels of government was found to be a key determinant in the effectiveness of COVID-19 pandemic responses (OECD, 2022[74]). This finding may be generalisable beyond the context of the pandemic, given that sub-national entities are typically responsible for health care, social care and transportation services, which are all critical to effective crisis management.

Institutional decision making needs to be accompanied by data about performance and outcomes. For example, healthcare prioritisation and the introduction of crisis standards of care without knowing whether they have improved or worsened the response will lead to wasted resources and potential harm to the population. Furthermore, few national statistical offices or education ministries undertook special data collections related to the pandemic and its effects on education, including school closures (OECD, 2022[74]). Evaluations based on high-quality data help policy makers to understand what is working (or could work), what is not, and for whom. They also provide citizens and stakeholders with information on whether strategies using public funds have achieved their intended objectives and are producing the expected results.

Strategies that are developed and enacted will benefit from understanding the potential trade-offs and risks from multiple perspectives. Stakeholder involvement generates legitimacy which, in turn, promotes trust. This is especially true when crisis standards of care need to be introduced. The severe shortages of PPE early in the pandemic led to the prioritisation of some health care activities over others. It is important that mechanisms for stakeholder involvement in crisis standard of care are developed before they are required, as they can be difficult to design and implement during a crisis. These mechanisms need to be based on appropriate ethical, legal and governance considerations.

Trust has been demonstrated to be an important pre-condition for whole-of-society responses. Trust requires transparency, not only through frequent and targeted crisis communication but also by engaging stakeholders and the public in risk-related decision making and scrutiny. The pandemic brought structural and social issues to light, including the erosion of confidence in government and expert advice, which was compounded by misinformation and disinformation. The OECD Draft Principles of Good Practice for Public Communication Responses to Help Counter Mis- and Disinformation stress the importance of transparency and honesty in communication (OECD, 2022[75]). Efforts to combat misinformation and disinformation have increased, and should continue, informed by evidence generated about their effectiveness. Resilience will decrease if trust in institutions and governments falls.

1.7. Resilient health systems provide high-quality care before, through, and after crises

Integrating the above policy recommendations into health systems requires incentives to be aligned with improved resilience while minimising the opportunity cost – that is, incentives should be efficient in the pursuit of resilience. A system needs to be financially viable to be sustainable. Thus, increases in resilience that are not cost-saving in the short term will need extra funding – for example, increased workforce. Predictable funding may be required for some functions, such as maintaining surveillance capacity or critical care surge capacity, even if these functions do not need to be called upon until a shock occurs.

Across OECD countries, an increased annual investment of 1.4% of GDP will be needed for the recommended policy areas (see the chapter on investing in health system resilience). At least half of this increase would require investment in promoting workforce retention and recruitment (0.7%), representing an increase of over 3 million health and long-term care workers across the OECD. Further development of infrastructure to promote data collection and use in the health system represents another 0.3-0.4% of GDP. Additional investments in promoting population health are also included (0.3%).

These proposed investments are not limited to the health system – they also include the long-term care sector. The figures are calculated relative to 2019; they therefore do not include investments made by countries since 2019 and after the pandemic began. They represent the annual increase in healthcare expenditure as a percentage of GDP anticipated in the medium term. The ranges represent the differences in increased expenditure between OECD countries: differences in current expenditure in 2019 between countries result in different estimates for the increases in modelled expenditure for the future.

Implementing the policy recommendations in this report will achieve a resilient health system through:

- reduced demand for health services during crises
- early identification of shocks, followed by effective co-operation to respond to them
- improved decision making, based on high-quality and timely data, and relevant information
- flexible use of resources
- good governance within and beyond the health system
- learning and adapting from past experiences.

This report is published in 2023 against the backdrop of a darkening economic outlook and government budgets tightening. This requires governments to make tough policy choices. Nonetheless, a window of opportunity exists for governments to evaluate and learn from recent experiences and shared challenges. Introducing measures to improve health system resilience, such as those recommended in this report, will not only speed up recovery from the COVID-19 pandemic but also allow societies to respond to future shocks quickly and efficiently. Investing in health system resilience will benefit societies by ensuring that the building blocks are there to face future challenges. While these investments will require resources, without them health systems and societies will be vulnerable, and large, costly and less effective interventions will be the result.

The recommendations in this report will contribute to societies, economies and health systems being **ready for the next crisis**.

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2 Investigating resilience in other sectors

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Although relatively new to health systems, the resilience methodology has decades of application in other fields. This chapter outlines the common features of resilience across various sectors. It discusses how resilience has been applied in infrastructure, finance, the environment, cybersecurity, disaster response, and medicine and public health. Common features and lessons for health systems, and common methods of testing for resilience are identified. Improving health system resilience should use the lessons learnt from its application in other sectors, with a focus on systems adapting to shocks and an emphasis on a multi-systems view.

Key findings

Resilience has decades of application in disciplines beyond health. All resilience analysis requires stakeholders to adopt a perspective that recognises the connections between systems – interdependency – and the need to go beyond risk to absorb, recover from and adapt to disruption.

Resilience is a rapidly developing field of endeavour. Many different approaches are used to analyse and improve resilience of systems, from scorecards and tabletop exercises to simulations using artificial intelligence. More advanced approaches require both more data and more sophisticated approaches to modelling the systems of interest.

Multiple sub-systems must work together for any system to be resilient. A generic conceptualisation of the sub-systems includes, but is not necessarily limited to, the following domains:

- physical – equipment and facilities
- information – data
- cognitive – understanding and decision making
- social – interactions between actors.

Resilience is a function of system performance. The capacity for systems to recover from and adapt to disruption cannot be engineered in silos – it should be undertaken holistically. Longer time horizons and the complex, adaptive nature of the environment and population that the system serves should be considered. Improving one domain without the others may not improve resilience. For example, over-reliance on physical infrastructure (such as intensive care unit beds) without considering social behaviour (for example, adherence to containment and mitigation policies) will not produce resilience in response to a pandemic. Resilient systems should foster risk prevention and mitigation to specific and well-characterised threats, but must also possess a "risk-agnostic" or "all-hazards" capability to manoeuvre in the face of disruption.

In the infrastructure sector, disruptions that place transportation networks or energy facilities offline cannot be effectively engineered against. A focus on maximum efficiency can leave systems vulnerable to disruption. This has meant that resilience efforts focus not only on mitigating risk and preparing for shocks, but on recovering from and adapting to them.

In the finance sector, the global financial crisis (2007-08) was the impetus for resilience thinking and implementation. Financial systems have operationalised resilience by trying to prepare for and absorb shocks through stress testing. The purpose of these tests is to identify areas of financial systems that should be bolstered. The results of these tests are published and can be brought into the public domain.

In the environmental sector, systems still require resilience, although they are formed rather than designed. For example, the Environmental Protection Agency of the United States has explored qualitative approaches to evaluating resilience. Resilience to the impacts of climate change is also a growing field.

Further, experiences in cybersecurity and digital systems show the potential for feedback loops and interdependencies between systems. For example, cyber attacks that disrupt the provision of essential goods and services – such as fuel – can result in hoarding behaviour, further exacerbating shortages.

Experiences in the health sector, including outbreaks of the Ebola virus, also demonstrate the importance of considering resilience at different levels: the individual, the local community, institutions and the whole system. These are linked with each other and the socio-economic determinants of health.

The key lesson learnt from analysing other sectors is that health systems should use the basic principles of resilience: preparing for, absorbing, recovering from and adapting to adverse events. For health systems, which are frequently confronted by challenging events, developing the capacity to recover from and adapt to emergent conditions is necessary to prevent collapse and allow health care to continue.

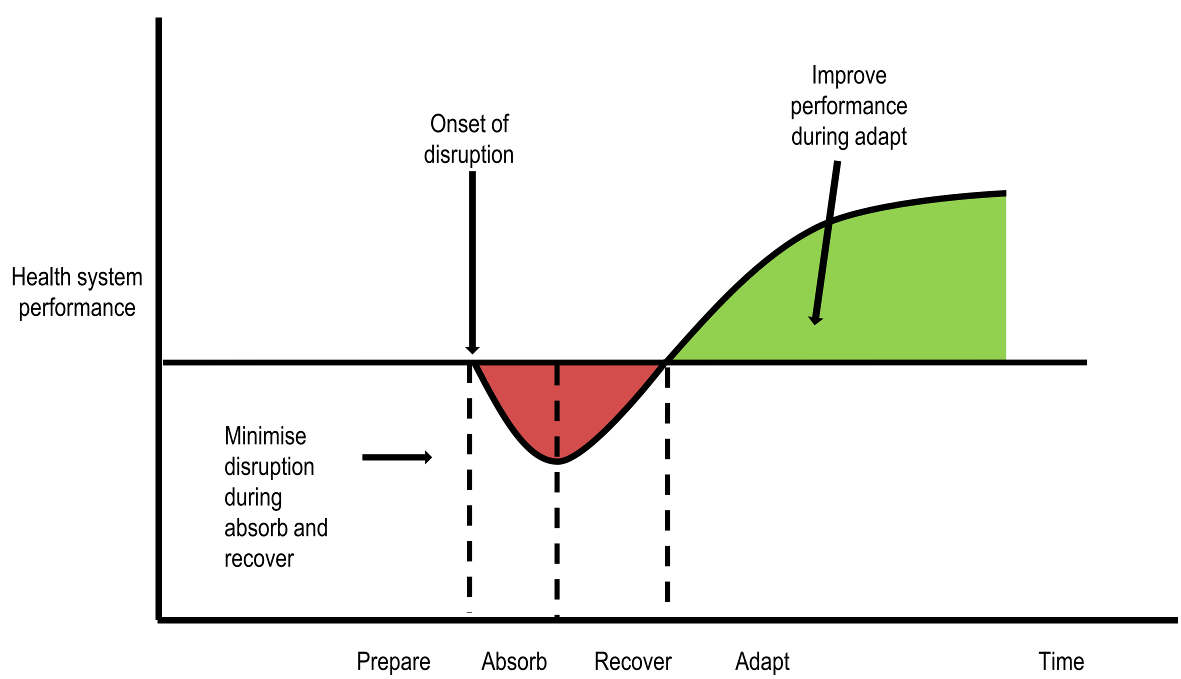
The question that follows – which the remainder of this report explores – is "What components of the health system should be improved to strengthen health system resilience to be ready for the next crisis?"

2.1. Introducing resilience

Resilience has decades of application in a range of fields, including psychology, military operations, and civil and environmental engineering. Synonyms commonly used for resilience include "elasticity" and "toughness". Resilience or resilient behaviour in systems is focused on these ideas, but more modern applications have analysed how systems rebound from disruption. The many fields that apply resilience have derived various methods and tools by which resilience is analysed and implemented.

Resilience as a philosophy and methodological practice underscores absorption of and recovery from a disruption. From a philosophical lens, this mind-set is grounded in maintaining system survival while accepting risks will inevitably materialise. From a methodological lens, practitioners of resilience seek to optimise available resources to safeguard their systems from a host of possible and even unknown threats, while acknowledging threats are inevitable. This can be contrasted with the more traditional approach of risk management and assessment, which focuses on systemic threats, employing risk science on a per-threat basis to quantify how individual threats can exploit a system's vulnerabilities.

Figure 2.1. The disruption cycle: the four stages of a response over time



Sources: Adapted from OECD (2019[1]), "Resilience-based Strategies and Policies to Address Systemic Risks", https://www.oecd.org/naec/averting-systemic-collapse/SG-NAEC(2019)5_Resilience_strategies.pdf, and National Research Council (2012[2]), "Disaster resilience: A national imperative", https://doi.org/10.17226/13457.

Ultimately, applications of resilience are defined by two components: time and space. Considering time, a system's resilience is not a singular, temporal phenomenon; its application is the process of understanding how a system absorbs and overcomes disruption. Considering space, analysts of resilience must determine the interconnections in systems once disruption occurs – keeping in mind that those connections may be either easily identifiable or hidden.

Resilience has been adopted by governments and international actors – such as the OECD, the Group of Twenty (G20), the International Risk Government Council – as a term to address various risks that could cause cascading, negative effects through systems that are interdependent over time and scale. The OECD adopted resilience as an international strategy after the financial crisis in 2007-08, and it has been adopted increasingly to mitigate and address disruption. The G20 published a Note on Resilience Principles in G20 Economies in 2017, which detailed advice to "strengthen macroeconomic foundations and policy frameworks to reap the benefits of openness to trade and international capital flows" (Nienaber, 2017[3]). International actors, including the OECD, have promoted resilience in addition to conventional use of risk assessment as a method to get systems ready to recover and overcome disruptive shocks efficiently, providing a softer landing for the entire system and its individual units (Linkov, Trump and Fox-Lent, 2016[4]). Resilience methodology has proved useful for increasingly intricate and interdependent systems through identifying the vulnerabilities that disruptors present as well as to strengthen system-wide capability despite the magnitude and likelihood of shocks.

Alberts and Hayes (2003[5]) characterise four network-centric operation domains essential for system flexibility, which they define as "the ability to successfully effect, cope with, and/or exploit changes in circumstances". This process of "resilience thinking" makes its users consider the vast array of decisions that influence a system's performance. Domains are affected in different ways, and one domain's success in defence against disruption does not guarantee success in others. Additionally, resilience is at its maximum strength for a system when all its domains consider a resilience approach. These network-centric operation domains are as follows (Hayes, 2004[6]; Alberts, 2007[7]):

- physical: sensors, facilities, equipment, system states and capabilities
- information: creation, manipulation and storage of data
- cognitive: understanding, mental models, preconceptions, biases and values
- social: interaction, collaboration and self-synchronisation between individuals and entities.

The domains can be applicable to any complex system, but are targeted toward resilience of systems (Roege et al., 2014[8]; Collier and Linkov, 2014[9]).

The physical domain is typically the most obviously affected, as this is where the disruption meets the physical environment. This includes infrastructure – ranging from transportation systems (highways, streets, railways, airports, etc.) to cyber networks and energy infrastructure that delivers goods and services to populations (DiMase et al., 2015[10]). These areas of impact are typically those most visibly disrupted, but other domains can also be affected because of disruption to the physical sector. Infrastructure threats include environmental disruption (i.e. disasters and natural hazards) and anthropological disruption (i.e. socio-political factors). The physical domain's objective for resilient behaviour is to restore infrastructural systems to full integrity, post disruption.

The information domain houses data and knowledge. It also incorporates how data are changed and shared. Examples include public or private databases, which have increasingly become targets for attack (Zhao and Zhao, 2010[11]; Osawa, 2011[12]). Furthermore, information domain risks have increasingly attacks on online communications. These attacks range in impact from individual humiliation to state-wide security risks (Berghel, 2015[13]; Petrie and Roth, 2015[14]). Such attacks are growing and inevitable in the Information Age (Kaur, Sharma and Singh, 2015[15]), which necessitates protection against these risks and bolstering of the information domain for public and private companies (Lino, 2014[16]). This domain's objectives for resilient behaviour are to plan and prepare individual and system assets for any range of attacks, while ensuring that the system can react quickly. Risk preparation, absorption, recovery, and adaptation in the information domain entails unique tools and datapoints to monitor, and are particularly critical for governments and businesses (Björck et al., 2015[17]; Collier et al., 2014[18]; Linkov et al., 2013[19]).

The cognitive domain comprises the beliefs, perceptions, levels of awareness and values that inform individual and system decision-making (Eisenberg et al., 2014[20]). Parallel to the social domain, the cognitive domain is regarded as the “locus of meaning, where people make sense of the data accessed from the information domain” (Fox-Lent, Bates and Linkov, 2015[21]). These factors can be overlooked or even dismissed as a result of common reliance on physical systems to facilitate public response to disruption, yet the tenets of the cognitive domain are invaluable to how a system’s resilient operations are undertaken (Wood et al., 2012[22]). Without policy recommendations that factor in the beliefs and perceptions of individuals and the system, even robust resilience plans may fail. This is particularly important when a disconnect exists between policy makers and the public – for example, with international infrastructure development projects geared toward health-based interventions. In these cases, sensible policy may refute common opinion or the belief of local people, causing discord in the system’s resilience.

The social domain incorporates the interactions both between and within the entities involved in the system. Careful attention must be paid in the social domain to building community resilience. As social aspects of societies can affect physical health (Ebi and Semenza, 2008[23]), communities with strong social cohesion can recover better from disruption, such as from a pandemic. Both the social and information domains require trust in information sources. If the community does not trust the provider of information, a delay can occur until the content of the information is relayed and considered trustworthy (Longstaff, 2005[24]). This has a notable impact on resilience plans: if social actors do not implement a resilience plan for any reason, the resilience of an entire system can diminish (see the chapter on containment and mitigation).

This chapter discusses how resilience is characterised in other sectors to identify instances of resonance and dissonance for health systems. By taking the lessons learnt from applying resilience in other sectors, health systems have the potential to be at the forefront of resilience by learning how to prepare for, absorb, recover from and adapt to disruptions.

2.2. Infrastructure

Resilient infrastructure systems are a target of the United Nations Sustainable Development Goals and Sendai Framework (UNDRR, 2015[25]). While this aim is subjective, the vision of the United Nations remains clear: settle the disparity between developing and developed countries’ infrastructure systems. The picture of what resilience entails for infrastructure systems, however, remains unidentified, since infrastructure is a broad “umbrella” term encompassing vastly different services; and the connections between infrastructure systems (and thus their failures) are noticeable, but difficult to quantify or predict.

Infrastructure systems are diverse and numerous; thus, the discussion around characterising infrastructure resilience is similar. From power generation, transportation and water to telecommunications and beyond, resilience in infrastructure systems typically refers to the infrastructure’s ability to “bounce back” from any disruption (Bocchini et al., 2014[26]; Labaka, Hernantes and Sarriegi, 2016[27]; Linkov et al., 2014[28]; Panteli et al., 2017[29]; Vugrin et al., 2010[30]). While the need to prevent and absorb disruption to infrastructure is discussed (Kumar et al., 2021[31]), the inevitability of disruption that places infrastructure systems offline warrants discussion of how to improve resilience for infrastructure (Francis and Bekera, 2014[32]). For example, as the COVID-19 pandemic surged and air travel decreased due to travel restrictions, the first response of airlines was to maintain profitability and efficiency by reducing staffing (Sun, Wandelt and Zhang, 2022[33]). Such decisions highlighted the interdependencies within supply chains, which challenged airlines to crafter newer, improved models for operation (Reeves and Varadarajan, 2020[34]). As seen through real-time data, the pandemic and its consequences for cancelled flights revealed and compounded the brittleness of an overburdened transportation system.

To begin measuring resilience for infrastructure, existing tools can be categorised based on the Linkov et al. (2018[35]) tiered methodology for resilience assessment.

- Tier 1 assessments are coarser in scope yet more readily available, operating at the qualitative level – including scorecards and tabletop exercises.
- Tier 2 assessments uphold elements of decision making and analysis to make semi-quantitative analyses, such as resilience matrices and stress testing.
- Tier 3 assessments provide granular assessments of system resilience at the link-and-node level of systems through artificial intelligence (AI) and simulations.

Scorecards have been used to provide a snapshot in time of any nation's infrastructure, such as the Report Card for America's Infrastructure (ASCE, n.d.[36]) or the UN's Disaster Resilience Scorecard (UNDRR, 2017[37]). While these provide valuable exercises to begin the discussion of resilience in infrastructure, the outcomes can be somewhat hazy, since generalisation is a requirement for evaluation. Furthermore, scorecards analyse infrastructure using a piecemeal approach. Connections between infrastructure systems are typically not explored, although these interconnections can result in cascading failures (for example, the supply chain challenges that occurred during the first year of the COVID-19 pandemic, see the chapter on securing supply chains). Since these tools are, however, highly visible and accessible to the public, they act as a vehicle to direct attention to the need for resilience. Scorecards are generally approachable for stakeholders with limited means or within small communities to foster a full resilience study (Ludin and Arbon, 2017[38]; Sachinthana, Chandana and Shehara, 2022[39]).

Tabletop exercises are another form of subjective, qualitative exercise to evaluate the resilience of infrastructure systems. The US Cybersecurity and Infrastructure Security Agency (CISA) provides one example of tabletop exercises, including a host of "what-if" scenarios that decision makers can discuss to form conclusions about where gaps lie in their infrastructure systems (CISA, n.d.[40]). The scenarios present a range of disruptions that might happen, such as earthquakes, wildfires, tsunamis, hurricanes and socio-political threats. Connections between infrastructure systems become apparent as the tabletop exercises guide decision makers with questions about how these systems may be co-dependent or mutually affected.

Resilience matrices have been developed by Fox-Lent, Bates and Linkov (2015[21]) to represent resilience temporally and spatially. From a temporal perspective, the matrices utilise the elements of resilience to consider a system before and after disruption, using preparation, absorption, recovery and adaptation as temporal indicators (the disruption cycle). Spatially, the system is broken down across domains, namely the infrastructure's physical characteristics, cyber components, social linkages and cognitive requirements. At least 16 unique metrics are created for the 4×4 matrix to operate resilience as a function of space and time. This enables decision makers and policy makers to identify where the system is most likely to fail.

Discussion of stress testing is also prevalent in the literature on critical infrastructure, such as with the nuclear industry. The term "critical infrastructure"[1] is a broad one that generally covers any transportation, utility or robust engineered system (Chopra and Khanna, 2015[41]). Evaluation of such a wide range of physical infrastructure and modes of engineering has led to many applications of stress testing for critical infrastructure. For example, unique modes of stress testing exist for water, transportation, telecommunications and energy (Environmental Protection Agency (EPA), 2015[42]; Jovanovic and Auerkari, 2016[43]; Pitilakis et al., 2016[44]; Samoylenko, Panychev and Panychev, 2017[45]). Creation of a combined approach to evaluate all sectors has been increasingly considered over the past decade (Comes, Bertsch and French, 2013[46]; Galbusera et al., 2018[47]; Tsionis et al., 2016[48]).

Tier 3 analyses use robust data analysis to provide resilience considerations for a system with optimal fidelity. These tend, however, to be costly (even prohibitively so for some end-users) and are intended for audiences that have the capability to understand advanced mathematics, AI and modelling through simulations. For example, Galbusera et al. (2018[47]) discuss how network science at the link-and-node level can be used to improve comprehension of heavy infrastructure systems. Through a deep understanding of this type of science, decision makers can optimise individual components of a system.

2.2.1. Everyday road transportation efficiency and resilience

Roadway design targets efficient movement of vehicles through a road transportation network (Samuelsson and Tilanus, 1997[49]; Kuhn, 2010[50]; Hoogendoorn, Van Arem and Hoogendoorn, 2014[51]; Sami, Pascal and Younes, 2013[52]). The designation "efficient" from this standpoint is conferred as a level of service in civil engineering, which is a subjective evaluation to identify congestion in the road network. Often, this type of efficiency sets the goal for roadway officials to maintain a given level of service while using only a certain amount of resources (Chang and Nojima, 2001[53]; D'Este, Zito and Taylor, 1999[54]; Yan et al., 2006[55]; Yamashita, Izumi and Kurumatani, 2004[56]). As one metric, the Texas A&M Transportation Institute uses and assesses the yearly delay spent in traffic per driver when it reports levels of traffic congestion in urban areas (Schrank et al., 2015[57]). Similarly, other studies measure driver delay but at an individual level (D'Este, Zito and Taylor, 1999[54])or by average travel time between commuted trip ends in the roadway network (Allen, Liu and Singer, 1993[58]). These metrics of travel efficiency can be affected by several variables beyond the design of the roadway – such as congestion, weather, construction, or special events (e.g. a parade). Resultant delays from these factors lead to wasted resources including time, money, fuel and emissions (Çolak, Lima and González, 2016[59]; Turnbull, 2016[60]). However, for many roadway transportation systems, this evaluation under normal or typical circumstances leaves out important information regarding the system's ability to cope with stress and less-than-optimal conditions (Caliendo, Russo and Genovese, 2022[61]).

Resilient infrastructure systems can adapt to atypical situations, both of relatively commonplace (vehicle accidents, road closures, or severe weather) to uncommon (hazardous material spills, mass casualty events, etc.). Since transportation systems play a vital role in emergency response, economic well-being and essential services, road networks have garnered increased policy making attention. Scholars have not yet, however, derived a common definition of resilience for transportation systems that could guide the design lifecycle of roadway network, as it is a multidimensional concept within different fields. For example, in comparison to many fields of engineering – including civil engineering – resilience is defined as a system's ability to prepare for, absorb, recover from and adapt to disruptions. Transportation resilience has often emphasised the importance of consistent service delivery. Disruption beyond an accepted range of delays (e.g. daily vehicle traffic) must be resolved, and the transportation system's ability to return to an acceptable service level as quickly and inexpensively as possible. More simple descriptors relate to a system's ability to minimise or reduce operational loss in transportation services. Colloquially, resilience in this field has also taken on synonyms such as robustness, redundancy, reliability or overcoming vulnerability, which complicates the focus upon system recovery and adaptation (Galaitsi et al., 2020[62]).

Contemporary research on transportation resilience has developed frameworks and measurement methods for resilience, including factors such as total traffic delay, economic loss, post-disaster maximum flow and autonomous system components (Lambert et al., 2012[63]). Since this research is driven by empirical methods, practical concerns are attributed to its effectiveness. It often dismisses indicators that cannot be quantified, and can be affected by heuristics, rules of thumb and subjective evaluation. Other methods of applying resilience in transportation systems include modelling of traffic networks to optimise locations for critical services (e.g. fire stations and hospitals), reducing travel distances and minimising the travel time necessary across the system. These network approaches can be data intensive, requiring information that can be difficult to track down. Furthermore, quantifying resilience for transportation networks typically only serves the system of interest and are not generalisable or easily changed. Since disruption is inevitable, resilient transportation systems must be characterised by their ability to withstand these stresses. As a result, concepts of transportation efficiency and resilience are often not implemented.

2.2.2. Case study: airport resilience and severe weather

Airports, especially international airports, are critical elements of transportation infrastructure that affect urban areas and their economies (Stevens, Baker and Freestone, 2010[64]). Airports (including its infrastructure, energy, communications and labour) are the nucleus of the supply chain for airline travel, including compliance for risk and security, sustainable operations and maintenance, and the production and sale of goods and services. This makes the capacity of airports to recover from and adapt to possible disruptions critical to passenger and worker safety, and to delivering socio-economic benefits to the areas they serve (Pickard and Gençsü, 2021[65]).

The focus of this case study – Dallas – Fort Worth (DFW) International Airport – ranks second in terms of passengers and third in aircraft movements (operations) globally.[2] Due to its heavy traffic, DFW has considerable societal benefits and obligations – both to maintain operations regardless of threats, as well as to mitigate environmental externalities such as carbon output. Lessening disruption effects while maintaining operational capacity has been challenging when combined with the need to mitigate greenhouse gas reductions.

In February 2011, minimum temperatures decreased at DFW between -10 to -20 (°C), prompting de-icing to meet necessary traction abilities for runway operations. As a result, only 440 flights could land and take-off daily, prior to recovery. Even though this event lasted five days, only three were needed for DFW and the airport's partners to bounce back to relatively normal operation standards. The lack of the airport's absorption ability was reflected in the steep decline in operations following the storm, but its recovery was demonstrated by its swift return to near-normal capacity. To adapt to future storms, DFW and its partner airlines collaborated to strengthen method for de-icing as well as the runway infrastructure itself to result in an "all weather airport" status in regard to airport equipment, procedures for winterisation and adaptive monitoring of traction on the runway (Federal Aviation Administration, 2020[66]).

Jumping to February 2021, a stronger winter storm blasted most of the state of Texas with both minimum and maximum below-freezing temperatures lasting eight days. Taking heed from the winter event that occurred in 2011, de-icing strategies and runway clearances were operated and maintained at normal levels. However, cascading disruptions from breaks in the water line, equipment affected by the low temperatures and reduced ability for staff to commute to their posts eventually led to a systemwide failure akin to what occurred in 2011 (Doss-Gollin et al., 2021[67]). Operations recovery was delayed (recovery took seven days as opposed to three days), meaning that post-2011 lessons learned did not lead to maintained system-wide resilience.

However, DFW has made post-2011 improvements. By establishing its Integrated Operations Center in 2021, DFW harmonised essential functions from key stakeholders into a 24/7 operating platform to strengthen collaboration, while decentralising decision making. Due to this, emergency response times to disruptions became faster. For example, when the arrival of fuel for snow and ice equipment was delayed due to the inclement weather in 2021, DFW provided alternative diesel quickly. Airport staff in the Integrated Operations Center received quicker communications, which supported real-time co-ordination in redirecting diesel, typically used for fuelling its fleet at onsite fuel stations, to snow- and ice-clearing equipment. DFW had also invested in owning and operating nearby hotels. As the 2021 event was underway, these assets proved advantageous because hotel rooms could be reserved for the occupancy of essential airport workers, helping recovery.

While DFW took a longer time to recover from the 2021 event compared to the 2011 event, this may be due to system-wide complexity. Air and landside operations as well as communities are entangled in networks, which benefit from or harmed by information flows in and out of the system. Although airport infrastructure is a complex web with many interdependencies, enhancing de-icing capabilities was found as the most critical method to mitigate risk from the more advanced risk analysis techniques.

Regardless of the sunk costs in economic investments for DFW in 2011, disruptions increased in severity over time. Critical system assets have failed from various forms of disruption, due to risk-based efficiency practices. Resilience adoption was a shortcoming, with resilience as the ability to plan for, absorb, recover from and adapt to disruptive events.

Improving resilience by design and intervention at airports

Resilience places emphasis on how the system performs after a disruption (resource requirements and recovery times) and not traditional threat prevention, mitigation and absorption (limiting the magnitude of the initial lost function). This means that the social domain of airport infrastructure operations should connect with infrastructure domains (like airline scheduling at the airports).

In practice and for this purpose, resilience can be achieved by design – in essence, allowing airports to have the ability to absorb disruptions – and by intervention – which involves the security of exogenous resources which strengthen the airport's operations in the face of disruption (Linkov et al., 2021[68]; Kott et al., 2021[69]).

Resilience by design can be improved on the airside of operations. Furthermore, investments in infrastructure also uphold resilience by design (e.g. building necessary redundancies) in physical, social, or information domains. For example, the Integrated Operations Center at DFW Airport (see the case study above) provides the sharing of data with analytics to inform decision making (DHS, 2017[70]). Other metrics for resilience prompt decision makers at the airport to forecast threats, benefitting real-time operations.

Resilience by intervention in the context of airport operations is reliance on community and/or landside-based relationships. Resilience by intervention leverages operations and efforts toward environmental mitigation within the airport to meet or even exceed regulatory requirements. Regulatory compliance and cost savings are balanced through resilience by intervention. One example drawn from the case study on DFW Airport (outlined above) was the airport's investment in hotel infrastructure. This strengthened the capacity of the community near the airport to receive and provide resources, contracts, and facilities, thereby lessening the impact of disruptions.

2.2.3. Case study: Texas deep freeze – energy systems and severe weather

The February 2021 polar vortex resulted in a shock in supply and demand in energy. In Texas, disruptions to energy contributed to residential energy blackouts and electricity price increases of 100 times for those still capable of operating household electricity (Jin et al., 2021[71]). Limited energy access and blackouts were triggered by temperatures far colder than the operating conditions of the available infrastructure.

Designed for maximum efficiency to reduce producer and consumer price burdens during expected operating conditions, the Texas electricity grid does not typically maintain backup storage (Douglas, 2021[72]). While limited natural gas reserve capacity is not uncommon for thermal power generation plants, consumption patterns in Texas placed the state in a more precarious condition – it consumes 14% of the total US natural gas but has only 8% of the total US storage field. With state-wide natural gas production declining by over 10 billion cubic feet per day during the February 2021 polar vortex, the lack of redundant capacity along with limited recovery planning for anomalous severe weather events disrupted energy provision to homes and businesses. It also required substantial time to fix what would otherwise not be experienced in other parts of the United States. The loss of available generating capacity shifted the Electric Reliability Council of Texas into emergency operating conditions, cutting power to 2 million homes during the freezing temperatures.

Complicating matter was the configuration of the Texas electricity network. Self-enclosed, the state electricity grid system is disconnected from other energy networks in the United States. While this allows the Texas electricity system to fluctuate operations and reduce costs to customers, it left it with fewer options to rely upon power generation and transfer from unaffected states within the same energy provider region. Likewise, the self-contained structure of the Texas energy network reduced federal regulatory oversight, which may identify possible disruptions and/or co-ordinate recovery when disruptions occur.

The brittle, isolated, and self-contained nature of the Texas energy grid had drawn warnings from the United States' National Academy of Sciences and other experts, particularly due to its vulnerability to cold weather and the limited adaptive capacity during emergencies at the local level (Jin et al., 2021[71]). The deregulated Texas energy market envisaged energy companies competing to deliver power to consumers through the common electricity grid. The idea was that this would facilitate new market entrants, enhance competition, and incentivise innovation to further benefit consumers. The state was supposed to intermediate between producers and consumers, with prices rising in the event of high demand. Unfortunately, electricity demand is inelastic – it does not respond to changes in price but does respond to changes in weather (Jin et al., 2021[71]).

The severe demand shock during tfhe polar vortex, coupled with the isolation of the electricity grid, non-winterisation of critical facilities and supply chain failures, meant that the state of Texas and other system stakeholders could not respond quickly to the disruption. Although the Texas electricity grid was minutes away from irreparable network damage, the decision to alleviate 5 gigawatts minimised strain on the system (Blunt and Gold, 2021[73]). This decision, however, came at a steep cost. Limited winterisation strategies and a lack of planning for resilience against weather anomalies resulted in fatalities, disrupted transit, and substantial local and state-wide direct and indirect economic losses.

Implementing strategies to improve the resilience of energy systems

A reliance upon extreme efficiency in energy network design and operations is not unique to Texas (see the case study above). Other US and European energy and utility systems have also experienced the consequences of weather disruption. Non-weather-related energy network disruptions also occur, including the software and operator errors that sparked the 2003 United States' Northeast blackout, and the synchronised multi-target cyberattack that caused power outages in Ukraine in 2015. As disruptions to interconnected networks and energy stakeholders are expected to increase, application of resilience in energy systems is paramount to ensure this critical function is delivered.

Efficiency is an incentive towards energy generation, transit, and consumption. It has been a guiding engineering principle in energy systems – redundancy costs money and resources that, when not being used, have less perceived value than if they had been deployed elsewhere. Supposedly efficient systems are, however, subject to increasing disruptions spurred by climate change, the potential risks of digitalisation, and growing interconnections between natural and human-made systems.

Efficiency, however, must also accommodate anomalous events that could degrade or destroy an infrastructure network. Resilience emphasises the capacity of a system to recovery and adapt to disruption. Risk management, in contrast, emphasises the planning and absorption of threats, placing less emphasis on cyclical recovery and post-disruption transformation. Resilience internalises the notion that, because disruptions are inevitable, a system should be designed not only to mitigate the risk of a disruption, but to recover and adapt when disruptions occur. Thus, resilience extends efficiency-based thinking from optimising resources for normal operations to optimising resources for anticipated and unanticipated disruptions, leveraging the capabilities of either regulated or deregulated energy networks.

Although operators, owners and other stakeholders favour efficiency in energy systems, resilience strategies have been implemented successfully, even if in an ad hoc manner. Regions that experience more frequent or regular disruptions have backup natural gas, coal or other supplies for power generation. Grid managers may forecast system maintenance in co-ordination with other external and internal drivers such as anticipated system demand, weather events or geopolitical events (e.g. Brexit, new pipelines, solar technology, etc.) that may affect supply, distribution and production. Fundamentally, the energy system design itself – through smart microgrids, modular systems for reorientation and localisation of disruptions, and adoption of advanced automation by distribution utilities – provides ample opportunity to leverage resilience strategies.

Resilience thinking leverages both stress testing and network science of the full system to allow for effective decision making to maximise resilience and efficiency to the greatest benefit to society (Linkov et al., 2022[74]). A network model of the entire system of the energy grid can be crafted from known data points and/or inferred through machine learning and AI techniques where system visibility is lacking. Using models, resilience analysis identifies weak points in the system by stress testing the network and the intricacies, complexities and interdependencies of the system. The results can be used to determine necessary corrective actions and policies from within the specific energy system to prevent degradation of critical functions, post disruption.

2.3. Finance

Research on financial systems primarily focuses the discussion of resilience on preparation for and absorption of shocks. As with infrastructure, the financial sector discusses resilience from multiple perspectives and disciplines, such as supply chain management, organisational management and economics (Anderies, Janssen and Ostrom, 2004[75]; DesJardine, Bansal and Yang, 2019[76]; Jüttner and Maklan, 2011[77]; Plummer and Armitage, 2007[78]). While these perspectives may deviate from each other, the concept of resilience is maintained: resilience is a strategy of thinking through a system’s dynamics to prepare for and absorb a financial loss.

Measuring resilience of financial systems stems from the Dodd-Frank Wall Street Reform and Consumer Protection Act (US Congress, 2010[79]). In response to global financial crisis of 2007-08, these tools aimed to operationalise resilient behaviour through better planning and absorption via stress testing. A stress test for financial systems is a host of “what-if?” scenarios, where critical variables are hypothetically tracked for performance in response to theoretical stimuli. The lessons learnt from the stress test are published to provide a status of the health of the financial system, and to announce changes that need to be made.

Various banking agencies perform stress tests and publish the results (Federal Reserve Bank of Minneapolis, n.d.[80]). While the methodology is often scenario based, variables are classified in an interconnected model to assess overall market risk. In other words, stress testing the financial sector is a strategy for supervising market activity to ensure more resilient behaviour (European Central Bank, 2021[81]; Levy-Carciente et al., 2015[82]). Several strategies have been created by researchers to simplify this process, such as the Basel stress testing scenarios, which were used routinely on the US bank system after the 2008-09 recession, resulting in several revisions to the methodology over the years (Heyen, 2008[83]; Jokivuolle, Virolainen and Vähämaa, 2008[84]; Miu and Ozdemir, 2008[85]). While most resilience and stress testing exercises emphasise system performance within financial institutions, the underlying assumptions (and scenarios) are often predicated on substantial shifts in individual and community behaviour, spending patterns and other considerations that affect the economic performance of countries.

Linking back to the Linkov et al. (2018[35]) tiered methodology (see Section 2.2), the vast majority of financial resilience assessments through stress testing operate in Tier 3. Advanced mathematics and an array of simulations are used to track system performance. In essence, the network of the financial system is analysed to discover where individual variables must be hardened. As stress tests seek to simulate probable, improbable and even uncharacterised shocks for finance (Berkowitz, 1999[86]; Foglia, 2008[87]; Geithner, 2014[88]), their focus answers the question “which elements of the system must be bolstered?” This correlates with the definition of resilience by identifying how systems can better plan for and absorb a shock, in the same way that a financial system may plan for and absorb an economic downturn.

2.4. Environment

Environmental resilience differs from built infrastructure resilience, in that environmental management stakeholders are not managing a "purposeful" system. Unlike physical infrastructure, which has designed operating requirements and service delivery capabilities, natural systems are formed, adapted and reformed over extensive cycles. They lack a predetermined purpose and achieve local equilibrium based on the balance of organisms living within them (Angeler et al., 2016[89]).

Environmental resilience is often reviewed through the lens of an area (rather than through common theories), such as climate resilience, air and water systems, and various ecosystems (e.g. tropical, oceanic, etc.). For example, the OECD continues to be active in efforts to strengthen the resilience of human and natural systems to the impacts of climate change (OECD, 2021[90]), including outlining a way forward for defining, measuring and mobilising adaptation-aligned finance (Mullan and Ranger, 2022[91]). These areas are beyond the remit of this chapter, meriting separate exploration.

The European Commission began exploring resilience analysis in 2013 when it called for proposals within the Horizon 2020 programme Disaster-resilience: Safeguarding and Securing Society, Including Adapting to Climate Change. This tasked EU Member States with building in principles of resilience analysis with the purpose of managing risks at the system level. Climate change was the primary driver for this resilience initiative, but the Commission also mentioned other societal disruptors, such as terrorism and unforecastable infrastructure threats. The European Commission noted that "a better understanding of critical infrastructure architecture is necessary for defining measures to achieve a better resilience against threats in an integrated manner including natural and human threats/events" (European Commission, 2015[92]). In this respect, the European Commission sought to promote a holistic approach by using resilience to address interdependent systems across Europe, recognising threats that are both purposeful (e.g. terrorism) and accidental (e.g. natural hazards) could affect the continent, if unprepared.

In the United States, the Environmental Protection Agency (EPA) mentions resilience as "the capacity for a system to survive, adapt and flourish in the face of turbulent change" (Fiksel, Goodman and Hecht, 2014[93]). With this strategy, the EPA seeks to lessen risk by increasing the preparedness of systems facing external disruptors, even when in-depth knowledge of such threats may not exist or is incomplete.

Although resilience analysis is still evolving in the environmental field, the EPA discusses its ability to provide "consideration of a system's capacity to withstand even unforeseen disturbances", which is necessary for an increasingly complex, globalised world with interdependencies that are both easily seen and hidden (Fiksel, Goodman and Hecht, 2014[93]). The EPA identifies that resilience analysis could be useful in guiding changes to policy in areas with challenges to their systems' resilience plans. However, it also mentions shortfalls and concerns about the method, including a lack of a governance structure to measure and characterise what resilience means.

The EPA identifies several possible methods of resilience analysis, contending that no "one size fits all" approach can apply to every scenario. It mentions five characteristics for evaluating resilience. These characteristics are diversity – known as "the existence of multiple behaviours within the system"; adaptability – "the capacity of the system to change in response to new pressures"; cohesion – "the strength of unifying forces"; latitude – "the maximum amount of change the system can absorb"; and resistance – "the capacity of the system to maintain its state in the face of disruptions" (Linkov and Trump, 2019[94]). Given these characteristics, the EPA notes that, where information is limited, a more quantitative assessment of resilience could be conducted. A close review of each of the five characteristics may provide input about the overall resilience of the system and its abilities to protect itself from crippling external forces. The EPA concludes that qualitative resilience analysis may be a useful starting point for further understanding the threats and uncertainties of a system's individual applications of resilience.

While the EPA has not formally adopted resilience analysis, some of its units apply these principles. For example, the EPA's Office of Water has created a Climate Resilience Evaluation and Awareness to give users the ability to "anticipate potential impacts of climate change to drinking water and wastewater utilities" (Fiksel, Goodman and Hecht, 2014[93]). The EPA's Gulf of Mexico Programme seeks to guide coastal communities to identify relevant environmental threats and boost their resilience to these disruptors.

To help communities identify the extent of their preparedness for coastal storms, the Sea Grant Mississippi and Alabama offices of the US National Oceanic and Atmospheric Administration (NOAA) built a Community Resilience Index. This Index is meant to identify areas of resilience performance both during and after a coastal storm. This is divided into six sections, asking yes/no questions to gauge resilience (such as services for transportation or even critical infrastructure). Checkmarks are tallied in the Index, resulting in subjective scores that are low, medium or high, pertaining to a jurisdiction's ability to bounce back from a coastal storm. Using this approach, leaders in communities can easily identify areas of weakness that need to be improved. The NOAA has sought to integrate stakeholder feedback in these analyses, inviting community leaders and members to find holes in the resilience plan (Emmer et al., 2010[95]). This co-operation serves as an example of how a government can co-operate with local areas to address long-term disruptions and potential risks to environmental resilience (Murphy et al., 2014[96]).

2.5. Cybersecurity and digital systems

In a world increasingly affected by the Internet of Things, cybersecurity and digital systems are intertwined with the resilience of every other sector mentioned in this chapter (see the chapter on digital foundations). How might cyber systems not only be used but required for the successful operation of this sector? For example, what might happen to a city's electricity grid or energy supply if malicious actors hack into the digital system?

These are not theoretical questions. For example, in 2021, a major gas pipeline on the east coast of the United States had its digital systems hacked and a feedback loop was created in the gas supply chain that caused prices to surge, leading to the Colonial Pipeline gas shortage (Jin et al., 2021[71]). As the malicious actors behind the hack in the system requested pay-outs, consumers began panic-buying gasoline as the Colonial Pipeline stopped distribution for several days. Gasoline/petrol stations went dry up the eastern seaboard of the United States, inflating prices significantly. This example shows why resilience is necessary in cybersecurity and digital systems.

The surrounding literature explores all stages of resilience: preparing for, absorbing, recovering from and adapting to disruption. For example, Kott and Linkov (2019[97]) and Linkov et al. (2013[19]) discuss the need to use this holistic approach to resilience for cyber systems. Depending on the application, however, other instances focus more on the earlier stages of resilience (preparing for or absorbing shocks) or later stages (recovering from or adapting to shocks).

Research into cyber systems that focuses on preparing for and absorbing disruption connects to exogenous systems that are "too big to fail" – in other words, where disruption can cause catastrophic consequences based on geography, the socio-political context and other variables. For example, researchers note cyber resilience as a property of systems to overcome adverse events (Arghandeh et al., 2016[98]; Björck et al., 2015[17]; Harris and Impelluso, 2008[99]) or intelligent systems, energy grids and financial systems. The goal of higher-order planning and absorption is to blunt or even avoid disruption entirely, since the recovery and adaptation stages still place consumers or users in a state of distress.

Conversely, research that centres discussion of resilience around overcoming and adapting to disruption links to endogenous cybersecurity. When a hack or disruption occurs, such as with the Colonial Pipeline, cyber experts attempt to restore the system's integrity and defend against similar attacks as quickly as possible. Cyber-based research surrounding cybersecurity focuses on this concept, including the definition of resilience for cyber systems to withstand, recover from and evolve from disruption (Carías et al., 2020[100]; Gisladottir et al., 2017[101]). From this perspective, the importance of defending the system is recognised, but the view is taken that disregarding the potential for malicious actors to outsmart the system is naïve.

Measuring the resilience of cyber systems similarly follows the Linkov et al. (2018[35]) tiered framework that was associated with infrastructure systems. Tier 1 evaluations apply CISA's tabletop exercise routine to cyber systems. As with infrastructure, these tabletop exercises characterise the system and coarsely identify areas of improvement for its ability to plan for, absorb, recover from and adapt to adverse events. For Tier 2, the cyber domain is a central consideration of the Fox-Lent, Bates and Linkov (2015[21]) resilience matrix, which argues that cyber systems are a requirement to classify the level of resilience for a given system. Tier 3 utilises essences of AI to promote resilience by design. For example, a Tier 3 tool could be antivirus software that has elements of resilience baked into the system by being able to identify potential threats, quarantine suspicious agents and remove malware in tenths of a second.

2.6. Disaster and emergency response

The US National Academy of Sciences has characterised four stages of resilience in disasters (National Research Council, 2012[2]). The first stage (planning/preparations) assesses the operational health of the system to identify where resources and/or services are required in the face of an unknown threat. The second stage (absorption) involves assessing the threat to maintain critical functions while managing the disaster. The third stage (recovery) assesses motivation to get the system back to pre-disaster operational capacity as quickly as possible. The last stage (adaptation) takes the lessons learnt from the disaster to make necessary changes to the system in the event of future disruptions of a similar class and magnitude.

Disaster resilience analysis often focuses on the first stage – preparation/planning. This may be due to the tendency of resilience analysis experts to think prospectively about theoretical scenarios, prepare for them and analyse how similar events were responded to in the past. This maintains more conventional risk analysis methods, which prepare systems at risk of identified disruptions. Such conventional methods of risk analysis focus on optimising available resources to respond to potential disasters with maximum protective capabilities. More conventional risk analysis lacks the ability to protect against high-consequence, low-probability events that are unforeseen or unidentifiable, complicating the governance requirements around recovery from them.

Research on the second and third stages – absorption and recovery – is increasing in publications and regulatory use because it begins to bridge the gap in overcoming risk present in common methods. The absorption stage focuses on maintaining the integrity of the system structurally and functionally both during and immediately after a disaster occurs. The recovery stage focuses on minimising the time needed to get the system back to being fully online and operational after the disruption.

Absorption is the current focus of governmental agencies in the United States. At least seven (the Department of the Interior, Department of Homeland Security (DHS), National Institute for Science and Technology (NIST), the EPA, US Army Corps of Engineers, NOAA and US Army Environmental Command) have adopted metrics to estimate the ability of resilience thinking to improve risk-based approaches to systems of interest. Tools of interest to review an asset's ability to absorb disruption include relative and standardised scoring functions, using quantitative and qualitative information, based on the method selected. Qualitative reasoning, however, tends to dominate in this field.

Like absorption, recovery (the third stage) is still underutilised in conventional risk analysis, but it is in nascent stages in the literature and government reports. While absorption focuses on preparing for a disruptive event, recovery focuses on events that occur after the disruption. While traditional risk analysis places some importance on reducing the time to recovery, this is not held in as high regard as it is in resilience thinking (Linkov et al., 2014[28]). Due to this difference from traditional risk management, recovery operations and policies tend to not secure the same level of attention or funding from government agencies as the first two stages. Nonetheless, more focus is being placed on this stage as the field advances.

Lastly, adaptation (the fourth stage) presents the largest difference from more conventional risk analysis methods. This departure is the result of this stage's intent to change the system from an infrastructural and/or organisational level to improve its ability to absorb and recover from future events. Adaptation is most similar to adaptive management, which is a decision-making process where norms and standards are changed through time to face shortcomings in systems (Linkov et al., 2006[102]; Stankey, Clark and Bormann, 2005[103]). Guiding tools to convey how systems should build for adaptation are rarely available. This stage is also the least reflected on by, for example governmental agencies in the United States – only the EPA, DHS and NIST included it in their resilience efforts in 2015.

Bakkensen et al. (2017[104]) compared five metrics that reported a level of resilience assessment to inform communities about how to recover from various disasters. While the indices they created used similar datasets, they were not always internally valid. For example, if one index reported better resilience for one county than another, others did not always agree. For local stakeholders and decision-makers who need these indices for decisions on policy or investment in the locality, the problem has intensified, contributing to concerns about for whom a resilience-based approach should be created; and what metrics or system components should be benchmarked as "resilience performance" for affected stakeholders.

In the United States, the Federal Emergency Management Agency (FEMA) is a key player in responding to and recovering from disasters and natural hazards. It is, therefore, crucial to resilience plans. FEMA began efforts to recommend and create certification programmes in the light of the goals for resilience of the DHS. For example, FEMA publications include *National Preparedness Goal* and *National Disaster Recovery Framework* (Federal Emergency Management Agency (FEMA), 2011[105]; Federal Emergency Management Agency (FEMA), 2015[106]). In the latter, FEMA creates checklists for before and after disasters for certain stakeholders (such as individuals and families and the non-profit sector). These checklists give recommendations, but not a quantified framework for assessment. FEMA also created a private sector accreditation for preparedness and a certification programme to grant recognition to organisations that apply DHS consensus-based standards for preparedness and best practices in the field. In general, these efforts take a system-level view of resilience.

The National Institute for Science and Technology (NIST) in the United States has a disaster resilience framework (Larkin et al., 2015[107]). This is designed to boost resilience for communities in the face of both natural and man-made disasters. Natural disasters include hurricanes, storms, earthquakes, tornadoes, floods, landslides, wildfires, tsunamis and excessive rain or snow; man-made disasters include vehicular impacts, blasts and many others. This assessment provides metrics for performance that should be attained in a limited amount of time, and lists goals to address disasters before, during and after they occur. These goals can be adapted by community leaders to apply more specifically, ensuring that all members of the community and relevant organisations benefit. The NIST's framework divides resilience into three stages: the response phase (0-3 days after the event), the workforce/neighbourhood recovery phase (1-12 weeks after the event) and the community recovery phase (4 to 36+ months after the event). These complement the absorption, recovery and adaptation stages respectively (Linkov and Trump, 2019[94]; National Research Council, 2012[2]). The response phase focuses on aiding community members before and during a disaster, focusing on the critical needs outlined by the NIST: food and water resources, life safety, health, shelter and situational awareness. The workforce/neighbourhood recovery phase addresses metrics for performance that allow a community to recover from a disaster efficiently and quickly. The community recovery phase entails long-term reconstruction of community infrastructure and organisation, including resilience.

2.7. Medicine and public health

Currently, there is no metric for health resilience, at either an individual or institutional level. Clinicians have focused on incorporation of biomarkers such as musculoskeletal changes, stem cell changes, serum markers, metabolic markers, hormonal changes and new inflammatory markers (Al Saedi et al., 2019[108]). More recently, epigenetics and genetic research is working to provide resilience indicators in health across an individual's lifespan. Additionally, social determinants of health are used, collected from socio-economic data as well as self-reported data and surveys for the collection of data specific to resilience. Sample sizes used in these studies are, however, typically rather small, and the surveys used are not the same, with varied questions and outcomes measured (Klasa et al., 2020[109]).

Health, however, is not just a product of individual genetics. Exogenous factors like the perception of race, the physical environment, poverty, and education may all affect outcomes for health of a person. As time continues, these factors can transform to play larger roles, which indicates that they are critical to system stability and service delivery. Five spheres influence an individual: physical activity and active living; individual determinants (genetic and behavioural); the social environment; the built environment and the natural environment (Table 2.1). These spheres directly affect factors that determine health behaviours, including institutional factors, community factors, public policy (i.e. governance and law-making), intra-personal factors and inter-personal processes (Mcleroy et al., 1988[110]). Owing to this complexity, resilience in health cannot completely avoid risk.

Table 2.1. Determinants of health

System	Baseline	Resilience
Physical activity and active living	Fitness	Healthy habits
	Disease free	Access to health care
Individual determinants	Financial security	Government welfare
	Minority status	Government protections
Social environment	Close familial relations	Close friends
Built environment	Amenities in proximity	Good transit
	Good cell/mobile reception	Telecommunications
	Residence in good repair	Place to go in case of danger
Natural environment	No disasters	Disaster insurance, protocols

Resilience is a dynamic process embedded within many systems of interactions – it is not an individual trait or characteristic. An individual is limited in how much they can adapt to a threat because many aspects of well-being are beyond their control. Without interventions to influence social interactions, environmental structures and health resources, resilience cannot be achieved at either the individual or the system level. An individual requires access to health care services, safety, social support and adequate education to optimise their capacities over their lifespan (Hayslip and Smith, 2012[111]). This provides a baseline from which multi-level strategies for health resilience can be designed and implemented.

Aggregating these factors could provide a resilience quantification for a specific profile of a person. A measurement that encompasses all these factors may not, however, adequately characterise the individual's response to a threat within the different domains (Table 2.2). Health determinants will be affected by disrupting the social environment, such as closing cafes as gathering places, but will not be aided by disaster insurance. Meanwhile, the impact of a disruption to the natural environment, like a cyclone, could disrupt all systems. A person resilient to one type of disruption may be extremely vulnerable to another. Resilience can be measured as resilience to specific events that trigger changes.

Can an individual show overall resilience? If resilience is framed as access to redundant resources, tight social connections can greatly expand an individual's available resources. A storm that destroys multiple aspects of the built environment and cuts the individual off from social activities, resulting in bodily or cognitive harm, may damage the individual far less when a concerned neighbour with a car takes the time to check in. Social connections are critical to individual resilience. Social connections also are capable of mobilising resources at relevant scales more quickly than the built environment. Thus, resources provided through an expansive social system may amount to redundancies in all other systems.

However, the flexibility that allows quick responses from social support arises because those supports are not structural and maintaining them in the long-term may be beyond the social network capacity (Cohen and Syme, 1985[112]). In studies of resilience to multimorbidity, the time during which support is available matters (Klasa et al., 2020[109]; Wister, Klasa and Linkov, 2022[113]). Different social or structural environments affect resilience over different time periods. This can lead individuals to be resilient to some circumstances but not others, and resilient in the longer term but not in the short term.

Perspectives on health system resilience often change over time. For example, demographic changes worldwide are leading to more adults seeking social support from relatively fewer able-bodied younger relatives and friends. In Japan, the role of the built environment in ensuring health and welfare is expected to increase, for example, with a focus on in-home smart appliances that evaluate health problems to help elderly people get needed medical support earlier. Whether capability improvements in one determinant of health can decrease the need for or replace another remains to be seen, and such insight would contribute to understanding how overall resilience could be best quantified for individuals.

Table 2.2. Selected definitions of resilience in medicine

Health actor or organisation	Definition
World Health Organization (2017[114])	Resilience is the ability to maintain or improve a level of functional ability in the face of adversity (either through resistance, recovery or adaptation).
American Psychological Association (n.d.[115])	The process of adapting well in the face of adversity, trauma, tragedy, threats or significant sources of stress – such as family and relationship problems, serious health problems or workplace and financial stressors. It means "bouncing back" from difficult experiences.
Mayo Clinic (n.d.[116])	Resilience means being able to adapt to life's misfortunes and setbacks.
USAID (2013[117])	The ability of people, households, communities, countries and systems to mitigate, adapt to and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth.
Kruk et al. (2015[118])	Health system resilience is the capacity of health actors, institutions and populations to prepare for and effectively respond to crises; maintain core functions when a crisis hits; and, informed by lessons learned during the crisis, re-organise if conditions require it.
Panter-Brick and Leckmann (2013[119]), Masten	Resilience is a process to harness resources to sustain well-being.
(2014[120])	The capacity of a dynamic system to adapt successfully to disturbances that threaten the viability, the function or the development of that system.
Ager, Annan and Panter-Brick (2013[121])	Structural resilience is building robust structures in society that provide people with the wherewithal to make a living, secure housing, access good education and health care, and realise their human potential.
Southwick et al. (2014[122])	Definitions of resilience range from a stable trajectory of healthy functioning after a highly adverse event; a conscious effort to move forward in an insightful and integrated positive manner as a result of lessons learned from an adverse experience; the capacity of a dynamic system to adapt successfully to disturbances that threaten the viability, function, and development of that system; and to a process to harness resources in order to sustain well-being.
Kruk et al. (2017[123])	Resilience focuses on the functions health systems need to respond and adapt to health shocks, introducing a dynamic dimension into more static health system models which can help the system cope with surges in demand and adapt to changing epidemiology and population expectations of care.
Garmezy, Masten and Tellegen (1984[124])	The concept of resilience is centred on the capacity to "bounce back" from an adverse event.
Wagnild and Collins (2009[125])	Resilience is the ability to adapt or "bounce back" following adversity and challenge and connotes inner strength, competence, optimism, flexibility and the ability to cope effectively when faced with adversity.

Source: Klasa (2020[109]), "Science and Practice of Resilience: Disaster Systems Applications to Aging Resilience", https://doi.org/10.1007/978-3-030-57089-7_4.

Public health and epidemiological resilience share some commonalities with medical science, although it is less focused on diagnosis and treatment of disease, and more on how social and environmental systems can be safeguarded or adapted to overcome stressors. Fundamentally grounded in a systems-based approach, public health resilience emphasises the interdependent nature of individuals, communities, governments, environments, economies and infrastructure, all of which contribute to and determine health outcomes. While there are many possible applications – such as environmental contaminants, air and water quality and so forth – one salient area of public health resilience is responding to human pathogens.

2.7.1. Case study: Ebola virus (2014)

Human pathogens trigger a dramatic system response whenever they arise. Directly, illness, long-term health debilitation and mass fatality can overwhelm health systems if they not adequately prepared for (see chapters on critical care surge and care continuity). Indirectly, socio-economic disruptions can result, as government and philanthropic institutions may struggle to deliver various services given increased demand (e.g. food, energy and heating services, housing assistance, education, and many others).

Ebola virus initiates a painful haemorrhagic fever which prompts mortality rates at an average of 50% or greater (Pourrut et al., 2005[126]). There is no remedy beyond oral hydration therapy, leaving many unlikely to survive its cascading health impacts. The virus was first described in 1976 in villages along the Ebola River. Until 2013, the disease was mostly sequestered in sub-Saharan Africa, where approximately 24 recognisable outbreaks contributed to 1 716 cases between 1976 and 2013 (Dixon and Schafer, 2014[127]).

Survivors of Ebola usually encounter challenges with reintegrating into society. In the face of social, health, and financial problems after initial recuperation from the disease, survivors are typically left vulnerable as the attempt to fully recover and stabilise normal life. Typical long-term effects include a range of ailments, such as: muscular pain, liver inflammation, fatigue and long-term weight loss, all placing the survivor's overall health in question (Magill et al., 2013[128]; Tosh and Sampathkumar, 2014[129]). The World Health Organization (WHO) (2015[130]) notes that survivors require strict monitoring – which is typically unavailable in sub-Saharan Africa – for years after recovery to ensure that other complications do not arise. Long-term problems with health are worsened by economic and social factors that surround the patient's recovery. For example, economic hardship has been a result for many survivors due to social discrimination preventing occupational pursuits (Lee-Kwan et al., 2014[131]; Levin-Sparenberg et al., 2015[132]; Curson, 2015[133]). In this respect, the Ebola virus indirectly weakens social resilience.

Resilience thinking is needed for the Ebola response. Strong consequences would follow if the Ebola disease spread to larger population centres, in terms of health, social order and trade. While a proliferated Ebola outbreak has yet to happen, the 2013-16 West African Ebola outbreak exemplified the virus's strength and the high consequential impacts of failure to maintain disease response and control. As a result of this outbreak, cases reached Europe and the United States from the primary host countries: Guinea, Liberia, Nigeria, and Sierra Leone. Even though fatality rates from this outbreak are estimated to hover around 40%, the real numbers are trickier to ascertain due to inefficient methods in accounting for the disease incidence and because some afflicted individuals refused to receive medical assistance.

Health workers also face an additional challenge with keeping safe from the disease, given that their roles require them to be proximate to infectious bodily fluids. In 2014, an estimated 10% of confirmed Ebola cases derived from health care workers, demonstrating the complexity of ongoing disease monitoring and treatment efforts. Likely causes include few trained staff during the onset of the disease, poor supplies, and a strong reliance of hastily constructed field hospitals. This should not denigrate or overlook the staff that have treated the thousands of cases of Ebola during this time – these professionals should be recognised for their courage in providing medical care in such risky conditions. Rather, this Ebola outbreak serves as an example of how governance for risk and disease in West Africa was inadequate to efficiently address the outbreak. Researchers have also found economic disfunction, social disunity, and a mistrust of public health authorities in the local populations flowed indirectly from this outbreak (Bonwitt et al., 2018[134]; Brown et al., 2017[135]; Massaro et al., 2018[136]).

Risk management would focus on building the individual pieces of how Ebola may propagate through countries. Instead, resilience classifies an observable range of components that are useful to quickly recover and adapt from the outbreak. For this particular disease, improving resilience may include adaptive governance to provide a scaled medical response, as well as to change medical protocols with the focus upon minimising contact between healthy and infected populations. An example includes the provision of adaptive methods for airport security, passenger biocontainment, and air traffic control to prevent the spread of the disease nationally and internationally. The US Center for Disease Control and Prevention (n.d.[137]) has provided guiding measures for medical air transport for affected patients to prevent the spread of the Ebola virus. Massaro et al. (2018[136]) identified that populations susceptible to outbreaks can be modelled using network science to chart the path an outbreak would take as well as its virulence, providing policy recommendations. The authors discovered that, while a risk-based strategy (like shutting down transportation systems between infected countries) seems logical, more flexible strategies to contain and mitigate the outbreak to lessen the impact of it would be medically, economically and socially preferrable.

Resilience thinking regarding a disease that was previously not determined to spread would also improve response. For example, Ebola's rare occurrence in West African history was an early difficulty for its identification by medical professionals in the first months of an outbreak (Baize et al., 2014[138]). Resilience to the Ebola virus must use an innovative, robust and interconnected approach that uses all reachable governmental support systems to alleviate future outbreaks.

2.8. Differences and similarities across sectors

There are differences in how sectors characterise resilience. These centre around the purpose and focus of the sector itself. For example, the finance sector is primarily concerned with preparing for and absorbing economic disruption, whereas the infrastructure sector tends to value recovery and adaptation to get systems back operating at capacity. While acknowledging the importance of the holistic definition of resilience, researchers within these sectors use differing narratives to approach resilience.

One key similarity across sectors, including health systems, is vocabulary to describe resilience. At the sector level, resilience is an endogenous property of each system to **withstand** and **overcome** disruption. Withstanding disruption tends to be risk-focused, operationalising resilience through risk assessment practices to prepare for and absorb disruption. Overcoming disruption tends to be resilience-focused, quantifying the potential risk while also attempting to boost the system's ability to recover from and adapt to the disruption. **Preparing**, **absorbing**, **recovering** and **adapting** are common terms in use across sectors, even if some focus on specific stages more than others (Table 2.3).

Another similarity across sectors is that there is no "silver bullet" to quantify resilience. While resilience encompasses risk analysis through preparing for and absorbing disruption, even the risk science that researchers use generally does not converge on an optimal method. New methods are still being discussed for recovery from and adaptation to disruption. The literature reveals more divergence than convergence on a single method. Researchers, however, tend to agree that quantifying resilience is complex because all systems are different. Qualitative tools that operate through rules of thumb and discussion prevail. Quantitative tools, such as stress testing, have been developed but are still nascent.

Table 2.3. Breakdown of resilience across sectors

Sector	Supplemental sources	Strategies of measuring resilience	Focus on preparation/absorption of shocks	Focus on recovery/adaptation from shocks
Infrastructure	Definition: the ability to bounce back from disruption.			
	Bocchini et al. (2014[26]), Labaka, Hernantes and Sarriegi (2016[27]), Linkov et al. (2014[28]), Panteli et al. (2017[29]), Vugrin et al. (2010[30])	Scorecards, tabletop exercises, resilience matrices, stress testing		
Finance	Definition: a strategy of thinking through a system's dynamics to prepare for and absorb a financial loss.			
	Anderies, Janssen and Ostrom, (2004[75]); DesJardine, Bansal and Yang, (2019[76]); Jüttner and Maklan, (2011[77]); Plummer and Armitage, (2007[78]); Hynes et al. (2022[139])	Stress testing, network analysis		
Environment	Definition: the capacity for a system to survive, adapt and flourish in the face of turbulent change.			
	Angeler et al. (2016[89])	Checklists, indices, scorecards and vulnerability assessments		
Cybersecurity and digital systems	Definition: preparing for, absorbing, recovering from and evolving systems to withstand and overcome disruption.			
	Kott and Linkov, (2019[97]); Linkov et al. (2013[19]); Arghandeh et al., (2016[98]); Björck et al., (2015[17]); (Harris and Impelluso, 2008[99])	Tabletop exercises, resilience matrices, AI, network analysis		
Disaster and emergency response	Definition: A four-stage framework to plan for, absorb, recover from and adapt to adverse events.			
	(Linkov et al., (2006[102]); Stankey, Clark and Bormann, (2005[103]); Linkov et al. (2022[140]); Argyoudis et al. (2022[141]); Bostick et al. (2018[142])	Indices, traditional risk assessment		
Public health and epidemiology	Definition: the functions health systems need to respond and adapt to health shocks, introducing a dynamic dimension into more static health system models that can help the system cope with surges in demand and adapt to changing epidemiology and population expectations of care.			
	Al Saedi et al. (2019[108]), Hayslip and Smith (2012[111]), USAID (2013[117])	Biomarkers, self-reported data and surveys		

Note: Darker colouring indicates stronger focus.

Furthermore, the methods used to quantify resilience map onto the Linkov et al. (2018[35]) framework of a tiered approach to resilience analysis, with increasing analytical rigour and fidelity of results from Tier 1 to Tier 3. The field of resilience still focuses primarily on Tier 1 assessments of scorecards and tabletop exercises, even though Tier 3 tools have been developed. Tier 1 qualitative assessments are valuable but lack data-driven objectivity. Nonetheless, stricter quantification of resilience is increasingly evident.

A final similarity is the top-down approach in governance to employ resilience for these sectors. National and international actors have responded to shocks, including the COVID-19 pandemic, by calling for more resilient thinking within relevant systems. These actors include the OECD, the World Health Organization and the World Bank, among others (see Section 2.1).

2.9. Conclusions: Lessons learnt for health system resilience

The key lesson learnt from analysing other sectors is that health systems should apply the same tenets that underlie the characterisation of resilience. The basic principles of resilience are: preparing for, absorbing, recovering from and adapting to adverse events. The question that follows is “what components of resilience are most crucial for health systems?”.

To address this, lessons learnt from both finance and infrastructure sectors can be adopted. In finance, the global financial crisis (2007-08) was the impetus for resilience. As a result, financial systems have operationalised resilience by seeking to prepare for and absorb shocks, especially through stress testing. In the infrastructure sector, disruptions that place transportation networks or energy facilities offline cannot be effectively engineered against. Accordingly, experts focus resilience efforts on recovering from the disruption, and adapting their systems to address future threats.

Health systems can – and should – take a similar approach. In health systems, however, there can be no stage of a disruption cycle left unaddressed. Recovering and adapting from shocks is as important as preparing for and absorbing them. Since each stage of the disruption cycle is equally important and the interactions between these stages are dynamic, one of the outcomes of a resilient health systems should be the movement of critical and scarce supplies and staff for greatest value-added use.

This report seeks to contribute to this ongoing effort by identifying weaknesses in each of the four stages of the disruption cycle and recommending policy responses (see the chapter on key findings and recommendations). All resilience analysis requires stakeholders to adopt a multi-systems view. In the case of the COVID-19 response, what appeared to be a sensible policy of reducing elective procedures to preserve capacity for patients with COVID-19 yielded immense downstream consequences. The health workforce has been left with a heightened burden of care for the foreseeable future, reducing the resilience of health systems (see the chapter on waiting times).

Therefore, health systems should be cognisant of interdependencies when measuring resilience. Tier 2 and Tier 3 tools, such as those used in the finance sector, provide a sound example of the interplay of systems. For example, a financial sector stress test places random stimuli on the system to witness how individual links respond. The health system would benefit from similar analysis of interconnections, such as the links between workforce, available resources and available beds. To make optimal use of an analysis of interconnected variables, however, there must be an effective governance structure around decision making to foster adaptability.

Governance for resilience in other sectors has operated on a top-down basis. Accordingly, health systems should take this into consideration. If policy makers set the vision but do not characterise what achieving the desired outcomes looks like, then noble efforts are for naught. Usually, success in improving resilience requires collaboration between multiple stakeholders, including government, industry, communities and others. Conversely, if a clear vision is not set, objectives are difficult to quantify. Thus, a structured governance agenda for resilience in health systems must be established that sets a clear vision while also bringing together the actors within the system to strive for the shared goal.

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Notes

[1] In some countries, for example, the United States, critical infrastructure has a precise definition. In the United States, it is defined as "[s]ystems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters."

[2] Based on Horton et al. (2022[143]).

3 COVID-19 outcomes across OECD countries

Chris James, Michael Mueller, Tiago Cravo Oliveira Hashiguchi and Philip Haywood

The impact of COVID-19 has been substantially different across OECD countries. This chapter offers an exploratory assessment of the impact of health system capacity and government strategies on COVID-19 outcomes until December 2021. The aim is to provide insights into why certain OECD countries had better outcomes over the first two years of the COVID-19 pandemic (2020-21) and how policy makers can shift their health systems to be better prepared for future challenges. After controlling for core demographic and economic factors, indicators of increased health system capacity and access to high-quality care were associated with better COVID-19 outcomes. Higher COVID-19 vaccination rates were also associated with lower excess mortality, as were certain measures of trust. Health risk factors and social risk factors also influenced outcomes. Beyond national aggregates, the chapter highlights how older people, socially disadvantaged populations, and ethnic minority groups suffered more from the pandemic than others. The main indirect effects of the pandemic are also analysed.

Key findings

COVID-19 has had a substantial negative impact on health. Over 3 million COVID-19 deaths were reported across OECD countries to the end of 2021; all-cause mortality for 2020-21 was higher than the 2015-19 average in all OECD countries with available data (with an average increase in total deaths of 14%); and life expectancy in 2020 fell in 75% of OECD countries. Beyond lives lost, mental well-being deteriorated. Many economies slid into recession. Analysis of key indicators of increased health system capacity and access to high-quality care found the following:

- After controlling for core demographic and economic factors, indicators of increased health system capacity – particularly in terms of health workforce – are associated with better COVID-19 health outcomes. Countries where a high share of the population were employed in the health and social sector had lower COVID-19 and excess mortality rates.
- Access to high-quality care is essential. Countries where the entire population had health coverage for a key set of health services, and where pre-pandemic treatable mortality was low, displayed better health outcomes.
- Vaccination strategy matters. A higher COVID-19 vaccination rate was associated with lower excess mortality.
- Trust also appears to be a factor, with certain indicators of trust in institutions and interpersonal trust associated with lower COVID-19 and excess mortality rates.
- Health risk factors and population health are important. Nationwide obesity levels, alcohol consumption and higher mortality rates from circulatory disease, diabetes and cancer were associated with COVID-19 deaths and/or excess deaths.
- Social risk factors also influence outcomes. Countries in which more of the population face difficulties in making ends meet, or that have higher long-term unemployment rates, had higher COVID-19 and excess mortality rates.
- Beyond national aggregates, older people, socially disadvantaged populations, and ethnic minority groups, suffered more from the pandemic than others. The pandemic also caused massive disruption to health services, a rise in mental health care needs and a significant number of people suffering from post-COVID-19 syndrome or “long COVID”.

Based on these findings, some clear policy implications emerge. First, investing in the health workforce is critical. Second, countries also need to ensure that the entire population has access to high-quality services. Finally, improving people’s underlying health will make them more resilient to future health shocks. Public health policies to reduce major risk factors should therefore be given greater priority.

3.1. Health and other public policies have an impact on COVID-19 outcomes

The pandemic has claimed, and continues to claim, millions of lives. Across OECD countries, more than 3.1 million people have died representing nearly half of the 6.6 million reported global fatalities (as of December 2022). Reported COVID-19 deaths underestimate the true death toll, however, owing to a lack of testing and accurate reporting.

Many more people have died or experienced ill health as a direct or indirect result of the virus, with people living in vulnerable conditions disproportionately hit. The pandemic has placed immense pressure on health services, disrupting health care for people not infected with the virus. COVID-19 has also left many in society mentally scarred by their experiences. In addition to worsening health and well-being, most OECD countries experienced sharp economic recessions – often deeper than during the global financial crisis (2007-08) – because of the pandemic and the policies adopted to slow the spread of the virus.

Behind these aggregate figures, the impact of COVID-19 has been substantially different across OECD countries. These differences reflect both factors beyond the control of policy makers, such as geographical factors or the structural characteristics of economies, and factors more amenable to policy both within and beyond the health system. This chapter offers an exploratory assessment of such differences – particularly the extent to which health system capacity and government strategies during the first two years of the pandemic (2020-21) translated into better COVID-19 outcomes. The purpose of this analysis is to provide insights into why certain OECD countries had better outcomes and how policy makers can shift their health systems to be better prepared for future challenges. The next global health crisis might not be caused by a respiratory virus, so it is essential to understand which insights from the analysis are generalisable and which are more likely specific to the COVID-19 pandemic.

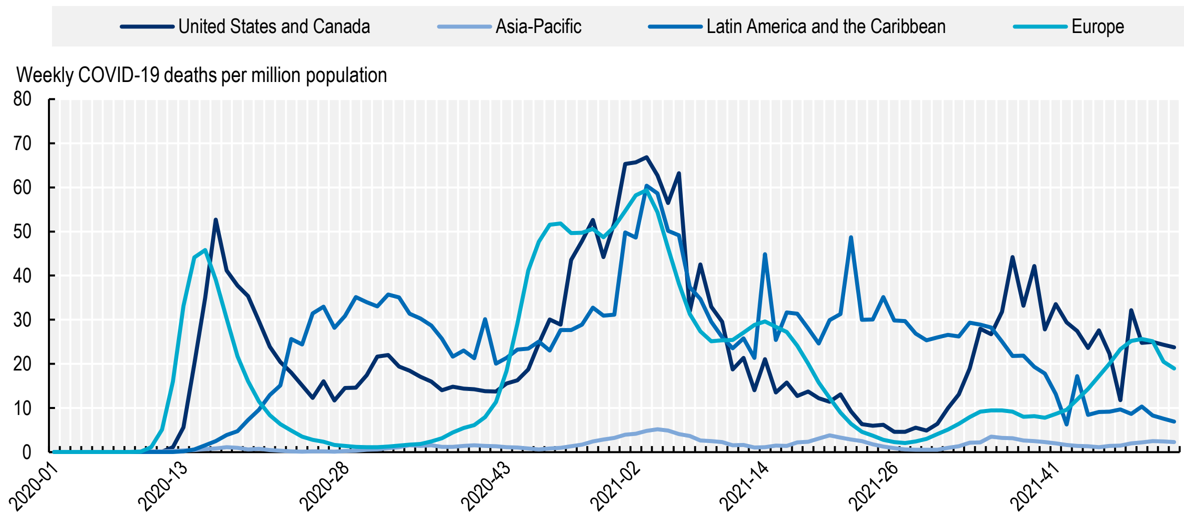
The rest of this chapter is structured as follows. Section 3.2 compares countries' COVID-19 outcomes across a range of health indicators and examines the consequences of disruption to health service provision. Section 3.3 then uses simple quantitative techniques to explore why some countries had better COVID-19 outcomes. The chapter concludes with the main implications of these findings for policy makers.

3.2. The impact of COVID-19 varied across OECD countries

3.2.1. COVID-19 has had a substantial impact on health, well-being and economic activity in OECD countries

Since the outset of the pandemic, there have been several peaks in SARS-CoV-2 infections and associated COVID-19 deaths, with differing impacts across OECD countries over time (Figure 3.1). Reported death rates peaked in late 2020 or early 2021 in most European OECD countries and this trend was similar in Canada and the United States. The situation among the OECD countries in Latin America was more diverse, with reported deaths highest in mid-2020 for Chile, in early 2021 for Mexico, and in mid-late 2021 for Colombia and Costa Rica. In the Asia-Pacific OECD countries, death rates were much lower throughout 2020 and 2021.

Figure 3.1. Weekly reported COVID-19 deaths, OECD countries grouped by region, January 2020 to December 2021



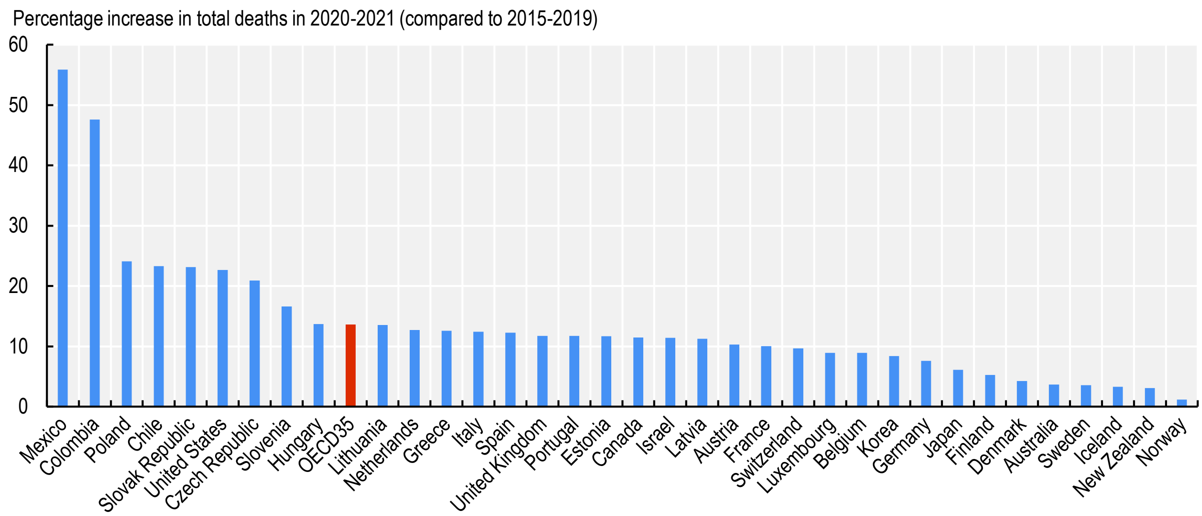
Note: Regional averages are calculated by dividing the total number of cases by total populations. Partly missing data for weeks 51 and 52 of 2021 have been estimated. European Centre for Disease Prevention and Control (ECDC) data use national data sources for non-European countries.
Source: ECDC (2022[1]), COVID-19 datasets, https://opendata.ecdc.europa.eu/covid19/nationalcasedeath/.

The impact of infection waves and associated peaks in fatality has been devastating. By mid-October 2022 (Figure 3.1), nearly 400 million COVID-19 cases and more than 3.1 million COVID-19 deaths had been reported across the 38 OECD countries. By then, cumulative reported COVID-19 death rates totalled around 2 260 per million inhabitants across OECD countries, but with marked cross-country variation. Rates ranged from less than 1 000 deaths per million in Australia, Iceland, Japan, Korea, New Zealand and Norway to over 3 500 deaths per million in the Czech Republic, Hungary and the Slovak Republic.

While the number of reported COVID-19 deaths offers the most direct measure of the number of lives lost to the pandemic, differences in testing capacities, recording, registration and coding practices across countries hamper the international comparability of these figures. Additional indicators to assess the full impact of COVID-19 on population health are therefore useful. The indicator "excess deaths" offers a broader measure, reflecting both the direct and indirect impact of the SARS-CoV-2 virus on mortality, with standardised reporting across OECD countries. It is not affected by capacity limitations to detect COVID-19 fatalities in countries or other differences in the registration of COVID-19 deaths. However, it is not a direct measure of the impact of COVID-19, since it captures all excess deaths in a particular period, irrespective of their cause. This can include other health events, such as exceptional influenza seasons or extreme weather, which have differing mortality impacts across countries.

All-cause mortality for 2020-21 was higher than the average for 2015-19 in all OECD countries with available data (Figure 3.2). The average increase in total deaths was 14% across OECD countries (equivalent to 2 923 excess deaths per million people). Mortality was particularly high in Mexico, which experienced a 56% increase in total deaths (6 094 excess deaths per million) and Colombia, which experienced a 48% increase in total deaths (3 590 excess deaths per million).

Figure 3.2. Excess mortality in 2020-21



Note: Excess mortality is calculated by comparing the average annual deaths in 2020-21 with the annual average for 2015-19. Data for Colombia until week 35-2021 are included. No mortality data are available for Costa Rica, Ireland and Türkiye for 2020-21. OECD average is unweighted. Comparator years to calculate the percentage increase in total deaths are 2015-19.
Source: OECD (2022[2]), *OECD Health Statistics*, https://doi.org/10.1787/health-data-en, based on Eurostat data and national data.

Changes in life expectancy also provide a broader but less direct measure of the mortality impact of the pandemic than reported COVID-19 deaths. In 2020, life expectancy fell in 75% of OECD countries, resulting in a drop in average life expectancy across OECD countries of half a year (from an average of 81.0 years in 2019 to 80.5 years in 2020). The annual reduction was particularly large in the United States (-1.8 years), Spain (-1.6) and Poland (-1.5). While in 2021 life expectancy recovered to some extent in half of OECD countries with available data (14 of 28), it fell by 2.0 years or more in the Slovak Republic, Estonia and Latvia. As a result of these developments, pre-pandemic levels in life expectancy had not been reached in three-quarters of OECD countries by 2021.

Measures of mental well-being and the state of the economy shed further light on the impact of COVID-19 beyond the number of lives lost. Around one in five adults experienced sadness in 2020 and this proportion was typically higher in countries with worse COVID-19 mortality outcomes (Gallup, 2021[3]). Further, except for Ireland and Türkiye, all OECD countries experienced an economic downturn in 2020, mainly due to wide-ranging measures to contain the spread of the SARS-CoV-2 virus. Contractions in GDP were particularly pronounced in Spain (-10.8%), the United Kingdom (-9.3%) and Greece (-9.0%). In 2021, all OECD economies returned to positive GDP growth; consequently, the economic output in 2021 was above pre-pandemic levels (in 2019) in around two-thirds of OECD countries. However, the global economy has since slowed and the economic outlook has worsened (OECD, 2022[4]).

Taken together, these indicators provide a comprehensive overview of COVID-19 outcomes – reflecting not only direct mortality impacts but also indirect mortality impacts, as well as societal and economic effects of the pandemic. Table 3.1 compares OECD countries across selected indicators of mortality, well-being and economic development over 2020-21, using the country dashboard approach used in the OECD Health at a Glance series (OECD, 2021[5]).

Table 3.1. Country dashboard of COVID-19 outcomes, 2020 and 2021

Country	Mortality								Well-being		Economy	
	COVID-19 deaths 2020-21 (per million)		Excess deaths 2020-21 (% change)		Life expectancy (change in years)				Experiencing sadness, 2020 (%)		GDP in 2021 in constant prices (2019 = 100)	
					2020-19		2021-19					
OECD	**1 634**		**13.6%**		**-0.5**		**-0.8**		**22.2%**		**101.6**	
Australia	87	▲	3.7%	▲	0.3	▲			22.0%	—	102.5	—
Austria	1 885	—	10.3%	—	-0.7	—	-0.7	—	24.2%	—	97.5	▼
Belgium	2 440	—	8.9%	—	-1.3	▼	-0.2	—	N/A		100.2	—
Canada	795	—	11.4%	—	-0.6	—	N/A		26.2%	—	99.1	—
Chile	2 007	—	23.3%	▼	0.2	▲	0.4	▲	N/A		104.9	—
Colombia	2 522	—	47.6%	▼	0.1	▲	0.2	▲	34.8%	▼	102.9	—
Costa Rica	1 427	—	N/A		0.1	▲	0.3	▲	31.5%	▼	103.4	—
Czech Republic	3 437	▼	20.9%	▼	-1.0	—	-1.9	▼	21.7%	—	97.3	▼
Denmark	558	▲	4.3%	▲	0.1	▲	-0.1	—	17.4%	—	102.5	—
Estonia	1 454	—	11.7%	—	-0.1	—	-2.1	▼	16.2%	▲	105.4	▲
Finland	310	▲	5.3%	▲	-0.1	—	-0.1	—	13.4%	▲	101.1	—
France	1 836	—	10.0%	—	-0.7	—	-0.5	—	23.9%	—	98.3	—
Germany	1 342	—	7.6%	—	-0.2	—	-0.4	—	23.1%	—	97.8	▼
Greece	1 990	—	12.6%	—	-0.3	—	-1.4	—	27.1%	—	98.6	—
Hungary	4 036	▼	13.7%	—	-0.8	—	-2.0	▼	16.8%	—	102.1	—
Iceland	100	▲	3.3%	▲	-0.1	—	0.0	—	13.2%	▲	97.0	▼
Ireland	1 186	—	N/A		-0.2	—	N/A		22.6%	—	120.0	▲
Israel	887	—	11.4%	—	-0.2	—	-0.3	—	N/A		105.7	▲
Italy	2 319	—	12.4%	—	-1.3	▼	-0.7	—	29.4%	▼	96.9	▼
Japan	148	▲	6.1%	▲	0.3	▲	N/A		11.2%	▲	97.0	▼
Korea	109	▲	8.4%	—	0.2	▲	N/A		14.8%	▲	103.1	—
Latvia	2 439	—	11.3%	—	-0.2	—	-2.3	▼	15.9%	▲	100.7	—
Lithuania	2 654	▼	13.5%	—	-1.4	▼	-2.0	▼	19.2%	—	104.9	—
Luxembourg	1 431	—	8.9%	—	-0.5	—	0.1	—	N/A		105.0	—
Mexico	2 363	—	55.9%	▼	0.1	▲	N/A		30.5%	▼	96.2	▼
Netherlands	1 200	—	12.7%	—	-0.8	—	-0.7	—	17.0%	—	101.0	—
New Zealand	9	▲	3.1%	▲	0.2	▲	N/A		18.5%	—	104.1	—
Norway	242	▲	1.2%	▲	0.3	▲	0.2	▲	16.5%	—	103.1	—
Poland	2 534	—	24.1%	▼	-1.5	▼	-2.4	▼	22.8%	—	103.7	—
Portugal	1 842	—	11.7%		-0.8	—	-0.7	—	25.6%	—	96.0	▼
Slovak Republic	3 054	▼	23.2%	▼	-0.8	—	-3.0	▼	21.5%	—	98.5	—
Slovenia	2 637	—	16.6%	—	-1.0	—	-0.7	—	17.7%	—	103.5	—
Spain	1 883	—	12.2%	—	-1.6	▼	-0.7	—	27.1%	—	93.8	▼
Sweden	1 463	—	3.6%	▲	-0.8	—	0.0	—	18.3%	—	102.5	—
Switzerland	1 406	—	9.7%	—	-0.9	—	0.0	—	16.1%	▲	101.1	—
Türkiye	972	—	N/A		N/A		N/A		49.5%	▼	113.0	▲
United Kingdom	2 636	—	11.7%	—	-1.0	—	N/A		25.4%	—	97.5	▼
United States	2 450	—	22.7%	▼	-1.8	▼	N/A		24.8%	—	102.1	—

Note: ▲ Better than the OECD average; — Close to OECD average; ▼ Worse than the OECD average. The classification of countries being close to, better or worse than the OECD average is based on an indicator's standard deviation (a common statistical measure of dispersion). Countries are classified as close to the OECD average (blue) whenever the value for an indicator is within one standard deviation from the OECD average. Particularly large outliers (more than three standard deviations) are excluded from calculations of the standard deviation to avoid statistical distortions – notably Türkiye for experiencing sadness, Colombia and Mexico for excess mortality and Ireland for GDP growth.
Source: Authors' analysis of Our World in Data, OECD Health Statistics 2022, Gallup, OECD Economic Outlook June 2022.

Correlations across most of these COVID-19 outcome indicators are statistically significant and in the expected direction (*P*-value<0.05). While correlation is not causation, they suggest that COVID-19 outcomes may not be independent. For example, Korea, New Zealand and Norway had comparatively good outcomes across mortality, well-being and economic indicators. Conversely, countries with higher reported COVID-19 death rates also typically had larger increases in excess deaths, more pronounced reductions in life expectancy, a greater share of the population experiencing sadness and larger contractions in GDP. Nevertheless, correlations between these COVID-19 outcomes were not always strong. For example, Mexico had reported COVID-19 death rates only slightly above the OECD average but the highest increase in excess deaths. Moreover, while a statistically significant negative correlation between COVID-19 deaths or excess mortality and economic activity can be observed for 2020, this was not true for 2021. Such results reflect the many different factors that influence economic growth in a country, including the structure of the economy, its reliance on exports, exchange rates and the impact of supply chain problems.

3.2.2. Older people and socially disadvantaged groups were hit harder by the pandemic

Beyond these national-level comparisons, certain population groups within countries face a much higher risk of severe illness or death from COVID-19 (Dessie and Zewotir, 2021[6]). In particular, the vast majority of deaths from COVID-19 have occurred in older populations. Residents of long-term care facilities have been especially vulnerable to contracting and dying from COVID-19 – particularly during the early stages of the pandemic. The chapter on long-term care analyses some of these at-risk groups and shows that:

- More than 90% of reported deaths were among individuals aged 60 years and over, with around half of all deaths occurring among people aged 80 years and over, across 22 OECD countries with comparable data. These proportions have remained relatively stable over the course of the pandemic.
- COVID-19 mortality among older people was particularly high in Slovenia, the United Kingdom, the United States and Belgium, where more than 2.5% of those aged 80-85 years and over have died (data up to May 2021) (Rocard, Sillitti and Llena-Nozal, 2021[7]).
- Long-term care residents accounted for around one-third of total COVID-19 deaths on average in 25 OECD countries with available information (data up to April 2022). Compared to 2020 and 2021, this share decreased in nearly all OECD countries, reflecting strengthened efforts to contain the virus and to protect residents in long-term care facilities, and prioritisation of long-term care residents and staff in countries' COVID-19 vaccination schedules.

While age remains the largest risk factor, people of all ages with certain underlying health conditions face an elevated risk, including those with obesity, diabetes, hypertension, cancer and chronic obstructive pulmonary disorder. Smoking and harmful alcohol use also increase the likelihood of dying from COVID-19 (Dessie and Zewotir, 2021[6]; Katz, 2021[8]; Reddy et al., 2021[9]; Sanchez-Ramirez and Mackey, 2020[10]) (see the chapter on care continuity).

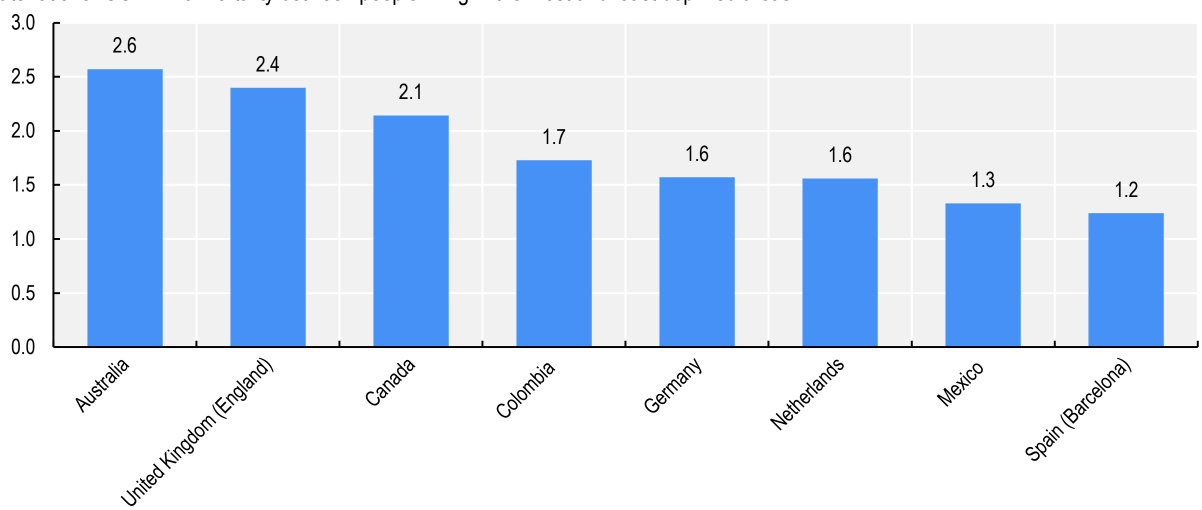
Both these risk factors and the risk of COVID-19 infection are not equally distributed: individuals that live in socially disadvantaged conditions have been at higher risk of infection, severe illness and death throughout much of the pandemic. For example, among OECD countries with available data, individuals living in socially deprived areas faced a 20% to 160% increased risk of dying from COVID-19 during the first year of the pandemic (Figure 3.3). A higher likelihood of infection and worse health outcomes were also found among people on lower incomes and with lower educational attainment. For example, in Canada, Sweden and the Netherlands, people in the lowest income group are between 1.4 times and 1.8 times more likely to die from COVID-19 (Berchet, forthcoming[11]). The pandemic also revealed demographic and ethnic inequalities: in six OECD countries with available data, foreign-born populations had a mortality risk that was 1.1-2.2 times higher than the risk of those born within the country. In eight

OECD countries, studies have shown substantial differences in mortality rates across ethnicity, with ethnic minority populations experiencing significantly worse outcomes.

Many interrelated causes may explain the unequal health toll of the pandemic. Populations living in disadvantaged social and economic contexts were at a higher risk of exposure to the virus through their working and living conditions. These individuals also accumulate risk factors that put them at higher risk of developing severe COVID-19 symptoms or dying from COVID-19, such as chronic health conditions, obesity and smoking. Crisis standards of care implemented during the pandemic (a move from delivering appropriate care to each individual to ensuring that the most lives are saved) risk embedding such health inequities (see the chapter on critical care surge for further discussion). Further, many of these individuals are already more likely to face barriers to accessing health care.

Figure 3.3. Relative mortality ratio for people living in deprived areas

Rate ratio for COVID-19 mortality between people living in the most and least deprived areas



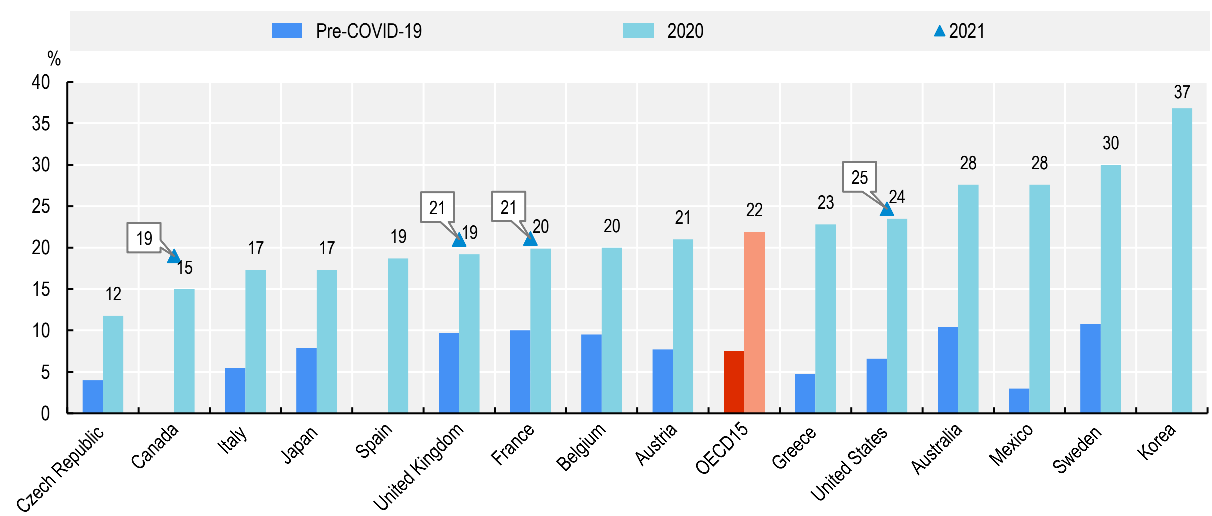
Note: Data are not directly comparable across OECD countries and regions – while the rate ratio is age-adjusted or multivariate methodology used in all countries, the timeframe of observation differs. For example, in Australia the data cover the first year of the pandemic to May 2021, while in Canada data cover the period January-August 2020.
Source: OECD Health Secretariat based on data in Berchet (forthcoming[11]), "Socio-economic and ethnic health inequalities in COVID-19 outcomes across OECD countries".

3.2.3. COVID-19 caused substantial disruption to health services, and long-term impacts are still emerging

The pandemic has led many people to experience prolonged ill health and caused massive disruptions to health systems. Levels of anxiety and depression, as well as other symptoms of poor mental health, have consistently been higher during the pandemic than before COVID-19. This reflects a range of factors, including a fear of infection, the rise in economic uncertainty during lockdowns and greater social isolation due to measures to contain the spread of the virus (Figure 3.4). The prevalence of mental health conditions has fluctuated during the pandemic, associated with the stringency of containment measures and the severity of the pandemic (OECD, 2021[12]). In response, most OECD countries reported permanent increases to mental health care support or capacity. However, these increases were not always commensurate with the rise in needs (see the chapter on mental health for analysis of the impact and associated policies).

The mental health of some population groups has been particularly affected by the pandemic. Young people, those living alone, people with lower socio-economic status and those who are unemployed have all had higher rates of mental health issues. In Canada, for example, a survey in May 2020 found that 27% of those aged 15-24 years were experiencing moderate to severe symptoms of anxiety – significantly above the 19% share among those aged 25-64 years (Statistics Canada, 2020[13]). In Japan, 31% of those aged 20-29 years were experiencing symptoms of depression, compared to 18% of older adults, based on survey responses from July 2020 (Fukase et al., 2021[14]). The higher share of young people experiencing anxiety and depression contrasts with pre-pandemic data, indicating that the mental health of young people has been disproportionately affected during the pandemic.

Figure 3.4. Share of the population suffering from depression or showing symptoms of depression



Note: To the extent possible, 2020 prevalence estimates were taken from March-April 2020, and 2021 estimates were taken from March-April 2021. The survey instruments used to measure depression and population samples differ between countries and in some cases across years, which limits direct comparability. Most national surveys cover the adult population aged over 18 years.
Source: National data sources reported in OECD (2021[12]), "Tackling the mental health impact of the COVID-19 crisis: An integrated, whole-of-society response", https://doi.org/10.1787/0ccafa0b-en.

A substantial share of people who survive a COVID-19 infection experience various health symptoms for an extended time. Post-COVID-19 syndrome or "long COVID" has led to many people experiencing fatigue, breathlessness and other symptoms that impede a return to normal life, with potentially long-lasting social and economic repercussions. The causes of "long COVID" are still not fully understood and there are differences in the notion of how it should be defined. In this context, the World Health Organization (WHO) now refers to "post-COVID conditions" to describe symptoms that exist three months after the onset of COVID-19, that last for at least two months, and that cannot be explained by any other diagnosis (WHO, 2021[15]). While evidence of the prevalence of these conditions varies widely (depending on the study design, study group, timing of the study, length of symptoms and other factors), results from some larger-scale research gives a sense of the magnitude of "long COVID":

- Large-scale population surveys regularly carried out in the United Kingdom and the United States found that 2% and 7.5% of the population were suffering from "long COVID" symptoms that lasted for at least 12 weeks in mid-2022 after a confirmed or suspected COVID-19 infection (Office of National Statistics, 2022[16]; Centers for Disease Control and Prevention, 2022[17]). For the United States, this equates with 19% of those who have had COVID-19 in the past.
- Electronic health records from over 270 000 COVID-19 survivors, mainly from the United States, found that 37% of patients suffer from at least one "long COVID" symptom 4-6 months after diagnosis (Taquet et al., 2021[18]). Summarising study results across Europe, the United States and

the People's Republic of China, Rajan et al. (2021[19]) suggest a lower prevalence of about one in ten experiencing symptoms after 12 weeks.

- Certain population groups appear to be at higher risk of "long COVID": symptoms are associated with age, being female, obesity, prior hospitalisation for COVID-19 and the number of symptoms in the acute phase (Rajan et al., 2021[19]).

The pandemic has also had major knock-on effects on people with other health care needs. The pressure on health systems to cope with COVID-19 has led to disrupted access to care at all levels of the health system – particularly early in the pandemic. Some of these disruptions are highlighted below and analysed further in other chapters in the report.

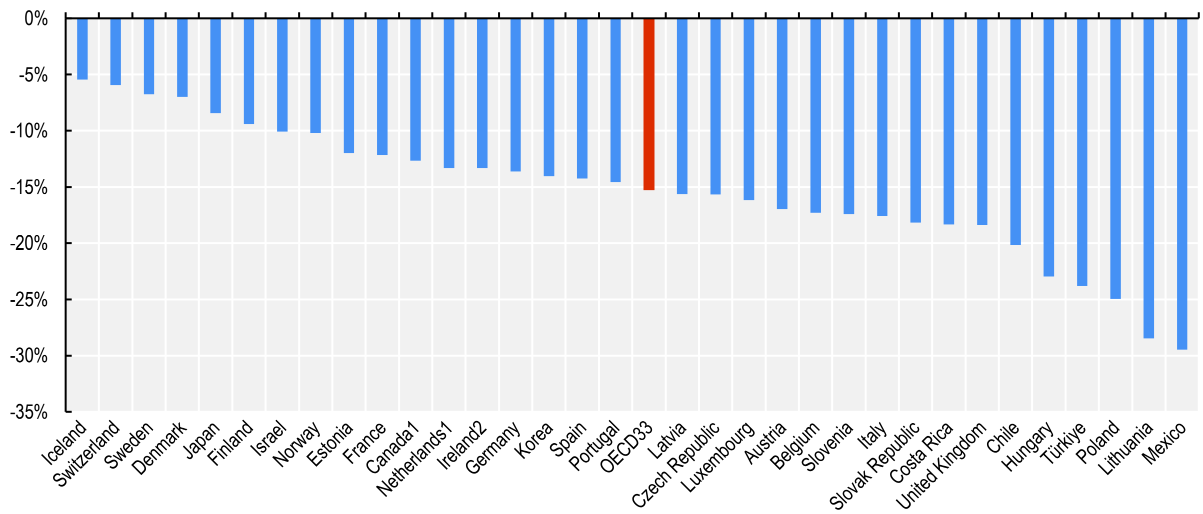
Reduced outpatient consultations, although this was offset to some extent by increased teleconsultations

The number of in-person consultations with doctors (in all settings) fell in 27 of 28 OECD countries in 2020, with an average reduction of 17%. In all five countries with available data for 2021, the number of face-to-face consultations remained below pre-pandemic levels. The drop in visits is also true for primary care, where monthly activity data for a smaller set of countries – including Australia, Belgium and Portugal – suggest a substantial fall in consultations, in particular between March and May 2020. However, reductions in in-person consultations were offset in part by a rise in use of teleconsultations. Data from a Eurofound Survey suggest that, since the start of the pandemic, across the European Union nearly 30% of people had a medical consultation online or via telephone by mid-2020, with this share reaching nearly 40% by early 2021 (see the chapter on care continuity).

An unprecedented fall in hospital inpatient activity due to policies to reserve hospital and intensive care capacity for COVID-19 patients

In all 33 OECD countries for which data are available, the total number of discharged patients per capita in 2020 was below the level of 2019 (Figure 3.5). On average, inpatient activity dropped by 15%. The reduction in activity was particularly marked for elective interventions. Across 30 OECD countries, nearly 4 million fewer elective surgical procedures (e.g. cataract surgery, hip and knee replacements and other non-urgent surgery) were performed in 2020 compared with 2019. This equates to average reductions of 16% in hip replacements and 27% in knee replacements across countries, although with wide cross-country variations (see the chapter on waiting times).

Figure 3.5. Total number of hospital discharges per capita in OECD countries, 2020 compared to 2019



1. Includes discharges for curative (acute) care only.2. Excludes activity in private hospitals.
Source: OECD (2022[2]), *OECD Health Statistics*, https://doi.org/10.1787/health-data-en.

Suspended elective care and diagnostics generated backlogs, leading to longer waiting times and waiting lists

Even before the pandemic, waiting times for elective surgery had started to rise in several countries (including Canada, Ireland, the Netherlands, New Zealand, Portugal and the United Kingdom), indicating that supply was not keeping up with demand. The disruption of services during the pandemic further increased this imbalance between supply and demand for elective surgery. Among the 17 OECD countries that record the data, the waiting time for surgery increased on average by 56 days for hip replacements and 69 days for knee replacements between 2020 and 2019. This rise was particularly pronounced in Poland, Portugal and Lithuania. Given existing capacity constraints, clearing the backlogs in a timely manner will be challenging in many countries. For example, in England (United Kingdom), research has projected that it will take until March 2025 to return to pre-pandemic waiting times (see the chapter on waiting times).

Disruptions occurred to cancer screening, diagnosis and treatment

For breast cancer, screening rates fell in 22 of 24 countries in 2020, and the average screening rate among women aged 50-69 years dropped from 60% to 55%. In five out of six countries with preliminary data for 2021, pre-pandemic levels had not been reached. Fewer screenings led to reduced levels of diagnostic activity, and a consequent decline in new cancer diagnoses in all 12 OECD countries with available data (Fujisawa, 2022[20]). Moreover, the number of cancer-related procedures also fell in 2020 for all six OECD countries with available data (see the chapter on care continuity).

As a result of service disruptions across health systems, levels of unmet need were high

On average across 22 OECD countries with comparable data, more than one in five people reported having forgone a needed medical examination or treatment during the first 12 months of the pandemic. This may be explained in part by patients postponing treatment voluntarily out of fear of exposure to the virus in health facilities, or in order not to overload the health system (see the chapter on care continuity).

People living with chronic health conditions were particularly affected

For example, among people aged 50 years and over in Europe, those with chronic conditions were on average over 40% more likely to report forgoing or postponing medical care due to COVID-19. Across 11 OECD countries, a study by the Commonwealth Fund found that around one-fifth of multi-morbid patients over the age of 65 years had an appointment with a health care professional cancelled or postponed because of the SARS-CoV-2 virus (see the chapter on care continuity).

Provision of mental health care was also disrupted

A WHO survey in the second quarter of 2020 found that up to 70% of countries worldwide reported disruptions in different types of mental health services, with community-based day care services most affected (WHO, 2020[21]). In OECD countries, this is likely to reflect both increased demand for mental health support and an increase in unmet need for mental health care. In a Commonwealth Fund survey conducted between March and May 2020, among those reporting a need for mental health care, 68% of adults in the United Kingdom and 69% in the United States reported not being able to obtain such care (Commonwealth Fund, 2020[22]) (see the chapter on mental health).

Service provision for long-term care recipients was also adversely affected

About 20% of older people who regularly received personal care from professionals or relatives (living outside their household) reported forgone or postponed care in 2021 in 23 OECD countries with available data (see the chapter on long-term care).

While some of these disruptions may have been short-lived, in many cases they extended the suffering of patients and may have contributed, or continue to contribute, to worse health outcomes. Hence, it will take years to assess the full impact of service disruptions due to COVID-19.

3.3. Why did some countries have better COVID-19 outcomes?

3.3.1. Differences in COVID-19 outcomes depend on factors within and beyond the control of policy makers

In assessing cross-country differences in COVID-19 outcomes,[1] it is important to emphasise that countries had different starting points and baselines – notably in terms of overall population health, health system capacity and pandemic preparedness, as well as relevant demographic, economic, institutional and geographical factors. These baseline characteristics determine how vulnerable a specific country is to a health emergency and they can affect how countries absorb and recover from challenges. Ultimately, they also impact the resilience of a country and how well it can endure a major health shock like COVID-19.

Table 3.2 illustrates some of the main factors that can explain why some countries had better COVID-19 outcomes, drawing from the emerging literature. For example, Bollyky et al. (2022[23]), Hradsky and Komarek (2021[24]) and Kapitsinis (2021[25]) all use multivariate analysis to explore potential explanatory factors. A distinction is made between COVID-19-specific responses, wider health system policies and other public policies. Explanatory factors are also categorised by the degree to which they are or are not amenable to policy interventions, including the likely timeframe in which policies can have an effect. For example, a country cannot become an island, and while it can reduce income inequalities, this cannot be achieved in the short term. In contrast, expanding health system capacity can, with the right measures in place, potentially be achieved in the short to medium term.

Table 3.2. Baseline country characteristics and factors more amenable to public policy

Factors influenced by COVID-19-specific policies (health and broader public policies)	
Short-term	**Government COVID-19 responses/strategies** Vaccination, non-pharmaceutical containment and mitigation measures, surge capacity
Factors influenced by health system policies	
Short to medium-term	**Health system characteristics** Workforce, hospital, laboratory and surveillance capacities, access and quality of care
Medium-term	**Population health status** Disease prevalence and risk factors (e.g. prevalence of chronic health conditions)
Factors influenced by broader public policies	
Long-term	**Socio-economic characteristics** Social risk factors (e.g. social deprivation, poverty rates, income inequality)
Long-term	**Economy** Level of economic development, structure of economy (e.g. importance of tourism industry)
Long-term	**Trust in institutions and interpersonal trust** Trust in government, science and the rule of law; interpersonal trust (social cohesion, nature of social interactions)
Factors largely beyond the control of policy makers	
	Population Demography, population density, population size
	Geography Island state/connectedness, climate, altitude, latitude

Note: Based on authors' analysis of the literature.

The quantitative analysis in this section focuses on the extent to which certain health and health system characteristics and government responses to the pandemic – that is, the first three rows in Table 3.2— are associated with COVID-19 outcomes. Such analysis compares countries in relative terms, examining how countries perform relative to baseline characteristics, and is therefore crucial for shaping policy recommendations. It provides additional insights to the more absolute cross-country comparisons in the previous section, where comparisons of COVID-19 outcomes were made without such adjustments. This chapter does not define "good performance" in the sense of a level above or below which a country is found to be performing well or not. Rather, the focus is on relative performance. Further details on the methods and data used are provided in Box 3.1 and in Annex 3.A.

Box 3.1. Overview of methods used to measure and explain differences in outcomes across OECD countries

The quantitative analysis compares national level COVID-19 outcomes across OECD countries, and the extent to which health system capacity and policies affect these outcomes. Data predominantly come from OECD databases. Indicators relate to health and health systems, and to governments, societies and economies. These have the benefit of harmonised collection and reporting processes.

However, there are only 38 OECD member countries, and so only a maximum of 38 observations at any given point in time – not enough to allow the testing of all potentially relevant variables. Therefore, variable selection focuses on those with data available for all or most OECD countries.

- COVID-19 **outcome** variables are mortality (cumulative COVID-19 and excess death rates, change in life expectancy), well-being (population experiencing sadness) and economy (GDP growth). Regression analyses focus on cumulative COVID-19 and excess death rates.

Possible explanatory variables for these COVID-19 outcomes are categorised into seven main groups. These reflect the main causal factors hypothesised in the literature, as in Table 3.2, while also considering sufficient data availability. The groups are:

- **government responses and strategies to COVID-19**: vaccination rates
- **health system characteristics**: workforce, hospital, laboratory/surveillance capacities, access and quality of care
- **population health status**: disease prevalence, health risk factors
- **socio-economic characteristics**: social risk factors
- **economy**: level of economic development
- **trust**: degree of trust in institutions and interpersonal trust
- **population**: demography.

Other than for specific government responses and strategies to COVID-19, data reflect a pre-pandemic baseline (2018 or 2019) to enable analysis of the underlying capacities and characteristics of countries. See Annex 3.A for further details on variables used.

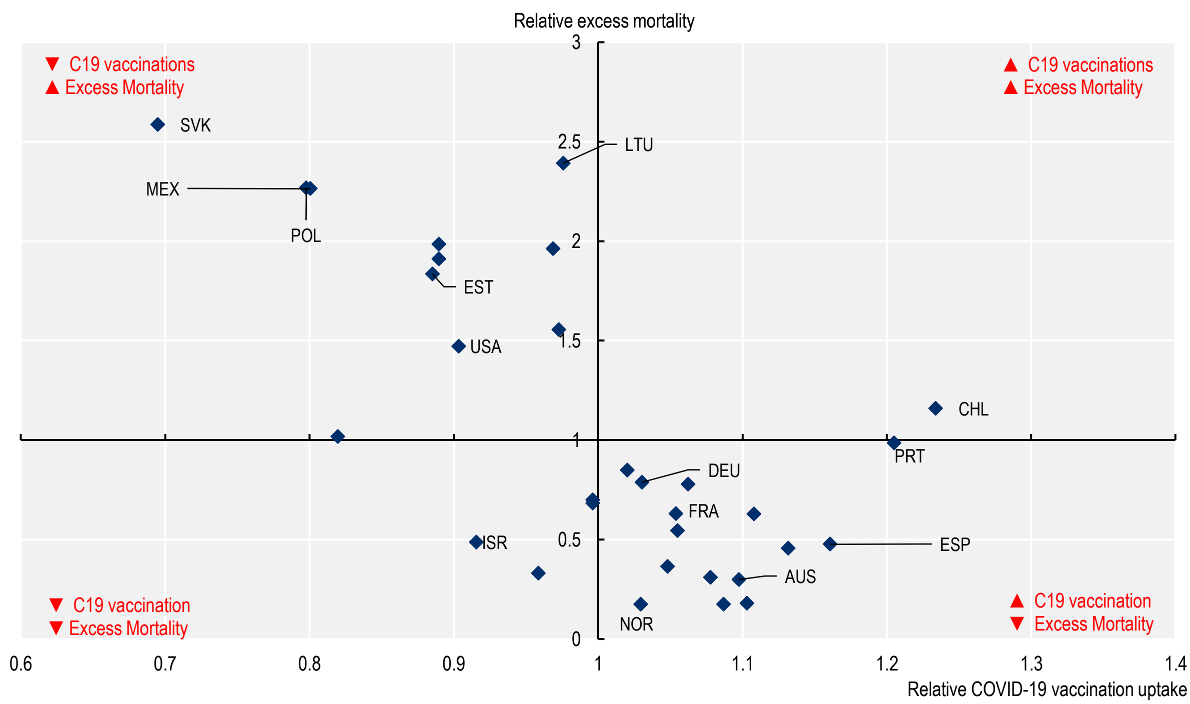
Associations between COVID-19 outcome variables and explanatory variables are first explored through simple pairwise correlations. Further controls are then made for GDP per capita and the share of the population aged 65 years and over. The approach is to run a battery of "partial" multivariate regressions, each analysing one variable of interest and including these two controls. This approach, adopted due to the small sample size, is methodologically more limited than a "full" multivariate regression model, where all relevant variables are included in a single multivariate regression. Such regressions are run for COVID-19 outcomes at the end of both 2020 (which can be considered a pre-vaccine period) and 2021. Note that explanatory variables are log-transformed (zero values are adjusted by adding 5% of the median value across countries for that variable). COVID-19 death rates are also log-transformed in the same way, but excess mortality is left unadjusted, since values can be negative. It is important to reiterate that associations do not imply causality.

Correlations and this partial multivariate regression analysis are supplemented by statistical clustering approaches, to help shed light on what countries that had better (or worse) COVID-19 outcomes have in common. K-means clustering is used to group countries, with countries clustered on cumulative COVID-19 death rates (at the end of 2021), cumulative excess mortality rates (at the end of 2021), the combination of COVID-19 death rates and excess mortality, and on indicators of baseline health system capacity identified in multivariate regressions as statistically significant (P-value<0.05). Selection of the number of clusters was based on the kink in the curve generated from the within-sum of squares of the clusters (Makles, 2012[26]). For the unidimensional clusters the chosen allocation was based on minimising the sum of the within-cluster sums of squared deviations. The results of the K-mean clustering on cumulative COVID-19 mortality between January 2020 and December 2021 are presented.

3.3.2. How have vaccines and other government strategies translated into better COVID-19 outcomes?

Vaccinations have been central to government efforts to combat the pandemic, reducing the risk of severe illness and death from COVID-19. Yet progress in vaccination coverage has varied markedly across OECD countries. Simple correlation analysis shows that countries with higher vaccination rates had, on average, lower excess mortality. Figure 3.6 plots completed initial vaccination schedules at the end of 2021 against excess mortality in 2021.

Figure 3.6. Higher vaccination rates are associated with lower excess mortality



Note: The quadrant chart shows the association between COVID-19 vaccination rates and excess mortality. The x-axis shows how much a country is above or below the OECD average for completed initial vaccination schedules per 100 at the end of 2021; the y-axis shows a country's distance from the OECD average excess mortality rate in 2021 (OECD average normalised to 1). Note that this analysis does not adjust for other factors; nor does it necessarily infer causality. Vaccination reported as of 31 December 2021 or nearest preceding date.
Source: OECD Statistics 2022 and OECD analysis of Our World in Data.

Among the 32 OECD countries with available data, 16 had higher vaccination rates and lower excess mortality than the OECD average (bottom right quadrant). A further 11 countries had lower vaccination rates and higher excess mortality (top left quadrant). A few countries deviate from this association, reflecting the complex determinants of excess mortality and differences in the speed and nature of vaccination coverage. For example, Chile had vaccination rates above the OECD average but higher excess mortality; Israel had slightly lower vaccination rates but lower excess mortality.

It is important, therefore, to go beyond simple pairwise correlations. After controlling for core demographic and economic factors, the positive association between vaccination and excess deaths is confirmed – countries with higher shares of their populations fully vaccinated and with more total vaccinations per capita had lower cumulative excess death rates at the end of 2021. For cumulative COVID-19 death rates, however, the association with vaccination variables was in the same direction, but the associations were not statistically significant at the 95% level. Supplementary regressions analyse the extent to which vaccination coverage is associated with health system characteristics and trust variables (Box 3.2).

Box 3.2. Exploring differences in COVID-19 vaccination rates across OECD countries

While the focus of this chapter is on analysing the impact of health and other public policies on COVID-19 outcomes, auxiliary regressions were run to explore what factors are associated with COVID-19 vaccination rates. Bivariate analysis found that greater health workforce capacity, higher influenza vaccination rates for older populations, trust in science, and better access to and quality of care, were all significantly associated (P-value<0.05) with higher vaccination rates across OECD countries. Only the influenza vaccination rate was significantly associated with higher COVID-19 vaccination rates when the control variables of GDP and age were added.

Alongside COVID-19 vaccination coverage, multiple studies have explored whether other government responses and strategies were associated with COVID-19 outcomes (Chiesa et al., 2021[27]; Yuan and Blakemore, 2022[28]; Dergiades et al., 2022[29]; Haug et al., 2020[30]; Oliu-Barton et al., 2021[31]). These studies focus mainly on the first wave of COVID-19 cases. A recent effort by Dergiades et al. (2022[29]), using daily data on the stringency of policies in 32 countries (including 22 OECD countries), found that the more stringent government interventions were – at an early stage in the pandemic – the more effective they were in slowing down or reversing the growth rate of COVID-19 deaths. In a descriptive analysis with similar findings, Oliu-Barton et al. (2021[31]) suggest that countries that aimed for elimination (or suppression, or zero COVID-19) early on fared better than countries that opted for mitigation, in terms of health outcomes and the economy. Both these studies analysed the early waves of the pandemic. The situation was different by the second half of 2022, as most OECD countries had moved away from more stringent elimination or containment strategies.

3.3.3. Do health system characteristics have an impact on COVID-19 outcomes?

Health systems with greater capacity should be better placed to monitor the virus and treat people who are severely ill from COVID-19, and consequently to have better COVID-19 outcomes, all else being equal. In particular, the pandemic caused many people to be hospitalised. Many of those requiring inpatient care needed treatment in intensive care units, which have high staffing and equipment requirements. Primary health care also played a crucial role in keeping patients with milder symptoms out of hospitals. Therefore, countries with more health workers and more hospitals/hospital beds should be better able to cope with sudden surges in COVID-19 patients, while also being better able to maintain health care services for non-COVID-19 patients. As well as workforce and hospital capacity, advanced laboratory infrastructure and surveillance capacity improves monitoring of the virus. At the same time, ease of access to these services, and the quality of care received, can also be expected to affect COVID-19 outcomes.

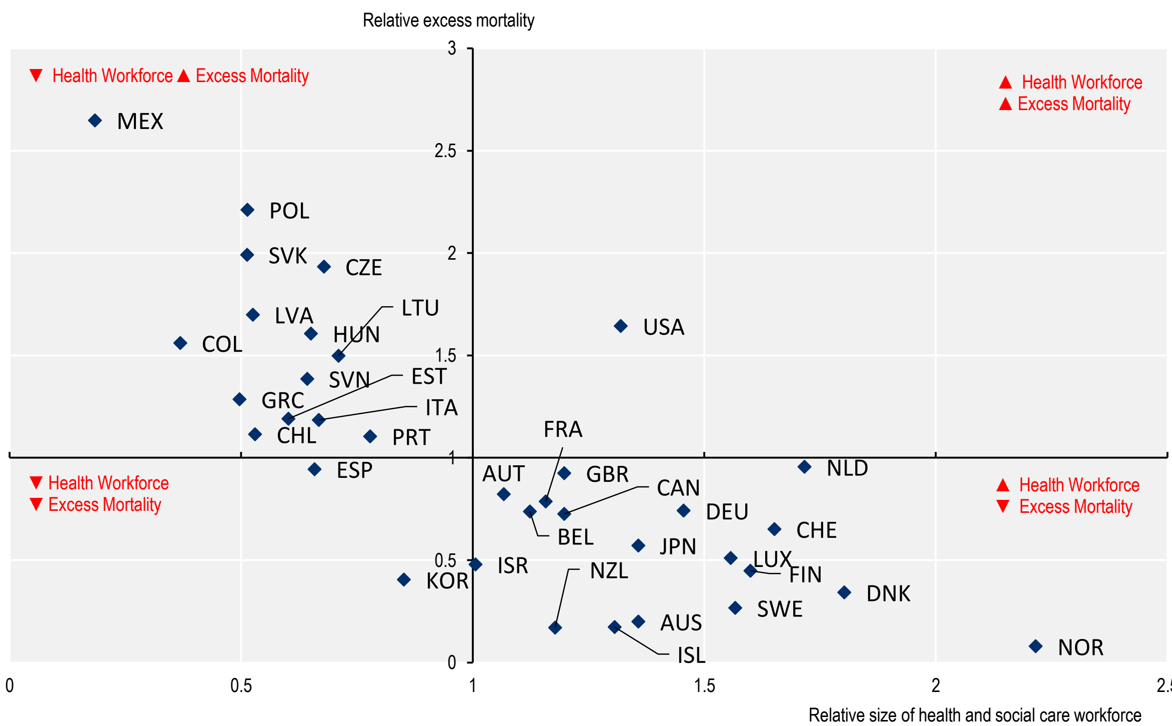
Several recent studies have found that countries with more medical professionals, more hospital beds, and better access to care, are associated with better COVID-19 outcomes – see, for example, Bayraktar et al. (2021[32]), Giancotti et al. (2021[33]), Liu and Eggleston (2022[34]), Kapitsinis (2021[25]) and Diaz Remirez et al. (2021[35]). Quantitative analysis of data for OECD countries are largely consistent with these findings from the literature, although with important nuances on which specific aspects of health system capacity appear most strongly associated with COVID-19 outcomes.

Indicators of health workforce capacity are associated with COVID-19 outcomes

Across OECD countries, higher numbers of health and social care workers serving the population were significantly associated with better outcomes (lower mortality) during 2020-21 (Figure 3.7). Among 35 OECD countries with available data, 18 countries had more health and social care workers and lower excess mortality than the OECD average (bottom right quadrant). A further 14 countries had fewer staff and higher excess mortality (top left quadrant).

Other simple correlations are also indicative of the importance of health workforce capacity. For instance, countries with higher remuneration of hospital nurses and specialists, more practising physicians and more nursing graduates also typically had better COVID-19 outcomes, all else being equal.

Figure 3.7. Increased numbers of health and social care employment associated with lower excess mortality



Note: The quadrant chart shows the association between the health workforce and excess mortality. The x-axis shows how much a country is above or below the OECD average for total health and social employment in 2019 (per 1 000 population); the y-axis shows a country's distance from the OECD average excess mortality rate for 2020-21 (OECD average normalised to 1). Note that this analysis does not adjust for other factors; nor does it necessarily infer causality. Health workforce figures for 2018 were used in the analyses.
Source: OECD Health Statistics 2022.

Analysis that controls for core demographic and economic factors confirms the relevance of health workforce capacity and other health system characteristics

Controlling for GDP per capita and the population share aged 65 years and above, analysis largely confirms the association of several health workforce indicators with COVID-19 outcomes, although it is important to reiterate that associations do not automatically imply causality (Table 3.3). Analyses also point to the importance of hospital capacity, laboratory and surveillance capacity, and certain indicators of access and quality of care. The results are, however, nuanced. While countries with more hospitals per capita typically had better COVID-19 outcomes, the number of hospital beds did not have a statistically significant association with COVID-19 or excess deaths for 2020 or 2021. Such results could imply that countries with fewer hospital beds were able to increase surge capacity or find alternative ways to cope with surges in demand for health care, or that they had strong primary health care systems.

Other indicators of health system capacity and health policy levers were not statistically significant. This was the case, for example, with total health expenditure – indicating, perhaps, that while health workforce and hospital, laboratory and surveillance capacity are important, other health spending components are less relevant for COVID-19 outcomes once GDP was controlled for, or that substantial inefficiencies exist. The empirical literature produces ambiguous results on the impact of health expenditure on COVID-19 outcomes – see, for example, Kapitsinis (2021[25]) and Canatay, Emegwa and Talukder (2021[36]).

Table 3.3. Impact of health system characteristics on COVID-19 outcomes after controlling for core economic and demographic factors

Share of the population aged 65 years and over and GDP per capita in 2018 included as control variables. Only variables with statistically significant (*P*-value<0.05) associations in at least one regression are shown.

Health system characteristics (capacity and access/quality indicators)		COVID-19 deaths	Excess deaths
Health system capacity			
Health workforce capacity	Total health and social employment (over 1 000 population)	↓↓ (both years)	↓↓ (both years)
	Total health and social employment (% of total employment)	↓ (2021)	↓↓ (both years)
Hospital capacity	Hospitals (per million population)	↓↓ (both years)	(not significant)
Health system access and quality indicators			
Access to care	Population coverage for a core set of services (%)	↓ (2021)	↓ (2021)
Access and quality of care	Treatable causes of mortality (per 100 000 population)	↑↑ (both years)	↑ (2021)

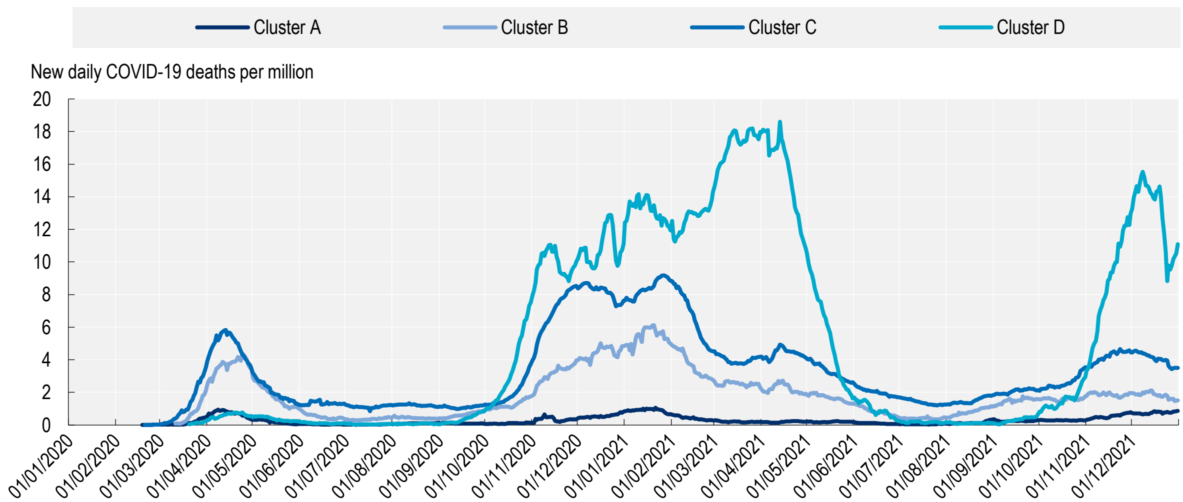
Note: Rates are cumulative to the end of 2021. An up arrow indicates positive coefficient, with ↑↑ for both 2021 and 2020, and ↑ only for the year indicated; a down arrow indicates negative coefficient, with ↓↓ for both 2021 and 2020, and ↓ only for the year indicated: statistically significant with *P*-value<0.05. See Annex 3.A for more detailed information on these and other variables included in multivariate regression analyses.
Source: OECD analysis of OECD Health Statistics, Our World in Data and OECD Short-Term Economic Indicators.

Countries with better COVID-19 outcomes tend to have greater health system capacity

To help understand what countries that performed better (or worse) during COVID-19 have in common, it is informative to group countries based on both COVID-19 outcomes and health system characteristics. To do so, this chapter employs statistical clustering techniques (as described in Box 3.1) and four clusters were identified. Countries in group A performed best, with the lowest mortality from COVID-19, while countries in group D had the highest COVID-19 mortality rates.

Australia, Denmark, Finland, Iceland, Japan, Korea, New Zealand and Norway are included in Cluster A. Canada, Costa Rica, Estonia, Germany, Ireland, Israel, Luxembourg, the Netherlands, Sweden, Switzerland and Türkiye are included in Cluster B. Austria, Belgium, Chile, Colombia, France, Greece, Italy, Latvia, Lithuania, Mexico, Poland, Portugal, Slovenia, Spain, the United Kingdom and the United States are in Cluster C. The Czech Republic, Hungary and the Slovak Republic are in Cluster D. Figure 3.8 shows the evolution of new deaths per million from COVID-19 over time, for the four country clusters.

Figure 3.8. Evolution of new COVID-19 death rates over time, averaged across different OECD country clusters



Note: Clusters of countries defined using clustering based on cumulative COVID-19 mortality rates. Results are the unweighted averages of the countries in each cluster.
Source: OECD analysis of Our World in Data.

Comparisons of the indicators of health system capacity and policy were significantly associated with COVID-19 outcomes in correlations and other analyses. They show that countries in Cluster A have greater health system capacity compared to countries in the three other groups. For example, countries in Cluster A have higher average numbers of hospitals, and higher shares of employment in health and social sectors, compared to countries in the three other groups, with the differences between the best and worst performing groups especially pronounced (Table 3.4). However, both the best and the worst performing groups had high numbers of hospital beds.

Although four clusters were identified using COVID-19 mortality, three clusters were identified using excess mortality. When clustering on excess mortality, Cluster C was removed, with Austria, Chile, France, Greece, Italy, Portugal, and Spain joining Cluster B. Belgium, Colombia, Latvia, Lithuania, Mexico, Poland, Slovenia, the United Kingdom and the United States joined Cluster D.

If there were a perfect correlation between cumulative COVID-19 mortality rates and health system capacity and policy levers, then clustering OECD countries on health system characteristics and health policy levers should lead to the same country groupings as clusters based on cumulative mortality from COVID-19. This is not the case. However, there is a relationship between these variables – countries that had better COVID-19 outcomes (such as Australia, Japan, Korea, New Zealand and Norway) tend to have one or more indicator of health system capacity and health policy levers higher than the OECD average. The opposite is true for some countries with worse COVID-19 outcomes, such as Hungary, Mexico and the Slovak Republic. The opposite was not true, however, for all countries, for example, the United States has a relatively high health workforce capacity.

Taken together, results from cluster analyses are consistent with correlations and analysis reported in this chapter. These results show the positive impact that health systems capacity and policy levers have had improving COVID-19 outcomes, albeit that other factors are involved. This is revealing for improving the readiness and resilience of health systems to withstand future shocks.

Table 3.4. Differences in population health and health system capacity in 2018 across OECD countries was associated with differences in COVID-19 outcomes

	Cluster A	Cluster B	Cluster C	Cluster D
Cumulative COVID-19 mortality until 31 Dec 2021 per million	195	1233	2277	3508
Total number of hospitals per million (2018)	49	21	38	21
Total hospital beds per 1 000 population (2018)	5.8	3.6	4.1	6.4
Total health and social employment (over 1 000 population) (2018)	72	57	37	30
Total health and social employment (% of total employment)	14%	11%	8%	6%
Diseases of circulatory system (deaths per 100 000 population)	175	241	350	483
Population coverage for a core set of services (%)	73%	69%	66%	60%
Treatable causes of mortality (per 100 000 population)	49	63	89	113

Note: Clusters of countries defined using clustering based on cumulative COVID-19 mortality rates. Only countries with reported figures in 2018 are included in the average, which is unweighted.
Source: OECD analysis of OECD Health Statistics and Our World in Data.

Did pandemic preparedness matter for COVID-19 mortality and case outcomes?

As well as health system capacity, pandemic preparedness – both within and beyond the health system – should, in principle, have had a beneficial effect on COVID-19 outcomes. Studies have found, however, that measures of pandemic preparedness are inconsistently associated with the number of cases of COVID-19 and mortality rates from COVID-19 (Bollyky et al., 2022[23]; Lee et al., 2021[37]; Abbey et al., 2020[38]).

The overall score of countries on the Global Health Security (GHS) Index has received much attention. The GHS Index includes six categories: prevention, detection and reporting; rapid response; health systems; commitments to improving national capacity financing and global norms, and risk environment. Studies have found that the overall GHS score was not associated with COVID-19 cases, deaths or case-fatality ratios, either globally or within OECD countries. Similar results are found when running regressions of the cumulative number of COVID-19 deaths per million in OECD countries: no statistically significant associations were found between deaths and how countries scored for pandemic preparedness, overall or by category. The GHS Project Team posits that preparedness capacity is important, but alone it is insufficient without strong health systems in place to serve all populations (GHS Index Project Team, n.d.[39]).

3.3.4. Are health and social risk factors associated with COVID-19 outcomes?

A wide body of research has identified several individual-level mortality-related risk factors for COVID-19, including age, certain underlying health conditions and health risk factors (Dessie and Zewotir, 2021[6]; Sorci, Faivre and Morand, 2020[40]; Oshakbayev et al., 2022[41]). These studies provide insights into what population level factors could be associated with worse outcomes. For example, given that age, chronic obstructive pulmonary disease, cardiovascular disease, cancer, diabetes and obesity are all predictors of COVID-19 mortality at the individual level, it makes sense that countries with older populations and higher prevalence of these health conditions and risk factors should have higher mortality from COVID-19, all else being equal.

After controlling for core economic and demographic factors, some of these factors are associated with COVID-19 outcomes (Table 3.5). For example, countries with higher pre-pandemic (2018-19) mortality rates from circulatory disease, diabetes and cancer, higher alcohol consumption, and higher obesity rates had higher cumulative COVID-19 and/or excess death rates at the end of 2021.

The literature has also highlighted the relevance of socio-economic characteristics for COVID-19 outcomes. As described in section 3.2.2, individuals living in socially disadvantaged situations are more likely to have living and working conditions that put them at higher risk of exposure to the virus, as well as higher prevalence of key health risk factors. Analysis here shows, for example, that countries where a higher proportion of people have difficulty making ends meet, and with higher long-term unemployment rates pre-pandemic, had higher cumulative mortality rates from COVID-19 at the end of 2021. Such results are consistent with other research (Banik et al., 2020[42]; Bosancianu et al., 2020[43]; Kapitsinis, 2021[25]). It is important to note again, though, that association does not imply causality.

Table 3.5. Impact of health and socio-economic characteristics on COVID-19 outcomes after controlling for core economic and demographic factors

Share of the population aged 65 years and over and GDP per capita in 2018 included as control variables. Only variables with statistically significant (*P*-value<0.05) associations in at least one regression are shown.

Population health and socio-economic characteristics		COVID-19 deaths	Excess deaths
Population health characteristics			
Risk factors for health	Population obese (% population aged 15+)	↑↑ (both years)	↑ (2021)
	Alcohol consumption (litres per capita among population aged 15+)		↑ (2021)
Disease prevalence	Diseases of circulatory system (deaths per 100 000 population)	↑↑ (both years)	↑ (2021)
	Diabetes (deaths per 100 000 population)	↑ (2021)	(not significant)
	Malignant neoplasms (deaths per 100 000 population)	↑↑ (both years)	↑ (2021)
	Consumption of antihypertensive drugs (defined daily doses)	↑ (2021)	(not significant)
Socio-economic characteristics			
Social risk factors	Population facing difficulty in making ends meet (% population aged 15+)	↑↑ (both years)	(not significant)
	Long-term unemployment rate (% population aged 18+)	↑↑ (both years)	(not significant)
	Poorer households without access to basic sanitary facilities (%)		↑ (2020)

Note: Rates are cumulative to the end of 2021 and end of 2022. An up arrow indicates positive coefficient, with ↑↑ for both 2021 and 2020, and ↑ only for the year indicated; a down arrow indicates negative coefficient, with ↓↓ for both 2021 and 2020, and ↓ only for the year indicated: statistically significant with *P*-value<0.05. See Annex 3.A for more detailed information on these and other variables included in multivariate regression analyses.
Source: OECD analysis of OECD Health Statistics, Our World in Data and OECD Short-Term Economic Indicators.

3.3.5. Does trust in institutions and people affect COVID-19 outcomes?

Recent empirical work has demonstrated the importance of trust, hypothesising that populations more trusting of government, science, the rule of law and each other are more likely to comply with major disruptive policies implemented by governments, such as mobility restrictions and vaccination programmes. For example, three recent studies found that higher levels of trust or confidence in government are associated with lower standardised infection rates, lower numbers of deaths and lower excess mortality (Bosancianu et al., 2020[43]; Zaki et al., 2022[44]; Bollyky et al., 2022[23]).In these analyses, multivariate regressions using measures of institutional and interpersonal trust point to trust being a relevant factor. Based on the Legutum Prosperity Index (2021[45]), countries where more people had trust in institutions and interpersonal trust had on average lower reported COVID-19 and excess death rates at the end of 2020 and/or 2021 (Table 3.6).

Table 3.6. The impact of trust on COVID-19 outcomes after controlling for core economic and demographic factors

Share of the population aged 65 years and over and GDP per capita in 2018 included as control variables. Only variables with statistically significant (*P*-value<0.05) associations in at least one regression are shown.

Institutions and culture		COVID-19 deaths	Excess deaths
Measures of trust			
Trust in institutions	Legatum Prosperity Index on confidence in institutions	↓↓ (both years)	↓↓ (both years)
Interpersonal trust	Legatum Prosperity Index on interpersonal trust	↓ (2021)	↓↓ (both years)

Note: Rates are cumulative to the end of 2021. An up arrow indicates positive coefficient, with ↑↑ for both 2021 and 2020, and ↑ only for the year indicated; a down arrow indicates negative coefficient, with ↓↓ for both 2021 and 2020, and ↓ only for the year indicated: statistically significant with *P*-value<0.05. See Annex 3.A for more detailed information on these and other variables included in multivariate regression analyses.
Source: OECD Health Statistics, Our World in Data, Gallop, Legatum Prosperity Index and OECD Short-Term Economic Indicators.

However, these results were not robust to the measure of trust used. Measures sourced from the Gallup World Poll (2018[46]) and the Wellcome Global Monitor Survey (2018[47]) did not find a statistically significant association between trust measures and COVID-19 outcomes (although the coefficients were of the expected sign). See Annex 3.A for details on the survey questions used. This result may reflect methodological limitations in the analyses: the validity of measurements of trust (OECD, 2017[48]); a lower degree of variation in perceptions of trust across OECD countries; and a small sample size (38), compared with analysis of a wider country set (217), restricting statistical power and increasing the importance of outliers.

3.4. Conclusions: Policy options exist to improve resilience

This chapter has shown substantial differences in COVID-19 outcomes across OECD countries and examined how factors amenable to public policy can explain some of these differences. After controlling for core demographic and economic factors, the following factors are associated cross-country differences in COVID-19 and excess death rates:

- **Increased health workforce capacity is associated with better COVID-19 health outcomes**. Countries where more people are employed in the health and social sector have lower COVID-19 and excess mortality.
- **Access to high-quality care is essential**. Countries where the entire population had health coverage for a key set of health services, and where treatable mortality was low in 2018, displayed better health outcomes.

- **Vaccination strategy matters**. A higher COVID-19 vaccination rate was associated with lower excess mortality.
- **Health risk factors and population health matter**. Nationwide obesity levels, alcohol consumption and higher mortality rates from circulatory disease, diabetes and cancer were associated with COVID-19 deaths and/or excess deaths.
- **Social risk factors also influence outcomes**. Countries in which more of the population face difficulties in making ends meet or which have higher long-term unemployment rates had higher COVID-19 mortality.
- **Trust appears to be a factor**. Certain measures of trust indicate that countries in which the population had more trust in their institutions and interpersonal trust had lower COVID-19 and excess mortality.

While these findings are generally in line with the literature, caution needs to be exercised in their interpretation. Such associations do not automatically imply causality. Further, while analysis controls for countries' wealth and demographic factors, they do not analyse the interaction between different potential explanatory variables. Analysis is also limited by the small sample sizes, with at most only 38 data points at any given point in time.

Nevertheless, these results help to identify important health system characteristics, policy levers and other public policies that have the potential to alter COVID-19 and excess death rates substantially. There is also general consistency in cross-country differences across COVID-19 outcome measures: countries with lower COVID-19 death rates also typically recorded fewer excess deaths, scored higher on well-being indicators, and had better economic performance, than those with higher COVID-19 death rates.

Beyond national aggregates, the chapter highlights how older people, socially disadvantaged populations, and ethnic minority groups suffered more from the pandemic than others.

Analysis also summarised the massive disruption to many health services, along with a rise in mental health care needs and people suffering from "long COVID" – factors whose impact on health outcomes will continue to be felt in the coming years.

Based on these findings, some policy implications emerge on how countries can strengthen the resilience of their health systems:

- **Investing in health workers is critical**. Having enough qualified personnel is crucial for dealing with increased demand for health care during a global health crisis. This requires strategies to train, recruit and retain health and long-term care workers, ensuring that these professions are attractive.
- **Improving people's underlying health will make them more resilient to future health shocks**. Public health policies to reduce major risk factors should therefore be given greater priority.

The chapter on investing in resilience explores how much priority health system investments are likely to cost across OECD countries. As well as exploring options for raising additional funds, such investments will require countries to seek efficiency gains to help free up resources. Indeed, analysis in this chapter shows that the overall level of health spending was not significant in explaining cross-country differences in COVID-19 outcomes, implying that many countries could improve outcomes by increasing the efficiency of health spending.

Beyond health policies, governments can create conditions to soften the negative health impact of pandemics and other types of shocks. Policies that reduce social inequities will make people less susceptible to a health shock, and strengthening trust in institutions can improve compliance with public health policies during a crisis.

The quantitative analyses in this chapter do not, and cannot, pinpoint the exact reasons why some OECD countries performed better than others during the COVID-19 pandemic. Nevertheless they confirm the importance of investing in sufficient health system capacity, and particularly in the health workforce (see chapters on workforce and long-term care). This key finding is not surprising. Capacity is crucial during an emergency. Having higher numbers of health care workers, and a higher percentage of the population covered by health insurance, all contribute to having more agility during periods of peak need. The main outcome indicators used in this paper capture a period of almost two years. Over that time, there were multiple waves of COVID-19; with each wave, health care resources were stretched. Having more health care resources to begin with provides a bigger buffer to deal with surges, especially when the negative effects of these surges will build over time.

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Annex 3.A. Variables used

Annex Table 3.A.1. Variables used in quantitative analyses (pre-pandemic data from 2018/19, unless stated)

Variable type	Indicator used
COVID-19 outcomes [dependent variables]	
COVID-19 deaths	• Cumulative reported COVID-19 death rates (end of 2021 and end of 2020)
Excess deaths	• Cumulative excess death rates (end of 2021 and end of 2020). 2021 data for Colombia only up to week 35.
Population and the economy [control variables used in all multivariate regressions]	
Population	• Share of population aged 65+
Economic development	• GDP per capita
Trust	
Trust in institutions	• Gallup (2018): percentage answering "Yes" to the question "Do you have confidence in the national government?" (2017 data used for Iceland) • Legutum Prosperity Index (2018): weighted average of Gallup and World Economic questions on confidence in institutions • Wellcome Global Monitor (2018): percentage answering "A lot" to the question "How much do your trust the national government in this country?"
Trust in science	• Wellcome Global Monitor (2018): percentage answering "A lot" to the question "In general, would you say that you trust science?"
Interpersonal trust	• Legutum Prosperity Index (2018): percentage of people responding "Most people can be trusted" to the question "Generally speaking, would you say most people can be trusted, or you can't be too careful?" • Wellcome Global Monitor (2018): percentage answering "A lot" to the question "How much do you trust the people in your neighbourhood?"
Socio-economic characteristics	
Social risk factors	• Difficulty making ends meet (% of people who report having difficulty or great difficulty in making ends meet) • Long-term unemployment rate (% of population unemployed for one year or more as a share of labour force) • Relative income poverty (% of people whose household disposable income is below 50% of the national median) • Overcrowding rate (% of households living in overcrowded conditions, adopting the EU-agreed definition) • Poor households without access to basic sanitary facilities (% of households with equivalised disposable household income below 50% of the national median without an indoor flushing toilet for the sole use of the household)
Population health characteristics	
Health risk factors	• Population obese (% of population aged 15+, self-reported) • Alcohol consumption (litres per capita among population aged 15+) • Tobacco consumption daily smokers (% of population aged 15+)
Disease prevalence	• Disease-specific mortality rates: of circulatory system, respiratory system; from COPD, diabetes, malignant neoplasms (age-standardised deaths per 100 000 population) • Consumption of drugs used in chronic conditions: diabetes drugs (A10), antihypertensive drugs (C02), respiratory system drugs (R03) (defined daily doses per 1 000 inhabitants per day)
Overall population health	• Population in good/very good health (% of population aged 15+ and aged 65+)

Variable type	Indicator used
Health system characteristics	
Overall health system capacity	• Health expenditure as a share of GDP
Health workforce capacity	• Total health and social employment (% of total civilian employment and per 1 000 population) • Physicians: practising physicians per 1 000 population; remuneration of specialists and of general practitioners (salaried income relative to average salary) • Nurses: practising nurses per 1 000 population; remuneration of hospital nurses (salaried income relative to average salary) • Pharmacists: practising pharmacists per 1 000 population
Hospital capacity	• Hospitals (per million population) • Hospital beds: total beds; curative (acute) beds (per 1 000 population)
Laboratory/surveillance capacity	• Global Health Security Detection and Reporting index
Access to care	• Population coverage for a core set of services (%)
Quality of care	• Treatable mortality (age-standardised rate per 100 000 population) • Preventable mortality (age-standardised rate per 100 000 population)
Government responses and strategies for COVID-19	
COVID-19 vaccinations	• Share of population fully vaccinated, end of 2021 • Total vaccines per capita, end of 2021

Sources: OECD Health Statistics, OECD Economic Indicators, Our World in Data, Gallup and Legutum Prosperity Index.

Notes

[1] The authors would like to thank Luca Lindner for her research assistance.

4 Containment and mitigation strategies for pandemics

Dongwoo Lee and Hansol Min

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 soley 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]).

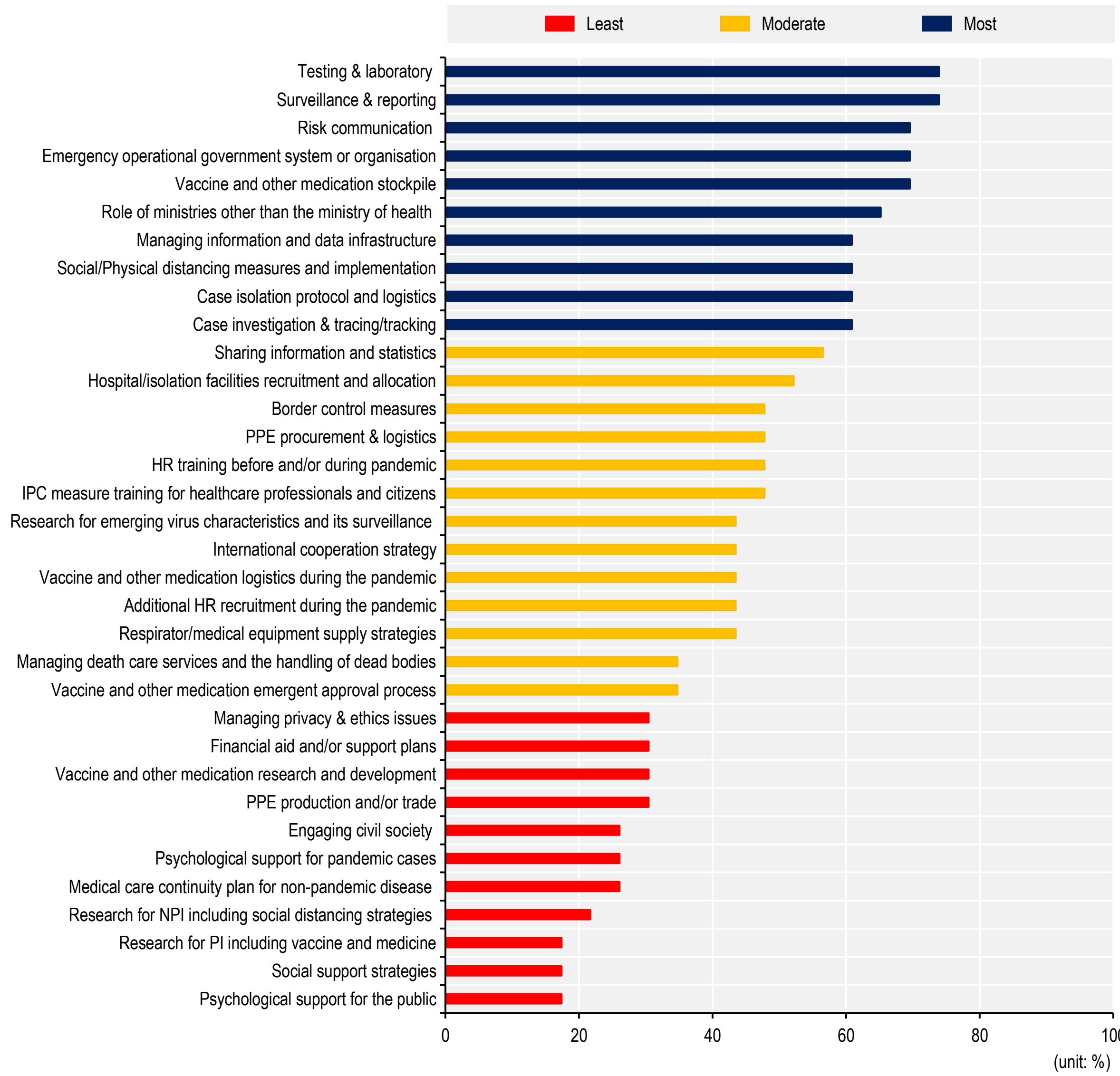
Two examples of capacity evaluation efforts follow:

- 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.

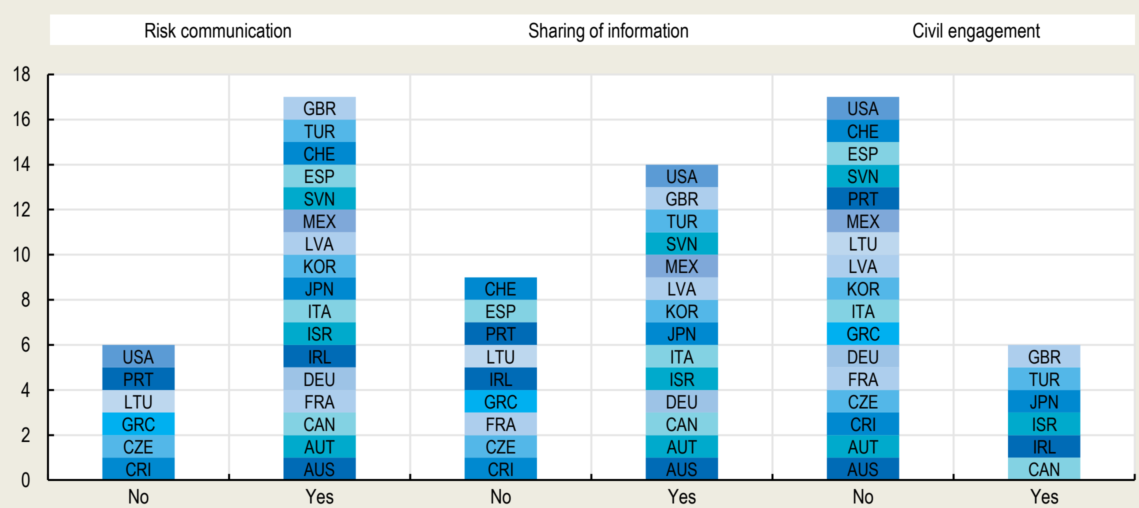
Conversely, other capacities – shown to be crucial after the COVID-19 pandemic began and emphasised in prior PHEP frameworks – were delineated in less than a third of OECD countries' preparedness plans. These included psychological support for the public; social support strategies; research for non-pharmaceutical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

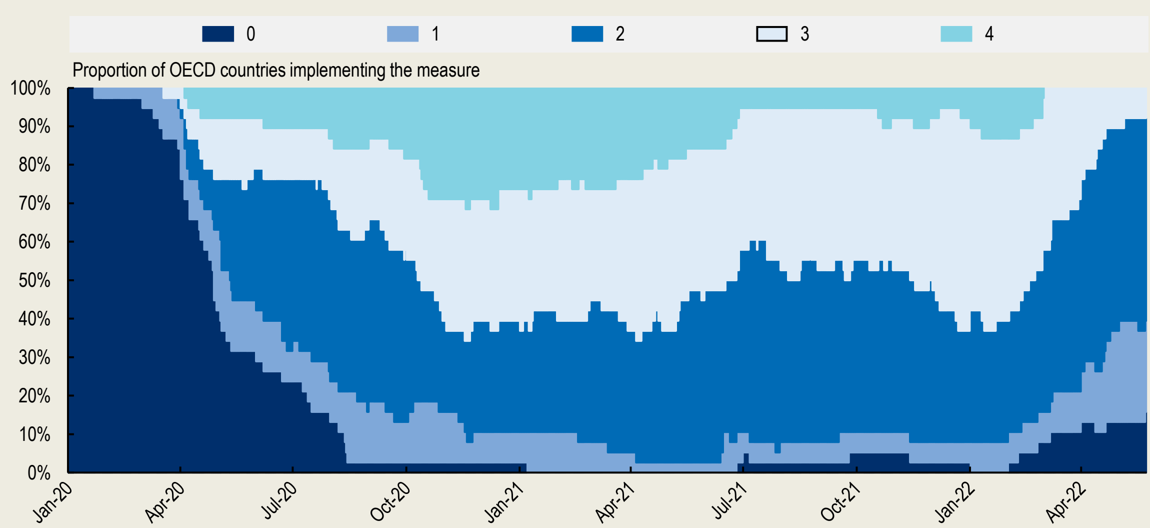
Box 4.5. Mask-wearing mandates: the necessity of public compliance

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 Gove 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

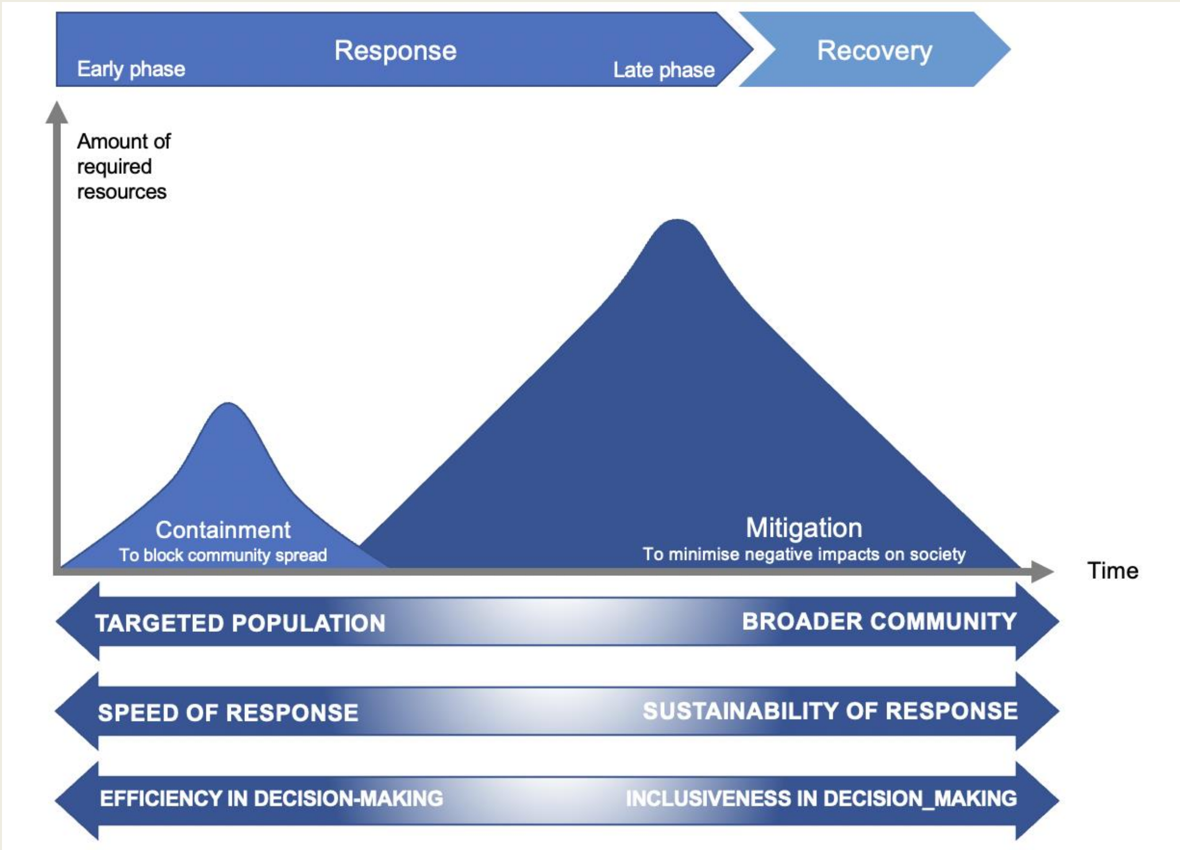
As the pandemic progresses and the response transitions from a "containment strategy dominant" phase to a "mitigation strategy dominant" phase, governments may change their policy priorities. This transition is an appropriate course of policy implementation to respond to escalating or de-escalating situations, 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 progress



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]).

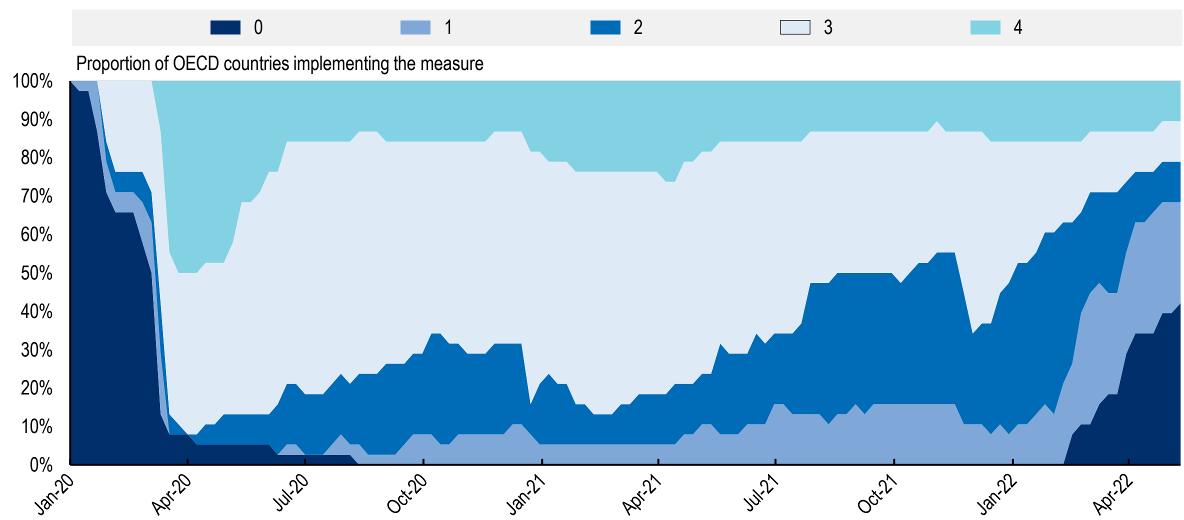
Despite their limited epidemiological effect, most countries imposed travel restrictions during almost the entire COVID-19 pandemic, initiated in part by political and economic motives in a situation of limited alternatives (Neumayer, Plümper and Shaikh, 2021[57]).

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 Gove Government Response Tracker)", https://doi.org/10.1038/s41562-021-01079-8.

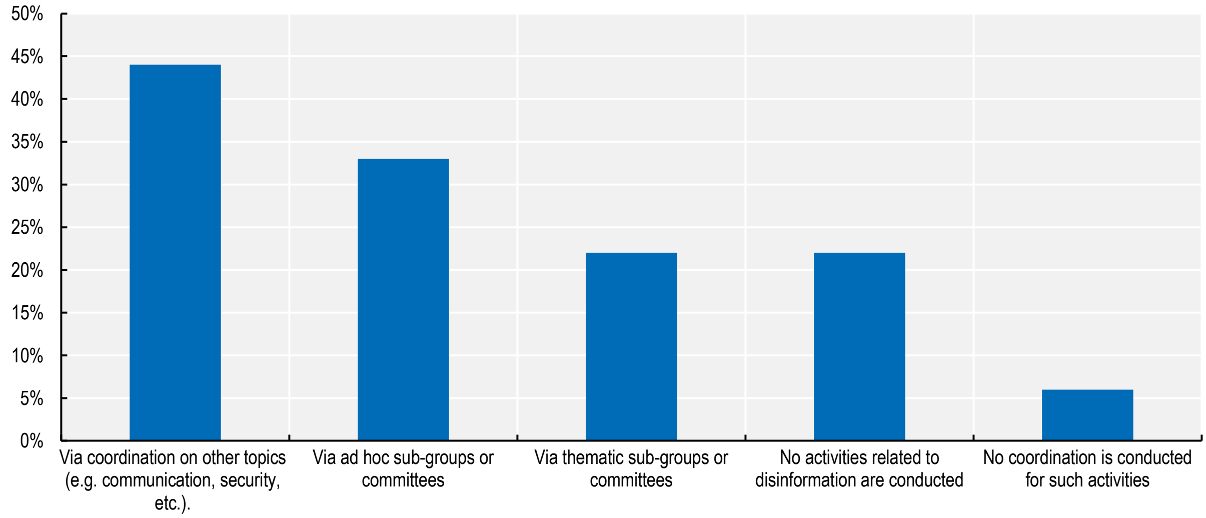
4.3.7. Countries sought to confront the "infodemic" of mis- and disinformation that accompanied the pandemic

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 unprecedently 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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5 Lessons from the COVID-19 critical care surge

Philip Haywood

The COVID-19 pandemic placed enormous strain on critical care resources. After introducing a framework for critical care surges, this chapter analyses the prepare and absorb stages of the response to the COVID-19 pandemic by OECD countries, identifying strengths and weaknesses. Capacity was increased with the introduction of more resources. Alternative uses of critical care resources were reduced, increasing their availability for patients with COVID-19. Organisational changes improved the efficient use of these resources. The use of modelling was valuable and widespread, but required data about resources and information to be developed. Increasing investment in critical care should be planned carefully to balance resilience and sustainability. Improving resilience in the future, including for threats beyond COVID-19, will need to build on the gains made during the pandemic response.

Key findings

The ability to manage a critical care surge is key to a health system's resilience. Critical care is the provision of medical care to those who have acute, life-threatening illness or injury.

Prior to the COVID-19 pandemic, in 2019, there was a fifteen-fold difference in intensive care unit (ICU) capacity between OECD countries. Increasing the availability of critical care to serve patient needs was an early challenge that countries faced when absorbing the impact of the pandemic.

This challenge needed to be met alongside widespread shortages of staff, physical space and supplies, while ensuring patient and staff safety from infection. Despite these obstacles, intensive care capacity increased by 8% from 2019 to 2020 across 16 OECD countries.

Almost all (95%) of OECD countries used modelling to predict demand and, therefore, the required critical care capacity. Modelling needed to be based on timely valid information about available resources and the demand for critical care to facilitate effective action. This was not always possible because of the novel nature of the virus and the initial lack of data and fit-for-purpose data systems.

OECD countries implemented containment and mitigation measures to reduce the number of patients requiring critical care at a point in time. Cancelling and delaying procedures increased the availability of critical care resources for patients with COVID-19. Occupancy in ICUs fell from 71% to 64% among reporting OECD countries in 2020 compared to 2019.

Improvements in information and co-ordination meant that countries made better use of the available resources. Load-balancing – moving critically ill patients to where there was available capacity – was a successful intervention. However, shortages in essential medical products (such as personal protective equipment and ventilators in the initial months of the pandemic) and persistent health workforce shortages were problematic.

Over three-quarters of reporting OECD countries (16 of 21) experienced a surge for which crisis standards of care were introduced. A legally and ethically justifiable basis for equitable resource allocation must be put in place prior to a crisis occurring.

Countries should build on the successful elements of the critical care surge response and address some of the less successful elements. COVID-19 admissions for critical care and, in some cases, local surges are still occurring; therefore, a degree of surge capacity is still required. Policies could include:

- enhancing the data infrastructure and data collections that facilitate effective resource management and load-balancing decisions, and ensuring interoperability of systems
- retaining and evaluating the modelling capacity used during the pandemic, including considering whether to extend modelling from COVID-19 demands to a more general all-hazards approach, which has the potential to lower the opportunity cost when responding to critical care surges
- continuing the load-balancing arrangements adopted during the pandemic, which may require changes in governance and financing arrangements
- ensuring the availability of adequate supplies and staff, and their equitable distribution within countries in times of crisis.

COVID-19 has not been eliminated; the potential remains for future increases in critical care requirements from subsequent waves. Beyond COVID-19, more work needs to be undertaken to ensure the right balance between permanent and staffed intensive care and critical care beds. The ability to increase critical care surge capacity, while minimising the opportunity cost for other essential care, will foster health system resilience for the next shock.

5.1. Critical care reduces morbidity and deaths

The COVID-19 pandemic placed enormous strain on intensive and critical care resources around the world (Abir et al., 2020[1]). This strain was neither uniform over time nor geographically. It was more intense in some areas and periods than others, including in Wuhan, People's Republic of China; Lombardy, Italy; and New York, United States during 2020 (Bottiroli et al., 2021[2]; Rezoagli et al., 2021[3]). The pandemic saw demands exceed the ability of critical care facilities to serve their communities (Elke et al., 2021[4]).

If critical care – the provision of medical care to those who have acute, life-threatening illness or injury – is not accessible when required, mortality and morbidity increase. This also occurs when critical care resources are stretched but not overwhelmed. Increasing occupancy of intensive care units (ICUs) has been demonstrated to be associated with increasing mortality (Bravata et al., 2021[5]). When this occurred during the COVID-19 pandemic, the mortality rate increased for those infected – in some cases more than doubling (Ebinger et al., 2022[6]).

Critical care involves not only provision of care in ICUs but also other hospital and out-of-hospital services (Schell et al., 2018[7]). Availability of critical care resources is an important component of absorbing a shock. However, maintaining a large surplus of critical care facilities is extremely costly, and must be balanced against the benefit those resources would offer if used in alternative ways. Therefore, it is important that critical care availability can be mobilised and "surged" when required in response to a shock.

The response to a shock 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.

This chapter is divided into three sections. Section 5.2 outlines a framework for critical care surges and the response to them. It also discusses the pre-pandemic capacity of OECD countries. Section 5.3 outlines implementation of the surge in critical care capacity during the absorb stage of the COVID-19 pandemic. It discusses the strengths and weaknesses of the approaches taken, with an emphasis on minimising the opportunity cost through modelling of critical care requirements. The final section (5.4) suggests adaptations for the future and important resilience considerations for surges in critical care capacity.

5.2. Surge capacity is essential and requires co-ordinated efforts

5.2.1. Surge capacity needs to be managed during a health crisis

Surge capacity is the ability to respond to a sudden increase in patient care demands (Therrien, Normandin and Denis, 2017[8]). A surge in critical care capacity is essential to health system resilience (Haldane et al., 2021[9]). It is the primary method of responding to a sudden increase in acute care demand during a mass critical care event. As demonstrated by COVID-19, pandemics can generate prolonged and substantial surges simultaneously across multiple countries. Planning for critical care surges uses an "all-hazards approach", with common resources used for different scenarios, such as pandemics, large numbers of trauma victims, armed conflict, terrorist attacks or disasters.

An effective response requires clinicians, hospital leadership, regional and national governments, and health systems to co-ordinate their efforts. At the extreme, normal clinical care standards during a crisis surge cannot be maintained and require modification. The four Ss – staff (trained personnel), space (in which to treat), supplies (and equipment) and systems (policies and procedures) categorise potential areas of deficit encountered during a surge (Hick et al., 2014[10]). Ideally, a critical care surge can be managed without interrupting essential services to the population (Therrien, Normandin and Denis, 2017[8]). Plans to enact critical care surge responses require continual review, updating and re-evaluation of potential threats (Sheikhbardsiri et al., 2017[11]).

A common framework for assessing surges and their implications follows the responses required for a conventional, a contingency and a crisis surge (Table 5.1). As identified in reviews of critical care surges (Hick et al., 2014[10]), there is a distinction between contingency capacity (i.e. increasing critical care capacity without a substantial impact on routine care) and crisis capacity (i.e. when changes to critical care capacity are likely to have an impact on routine care) (Abir et al., 2020[1]). The scope of strategies used in a crisis scenario may be considerable, requiring routine practice to be modified, as occurred during the COVID-19 critical care surge.

Table 5.1. Categorisation of critical care surges

Magnitude of Surge	Minor	Moderate	Major
Increased capacity required	20%	100%	200%
Response	Conventional	Contingency	Crisis
Standard of care	No significant alterations	Some changes in standards and processes of care	Significant alterations in standards and processes of care

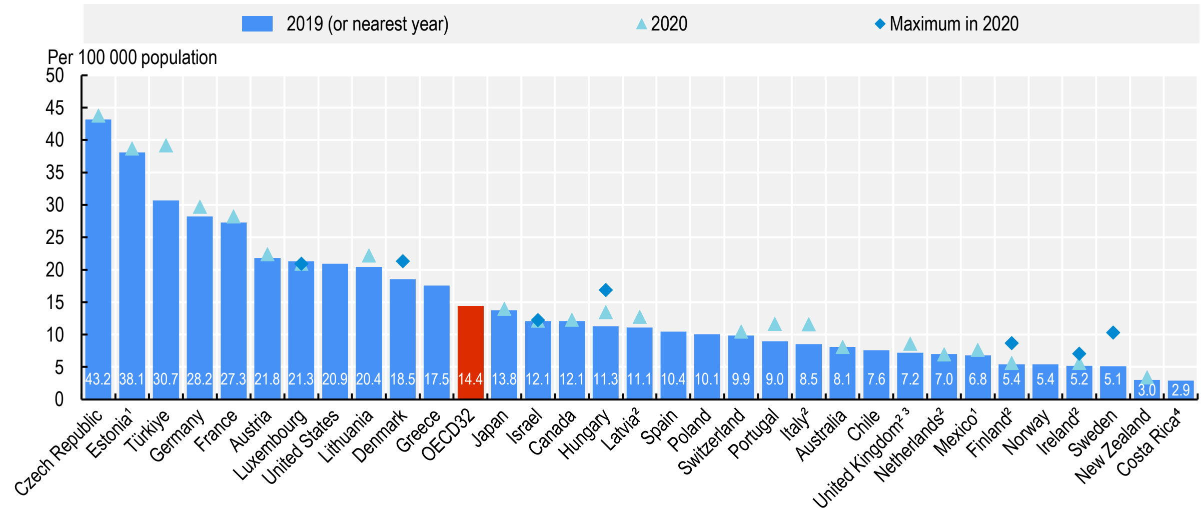
Source: Adapted from Christian et al. (2014[12]), "Introduction and Executive Summary: care of the critically ill and injured during pandemics and disasters: CHEST consensus statement", https://doi.org/10.1378/chest.14-0732.

As critical care surges move past conventional to contingency or crisis, it is common to reduce the usual activities of the hospital or health system and to increase resources to the servicing of critical care. The size of the system under consideration usually increases with the move from a conventional to a crisis surge. Conventional surges are often resolved at a local level, whereas crisis surges often require a regional, national or international approach.

5.2.2. There was nearly a fifteen-fold variation across OECD countries in pre-COVID intensive care capacity and acute care occupancy

Prior to the COVID-19 pandemic, the number of ICU beds per capita in OECD countries ranged from 2.9 ICU beds per 100 000 population in Costa Rica to 43.2 beds per 100 000 in the Czech Republic (Figure 5.1). Definitional differences between countries lower confidence in the comparisons (OECD, 2021[13]).

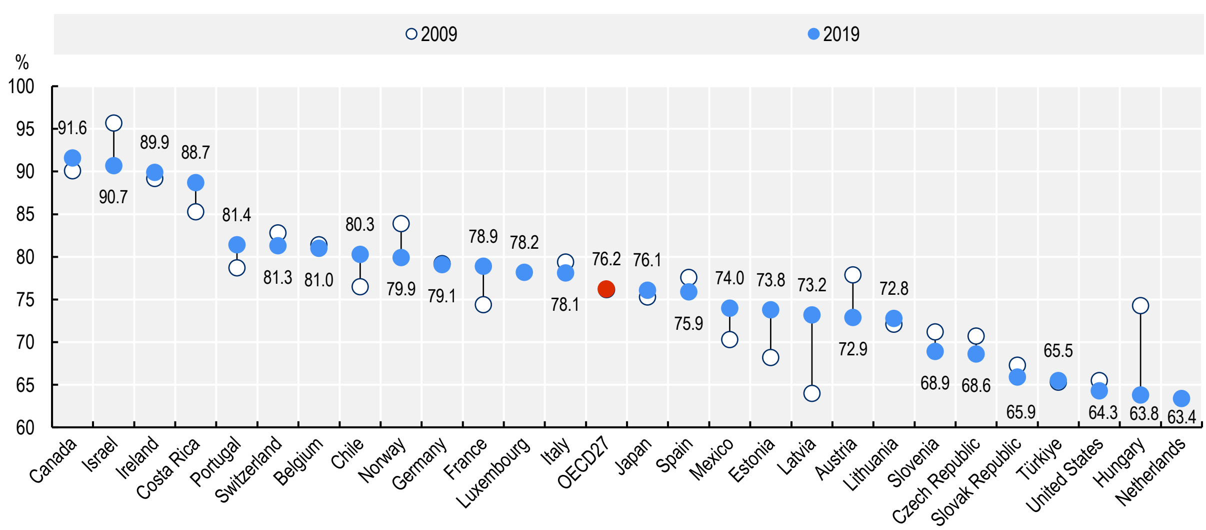
Figure 5.1. Adult intensive care beds, 2019 (or nearest year) and 2020



1. Data include neonatal and paediatric ICU beds. 2. Data cover critical care beds only. 3. Data refer to England. 4. Data cover public sector only.
Sources: OECD Health Statistics 2022; Joint Questionnaire on Non-Monetary Health Care Statistics 2022 (unpublished data); OECD (2021[13]); National sources.

Higher numbers of physical beds may imply greater surge capacity, but this relationship can be confounded by occupancy (Sheikhbardsiri et al., 2017[11]). The total number of specialist ICU and more general curative (or acute) care beds give an indication of the available space and associated staff. Occupancy rates give an indication of the spare capacity in the existing system (Figure 5.2.) The four OECD countries with relatively high occupancy rates in curative beds in 2019 (>85%) – Canada, Israel, Ireland and Costa Rica – also have below-average ICU bed numbers per capita.

Figure 5.2. Occupancy rate of curative (acute) care hospital beds, 2009 and 2019 (or nearest year)



Source: OECD Health Statistics 2022; OECD (2021[13]). *Health at a Glance 2021: OECD Indicators*, https://doi.org/10.1787/ae3016b9-en.

Increased occupancy can reduce the ability to mount a critical care surge response within the existing capacity (DeLia, 2006[14]). However, for a critical care surge response, it is the available capacity – both existing within the system and that can be created – that services demand.

5.2.3. Interconnected systems can support or hinder an effective critical care surge response

Critical care surge responses require management at a high level, often involving multiple systems within and beyond the health system. For most critical care surges, the issue is not simply an increase in acutely unwell patients who require care. The cause of the surge also generates other stresses, for example: destruction of infrastructure; loss of logistical capacity; interruption of usual governance practices; or reduction in available staff and supplies.

This occurred during the COVID-19 pandemic, when the strain on critical care resources was not independent of other pressures. Direct pressures came from the increasing number of infections, leading to an increased number of people requiring critical care. Indirect pressures came from measures to contain and mitigate the growing number of infections (see the chapter on containment and mitigation) and the requirements of other health services and systems. This can also occur with other disruptions like armed conflicts or earthquakes, which often destroy infrastructure, disrupt systems, and reduce the availability of staff. Successful management of a critical care surge requires a health system that contains, manages and mitigates these co-existing pressures.

Effective critical care relies on and is relied on by other systems in health care, including primary care, rehabilitative services and long-term care, among others. When healthcare service delivery is reduced in hospitals and other critical care providers, increased use of primary care is required for services that would have otherwise been provided in hospital. Medically fragile patients are likely to require additional support and may deteriorate without the usual pathways to care (see the chapter on care continuity).

There is potential for disruptions and feedback loops between these systems, as occurred during the pandemic. Patients with COVID-19 had increased care and resource requirements: personal protective equipment (PPE), increased space and increased infection control were necessary (Anesi, Lynch and Evans, 2020[15]). These changes resulted in an effective reduction in healthcare capacity and placed extra strain on the system in other settings. Similar issues can occur during other disruptions – for example, during an outbreak of a resistant pathogen, bioterrorism or a chemical leak. The prioritisation of resources may also worsen outcomes in other settings. For example, diversion of PPE to hospitals leaves other medical and non-medical services with less protection, in turn worsening health outcomes. This was evident in long-term care facilities in the first year of the pandemic (see the chapter on long-term care).

Patients are typically discharged from critical care into wards or rehabilitative settings. If resources are moved to critical care from other settings, the ability of these other settings to absorb the increased load may be compromised. This could potentially result in delayed discharge of patients from critical care settings. Prior existing shortages may become exacerbated, and poor transitions of care may harm patients or cause unnecessary readmissions into hospital (Hick et al., 2014[10]).

Critical care systems are typically nested within hospitals and hospital support systems (Einav et al., 2014[16]). They require pharmacy, laboratory, radiology, allied health, nutrition, patient transport, pre-hospital emergency services, mortuary and logistics services, among others. Increasing demand for these support services in the context of a critical care surge may affect other clinical services that require them. Alternatively, if support services cannot be scaled in proportion to the requirements of the critical care surge, it may affect the quality of services provided (see the chapter on securing supply chains). It is recommended that planning and consideration of this issue is undertaken before the critical care surge occurs (Hick et al., 2014[10]).

5.3. A substantial surge in critical care capacity was implemented during the pandemic

The requirement for critical care resources at the beginning of the pandemic, based on early evidence, was expected to be enormous. The treatment of patients admitted for COVID-19 early in the pandemic demonstrated a high rate of invasive ventilation and critical care admission, for example reports of 5% of patients infected with COVID-19 requiring critical care admission in early 2020 (Doidge et al., 2021[17]). Those admitted with COVID-19 pneumonia and organ failure at the beginning of the pandemic had a relatively long period of ICU admission and were likely to require invasive ventilation (Aziz et al., 2020[18]).

Many OECD countries increased critical care capacity in response to the expected requirements. This was achieved by both freeing up resources from within the health system and increasing resources to the health system. Improved information led to a greater ability to co-ordinate and better use of the available resources. However, capacity constraints in physical supplies and the workforce hampered the response.

5.3.1. Systems for planning resource requirements proved to be essential

The key question on surge capacity for critical care services is "How many patients will need hospital and ICU resources on a given day?" (Aziz et al., 2020[18]). Suggestions have been made in the past to target hospital beds for a surge response at approximately 500 beds per million population (Barbisch and Koenig, 2006[19]), but this would have been inadequate for the peak of the COVID-19 critical care surge. Answering this question requires modelling the future and is aided by real-time information (see the chapter on digital foundations). Estimating the number of patients requiring critical care, the type of care required, and the current capacity is a first step in determining appropriate resourcing.

Prior to widespread COVID-19 immunisation, the requirement for ICU beds during various periods of acute infection (waves) typically doubled every 2-3 days and took four weeks to reach its peak (Kaplan et al., 2020[20]). There was a challenge when modelling early recommendations and treatment of critical care patients who contracted SARS-CoV-2 (Xie et al., 2020[21]). Given the unknown nature of the disease, early estimates of important parameters were subject to substantial uncertainty, as they were derived from observational studies subject to confounding. The generalisability of some parameters between countries and settings continues to be subject to uncertainty (Cakir et al., 2019[22]).

Almost all country respondents to the OECD Resilience of Health Systems Questionnaire 2022 used modelling to predict the required critical care capacity in response to the pandemic, and almost all found it to be useful in planning resources (Table 5.2). Data from those countries that experienced the initial surge in COVID-19 infections allowed greater sensitivity in modelling for subsequent waves (Dhala et al., 2020[23]). Similar critical shortages were noted by most countries: ICU beds and trained ICU nurses.

Table 5.2. Prevalence and usefulness of modelling during the first two years of the pandemic

Forecasting or modelling used to plan critical care and hospital resources		How useful the forecasting was considered by countries	
Yes	95%	Very useful	68%
		Useful	26%
No	5%	Moderately useful	5%
		Slightly useful	0%
		Not useful	0%

Source: OECD Resilience of Health Systems Questionnaire 2022.

The information generated by the modelling was used at multiple levels within and beyond health systems. For example, it was used at a high level for planning containment measures alongside critical care capacity, to attempt to ensure that crisis critical care surges did not exceed capacity. It was used to guide the gaining and deploying of additional resources, including decisions on the distribution of resources between regions within a country. At a local level, it was used for planning of space (beds), cancellation of surgery, staffing requirements and procurement of supplies (including PPE and essential medicines).

OECD countries used a variety of different techniques to model. These ranged from short-term forecasting based on recent trends in infections and hospitalisations to very sophisticated modelling that could be used to predict several scenarios for different containment strategies. Several countries linked models together to provide a comprehensive overview for multiple domains. For example, Canada used an epidemiological model to predict case numbers, a hospitalisation model to predict resource requirements using the epidemiological model, and a critical drug model to assess the demand of hospital-based drugs relative to the inventory.

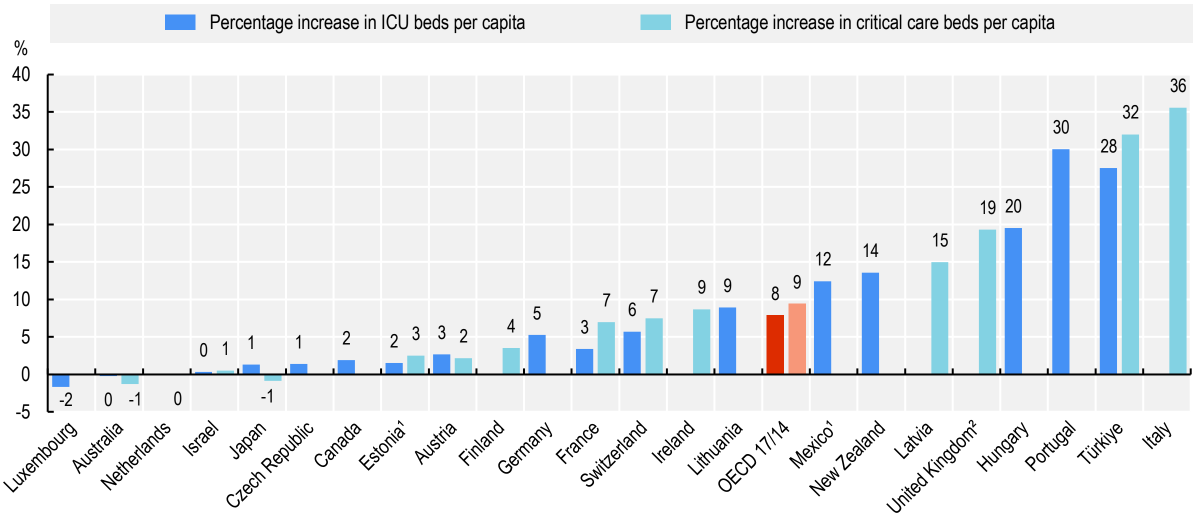
Modelling that allowed anticipation ensured that managers of health services took steps to secure or free up resources. Additionally, the modelling revealed limitations in the data made available to decision makers. For example, at the start of the pandemic, not all countries knew the numbers of ventilators and occupied hospital and ICU beds in real-time. In other countries, data were available, but differences in standards had to be overcome between regions or internationally. These limitations were compounded by uncertainty about the disease. For example, Portugal noted that it was very challenging to build scenarios under such high uncertainty – this included the initial uncertainty about the disease but subsequently also the uncertain impacts of vaccination, including its impact on transmission, waning of immunity and new variants.

5.3.2. Available space was successfully increased during the response

There are two major sources of increased supply of critical care capacity. The first is increasing the availability of staffed and supplied ICU and critical care beds. The second is increasing the ability to provide high-level critical care including invasive ventilator support in non-traditional spaces – for example, recovery rooms and operating theatres, wards and newly created temporary spaces (surge capacity).

The COVID-19 pandemic saw an 8% increase in the supply of intensive care beds per capita across reporting OECD countries (Figure 5.3). Supply of both ICU beds and more specialist critical care beds was increased across reporting OECD countries.

Figure 5.3. Percentage increase in average per capita intensive care unit and critical care beds from 2019 to 2020



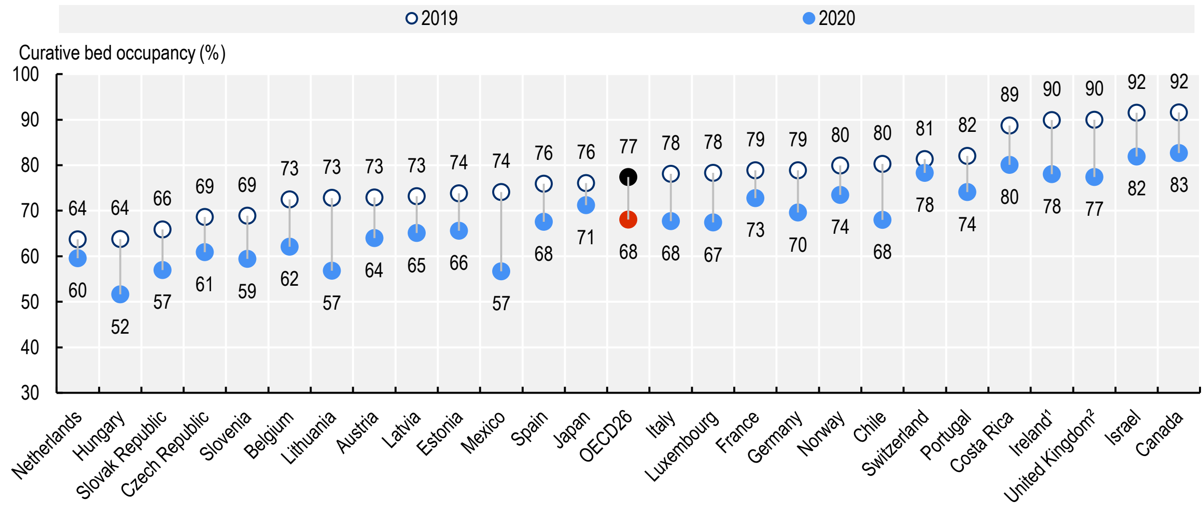
Note: The calculated OECD average is the unweighted average of all reporting OECD countries. These figures do not include increases in surge critical care capacity including ventilator support in non-ICU areas. Countries reporting the same number for ICU and critical care beds have been counted only once in the critical care bed classification. The maximum number of ICU and critical care beds is higher than the average and changes in the population resulted in small decreases in some countries. 1. Data include not only adult ICU beds but also neonatal and paediatric ICU beds. 2. Data refer to England (United Kingdom).

Sources: Joint Questionnaire on Non-Monetary Health Care Statistics 2022 (unpublished data); UK (England) data from NHS England (Critical Care Bed Capacity (NHS England, n.d.[24]), "Critical Care Bed Capacity and Urgent Operations Cancelled 2019-20 Data", https://www.england.nhs.uk/statistics/statistical-work-areas/critical-care-capacity/critical-care-bed-capacity-and-urgent-operations-cancelled-2019-20-data/, and Urgent and Emergency Care Daily Situation Reports (NHS England, n.d.[25]), "Urgent and Emergency Care Daily Situation Reports 2020-21", https://www.england.nhs.uk/statistics/statistical-work-areas/uec-sitrep/urgent-and-emergency-care-daily-situation-reports-2020-21/, were used) and the last date in December in 2019 and 2020 was used.

Beyond the increase in ICU beds, OECD countries also increased the potential to use invasive ventilator support in ICU and non-ICU beds. For example, Norway doubled the potential to provide ICU-level care for a limited time, as did several other countries, including Ireland and Sweden (Elke et al., 2021[4]). England (United Kingdom) expanded its capacity via several methods, including repurposing areas for additional ventilator support and use of temporary hospitals, increasing capacity by 68% (Mateen et al., 2021[26]).

Despite the increase in requirements for critical care and the increased burden of COVID-19, the total hospital curative (or acute) care bed occupancy rate fell in all countries reporting for 2020 (Figure 5.4). This reflected the reduction in elective surgery and other health services (see the chapter on waiting times).

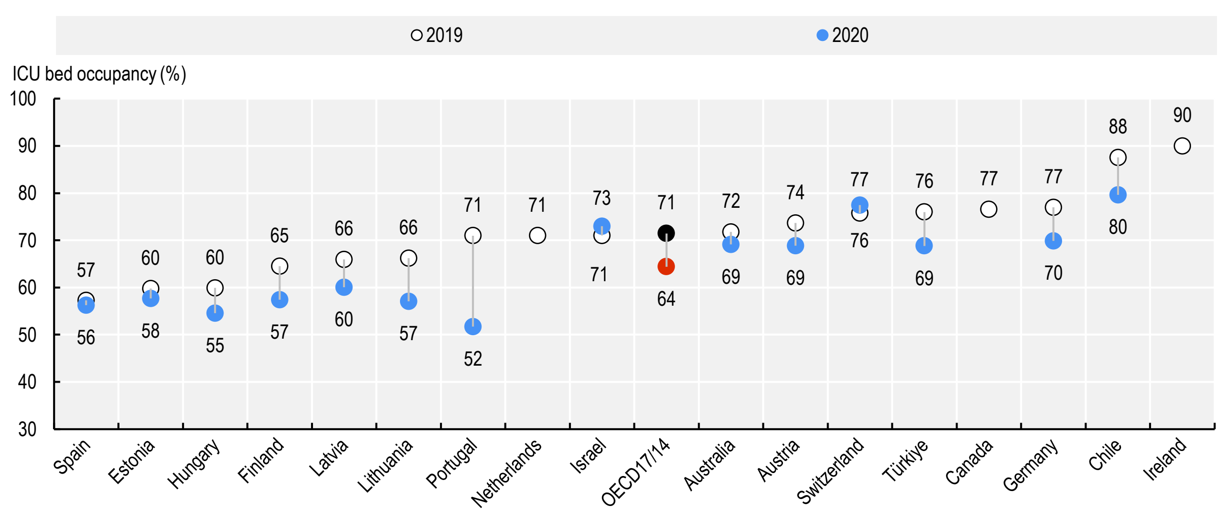
Figure 5.4. Occupancy rate of curative (acute) care hospital beds 2019-2020



Note: The OECD average is the unweighted average of the occupancy in each year. 1. Data for Ireland exclude private hospitals. 2. Data refer to England (United Kingdom).
Source: OECD Health Statistics 2022; UK (England) data from NHS England (NHS England, n.d.[27]), "Bed Availability and Occupancy Data – Overnight", https://www.england.nhs.uk/statistics/statistical-work-areas/bed-availability-and-occupancy/bed-data-overnight/.

The approaches taken successfully addressed the capacity constraints in physical space, beds (both formal increases in ICU beds and use of surge increases) and ventilator support at a national level. The data demonstrate that physical capacity was available most of the time. The four OECD countries reporting maximum occupancy of ICUs nationally during 2020 in the Joint Questionnaire on Non-Monetary Health Care Statistics (unpublished data) did not exceed 90% (Australia 81%, Hungary 89%, Israel 82% and Spain 68%). These findings are consistent with the published literature, which show that at a national level the expanded capacity was rarely exceeded (Elke et al., 2021[4]). On average, occupancy of ICU beds fell among OECD countries in 2020 compared to previous years (Figure 5.5).

Figure 5.5. Occupancy of adult intensive care unit beds, 2019-2020

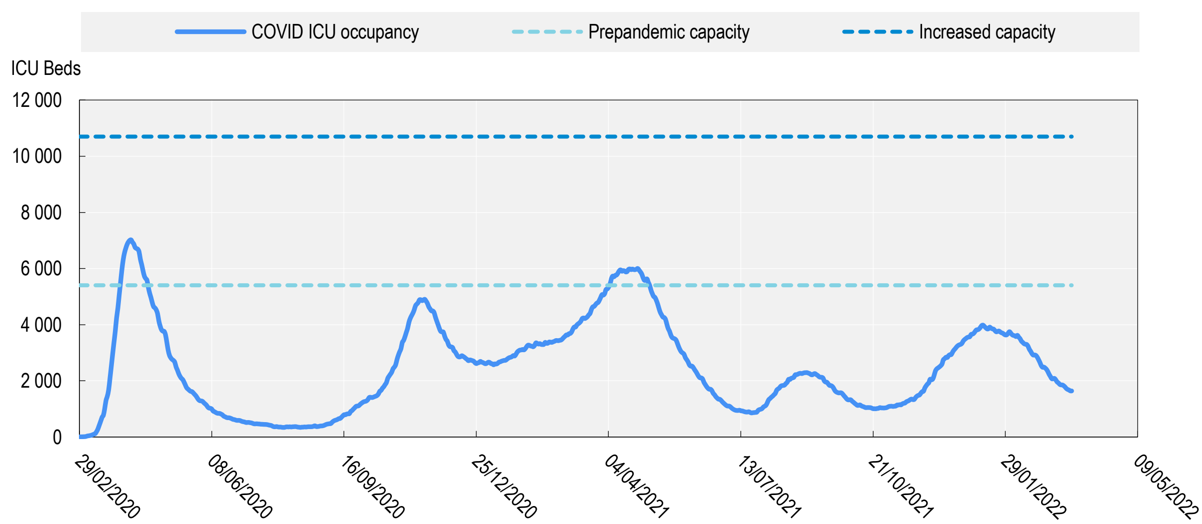


Note: The calculated OECD average is the unweighted average of all reporting OECD countries for that year. ICU capacity increased in many countries in 2020 (Figure 5.3). There are differences in the definitions used by countries for ICU beds that may limit the comparability of the data between countries. The 2019 figure for the Netherlands was sourced from 2018 – the last figure available.
Source: Joint Questionnaire on Non-Monetary Health Care Statistics 2022 (unpublished data).

However, without increasing specific components of critical care capacity, many OECD countries might not have had enough capacity to meet the demand created by the COVID-19 pandemic. In the case of France, which was close to the mean average of total ICU capacity per population across the OECD (Figure 5.6), the ventilated ICU capacity could have been exceeded several times during the pandemic if the critical care surge had not supplemented the number of ventilator-equipped beds.

Therefore, increasing the effective capacity for critical care treatment was essential during the absorb stage of the COVID-19 response. Without it, several countries would have had their pre-COVID-19 ICU capacity exceeded or almost exceeded, including the Netherlands, Sweden and the Lombardy region of Italy (Elke et al., 2021[4]).

Figure 5.6. Number of intensive care unit beds in France occupied by patients with COVID-19



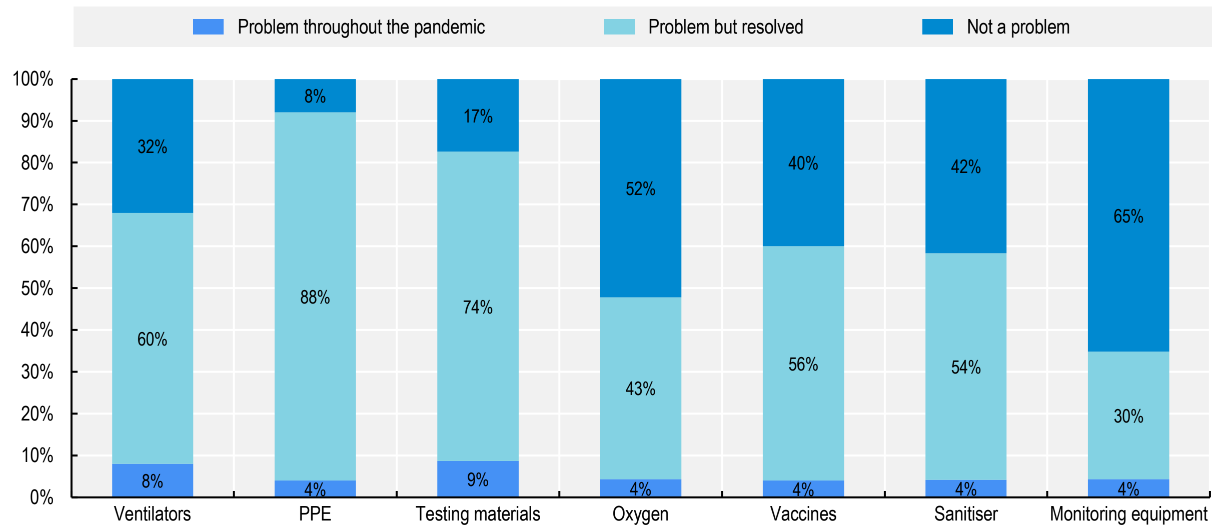
Note: Data definition is "Daily ICU occupancy (number of COVID-19 patients in ICU on a given day)".
Sources: ECDC (n.d.[28]), "Data on hospital and ICU admission rates and current occupancy for COVID-19", https://www.ecdc.europa.eu/en/publications-data/download-data-hospital-and-icu-admission-rates-and-current-occupancy-covid-19. The capacity was sourced from OECD/European Observatory on Health Systems and Policies (2021[29]), *France: Country Health Profile 2021*, https://doi.org/10.1787/7d668926-en, and refers to the number of beds with ventilator capacity.

Critical care services can bear an immense caseload with a rapidly spreading pandemic (Remuzzi and Remuzzi, 2020[30]). However, the demand for critical care during the COVID-19 pandemic was inconsistent within countries and over time. While the pandemic was widespread, the surges showed intense clustering, and overwhelmed local services even though capacity remained in surrounding areas (Doidge et al., 2021[17]). For many areas, the peak requirement for critical care was very high and intense. Additionally, multiple waves of critical care demand occurred, increasing and decreasing the required capacity. Finally, while availability of physical space was increased during the pandemic, this needed to be accompanied by an available workforce, equipped with supplies and timely information, to make the best use of this space.

5.3.3. A lack of supplies was devastating during the first months of the pandemic

Unmet needs for ventilators, oxygen, medicines and PPE were a problem for most OECD countries during the early months of the pandemic. The shortages of PPE were particularly critical, potentially reducing worker safety and worsening outcomes (Griswold et al., 2021[31]). Several countries took a national approach to address this supply challenge (see the chapter on securing supply chains), and most countries reported that they resolved problems with supplies of essential medical products over time (Figure 5.7.)

Figure 5.7. Percentage of countries reporting problems with the supply of essential medical products



Source: OECD Resilience of Health Systems Questionnaire, 2022.

Compounding challenges within critical care systems that come under extreme pressure may contribute to poorer system performance. As the numbers of patients increase, resources are exhausted, space becomes crowded, and staff are subject to enormous strain. Even if supply problems are resolved, diminished staffing and personnel who are less well trained may result in greater difficulty maintaining standards of quality of care, including appropriate use of PPE and infection control procedures. In turn, this leads to more infections – further reducing staffing capacity. This vicious cycle is likely to have a detrimental impact on patient outcomes.

5.3.4. A team approach was taken to leverage and develop health workforce skills

Expanding and maintaining the workforce for a surge response requires an adequate number of appropriately trained workers and protection of those staff. Workforce availability often constrains surge capacity during a crisis and this occurred during the COVID-19 pandemic (Al Thobaity and Alshammari, 2020[32]). Half of countries responding to the OECD Resilience of Health Systems Questionnaire 2022 reported that health workforce shortages had an important impact on their capacity to deal with the COVID-19 pandemic (see the chapter on workforce). In most countries doctors and nurses working in ICU were in short supply.

Previous work on resilience in critical care surges has highlighted the importance of ensuring that teams can function when some members are absent (Therrien, Normandin and Denis, 2017[8]). Hospitals with available high-technology remote facilities can provide additional support (Dhala et al., 2020[23]). Leveraging specialist personnel through telehealth is considered an important force multiplier (Dichter et al., 2014[33]). Consensus statements have outlined the importance of cross-training staff for a potential critical care surge and ensuring that specialist oversight is available, even if this has to be delivered remotely – this was prophetic for the COVID-19 pandemic (Einav et al., 2014[16]).

During the pandemic, the requirement to service critical care units resulted in relocation of healthcare workers to emergency departments and ICUs (Haldane et al., 2021[9]). Global surveys suggested that the lack of intensive care nurses was more prevalent than the lack of physicians during the pandemic (Wahlster et al., 2021[34]). The systems around staffing were altered – for example, changing staffing ratios and staff duties (Dhala et al., 2020[23]). Other activities, such as documentation requirements, were also altered (Harris et al., 2020[35]).

Virtual training was undertaken to foster and update skills (Haldane et al., 2021[9]). The pandemic produced challenges in undertaking prompt training while ensuring that safety and infection control protocols were followed. The impact of redeployment on healthcare worker safety needed to be addressed to ensure worker buy-in (Vera San Juan et al., 2022[36]).

Individual hospitals reported successful experiences of increasing their critical care surge workforce by teaming critical care nurses with other nurses to care for multiple patients (Fiore-Lopez, 2021[37]). Systematic reviews suggested that successful deployment and training facilitated strong collaboration across multi-disciplinary teams to optimise resources during the pandemic. A key factor in successful deployment was being able to match the specific roles with workforce availability, minimising the need for training. This approach requires the use of treatment teams (Vera San Juan et al., 2022[36]). The constantly changing nature of the pandemic meant that scaling up and scaling down of surge capacity was needed. This requires clear processes for decision making.

A feature of the COVID-19 pandemic, which complicated the response and potentially contributed to compounding challenges, was the chronicity of the crisis. One common approach to surging staff numbers in emergencies is increased hours and calling back staff (Sheikhbardsiri et al., 2017[11]). This may be counterproductive, however, when the surge is chronic rather than acute. Provider distress and burnout was associated with providing care to large numbers of patients with COVID-19 (Wahlster et al., 2021[34]) (see chapters on mental health and workforce). History has shown that health systems can be overwhelmed by infectious disease epidemics (Nuzzo et al., 2019[38]) and spread can occur within the health system and between hospitals.

5.3.5. Systems for extensive co-ordination were developed

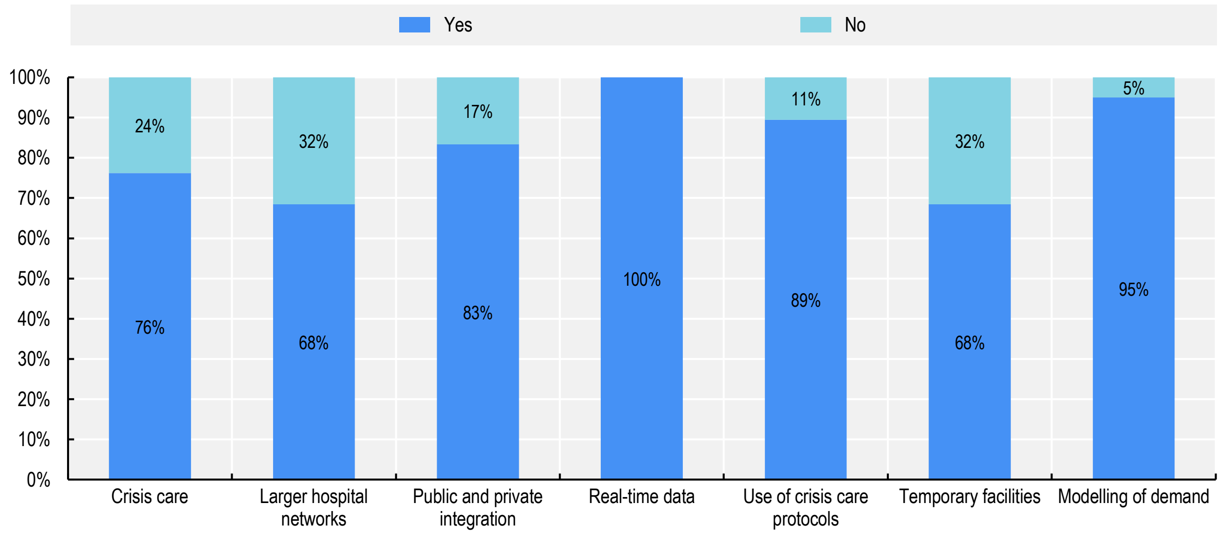
Assessing the feasibility of implementing a critical care surge is required once an epidemic's progression is modelled and the required critical care capacity is established. Not all geographical areas of a country have the same resource base. Therefore, since resources such as ICU beds, staff and ventilators may vary within a country, the required surge response above the usual capacity will differ.

Previous crises, including previous epidemics, have shown that shortages of workforce, equipment and medicines limit the response. This was also demonstrated by the COVID-19 pandemic. Three-quarters of country respondents (76%) to the OECD Resilience of Health Systems Questionnaire 2022 reported experiencing a crisis-level critical care surge (Figure 5.8).

Most countries followed common approaches to increasing critical care capacity and co-ordinating critical care resources. Efforts were made to introduce real-time data for decision making (100%). Additional resources and space (68%) were introduced into systems and services reorganised, both in scale (68%) and in the mix of public and private facilities (83%). Protocols for decision making in these situations were also introduced (89%).

The OECD country responses mirror the guidelines produced for COVID-19 (WHO, 2020[39]): suspending all but the most urgent elective medical and surgical procedures; expediting credentialing processes; reclaiming and hiring back retired critical care staff; redeploying staff from other areas; providing simulations for non-ICU staff to prepare them for their roles; maintaining a safe working environment; using telemedicine to increase the number of overseeing providers; and restructuring teams to augment the ability of experienced staff to care for as many patients as possible. Systems-level changes suggested included: clarifying a chain of command; designating hospitals to receive patients with COVID-19; ensuring mechanisms to address shortages of supplies; and supporting healthcare providers to adjust their priority settings among critical care surges.

Figure 5.8. Examples of systems-level implementation for increasing surge capacity



Source: OECD Resilience of Health Systems Questionnaire 2022.

Extra resourcing helped to increase critical care capacity

Extra resources were provided for the critical care surge response from societal resources and stockpiles, thereby increasing the resilience of health systems to absorb the impact of the COVID-19 pandemic. These included all resource components for a critical care surge response: staff, supplies and space. Staff numbers were increased directly and indirectly. The workforce was increased directly through recruitment of recently retired staff and students, and deployment of reserves. It was increased indirectly by freeing up currently employed staff and redeploying them to aid the critical care surge response.

The majority of respondents to the OECD Resilience of Health Systems Questionnaire 2022 increased space (68%) through use of temporary facilities. Several countries co-ordinated stockpiles and extra resourcing of equipment and medicines in short supply at a regional or national level. Combined with the information about spare capacity, these resources could be dispatched to the areas of greatest need.

5.3.6. Delivery of effective and equitable care proved to be vital

The importance of objective ethical triage criteria has been highlighted (Sprung et al., 2010[40]). Several key challenges occur when a crisis critical care surge is required, and these need to be addressed rapidly as the surge develops. One issue is the potential for introducing crisis standards of care. This is a move from supplying each individual appropriate care to ensuring that the greatest number of lives are saved. Most countries reported in the OECD Resilience of Health Systems Questionnaire 2022 that crisis standards of care were introduced at some time during the COVID-19 pandemic

However, shocks can also involve – at least initially – some uncertainty about the nature of the shock and, therefore, the most appropriate response to it. This may manifest in concern about a lack of consistent clinical guidance (Kaplan et al., 2020[20]). Kerlin et al. (2021[41]) noted the disparate and variable nature of the strategies undertaken and a lack of consistency relative to the pandemic context. Few changes to triage protocols were implemented in anticipation during the first six months of 2020 (Kerlin et al., 2021[41]). A key issue with the COVID-19 critical surge was that outcomes worsened when critical care delivery was placed under strain but before it was overwhelmed. This suggests that continued monitoring of outcomes, as well as spare capacity, is important to delivering effective and equitable care.

Resource allocation must be ethically and legally justifiable, and non-discriminatory. Ensuring appropriate safeguards is important. Previous work has indicated that implementation of crisis standards of care should be embedded in a formal legal structure (Christian et al., 2014[12]). It has also been suggested that technologies – including pulse oximetry and telemedicine – should be used to improve efficiency of resource allocation. However, this approach may embed inequities that existed prior to a surge (Riviello et al., 2022[42]), so care should be taken to consider how these policies will balance effectiveness and equity in their implementation. Further, barriers to access for vulnerable groups should be addressed and systematic inclusion of the patient voice should be considered (Van de Voorde et al., 2020[43]).

As critical care surges divert resources from other compelling high-priority healthcare usage, crisis management cannot be conducted exclusively from a critical care perspective. It requires input from multiple stakeholders, including the public (Arabi et al., 2021[44]). There is also a need for a common understanding of the approach that will be taken (Rodriguez-Llanes et al., 2020[45]).

5.3.7. Feedback loops and complexity complicated the critical care surge

Other measures and policies in place reinforce or reduce the ability of a health system to undertake a critical care surge response. At the onset of the pandemic, growing numbers of infections resulted in the introduction of additional containment and mitigation measures (see the chapter on containment and mitigation). This resulted in reduced healthcare seeking by the population and thereby increased available resources to meet the critical care surge (see the chapter on care continuity). However, containment had a countervailing impact, diminishing resources to meet a critical care surge. Production and supply of medicines and PPE were affected by containment and mitigation efforts, such as physical distancing and the need for production workers to isolate, thereby interrupting supply chains (see the chapter on securing supply chains).

The surge in critical care demand occurred at the same time as infections increased. In turn, this increased demand for alternative uses of health resources (such as the use of dialysis machines for COVID-19 patients rather than routine kidney failure patients), and reduced supply of those very resources. Examples of other simultaneous demands included: increased demand for non-critical care of a growing number of COVID-19 patients; increased demand for the successful track and trace of COVID-19 transmission; and, later in the pandemic, increased demand to provide immunisation services. Ensuring that patients infected with the novel coronavirus did not transmit it to unaffected people also required staff and space to be organised to minimise cross-contamination. During the pandemic, infections and requirements to quarantine among healthcare staff reduced the available workforce (Pan et al., 2020[46]).

Containment and mitigation efforts, and infection control within critical care facilities, also had an impact on how the health system engaged carers and families. Family engagement is important, as it reduces anxiety both for patients who have been admitted and for their families (Dhala et al., 2020[23]). Reduced engagement may also increase the workload of staff and lead to greater anxiety (Hugelius, Harada and Marutani, 2021[47]). Some COVID-19 related studies have suggested an increase in family members' distrust of practitioners, potentially driven by a decrease in bedside relationships because of physical distancing and restrictions in attending hospital (Amass et al., 2022[48]).

Despite these challenges, controlling community spread of the virus in an unvaccinated population was a crucial component of preventing critical care facilities from becoming overwhelmed, especially after the onset of the pandemic. The interaction between the number of cases and the requirement for critical care capacity formed part of the "flatten the curve" strategy implemented in many countries, to avoid catastrophic failure of health systems (Rezoagli et al., 2021[3]). Ensuring that critical care capacity met projected demand entailed strategies for both supply and demand, involving the co-operation of everyone in society.

5.3.8. Co-ordination and an adaptive response had a positive impact

It has long been appreciated that successful management of a crisis – and the resultant critical care surge – requires implementation of pre-existing plans and adaptation to the threat as needed (Hick et al., 2014[10]). An optimal response to a novel and emerging threat requires adaptation to the situation as it develops (Therrien, Normandin and Denis, 2017[8]). As well as plans, appropriate models need to be in place for decision making. Previous pandemic preparedness research has suggested that management systems at multiple levels – including at regional, national and international levels – may be required to exercise control over resources (Sprung et al., 2010[40]).

This occurred during the COVID-19 critical care surge, when local and national systems needed to solve different issues. These systems needed to be maintained over time and through multiple waves of the pandemic. The sheer magnitude of critical care requirements often entailed changes in the systems surrounding care – for example, changes in the systems surrounding rapid assessment and triage, which was reversed when case numbers fell. The chronicity of the pandemic, while unfortunate, offered the opportunity for systems to be modified and improved.

Summaries of crisis surge strategies – including for the COVID-19 pandemic – highlight several important elements of an effective response (Rodriguez-Llanes et al., 2020[45]), which were confirmed in the country responses to the OECD Resilience of Health Systems Questionnaire 2022.

The first element of an effective response is co-ordination. This is extremely important in a dynamic situation. A surge response requires co-ordination of multiple actors at different levels and between jurisdictions. This spreads the load from an intense increase in resources, and helps systems move seamlessly between crisis critical care surges and ensuring capacity for these surges.

The second element for an effective response is anticipating key challenges to the system and implementing appropriate responses. This requires real-time data and reactive capacity (Dichter et al., 2014[33]), which is a key challenge for a resilient health system (Winkelmann et al., 2021[49]).The performance of the system requires relevant and timely information to be transmitted and used where most effective (see the chapter on digital foundations). In response to the pandemic, traditional organisational and jurisdictional boundaries were re-considered, including to allow information to be disseminated widely and to reduce administrative burdens on the movement of resources and patients (Rodriguez-Llanes et al., 2020[45]). This occurred in many OECD countries. For example, Switzerland pooled resources around newly formed networks.

A common systemic change in the pandemic response was co-ordination of critical care supply and demand at a regional or national level. Load-balancing is the transfer of patients from facilities with high occupancy or stress to facilities with low occupancy or stress (Box 5.1). Load-balancing requires several components to be successful: available physical and workforce resources, communication and co-ordination, and safe and available transport services. Load-balancing is aided by systemic changes, larger networks, integration of public and private facilities, and use of real-time data.

Box 5.1. Load-balancing and co-ordination

Load-balancing reduces the chances of failure in an institution. COVID-19 produced a demand for critical care services that was not uniform across regions or countries: this heterogeneity creates the potential for load-balancing to improve outcomes (Lacasa et al., 2020[50]).

During the COVID-19 pandemic, load-balancing was used to match the supply and demand of critical care services. This was undertaken regionally, nationally and even internationally (Winkelmann et al., 2022[51]). The use of all available critical care capacity was a common approach: over 80% of countries responding to the OECD Resilience of Health Systems Questionnaire 2022 had integrated private facilities into delivery of care.

Over 26 days, Australia rapidly developed a nationwide Critical Health Resources Information System. All public and private ICUs (both paediatric and adult) were instructed to enter data twice a day, and within three weeks 98% of ICUs were contributing data. Each ICU and transport agency (ambulance and paramedical transport) could review the data. When COVID-19 cases rose in June 2020 and a rapid and localised increase in demand was experienced, real-time data allowed rapid transfer of patients to less burdened ICUs, and standards of care were maintained (Pilcher et al., 2021[52]).

The Czech Republic operated a similar system: the newly implemented Control Centre for Intensive Care gave a daily update of available bed, ventilator and staff capacity, making it available to national and regional co-ordinators. This allowed the transfer of patients, alongside scaling up of resources at hospitals (Komenda et al., 2022[53]).

International load-balancing occurred, notably in the European Union (Winkelmann et al., 2022[51]). This brings additional complexities and further interoperability of information systems is consequently required (Sommer et al., 2022[54]).

A final element of successful crisis surge strategies is adaptability in financing and payment systems. They may generate incorrect incentives when a health system is faced with a critical care surge. For example, activity-based funding may encourage facilities to keep elective activity continuing when inappropriate. The reduction in occupancy seen in 2020 demonstrates this concern (Figure 5.4). In the context of the pandemic, countries acted to maintain budgets. For example, France instituted financial guarantees to maintain budgets despite the reduction in activity. Other countries increased fees, introduced new payments, or based payments on previous years. For example, Germany introduced payments for empty beds and compensated for cancelled surgery to preserve intensive care capacity (Waitzberg et al., 2021[55]).

Multiple critical care surges require responses to be scaled up and down

A common feature of planning a critical care surge response is to reduce or delay other health services. This reduction in demand frees up resources for an increase in critical care requirements. In a pandemic scenario, it may also reduce exposure to the virus for those entering healthcare facilities. These reductions both relieve the strain on critical care resources and allow resources to be repurposed for critical care (Abir et al., 2020[1]).

A strategy used frequently during the COVID-19 pandemic was cancellation of elective surgery (see the chapter on waiting times) (Kerlin et al., 2021[41]). A reduction in hospital services needs to be managed, however, to ensure that essential care continues to be delivered (see chapters on care continuity and waiting times).

As more resources are drawn towards provision of critical care, there is potential for delayed and deferred care to become more acute and the burden of delay more serious. A corresponding reduction in preventive, primary and secondary care can cause increased morbidity and mortality. If care is interrupted, the burden on society is increased. Balancing these issues over time is essential. For example, diverting PPE to implement a critical care surge response resulted in the inability of other services to continue during the COVID-19 pandemic, even with available staff and space. Conversely, if services continued without this equipment, the risk of infection increased (Winkelmann et al., 2021[49]).

Over time, systems became more adaptive in response to the COVID-19 pandemic. Greater confidence in understanding the demands meant that countries could more finely tune their critical care capacity requirements for COVID-19, and more flexible approaches could be used (Winkelmann et al., 2022[51]). This was very important because it lowered the opportunity cost. Achieving this adaptability is critically dependent on having both information and the means to use the information to alter treatment priorities.

5.3.9. Flexibility remains important as critical care requirements change over time

The experience of the COVID-19 pandemic demonstrates the requirement for flexibility over time in provision of medical services. As the pandemic continues to evolve, so too do the critical care demands. One source of change in critical care demand and supply is the knowledge gained during the management of a novel disease. Changes based on such learning resulted in improved survival for those admitted to ICU or critical care. They also altered treatment both within ICUs – with less invasive ventilation and renal replacement therapy (Doidge et al., 2021[17]) – and outside ICUs. This altered the mix and volume of services provided during the pandemic (Box 5.2).

There were also changes in the contagion. With the Delta variant, prior to vaccination, an increase in the level of contagiousness saw increased societal demand for critical care services. Following uptake in vaccination, the demand for ICU beds and hospital beds altered relative to requirements for other services, such as primary health care and other out-of-hospital services.

Box 5.2. Changing COVID-19 resource requirements over time

Use and substitution of intensive and critical care has changed over the course of the COVID-19 pandemic. Early reports confirmed that a relatively large proportion of those with COVID-19 required admission to hospital and critical care support, and both invasive and non-invasive ventilation support were used. Over time, however, there was a movement towards greater relative use of non-invasive ventilation and non-ICU hospitalisation, as well as use of virtual hospitals and telehealth.

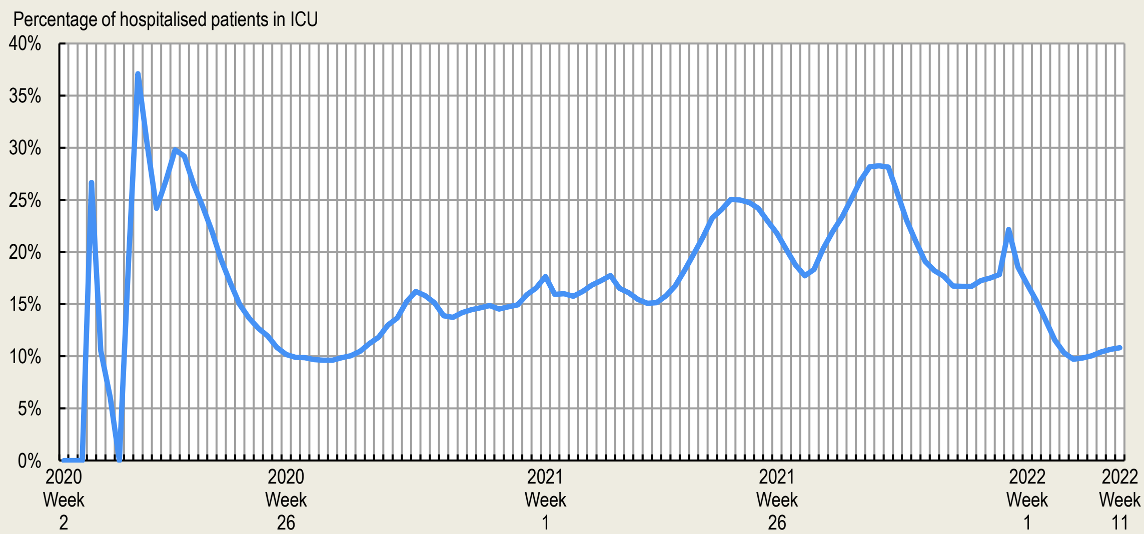
Invasive ventilation involves intubation of the trachea and use of a ventilator to provide oxygen under pressure to the patient. It is resource intensive, is usually provided in an intensive care or high-dependency situation, requires intubation (a technical and demanding skill that can involve sedation), and is associated with complications (Popat and Jones, 2012[56]). Non-invasive ventilation is provision of respiratory support without intubation. It can be provided in a wider variety of settings (such as on wards or outside hospitals). The most common type of non-invasive ventilation is provision of positive-pressure ventilation through a mask or other device.

Greater proportions of patients with COVID-19 in ICUs received invasive ventilation in the first months of the pandemic. In the United Kingdom between February and March 2020, 75% received invasive ventilation on the first day and 85% during the course of their stay. A few months later, invasive ventilation had decreased to 43% on the first day of ICU care (Doidge et al., 2021[17]). Similarly, the proportion of those requiring invasive ventilation compared to non-invasive ventilation fell in an analysis of German health insurance administrative data. Of all those receiving ventilation, 75% received invasive ventilation between February and May 2020, compared to 37% between October 2020 and February 2021 (Karagiannidis et al., 2022[57]).

As with other areas of medical service delivery, telemedicine was widely used both within hospitals and between hospitals and the community (see chapters on care continuity and mental health), including use of virtual hospitals and to expedite discharges. This may increase effective hospital capacity. For example, patients in France were discharged and continued on oxygen therapy monitoring at home using a web-based system (Dinh et al., 2021[58]). Telemonitoring and use of non-invasive ventilation was also demonstrated to be safe and feasible (Adly, Adly and Adly, 2021[59]).

The relative portion of hospitalised patients with COVID-19 requiring ICU admission was initially approximately 30% of admitted patients (Figure 5.9). The rate fell before slowly increasing over time and decreasing again in the last quarter of 2021. These fluctuations were associated with more widespread vaccination and the Omicron variant.

Figure 5.9. Proportion of hospitalised patients in intensive care units (selected European OECD countries)



Note: Includes Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungry, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain and Sweden.
Source: ECDC (n.d.[28]), "Data on hospital and ICU admission rates and current occupancy for COVID-19", https://www.ecdc.europa.eu/en/publications-data/download-data-hospital-and-icu-admission-rates-and-current-occupancy-covid-19.

5.4. COVID-19 upended the status quo and challenges remain for critical care capacity

COVID-19 – a new worldwide infectious disease requiring critical care treatment – changed the status quo. Without completely effective immunisation or other very effective preventive or early treatment care, it is likely additional critical care capacity or surge capacity will still be required for several years. There is the potential for rapid increases in demand for critical care associated with a spike in infections accompanying new variants, as occurred with the Delta variant.

Beyond these surges, the burden of COVID-19 and the response to it will add to existing demand and resource requirements in hospital and critical care. This demand results from admissions due to SARS-CoV-2 infections, both the acute disease and its long-term complications. Additional critical care capacity may be required to catch up on the delayed and deferred treatment for non-COVID-19 reasons, such as hip replacements, that occurred during 2020-2021. Beyond an increase in the number of admissions, the resources required for each admission may increase, associated with increased patient acuity.

Work has been done to model the return of delayed services. For example, McCabe et al. (2020[60]) concluded that unless COVID-19 hospitalisations reduce to a very low level, enhancing critical care capacity may still be required in the United Kingdom.

Additional capacity will come at an opportunity cost, which needs to be minimised. This will require regular collection of data and updating of modelling – both of SARS-CoV-2 and of the resources required to treat it. These resources may not simply be additional ICU capacity: they will need to match the requirements of waxing and waning SARS-CoV-2 infections. The requirement may not necessarily be for a permanent increase in ICU capacity; rather, a focus may be needed on building additional surge capacity that can be escalated and de-escalated as required. The worst-case scenario would be the sudden appearance of a new variant for which vaccine immunity was low. In this case, a rapid increase in critical care capacity would be required – in space, staff, supplies and management through pre-existing systems.

While some of these stresses are unique to infectious diseases, similar relationships between factors also occur with other shocks to health systems. For example, disasters increase critical care requirements while reducing available resources. Large-scale critical care surges often occur in scenarios of reduced resources. The remaining resources become overstretched and potentially collapse. COVID-19 pandemic-related disruptions did not stop other shocks affecting health systems. In some instances, shocks (such as disasters) may result in separate requirements for critical care surge responses. In other instances, these shocks (such as cyber attacks) may not require a critical care surge response, but may nonetheless test the resilience of health systems.

5.4.1. OECD countries are building on the advantages found in modelling

Several improvements were suggested by countries to improve modelling in the future (Table 5.3). These included: increasing capacity for modelling; ensuring availability of data; and including more strategies and outcomes. Some improvements were specifically suggested for modelling the COVID-19 pandemic, including modelling the implications of vaccination. Most countries anticipated using critical care modelling in the future, either specifically for COVID-19 or for other critical care surge events.

Table 5.3. Suggestions and anticipated benefits for future critical care modelling

Capacity and general improvements	COVID-19-specific improvements	Decision making and expected benefits
• Hospital capacity and utilisation information in real-time • Common data definitions • More detailed and granular forecasts at regional and hospital levels • Inclusion of more outcomes of interest – for example, hospital bed utilisation and expected staff furloughing • Inclusion of a greater number of strategies in the modelling • Recognition of the need for modelling capacity, including identifying and developing human capacity within the public system, and tools • Development of models for simulating integrated care within and outside hospital	• Inclusion of information about variants of SARS-CoV-2 • Inclusion of new epidemiological information (e.g. sewage testing) • Inclusion of more information about vaccination (and its impacts) • Forecasting of both COVID-19 and non-COVID-19 requirements	• Linkage to hospital bed management in emergency situations • Increased co-ordination between ICUs and hospital units • Increased data availability to central health planners • Undertaking more detailed planning and contingency exercises • Planning of the number and location of ICU facilities

Source: OECD Resilience of Health Systems Questionnaire 2022.

5.4.2. OECD countries are implementing multiple critical care adaptations

Countries highlighted several changes that are being introduced or considered at a systems level to improve critical care. These include strategies for increasing both ongoing critical care capacity (for example, increasing the critical care workforce) and critical care surge capacity (for example, infrastructure that could be converted for dual use) (Table 5.4). Many countries also suggested that monitoring in real-time would continue to be used to assess spare capacity.

Table 5.4. Anticipated systems-level changes to improve implementation of critical care surge responses

Physical (space)	Workforce (staff)	Physical (supplies)	Systems
• Conversion of existing infrastructure and adaptation to future requirements for surge capacity • Use of telehealth • Increased critical care capacity • Use of non-invasive ventilation and ventilation on wards	• Training healthcare workers with critical care skills • Training pyramid teams (teams in ICUs led by a critical care nurse) • Increased critical care capacity	• National stockpiles for equipment and medicine needs across critical care • National procurement and distribution systems for PPE • Increased critical care capacity	• Improved, comprehensive and timely data flows at local, regional and national levels • Introduction of objective criteria for prioritisation • Additional services fees for accepting patients with COVID-19 who require continued treatment • Systems for monitoring and facilitating transfer of patients • Increased mechanisms for co-ordination regionally and nationally, and between public and private sectors

Source: OECD Resilience of Health Systems Questionnaire 2022.

Successful strategies should be evaluated to ensure transferability

Although many strategies were used to increase critical care surge capacity during the COVID-19 pandemic, evidence about the absolute and relative effectiveness of the strategies is limited (Winkelmann et al., 2021[49]). Successful implementation of a capacity increase, rather than its relative effectiveness, was the outcome discussed in most articles and references reviewed. In some cases the successful strategies suggested were opposites; for example, maintaining teams to leverage pre-existing trust (Yager, Whalen and Cummings, 2020[61]) versus spreading expertise (Dhala et al., 2020[23]). This suggests that solutions are likely to be both context specific and dependent on local resources and structures. Accordingly, care should be taken when translating evidence generated during the pandemic from one context to another.

5.4.3. Improving resilience involves more than critical care adaptations

Improving health systems resilience requires both “resilience by intervention” and “resilience by design” elements (see the chapter on resilience in other sectors). Resilience by design is when the system is proactively designed and resourced before a disruption, while resilience by intervention is when extra resources are provided to the health system at the time of the disruption. The experience of the COVID-19 pandemic demonstrated both resilience by design and resilience by intervention features were required.

Resilience by design features include information, modelling and co-ordination, as well as sufficient space, supplies and staff. These features should be evaluated, and those that were effective should be retained and extended.

Space

Availability of space, in the form of critical care beds, remains essential for a critical care surge response. As discussed earlier, the key issue is to expand either critical care capacity, critical care surge capacity or both. Countries will differ in their requirements – ideally steps to address these should be based on modelling and evidence. Financing should not produce incentives to over- or undercapitalise on investment in space. Indicators of the available capacity would aid estimation of resilience. Current metrics focus on the critical care capacity rather than the critical care surge capacity, but both need to be estimated.

Supplies

Supplies of essential goods were a crucial limitation in the early months of the COVID-19 pandemic. While improved supply chains will increase certainty, stockpiling and capacity guarantees are likely to be required at the beginning of another sufficiently large crisis. These would be more efficiently organised at a regional, national or international level so that they can be released to areas of need (see the chapter on securing supply chains).

Staff

Availability of critical care staff – especially nursing staff – was noted as a key limitation in the COVID-19 critical care surge response. While ventilators, space and supplies were also limitations, they were progressively overshadowed by the limitations of insufficient staff availability. Shortages of staff were compounded by the quarantining of staff after exposure to the virus.

This key shortfall is one that resilience by design would seek to overcome. For changes to be sustainable, they need to be financially feasible and maintained, entailing additional investment in staff numbers and in the skills of the health workforce. This may require consideration to be given to different models of financing and training to improve staff availability and capability, alongside increased support during and after surges to ensure staff safety and well-being. A key point in the review undertaken in Belgium was the importance of financing the co-ordinator of plans to implement surge capacity (Van de Voorde et al., 2020[43]).

Systems

Local overburdening of health services because of increasing numbers of patients requiring critical care was evident during the pandemic. An important development to minimise this effect materialising again would be the use of valid strain indicators to minimise the need for crisis triage and to allow earlier transfer of patients (Dichter et al., 2021[62]). These resilience by design features require provision of timely, valid information and associated modelling to relevant decision makers.

In the future, it is likely that requirements for surge capacity will be continued when load-balancing over the existing capacity is insufficient to deliver care. The balance between permanent increases in intensive care capacity versus surge care capacity will require careful planning.

For a surge response as large as that required for the COVID-19 pandemic, reorganisation and transformation within the health system (resilience by design) was insufficient to provide the required resources for the critical care surge. Additional resourcing, space, staff and supplies were injected into health systems in response to the disruption. This will always be the case with a sufficiently large disruption.

People changed their behaviour to reduce the peak demand for critical care services. The most obvious manifestation of this change was the widespread restrictions on movement, reduced social contact and physical distancing. A whole-of-society commitment and whole-of-government co-ordination needed to exist for this change to materialise. In many countries, previously decentralised functions were centralised to ensure efficiency and equity.

The COVID-19 pandemic demonstrated the importance of anticipating the next shortage or crisis point, and of preparing early for shocks. This requires clear communication and clear authority. It also necessitates a careful balancing of competing demands for healthcare resources, an understanding of the opportunity costs of choices, and careful monitoring for unanticipated outcomes. Appropriate information flows, having the resources to deploy and the mechanisms to deploy them are also critical to resilience by intervention.

In a worst-case scenario for COVID-19 – a new more deadly variant – extra planned resourcing will need to be injected into the health system, combined with a whole-of-government approach to limit demand. The lessons of previous years should be used to prepare for this potential risk. The changes countries are making to improve information, increase staff and space, make more effective use of resources and introduce protocols will aid decision making. These lessons will also be useful for large-scale responses to all critical care surges.

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6 Preserving continuity of care

Caroline Berchet, Eliana Barrenho and Katherine de Bienassis

The impact of the COVID-19 pandemic was particularly felt among those who live with chronic diseases. This chapter outlines the impact on, and response of, non-COVID-19 services in the pandemic context. It also describes the impact on primary care services and the changes that took place in the mix of providers and service delivery models. Roles in the delivery of primary health care services changed. The use of telehealth was widespread. Adaptations to improve continuity of care and limit the harm of future shocks include improving preventive care; supporting a workforce capable of adapting to shocks; and ensuring that governance models, information systems and financial incentives support integrated care.

Key findings

The impact of absorbing COVID-19 on health care and outcomes was significant:

- Primary health care was one of the categories of health services most affected during the absorb stage of the pandemic response, specifically for people with chronic conditions.
- Many essential health services were postponed or forgone. For example, the number of consultations with general practitioners fell by 66% in Portugal, about 40% in Australia, 18% in Austria and 7% in Norway in May 2020, compared to May 2019.
- Those living with chronic health conditions were particularly affected: among people aged 50 years and over, over 40% were more likely to report either forgoing or postponing medical care due to the pandemic.
- Delays in access to diagnostic services were also observed in many countries. Across 23 OECD countries, there was an average decline of over 5 percentage points in the proportion of women screened for breast cancer. Further, an estimated 100 million cancer screening tests were not performed in Europe, and 1 million patients living with cancer remained undiagnosed due to a backlog of screening tests.

Despite these pressures, innovations in primary health care adopted by countries mitigated the disruptions in care continuity for non-COVID-19 patients:

- Most OECD countries adopted a mix of new service delivery models, including integrating telehealth into routine care, expanding multidisciplinary teams with public health and community services to contact vulnerable patients proactively, and expanding home-based care.
- Countries expanded health workforce roles and responsibilities. Several countries issued short-term fast-track licences and provided exceptional training to mobilise health care providers.
- Countries revisited payment models to offer new services for primary health care providers. Most of the OECD countries (19 of 26) that responded to the OECD Resilience of Health Systems Questionnaire 2022 adopted changes to payment models; most adopted additional salary payments or additional fee-for-services payments. A few countries also adopted new capitation or bundled payments and new pay-for-performance mechanisms.

Notwithstanding innovations in primary health care, more can be done to strengthen resilience:

- Core primary health care functions around primary, secondary and tertiary prevention need to be reinforced to provide effective health promotion, early detection and better long-term management of chronic conditions. These core functions increase societal preparedness and create capabilities that can be drawn on when needed. During a shock, they help health systems to adapt – notably through primary prevention (such as the rollout of COVID-19 vaccination), secondary prevention (such as early detection of COVID-19), and tertiary management (such as management of mild COVID-19 in the community).
- A sufficient and capable workforce is a foundation of resilient health systems, but COVID-19 brought renewed attention to the occupational hazards facing health workers. The primary health care workforce needs to be supported though concrete action and appropriate resourcing, such as training, guidelines and access to services to promote employee well-being.
- Integrated care should be improved through strengthened governance, strong information systems and better use of financial incentives. Fragmented care between hospitals, primary health and social care jeopardises the delivery of appropriate care for COVID-19 patients, while delaying access to high-quality and safe care for patients with non-COVID-19 health needs.

6.1. Strong primary health care is essential to absorb and recover from shocks

The COVID-19 pandemic has put tremendous pressure on health systems around the world. Policy makers responded promptly to this crisis, mobilising policies to contain the spread of COVID-19 and deliver health care to people with severe symptoms. Most policy actions focused on increasing critical care (see the chapter on critical care surge). This prompt response was necessary and saved many lives, but it also underscored a key lesson of the pandemic: the ability to ramp up hospital capacity alone is insufficient to ensure that health systems are resilient to future shocks.

The COVID-19 pandemic has made clear how health systems need to be built on strong primary health care to foster access to and maintain continuity of care for all health care needs. Care disruptions during the pandemic were of particular concern for patients living with chronic health conditions. These patients often have comorbidities, disability and sometimes frailty; they also have high health care needs, and are at risk of complications if their conditions are not well managed.

The response to a shock 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 of 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 the 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.

Strong primary health care systems are essential to absorb and recover from shocks such as the pandemic by managing acute care needs in co-operation with hospitals, and by keeping people in better health through routine and continuous care. By improving population health, strong primary health care helps to increase societal preparedness to deal with emerging pathogens or health shocks such as COVID-19, creating capacity that can be drawn on when needed. The community-based approach of primary health care, which involves deep knowledge of the local context and populations, is well placed to assist in identifying and managing COVID-19 cases. Strong primary health care is also critical to rapid implementation of a vaccine rollout, which is a key step towards full recovery from COVID-19.

This chapter starts by outlining some of the compelling reasons that maintaining care continuity is a critical part of a resilient health care system, assessing the impact of COVID-19 on routine care for people with chronic diseases and other non-COVID-19 care needs. It then evaluates how health systems have built and maintained strong primary health care systems that are responsive to those with ongoing care needs during a pandemic. Finally, it explores opportunities to make health systems more resilient through a strong primary health care system.

6.2. The impact of absorbing COVID-19 on health care provision and outcomes was significant

6.2.1. Declines in access to and use of health care services were widespread

Care was disrupted among many routine services

Among other universal impacts, the COVID-19 pandemic caused broad disruptions to health systems. Routine and chronic care was no exception; disruption was experienced in services ranging from dentistry to dermatology, and from perinatal care to vaccination (Table 6.1). During the first wave of COVID-19 infections (from March to June 2020), most OECD countries postponed non-emergency surgery and reduced outpatient care for non-COVID-19 cases to increase capacity for patients with COVID-19 complications (see chapters on critical care surge and waiting times). Other routine care services were reduced as part of infection control, protecting both patients and health professionals (see the chapter on containment and mitigation).

Delays in access to health care, even short ones, have the potential to cause significant and negative impacts on outcomes. In the case of COVID-19, delays in care were unprecedented in terms of both length and scope. Moreover, the ability of health systems to catch up on care has not always been quick enough to address gaps in care needs fully (see chapters on waiting times and mental health).

Table 6.1. Selected examples of reductions in routine care due to COVID-19 in 2020

Service	Setting	Type of delayed care	Sample	Timeframe	Source
Dental visits	Nationally representative online survey in Germany	22% of respondents postponed scheduled dental care	n = 974	July 2020	Hajek et al. (2021[1])
Dermatology	Web-based global survey of dermatologists	74% of dermatologists stopped performing procedures	n = 733	April 2020	Bhargava, McKeever & Kroumpouzos (2021[2])
Endoscopy	Endoscopy units in 55 countries	83% reduction in total endoscopy volumes	n = 252	April-May 2020	Parasa et al. (2020[3])
Hip and knee arthroplasty	15 US institutions	86% of patients had surgery postponed or cancelled	n = 2 135	May-June 2020	Brown et al. (2021[4])
Magnetic resonance imaging (MRI) examinations	Israeli national MRI registry	47.5% reduction in MRI exams	n = 31 facilities	March-December 2020	Luxenburg et al. (2021[5])
Primary care	Appointments recorded in general practitioner practice systems in the United Kingdom	Over 33% reduction in appointments	n = 23 775 328	April 2020	NHS (2020[6])
Perinatal care	International web-based survey	29% of patients experienced cancelled care	n = 917	May-June 2020	Brislane et al. (2021[7])
Routine vaccination	Nationally representative online survey in Germany	40% of routine vaccination appointments for children and adults cancelled	n = 1 032	March-June 2020	Schmid-Küpke et al. (2021[8])

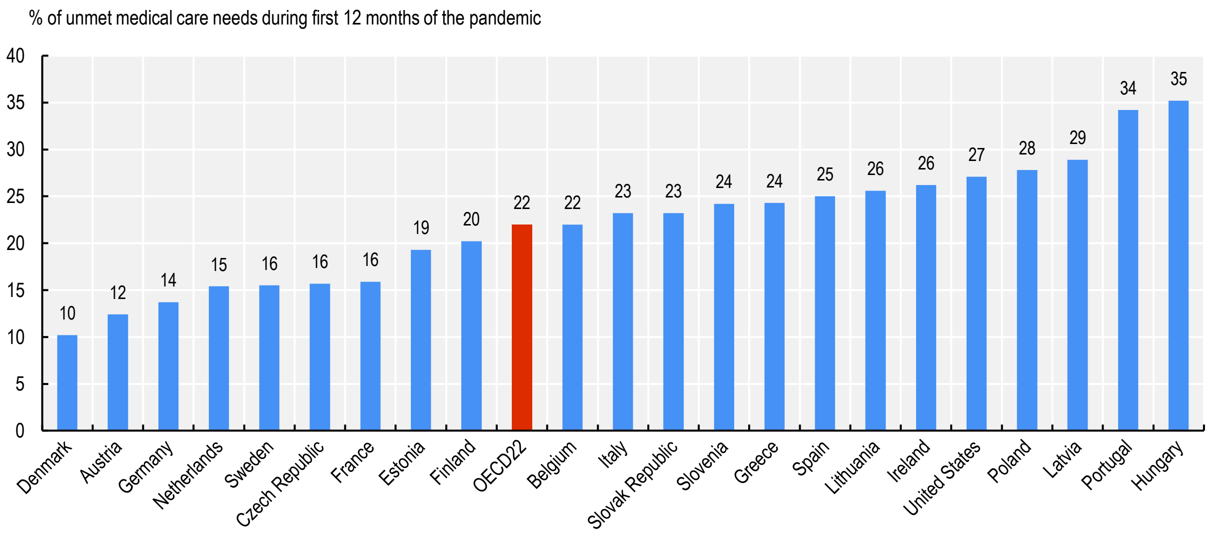
Note: The data are not directly comparable across OECD countries and with 2022 OECD Health Statistics due to different study design, methodology and timeframe of observation.

While some increases in unmet care needs were caused by policy changes that limited or postponed services, demand for care often dropped as well, and reductions in utilisation were experienced from the patient perspective. On average, across 22 OECD countries with comparable data, more than one in five people reported having forgone a needed medical examination or treatment during the first 12 months of the pandemic (Figure 6.1). A survey from Canada found that 30% of adults needing health care services indicated that they had delayed contacting a medical professional about a problem in the previous year (Statistics Canada, 2021[9]).

Reasons for delaying care were often related to taking precautions against COVID-19 – both for personal protection and to help reduce pressure on the health care system. About 18% of those needing health care services delayed contacting a medical professional because of fear of possible COVID-19 exposure in health care settings or public settings (such as transportation). Over 1 in 10 indicated that they delayed care due to concern about overloading the health care system.

Figure 6.1. Unmet medical care needs during the first 12 months of the pandemic, 2020-21

Percentage of unmet medical care needs



Note: Data for Luxembourg are excluded due to low reliability.
Source: Eurofound Living, Working and COVID-19 Survey carried out in February/March 2021, and Centers for Disease Control and Prevention Household Pulse Survey carried out between April 2020 and April 2021.

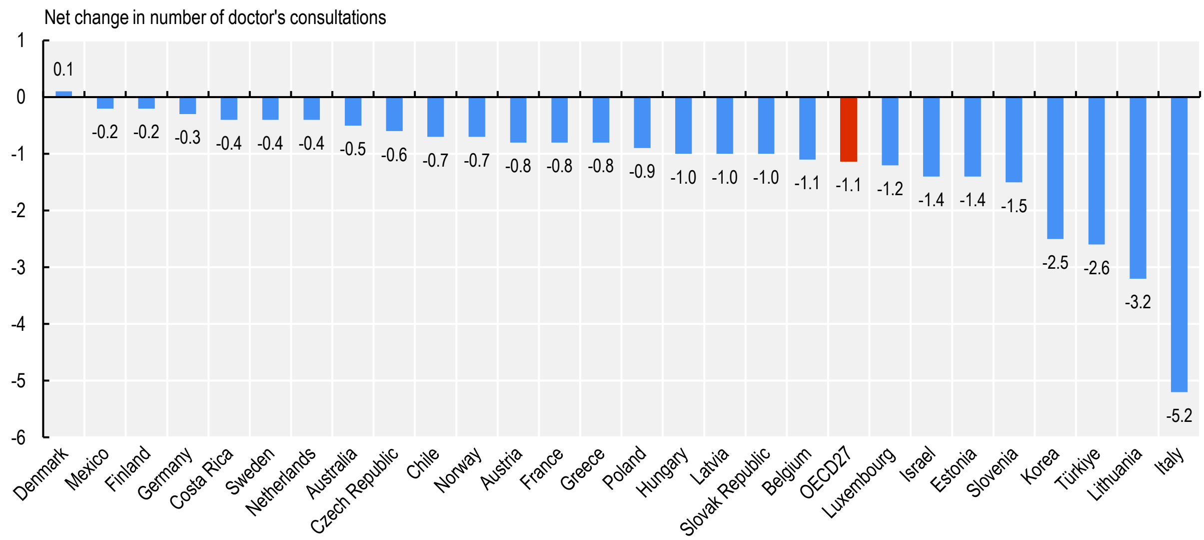
In-person primary health care consultations – a key source of routine care – decreased

Primary health care takes into account the whole person; it is patient-focused, as opposed to disease- or organ system-focused. It thus recognises not only physical but also psychological and social dimensions of health and well-being (OECD, 2020[10]). Key attributes of such a primary health care system include:

- Person and community-oriented care: primary health care operates in close geographical proximity to where people live or work, and provides care focused on the needs of local people and their families.
- Continuous care: primary health care is often the first point of contact with the health system, and the people who use it identify it as their main source of care over time.
- Comprehensive care: primary health care addresses the majority of health problems of the people it serves, providing preventive, curative and rehabilitative services.
- Co-ordinated care: primary health care helps patients navigate the health system, communicating effectively with other levels of care. It goes beyond services provided solely by primary health care physicians, encompassing other health professionals such as nurses, pharmacists, auxiliaries and community health workers.

During the absorb stage of the COVID-19 pandemic, tightened restrictions across health and other sectors meant that many essential health services were postponed or forgone entirely. Primary health care was one of the most affected categories of health services. In-person primary care consultations dropped: the number of consultations with general practitioners (GPs) fell by 66% in Portugal, about 40% in Australia, 18% in Austria and 7% in Norway in May 2020 compared to May 2019. In Luxembourg, GPs saw their consultations decrease by 11% over 2020 compared to 2019, and by almost 30% during the first wave of the pandemic in March-May 2020 (OECD, 2023[11]). On average across OECD countries, total doctor's consultations per capita fell by more than one between 2019 and 2020 (Figure 6.2). In Italy, Lithuania, Türkiye and Korea, the average number of overall doctor's consultations per person fell by more than two over the course of 2020 compared to 2019.

Figure 6.2. Net change in the total number of doctor's consultations per capita, 2019-20



Source: OECD (2022[12]), OECD Health Statistics, https://dx.doi.org/10.1787/19991312.

Those living with chronic health conditions were particularly affected

The ability of health systems to maintain essential services during times of acute stress and demand is one of most important indicators of health system resilience. The COVID-19 pandemic revealed that many health systems faced challenges in maintaining care for people with chronic conditions during the absorb stage of the pandemic.

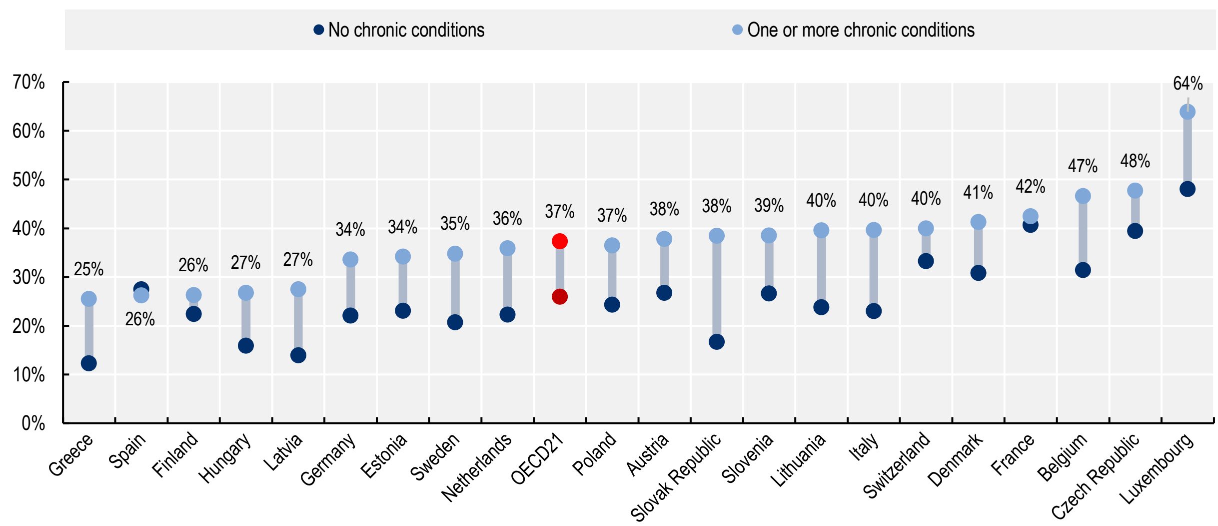
Findings from 92 participating countries, territories and areas surveyed by the World Health Organization (WHO) show that 54% reported that essential services in community care had been disrupted, and 52% reported that essential services delivered in primary care had been disrupted (WHO, 2022[13]). In Australia, a national survey conducted in May 2020 (the first month of COVID-19 restrictions) found that, among respondents who cited a need for health care/disability services, over 40% of those aged 45 years and less and over 50% of those aged 45 years and over found that access to care had worsened (Cicuttini et al., 2022[14]).

These results are supported by other international findings. The Survey of Health, Ageing and Retirement in Europe (SHARE) found that among people aged 50 years and over, those with a chronic condition were, on average, over 40% more likely to report either forgoing or postponing medical care due to COVID-19 (Figure 6.3). On average, 37% of those who indicated having a serious chronic health condition reported cancelled or postponed care, compared to only 26% of people without a chronic health condition. In Luxembourg, the Czech Republic, Belgium, France and Denmark, over 40% of survey respondents with a self-reported chronic condition reported cancelled or postponed care.

In addition to being affected by care disruptions, people living with certain chronic conditions were found to have a higher risk of severe COVID-19 symptoms (OECD, 2021[15]).

Figure 6.3. Proportion of people with chronic health conditions having forgone or postponed care

Percentage of people aged 50 years and over who reported forgoing or postponing medical care due to COVID-19, with and without a self-reported chronic health condition

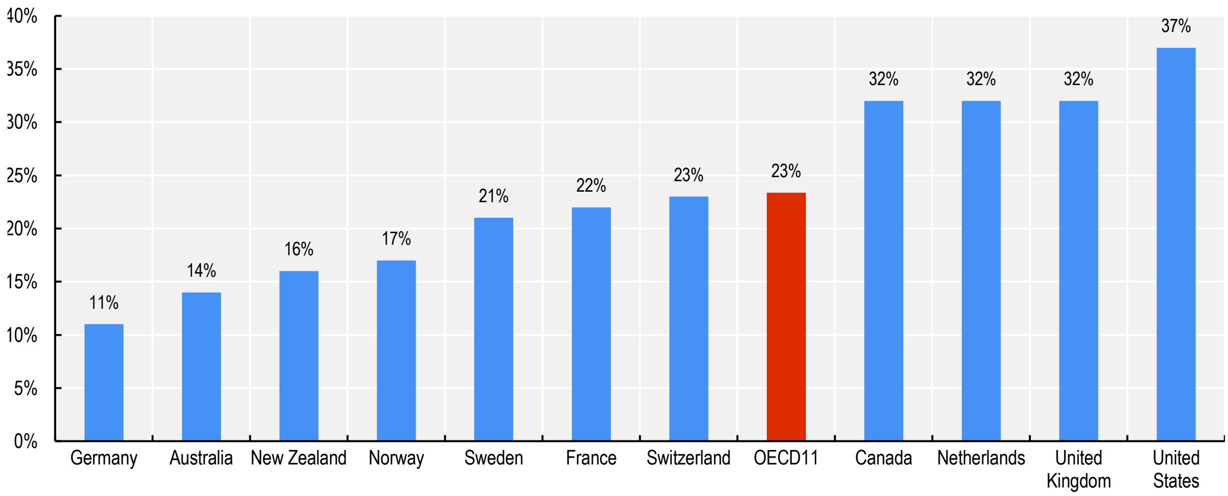


Note: Chronic conditions include: acute myocardial infarction/heart failure, high blood pressure or hypertension, high cholesterol, stroke or vascular disease, diabetes or high blood sugar, chronic lung disease, Parkinson's disease, Alzheimer's disease, dementia or other serious memory problems, rheumatoid arthritis, osteoarthritis or other rheumatism or chronic kidney disease. Data collected between June and August 2020.
Source: SHARE wave 8, 1st SHARE Corona Survey Project.

Patients with multimorbidities are particularly vulnerable to disruptions in care, which can lead to severe consequences and long-term complications (Figure 6.4). This group of patients is at particular risk, as they have high health care utilisation rates; often see multiple providers; and have high rates of emergency department visits and hospital admissions. A study from the United States assessing older patients with chronic health conditions found that one in four Medicare patients was at high risk for delayed and missed care, which was associated with higher rates of non-COVID-19 mortality during the COVID-19 pandemic (Smith et al., 2022[16]).

Figure 6.4. Older adults with multimorbidities reporting cancelled or postponed care due to COVID-19

Percentage of adults aged 65 years and over with two or more chronic conditions who reported that an appointment with a doctor or other health care professional was cancelled or postponed because of the coronavirus pandemic



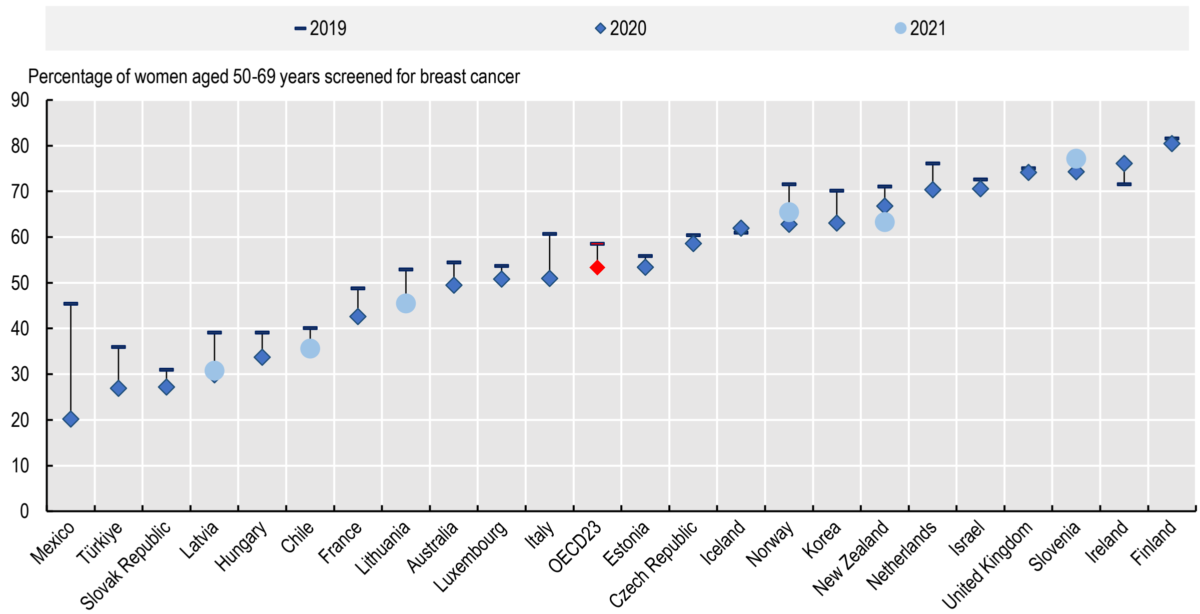
Source: Reginald and Williams (2021[17]), The Impact of COVID-19 on Older Adults: Findings from the 2021 International Health Policy Survey of Older Adults, https://doi.org/10.26099/mqsp-1695.

Delays in cancer screening, diagnosis and treatment were large

Cancer screening and diagnosis were significantly affected by care disruptions caused by the COVID-19 pandemic. According to the European Cancer Organisation, an estimated 100 million cancer screening tests were not performed in Europe (EU27 and the United Kingdom) throughout 2020 as a result of the pandemic, and 1 million patients living with cancer remained undiagnosed due to a backlog of screening tests, reductions and delays in referrals, and restricted health care resources (European Cancer Organisation, 2021[18]).

Delays in access to diagnostic services during the pandemic, which resulted in delayed diagnoses, were observed in many OECD countries. There was an average decline of over 5 percentage points in the proportion of women screened for breast cancer across 23 OECD countries (Figure 6.5). In Mexico, a study of social security data found a decline of over two-thirds in breast cancer (-79%) and cervical cancer (-68%) screening attendance compared to pre-pandemic levels (Doubova et al., 2021[19]). In Luxembourg, data from the Inspection Générale de la Sécurité Sociale indicate that the number of breast cancer screening appointments throughout 2020 was 7% lower than in 2019. On cancer treatment, evidence from Luxembourg shows that the number of radiotherapy sessions fell by almost one-quarter in May 2020 compared to the same month in 2017-19 (Backes et al., 2020[20]).

Figure 6.5. Proportion of women screened for breast cancer in 2019-21 based on programme data



Source: OECD (2022[12]), OECD Health Statistics, https://dx.doi.org/10.1787/19991312.

Survey data on the impact of COVID-19 on 356 cancer centres in 54 countries on six continents (Africa, Asia, Australia, Europe, North America and South America) found that almost 90% of centres reduced their usual level of care. In almost half of cancer centres, at least 1 in 10 patients missed a round of chemotherapy treatment due to COVID-19 (Jazieh et al., 2020[21]). In Australia, an online survey of cancer patients and people with a history of cancer found that 42% of respondents had experienced some level of care disruption. A parallel survey of health care workers found that 43% of respondents experienced atypical delays in delivering cancer care, and half agreed that patient access to research and clinical trials had been reduced (Edge et al., 2021[22]). According to the Cancer Foundation in Luxembourg, around 500 cancers that should have been diagnosed in 2020 were not, because of the pandemic. In total, estimates show that about 10% of expected cancers were not detected and surgeries not performed in 2020 (Mittelbrownn, 2021[23]). Findings from Canada show that in the first year of COVID-19 overall cancer services decreased by a total of 20% and some services – such as biopsies to confirm cancer diagnoses – decreased by over 40% (Walker et al., 2022[24]).

6.2.2. The human costs of care disruption proved high in most OECD countries

Delays to cancer diagnoses and treatments create high costs for health systems – both human and financial. Lower rates of cancer screening may result in poorer outcomes, as patients may be diagnosed later in the course of the disease, making treatment more complex and expensive, and reducing patient survival rates. Delaying surgical treatment for cancer by four weeks for bladder, breast, colon, rectum, lung, cervix, and head and neck cancers has been estimated to increase the risk of death by about 7%, while a delay in commencing systemic therapy (such as chemotherapy) or radiotherapy by four weeks may increase the risk of death by up to 13% (Hanna et al., 2020[25]).

Evidence shows the substantial impact that delays in screening and diagnosis may have on survival (Table 6.2). In England (United Kingdom), diagnostic delays have been projected to increase five-year mortality for four types of cancer between about 5% (lung cancer) and 16% (colorectal cancer) (Maringe et al., 2020[26]). Overall, between 3 291 and 3 621 lives could be lost to four main cancers over the next five years due to delays in diagnosis caused by the COVID-19 response. Accordingly, the total years of life lost compared to pre-pandemic data for these cancers is estimated to range between 59 204 and 63 229 years. In Canada, cancer care disruptions during the COVID-19 pandemic are estimated to lead to 21 247 more cancer deaths in Canada in 2020-30, representing an increase of 2% (Malagón et al., 2021[27]).

Table 6.2. Excess mortality due to delayed cancer care, selected OECD countries

Country	Type of delayed cancer care	Additional cancer deaths related to COVID-19	Source
Australia	Disruption of three months to the national bowel cancer screening programme	2 400 additional colorectal cancer deaths over 2020-60	Cancer Council (2020[28])
Canada	Disruption to cancer care for all sites	21 247 more cancer deaths by 2030 (+2%)	Malagón et al. (2021[27])
France	Reduction in cancer treatment during March-July 2020	1 872-9 756 more cancer deaths in the next five years	Blay et al. (2021[29])
United Kingdom	Diagnostic delays for breast, colorectal, oesophageal and lung cancer	3 291-3 621 additional deaths within five years (+281-344 for breast, +1 445-1 563 colorectal, +330-342 for oesophageal and +1235-1372 for lung cancer)	Maringe al. (2020[26])
United States	Disruption to breast cancer screening and treatment	2 487 excess breast cancer deaths by 2030 (+0.52%): 950 excess breast cancer deaths related to reduced screening, 1 314 associated with delayed diagnosis, and 151 associated with reduced chemotherapy use for early-stage cancer.	Alagoz (2021[30])

Source: OECD Secretariat based on available modelling studies.

6.2.3. Delayed and missed care for chronic conditions was associated with worse health outcomes

Concerns were raised during the COVID-19 pandemic about chronic conditions beyond cancer due to care disruptions. An alarming reduction in health care activity for cardiovascular diseases occurred during the pandemic. The volume of health care service utilisation and procedures for ischaemic heart disease and stroke declined substantially across OECD countries, leading to potentially life-threating complications. While available data are limited, growing evidence suggests an increase in the severity of cardiovascular events at hospital admission. In Germany, for example, the severity of myocardial infarctions was 289% higher during the COVID-19 pandemic than beforehand (Primessnig, Pieske and Sherif, 2021[31]); in Türkiye, the severity was 133% times higher (Kiris et al., 2021[32]). In the United States, Japan and Italy, the severity of myocardial infarctions also increased but to a lower extent (Yasuda et al., 2021[33]; Smith et al., 2021[34]; Tomasoni et al., 2020[35]). Similar consequences were found when assessing the severity of presentation of heart failure and stroke patients (Primessnig, Pieske and Sherif, 2021[31]; Tomasoni et al., 2020[35]; Padmanabhan et al., 2021[36]).

More severe health outcomes due to delayed or missed care were found for people with other chronic conditions, including Alzheimer's disease, dementia, diabetes, chronic obstructive pulmonary disease and anxiety. Among a panel of US Medicaid patients with chronic health conditions, mortality increased by 19 patients per 1 000 annually among those with high rates of delayed and missed care from 1 April 2020 to 31 December 2020 compared to the same period in 2019 (Smith et al., 2022[16]).

6.3. Innovations in primary health care mitigated disruptions to care continuity

During the absorb stage of the pandemic, acute and urgent care was prioritised, disrupting routine care and chronic disease management. During the recovery stage, primary care providers adopted some innovative, flexible and integrated models of care to mitigate the disruptions to ongoing care needs.

6.3.1. New service delivery models were adopted to maintain care continuity for non-COVID-19 patients

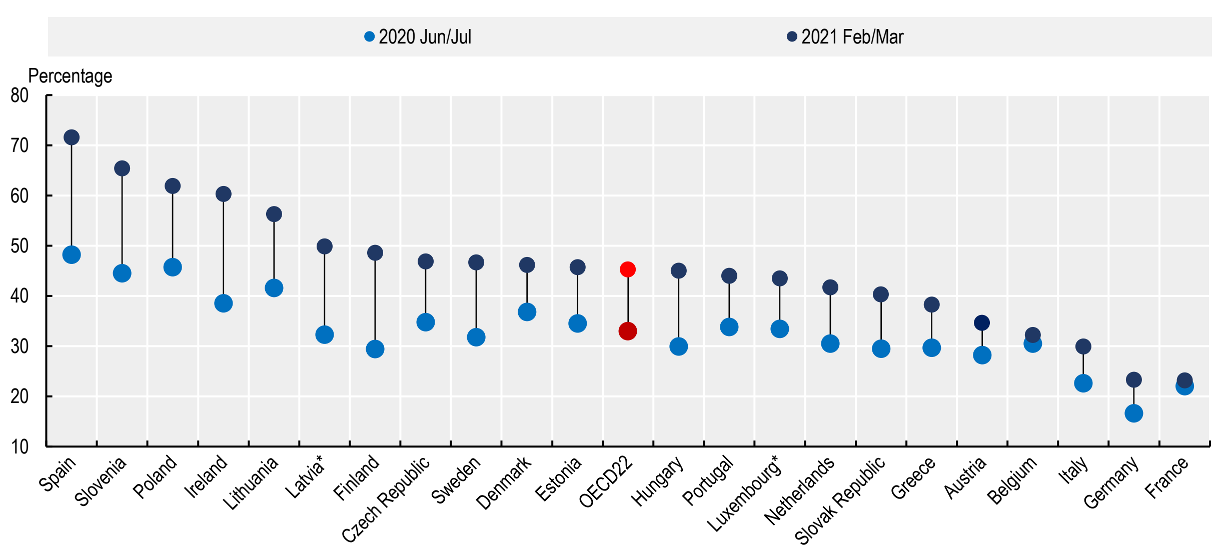
Telehealth was integrated into routine care

Most OECD countries transitioned rapidly to remote care to prevent the spread of COVID-19 and ensure continuity of care – especially for vulnerable individuals such as elderly people and those with chronic illness. Data collected by Eurofound in 2020 and 2021 show widespread use of telehealth in most EU OECD countries (Figure 6.6). In 2021, over 40% of respondents reported having received a medical consultation online or by telephone from a doctor since the start of the pandemic.

Data from the OECD Resilience of Health Systems Questionnaire 2022 show that Australia, Austria, Canada, Costa Rica, the Czech Republic, France, Finland, Germany, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, Portugal, Spain, Türkiye, the United Kingdom and the United States scaled up telehealth and implemented new digital tools to maintain access to primary health care services and improve care co-ordination for non-COVID-19 patients. Moreover, a recent systematic literature review shows that telehealth was rapidly provided in a number of countries – including Belgium, Canada, France, the United Kingdom and the United States. A number of new telehealth formats were introduced, including smart phone applications for remote patient monitoring, patient portals and interactive chatbots, bedside video consultations, crisis and help lines, emails and text messages (Matenge et al., 2021[37]).

Figure 6.6. Increased use of telehealth services during the COVID-19 pandemic

Proportion of respondents who reported having received a medical consultation online or by telephone from a doctor since the start of the pandemic



Note: The data show numbers of respondents in the OECD answering "Yes" when asked "Since the pandemic began, have you received any of the following services from a doctor? Online health care: medical consultation online or by telephone". The survey was carried out in June/July 2020 and February/March 2021. * Low reliability for Latvia and Luxembourg because of low sample size.
Source: Eurofound Living, Working and COVID-19 Survey.

A large range of routine care functions were provided remotely.

- Remote disease management and monitoring was scaled up. In Canada, the Federal Government committed additional funding to scale up remote patient monitoring tools. In the United States, smart phone apps were used with self-monitoring kits and devices to monitor blood pressure, oxygen uptake and glucose to enable chronic disease management remotely (OECD, 2021[15]). In Latvia, some primary health care providers piloted digital tools (such as health apps and telemonitoring platforms) to monitor non-COVID-19 patients. The United Kingdom (Leicester, Leicestershire and Rutland) saw a rapid expansion of remote monitoring to keep track of patients with chronic conditions (such as chronic obstructive pulmonary disease, heart failure and pulmonary rehabilitation) safely in their own homes (NHS, 2021[38]).
- Co-ordination across different levels of care was improved. For example, Costa Rica, the Czech Republic, Finland, Latvia and the United States reformed referral policies between primary health care and long-term care, hospital care and end-of-life care to enable the primary health care system to contact priority populations during the pandemic. In Finland and Spain, digital health services were used during the pandemic to integrate health services further at the local and regional levels. In Latvia, teleconsultations enabled co-ordination of care between care providers, facilitating communication between doctors and fostering teleexpertise.
- Provision of mental health services was increased (see the chapter on mental health).
- Electronic prescribing and other services were also scaled up. For example, Austria scaled up contact-free prescription of medication via the e-Medication service. Australia also implemented electronic prescribing from May 2020 via SMS or email. In the Czech Republic, outpatient physicians provided more teleconsultations to facilitate communication between patients, hospitals and other health care providers, and expanded use of electronic sick notes and e-prescriptions. In New Zealand, remote technologies were used to facilitate repeat medication prescriptions (Al-Busaidi IS, 2020[39]). In Luxembourg, a newly created platform set up in March 2020 allowed patients to consult their treating physicians, dentists or midwives, and to obtain a certificate of incapacity for work or medical prescription via telephone or teleconsultation.

Care integration via multidisciplinary teams enabled proactive contact with vulnerable patients

Several countries including Australia, Ireland, Lithuania and Spain adopted proactive integrated and community-based approaches to identify and engage with high-risk individuals, including elderly people and those living with chronic diseases.

- In Australia, general medical practices across the country, which comprise GPs, primary care nurses, allied health and other health care professionals, provided regular essential primary care services to their patients for chronic conditions, preventive care and mental health concerns (Desboraugh et al., 2020[40]).
- In Ireland, care delivered in the community supported people to live more independently. services between GPs, nurses and other health professionals were co-ordinated and integrated to provide local delivery of primary health care and community services to various target vulnerable populations, including older people and those living with chronic conditions.
- In Lithuania, mobile teams of primary care professionals were introduced to visit patients in their homes to ensure provision of primary care services.
- In Spain, primary health care was provided by multidisciplinary primary care teams composed of GPs, paediatricians, geriatricians, nurses, nurse aides and social workers. In the Asturias region, for example, steps were taken to integrate primary health care better with long-term care. Primary care nurses, who acted as case managers, worked in close collaboration with geriatricians, family doctors and other nurses to ensure continuity of care for fragile chronic patients (WHO, 2021[41]).

Deployment of mobile primary health care units was implemented in 15 OECD countries, including France, Greece, Italy, Mexico, Türkiye and the United States (see Section 6.4). Such community-based models of care, developed with deep knowledge of local contexts, remain key to recovering from the COVID-19 pandemic, particularly given its disproportionate impact on vulnerable groups (Haldane et al., 2021[42]).

In France, for example, ambulatory health care facilities were created to improve access to primary health care in the most deprived areas, and mobile primary care teams were deployed to reach the most vulnerable populations (Rousseau, Bevort and Ginot, 2020[43]). The supply of *Permanence d'Accès aux Soins de Santé and of Equipes Mobiles Psychiatrie Précarité* was also reinforced in France to enhance access to COVID-19 and non-COVID-19 care (including mental health support) for disadvantaged populations. In addition, to remove individual and structural barriers to accessing COVID-19 vaccinations, primary health care teams provided vaccinations at home in at least 18 countries (see Section 6.4).

Home-based care was provided and expanded

Countries increasingly adopted new models of home-based care and "hospital at home" programmes to maintain routine care as they transitioned from the absorb to the recovery stage of the pandemic. This was the case in Australia, France, Germany, Israel, Italy, Lithuania, Mexico, Slovenia, Spain, Switzerland, Türkiye, the United Kingdom and the United States (OECD, 2021[15]). This included models of medicalised hotels, daily medical and nurse visits (in person and via remote care), standard diagnostic and imaging tests, and medicine administration.

- Australia supported home delivery of medicines to vulnerable people. The Home Medicines Service was a temporary programme that paid a fee per delivery to Australian pharmacies for home delivery of medicines to maintain care continuity for patients with underlying health conditions.
- France adopted a national plan to maintain care continuity for elderly people at home to avoid any health complications or health deterioration during the pandemic (Ministère des solidarités et de la santé, 2020[44]). To this end, the *Services de soins infirmiers à domiciles* was reinforced, with greater teamwork between GPs, multidisciplinary medical centres, long-term care mobile units and palliative care networks. Specific hotlines for health workers were developed to offer support and expertise, and to help to organise more collaborative procedures.
- Germany used digital consultations to replace home visits for long-term care insurance needs assessments, and for obligatory counselling by care services for recipients of long-term care.
- In Spain, regional integrated health care services used a variety of new digital health tools (such as patient portals, teleconsultations, virtual assistants and chatbots) to deliver care at home
- (Pericàs et al., 2021[45]).

Expanding the health workforce helped to maintain continuity of care, to some extent, for patients with ongoing health needs and to respond to COVID-19 needs (see the chapter on workforce).

Several countries made efforts to issue short-term, fast-track licences and to provide exceptional training to mobilise health care providers. Health care workforce capacity was built through increased training and capacity building of existing workers. Capacity was also generated by expanding the roles of non-physician primary health care workers – such as nurses, pharmacists, community health workers and auxiliaries. In turn, this helped to alleviate the burden of COVID-19 on the health system and may have boosted capacity for maintaining routine care.

Data from the OECD Resilience of Health Systems Questionnaire 2022 show that various countries – including Australia, Austria, Belgium, Costa Rica, Finland, Latvia, Spain, Switzerland, the United Kingdom and the United States – created new roles and rearranged tasks from both physician and non-physician health workers to maintain care continuity for non-acute COVID-19 cases in the community or at home. For example, in Belgium (Flanders), a new function of "co-ordinating physician" was established at nursing homes (Verhoeven et al., 2020[46]).

In addition, many reforms to expand the role of and responsibilities pharmacists pre-dated the COVID-19 pandemic (OECD, 2020[10]), but its onset propelled further expansion (Box 6.1). For example, in Australia, Canada, France, Germany, Ireland, Luxembourg and the United States, pharmacists are permitted to give COVID-19 vaccinations.

Box 6.1. Expanding the role of community pharmacists to support health system resilience

In several OECD countries, community pharmacy demonstrated its ability to take on roles traditionally delivered elsewhere in the system, making health systems more flexible.

In the United States, pharmacies are increasingly responsible for vaccination delivery. For the 2020-21 season, more adults received their influenza vaccinations at a pharmacy (39%) than at any other location, including a doctor's office or health maintenance organisation (34%).

In Portugal, pharmacies are involved in point-of-care COVID-19 antigen testing. Evidence shows that participation of pharmacies reduced the average distance of each person to the closest testing place, and reduced by almost 40% income inequalities in access to testing.

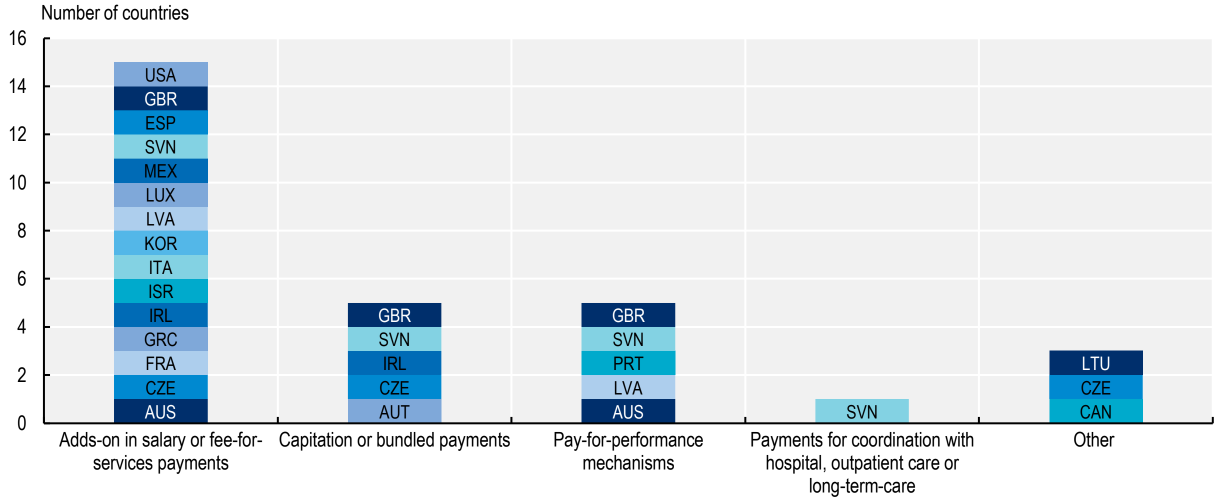
In Australia, community pharmacies are permitted to renew or extend existing prescriptions related to chronic conditions. As a result of the 2020 bushfire crisis and the COVID-19 pandemic, the pre-existing "continued dispensing" arrangements were expanded to include most medicines subsidised for chronic conditions under Australia's Pharmaceutical Benefits Scheme In 2021, community pharmacists dispensed more than 498 000 items to patients who could not otherwise obtain a new prescription, compared to just 14 000 in the year to June 2019.

Source: Authors, based on available evidence in Australia (Australian Government of Health), https://www.pbs.gov.au/info/statistics/expenditure-prescriptions/pbs-expenditure-and-prescriptions-report-30-june-2021; Portugal Infosaude (2022), "Performance of Rapid Antigen Test for Professional Use for the Diagnosis of Sars-Cov-2 in Community Pharmacies"), and the United States (Centers for Disease Control and Prevention), https://www.cdc.gov/vaccines/covid-19/retail-pharmacy-program/index.html.

Countries revisited payment models to offer new services

Countries revisited payment models to offer new services for primary health care providers and maintain care continuity for non-COVID-19 patients. Data from the OECD Resilience of Health Systems Questionnaire 2022 show that, of 26 countries, 19 adopted changes to payment models (Figure 6.7).

Figure 6.7. New payment models introduced to help maintain care continuity for non-COVID-19 patients



Note: N = 26 respondent countries.
Source: OECD Resilience of Health Systems Questionnaire, 2022.

Most countries adopted additional payments in salaries or additional fee-for-services payments. This was the case in Australia, Austria, Canada, the Czech Republic, France, Greece, Ireland, Israel, Italy, Korea, Latvia, Luxembourg, Mexico, Spain, the United Kingdom and the United States.

- Austria extended reimbursement of telemedicine treatment in the tariff agreements/fee schedules of the health insurance funds to include specialist consultations. Moreover, the second COVID-19 Act, enacted on 20 March 2020, regularised important labour market measures and gave additional financial injections to the social health insurance funds (the latter with a budget of EUR 60 million). It also modified the Long-term Care Fund Act, adding a section on extraordinary financial charges (European Observatory on Health Systems and Policies, 2021[47]).
- In the Czech Republic, insurance funds expanded reimbursement mechanisms to allow providers to deliver services via digital health. The 2020 amendment to the Compensation Reimbursement Directive compensated providers for financial losses caused by decreased activity resulting from the pandemic. The Directive also increased fee-for-services payment reimbursements for hospitals and the outpatient sector, and bed-day reimbursements for long-term care providers. Further, it indexed the prospective budget reimbursement for hospitals to account for personal protective equipment (PPE) purchasing and to incentivise providers to increase their activity to manage forgone care (European Observatory on Health Systems and Policies, 2021[47]).
- Luxembourg introduced changes to providers' payment systems by covering real-time teleconsultations, e-prescriptions and sick notes. The fee for this new procedure is aligned with the fee for in-person consultations with a GP and a specialist in geriatrics.
- In the United Kingdom, multidisciplinary team-working in primary care (bringing 26 000 new primary care professionals into general practice) was supported by the Additional Roles Reimbursement Scheme.
- The United States created flexibilities for providers to practise across states and to receive payment for previously unreimbursed telehealth services through Medicare and Medicaid. As of 2021, the Centres for Medicare and Medicaid Services permanently expanded reimbursable telehealth codes for physician fee-for-services payments to include remote monitoring and teleconsultation by health care professionals (Donohue, 2020[48]).

Austria, the Czech Republic, Ireland and Slovenia also adopted new capitation or bundled payments. For example, the Czech Republic adopted a new capitation payment in dental care to finance basic dental hygiene and several simple dental procedures to free up time for dentists to expand dental care and provide more preventive care and specialised care. The country also adopted bundled payments for maternal care to enforce clinical guidelines and prevent wasteful spending.

A few countries revised their pay-for-performance mechanisms (including Australia, Latvia, Portugal, Slovenia and the United Kingdom). For example, Australia doubled payment fees for its Practice Incentives Program Quality Improvement Incentive for practices that remained open for at least four hours per business day to provide face-to-face services to patients. Portugal adopted a law in March 2021 to financially incentivise primary health care to recover activity forgone during the pandemic. An additional maximum financial payment of 95% was targeted to first in-person consultations, follow-up consultations for chronic patients and referrals to hospital care. Another law in Portugal established additional payments of a maximum of 75% for extra activity for elective surgery using diagnosis-related group tariffs defined before the pandemic.

6.4. More can be done to strengthen resilience using primary health care

6.4.1. Strengthening the core functions of primary care brings benefits during and beyond crises

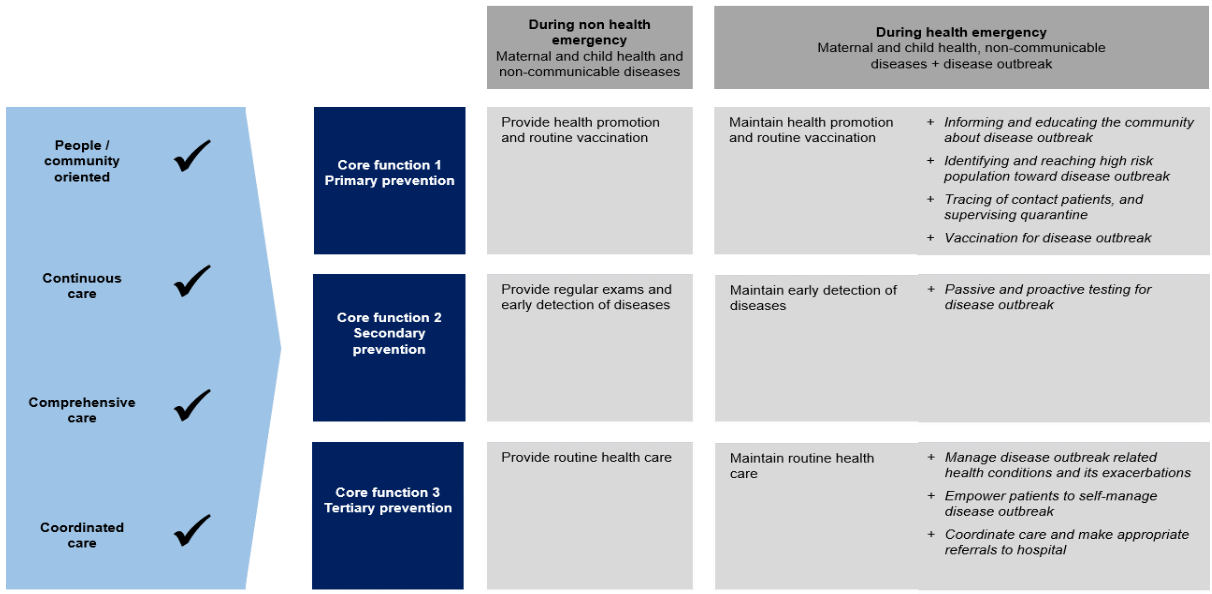
When primary health care services are the main source of care to address the majority of patient needs, have appropriate information to assess a patient’s medical history, and are able to co-ordinate care effectively with other health services, they are well positioned to carry out three core functions:

- primary prevention – especially providing health promotion and immunisation;
- secondary prevention – including providing regular exams and early detection of diseases; and
- tertiary prevention – providing routine health care.

These three core functions are critical to primary health care preparedness and resilience during crises, including health emergencies (Figure 6.8). Evidence confirms that most burdens related to health emergencies fall within the mandate of primary health care roles and functions (Burns et al., 2020[49]). For example, general practice in Australia and New Zealand, which experienced several disasters between 2009 and 2016, undertook a range of critical roles in providing responsive health care. These included providing primary health care in alternative health care facilities, adapting existing health facilities for the purpose of providing disaster health care, and maintaining care continuity for management of chronic diseases. As such, resilient primary health care is key to health systems absorbing and recovering from shocks.

Many key linkages can be found between the core primary health care functions and the ability of countries to respond effectively to the COVID-19 pandemic. For example, primary health care played an important part in COVID-19 vaccine rollouts, informing patients and the community about COVID-19, contributing to early detection of COVID-19 and using outreach services to manage mild COVID-19 in community and primary care settings (Figure 6.8). Primary health care systems also helped to manage the burden of COVID-19, in co-operation with hospitals, to bring efficiency gains in containing viral spread and managing patients, while helping to avoid overcrowded hospitals (see the chapter on critical care surge).

Figure 6.8. Linkages between key primary health care functions ordinarily and during a health emergency



Source: OECD (2022[50]), *Primary Health Care for Resilient Health Systems in Latin America*, https://doi.org/10.1787/743e6228-en.

Countries with strong core primary care functions have absorbed and recovered more quickly from COVID-19-related challenges, showing the way forward.

Primary health care helps build a healthier and more resilient population

The core functions of primary health care build population health resilience and increase capacity for individuals and populations to protect their own health – during the COVID-19 pandemic and in the face of potential future crises. Accessible and high-quality primary health care delays the onset of chronic disease, decreases the need for hospitalisation and reduces avoidable mortality. A convincing body of evidence shows that strong primary health care is associated with better health outcomes across OECD countries (OECD, 2020[10]). A systematic review of 22 studies also shows that continuity of primary health care practice is associated with lower mortality rates (Pereira Gray et al., 2018[51]), a relationship confirmed by previous work (Macinko, Starfield and Shi, 2003[52]; Kringos et al., 2013[53]). More recently, a nationwide study of the Norwegian population shows that continuity in primary health care practice is significantly associated with decreased mortality and reduced acute hospital admissions. If the regular GP – patient relationship has lasted for more than 15 years, the probability of acute hospital admissions and mortality is reduced by 25-50% (Sandvik et al., 2022[54]).

The underlying hypothesis is that the key characteristics of strong primary health care – acting as the first point of contact with the health system, being patient- and community-focused, offering a comprehensive and co-ordinated service – enable health systems to undertake health promotion activities, early detection and better long-term management of chronic conditions (Figure 6.8). Primary care systems can assist with proactive primary prevention to address major risk factors for health, which contribute to the infectious and the non-communicable disease burden (Box 6.2). Primary health care is also in a unique position to understand a patient's medical history and current needs, to identify those at risk of disease and to seek out patients for preventive treatment before they get sick. The long-term relationship with primary health care practice also leads to more personalised medical management tailored to patient needs.

The beneficial impact of strong primary health care on population health is particularly relevant in the context of COVID-19. Research from several countries shows that people living in good health are at lower risk of severe COVID-19 symptoms, while COVID-19 symptoms and outcomes are more severe in people with chronic diseases or underlying health conditions (Honardoost et al., 2021[55]; Centers for Disease Control and Prevention, 2022[56]).

Box 6.2. Reducing risk factors can contribute to resilient and sustainable health systems

Addressing low physical activity, unhealthy diets and obesity improves the overall health of the population, making it more resilient to COVID-19 and potential future outbreaks of infectious diseases. Evidence has shown that physical activity provides protective effects against severe COVID-19 outcomes (Sallis et al., 2021[57]), that a diet characterised by healthy plant-based foods is associated with lower risk and severity of COVID-19 (Merino et al., 2021[58]), and that people with severe obesity are more likely to develop severe symptoms or die from COVID-19 (Booth et al., 2021[59]).

Moreover, regular moderate-to-vigorous physical activity has been shown to increase the potency of vaccination (Chastin et al., 2021[60]). Increasing physical activity can also help to reduce the considerable impact of a pandemic on mental health. Since the start of the COVID-19 pandemic in early 2020, prevalence of anxiety and depression has increased (OECD, 2021[61]) (see the chapter on mental health). Physical activity can help to tackle this issue, as it is as effective as cognitive behavioural therapy or antidepressant medication for mild depressive symptoms (WHO, 2019[62]).

Primary health care facilitates the ongoing rollout and uptake of COVID-19 vaccines

Person- and community-oriented primary health care is best placed to reduce the impact of the pandemic through rapid implementation of COVID-19 immunisation. Primary care teams have traditionally played a critical role in vaccine delivery, including childhood and adult vaccination programmes – for example, to prevent the spread of measles, diphtheria, tetanus toxoid and pertussis.

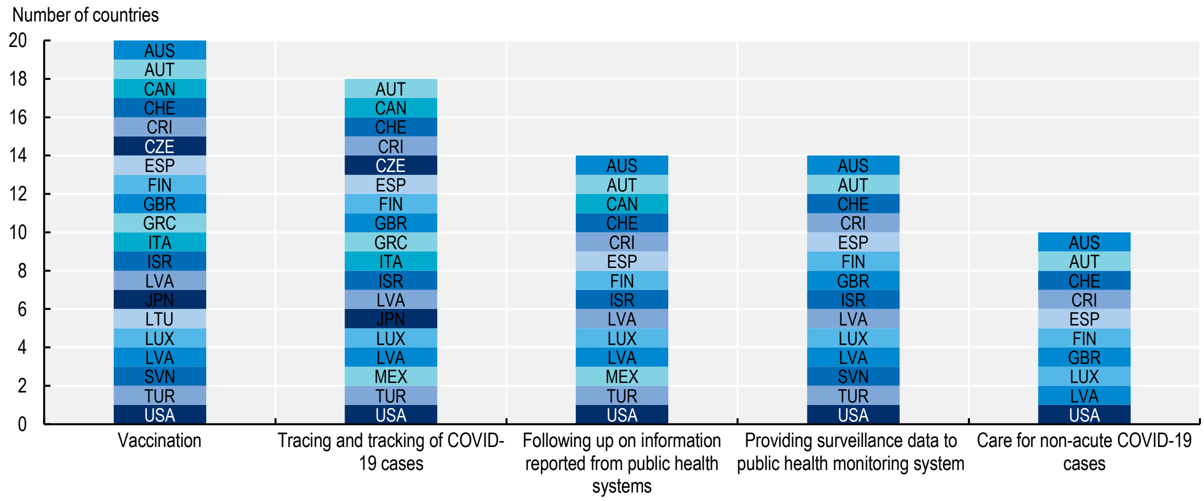
Given the experience of many countries in embedding vaccination programmes into their primary care system functions, primary care teams have been – and remain – uniquely placed to facilitate uptake and delivery of COVID-19 vaccines in the community, including for people living in deprived, rural and remote areas (Pinaka et al., 2021[63]; Lewis, Nuzum and Schneider, 2021[64]).

Knowledge about the local population and long-term relationships with patients are key elements for successful and personalised vaccine rollout. In addition, as a trusted source of information, primary health care providers are often well placed to provide immunisation counselling, and to counter vaccine hesitancy and misinformation (Chiolero, 2021[65]). Recent evidence from high-income countries confirms that the most important person in an individual's decision to get vaccinated is the primary care provider, because of this relationship, through which they can address any hesitancy or concerns in a personal way (ACP Internist, 2021[66]).

Almost all respondents to the OECD Resilience of Health Systems Questionnaire 2022 (20 out of 26 countries) reported using non-physician health workers – including nurses, pharmacists, community health workers and auxiliaries – to support COVID-19 vaccination efforts (Figure 6.9). For example, in Australia, Canada, France, Germany, Luxembourg and the United States, pharmacists administered COVID-19 vaccinations. In Ireland, community pharmacists (in addition to GP surgeries) administered over 600 000 COVID-19 vaccinations, including booster shots. This supported the COVID-19 vaccine rollout, including among those who had previously shown vaccine hesitancy. In Slovenia, where primary health care centres work in close co-operation with public health teams, health-promoting nurses were redeployed to vaccination centres. They were responsible for communicating with the public to counter vaccine hesitancy and misinformation.

In response to COVID-19, countries have also used non-physician primary care workers to carry out other important public health functions. In at least 18 OECD countries, non-physician health workers supported work to track and trace COVID-19 cases, and in 14 countries they also provided information to public health systems and surveillance data to public health monitoring systems.

Figure 6.9. Countries using non-physician health workers in COVID-19 vaccination and track and trace activities



Note: N = 26 respondent countries.
Source: OECD Resilience of Health Systems Questionnaire, 2022.

Primary health care helps with early detection and management of mild COVID-19

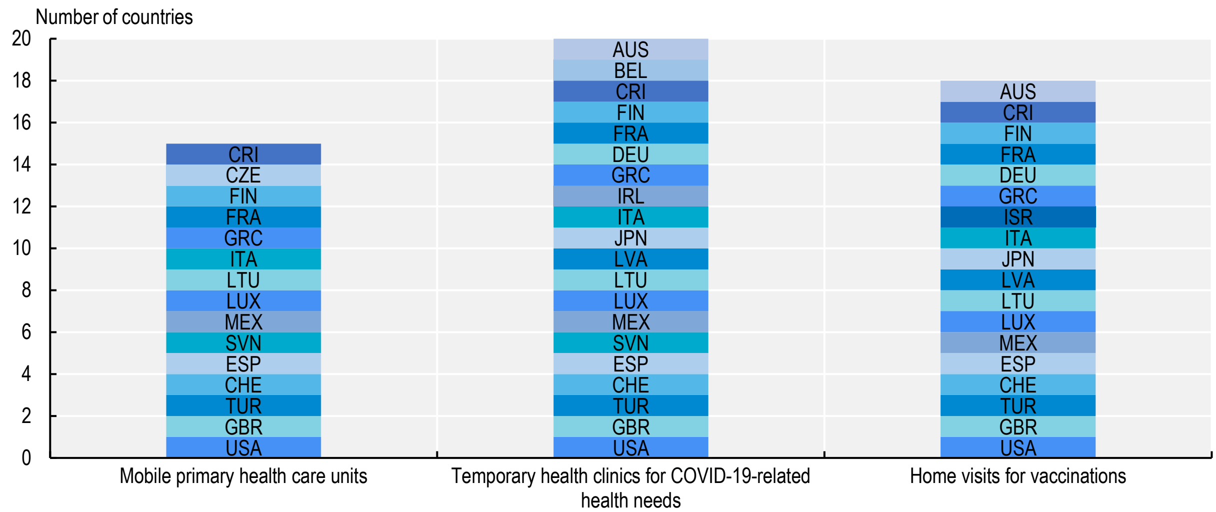
Primary health care teams play a pivotal role in carrying out early and precise case detection in the community – through passive or proactive testing – and in managing non-acute COVID-19 (consistent with secondary and tertiary prevention in Figure 6.8). Early detection of COVID-19 and patient management in the community are key to minimising virus circulation and maximising protection, including of elderly people, chronic patients and health care workers (Haldane et al., 2021[42]) (see also the chapter on containment and mitigation).

Research from Australia and New Zealand has shown how primary health care systems have assumed a wide range of relevant roles, including providing patient triage and medical attention for mild cases, and empowering patients to self-manage COVID-19 (Burns et al., 2020[49]).

At least 20 OECD countries used temporary health clinics set up in primary and community settings to increase COVID-19 response capacity (Figure 6.10). In Belgium, “corona centres” were established by primary care physicians, often organised within the structure of out-of-hours GP co-operatives to perform COVID-19 testing and separate COVID-19 and non-COVID-19 care delivery (Verhoeven et al., 2020[46]). In Luxembourg, proactive large-scale testing was launched in the community from 18 May 2021 for the entire population and cross-border workers. The overarching objective was to identify asymptomatic individuals to break the chain of transmission and reduce the spread of the virus. In parallel to this large-scale testing, a contact tracing unit was set up by the Health Directorate to identify contacts, administer quarantine and manage cluster of infection. Evidence has shown the effectiveness of large-scale testing to control transmission of the virus, especially among asymptomatic COVID-19 patients (Wilmes et al., 2021[67]).

Figure 6.10. Countries that introduced temporary health clinics to manage COVID-19-related health needs

Enhanced capacity for primary health care during the COVID-19 pandemic



Note: N = 26 respondent countries.
Source: OECD Resilience of Health Systems Questionnaire, 2022.

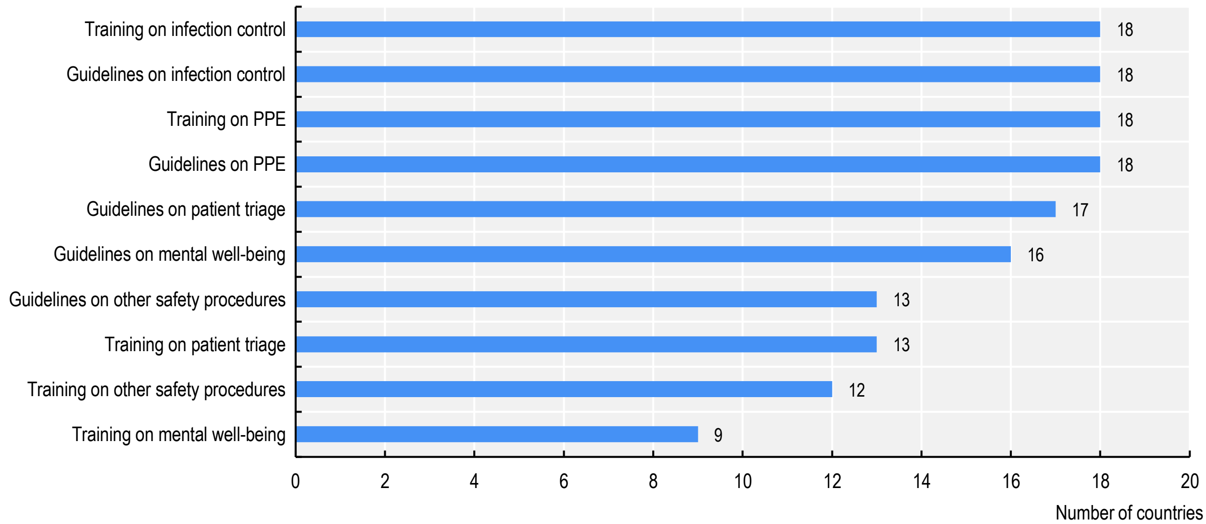
In Slovenia, entry points for COVID-19 patients have been organised in community care units next to the location of 16 primary health care centres to carry out testing and patient triage. In Mexico, COVID-19 respiratory triage and health care flowcharts for primary health care facilities were introduced to proactively identify patients with COVID-19 symptoms on entry to primary health care facilities. Overall, 4 094 respiratory care modules were developed to detect COVID-19-infected people in family medicine clinics.

Enhancing primary health care workforce capacity

A strong and well-equipped primary health care workforce has robustly supported the COVID-19 response. Health care workers faced high prevalence of stress, depression and anxiety during the pandemic, as described in chapters on mental health and workforce. This highlights the need to promote health workforce capacity as a key strategy to create adaptability and resilience to future shocks. Enhancing this capacity and building its resilience over the longer term requires timely guidelines and appropriate training on infection control, PPE and support for worker well-being (Figure 6.11).

Most OECD countries have developed new policies on PPE and infection control, in particular. In Latvia, for example, initiatives implemented included guidelines and training on the use of PPE, recommendations for development of hygienic and epidemic plans of medical institutions, guidelines on infection control and prevention in GP practices and for nurses, midwifes and assistant nurses, among others. The United Kingdom also issued guidance on SARS-CoV-2 infection prevention and control in health care settings and primary care. Likewise, Costa Rica, Greece, Ireland, Mexico, Slovenia and the United States have published guidelines on infection control, ventilation, PPE use and other topics. Respondents to the OECD Resilience of Health Systems Questionnaire 2022 had also implemented new training and guidelines on mental well-being. Austria, Ireland, Lithuania and Slovenia reported that they had developed guidance and training in relation to mental well-being.[1]

Figure 6.11. Countries developing training and guidelines on infection control, personal protective equipment (PPE) use and safety procedures



Note: N = 26 respondent countries.
Source: OECD Resilience of Health Systems Questionnaire, 2022.

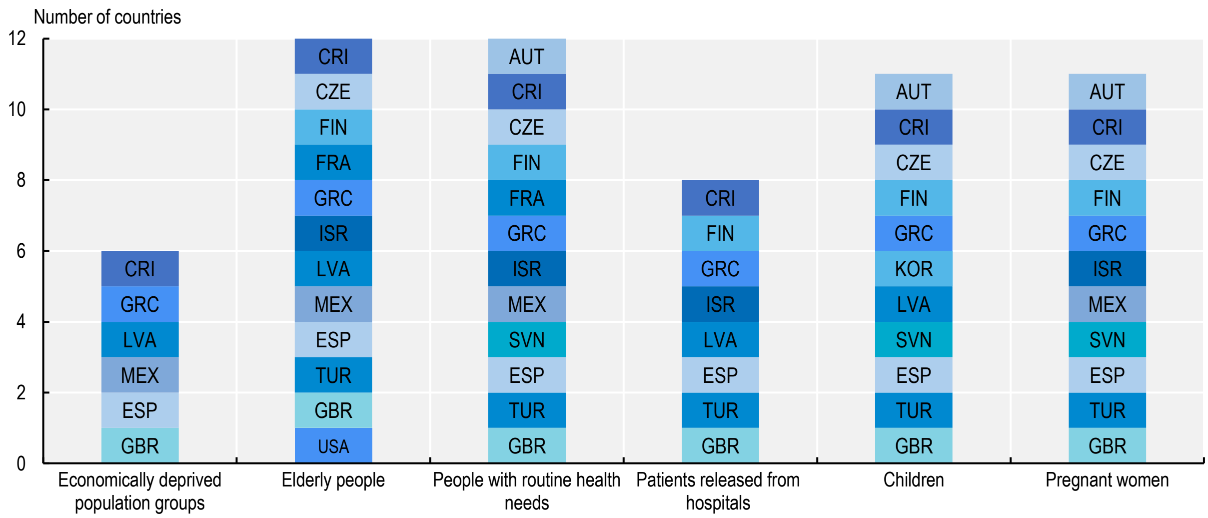
Better targeting and outreach to vulnerable groups

Countries need to focus more on proactive delivery of primary health care services to hard-to-reach populations. This will help to drive recovery from the pandemic, as well as preparing primary health care services for future shocks. Research from several OECD countries shows that vulnerable populations are at greater risk from COVID-19 (see the chapter on COVID-19 outcomes). Across 12 OECD countries, people living in the most deprived areas have consistently higher risk of dying from COVID-19. In Australia, Canada, England and Scotland (United Kingdom), the risk of dying from COVID-19 is between 2.1 and 2.6 times higher among people living in the most deprived areas.

The disparity of COVID-19 health impacts emphasises the need to activate primary health care services to reach lower socio-economic and other vulnerable groups. This requires primary health care systems to be able to identify and contact specific priority populations, but during the COVID-19 pandemic, only 12 OECD countries reported having the functionality to identify and contact elderly people and those with routine health needs (Figure 6.12). Further, only six countries reported that their primary health care systems had the functionality to identify economically deprived populations at high risk of severe COVID-19 illness.

Strong data systems, such as electronic health records (EHRs), should be used to generate lists of patients in high-risk groups for targeted outreach (see the chapter on digital foundations). Such systems offer the opportunity to prioritise patients who need to be seen immediately, and to contact these vulnerable people proactively, providing them with education or a telehealth consultation when face-to-face consultation is not possible. In the United States, 98% of health centres in 2020 had EHR systems installed at all their sites, and these systems were used by all providers during the pandemic. Health centres used their EHRs to identify, track and contact specific priority populations for delivery of primary health care services, including vaccination, routine follow-up for chronic care and education (HRSA, 2021[68]).

Figure 6.12. Countries where primary health care can identify and contact specific vulnerable population groups



Note: N = 26 respondent countries.
Source: OECD Resilience of Health Systems Questionnaire, 2022.

6.4.2. Governance, data and funding models to integrate care can foster adaptability and resilience

The pandemic calls for accelerated action to integrate care

Overall, new models of care delivery were evident during the absorb and recovery stages of the pandemic. These new models relocated acute care outside hospitals, broadened coverage of primary health care, accentuated home-based care and blurred the boundaries between health and social care. In many instances, these new models relied on digital solutions and workforce flexibility for their effectiveness. People with complex health care needs often require multiple treatment regimens and interactions with different providers, making them more susceptible to poor and fragmented care. This requires integrated systems capable of continuous, co-ordinated and high-quality care delivery throughout people’s lifetime across different settings. However, care co-ordination across OECD countries remains challenging.

High rates of hospitalisations of patients living with chronic conditions signal that systems have failed to act in delivering seamless care. Recent OECD data flag large cross-country variation in one-year readmission rates and mortality after discharge from stroke and congestive heart failure hospitalisation (Barrenho et al., 2022[69]), and avoidable admissions for prevalent long-term conditions (OECD, 2021[70]) as signs that health systems are failing to deliver effective prevention in the community and care co-ordination across settings. Poor co-ordination is also reported between health and social care. In 2019, between 36% and 88% of primary care physicians in 11 OECD countries reported not co-ordinating care frequently with social services or other community care services (Doty et al., 2020[71]).

Numerous health systems still face challenges imposed by inconsistent institutional leadership, weak governance models and ineffective reorganisation of care delivery that undermine integrated care (Gordon et al., 2020[72]; Borgermans and Devroey, 2017[73]). Strong governance is key to strengthening co-ordination of care delivery between primary health care, hospitals, community health services and long-term care (see the chapter on long-term care).

Governance and reorganisation of service delivery may entail establishment of care networks, organisational restructuring of various levels of providers into a single organisation, and adoption of new service platforms like intermediate care, mobile health clinics, “hospital at home” programmes or multidisciplinary team-based primary care. For instance, in Finland, a new social and health care reform aims to bring primary care, community care, basic mental care, oral care, social care, outpatient rehabilitative care and some other specialist care services under the same management. Moreover, the Basque Country (Spain) has merged hospitals and primary health care structures into integrated health care organisations.

Disruptions like COVID-19 emphasise the crucial role of better data and stronger information systems

While the widespread implementation and use of telehealth during the pandemic was remarkable, there is an urgent need for more evidence about the cost-effectiveness of telehealth in improving outcomes for those living with chronic diseases, which is still limited (Bitar and Alismail, 2021[74]). At the same time, many obstacles to care remain, including equal access to technology and new digital tools, and appropriate digital health literacy (Hinchman et al., 2020[75]).

Stronger information systems can help to promote care co-ordination between patients and their providers, improve the accuracy of diagnoses and clinical decisions, help to monitor and deliver care remotely, and empower people in co-producing health to deliver more people-centred health systems (OECD, 2021[76]; Barrenho et al., 2022[69]). However, better governance frameworks need to be fit for resilience, and need to solve current regulatory framework and data protection limitations (see the chapter on digital foundations). Some countries are investing heavily in digitalisation. The German Federal Government endowed EUR 4.3 billion and the federal states another EUR 1.3 billion (a total of EUR 5.6 billion) to the Future-proof Hospital Programme to modernise digital infrastructure in hospitals.

Financing policies and payment mechanisms must align with provider incentives

How health care providers are paid is a key lever for policy makers to improve health performance, including resilience and efficiency. Financing health care is, however, a cascade of mechanisms involving collection of funding from multiple sources (including both public and private), pooling of funding and purchasing of services. This requires the design of provider payment mechanisms that incentivise co-ordination and value-based care. Financial integration is one possible way of improving care co-ordination. Countries are also revisiting alternative innovative payment approaches, including add-on and bundled payments, to incentivise providers to work together effectively.

While the evidence of their success is mixed so far (Barnett et al., 2019[77]; Joynt Maddox et al., 2018[78]; Stokes et al., 2018[79]), some countries are using different payment mechanisms to incentivise integrated care. For example, France is piloting a bundling payment across inpatient and outpatient specialist care within 135 days after hip surgery (ATIH, 2020[80]). Other countries (Canada, the Czech Republic, Denmark, Sweden and the United Kingdom) are paying to encourage reductions in delayed hospital discharges (OECD, 2020[10]).

6.5. Conclusions: Strong primary care underpins a resilient health system

Primary health care has been one of the most affected categories of health services during the COVID-19 pandemic – especially during the absorb stage, and specifically for people with chronic conditions. For example, according to SHARE data, those who had a chronic condition were almost 40% more likely to report either forgoing or postponing medical care due to COVID-19. Delays in cancer screening, diagnosis and treatment have also been significant. An estimated 100 million cancer screening tests were not performed in Europe as a result of the pandemic, and 1 million patients living with cancer remained undiagnosed due to a backlog of screening tests, reductions and delays in referrals, and restricted health care resources. Such care disruption has come at a high cost for people and health systems.

Many changes were made to service provision to maintain care continuity during the pandemic. Several primary health care services were moved to a telemedicine format, but the impact on health outcomes has not yet been evaluated. To a lesser extent, countries have used multidisciplinary teams with public health and community services to contact patients with underlying health needs proactively. Countries adopted strategies to maintain care continuity by attributing new roles and responsibilities for health workers. These ranged from increasing the role of nurses and community health workers providing home-based care (in Slovenia, the United Kingdom, the United States) to allowing community pharmacists to prescribe or extend prescriptions for chronic conditions (in Austria, France, Portugal).

International learning from the pandemic indicates that countries with stronger primary health care demonstrated greater resilience through, for example, facilitating COVID-19 vaccine rollout (Canada, France), helping with ongoing early detection of COVID-19 (Australia, New Zealand) and management of mild COVID-19 (Belgium, Luxembourg). There are many key links between core primary care functions during non-health emergencies and the ability of countries to respond and recover effectively from the COVID-19 pandemic. In adapting for the future, primary health care should therefore undertake three core functions: primary prevention (providing health promotion and immunisation); secondary prevention (providing regular exams and screening tests to identify diseases); and tertiary prevention (managing diseases post-diagnosis).

Policy makers also need to focus on how to support an appropriate workforce – especially those working in community, long-term and primary care settings, to build resilience for primary care. The primary health care workforce needs to be supported though concrete policy actions and appropriate resourcing, such as training and access to services to promote employee well-being.

Finally, policy makers should focus on improving integrated care through strengthened governance models, strong information systems and better use of financial incentives. The efforts made during the pandemic to strengthen health data infrastructure should also continue, with the aim of strengthening health systems resilience through primary care.

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Notes

[1] Lithuania has implemented a number of reforms around health care workforce well-being, including creation of crisis training and institution crisis action plans in relation to addressing psychological crises and psychological resilience training in personal health care institutions. Austria has developed mental health recommendations during the COVID-19 pandemic for team leaders, managers and health care workers in health care facilities. Ireland has made guidelines and training on mental well-being available to Health Service Executive staff, including how to deal with stress, build resilience, improve sleep and provide mental space from COVID-19. Similarly, Slovenia has implemented training on psychosocial support for employees in social welfare institutions to facilitate coping with work-related burdens. Türkiye has also developed guidance and training on mental well-being.

7 Strengthening resilience in long-term care

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This chapter describes the impact of the COVID-19 pandemic and the corresponding policy responses on the long-term care sector. It also presents policy avenues to make long-term care more resilient in the future. The chapter focuses on avoiding fragmentation of long-term care, financing and funding of the sector, preventive and rehabilitation services, and the critical role of long-term care workers and informal carers.

Key findings

The COVID-19 pandemic has severely affected the long-term care (LTC) sector. This sector supports dependent people with the activities of daily living (such as eating and washing) alongside some types of medical care, or provides services (including cooking and cleaning) to assist people to live independently. Analysis of the impacts of the pandemic and the response to it found the following:

- Around 34% of all cumulative COVID-19 deaths were among residents in LTC facilities by April 2022. However, this share was down from 40% in early 2021, suggesting that efforts to contain and mitigate the spread of the virus among LTC recipients improved.
- The vaccine rollout was a game changer. Residents in LTC facilities and staff were prioritised to receive COVID-19 vaccinations in virtually all OECD countries from the end of 2020 to early 2021, and there was a decline in deaths shortly afterwards. However, the pandemic may still pose a threat to LTC residents due to the emergence of variants.
- LTC was often delayed and cancelled. About 20% of older people who received personal care from people living outside their household regularly reported forgone or postponed care in 2021 across 23 OECD countries. LTC workers were also very exposed, and typically worked longer hours or became ill themselves. Informal carers generally reported an additional burden.

A range of policy actions can improve the readiness of the LTC sector to respond to future shocks, some of which OECD countries implemented once the pandemic began:

- Infection prevention and control protocols, testing and personal protective equipment should remain updated/available. Maintaining high vaccination rates for LTC workers and residents is very important.
- Countries need more LTC workers, and these additional workers must be well prepared and trained. Around 90% (20 of 22) of surveyed OECD countries implemented mobile teams to support rapid responses during outbreaks, especially in LTC facilities, according the 2021 OECD Survey on COVID-19 and LTC. While many countries increased the workload of LTC workers, nearly all countries made efforts to recruit staff.
- Efforts should be made to expand the use of digital technologies to ensure care continuity and maintain social contact between care recipients and their relatives in times of crisis. LTC facilities expanded the use of telehealth in 21 OECD countries after the pandemic began.
- Task forces should include LTC experts, or LTC-specific task forces should be set up. Nearly 20% (5 of 26) of surveyed countries did not have COVID-19 task forces that included an LTC expert.

Many of these actions taken by OECD countries, while valuable, were temporary and limited. OECD countries can and should make structural changes to better withstand population ageing and strengthen resilience:

- Countries should further harmonise eligibility criteria and benefits in the LTC sector.
- Countries should consider allocating additional permanent funding to long-term care, including to bolster the workforce. Over one-third of people across OECD countries would be ready to pay an additional 2% of their income in taxes and social contributions to fund more public support for LTC. Avenues to fund more LTC may rely on broad-based funding routes.
- Countries should develop further preventive, rehabilitation and end-of-life care services. These can improve quality of life and/or postpone LTC needs and related spending.
- Ensuring that sufficient carers are available is vital. This requires policies to improve pay and working conditions that address structural workforce shortages in the sector. Countries can also provide better public support to informal (family) carers, including respite and leave entitlements.

7.1. The COVID-19 pandemic and responses to it have impacted long-term care

The COVID-19 pandemic was a shock that severely affected the long-term care (LTC) sector. Over one-third of all cumulative COVID-19 deaths were among residents in LTC facilities on average across OECD countries by April 2022. However, the share had decreased in virtually all countries with available data, suggesting that the vaccination rollout was a game changer. Care services were considerably disrupted at the beginning of the pandemic but resumed gradually. Providing adequate care nonetheless proved challenging during infection peaks when LTC workers were ill. Policy measures such as stringent visit restrictions impacted negatively on the well-being of LTC residents and their relatives, and a substantial share of care recipients at home felt low. Many LTC workers reported poor mental well-being.

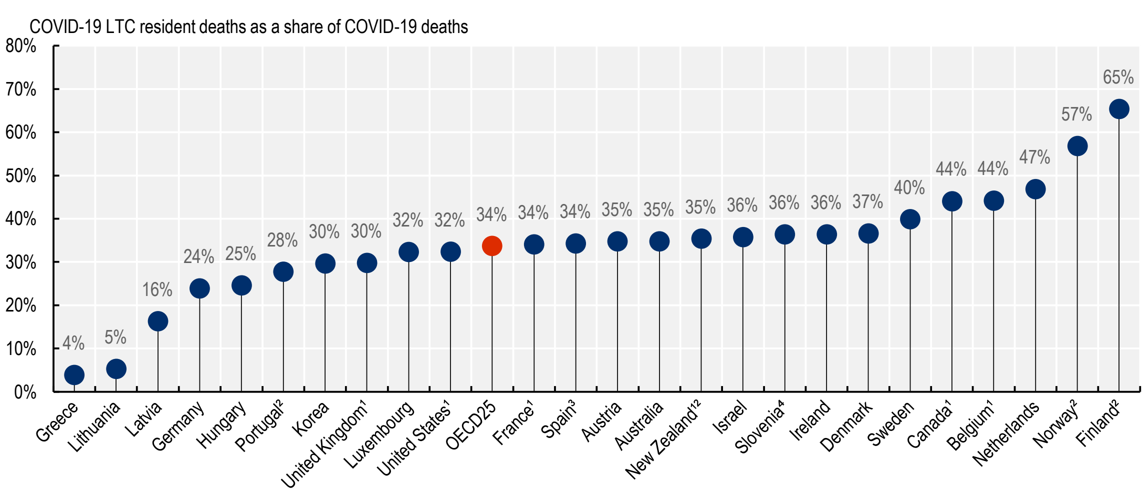
7.1.1. Over one-third of all COVID-19 deaths were among long-term care residents

COVID-19 disproportionately affects older people, who are at a higher risk of developing severe symptoms and dying because of underlying health conditions and frailty. More than 90% of all cumulative COVID-19 deaths were among people aged 60 years and over, and over 50% were among those aged 80 years and over on average across 22 OECD countries by April 2022. These latter OECD averages have remained stable over the course of the pandemic. The rate of COVID-19 deaths among the population aged 60 years and over was over 7 800 deaths per million people and among those aged 80 years and over was 24 000 deaths per million by mid-April 2022.

Residents of LTC facilities have been particularly affected. Older adults living in LTC facilities (including nursing homes, assisted living facilities, etc.) are at the highest risk because of both individual and group-level factors. At the individual level, they are typically in poorer physical and mental health; at the group level, they live in shared areas with group-based activities, and congregate during meals, facilitating the spread of the virus.

Over one-third (34%) of total COVID-19 deaths were among LTC residents across 25 OECD countries by April 2022 (Figure 7.1). While Finland and Norway had the highest shares of LTC resident deaths among all COVID-19 deaths, they were also among the OECD countries with the lowest overall COVID-19 mortality rates.

Figure 7.1. Proportion of LTC residents among all COVID-19 deaths across OECD countries



Note: Data on cumulative deaths covers different periods: data cover up to May 2022 for eight countries or else up to 2021 for the remaining countries, except for Israel (2020). 1. Includes confirmed and suspected COVID-19 deaths. 2. Only includes deaths occurring within LTC facilities, not those occurring after transfer to hospitals. 3. Data come from regional governments using different methodologies, some including suspected deaths. 4. Slovenia includes deaths in nursing homes and social LTC facilities.
Source: LTC COVID-19 website, complemented with European Centre for Disease Prevention and Control (ECDC) data and 2021 OECD Questionnaire on COVID-19 in LTC.

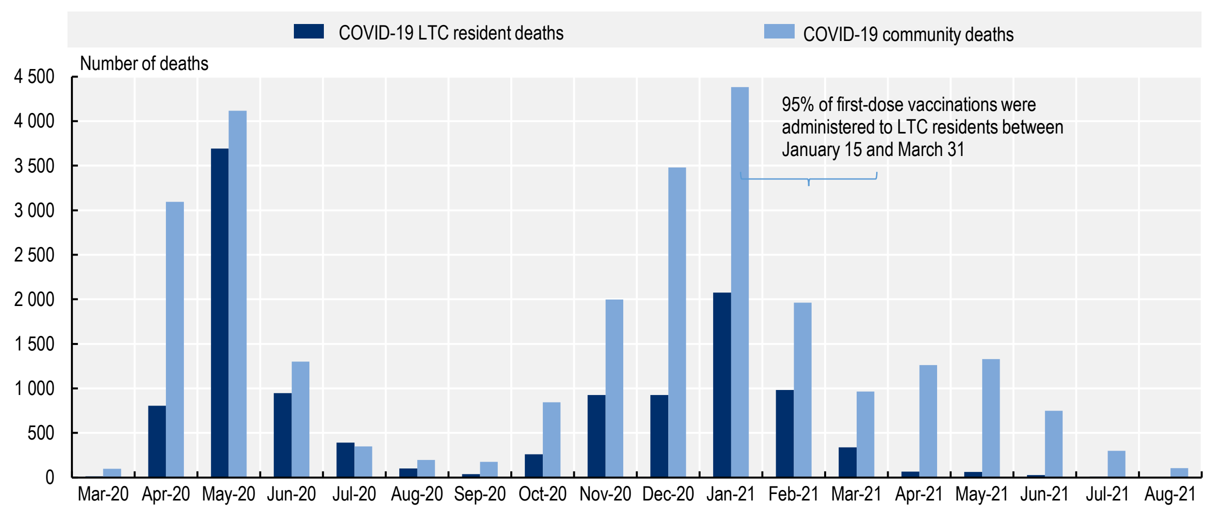
Compared with the shares among all cumulative COVID-19 deaths up to 2020 and up to 2021, the share of LTC resident deaths among all cumulative COVID-19 deaths up to 2022 decreased in nearly all OECD countries with available data. The strongest reductions occurred in Australia and New Zealand – two countries with low COVID-19 mortality rates compared to other OECD countries during the pandemic. This suggests that vaccination rollouts had a strong impact on the LTC sector.

7.1.2. Vaccines have been a game changer in long-term care

LTC residents and staff were prioritised to receive COVID-19 vaccinations in most countries from the end of 2020 and early 2021, when many countries were hit by a COVID-19 peak. There was a marked decline in deaths thereafter.

For example, in Canada, 95% of residents in most jurisdictions received their first dose of the vaccine between 15 January and 31 March 2021, compared with only 3% of the general population (Figure 7.2). This high vaccination rate reduced both infections and deaths among LTC residents by over 90%. The vaccine rollout for staff was slower. By 15 March 2021, 60% of staff had been vaccinated, and cases had declined by 63% (Canadian Institute for Health Information, 2021[1]). The number of COVID-19 deaths in the community decreased at a slower pace in early 2021. By November 2021, the vaccination rate of LTC workers was above 95% in provinces with available data.

Figure 7.2. Reductions in COVID-19 mortality in LTC facilities in Canada after vaccination rollout



Source: Canadian Institute for Health Information (2021[1]), COVID-19*s impact on long-term care*, https://www.cihi.ca/en/covid-19-resources/impact-of-covid-19-on-canadas-health-care-systems/long-term-care.

Similarly, in Italy, the number of deaths of COVID-19-positive LTC residents decreased after vaccinations were rolled out. The share of COVID-19 deaths among residents decreased from 0.4% in January and February 2021 to around 0.2% in April 2021. The share stabilised at around 0.1% or below afterwards, including during the winter's infection peaks in Q4 2021 and Q1 2022 (Istituto Superiore di Sanità, 2022[2]).

7.2. The absorb stage of the pandemic was challenging in long-term care

The response to a shock 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.

At the start of the COVID-19 pandemic, when countries were absorbing its impacts, care was severely disrupted. Home-based care was reduced. Day-care centres closed. LTC facilities were typically shielded when an outbreak occurred, with non-essential care delayed or deferred. However, care resumed progressively with appropriate infection prevention and control measures. The pandemic and the policy responses to absorb it came at a high cost for care recipients, LTC workers and informal carers.

7.2.1. Disruption was high during the absorb stage, but care resumed progressively

During the first months of the pandemic, home-based care was reduced. Day-care centres also closed nationally in most OECD countries.

For example, in Germany, there was a slight reduction in available home-based LTC and a considerable reduction in day care (Lorenz-Dant; Fischer and Hämel, 2022[3]). A survey among care providers in April/May 2020 showed that two-thirds of day-care organisations closed completely or stopped accepting new clients. About 50% of home-based care service providers also recorded a change in uptake of services – mostly a reduction (Wolf-Ostermann et al., 2020[4]). After these first months, day-care centre closures were typically decided based on the local epidemiological situation, and home care resumed, although over 40% (11 out of 26 surveyed countries, as part of the OECD Resilience of Health Systems Questionnaire 2022.) reported delays in accessing LTC in 2022, for various reasons.

In England (United Kingdom), a 2021 survey of adult social services (for disabled or older people) offers insight into the impact of the pandemic and its policy responses in the LTC sector. The survey found that an estimated 391 000 people were waiting for an assessment or overdue reassessment of their care needs, or for a service to be provided after assessment in November 2021. More than 41 million hours of care and support were provided for people in their homes from August to October 2021, an increase of 15% since May to July 2021.However, 1.5 million hours that had been commissioned could not be provided because of a lack of staff. Between June and November 2021, 48% of directors of adult social services needed to respond to a care home closure or a home provider going out of business, compared with 25% before the pandemic (Association of Directors of Adult Social Services, 2021[5]).

Many older people receiving home care also had to forgo health care for fear of infection, or were asked to postpone it. About 20% of older people who regularly received personal care from professionals or relatives living outside their household reported forgone or postponed care in 2021, based on the Survey of Health Retirement and Ageing (SHARE) data in 23 European countries and Israel.

LTC facilities were typically shielded when an outbreak occurred, discontinuing non-essential care such as some general practitioner (GP) visits. For example, in Canada, physician visits to LTC residents declined by 22% in April 2020, although they had returned to near pre-pandemic levels by June 2021 (Canadian Institute for Health Information, 2021[1]). However, teleconsultations helped to maintain care continuity with primary care professionals to a certain extent.

One particular concern was related to the lack of access to physiotherapy and physical activity among recipients in LTC facilities, even though some countries took action. In France, there is evidence of the impact on physical health due to the disruption of physiotherapy support, with considerably higher numbers of older people losing autonomy, and requiring support with walking and other activities of daily living (Mission d'information sur l’impact, la gestion et les conséquences dans toutes ses dimensions de l’épidémie de Covid 19, 2020[6]). Similarly, in Germany, lockdowns of nursing homes during the first wave of the pandemic led to disruption of physical activity programmes. There were attempts to promote physical activity in LTC facilities, but the staff were not trained for this (Lorenz-Dant; Fischer and Hämel, 2022[3]). Some countries implemented targeted efforts to maintain a certain level of physical activity. For instance, in Navarre, Spain, 85% of nursing homes organised physical activity exercises and emotion management (Fresno, 2020[7]). In Chile, special isolation facilities for those infected with COVID-19 were coupled with an additional budget for rehabilitation.

Transfers from LTC facilities to hospitals also decreased during the pandemic, although the reduction varied across countries. Reductions were more likely when hospitals were at full capacity. In Canada, there was an overall drop of 25% in transfers from LTC facilities to hospitals between March 2020 and June 2021 compared with the pre-pandemic period, following changes in transfer protocols (Canadian Institute for Health Information, 2021[1]).

Countries also initially banned or heavily restricted visits from relatives in LTC facilities, and restricted activities. However, the most stringent restrictions were generally lifted after the first wave in 2020 because of important concerns about care recipients' mental well-being. Visits were allowed with appropriate physical distancing and restrictions on the number of visits. Large group activities such as recreational activities were heavily restricted. In 17 OECD countries, it was also recommended that meals be eaten in bedrooms on a regular basis. Other countries kept such activities but encouraged physical distancing among residents. As countries have moved to the recover stage, communal activities face restrictions contingent on the epidemiological situation of the facility.

7.2.2. The pandemic had substantial impacts on LTC workers, care recipients and informal carers

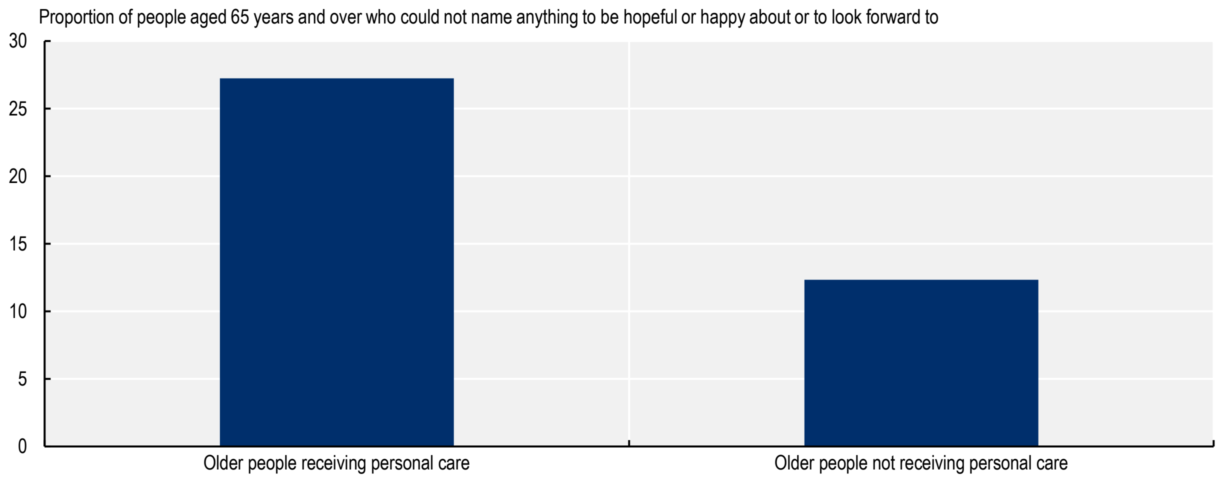
LTC workers were particularly exposed to infections in LTC facilities. Available data on incidence among LTC residents and LTC workers show that the trends among LTC residents and LTC workers mirrored each other (including in the Czech Republic, Latvia and the United States).

LTC workers were put under pressure – particularly during outbreaks. They had to implement infection prevention and control protocols that required more work, while more of their colleagues were on sick leave or self-isolating. For example, in the United Kingdom a small survey undertaken after the first wave in 2020 found that over half of social care workers reported increased working hours, and 18% had had to self-isolate (and nearly one-fifth of those who had self-isolated had not received pay when self-isolating) by July-August 2020. Nearly 90% of care workers working in LTC facilities reported increased feelings of tension, uneasiness and worry (Hussein et al., 2020[8]).

LTC workers who provide 24-hour home-based care were particularly affected. They faced greater financial precariousness and increased dependence on their employers and/or brokers. Undeclared workers experienced worse conditions as they were excluded from bonus payments, relief funds and travel facilitation. They generally lacked key employment law protections that safeguards workers in most other employment fields, as even where regulations exist, they are not always enforced in private households.

In addition, poor mental well-being among care recipients became a source of concern. About 27% of older people receiving personal care at home could not name anything to be hopeful or happy about or to look forward to across 23 OECD countries in 2021, based on SHARE data (Figure 7.3). In comparison, the share was 12% among older people who were not receiving personal care at home.

Figure 7.3. Proportion of older people who could not name anything to be hopeful or happy about or to look forward to



Note: questions were "What was your most uplifting experience since the outbreak of COVID-19 – in other words, something that inspired hope or happiness?" and "What is it that you are looking most forward to doing once COVID-19 abates?". Personal care refers to care provided by anyone living outside the household, and care recipients in LTC facilities are excluded. Weighted data cover 23 OECD countries and refer to those aged 65 years and over.
Source: SHARE wave 9 (SHARE Corona Survey 2).

Similarly, 15 surveyed OECD countries reported that the COVID-19 pandemic had a substantial negative impact on the mental health of LTC recipients, and 14 reported that it had exacerbated mental health issues for LTC recipients with dementia in particular (Box 7.1). Care recipients suffered particularly from the strictest isolation measures (e.g. remaining isolated in a bedroom).

Box 7.1. The challenge of containment strategies for patients affected by dementia

People affected by dementia require particular attention, as they face serious difficulties in understanding, accepting and remembering rules and restrictions, and they usually belong to the category of patients most at risk of dying from COVID-19. Moreover, prolonged isolation tends to cause or exacerbate feelings of loneliness, depression and stress (Korczyn, 2020[9]). Worsening of cognitive symptoms and lower independence also emerged in some cases, following periods of prolonged isolation (Canevelli et al., 2020[10]). Being isolated and/or treated in intensive care units by unfamiliar doctors often triggered restless reactions in dementia patients, sometimes requiring sedation and causing post-traumatic stress disorder (Korczyn, 2020[9]).

Some OECD countries implemented special programmes for dementia patients, but decisions on this type of measure were often left to facilities and doctors. For example, in the Czech Republic and Greece, decisions were taken by individual doctors. Conversely, Korea set up nationwide programmes for patients with cognitive impairment during the pandemic. Korean LTC residents with dementia could take part in cognitive enhancement programmes, and outdoor activities replaced indoor group activities.

Countries should strive to find the right balance between sheltering dementia patients at risk of developing severe COVID-19 symptoms and ensuring a good quality of life, taking into account the specificities of dementia symptoms. Implementing telehealth services can facilitate communication both with health care workers and with relatives.

With reduced formal services, the pandemic and its corresponding policy responses (such as closure of day centres and reduced home-based care) created an additional burden on informal carers. In 23 OECD countries, 12% of people aged 50 years and over reported providing personal care to their own parents (outside their household), and 61% reported that they provided as much care in 2021 as during the first wave of the pandemic in 2020, based on SHARE data. In the United Kingdom, as part of a small survey of carers of people affected by dementia, 83% of carers said they had fewer opportunities to take a break from caring, and 86% said there had been a negative impact on their own physical, mental or social well-being (Dementia UK, 2020[11]). Similarly, in Germany, a survey found that more than half of respondents reported that their perceived health and quality of life had worsened since the beginning of the pandemic. Over two-thirds of informal carers reported that reconciliation of work and care had become more difficult due to the pandemic (Rothgang et al., 2020[12]).

7.3. Policies are needed to make long-term care ready for future disruptions

The LTC sector was generally poorly prepared to tackle a health emergency: just over half of OECD countries had guidelines on infection controls in LTC facilities before the pandemic.

A range of policies can ensure that LTC systems are better prepared for – and can more effectively absorb, recover from and adapt to – shocks. LTC experts should be included in crisis planning and preparedness, including for future pandemics (but not limited to this type of large-scale disruption). Infection prevention and control, and vaccination, are important avenues to contain and mitigate the impacts of newly emerging infectious diseases and/or future pandemics (see the chapter on containment and mitigation). Countries also need more LTC workers to strengthen the sector’s agility and responsiveness to future disruption. Expanded use of digital technology in the sector will also help to ensure care continuity and maintain social contact between care recipients and relatives, including in circumstances of crisis.

7.3.1. Infection prevention and control, and sufficient supplies, will better prepare the long-term care sector

Well before the COVID-19 pandemic, a body of evidence showed that outbreaks of infectious diseases occurred in the LTC sector because of suboptimal infection prevention and control practices (Eze, Cecchini and Oliveira Hashiguchi, 2022[13]).

LTC systems with suboptimal practices put care recipients and LTC workers at a higher risk, and countries with stronger practices coped far better with the pandemic. For example, in Belgium, a non-representative survey showed that virucidal products were in short supply in about 15% of nursing homes, and medical devices were not disinfected appropriately in 19% of nursing homes that received support from the non-governmental organisation Médecins Sans Frontières at the beginning of the pandemic (Médecins Sans Frontières, 2020[14]). Belgium was one of the countries hardest hit during the first wave in March 2020. Conversely, Japan had stronger routine protocols of infection prevention and control after the severe acute respiratory syndrome (SARS) outbreak in 2002-03, and was well prepared.

The pandemic highlighted the importance of adequate supplies of PPE, testing capacities, hand sanitisers, gloves and virucidal products to implement infection prevention and control protocols (see the chapter on securing supply chains). Support from line managers contributes to adequate availability and proper use of supplies.

While the LTC sector was typically not prioritised for PPE distribution at the onset of the pandemic, a couple of countries stood out as well prepared, and all OECD countries had sufficient PPE by mid-2020. Korea took particularly swift measures. In March 2020 the country established a working group to manage supplies and an information technology (IT) system to distribute 5.46 million face masks for 770 000 employees swiftly via LTC providers.

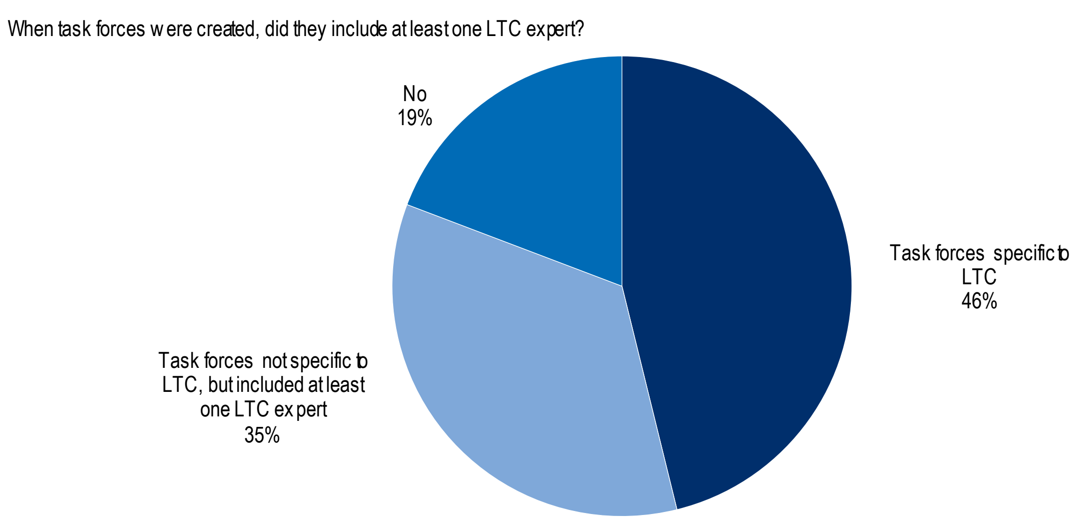
Insufficient testing in nursing homes also hampered effective detection and isolation of confirmed cases at the early absorb stage of the pandemic, but countries took a range of measures to increase testing capacity. These included increasing training and equipment in LTC facilities, setting up mobile teams and providing extra funding. By March 2021, most OECD countries had policies to test LTC workers and residents with COVID-like symptoms, and to notify them when they have been in contact with a confirmed or suspected COVID-19 case.

Following the vaccine rollout, and as countries moved to recover from the pandemic, testing strategies were generally maintained with more flexible arrangements. Nearly 85% (19 out of 23) of surveyed countries reported that they had testing requirements in place. Austria, France, Lithuania and Spain did not require regular testing for vaccinated workers, although they recommended it in the event of outbreaks. Regular testing remained required or highly recommended for vaccinated and non-vaccinated workers in the Czech Republic, Finland and Switzerland. In Korea, regular tests were recommended, and all LTC workers who tested received a monthly benefit of KRW 100 000 (EUR 74) per month between February and April 2022.

7.3.2. Pandemic task forces should include long-term care experts

The pandemic also demonstrated that task forces on pandemic preparedness and management should include LTC experts. Task forces consist of groups of experts organised at the national, local or facility level, with the aim of managing and co-ordinating responses to the COVID-19 pandemic. They are usually temporary, but Japan and Korea have permanent task forces in place to respond quickly to a crisis. While nearly half of the OECD countries surveyed created an LTC-specific task force, about 20% of countries did not include at least one LTC expert in COVID-19 task forces (Figure 7.4).

Figure 7.4. COVID-19 task forces that included a LTC expert



Note: Data collected in 2021 from the OECD Questionnaire on COVID-19 and LTC.
Source: Rocard, Sillitti and Llena-Nozal (2021[15]), "COVID-19 in long-term care: Impact, policy responses and challenges", https://doi.org/10.1787/b966f837-en.

Task forces are particularly useful given that LTC systems are fragmented across stakeholders. A lack of co-ordination with the health care system negatively affected LTC residents (Box 7.2).

Box 7.2. Impacts of the pandemic on LTC residents from a lack of co-ordination with the health care system

There is evidence that the lack of co-ordination with hospitals and primary care hampered swift reactions in many countries, including France, Italy and the United Kingdom. In France, the division of LTC responsibilities between the regional health authorities and departments was a possible source of confusion in responding to the COVID-19 pandemic. Some regional health authorities did not possess sufficient information regarding home-based LTC workers in their territories to be proactive, while others were able to contact them to propose, for example, a specific point of contact and help them to secure PPE (Commission d'Enquête Évaluation des politiques publiques face aux pandémies, 2020[16]). In Italy, nine regions left hospitals and LTC facilities responsible for transfers between them. In some cases, transfers were hampered or blocked (Berloto et al., 2020[17]). In north-west England (United Kingdom), there was an apparent reluctance among some LTC facilities to accept discharged hospital patients in a context of testing and PPE shortages during the first wave, and in the absence of a clear division of responsibilities (Comas-Herrera et al., 2020[18]).

The lack of primary care within nursing homes created particular difficulties – especially in places where transfer to hospital was not forthcoming. Since the pandemic, eight OECD countries have introduced new measures to foster multi-disciplinary teams, with the aim of integrating more primary care into LTC facilities. A few countries have also encouraged GP visits. In France, a new financial incentive is provided to primary care doctors to visit LTC residents. In Korea, an initiative is currently being tested to ensure that LTC facilities receive at least one GP visit twice a week.

In Israel, policy makers created a task force dedicated to outbreaks in LTC facilities one month after the start of the pandemic. At that time, LTC residents accounted for more than 50% of all COVID-19 deaths, even though they made up less than 0.5% of the total population. The share of LTC residents had dropped to 36% of all COVID-19 deaths in Israel by the end of April 2020 (Tsadok-Rosenbluth et al., 2021[19]).

Another example is Bavaria, Germany, which introduced a specific task force to support residential care settings in December 2020, after creating a broader task force on infectious disease in March 2020. The task force is called in as soon as one confirmed case has been established in a care home to prevent, advise on and control infections (Lorenz-Dant; Fischer and Hämel, 2022[3]).

Countries should review LTC infection prevention and control protocols and training regularly. Policy makers could identify LTC experts who could be involved in permanent or temporary task forces on infectious diseases. They could also ensure that LTC facilities conduct regular pandemic preparedness drills with the appropriate level of granularity (WHO, 2022[20]).

In addition, data related to infections and mortality should be generated to be useful for decision making in the absorb stage. Data on the share of LTC deaths among COVID-19 deaths were challenging to collect in the early stages of the pandemic, hampering swift reactions. Meanwhile, prioritisation of resources towards the health system and not the LTC system exacerbated the pandemic's impact on LTC residents. Data on infections and mortality became available later, although they were sometimes not sufficiently updated to be useful for decision making. It is important that countries keep monitoring key indicators, such as the number of COVID-19 deaths in LTC facilities, and disseminate the findings in a timely manner.

7.3.3. A high vaccination rate among care recipients and LTC workers is crucial

Almost all OECD countries prioritised care recipients and LTC workers during the vaccine rollout, and this strategy was successful in reducing COVID-19 case numbers and deaths (see Section 7.1).

Vaccinations rates among LTC workers were high in virtually all countries with available data. The rate was 90% or above in 2022 in Australia, Costa Rica, Germany, Israel, Italy, Latvia, Luxembourg, Mexico, Portugal and the United Kingdom. The rate was between 80% and 90% in Korea and the United States. It was at 70% in early 2021 in Slovenia, where LTC workers were not required to be vaccinated.

About 60% of surveyed countries required LTC workers to be vaccinated against COVID-19. Vaccine hesitancy could have limited the success of vaccination programmes. Nonetheless, the overwhelming majority of OECD countries reported that achieving vaccination among LTC workers was not a concern or was a relatively low concern for policy makers.

In the future, it will be important to update vaccination requirements for possible boosters and, more generally, to promote confidence in vaccines.

7.4. Countries need rapid recruitment strategies to be better prepared

LTC workers are essential to implement any effective response to a crisis or large-scale shock, such as a future pandemic, in LTC facilities.

In response to the COVID-19 pandemic, countries implemented mobile teams and increased recruitment and retention efforts, although most measures were temporary. Reducing staff mobility was key to helping prevent and limit outbreaks. Evidence shows, however, that higher staffing was associated with fewer deaths, even though greater staff numbers were associated with a higher probability of an outbreak (Konetzka et al., 2021[21]). Bolstering the workforce was, and continues to be, very important to strengthening resilience in the LTC sector (see the chapter on investing in resilience).

7.4.1. Mobile teams supported rapid responses during outbreaks

Along with visitors, LTC workers represent potential transmission vectors, and countries implemented a range of policies to reduce staff mobility. For example, a study estimated that 49% of COVID-19 cases in residential aged care facilities could be attributed to staff movement between facilities in the United States (Jepsen and Barker, 2020[22]). Policies to reduce staff mobility included reduced staff rotation within LTC facilities, reduction of multiple-site work and single-site policies. While these policies had some success (Jones et al., 2021[23]), restricting the movement of LTC workers between facilities is difficult to implement when many have multiple part-time jobs. Across OECD countries, 42% of LTC workers held part-time jobs in 2019 (OECD, 2021[24]). Asking LTC workers providing care at home to limit their mobility also led to reductions in wages that were already low. Some countries, such as Canada and the United Kingdom, provided time-limited financial support to address the financial implications of such measures.

In the context of staff shortages, countries typically implemented mobile teams. Around 90% of surveyed countries prepared rapid response teams – at either the national or subnational level – to counteract staff shortages in overwhelmed facilities (Rocard, Sillitti and Llena-Nozal, 2021[15]). Workers came from different sectors or from geographical areas that were less hit by the pandemic. For example, in Australia, interstate staff recruited included registered nurses, enrolled nurses, personal care workers and cleaners. Workers could be deployed to care facilities for a four-week period, followed by two weeks of quarantine. They were supplied with uniforms and PPE, regular COVID-19 tests during their placement, and access to pastoral and mental health support (Low et al., 2022[25]). In at least five countries (Canada, the Czech Republic, Estonia, Germany and Israel) the army also deployed staff in facilities.

However, rapid response teams are not a panacea. In Australia, an independent review found that some of the additional workforce did not have appropriate skills and experience, had insufficient training in infection prevention and control, or did not speak English well enough. Many care homes preferred to avoid using workers they did not know (Low et al., 2022[25]).

7.4.2. Nearly all OECD countries boosted the recruitment of long-term care workers, and many increased the workload of existing staff

Nearly all the OECD countries surveyed took temporary actions to recruit staff – particularly nurses and personal carers – in 2020 and 2021 (Rocard, Sillitti and Llena-Nozal, 2021[15]). These recruitment efforts were in line with those taken in the health system (see the chapter on workforce).

Action focused on recruitment of former and unemployed LTC workers, LTC students and volunteers. A few initiatives were put in place to recruit foreign workers (as in Israel, which brought in 2 500 foreign workers) or to implement fast-track training programmes. For example, Canada committed CAD 23.2 million in 2020 to support training of up to 4 000 personal support worker interns through an accelerated six-week online training programme combined with a four-month work placement, to address acute labour shortages in the LTC and home care sectors. Countries that had a “sanitary reserve” force, such as France and Luxembourg, activated it. In Luxembourg, nearly 200 health professionals were deployed in LTC facilities during the first wave of the pandemic in 2020, but the recruitment efforts were still insufficient to address staff shortages.

As at 2022, the evidence about the short-term and long-term effects on turnover of LTC workers is scarce, although ten countries reported a perceived increased turnover since the beginning of the pandemic. At the same time, in Japan, survey data showed that the turnover rate was on a downward trend, and the total turnover rate of LTC workers in October 2019 to September 2020 was the lowest since fiscal year 2005. In the United Kingdom, Skills for Care reported that between 2019/20 and 2020/21 the turnover rate for care workers decreased from 38% to 34%. However, unweighted updates reported by Skills for Care in 2021/22 suggest that the number of staff in the sector has been falling.

In addition, seven OECD countries reported increasing the responsibilities and workload of existing LTC workers, but many also recognised LTC workers for their particularly heavy workload during the pandemic. For example, at the absorb stage of the pandemic, Finland allowed deviations from statutory annual leave to ensure sufficient staff availability. Exceptionally, France moved the maximum legal daily work time from 10 hours to 12 hours in April 2020. In Slovenia, health and social care providers also worked prolonged working hours (overtime). Germany suspended regular quality controls in LTC facilities at the beginning of the pandemic. About 50% of the 26 OECD countries surveyed in the 2021 OECD Survey on COVID-19 and LTC provided one-off bonuses to LTC workers for their exceptional efforts in 2020 (Rocard, Sillitti and Llena-Nozal, 2021[15]).

Task shifting was another strategy used to respond to workforce shortages, although this is not new. In the United Kingdom, care workers have increasingly taken on responsibility for more clinical tasks delegated from nurses in recent years. There is no information on specific tasks that can or cannot be delegated in the code of practice of nurses, nor a national framework or process for delegation of health care tasks to care staff such as care workers. In addition, decisions on responsibility increases and the workload of LTC workers during the pandemic were generally made at a local level, depending on the specific context and needs of local authorities and care providers.

It is thus incumbent on OECD countries to prepare avenues for rapid recruitment of LTC workers in the event of crises such as pandemics. Recruiting former and unemployed LTC workers, LTC students and volunteers, and increasing LTC workers’ workload enabled countries to address LTC worker shortages rapidly. Timely investment in these measures will enable countries to be well prepared for – and better able to absorb and recover from – workforce shortages in the future.

7.4.3. Digital technologies were scaled up, especially in long-term care facilities

The pandemic highlighted the importance of digital technologies to ensure LTC continuity (see the chapter on digital foundations).

Greater use of fit-for-purpose technology in LTC facilities has demonstrated its potential to enhance co-ordination with the health care system, increase productivity, improve working conditions and enhance care quality (OECD, 2020[26]). This can free up professionals' time from tasks that can be automated, allowing them to focus on the activities that are most important for people in need of care. Recording of data on older people is a laborious task that is still done by hand in many countries. Electronic devices can help to automate registration of user data for monitoring and to enhance communication across teams (e.g. between a nursing home and a hospital). For example, digital needs assessments facilitate collection of multi-use data relevant to key questions from providers and policy makers (see Box 7.3).

Box 7.3. Digital needs assessments

With a digital needs assessment, the data collected are likely to meet the data needs of a broad group of stakeholders, including those covering:

- eligibility to public support
- care planning for providers (provided the assessment takes place on a regular basis)
- evaluation of care effectiveness (people are followed at different points in time)
- monitoring of providers' care quality indicators
- monitoring of care quality at municipal and national levels
- international comparisons of care quality, if using standardised needs assessment instruments already implemented in many countries (e.g. InterRAI instruments).

While digital needs assessments are extremely useful, there are two pre-requisites: an excellent IT system and trained staff.

While over half of surveyed OECD countries did not have programmes or guidelines on development of telehealth services in LTC before the outbreak, 21 OECD countries expanded the use of telehealth services to allow remote consultations between patients and the health care sector, and to keep LTC residents in touch with their relatives outside the facilities. Scaling up digital technologies includes setting up coverage rates or fee-for-services, remote management, data sharing and monitoring technologies (see the chapter on care continuity for other examples).

For example, Portugal developed a digital platform to help residential facilities monitor the health status of COVID-19-positive residents. It generated alerts if situations arose in which it was necessary to intervene; facilitated recording and monitoring of users' measurements; and supported institutions in active surveillance of symptoms associated with COVID-19, as well as early identification of other respiratory diseases (Rocard, Sillitti and Llena-Nozal, 2021[15]).

Digital technologies were also useful to maintain social contact between LTC residents and their relatives, especially when facilities experienced outbreaks. Pre-requisites for this include enough skilled staff, allowing staff to support contact, access to technologies and good internet connections. There is no "best" way to stay in touch for LTC residents and their relatives. While the pandemic led to new methods of contact (such as tablets), other ways were also used, such as phone calls and mail. Preferred options could be part of residents' care plans, which should be updated regularly.

7.5. More resilient long-term care systems need to be built

There are many options available to OECD countries to improve LTC resilience in response to future shocks. Many OECD countries could harmonise their LTC governance and needs assessments to develop one coherent LTC system. As financial sustainability is crucial to more resilient LTC, avenues to fund better and more LTC could be considered. In addition, many countries could develop further preventive and rehabilitation services, as well as end-of-life care at home, to improve quality of life and potentially limit spending increases. They could also build on current recruitment and retention measures to expand the LTC workforce and offer better support for informal carers to help them continue to provide care.

7.5.1. Fragmentation of care in long-term care needs to be eliminated

At the onset of the pandemic, early responses were key to limiting and absorbing the health impact of infections. However, this was challenging because LTC systems tend to be very fragmented. Harmonising LTC governance and needs assessments for LTC cash benefits and services are necessary to create coherent LTC systems, rather than aggregations of cash and in-kind benefits with overlaps and gaps. More coherent systems would be better prepared to cope with external shocks such as COVID-19, and resilient enough to withstand population ageing.

LTC governance would improve integration of LTC systems

Many countries in the OECD lack coherent LTC systems. LTC systems are sometimes spread out across health and social sectors, and incoherent frameworks result in overlaps and gaps in access and coverage, and possible cost shifting. Fragmentation also makes it difficult for users to get the support they need, considering the complexity of the system they must navigate. Harmonising LTC governance would foster integration in the sector. Single legislative frameworks and stronger public organisations dedicated to LTC are key methods to achieve coherent and stronger LTC governance. Ensuring a single entry-point to provision of cash benefits and services based on one standardised needs assessment would help with building more resilient LTC systems.

In Estonia, Latvia, Lithuania and the Slovak Republic, for example, separate legislative frameworks specify the division of responsibilities between the health care and the social care sector. These frameworks do not necessarily seek to harmonise provision of public support across the health and social sectors to form one coherent LTC system. The lack of co-ordination with hospitals and other parts of the health care system does not help (Box 7.4; see also Box 7.2).

Box 7.4. Unnecessary hospital admissions resulting from a lack of co-ordination with the health care system

The fragmentation of LTC systems leads to a lack of co-ordination between LTC workers, primary care professionals, hospitals and social workers. Poor co-ordination increases the risk of unnecessary hospitalisation, long hospital stays and readmissions. For example, a study of six areas of England (United Kingdom) found that care home residents experienced 0.78 emergency admissions each per year on average, compared with around 0.11 for England as a whole (although the areas were not representative of England overall). Even though residents have higher needs, the authors estimated that 40% of admissions from care homes were for conditions that could potentially be managed outside the hospital setting or avoided altogether – such as pneumonia or urinary tract infections (Steventon et al., 2018[27]; Lloyd et al., 2017[28]).

However, there are exceptions. In Portugal, LTC is provided jointly, as the Ministry of Health and the Ministry of Labour and Social Solidarity (responsible for social services) agreed on joint assessments and services in 2006 (Lopes, Mateus and Hernández-Quevedo, 2018[29]), and the pandemic reinforced this co-ordination. In Scotland (United Kingdom), the government unified health and social care in 2016 to enhance services for LTC users. Slovenia passed a law in 2021 that defines LTC and outlines integration of health and social services for adults, after longstanding discussions. In Finland, a landmark law passed in 2021 will integrate health care and social services, including LTC, in 2023. In Lithuania, an ongoing reform process aims to integrate health and social services for older people (OECD, 2022[30]).

While there is no one-size-fits-all approach for a single LTC-related legislative framework, essential elements typically include definition of LTC (including a possible age threshold[1]), roles and responsibilities, needs assessments (except in some Scandinavian countries), cash benefits, services and financing schemes. Other laws related to finance typically set out funding routes, except in countries that have LTC insurance (such as Germany).

Single legislative frameworks are relatively recent – they were typically implemented within the last 30 years or so in Austria, France, Germany, Japan and the Netherlands. Austria has had one legislative framework since 1993, and Germany since 1995. In Japan, LTC insurance and the current LTC system were adopted in 2000.

In a number of OECD countries, a specific public organisation is in charge of a least one element of the LTC system, and often serves as the basis on which countries' LTC systems are built. In countries with LTC insurance, like Germany and Japan, the LTC insurance fund is usually a public organisation. France, Scotland (United Kingdom) and Slovenia recently decided to strengthen the role of these LTC-related public organisations to build better integrated LTC systems. France is gradually expanding the role of one public organisation (CNSA) over a 10-year period by transferring or giving more responsibilities for funding, financing and care provision, to ensure full integration and development of LTC. A 2020 law started the expansion by transferring the current funding schemes to this organisation and developing a roadmap. The CNSA will become the organisation in charge of a new branch called "autonomy", which covers the majority of LTC for disabled adults and older people. It should be fully operational in 2030. Scotland passed a law in 2022 to create a new body – the National Care Service. It will be formed to set standards and commissioning priorities for delivery by newly established local care boards by 2026. In doing so, it will take away responsibility for social care from local authorities and centralise it. Slovenia's 2021 reform has given an important role and new responsibilities to a new branch of the health insurance fund to assess LTC needs and manage the distribution of funds.

Harmonising cash benefits and services would reduce fragmentation

The current body of evidence suggests that well-structured and developed LTC benefits and services reduce use of emergency care (Rapp; Chauvin and Sirven, 2015[31]), and hospital admissions and utilisation. In Spain, a study showed that the structural LTC reform of 2007 reduced hospital admissions and use among both those receiving a caregiving allowance and beneficiaries of publicly funded home care, which amounted to 11% of total health care costs. Regions that had an operative regional health and social care co-ordination plan saw stronger declines. This reform introduced a new structure of care benefits and expanded the availability of publicly funded home care (Costa-Font; Jimenez-Martin and Vilaplana, 2018[32]). However, the evidence remains mixed, and effect on hospital admissions and use is not always clear.

Nationwide standardised needs assessments are in place in Austria, Belgium, the Czech Republic, France, Germany, Japan, Latvia, Lithuania, the Netherlands, Portugal and Spain to ensure equal access and to reduce incidence of cost shifting. Ireland and Slovenia are introducing nationwide standardised needs assessments as part of ongoing LTC reforms. However, some countries have more than one LTC needs assessment, because they target different benefits (e.g. a specific cash benefit) or because they are designed by and for subnational areas, such as municipalities. For example, Swedish municipalities set their own needs assessments.

Lithuania has one needs assessment for social services at home or in care institutions, and one for home care provided by the health care system, but none to access nursing hospitals (where a doctor's referral is needed), although nursing hospitals overlap with care institutions. This fragmentation leads to overlaps and gaps in services, and more coherent frameworks for needs assessment might improve efficiency (OECD, 2022[30]).

Needs assessments typically evaluate a wide range of physical and mental capacities (see Figure 7.5). A gradation ladder of LTC needs is identified. Users of LTC are placed into tiers on the ladder depending on the severity of their condition, and receive higher or lower benefits accordingly. This can ensure that access to LTC cash benefits and services is identical across a country, and the approach tends to be easier to navigate for LTC recipients and their relatives. Such ladders exist in OECD countries, such as France, Germany and soon Slovenia. Each care grade can be related to a type of support – whether formal services, a cash benefit to LTC users, or direct or indirect cash benefits for informal caregivers. One advantage is that this can ensure that eligible people receive coherent benefits. It can also help operationalise a transition towards a more community-based care model that would reserve LTC facility space for those who need it the most. In addition, it can empower LTC users to choose the form of LTC care that works for them, whether formal or informal – which may help in part to address staff shortages.

Figure 7.5. A needs assessment linked to a gradation ladder of LTC needs

Gradation ladder

	Care level 1	...	Care level 5
Cash benefit to LTC recipient			
Home care			
Residential care			
Cash benefit for informal carer			
In-kind respite for informal carer			
Housing adaption			

Note: This diagram builds on several needs assessments and gradation ladders, but does not represent any specifically.

7.5.2. Long-term care systems need further financing to be more resilient and meet more people's needs

Provision of LTC for people with limitations in activities of daily living or instrumental activities of daily living can be very costly, but the generosity and coverage of the LTC system can be very limited (Oliveira Hashiguchi and Llena-Nozal, 2020[33]), in part because of insufficient funds. As a result, either the costs are borne elsewhere by families, civil society and other informal caregivers, or LTC needs are left unmet. About 30% of older people with at least one limitation in activities of daily living reported unmet LTC needs across 22 OECD countries in 2019-20, based on SHARE data.

During the COVID-19 pandemic, about 89% (17 out of 19 surveyed countries) of surveyed OECD countries reported that substantial temporary additional financing was made available to bolster LTC services (Box 7.5). However, many countries would need to increase funding permanently to increase the number of LTC workers.

Even without aiming to increase the LTC workforce and reduce unmet needs, countries should consider further additional permanent funding to factor in population ageing and to build resilience to future disruptions, including climate change. The share of people aged 65 years and over will reach 27% by 2050 across the 38 OECD countries, compared with 17% in 2019. About 11% of older people received LTC in 2019 across the 23 OECD countries with available data. Older care recipients depend on carers and medications that may be unavailable when absorbing and responding to future disruptions. They are also more likely to be isolated, making them more difficult to reach. With climate change disruptions, older people are at elevated risk for various reasons; for example, they are especially vulnerable to extreme temperatures since capacity to maintain core body temperature becomes compromised with age.

Box 7.5. Temporary funding provided to LTC systems in response to the pandemic across OECD countries

Canada committed up to CAN 1 billion through the Safe Long-Term Care Fund to help provinces and territories improve infection prevention and control in LTC (for example, via hiring additional staff, wage top-ups, new or renovated infrastructure including ventilation, and readiness assessments). In addition, the Safe Restart Agreement included CAN 740 million in funding to improve infection prevention and control measures to protect those in LTC, home care and palliative care. Canada also provided CAN 3 billion in emergency federal funding to its provinces and territories to increase the wages of low-income essential workers, including workers in LTC facilities and in the home care sector. In addition, it announced a further CAN 3 billion investment, starting in 2022-23, to support provinces and territories in their efforts to ensure that standards for LTC are applied, and permanent changes are made. Provinces and territories have also invested substantially to improve LTC services.

In Germany, expenditure on LTC insurance for pandemic-related expenses in LTC facilities (nursing homes, day care and care services) and for family carers totalled EUR 4.87 billion in 2021.

In Japan, the budget to cover the costs of emergency hiring of LTC staff and disinfection and other measures reached JPY 6.8 billion in fiscal year 2020 (government expenditure basis). This was covered as part of a budget of JPY 13.7 billion for LTC facilities with outbreaks. Japan also supported thorough countermeasures against infectious diseases in LTC facilities and provided benefits to LTC staff as part of a budget of JPY 491.8 billion for fiscal year 2020 (government expenditure basis).

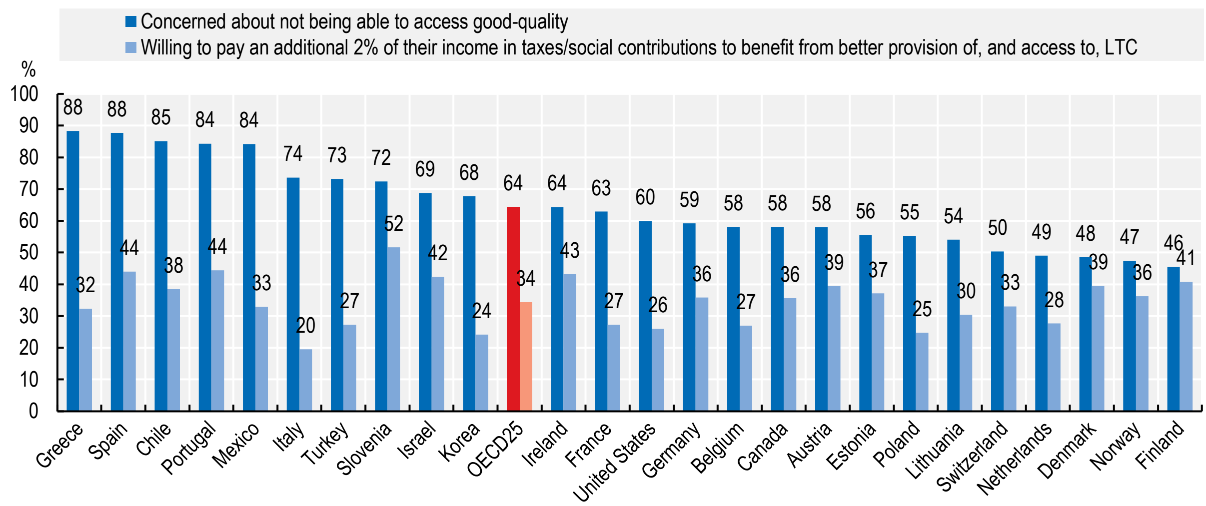
The United Kingdom supported LTC services for disabled adults and older people with funding of GBP 1.81 billion for infection prevention and control and GBP 523 million for testing. In addition, GBP 583 million was provided to support workforce capacity, recruitment and retention through the Workforce Capacity Fund in 2021 and two Workforce Recruitment and Retention Funds in 2021-22. The United Kingdom made available an additional GBP 60 million to local authorities through the Omicron Support Fund in January 2021.

The United States provided additional financing through the Coronavirus Aid, Relief, and Economic Security (CARES) Act. Nursing homes and assisted living communities received about USD 14 billion from the Provider Relief Fund established by the CARES Act. The American Rescue Plan includes USD 200 million to support infection control and vaccine uptake at skilled nursing facilities. In addition, USD 337.5 million was appropriated to extend the existing Money Follows the Person Programme, which provides support to Medicaid beneficiaries requiring LTC moving from institutions to the community. The federal government also provided additional funding to states, including to help them address existing home and community-based workforce and structural issues, expand the capacity of critical services, and begin to meet the needs of people on waiting lists and family caregivers. Some states increased Medicaid reimbursement to nursing homes.

Pooling existing funding can be a step towards better funding. Combining funds into one well-defined budget can also improve transparency and facilitate distribution of existing funds in a more effective and efficient manner. It can help to reduce unnecessary activities, overuse of services, duplication of effort and cost shifting. For example, France has pooled the majority of its LTC funding schemes for the CNSA since 2020 to facilitate collection and the distribution of funds. An important next step is that the organisation should receive additional funds collected via the “generalised social contribution tax” to fund LTC services currently covered by statutory health insurance by 2024.

Many citizens reportedly support greater spending on LTC services, even if this would mean increasing taxes and social contributions. In 2020, between about 45% and 90% of people reported that they were concerned about not being able to access good-quality LTC, according to the OECD Risks That Matter Survey. In addition, around 20-50% of people would be ready to pay an additional 2% of their income in taxes and social contributions to fund more public support for LTC (see Figure 7.6).

Figure 7.6. Proportion of people willing to pay more taxes to fund LTC across 25 OECD countries



Source: OECD Risks That Matter Survey (data refer to 2020).

Avenues to fund more LTC services may rely on diverse and broad-based funding routes. These comprise LTC insurance, taxes and social contributions on incomes and assets. Diverse sources of funds might also make LTC systems more resilient to individual shocks.

LTC insurance may be one approach to ensure more funding. Belgium, Germany, Japan, Korea, Luxembourg and the Netherlands have implemented a public form of LTC insurance. In Japan, about half of funding comes from LTC insurance and the other half from national and subnational taxes. The Japanese LTC insurance fund spent JPY 11.1 trillion in 2018 (over EUR 79 billion in nominal euros of 2022). Slovenia passed an LTC law in 2021 that defines the broad future funding routes of the future LTC system – a mixture of a new LTC insurance borne by workers, current pension and health insurance funds reallocated to LTC and the state budget (OECD, 2022[30]). In accordance with the LTC Act, funding for LTC will be provided from existing funds and the state budget until mid-2025, and adoption of a specific law on compulsory insurance for LTC is planned during this timeline.

Advantages of LTC insurance include greater transparency in managing funds and horizontal justice. Transparency is improved because the introduction of LTC insurance links funds to specific policies. Horizontal justice means that the services are the same for everyone, independent of the incomes of people in need, while contribution levels increase with the incomes of contributors. However, LTC insurance can create the expectation that anyone should access LTC, meaning that people might expect to be entitled to the benefit even if demand were to increase. If the LTC insurance fund were insufficient, countries would need to complement it with taxes and social contributions, and/or borrow to meet citizens’ expectations.

The main advantages of tax-based funding for LTC systems are that taxes can be broad-based, and citizens can expect benefit expenditure to align with public financial resources. However, there are sometimes concerns about fluctuations in funding – especially during an economic recession – as well as a lack of transparency in allocation of funds. Tax-based funding for LTC systems exists in many OECD countries, including in Austria, Scandinavian countries and Spain.

Funding can also come from a mixture of social contributions and taxes; in this case, countries typically levy money on a base broader than labour incomes. For example, in France, funding stems mostly from social contributions and taxes that cover a base that goes well beyond labour income.[2] In many central and eastern European countries, LTC funding from the social sector is more tax-based, while LTC funding from the health care sector is more mixed.

Improving funding for LTC services is vital to address the needs of older people. It represents a substantial investment in the lives of future LTC recipients and the LTC workforce. This is imperative at a time when many OECD countries are experiencing ageing populations in a context of high inflation and budgetary pressure. There is a tension between improving LTC resilience and short-term budgetary sustainability, which should be addressed.

7.5.3. Further preventive and rehabilitation services and end-of-life care need to be developed

OECD countries could consider developing preventive and rehabilitation services at home to improve quality of life and potentially limit cost increases while improving resilience. Developing end-of-life care may be another cost-efficient means to improve quality of life. Increasing preventive care and rehabilitation decreases the vulnerabilities of the population. In turn, this improves resilience by reducing requirements on health and LTC systems in times of stress.

Preventive and rehabilitation services can improve quality of life and be cost-efficient

Scandinavian countries and some other OECD countries have well-developed preventive and rehabilitation services that can contribute to improving quality of life and potentially be cost-efficient. Preventive and rehabilitation services can help to postpone LTC needs, thereby potentially containing LTC expenditure.

In Denmark, municipalities provide preventive services, including preventive home visits and activities. Everyone aged over 75 years must be offered a home visit. The offer is also extended to people aged 65-75 years who are in a special risk group, including widows, people who live in a secluded area and those recently discharged from hospital. Finally, those aged 80 years and over are offered a visit every year. Municipalities can organise group visits for those who usually decline home visits. Municipalities also carry out preventive activities of varying scope and type, such as workshops, education, talks and physical activity (Kvist, 2018[34]).

In Norway, introduction of the Preventive Home Visit Programme significantly lowered residential care in LTC facilities while increasing home care. A study found that care in nursing homes was reduced by 1.4 percentage points among people aged 80 years and over, from a baseline of 19%. This decline was partly matched by an increase in home-based care, from a baseline of 35%. In addition, hospital admissions were reduced by about 7%, and mortality rates declined by nearly 5% in the years following the introduction of preventive home visits (Bannenberg et al., 2021[35]). Overall, evidence indicates that many preventive programmes are cost-effective (Scheckel, Stock and Müller, 2021[36]), and that preventive services can support LTC resilience.

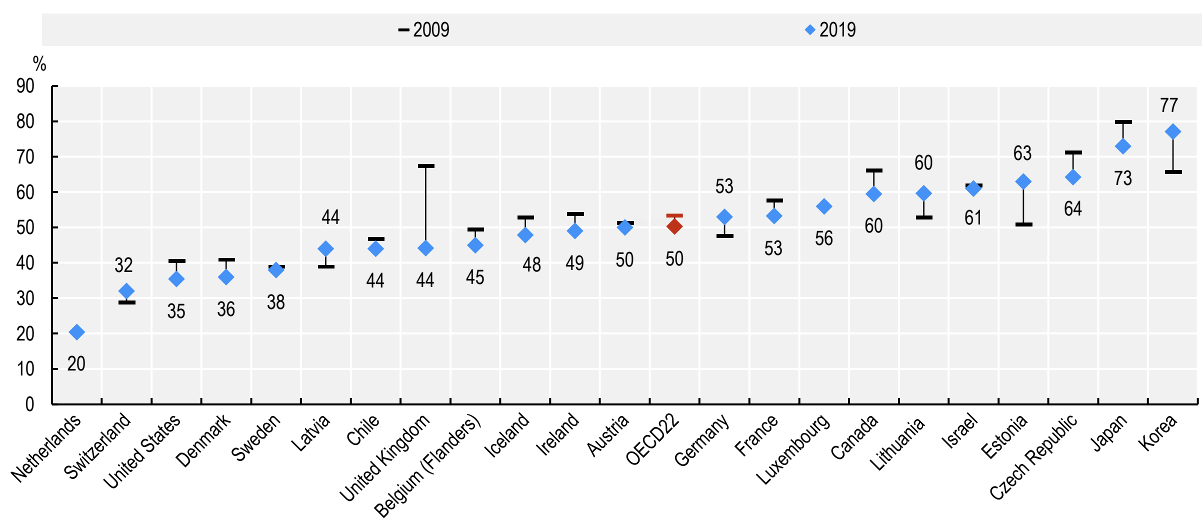
Denmark has also put strong emphasis on rehabilitation services. Municipalities must offer a short and intensive (4-10 weeks) rehabilitation programme prior to assessing the need for home help. The programme comprises one or more of the following elements: training in everyday activities (personal care), physical training, assistive devices and adaptation of the home (Kvist, 2018[34]). In 2018, 4.3% of people aged 65 years and over received rehabilitation services instead of – or alongside – home help (Rostgaard, 2021[37]). Danish evidence shows improvements in functional ability, a reduction in home care use and higher work motivation among staff. While there are no studies on the cost-effectiveness of these rehabilitation services, a decrease in home care use suggests possible savings (Rostgaard, n.d.[38]). More generally, a body of evidence shows that many specific rehabilitation programmes (e.g. for stroke) are cost-effective (Allen et al., 2018[39]).

End-of-life care at home can also improve quality of life and be cost-efficient

Countries could also strengthen end-of-life care for LTC recipients to respect their preferences. In addition, evidence from several countries shows that introduction of better access to palliative care can result in more cost-effective outcomes (Public Health England, 2017[40]). The effectiveness of palliative care stems mainly from reducing the length of hospital stays, readmissions and visits to intensive care units, thereby reducing the strain on health systems – including during times of disruption and stress. Hospital palliative care teams can be cost-effective, for instance, especially with early introduction and when integrated with other treatments (KMPG, 2020[41]).

When nearing the end of life, older people generally have a preference about their place of death. However, the actual place of death often does not align with these preferences. Home is often indicated as the patients' preferred place of death (Calanzani et al., 2014[42]). However, 50% of all deaths occurs in hospitals across 22 OECD countries, although the share decreased slightly in the last decade (2009-19) in over half of OECD countries (see Figure 7.7).

Figure 7.7. Deaths occurring in hospitals in 2019 across OECD countries



Source: OECD (2021[43]), *Health at a Glance 2021: OECD Indicators*, https://doi.org/10.1787/ae3016b9-en.

Some OECD countries reported that the pandemic and its policy responses negatively affected palliative care (Canada, France, Israel, Mexico, Slovenia, the United Kingdom and the United States), although evidence is lacking or anecdotal. For example, a report noted that many LTC workers administered medical and palliative care in the absence of GPs (Oung, 2022[44]). In Luxembourg, primary care doctors were permitted in April 2020 to retrieve "COVID-19 kits", which contained end-of-life care medication – including for pain management and relief, from specific pharmacies.

The availability of staff with end-of-life care knowledge is important to ensure both early identification of needs and adequate access to end-of-life care services at home and in institutions. In OECD countries, primary care professionals are not necessarily sufficiently trained and palliative care training could also be more common in nursing school education. Residency programmes for GPs/primary care doctors incorporates some palliative care training in 22 OECD countries (65%) and in less than half (44%) of 25 OECD countries medical schools include mandatory palliative care education in undergraduate curricula. Nearly three-fifths (58%) of 24 OECD countries include mandatory palliative care training in nursing school curricula, and a further 21% report that palliative care training in undergraduate nursing programmes is mandatory in at least some regions of their country (OECD, 2023[45]).

Some countries have recently developed guidelines and training programmes to improve knowledge around end-of-life care among LTC workers. In Australia, the End of Life Direction for Aged Care toolkits aim at providing LTC workers with better knowledge and understanding of end-of-life care. England (United Kingdom) has piloted a training model for care homes, where LTC workers receive training from hospital teams on recognising dying, advance care planning, co-ordination of care, symptom control, and bereavement care. Results from the pilot showed an increase in the share of people dying in their preferred place. Nevertheless, care guidance on end-of-life care is more common in hospital settings (90%) than in LTC facilities (62%) (OECD, 2023[45]).

7.5.4. Efforts are needed to ensure that sufficient carers are available in the long term

Providing LTC is labour-intensive. The pandemic has exacerbated workforce shortages, while informal carers have had to ensure care continuity, adding more pressure on them. Strengthening recruitment and retention policies for formal LTC workers is key to building LTC resilience and avoiding shifting the burden to health systems under stress (see the chapter on workforce). In addition, better public support for informal carers will help them continue to care.

Recruitment and retention policies are needed to tackle staff shortages

Poor working conditions contribute to structural staff shortages. Even though OECD countries have been implementing recruitment and retention policies, additional measures are needed. Non-standard working conditions contribute to low attraction and retention in the sector. About 42% of LTC workers worked part time in OECD countries in 2019. Temporary employment is also common. About 17% of LTC workers held a temporary contract in OECD countries in 2019. In addition, pay is often low. In more than half of OECD countries, population ageing has been outpacing the growth of LTC supply in the last decade (OECD, 2021[43]). In response, countries have implemented three main types of policies over the last decade. These aim to widen recruitment efforts to attract workers; to improve retention by enhancing working conditions, job quality and training for career progression; and to increase the effectiveness of the services provided (OECD, 2020[26]).

Following the start of the pandemic, the Czech Republic, France, Germany, Korea and other countries improved wages permanently to attract and retain more workers (more in the forthcoming *Beyond Applause* OECD publication).

Another option that emerged during the pandemic was increasing the minimum staff ratio recommendations or requirements. Four countries introduced guidelines on staff ratios (Japan, Lithuania, the Netherlands and Slovenia). In Ontario, Canada, in November 2020 the provincial government announced a commitment to increase the minimum number of hours of direct care to an average of four hours per resident by 2024-25. In Finland, under the Older Person's Care Act, the nurse-client staffing ratio will be increased gradually from 5:10 to 7:10 by 2023, and will vary according to needs assessments.

Rising minimum staffing levels can be associated with better care quality, but higher requirements come at a cost. In the United States, a study examined the effect of a proposal to raise minimum staffing levels (presented in Congress in 2019) in skilled nursing facilities – for the three American categories of nurses and in total (4.1 total nursing hours per resident day). In 2019, only 5% of skilled nursing facilities met all four categories of minimum staffing levels; 25% met the minimum 4.1 total nursing hours per resident day, while 31% met the threshold for registered nurses, 85% met the threshold for licensed practical nurses, and 11% met the threshold for certified nursing assistants. Achieving the proposed federal minimums nationwide would require an estimated additional 35 804 registered nurses, 3 509 licensed practical nurses and 116 929 certified nursing assistants (full-time equivalent), at an annual salary cost of USD 7.25 billion (Hawk et al., 2022[46]).

At the same time, high rates of staff turnover generate not only a poorer quality of care but also higher costs. Turnover means that replacement staff need to be hired, which entails recruitment costs and generates periods of understaffing. In addition, newly hired personnel require training in the facility's policies and work procedures (OECD, 2020[26]).

Factoring in these needs in short-term and medium-term workforce projections and budget allocation decisions is essential for a sustainable recovery from the pandemic, while avoiding over-reliance on redeployment and minimising disruptions to provision of LTC services (WHO, 2022[20]).

Better public support for informal carers would help them continue to provide care

Over recent decades, community-based LTC has been encouraged for various reasons – it respects people's preference to stay at home and it can be seen as a less costly option than LTC facilities. It is typically used when LTC needs are moderate, and when older people do not have strong cognitive limitations or aggressive behaviour towards LTC workers. Over 50% of care recipients at home reported a combination of formal and informal care across 28 OECD countries in 2021, based on SHARE data.

Informal carers make a substantial contribution to societies and to broader societal resilience to address future shocks. A European Commission-funded study estimated that the value of the number of hours spent on informal care of older people and disabled adults probably ranged between 2.4% and 2.7% of EU GDP in 2018, depending on the methodology and assumptions used. In comparison, public expenditure on LTC was estimated at 1.7% of EU GDP in 2019 (European Commission, Directorate-General for Employment, Social Affairs and Inclusion, 2021[47]).

While informal carers may provide the bulk of care, and may be the preferred option of older people, they can suffer from negative consequences of care. Informal carers report negative impacts on their labour-force participation, finances, and physical and mental health, especially if they provide intensive care (more than 20 hours per week) or care for someone with strong cognitive limitations (e.g. dementia) (Rocard, E; Llena-Nozal, A, 2022[48]).

The participation of informal carers is not guaranteed in the future. Demographic changes are at play, including higher labour-force participation of women (who represent most carers, especially among the working-age population), smaller families and greater geographical distances between family members.

A comprehensive set of policy measures would make care more manageable for informal carers, including provision of information on support, counselling and training, respite, cash benefits, leave and other flexible work arrangements. While governments have improved access to information for carers in the past decade, provision of counselling and training continues to depend heavily on the voluntary sector. Moreover, respite measures typically remain insufficient, with low rates of uptake due to low compensation, low availability of services and organisational challenges. About two-thirds of the OECD countries provide cash benefits to informal carers, either paid directly through a carer's allowance or paid to those in need of care, at least part of which is then used to compensate registered informal carers formally. Nearly two-thirds of OECD countries also mandate paid or unpaid leave entitlements to provide care for a family member (Rocard, E; Llena-Nozal, A, 2022[48]).

7.6. Conclusions: Preparation reduces the impact of crises in long-term care

The COVID-19 pandemic has severely affected the LTC sector, with substantial infection and mortality rates among LTC residents, and delayed and cancelled care. Over one-third of all COVID-19 deaths were among LTC recipients. LTC workers were also very exposed – falling ill or working longer hours, and informal carers generally reported an additional burden.

The LTC sector was not sufficiently prepared to absorb the COVID-19 pandemic initially, but infection prevention and control protocols, testing and PPE in long-term care became available. Countries implemented task forces to react promptly to outbreaks. They also sought to overcome temporary staff shortages by using mobile teams and recruiting additional workers. Countries generally expanded use of digital technologies to ensure care continuity and maintain social contacts.

While invaluable, most of these measures have been temporary and limited. Many OECD countries can – and should – make structural changes to build stronger LTC systems to withstand population ageing, transition further towards a community-based model and strengthen resilience to future shocks. Eliminating fragmentation of care by harmonising LTC governance, needs assessments, and cash benefits and services are important avenues to build resilient long-term care systems. Countries could also consider additional permanent funding of LTC based on diverse and broad-based funding routes.

Countries could develop further preventive and rehabilitation services and end-of-life care for LTC recipients. These services can improve quality of life while potentially being cost-efficient.

Finally, countries can ensure that sufficient carers are available by strengthening recruitment and retention policies for LTC workers (see chapters on workforce and investing in resilience), and providing better public support to informal carers.

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Notes

[1] This element is crucial to ensuring that LTC benefits are coherent with disability benefits.

[2] France’s Generalised Social Contribution relies on a very broad base (capital income, pensions, unemployment benefits, etc.) and has a relatively low rate. It levies over EUR 100 billion every year, which is more than the personal income tax.

8 Protecting mental health

Sofia Astorga-Pinto, Emily Hewlett and Philip Haywood

This chapter focuses on the impact of shocks and systemic disruptions on people's mental health, with a focus on the COVID-19 pandemic. It presents information about the prevalence of anxiety and depression in OECD countries, and about the disruption to mental health services. In response to the pandemic, the chapter reviews measures taken by OECD countries to protect and promote mental health, and improve mental health support. It concludes by offering recommendations to strengthen mental health and mental health support at individual and societal levels to build resilience and readiness to face future challenges.

Key findings

Shocks such as pandemics, large-scale displacements of people, natural and climate-related disasters, and financial crises can affect people's mental health profoundly. They can increase the prevalence of mental health issues and disrupt mental health services.

The COVID-19 pandemic had a sizeable and negative impact on population mental health across OECD countries. There was a substantial increase in the prevalence of anxiety and depression symptoms associated with rises in COVID-19 deaths and increased stringency of confinement policies in several OECD countries. Since the pandemic began, young people (aged up to 29 years) have consistently reported a higher prevalence of mental health issues than other age groups.

The pandemic disrupted mental health service referrals and delivery. Countries responded with a rapid shift to telehealth and other ways of delivering mental health support. All 26 OECD countries responding to the OECD Resilience of Health Systems Questionnaire 2022 introduced emergency mental health services and almost all (25 of 26) reported introducing permanent increases in services. Over two-thirds of responding OECD countries (20 of 26) undertook mental health prevalence surveys, or tracked the impact of COVID-19 on mental health service use (19 of 26).

While OECD countries made efforts to support mental health during the pandemic, it exposed a lack of capacity in mental health services and underinvestment in prevention. As the mental health legacy of COVID-19 persists, a higher risk exists of key groups (including young people, women and people who are unemployed) presenting with mental health conditions and having unmet needs, generating or deepening inequalities in mental health.

Given the challenges the COVID-19 pandemic presented for people's mental health, and the potential opportunities for reform, it is recommended that OECD countries:

- use the momentum gained during the pandemic to transform short-term measures into long-term changes to improve population mental health
- include mental health considerations in crisis planning, developing mechanisms to understand the impact of public policies on population mental health in a crisis and improving mental health information systems
- ensure the availability of valuable real-time information on the prevalence of mental health symptoms or issues and the knock-on effects of mental health service disruption to make evidence-based decisions
- implement interventions at an individual and population level to promote well-being and prevent mental health issues from arising, appreciating the interconnectivity of mental health with other systems and services requiring a whole-of-society approach
- improve access to and use of mental health services, especially for vulnerable populations.

8.1. Crises affect people's mental health

Crises have a negative impact on mental health (WHO, 2014[1]; Lund et al., 2018[2]). The population affected by a sufficiently large shock will experience a degree of psychological distress that will usually improve over time. Some individuals will, however, develop a mental health issue, such as a depressive, anxiety and/or post-traumatic stress disorder (WHO, 2022[3]).

Shocks such as disasters, accidents, wars and economic crises affect not only individuals but also communities, institutions and systems. They can also deepen social inequities (WHO, 2014[1]). Disruptions to the health system also affect delivery of mental health services, worsening the impact of a crisis on people's mental health.

The response to a crisis comprises four stages (see the key findings and recommendations chapter): prepare, absorb, recover and adapt. The *prepare* stage includes the steps taken to prepare critical functions to avoid and mitigate shocks. This occurs prior to the crisis. The *absorb* stage occurs after the shock commences. It comprises the capability of the health system to maintain core functions and absorb the consequences without collapse, limiting the extent of the disruption and minimising the morbidity and mortality impact. The *recover* stage involves regaining the disrupted functions as quickly and efficiently as possible. The *adapt* stage is the capacity of the health system to "learn" and improve its ability to absorb and recover from shocks, reducing the impact of similar threats in the future.

If mental health issues in a crisis are addressed promptly and effectively during the absorb stage, people will suffer fewer long-term effects as the response unfolds (WHO, 2022[3]). Analysing and implementing the lessons of the short-term interventions undertaken during the COVID-19 pandemic – for example, the increased use of telehealth during the absorb and recover stages – could lead to beneficial long-term changes in mental health services during the adapt stage (WHO, 2020[4]). It is relevant, therefore, to understand the impact of shocks on people's mental health, to promote more resilient health systems.

The following sections examine the impact of crises on people's mental health (Section 8.1), the disruption to mental health services following the COVID-19 pandemic, and measures taken by OECD countries to protect and promote mental health, and improve mental health support (Section 8.2). The final section (8.3) offers recommendations to strengthen mental health and mental health support to build resilience and readiness for future crises. Box 8.1 outlines the terminology, data and scope of this chapter.

Box 8.1. Terminology, data and the scope of the chapter

The terms "mental health conditions" and "mental health issues" are used in this chapter. This is to align the language with ongoing efforts to raise awareness and address stigma, and to ensure – where possible – that language is person-centred, strengths-based and recovery-focused, reflecting the differing experiences of mental health issues from individual to individual.

This OECD report uses LGBTQI+ to refer to lesbian, gay, bisexual, transgender, queer (or questioning), intersex and gender fluid populations. However, other institutions, organisations, country policies and researchers use many variations on this term (McBrien, Rutigliano and Sticca, 2022[5]). This chapter includes the terminology in the original research or citation. This includes LGBTQ2S+: lesbian; gay; bisexual; transgender; queer or questioning; and two-spirit (Mental Health Research Canada, 2022[6]).

Population mental health data (especially age-stratified data) remain limited in coverage. This chapter primarily uses prevalence of symptoms of anxiety and depression, estimated through surveys, as a proxy for mental health issues. Where possible, it uses validated instruments – such as the 7-item General Anxiety Disorder scale (GAD-7) for anxiety and the 9-item Patient Health Questionnaire (PHQ-9) for depression. Samples are not necessarily nationally representative (especially for rapid surveys undertaken during the COVID-19 pandemic), and survey methods differ between studies, limiting the opportunity for cross-country comparisons. As symptoms are self-reported, increasing prevalence may reflect changes in levels of awareness or stigma about mental health, which can influence trends across countries and over time.

The very limited discussion of mental health issues beyond anxiety and depression in this chapter does not reflect their importance. These areas require further investigation and inclusion in plans to improve health systems resilience. Further data and information would benefit and nuance the findings made and the recommendations offered.

This chapter focuses on specific populations and highlights several issues for specific groups. Some of the mental health implications for specific populations are covered in other chapters. For instance, the impact on carers and on those in long-term care is discussed in the chapter on long-term care. The impact on health care workers is discussed in the chapter on the health workforce. More comprehensive information can also be found in other OECD publications (OECD, 2021[7]), including a focus on the mental health of young people (OECD/European Union, 2022[8]; OECD, 2021[9]).

8.1.1. Examples of crises that affected people's mental health in OECD countries

Box 8.2 focuses on examples from Chile (2010 earthquake) and Australia (2019-20 bushfires). Another example was the global financial crisis (2007-08), which was linked to an increase in suicide rates in Greece (Kentikelenis et al., 2011[10]),the United Kingdom (Barr et al., 2012[11]), United States (Reeves et al., 2012[12]) and ten European countries (Stuckler et al., 2011[13]).

Box 8.2. Examples of crises that affected mental health and disrupted health systems

Chile

In 2010, Chile suffered a magnitude 8.8 earthquake followed by a tsunami. Hundreds of people died, and thousands lost their homes. This led to an increase in prevalence of mental health issues, including psychological distress, post-traumatic stress disorder, anxiety and depression (Leiva-Bianchi, 2011[14]; Díaz, Quintana and Vogel, 2012[15]; Fernandez et al., 2020[16]; Dutta et al., 2022[17]). Female adolescents (compared to male adolescents) and people exposed to multiple stressors were more at risk of developing mental health issues (Díaz, Quintana and Vogel, 2012[15]; Fernandez et al., 2020[16]). After two years, those with risk factors still had a higher prevalence of mental health conditions (Andrades, García and Kilmer, 2021[18]).

The quick response of the health system in some cities avoided heavy disruption of mental health care. The Hospital of Curicó was destroyed during the earthquake, but mental health services were rapidly relocated, and care continued to be provided two days after the earthquake (Vitriol G et al., 2013[19]). However, coverage of mental health services during the crisis was distributed unequally. Mental health interventions were implemented in affected areas, but only covered 35% of the affected population and focused mainly on areas that were geographically accessible and where people of high socio-economic status lived (Vitriol et al., 2014[20]).

Australia

The bushfire season in Australia lasted over nine months between 2019 and 2020. There were 33 direct deaths, over 400 excess deaths, millions of hectares were burnt, and thousands of homes were destroyed. Studies showed an increase in mental health issues, including anxiety, depression, stress and sleep disturbances (Rodney et al., 2021[21]; Podubinski and Glenister, 2021[22]; Isaac et al., 2021[23]). Women and people with pre-existing medical conditions were more vulnerable to this crisis.

Podubinski and Glenister (2021[22]) also studied the cumulative impacts of multiple crises on mental health by analysing the interaction of fire exposure and COVID-19, and their effects on mental health in Australia. They found that people who had experienced prior crises or disruptions (such as exposure to fires or another form of shock) required additional support to protect their mental health during the pandemic. This demonstrates the compounding nature of stresses.

8.1.2. The pandemic was no exception: it affected people's mental health

The COVID-19 pandemic was very disruptive. Its health impact was compounded by the social and economic consequences, such as lockdowns and other containment and mitigation measures, schooling disruption and changing employment status.

Previous OECD publications have highlighted the significant initial impact the pandemic had on population mental health (OECD, 2021[24]; 2021[9]; 2021[7]). These studies also found that population mental health is worse than before the pandemic, with the prevalence of mental health symptoms having doubled in some OECD countries. For example, the share of young people (aged 18-29 years) with symptoms of depression more than doubled in seven European countries for which broadly comparable pre-pandemic and pandemic data are available (OECD/European Union, 2022[8]).

Recent evidence provides a more comprehensive view of the impact of the pandemic on population mental health, especially over the longer absorb and recover stages of the response to it (see the chapter on key findings and recommendations).

Figure 8.1 to Figure 8.6 present data on prevalence of depression and anxiety from the first two years of the pandemic for six countries. Available data from selected OECD countries were analysed to identify some points of comparison (Box 8.3).

In general, the mental health status of populations in these six countries in late 2021 and early 2022 was better than during the first and second lockdown periods, but it was worse than at the beginning of the pandemic in some countries. For example, in Canada (Figure 8.2), the depression and anxiety point estimates were above the 100 baseline during the remainder of the data presented. On the other hand, data from populations in countries like Switzerland (Figure 8.4) and the United Kingdom (Figure 8.5) suggest a lower burden of mental health symptoms in late 2021 and early 2022 than earlier.

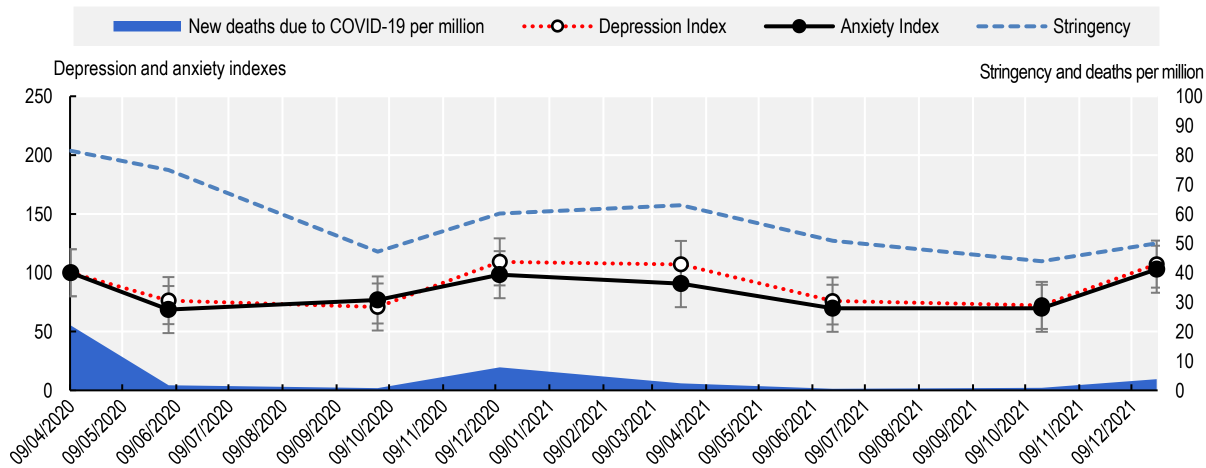
Additionally, Figure 8.1 to Figure 8.6 show that, in general, anxiety and depression followed a similar trend to numbers of deaths due to COVID-19 and the stringency of government responses (Table 8.1). Thus, when the stringency of measures and deaths increased, the prevalence of anxiety and depression symptoms also increased. These relationships varied, however, depending on the country, the mental health symptoms examined and other pandemic variables.

Box 8.3. Definitions and comparability for Figures 8.1 to 8.5

The countries assessed depression and anxiety differently (see the footnotes for each figure), and began collecting data at different time-points, impeding direct comparisons between countries. To understand the variation in these mental health issues better, an index was calculated using the first time-point with available data as a baseline. The baseline was transformed into a 100 value, and the rest of the data points were converted by calculating their variation from the 100 baseline. Thus, the data can be interpreted as how much the prevalence of anxiety and depression symptoms varied from the point at which the relevant country started collecting data (usually at the beginning of the pandemic).

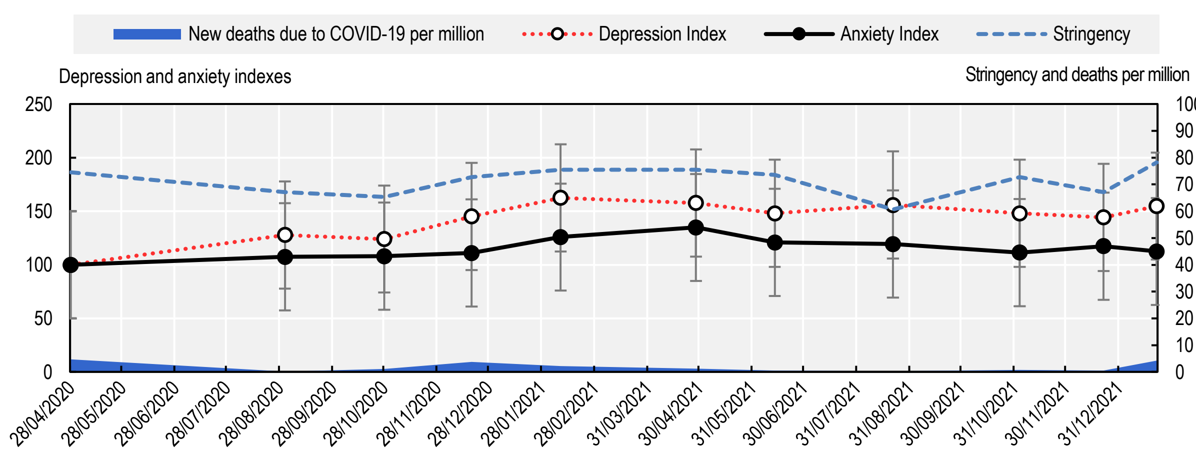
The values for COVID-19 deaths are based on the daily reports of new deaths due to COVID-19 per million people (smoothed values) (Mathieu et al., 2020[25]). A 7-day mean of new cases was calculated for this chapter, from 21 January 2020 until March 2022. Finally, the Stringency Index was calculated by the Oxford Coronavirus Government Response Tracker (Mathieu et al., 2020[25]). The data were extracted on 11 April 2022.

Figure 8.1. Prevalence of depression and anxiety, stringency of containment measures, and COVID-19 deaths, Belgium, 2020-22



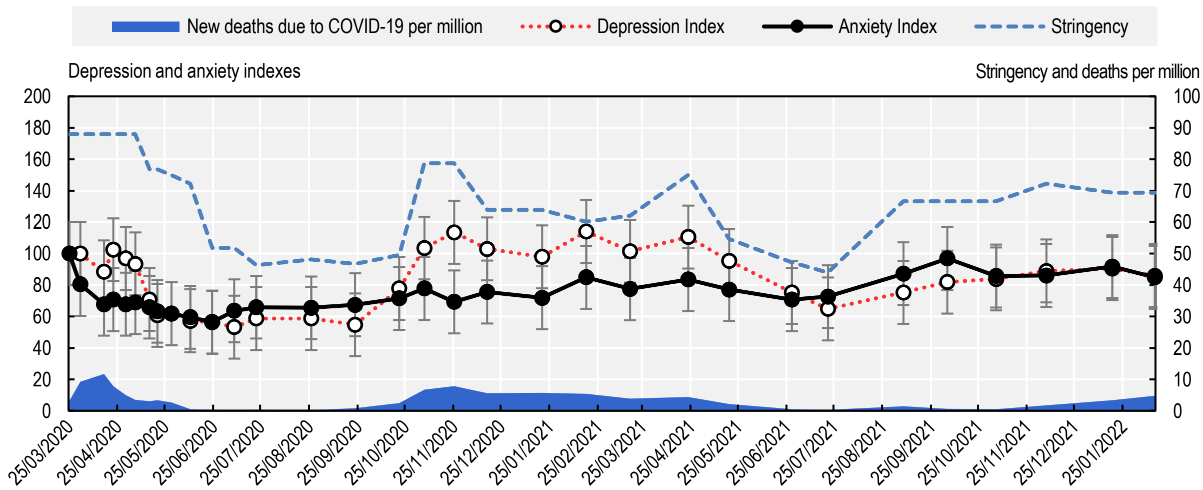
Note: PHQ-9 was used to assess depressive symptoms and GAD-7 to assess anxiety symptoms.
Source: Superior Health Council of Belgium (n.d.[26]), Belgium *COVID-19 Epidemiological Situation: Mental Health Studies*, https://datastudio.google.com/embed/reporting/7e11980c-3350-4ee3-8291-3065cc4e90c2/page/ykUGC.

Figure 8.2. Prevalence of depression and anxiety, stringency of containment measures, and COVID-19 deaths, Canada, 2020-22



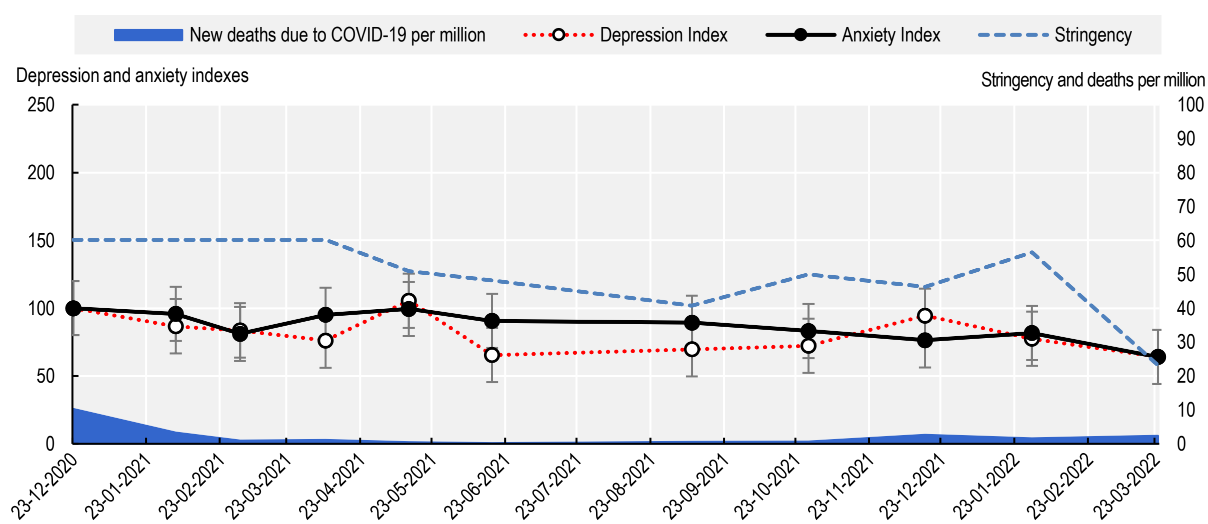
Note: Anxiety and depression indexes were calculated based on the self-rated levels of anxiety and depression in answer to the question: "Your level of anxiety/depression since the coronavirus (COVID-19) outbreak in Canada", on a 0 to 10 scale, where "10" is extremely high and "0" is none. Categories were low (0-4), medium (5-7) and high (8-10). The chart presents the high results. The data do not include Canada's territories (Yukon, Northwest Territories and Nunavut).
Source: Mental Health Research Canada, (2022[6]), Mental Health in Crisis: How COVID-19 Is Impacting Canadians National Poll (Poll 12), https://www.mhrc.ca/national-polling-covid.

Figure 8.3. Prevalence of depression and anxiety, stringency of containment measures, and COVID-19 deaths, France, 2020-22



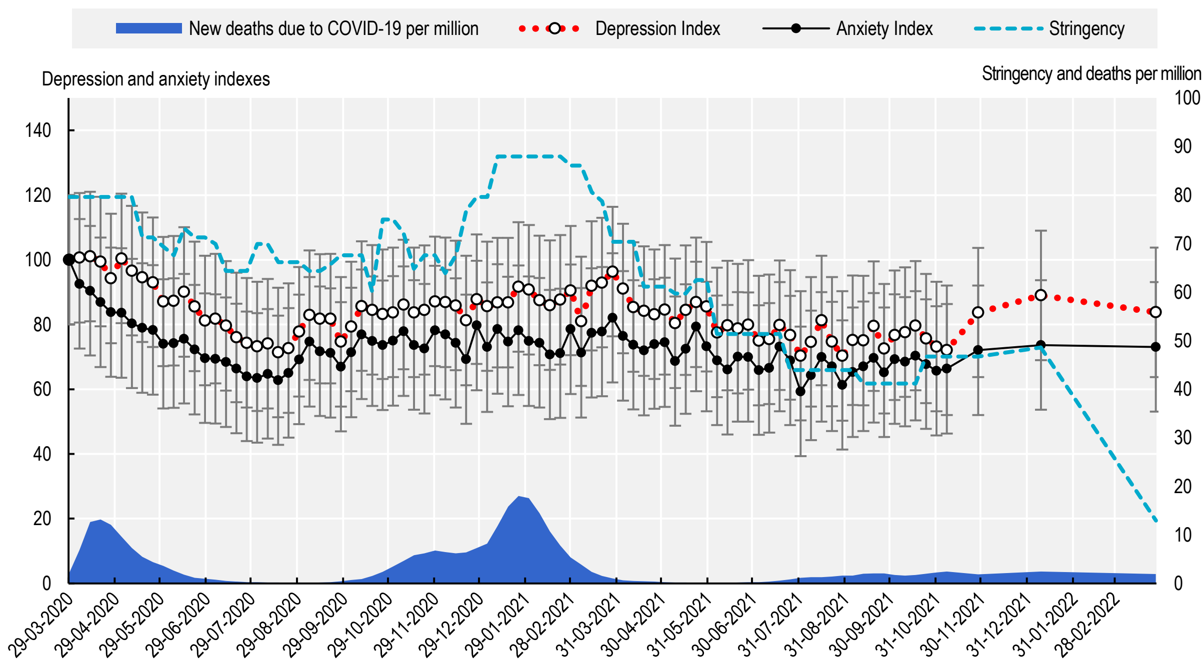
Note: The Hospital Anxiety and Depression scale (scores of >10) was used to assess anxiety and depression symptoms.
Source: Santé publique France (2022[27]), CoviPrev, https://www.santepubliquefrance.fr/etudes-et-enquetes/coviprev-une-enquete-pour-suivre-l-evolution-des-comportements-et-de-la-sante-mentale-pendant-l-epidemie-de-covid-19.

Figure 8.4. Prevalence of depression and anxiety, stringency of containment measures, and COVID-19 deaths, Switzerland, 2020-22



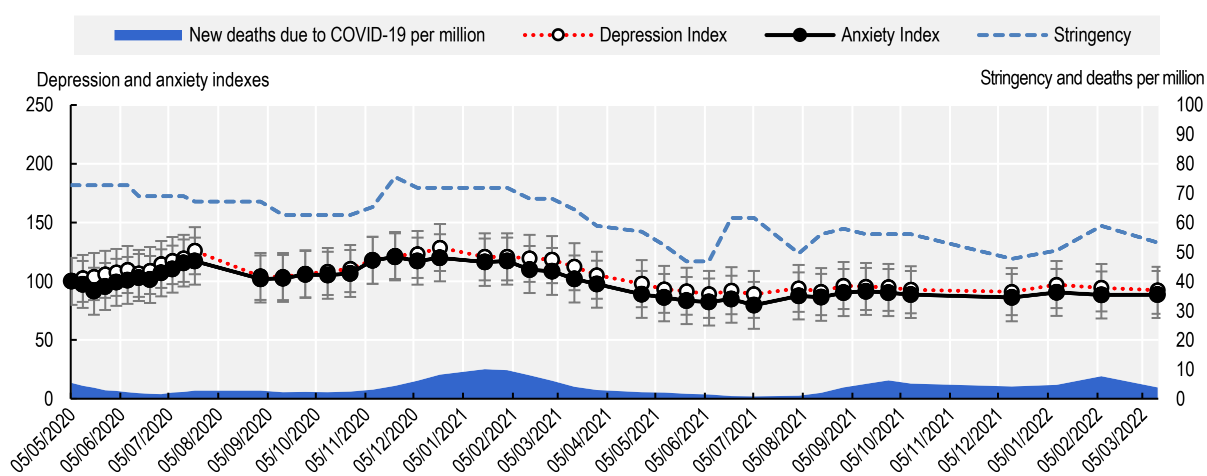
Note: The PHQ-4 anxiety subscale 0-6 was used to assess anxiety symptoms and the PHQ-4 depression subscale 0-6 to assess depression symptoms. The data present results categorised as “red flag for depression/anxiety disorder” (≥5 is a red flag, while ≥3 is a yellow flag). Please note the first time point is December 2020.
Source: Höglinger et al. (n.d.[28]), COVID-19 Social Monitor: Mental Health, https://covid19.ctu.unibe.ch.

Figure 8.5. Prevalence of depression and anxiety, stringency of containment measures, and COVID-19 deaths, United Kingdom, 2020-22



Note: PHQ-9 was used to assess depressive symptoms and GAD-7 to assess anxiety symptoms. The size of the graph has been increased to show the number of time points clearly.
Source: UCL (2022[29]), *UCL* COVID-19 *Social Study Reports*, https://www.covidsocialstudy.org/results.

Figure 8.6. Prevalence of depression and anxiety, stringency of containment measures, and COVID-19 deaths, United States, 2020-22



Note: The modified PHQ-2 was used to assess depressive symptoms and modified GAD-2 to assess anxiety symptoms.
Source: CDC (2022[30]) *Household Pulse Survey*, https://www.cdc.gov/nchs/covid19/pulse/mental-health.htm.

Table 8.1. Depression and anxiety indexes: correlations with stringency and mean 7-day new deaths due to COVID-19 per million for six OECD countries, 2020-22

		Mean	Standard deviation	Correlation with Stringency	Correlations with COVID-19 deaths*	Correlation of Anxiety and Depression indices
Belgium	Depression index	89.97	17.42	0.33	0.47	1
	Anxiety index	84.70	14.87	0.28	0.62	0.92
Canada	Depression index	142.57	18.42	0.14	-0.28	1
	Anxiety index	115.33	9.68	0.16	-0.36	0.80
France	Depression index	83.17	19.23	0.50	0.70	1
	Anxiety index	74.73	10.88	0.20	0.07	0.52
Switzerland	Depression index	81.43	13.97	0.48	0.47	1
	Anxiety index	86.98	10.97	0.68	0.26	0.49
United Kingdom	Depression index	83.44	7.55	0.62	0.55	1
	Anxiety index	72.79	6.74	0.53	0.47	0.93
United States	Depression index	105.48	11.55	0.75	0.38	1
	Anxiety index	99.57	11.87	0.72	0.39	0.97

*Mean 7 days of new deaths due to COVID-19 per million population.
Note: Care must be taken when comparing data across countries because they assessed mental health with different screening tools. Strength of the correlation coefficients can be interpreted with the following rule of thumb (for positive or negative correlations): 0.90-1.00 = very high correlation; 0.70-0.90 = high correlation; 0.50-0.70 = moderate correlation; 0.30-0.50 = low correlation; 0.00-0.30 = very low correlation.
Source: Mukaka (2012[31]), Statistics Corner: A guide to appropriate use of correlation coefficient in medical research, https://pubmed.ncbi.nlm.nih.gov/23638278/

Evidence on suicide rates is currently inconsistent, showing increases and decreases depending on the country and stage of the pandemic. Although suicide rates did not increase significantly across populations in 2021, suicidal ideation increased during the COVID-19 pandemic, especially among young people (WHO, 2022[32]; OECD, 2021[24]). For example, the increase was around five-fold in reported rates of suicidal ideation in Belgium (among those aged 18-29 years) and in France (among those aged 18-24 years), compared to pre-pandemic prevalence (OECD/European Union, 2022[8]). It is therefore critically important that suicide prevention measures are strengthened and that rates of death by suicide are monitored closely as the pandemic continues.

8.1.3. Uneven mental health impacts led to inequities

The mental health impact of the COVID-19 crisis was borne inequitably across the population of OECD countries. Some of the key population groups affected disproportionately were those with pre-existing health conditions, people infected with COVID-19, unemployed people, people with lower socio-economic status and education levels, women, transgender people, members of the LGBT2Q+ community and young people. These groups have a higher risk of poor mental health and greater unmet mental health needs. However, this list is not exhaustive. Other vulnerable populations' needs should also be considered in some countries – for example, indigenous peoples in Canada (Jenkins et al., 2021[33]).

People with pre-existing health and mental health conditions were at a higher risk of experiencing mental health issues during the COVID-19 pandemic (WHO, 2022[32]). For example, in Finland, the effects were more severe for people with previous mental health conditions – especially children and adolescents (Kestilä et al., 2022[34]). In Canada, people with pre-existing mental health issues (due to health, social and/or structural vulnerabilities) were also more likely to report worse mental health (Jenkins et al., 2021[33]).

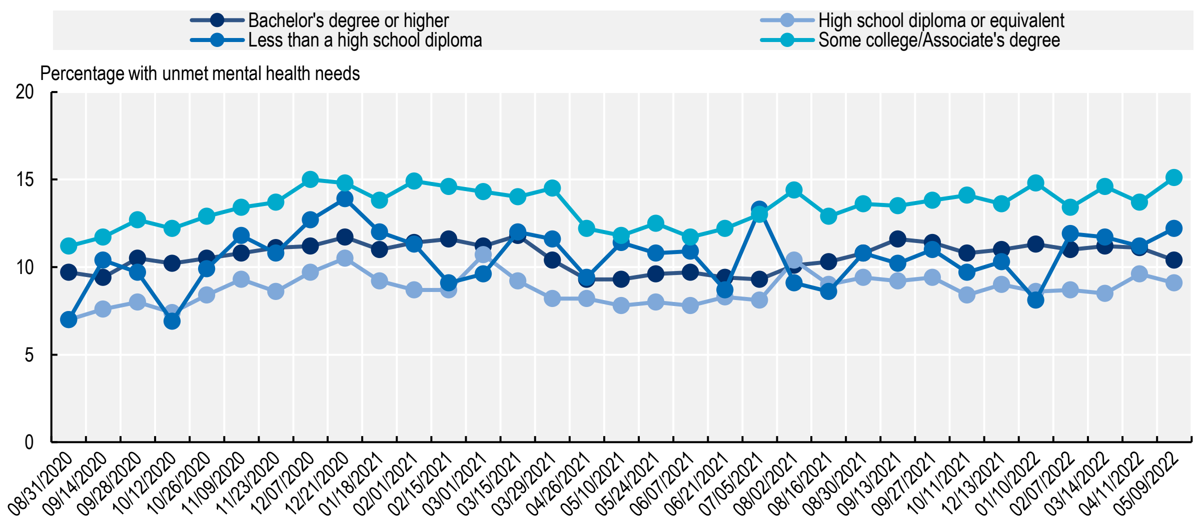
People infected with COVID-19 reported a higher prevalence of mental health issues than non-COVID-19 patients (WHO, 2022[32]). Studies into mental health and post-COVID-19 syndrome or "long COVID" patients have some limitations – including the lack of a clear definition of long COVID, and inconsistent criteria for selecting participants. However, the evidence is accumulating as OECD countries transition into the recovery stage of the pandemic. A study from Hungary in 2022 found that higher levels of depressive and anxiety symptoms were associated with a higher number of long COVID symptoms, and that depression was a predictor of a higher number of long COVID symptoms (Ocsovszky et al., 2022[35]). Life satisfaction and social support are also negatively associated with long COVID symptoms. A longitudinal study in the People's Republic of China found that, even though COVID-19 survivors' mental health had improved after two years, they still had a higher prevalence of anxiety and depression than people without long COVID symptoms (Huang et al., 2022[36]). Further research is needed to study the relationship between long COVID and mental health outcomes.

Unemployment is commonly related to poorer mental health outcomes (OECD, 2021[37]). The pandemic exacerbated this situation: **people who were unemployed** reported more symptoms of depression and anxiety (OECD, 2021[24]). In France, unemployed people were more likely to report depression and anxiety symptoms than those in employment. In the United Kingdom, workers who were in long-term insecure jobs before and after the start of the pandemic without furlough reported a significant increase in mental distress during the pandemic (OECD, 2021[24]; Smith, Taylor and Kolbas, 2020[38]). A Finnish study found an increase in psychological stress for unemployed people, and especially unemployed women, in 2020 compared to 2018 data (Kestilä et al., 2022[34]). This study also found that retired women experienced a higher increase in psychological stress during the pandemic. In 2021 and early 2022, self-rated levels of anxiety and depression continued to be worse for unemployed people in Canada (Mental Health Research Canada, 2022[6]).

It was well known before the COVID-19 pandemic that socio-economic status and education are determinants of mental health: **people with lower socio-economic status and education levels** tend to have poorer mental health outcomes (WHO, 2014[1]). These determinants were a factor during the pandemic, but data supporting the association were not consistent across countries. For example, in the United Kingdom, people with lower education and income levels presented with higher anxiety scores (Fancourt, Steptoe and Bu, 2021[39]). The United States had similar findings: the group with the lowest education levels consistently presented with a higher prevalence of depressive symptoms compared to groups with higher education levels (CDC, 2022[30]). In Finland, however, psychological stress was found to have increased among highly educated women, as well as among less-educated men and women (Kestilä et al., 2022[34]; CDC, 2022[30]).

Similar inconsistencies according to socio-economic status and education level were reported for unmet mental health needs. The US Household Pulse Survey 2022 found that the population with a medium education level was the group with the highest unmet mental health needs – they needed counselling or therapy but did not receive it (Figure 8.7) (CDC, 2022[30]). The survey also found, however, that the group with high education levels used counselling or therapy more. Therefore, the groups with a higher prevalence of depressive symptoms and higher unmet needs were not the groups using more counselling or therapy services, meaning that the delivery of care was potentially inequitable. This is an ongoing challenge for many OECD countries as countries seek to recover from the pandemic.

Figure 8.7. People with unmet mental health needs by education level, United States, 2020-22

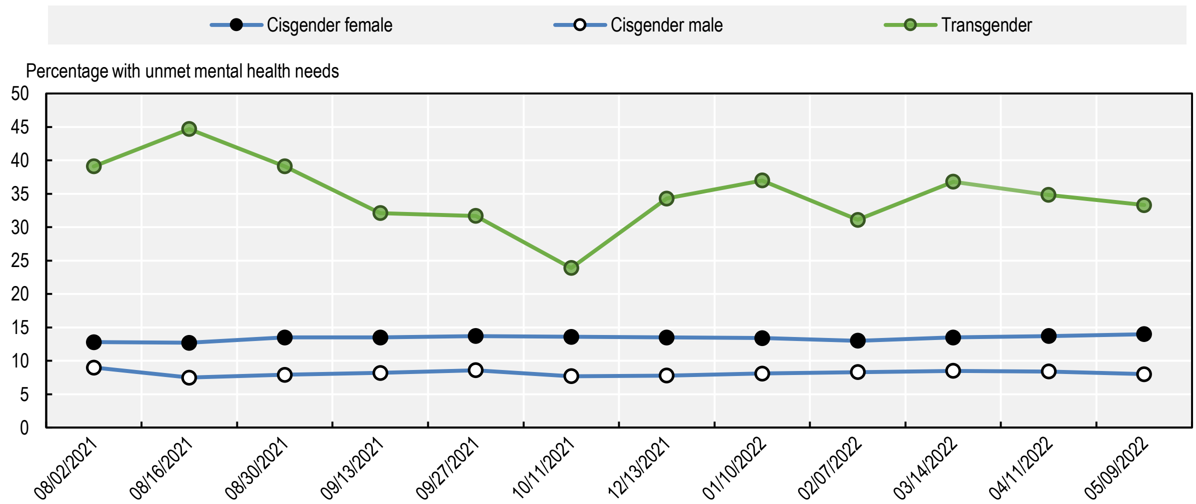


Note: Unmet mental health needs refer to the number of people that needed counselling or therapy but did not receive it.
Source: CDC (2022[30]) *Household Pulse Survey*, https://www.cdc.gov/nchs/covid19/pulse/mental-health-care.htm.

Before the pandemic, **women** were already more likely to report and be diagnosed with depression and anxiety symptoms than men, but the pandemic increased the gap in mental well-being between women and men (WHO, 2022[32]; OECD, 2021[24]). In the first months of the pandemic, the gap widened by 66% in the United States (Adams-Prassl et al., 2020[40]). This trend then continued. For example, in Canada, women had a higher prevalence of self-reported anxiety than men (25% vs. 16%) in 2022 (Mental Health Research Canada, 2022[6]). In Finland, highly educated and retired women presented with increased psychological stress during the pandemic (Kestilä et al., 2022[34]). Women also had higher unmet needs than men, at least in some countries. In the United States, women reported higher unmet mental health needs than men, and this was consistent during the first two years of the pandemic (CDC, 2022[30]).

The US Household Pulse Survey 2022 found that **transgender people** had a higher prevalence of unmet mental health needs compared to cisgender females and males (CDC, 2022[30]) (Figure 8.8). Also, **members of the LGBTQI+ community** in general (LGBTQ2S+) presented with higher levels of self-reported anxiety and depression than the adult population in Canada in 2022 (Mental Health Research Canada, 2022[6]).

Figure 8.8. People with unmet mental health needs by gender, United States, 2021-22



Note: Unmet mental health needs refer to the number of people that needed counselling or therapy but did not receive it.
Source: CDC (2022[30]) *Household Pulse Survey*, https://www.cdc.gov/nchs/covid19/pulse/mental-health-care.htm.

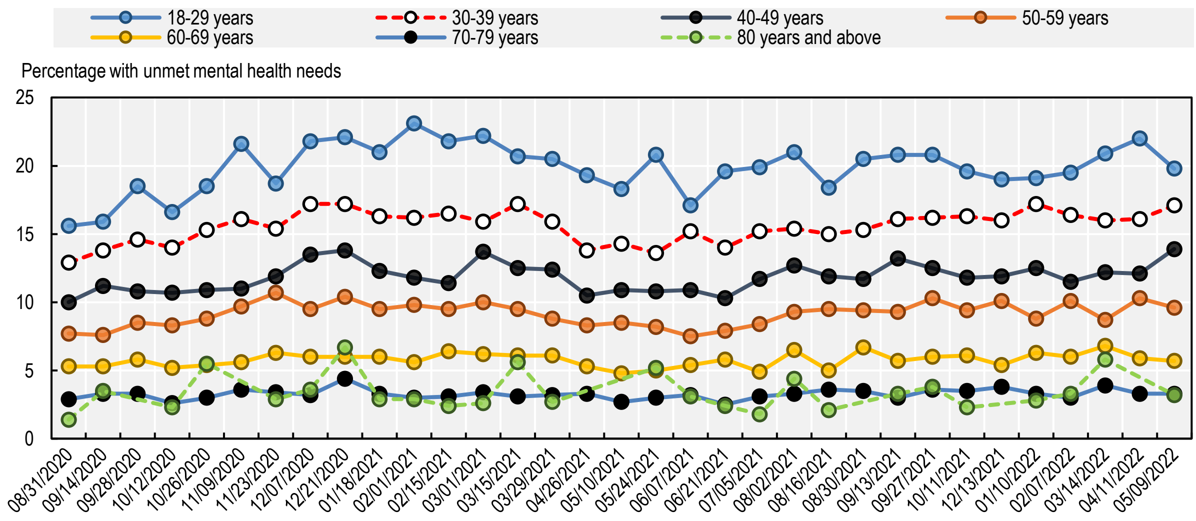
Young people (aged up to 29 years) consistently reported a higher prevalence of mental health issues compared to other age groups since the pandemic began. In OECD countries, the increase in prevalence of anxiety and depression symptoms in this group was significant (OECD/European Union, 2022[8]). Additionally, the prevalence of symptoms has not returned to pre-pandemic levels, despite the lifting of containment and mitigation measures (OECD, 2021[9]). A WHO report found that younger age was reportedly a risk factor for mental health issues in several studies and countries during the pandemic (WHO, 2022[32]). A global meta-analysis of studies reporting on symptoms of anxiety and depression in people aged up to 18 years found that prevalence of symptoms was double pre-pandemic levels, with one in four experiencing symptoms of depression, and one in five experiencing symptoms of anxiety (Racine et al., 2021[41]).

In Japan, 31% of people aged 20-29 years presented with depression symptoms compared to 18% of older adults in mid-2020 (Fukase et al., 2021[42]). In 2021, young people (aged 18-29 years) in Belgium, France and the United States showed a 30-80% higher prevalence of anxiety and depression symptoms than the general population, and this was twice the prevalence they experienced before the pandemic (OECD, 2021[9]).

This situation continued into 2022. Younger groups in Canada showed a higher prevalence of self-reported anxiety than older groups (24% of people aged 16-17 years and 31% of people aged 18-34 years, compared to 14% of people aged 55 years and over) (Mental Health Research Canada, 2022[6]). In Finland, mood problems among children and young people have reportedly increased, albeit with no large differences between girls and boys. People aged 15-29 years reported experiencing more stress during the pandemic compared to older age groups (Kestilä et al., 2022[34]).

Younger people also presented with higher unmet mental health needs compared to older age groups. The US Household Pulse Survey 2022 found that a higher number of people aged 18-29 years reported needing counselling or therapy, but fewer received it compared to older age groups (Figure 8.9) (CDC, 2022[30]).

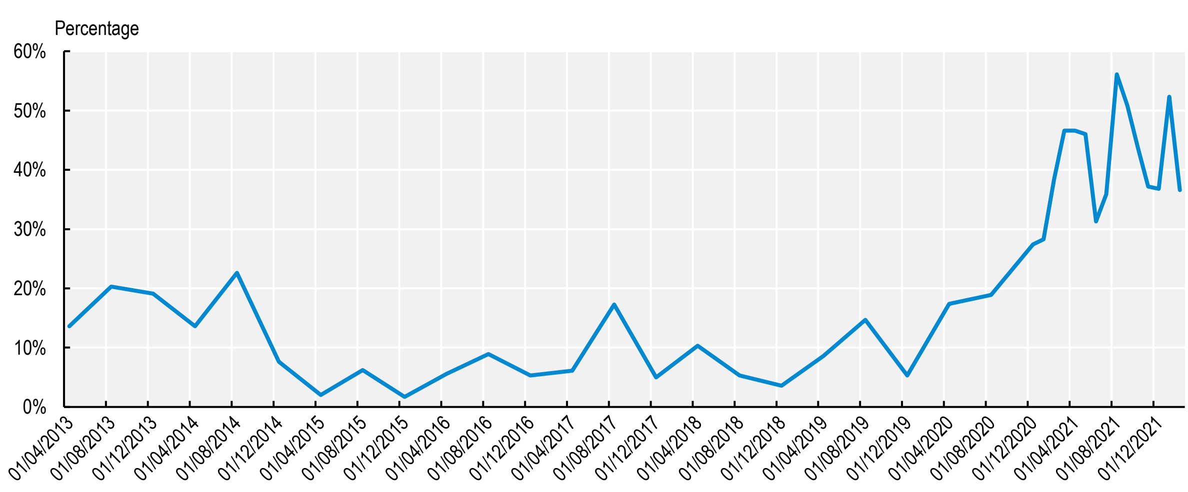
Figure 8.9. Unmet mental health needs according to age group, United States, 2020-22



Note: Unmet mental health needs refer to the number of people that needed counselling or therapy but did not receive it.
Source: CDC (2022[30]) *Household Pulse Survey*, https://www.cdc.gov/nchs/covid19/pulse/mental-health-care.htm.

Data from Finland showed an increase in the number of children and adolescents who waited more than 90 days for mental health treatment during the pandemic (Terveyden ja hyvinvoinnin laitos, 2022[43]). A large increase occurred at the end of 2020 (Figure 8.10). Another Finnish study found that only 39% of children and adolescents received help with learning during the pandemic, and there was an association between not receiving support and higher anxiety levels. This association was strong for both girls and boys; however, more girls needed learning support but did not receive it (Kestilä et al., 2022[34]).

Figure 8.10. Percentage of children and adolescents waiting more than 90 days for treatment, Finland, 2013-21



Source: Terveyden ja hyvinvoinnin laitos (2022[43]),Mental health services for children and adolescents – Queue situation in specialised medical care, psychiatry – THL cube and sealing interface.

8.2. OECD countries addressed disruptions to mental health services, but unmet needs persist

8.2.1. The onset of the pandemic disrupted mental health services

The pandemic disrupted the delivery of mental health services globally, including across OECD countries (OECD, 2021[7]). Worldwide, 93% of countries reported interruptions in their mental health services (WHO, 2020[4]). In the Netherlands, there was a drop of 25-80% in the number of referrals to mental health providers and a drop of 10-40% in treatment demand during the first wave of the pandemic (OECD, 2021[24]). In Switzerland, access to mental health care was also reduced owing to containment and mitigation measures (Stocker et al., 2021[44]). Effective and timely delivery of mental health care was already challenged before the pandemic began. Containment measures during the early months of the pandemic magnified these challenges in many OECD countries.

The reasons for the disruption are well understood. The absorb stage of the pandemic response focused on tackling the critical care requirements of the crisis (see the chapter on critical care surge). Elective care was cancelled (including mental health care), and hospital beds typically reserved for mental health patients were instead used for COVID-19 patients (WHO, 2020[4]; OECD, 2021[7]). Additionally, patients did not attend in-person mental health consultations because of fears of contracting the virus, and travel restrictions also affected access. Altruism and concern for freeing up health resources also played a role. For example, in Switzerland, some patients withdrew from telephone mental health consultations because they considered themselves non-urgent cases. Also, people declined to attend day clinics because they were (or could be) high-risk COVID-19 patients (Stocker et al., 2021[44]).

Community-based services were among the most affected mental health services (OECD, 2021[24]). Worldwide, 40% of countries closed their community-based mental health services entirely or in part (WHO, 2020[4]). In Italy, 14% of community mental health centres closed, and 25% reduced their hours in April 2020 (Carpiniello et al., 2020[45]). England (United Kingdom) also reduced primary care contacts for mental health conditions (Mansfield et al., 2021[46]).

Outpatient and emergency mental health services in hospitals were also disrupted heavily (OECD, 2021[24]). Approximately 78% of day hospitals closed in Italy in April 2020 (Carpiniello et al., 2020[45]). In Lombardy (Italy), emergency department psychiatric visits suffered a 43% reduction (Stein et al., 2020[47]). Three hospitals in Paris (France) sustained a 54.8% drop in the number of emergency psychiatric consultations during the first weeks of the pandemic (Pignon et al., 2020[48]). On the other hand, psychiatric services in Swiss hospitals stayed almost entirely open and were available during the first lockdown. Only a few day clinics closed for some weeks or continued operating on a reduced scale (Stocker et al., 2021[44]).

Other mental health services also experienced disruptions. Services focused on prevention and promotion – which were already struggling before the pandemic – were affected profoundly (WHO, 2020[4]). Home care and day services were closed completely or partly in 60-70% of countries surveyed by WHO. In England (United Kingdom), referrals to the Increasing Access to Psychological Therapies Programme fell by 61% between February and April 2020 (Johnson et al., 2021[49]). In Switzerland, psychiatric rehabilitation services were inaccessible or had limited accessibility during and after the first lockdown.

Mental health support in schools, workplaces and broader community settings is a critical part of overall delivery of mental health services (OECD, 2021[50]; 2021[37]). Extensive evidence is available on the relevance of integrating mental health treatment with employment support to improve work and mental health outcomes. These services were also disrupted significantly during the absorb stage of the pandemic, with closed schools and workplaces. In 2020, around 75% of school or workplace mental health services were disrupted fully or partly (WHO, 2020[4]). In early 2021, school-based mental health programmes were still highly interrupted (WHO, 2021[51]).

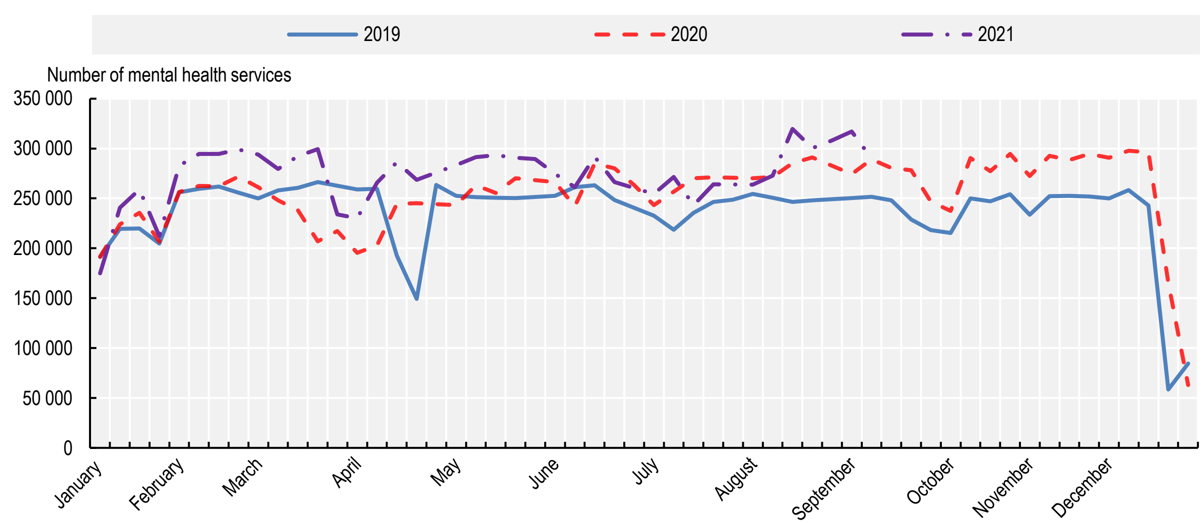
8.2.2. The pandemic was a catalyst for action to protect and improve population mental health

In response to the COVID-19 pandemic, several OECD countries rapidly included mental health in their plans to address the crisis. By mid-2020, 89% of the countries surveyed by WHO reported that mental health and psychosocial support were included in their COVID-19 response plans (WHO, 2020[4]).

As countries move further into recovering from the pandemic, mental health support has broadened and deepened. Among respondents to the OECD Resilience of Health Systems Questionnaire 2022, 100% of countries (26 of 26) reported having introduced emergency mental health support measures for the public during the pandemic. Additionally, 96% (25 of 26) reported having permanently increased mental health support or capacity since the start of the crisis. This said, only 58% of countries (15 of 26) reported having new or temporary mental health services or including service entitlement in emergency mental health support.

As OECD countries began addressing the disruptions, the use of mental health services increased in 2020 and 2021 compared to previous years. For example, in Australia, the number of mental health services provided in 2021 was higher than in 2019 and 2020 (Figure 8.11) (Australian Institute of Health and Welfare, 2022[52]). The total number of weekly mental health services increased by 25% from March 2020 to December 2020. It then decreased by 41% in January 2021 and peaked in August 2021 – an 83% increase. Figure 8.11 also shows that 2019, 2020 and 2021 had similar seasonal patterns in the number of mental health services provided, defined as consultations provided by mental health workers. The steeper decrease in December-January is explained by holiday leave arrangements.

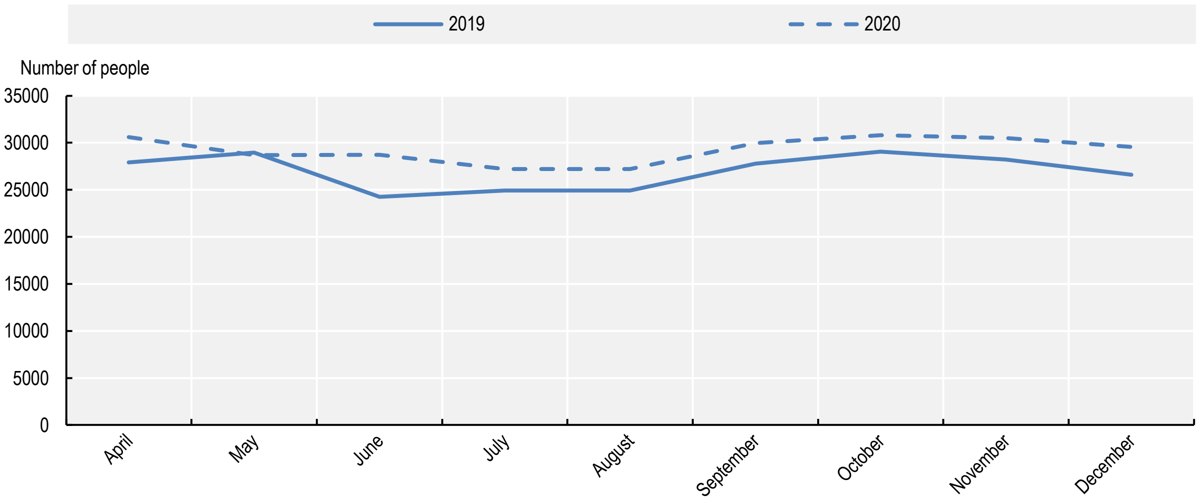
Figure 8.11. Number of mental health services provided in Australia, 2019- 2021 (to September)



Note: These are services billed via the Medical Benefits Schedule by a recognised practitioner; data exclude services that are not billed under these arrangements (including, for example, some public hospital services and some crisis support services).
Source: Australian Institute of Health and Welfare (2022[52]), Mental health impact of COVID-19, https://www.aihw.gov.au/reports/mental-health-services/mental-health-services-in-australia/report-contents/covid-19-impact-on-mental-health.

In Lithuania, like Australia, the number of people who sought treatment for depression, anxiety and high-stress disorders was higher in 2020 than 2019, according to responses to the OECD Resilience of Health Systems Questionnaire 2022 (Figure 8.12).

Figure 8.12. People seeking treatment for depression, anxiety and high-stress disorders, Lithuania, April to December 2019-20

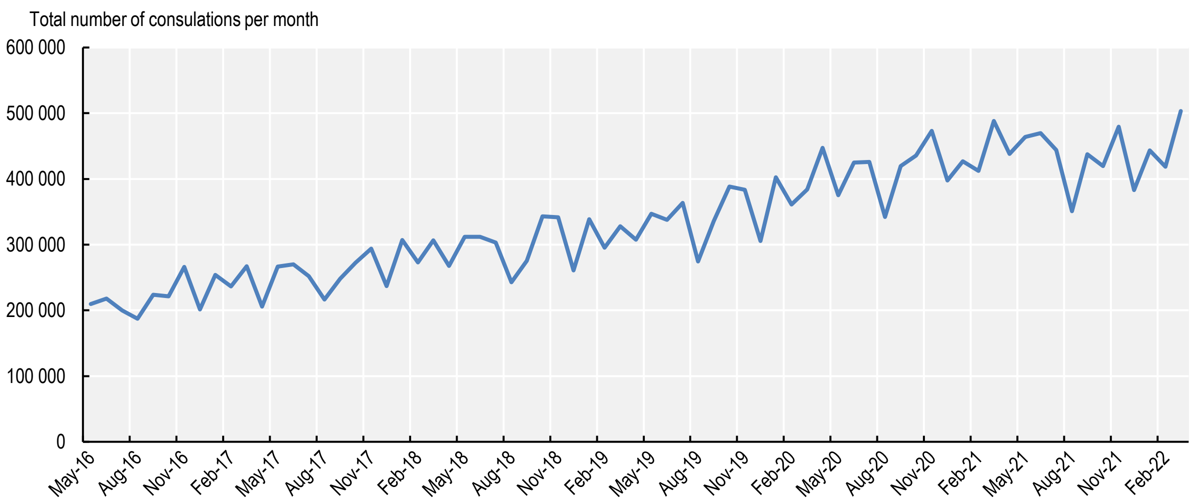


Source: Data provided by the Ministry of Health of Lithuania in response to the OECD Resilience of Health Systems Questionnaire 2022.

Canada also saw an increase in the number of people accessing mental health services once the pandemic began. According to a national survey of mental health and COVID-19, 10% of participants accessed mental health support in 2019, whereas 22% of participants accessed this support after the pandemic began (Mental Health Research Canada, 2022[6]). In terms of age distribution, 35% of the group aged 18-34 years accessed support, compared to 25% of the group aged 35-54 years and 10% of the group aged 55 years and over. The number of people who decided not to attend mental health services due to an inability to pay also fell (from 37% in 2019 to 16% in 2020) (Mental Health Research Canada, n.d.[53]).

In Switzerland, the use of mental health services was on an upward trend before the pandemic. It then increased markedly once the pandemic began (Stocker et al., 2021[44]). This research found that women sought and received more mental health services, and that children, adolescents and young people were important groups seeking mental health services. However, the report also found that people with a migrant background did not access mental health services often. In Finland, children and adolescents showed an increase in mental health symptoms, but their use of services also increased (Kestilä et al., 2022[34]). Similarly, England (United Kingdom) saw an upswing in mental health service referrals and contacts for children and adolescents aged 0-18 years (Figure 8.13).

Figure 8.13. Number of child and adolescent mental health consultations, England (United Kingdom), 2016-22



Note: Total variable includes all consultation mediums for mental health care (email, face-to-face communication, SMS text messaging, telehealth web camera, telephone, talk type for a person unable to speak, instant messaging, message board, text message, video consultation, chat room, face-to-face communication, other, other not listed, missing and invalid). The data are from May 2016 to March 2022.
Source: NHS digital (2021[54]), Mental health services referrals and care contacts for children and young people aged 0 to 18 years, NHS digital, https://digital.nhs.uk/data-and-information/data-tools-and-services/data-services/mental-health-data-hub/dashboards/mental-health-services-monthly-statistics#mental-health-services-referrals-and-care-contacts-for-children-and-young-people-aged-0-to-18.

8.2.3. Telehealth became an essential alternative to in-person mental health consultations

The COVID-19 pandemic accelerated the delivery of mental health services via telehealth (online or by phone), and catalysed the availability and use of virtual mental health tools. Worldwide, 70% of countries replaced in-person attendance with telehealth and 68% introduced mental health helplines (WHO, 2020[4]).

OECD countries observed a substantial increase in the delivery of mental health services through telehealth (OECD, 2021[7]; 2021[24]). Digital mental health support services offered included screening, self-management and treatment, as well as information. In Canada, the reduction in in-person mental health care in 2020 was complemented by telehealth (Mental Health Research Canada, n.d.[53]).

Responses to the OECD Resilience of Health Systems Questionnaire 2022 revealed that 88% of countries (23 of 26) introduced new phone support lines as emergency mental health support for the public once the pandemic began (Box 8.4). These countries included Australia, Austria, Canada, Costa Rica, the Czech Republic, Finland, France, Germany, Greece, Ireland, Israel, Italy, Korea, Latvia, Lithuania, Luxembourg, Mexico, Portugal, Slovenia, Spain, Türkiye, the United Kingdom and the United States (Box 8.4).

Box 8.4. Examples of mental health support phone lines introduced by countries after the COVID-19 pandemic began

Austria implemented new telephone helplines in Vienna and Tyrol, and scaled up existing helplines nationwide.

Costa Rica implemented a mental health support line for families who lost members due to COVID-19 or for other reasons. The country also introduced helplines for students and suicide prevention helplines.

Finland offered support for students via phone, email or other digital platforms.

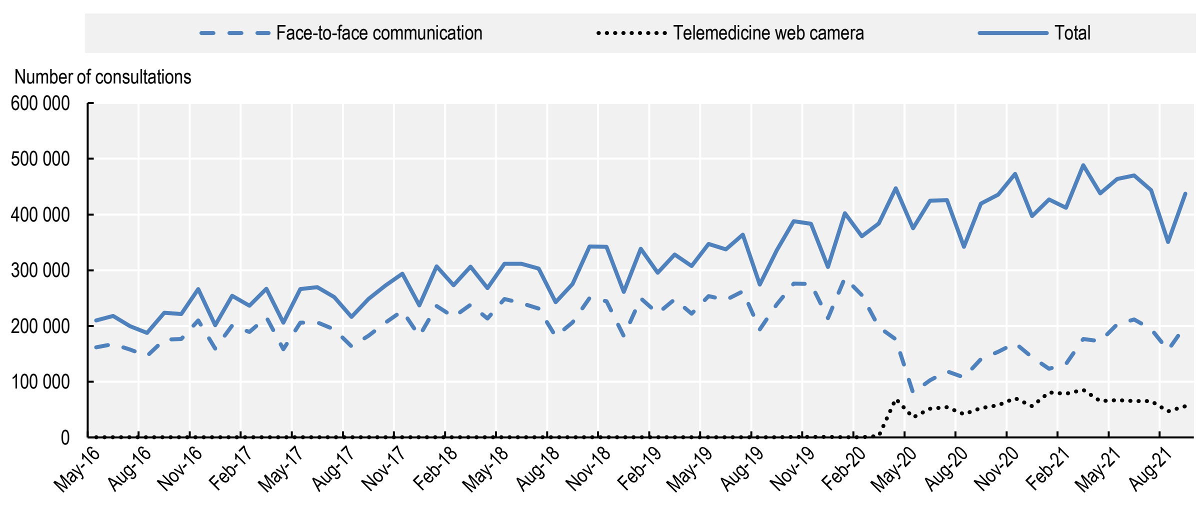
Latvia introduced two phone lines for psycho-emotional support for adults and adolescents.

Lithuania implemented a free phone line for emotional support, including specific helplines for children, young people, women and parents.

Source: Examples provided by countries in response to the OECD Resilience of Health Systems Questionnaire 2022.

In England (United Kingdom), in-person consultations for children and adolescents (aged 0-18 years) also suffered a drop in 2020 when the pandemic started, but this was complemented by telehealth appointments (Figure 8.14). Numbers of face-to-face sessions were, however, still higher than those of online sessions up to the end of the reporting window in August 2021 (NHS digital, 2021[54]).

Figure 8.14. Type and number of children and adolescents receiving mental health care, England (United Kingdom), 2016-21



Note: Total includes all consultation mediums for mental health care (email, face-to-face communication, SMS text messaging, telehealth web camera, telephone, talk type for a person unable to speak, instant messaging, message board, text message, video consultation, chat room, face-to-face communication, other, other not listed, missing and invalid).
Source: NHS digital (2021[54]) *Mental health services referrals and care contacts for children and young people aged 0 to 18 years*, https://digital.nhs.uk/data-and-information/data-tools-and-services/data-services/mental-health-data-hub/dashboards/mental-health-services-monthly-statistics#mental-health-services-referrals-and-care-contacts-for-children-and-young-people-aged-0-to-18.

Increasing evidence supports the use of telehealth for therapy, showing that treatment efficacy is not sacrificed with mental telehealth (Bean et al., 2022[55]; Feijt et al., 2020[56]; Wilczewski et al., 2022[57]). For example, cognitive behavioural therapy via telehealth shows similar efficacy levels to in-person treatment, and there are no significant differences in symptom reduction between the modes of delivery. Mental health providers in the United States agree that it is possible to form a therapeutic relationship with patients, which was an initial concern with mental telehealth. Telehealth is also more affordable than in-person therapy (considering the costs and time of transportation as well) and it can reach patients who would usually not access these services. In Canada, 84% of the participants in the Canadian Digital Health Survey reported being satisfied with the care received through mental telehealth (Canada Health Infoway, 2021[58]).

The increased use of telehealth for mental health support does, however, have limitations. One relevant concern is data security and how institutions use this information. In Canada, some people opt not to use virtual mental health support because of concerns about security and privacy of personal information (Mental Health Research Canada, n.d.[53]). Another issue is the number of people who can access telehealth services, given that not everyone has access to electronic devices (Fisk, Livingstone and Pit, 2020[59]). Issues including poor Internet connection, lack of digital knowledge and patients' perceptions of telehealth also affect delivery (Wilczewski et al., 2022[57]).

Countries are increasing economic and legal support for delivery of mental health services through telehealth (OECD, 2021[24]). For example, the United States changed legal regulations and funding so that telehealth is covered by Medicaid and third-party payer reimbursement (Bartels et al., 2020[60]). Australia provided additional funding to improve access to mental telehealth services, and increased the entitlement to reimburse psychological therapies under the Medicare Benefits Scheme (Australian Institute of Health and Welfare, 2022[52]). Canada responded to the OECD Resilience of Health Systems Questionnaire 2022 that it had implemented measures to ensure that practitioners are reimbursed for telehealth.

8.2.4. OECD countries adopted a whole-of-society approach to mental health

The disruption to mental health services was not only at the health system level; it was also experienced in schools and workplaces, as highlighted in Section 8.2.1. In response, several countries **adopted a multi-sectoral approach** to support mental health – a combined effort of different public and private organisations, providing local, regional and/or national support – in line with OECD recommendations of an integrated and multi-sectoral approach (OECD, 2021[24]).

According to the World Health Organization (2020), 65% of countries used multi-sectoral partnerships to address the impact of the pandemic on mental health (WHO, 2020[4]). These partnerships often involved ministries of health, social affairs and education, as well as non-governmental organisations (Hyun et al., 2020[61]). Responses to the OECD Resilience of Health Systems Questionnaire 2022 show, for example, that the Ministry of Health and Welfare of Korea, along with other ministries and 17 provinces, set up a COVID-19 Depression Consultative Group to discuss the policy direction for mental health support. This Group co-operates with private societies of psychiatry, social welfare and psychology to provide professional and in-depth psychological support. Australia, Canada and France also used multi-sectoral partnerships to help address the impact of the pandemic on mental health, reaching school students and/or employees (OECD, 2021[24]). Luxembourg provided financial support to encourage children and families to participate in sports clubs in the context of the pandemic (OECD, 2022[62]).

Many OECD countries **used new ways to communicate online** and delivered new mental health information during the pandemic (OECD, 2021[24]). The OECD Resilience of Health Systems Questionnaire 2022 found that 85% of country respondents (22 of 26) introduced new online information as an emergency mental health support measure. For example, Canada created a new webpage about staying mentally healthy during the pandemic (https://www.canada.ca/en/public-health/services/mental-health-services/mental-health-get-help.html). Germany implemented an information portal called "Mind Your Mental Health" in April 2020 to improve coping mechanisms and share information about mental health services (https://www.zusammengegencorona.de/corona-im-alltag/psychisch-stabil-bleiben/). Other Questionnaire respondents reporting similar initiatives were Australia, Austria, Costa Rica, the Czech Republic, Finland, France, Greece, Ireland, Korea, Latvia, Lithuania, Luxembourg, Mexico, Portugal, Slovenia, Spain, Switzerland, Türkiye, the United Kingdom and the United States.

International agencies including the WHO, the Inter-Agency Standing Committee (IASC) and the European Commission also produced digital guidelines on coping during the COVID-19 crisis (OECD, 2021[24]). For example, the IASC developed an illustrated book for children about coping during the pandemic (IASC, 2020[63]).

Responses to the OECD Resilience of Health Systems Questionnaire 2022 showed that some countries have taken significant steps to **increase funding for mental health**. OECD countries, including Australia, Austria, Canada, Chile, Latvia, Lithuania and the United Kingdom, announced new mental health care funding in response to the pandemic (OECD, 2021[24]). For example, the United Kingdom provided an additional GBP 500 million in the financial year 2021/2022 to increase access to mental health support, reduce the waiting time for mental health services and invest in NHS workers. In Lithuania, funding for mental health support helplines was increased by 80%. Austria launched the Healthy Out of the Crisis Project in March 2022 to strengthen the mental health of children and adolescents, with funding of EUR 13 million. In 2020, Australia increased the budget and services for mental health support, allocating more than AUD 1 billion (more than USD 700 million). This budgetary support was maintained in 2021 (Australian Institute of Health and Welfare, 2022[52]). However, this was not the case for most countries. According to the WHO, the increase in mental health support during the first year of the pandemic was not always related to a rise in investment: only 17% of countries reported additional funding to cover additional mental health support (WHO, 2020[4]).

Some countries also offered training in basic psychosocial skills for health workers during the pandemic (WHO, 2020[4]). According to responses to the OECD Resilience of Health Systems Questionnaire 2022, the Portuguese Society for Traumatic Stress Studies offered training in trauma prevention and crisis intervention strategies for frontline staff to promote psychological resilience. There was also an increase in training of mental health workers – for example, Spain increased training for psychiatry by 19% and clinical psychology by 45%.

Among countries responding to a WHO survey, 53% reported **collecting data on mental health issues or symptoms in people infected with COVID-19**, and 66% mentioned having ongoing or planned studies on the impact of COVID-19 on mental health (WHO, 2020[4]).

Most OECD countries collected data on mental health issues. The OECD Resilience of Health Systems Questionnaire 2022 found that 77% of respondents undertook mental health prevalence surveys in 2020-21. These included national longitudinal surveys and repeated cross-sectional studies with several time-points to collect up-to-date data on mental health issues, including anxiety and depression symptoms, and psychological distress. Many of these surveys included information about age, sex and gender, occupation and other relevant demographic variables. Additionally, 73% of respondents reported tracking the impact of COVID-19 on mental health service use and delivery.

8.3. Strengthening mental health support to adapt and prepare for the future

The following recommendations are designed to offer a non-exhaustive suite of options for improved mental health support and service delivery within the lens of health system resilience. It is vital that OECD countries continue to examine and share evidence of mental health initiatives that work well (and those that do not), and to analyse the outcomes. These data can be used to inform longer-term reforms that will help to buffer population mental health and mental health service delivery against future crises and systemic disruptions.

8.3.1. Short-term measures need to be transformed into long-term improvements to mental health

Crises reinforce the importance of resilience in population mental health and in mental health service delivery. Historically, mental health has suffered from a lack of resources and attention from governments, called the “treatment gap” – a gap between the mental health needs of populations and the resources available to address these needs (WHO, 2022[64]; OECD, 2021[50]). Worldwide, the treatment gap exceeds 50% (WHO, 2022[64]). Previous work estimated that 63.7% of working age people in OECD countries indicated they have difficulty accessing mental health for financial or geographical reasons, or because of long waiting times (OECD, 2021[50]).

The COVID-19 pandemic has exacerbated this situation, generating an increase in the prevalence of mental health conditions, unmet needs and disruption of mental health services. The higher burden has fallen heavily on some groups, including (but not limited to) the younger population, women and unemployed people.

Despite countries having taken measures (mental telehealth, increased investment, improved information access and so on), mental health is now an even larger public health concern. Mental health in 2022 has not reduced to levels seen before the pandemic (OECD/European Union, 2022[8]). This suggests that mental health support and the scale-up of mental health services during the pandemic’s recovery stage, while commendable, remain insufficient to cover growing needs, including for people whose mental health is affected by long COVID (CHNP, 2021[65]). The situation requires concerted efforts by countries and other stakeholders to embed and implement long-term reforms and improvements to population mental health and mental health support.

8.3.2. Including mental health in crisis preparedness and response planning should be routine

Including mental health in crisis planning will help to build more resilient health systems. This involves addressing mental health needs in planning, absorbing and recovering from crises, and ensuring that systems learn so that they adapt in the future.

According to responses to the OECD Resilience of Health Systems Questionnaire 2022, 77% of countries included, or planned to include, mental health considerations in routine crisis preparedness and planning. Countries gave different examples of how mental health is considered in crisis planning, including integration into general health system planning and independent action. For example, Australia developed a specific National Mental Health and Well-being Pandemic Response Plan in May 2020. On the other hand, Austria included mental health in the country’s overall health plan for pandemics. Similarly, Slovenia developed an action plan to provide psychological assistance in epidemic or pandemic situations in October 2020, which forms part of the National Plan for Protection and Rescue in the Outbreak of Human Infectious Diseases or Pandemics.

Improving health system resilience requires an appreciation of the interconnectivity between systems and services, including mental health services. Mental health cannot be separated from broader systems, given that it is affected not only by individual factors but also by socio-economic determinants (WHO, 2014[1]). One example is the relationship between mental health and employment presented in *Fitter Minds, Fitter Jobs* (OECD, 2021[37]), which recommends integrating health (and mental health), education and employment services to strengthen the positive impact of mental health policies. Therefore, to avoid potential cascading failure, it is critical that mental health crisis planning appreciates the connectivity with other systems and services.

When including mental health in crisis planning, countries should have mechanisms to understand the impact of public policies on mental health in a crisis – such as containment or public health policies, limits on movement, school closures and measures that have economic impacts – and the potential to adapt policies in the light of mental health concerns. Plans should consider potential disruptions to mental health services and the implication of such disruptions. For example, if countries need to use mental health beds or staff for other health services during a crisis, they should implement measures to address this challenge. Disruption of systems might be unavoidable, but it is relevant to consider how this can affect people's mental health, especially among vulnerable groups and more severely ill patients.

Decision making during crises can be difficult. Countries should be able to understand when there is a need to protect the general population's mental health and/or the mental health of specific groups. Valuable real-time data inform good decisions in this challenging context. Having high-quality mental health data on the prevalence of mental health symptoms or issues and information about mental health service disruption should help policy makers to understand:

- people's needs, and the groups affected unequally by the crisis
- how mental health services can still be delivered during and in response to the crisis
- the capacity of countries to provide immediate responses during the crisis.

Being able to quantify the resilience of mental health services is helpful during a crisis. It will aid decision making, including any necessary trade-offs between systemic efficiency and resilience. Australia is an example of an OECD country that focused on mental health planning to respond to disasters (Box 8.5).

Box 8.5. Mental health planning during crises: Australia

Australia was one of the first countries in the world to recognise the mental health impacts of the pandemic and to develop a specific National Mental Health and Well-being Pandemic Response Plan, announced on 15 May 2020. In addition to the COVID-19 pandemic, droughts, cyclones, floods and bushfires are among the many crises Australia has experienced in recent decades. The National Mental Health Commission is leading the development of a national framework to guide a co-ordinated approach to psychosocial and mental health issues in the context of disasters (Australian Goverment, 2022[66]). This will aim to improve how state governments work together to respond to and support people's mental health before, during and after disasters.

8.3.3. Valuable information on mental health needs and delivery informs evidence-based decisions

Having timely available data on mental health is crucial to identifying needs and allocating funding for mental health support (OECD, 2021[50]). OECD countries made valuable efforts to continue collecting data and tracking the mental health status of the population during the pandemic. It is important to retain this momentum to improve the information systems for mental health and to integrate mental health into routinely collected data, subject to appropriate privacy and other safeguards.

Different types of information on mental health can be collected. However, countries need to collect data that leads to implementation of interventions and policies that will tackle mental health issues and needs at a population level. Data on prevalence of mental health conditions and disruption of mental health services are crucial because countries need to understand their population's mental health situation. In the context of the COVID-19 pandemic, it has been recommended (Kestilä et al., 2022[34]) that governments should be able to assess:

- the extent to which mental strain is alleviated by the removal of restrictions on everyday life and the reduction of COVID-19 infections

- which mental health symptoms remain more persistent, requiring treatment and rehabilitation
- the most effective ways to combat the adverse mental health effects of the pandemic.

Screening for symptoms is accessible and inexpensive; compared to the use of diagnostic tools, it can be self-assessed and undertaken more frequently (Regier et al., 1998[67]; Schmitz et al., 1999[68]). It is recommended, however, that countries also assess the prevalence of mental health conditions through diagnostic tools. This is usually done with less frequency because it needs to be undertaken by a mental health professional (so it requires more time and resources), but it delivers high-quality data to inform policies and interventions. While use of diagnostic/screening tools to assess the prevalence of depression and anxiety is more common, it may be worthwhile to consider post-traumatic stress disorder prevalence, given the accumulative effect of stressors (Fernandez et al., 2020[16]; Podubinski and Glenister, 2021[22]). Maintaining surveillance of mental health conditions requires collaboration among institutions in the health sector – whether data are collected routinely in mental health services or through national health or mental health surveys.

Additionally, countries should track disruption to mental health services. During a crisis or large-scale shock, it is helpful to track the services that have been interrupted and evaluate the need to offer alternatives. It is recommended that countries should also monitor the number of people using mental health services (for example, via admission and discharge numbers) outside crisis periods to assess potential disruptions in access to and use of services.

Countries should also collect data on socio-demographic variables to identify possible vulnerable groups in the population. These could include age, sex, gender identity, socio-economic status, employment status, ethnicity, and migration background. This information will help policy makers to identify groups at higher risk of having mental health issues who are not accessing mental health services. Identifying risk factors from the data will also help to inform future mental health protections and address potential inequalities in mental health.

Independently of the type of data countries decide to collect and analyse, they should use the same tool consistently. Having one screening/diagnostic tool facilitates comparison of different time periods and observation of changes in trends, which are especially useful for understanding the impact of crises. The tools must be validated for the national context. Examples of good screening tools are Patient Health Questionnaire-9 (PHQ-9) to assess depressive symptoms and General Anxiety Disorder-7 for anxiety symptoms (Box 8.1). PHQ-9 is considered one of the most reliable screening tools for depressive symptoms and depression. It has been used across many different countries and settings (Costantini et al., 2021[69]).

The frequency of data collection can be monthly or even weekly, depending on the stage of a shock. It would, however, be useful to track the data in all stages of a shock and afterwards, to have comparison points and to understand how mental health is affected over time. This will help policy makers to understand the short and longer-term impacts of a shock better, and thus to design and implement more effective policy responses.

8.3.4. Strengthening population mental health delivers benefits both during and beyond crises

Reducing vulnerabilities in the population will reduce demand on the health system during crises and systemic disruption. To strengthen mental health, countries should implement measures aimed at both populations and individuals to promote well-being and to prevent mental health issues from arising.

Governments should implement strategies to increase the capacity of individuals and populations to protect their mental health as much as possible before future crises. In this sense, engaging early with people with vulnerabilities is pivotal to addressing the individual barriers and stigma around mental health during all stages of the disruption cycle. Additionally, countries should implement population-scale public mental health interventions. These types of measures not only improve mental health and well-being but also lead to economic savings in the short- and long-term (Campion and Knapp, 2018[70]). Reducing the vulnerability of populations prior to a crisis will reduce the demand during a crisis. This action during the prepare stage of the disruption cycle will limit the impact of the disruption during the absorb stage and speed up recovery.

The focus of mental health should be on the whole population, including vulnerable groups. This includes groups that have historically been in vulnerable situations for mental health issues (such as women and unemployed people) but also “new” groups that arise from specific crises – for example, in the context of the pandemic, the younger population and those with long-COVID. Having timely and high-quality data on mental health helps policy makers to identify high-risk groups. Without this information, mitigation strategies cannot be implemented effectively.

It is also necessary to improve access to and use of mental health services, especially for vulnerable populations. While mental health service use increased as the COVID-19 pandemic continued, access to services was not equal for all groups. People with higher prevalence of mental health conditions also presented with higher unmet needs; therefore, they were unable to access or use the mental health services they needed, worsening their situation. Countries should consider hard-to-reach populations (for example, migrants, asylum seekers, people who are homeless and indigenous people) and geographical areas (such as remote and rural areas, islands etc.).

Countries should also continue to offer alternatives to in-person consultations. Offering mental health support through different mediums and at different times (especially outside business hours) is essential to improve access to and use of such services (Stocker et al., 2021[44]). It is recommended that countries consider training in mental telehealth for future crises, as well as improve the quality of mental health care in non-crisis times (Wilczewski et al., 2022[57]).

8.3.5. Mental health should be considered in all policies to address population needs

Mental health services are only part of what countries need to consider when addressing the lingering impact of the pandemic on people’s mental health (Kestilä et al., 2022[34]). An inter-disciplinary and inter-system approach is relevant for designing mental health public policies, and this will help to address inequalities in mental health (WHO, 2014[1]; Lund et al., 2018[2]). A whole-of-society approach is required.

Countries should continue to implement measures to move beyond hospital-based mental health care and incorporate and/or strengthen mental health in primary health care. In some cases, mitigating disruptions to employment, schooling, sporting and community activities will also improve people’s mental health (OECD, 2021[24]). For example, an Australian study found that measures to promote employment, invest in childcare and expand mental telehealth services were among the most effective in addressing the negative impact of the COVID-19 pandemic on mental health (Occhipinti et al., 2020[71]). The OECD has also found that measures to protect jobs play an essential role in mitigating the pandemic’s impact on mental health (OECD, 2021[24]).

The decline in people’s mental health seen in the COVID-19 pandemic is not immutable. The adaptions suggested in this chapter are designed to improve the resilience of health systems by strengthening mental health prior to and during crises.

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9 Managing elective care and waiting times

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This chapter reviews the impact of the COVID-19 pandemic on access to elective (non-urgent) care and waiting times. In many OECD countries, waiting times for elective care were already on the rise before the pandemic, indicating that supply was not keeping-up with demand. The pandemic exacerbated the backlog for elective procedures as most OECD countries suspended non-urgent care to divert efforts towards COVID-19 patients and avoid other patients being infected. Recovery of these "missing" volumes and the impact on waiting times differed across OECD countries, reflecting differences in the effectiveness of containment measures, the speed at which elective care resumed, the pre-existing capacity of health workers and equipment, and the ability to mobilise additional resources to increase activity. Addressing the backlog in elective procedures calls for activity-based financing, boosting the supply of health workers, and better management and monitoring of waiting lists. The chapter concludes with policy recommendations to tackle waiting times for elective care.

Key findings

Most OECD countries suspended elective (non-urgent) care during the pandemic to divert efforts towards COVID-19 patients and avoid others being infected while seeking care.

Compared with 2019, nearly 4 million fewer elective surgical procedures from a set of 15 operations (an 18% reduction), and over 7 million fewer magnetic resonance imaging (MRI) and computerised tomography (CT) diagnostic exams (a 6% reduction), were performed in 31 OECD countries in 2020. These figures exclude the United States, where 33 million fewer MRI and CT scans were performed in 2020 (a reduction of 20% in CT exams and 35% in MRI exams). The suspension of elective care generated backlogs in many countries, leading to longer waiting lists and waiting times.

Even before the pandemic, waiting times for elective surgery had started to rise in several countries, indicating that supply was not keeping pace with demand. The disruption of services during the pandemic further increased this imbalance. Longer waiting times postpone health benefits and can reduce the effectiveness of health care, highlighting the need to address backlogs as quickly as possible.

Reductions in elective care volumes during the pandemic and the subsequent increases in waiting times in 2020 and 2021 differed significantly across OECD countries. Some countries recovered more quickly than others because they contained the number of COVID-19 cases and hospitalisations, and thereby minimised disruptions to other health services. Some had greater pre-existing capacity in terms of health workers and equipment, resumed elective treatment and diagnostic services rapidly, and/or mobilised additional resources to increase activity. Australia, Finland, Israel, Norway, Portugal and Switzerland were among the countries that achieved a swift recovery.

Following the increase in waiting times for elective procedures associated with lockdowns or prioritisation of medical facilities for treatment of COVID-19 patients, OECD countries adopted a range of strategies to manage waiting times:

- Many countries continued to set maximum waiting-time guarantees or targets that were common before COVID-19, although the gaps between the maximum waiting times and the actual waiting times were often exacerbated during the pandemic.
- Several OECD countries provided additional or earmarked funding for elective care in 2020 and 2021 to boost supply.
- Many countries are incentivising health workers to work longer hours, although this strategy is limited as staff may be or become exhausted. Some countries are relying on international recruitment of doctors and nurses to address immediate needs, but this can in turn exacerbate shortages in countries of origin.
- After some interruptions to offset declining revenues for providers of elective procedures during the pandemic, several countries have or are planning to reintroduce activity-based financing.
- Several OECD countries stimulated the supply of diagnostic tests, such as MRI or CT scans, following the first wave(s) of the pandemic. The policies adopted are similar to those for elective treatments, including performance monitoring and creating dedicated diagnostic hubs.
- On the demand side, the main criteria to prioritise patients on waiting lists have not changed. They include clinical need, urgency and long waiting time. Some countries have more tightly enforced existing prioritisation criteria.

The following **policy recommendations** are offered to improve the management of elective care and waiting times:

- Maximum waiting times should remain a key performance measure against which health systems can assess the progress of health care providers in recovery from the pandemic.
- Boosting supply through additional funding and activity-based financing is necessary to reduce backlogs and recover as quickly as possible. Properly designed activity-based financing should align financial incentives between providers and funders, and safeguard value for money by ensuring that reimbursement reflects costs.
- There is no “quick fix” to address current workforce shortages; better workforce planning is key. In the short term, OECD countries must balance the need to reduce the backlog of elective procedures without placing too much pressure on the current workforce. In the medium term, careful health workforce planning and greater training are needed to increase elective volumes and reduce waiting times. Planning needs to pay particular attention to critical shortages in different specialties (such as operating room nurses and anaesthesiologists in some countries), and training and other strategies should be developed to address such shortages.
- Improved access to diagnostic tests, such as MRI or CT scans, needs to be included in supply-side policies addressing backlogs, because diagnostic tests act as a bottleneck in patient pathways.
- Improving the management and monitoring of waiting lists is important to optimise the use of operating rooms and the match between patients and surgical teams. Improved information systems, including active communication with patients on appointments, is important to avoid “no shows”.
- Prioritisation policies are an opportunity to rationalise demand and reduce inappropriate referrals, but this should not come at the cost of widening inequalities in access.
- Countries should be ready to determine those procedures or patients for which or for whom maximum waiting times may be suspended temporarily, based on urgency and clinical needs. This can be achieved by developing clinical guidance criteria before the next shock to the health system.

9.1. The pandemic resulted in delayed care and increased backlogs and waiting times

The COVID-19 pandemic, particularly during the first waves in 2020, resulted in the cancellation of many elective (non-urgent) diagnostic services and surgical procedures to protect patients and health workers from the risks of infection, and to free up hospital capacity for COVID-19 patients (see chapter on critical care surge). However, the reduced volume of activities and the increased waiting times varied widely across countries and between patient groups within each country, reflecting differences in the management of waiting lists and responses to COVID-19.

Long waiting times matter for patients: they generate dissatisfaction because the health benefits from treatment are postponed; patients can experience pain and discomfort while waiting; and the wait may worsen health outcomes for patients before and after the intervention. The effect of waiting times on health outcomes depends on the duration of the wait, the health issue and the clinical prioritisation.

In the context of elective care, resilience can be thought of as the ability of health systems to minimise disruptions to the supply of non-urgent (or less urgent) diagnostic services and treatments, to resume supply and to catch up with the backlog of patients on waiting lists as quickly as possible. The catch-up takes place primarily in the recover stage of the disruption cycle (see the chapter on key findings and recommendations for a description of the disruption cycle).

This chapter addresses the following questions regarding the resilience of OECD health systems in the provision of elective care during the pandemic and recovery from it:

- To what extent was the volume of diagnostic exams and elective surgical procedures reduced in 2020 compared with pre-pandemic levels, and what has been the impact on waiting times?
- What policy actions did OECD countries take to resume elective care and address the backlogs as quickly as possible, and what have been the main constraints and enabling factors?
- What lessons learnt and recommendations can be drawn from country experiences in managing elective care and waiting times during the pandemic?

This chapter draws on the annual OECD data collection from 2022 on the volume of diagnostic and surgical procedures, as well as waiting times for elective surgery. It also draws on the results from the OECD Resilience of Health Systems Questionnaire administered in 2022.

Following the absorb stage of the pandemic, many OECD countries have implemented similar strategies to address the backlogs in elective care that resulted from the interruption to many services. In many cases, these strategies involve injecting new funds to increase the volume of activities. However, clearing the backlogs will take longer in some countries because of different degrees of disruption to elective care, variation in the additional resources mobilised, as well as differences concerning the extent to which patients who missed care still demand care. In England (United Kingdom), the National Audit Office estimated at the end of 2021 that many millions more people would be on waiting lists by March 2025 than there were before the pandemic. However, the increase would be lower if the supply of elective care was greater than initially planned, and if only half of the “missing” patients returned to seek care (NAO, 2021[1]).

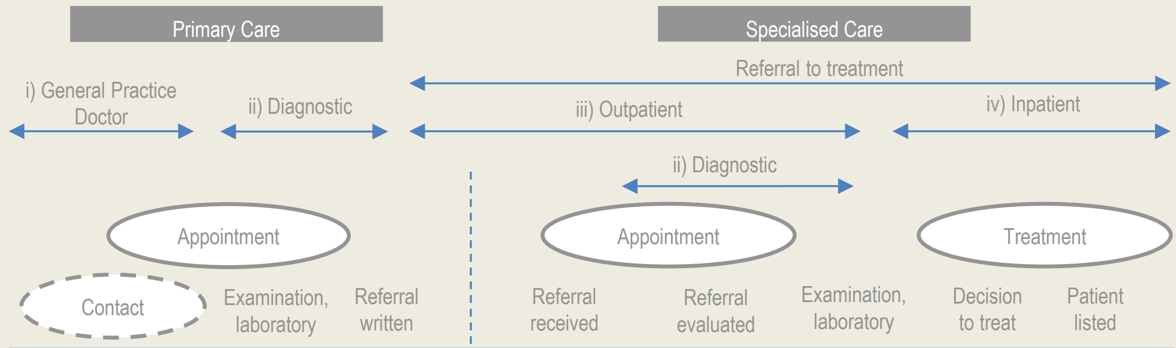
9.1.1. An analytical framework to assess the impact of the pandemic on waiting times and waiting lists

Waiting lists and waiting times are the result of the imbalance arising from the demand for care being greater than the supply. A waiting list increases when the number of patients added to the list (the demand) is greater than those taken out of the waiting list following diagnostics or treatments (the supply). Waiting times can occur for a wide range of services from different providers (Box 9.1).

Box 9.1. Different waiting times along the patient pathway

Several possible waiting times may arise along the patient journey (Figure 9.1). For non-urgent care, patients typically seek first an appointment with a primary care physician/GP. Following a GP visit, they may be referred to a specialist and wait weeks or months for an appointment. Patients may also wait for a diagnostic test, if required, such as an MRI and CT scan, and for surgery or other treatment. Following the specialist assessment, patients may be added to a waiting list. Waits for elective surgical treatment are typically the longest.

Figure 9.1. Possible waiting times for different health services



Source: Adapted from Siciliani, Borowitz and Moran (2013[2]), *Waiting Time Policies in the Health Sector: What Works?*, https://doi.org/10.1787/9789264179080-en.

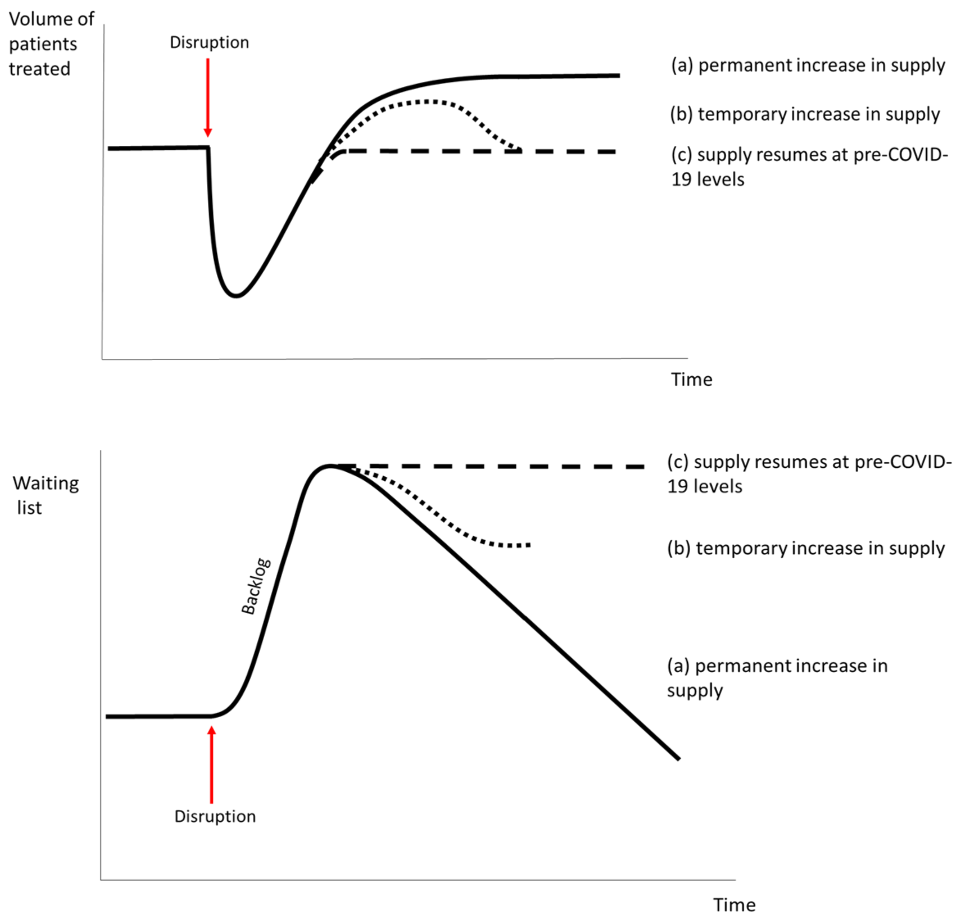
The COVID-19 pandemic disrupted health services and reduced the supply of elective care at least temporarily, generating a larger excess demand. The accumulated waiting list, sometimes referred to as the backlog, can be thought of as the combined excess waiting list between the beginning of COVID-19 and the time the supply was able to resume to a level when the number of patients treated started to exceed the number of patients added to the list.

Figure 9.2 illustrates the relationship between supply, the waiting list and the accumulated backlog during COVID-19. Taking elective surgery as an example, the top panel plots the volume of surgeries over time (e.g. by month). The bottom panel plots the waiting list. The chart considers a scenario where before COVID-19 the number added to and taken out of the waiting list is the same, so that it is stable over time. Following COVID-19, the supply drops, but patients keep being added to the waiting list at the same rate. As a result, the waiting list builds up rapidly to reflect the accumulated additions to the list (net of the limited supply during COVID-19). It is only when the supply increases to a level that is higher than the additions to the list that the waiting list starts to gradually decrease. The speed of recovery will be determined by the excess supply – namely, the supply net of additions to the list.

Figure 9.2 also shows some possible post-pandemic scenarios. In the first scenario (a), the supply is higher post-COVID-19 due to investment in new staff and new equipment, or higher permanent funding for the health system. The waiting list initially grows rapidly owing to the disruptions in volume, and then gradually reduces in the long run. In the second scenario (b), the supply increases temporarily after a period of disruption, before levelling off to pre-pandemic levels. After a period of sharp growth, the waiting list gradually reduces, before levelling off to a higher level relative to pre-COVID-19. In the third scenario (c), the supply resumes at pre-pandemic levels, and the waiting list remains stable but at a higher level, following a period of sharp growth.

During COVID-19, the reduction in supply of elective care depicted in Figure 9.2 arose globally through different channels, although its extent varied by country. When health workers were redeployed to treat COVID-19 patients, this reduced the volume of available workers for elective care. Some health workers were also on sick leave due to COVID-19 infection or quarantining because of exposure. Working conditions and workload for other health workers deteriorated, leading to exhaustion and burnout, and in some cases to workers leaving the occupation. Moreover, as supply resumed, the cost of treating patients in a safe (COVID-19-free) environment or operating theatre increased, as stricter hygiene protocols were introduced during surgery or other treatment procedures. Reimbursement mechanisms also changed to cover COVID-19-related care, and to prevent providers from going bankrupt. For hospitals, this often involved a switch from activity-based payments to fixed budgets to keep providers solvent, which if unchanged can weaken incentives to boost supply.

Figure 9.2. Supply, waiting list and accumulated backlog



The determinants of the supply are discussed more systematically in Section 9.2 below. Policy makers need to ensure that possible bottlenecks in the production of services are identified; otherwise, there is a risk that higher spending will not translate into higher supply. This will impede a successful elective care recovery.

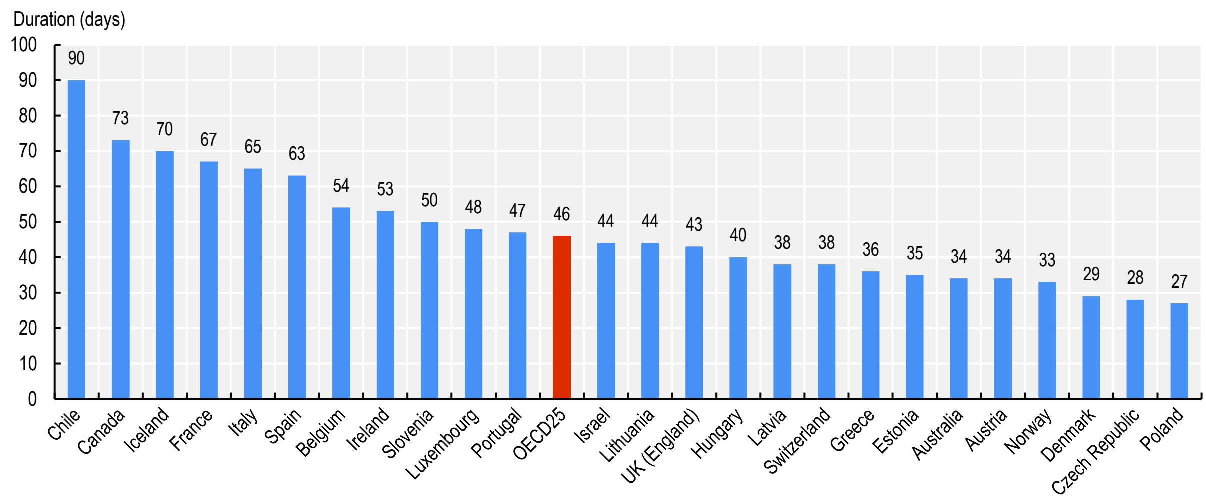
The degree to which waiting lists increased during the pandemic also depends on how many patients demanded treatment and were added to the list. Access to primary care was hindered during the absorb stage of the pandemic, even with new models of care delivery (see the chapter on care continuity). Consequently, referrals to specialists were delayed, and patients were only added to waiting lists later. This implies that the waiting lists for diagnostics and treatments would grow initially at a slower rate and later at a faster rate, thereby not changing in the longer term.

Another possibility is that additions to the list dropped during the pandemic because some patients did not seek health care due to fear of COVID-19 infection, leading to a temporary drop in demand. However, for most elective surgery, it seems unlikely that patients would give up treatment completely rather than postpone it. For example, a patient in need of a hip replacement will be in pain, have limited mobility, and would eventually want to receive surgery to improve this. Specialists, however, might decide to apply more stringent criteria to adding patients to the waiting list, and only add those with higher needs above a tighter severity threshold. The reduced additions to the waiting list would then translate into a shorter waiting list in the longer term. One concern with reduced demand is that it can lead to unmet needs if patients are not prioritised correctly, or if patients with lower socio-economic status are less able to engage with the health system when access becomes difficult, leading to an increase in health inequalities (see the chapter on care continuity).

9.1.2. Disruptions to health services led to reductions in diagnostic and surgical procedures in 2020

The volume of surgical procedures and diagnostic exams fell in nearly all OECD countries in 2020 compared with 2019. This reduction was due to disruptions of many health services, particularly during the initial months of the absorb stage of the pandemic. In many OECD countries, the suspension of elective care during the first wave of the pandemic lasted for 4-12 weeks, although there were regional variations in some countries in the interruption and reopening dates (Figure 9.3). While services resumed after this period, the reopening was often gradual, and some activities were again suspended in subsequent waves of the pandemic later in 2020 and in 2021.

Figure 9.3. Duration of restrictions in non-urgent care and elective surgery between March and June 2020, OECD countries



Note: Some countries had regional variations, so the summary table only captures the national guidance (except for Canada, where the information relates to Ontario – the biggest province).

Source: Health System Response Monitor for European countries; Reed et al. (2020) for Australia, https://www.aihw.gov.au/reports/burden-of-disease/the-first-year-of-covid-19-in-australia/summary; Wang et al. (2020) for Canada, https://pubmed.ncbi.nlm.nih.gov/32873541/; Ministry of Interior and Public Security (2020) for Chile, https://www.minsal.cl/wp-content/uploads/2020/03/Diario-Oficial-30-de-marzo.pdf.

These interruptions in elective care resulted in a sharp decline or temporary halt in these activities during the weeks of restrictions. In most countries, and for most procedures, this decline could not be offset by activities performed at a greater than usual volume in the remainder of the year. Hence, most countries saw a sharp drop in the volume of elective surgery in 2020 compared with the previous year. In many countries, the reduction in diagnostic procedures was less pronounced as a percentage of the total volume, but it was nonetheless significant. Overall, from a set of 15 operations, nearly 4 million fewer elective surgical procedures were performed across 31 OECD countries in 2020 compared with 2019 (equivalent to an 18% reduction). In addition, over 7 million fewer MRI and CT diagnostic exams were performed (a 6% reduction). These figures do not include the United States, where 33 million fewer MRI and CT scans were carried out in 2020 (a reduction of 20% in CT exams and 35% in MRI exams).

The reduction in diagnostic exams and selected elective procedures varied widely across countries. Looking at five common surgical procedures, the reduction in 2020 was much greater in Chile, Costa Rica, Mexico, Poland, Türkiye and the United Kingdom than in Australia, Denmark, Estonia, Finland, Korea, Israel, Norway and Switzerland (Table 9.1).

Table 9.1. Changes in diagnostic and surgical procedures between 2019 and 2020, OECD countries

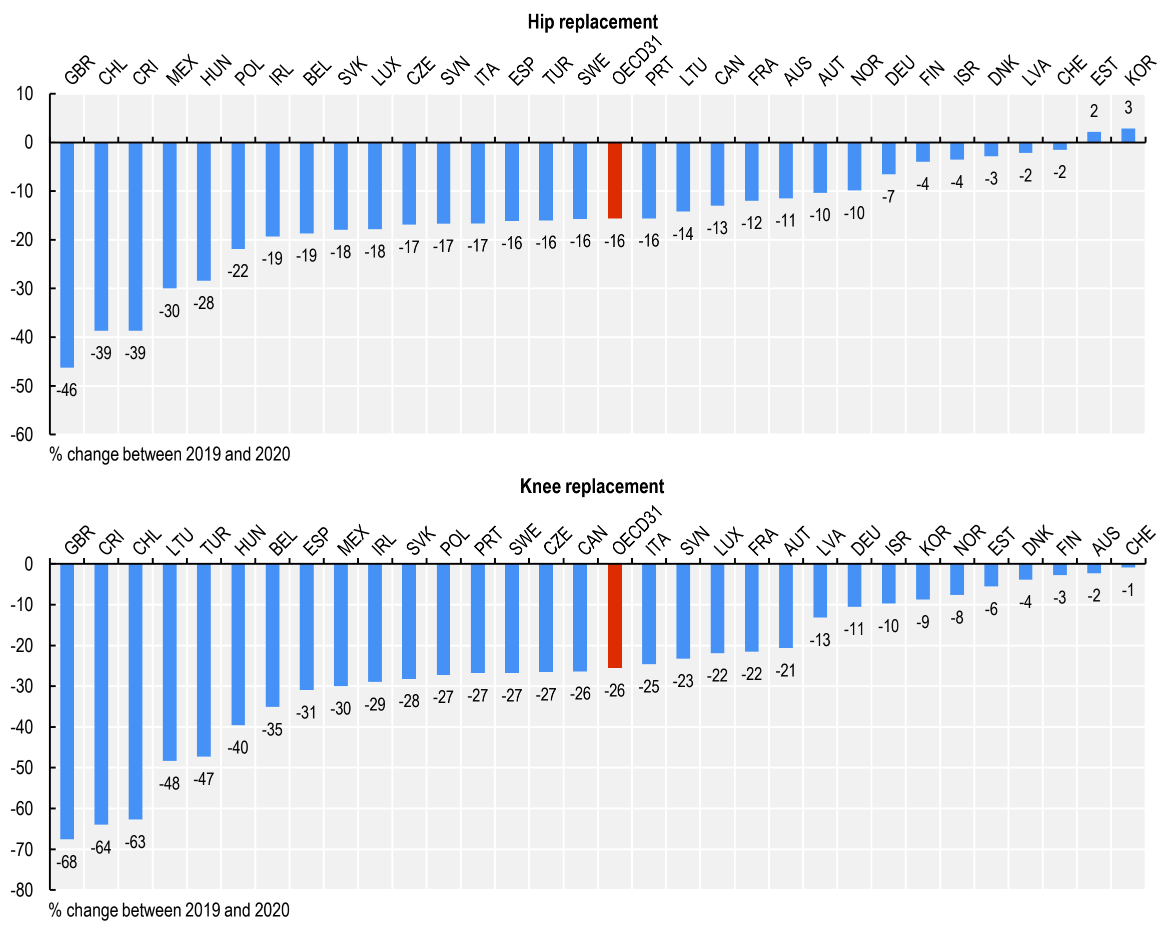
Country	Diagnostic procedures		Surgical procedures				
	CT exams	MRI exams	Cataract surgery	Hip replacement	Knee replacement	Coronary bypass	Coronary angioplasty
Australia	3.9%	1.0%	-12.7%	-11.5%	-2.3%	1.1%	0.3%
Austria	-6.8%	-4.6%	-15.5%	-10.4%	-20.6%	-10.9%	-5.6%
Belgium	0.5%	-10.5%	-29.8%	-18.7%	-35.1%	-14.8%	-8.8%
Canada			-20.7%	-13.0%	-26.3%	-15.6%	-9.4%
Chile	-13.0%	-26.8%	-46.5%	-38.7%	-62.7%	-19.8%	-21.7%
Costa Rica	-7.0%		-52.8%	-38.7%	-64.0%	-30.4%	-4.0%
Czech Republic	-5.1%	-3.8%	-51.6%	-16.9%	-26.5%	-15.5%	-10.3%
Denmark	3.2%	0.3%	-8.9%	-2.8%	-3.9%	8.8%	-5.9%
Estonia	-6.1%	-0.4%	-7.1%	2.2%	-5.6%	-13.2%	-5.2%
Finland			-6.4%	-4.0%	-2.7%	17.0%	-6.2%
France			-18.9%	-12.0%	-21.5%	-14.0%	-5.7%
Germany	-0.7%	0.2%	-2.7%	-6.5%	-10.5%	-14.4%	-8.3%
Greece	-37.8%	-46.9%					
Hungary	-5.5%	-17.6%	-36.3%	-28.4%	-39.5%	-16.8%	-13.2%
Iceland	-5.7%	-2.5%	-3.9%	-17.7%		1.4%	-18.8%
Ireland			-36.6%	-19.3%	-28.9%	-19.8%	-21.2%
Israel	-4.0%	0.0%	2.9%	-3.5%	-9.7%	-7.7%	-1.1%
Italy	-10.5%	-14.6%	-33.3%	-16.6%	-24.6%	-24.5%	-14.9%
Korea	0.7%	-2.7%	1.8%	2.8%	-8.8%	0.0%	-2.8%
Latvia	3.2%	2.6%	-37.7%	-2.2%	-13.1%		
Lithuania	-16.4%	-19.0%	-22.9%	-14.2%	-48.3%	-27.5%	-18.6%
Luxembourg	-4.4%	4.0%	-12.2%	-17.8%	-21.9%	2.0%	-13.8%
Netherlands	3.3%	-0.9%					
Norway	-0.8%	1.4%	-9.4%	-9.9%	-7.6%	-4.6%	-7.3%
Poland	-10.8%	-4.1%	-35.9%	-21.9%	-27.2%	-32.8%	-18.0%
Portugal	-4.5%	-9.5%	-20.4%	-16.6%	-27.0%	-6.4%	-16.6%
Slovak Republic	-10.2%	-7.0%	-27.2%	-18.0%	-28.2%	-27.2%	
Slovenia	1.1%	0.0%	-10.2%	-16.7%	-23.2%	-15.1%	-9.8%
Spain	-8.4%	-14.2%	-20.0%	-16.0%	-30.9%	-16.0%	-10.9%
Sweden			-8.8%	-15.7%	-26.7%	-13.1%	-11.0%
Switzerland	1.7%	-2.8%	-8.7%	-1.5%	-0.9%	-10.9%	-5.8%
Türkiye			-40.7%	-16.0%	-47.2%	-23.6%	-11.5%
United Kingdom	-8.2%	-24.9%	-46.8%	-46.3%	-67.6%	-36.3%	-12.5%
United States	-20.1%	-34.8%					
OECD total	-13.3%	-21.4%	-21.6%	-15.5%	-25.5%	-18.0%	-9.6%

Green	≥ 0%
Yellow	0 to -10%
Red	< -10%

Note: For Ireland, data pertain only to publicly funded hospitals; public patients treated in private hospitals are not included, which overestimates the presented reduction. Japan does not report data on diagnostic or surgical procedures, and Colombia, Mexico and New Zealand did not report data for 2020 in the 2022 data collection.
Source: OECD Health Statistics 2022, https://doi.org/10.1787/health-data-en.

Figure 9.4 focuses on the reduction in hip and knee replacements in 2020. The number of hip replacements fell by 16% compared with 2019 across 31 OECD countries, but this ranged from a reduction of over 35% in Chile, Costa Rica and the United Kingdom to a reduction of less than 5% in Denmark, Finland, Israel, Latvia and Switzerland, and a small increase in Korea and Estonia. The fall in knee replacements was even larger in nearly all countries, at 26% across the same 31 OECD countries, but it ranged from a reduction of over 60% in Chile, Costa Rica and the United Kingdom to a reduction of less than 5% in Australia, Denmark, Finland and Switzerland.

Figure 9.4. Reductions in hip and knee replacements in 2020 compared with 2019, OECD countries



Note: The OECD average is the total reduction across all OECD countries for which data are available.
Source: OECD Health Statistics 2022, https://doi.org/10.1787/health-data-en.

In England (United Kingdom), the sharp reduction in elective care during the first year of the pandemic was followed by a partial recovery in the second year, although the activity level remained 16% lower between March 2021 and February 2022 than over the same 12-month period before the pandemic for a selected set of elective procedures (Table 9.2). There were substantial differences across procedures – in both the reduction during the first year of the pandemic and how quickly activity rates recovered during the second year. The reduction during the first year was generally sharper for diagnostic than for therapeutic procedures, and the recovery during the second year was slower for diagnostic procedures. For example, diagnostic cardiac procedure activity remained 30% below pre-pandemic levels in the second year. Cataract operations (which are performed as ambulatory surgery in almost all cases) almost fully recovered in 2021, while the recovery was more partial for procedures requiring hospitalisation, such as hip and knee replacements (Nuffield Trust, 2022[3]).

Table 9.2. Reductions in selected elective procedures in the first two pandemic years, England (United Kingdom)

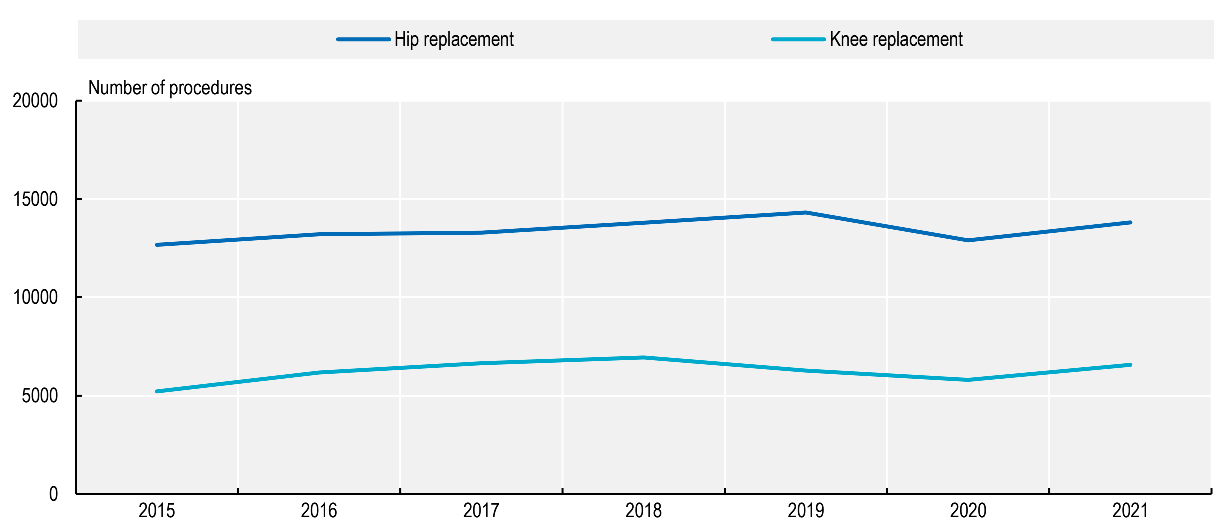
Procedure	Pre-COVID-19 year (March 2019 – February 2020)	First COVID-19 year (March 2020 – February 2021)		Second COVID-19 year (March 2021 – February 2022)	
		Counts of elective procedures	Fall in activity vs. pre-COVID-19 year (%)	Counts of elective procedures	Fall in activity vs. pre-COVID-19 year
Cardiac (diagnostic)	75 101	43 977	-41.4	52 614	-29.9
Cardiac (therapeutic)	86 997	61 907	-28.8	70 849	-18.6
Cataract	560 297	318 785	-43.1	555 930	-0.8
Dental	165 636	60 658	-63.4	107 047	-35.4
Gastrointestinal endoscopy (diagnostic)	1 297 919	701 909	-45.9	1 032 142	-20.5
Gastrointestinal endoscopy (therapeutic)	296 484	176 389	-40.5	274 536	-7.4
Hip and knee replacement	131 386	46 314	-64.7	96 289	-26.7
Selected procedures (total)	2 613 820	1 409 939	-46.1	2 189 407	-16.2

Source: Adapted from the Nuffield Trust (2022), based on Hospital Episode Statistics admitted patient care data.

In France, the reduction in elective surgery during the first year of the pandemic was much less pronounced than in the United Kingdom, and the recovery in surgical activity in 2021 was fairly strong, with rates almost returning to pre-pandemic levels. This was particularly the case for ambulatory surgery (such as cataract procedures), which saw a strong rise in 2021 (Assurance Maladie, 2022[4]).

In Norway (a country less affected by the pandemic and the disruption of services during the first and second year than most OECD countries), surgical activities usually requiring hospitalisation such as hip and knee replacements recovered in 2021 and almost returned to pre-pandemic levels (Figure 9.5).

Figure 9.5. Recovery of hip and knee replacement activity in Norway in 2021

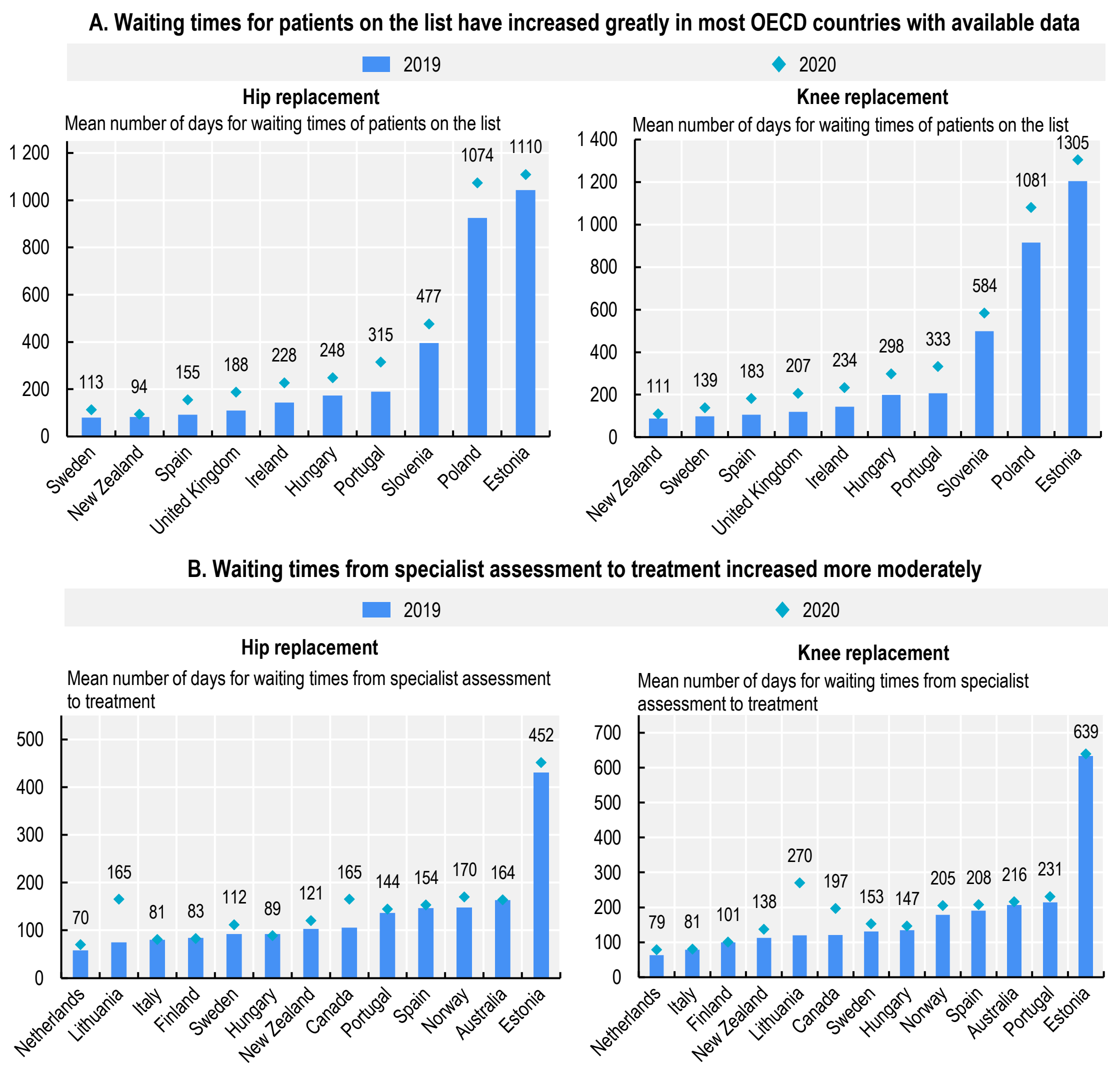


Source: OECD Health Statistics 2022, https://doi.org/10.1787/health-data-en.

9.1.3. Reductions in volumes of surgical activity in 2020 led to marked increases in waiting times

The reductions in the volume of surgical activities in 2020 resulted in a marked increase in waiting times in those countries that monitor these on an ongoing basis – particularly for patients who remained on waiting lists during the pandemic. The increase was generally lower for patients who managed to get treatment in 2020 (Figure 9.6; Box 9.2). The increase in waiting times for patients on the list was particularly large in Poland and Portugal, although the increase in waiting times for patients who were treated was much smaller (almost nil) in Portugal.

Figure 9.6. Increases in waiting times for hip and knee replacements in 2020, OECD countries



Source: OECD Health Statistics 2022, https://doi.org/10.1787/health-data-en.

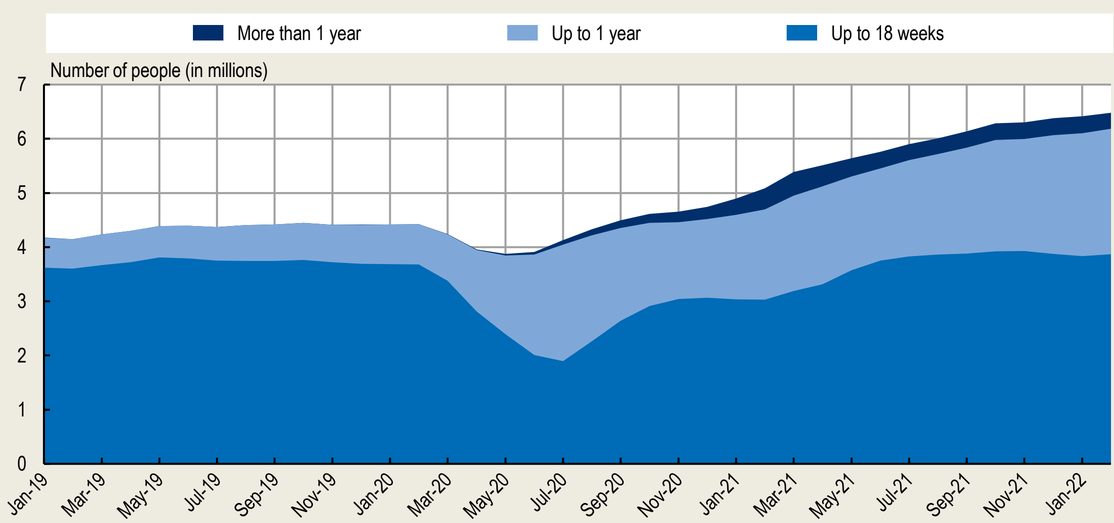
Box 9.2. Higher increases of waiting times for patients on lists than for those who got treatment

Waiting times can be measured in different ways, including by the distribution of waiting times of patients treated in a given period (e.g. a year) and the distribution of waiting times of patients still on the list at a point in time (e.g. a census date such as 31 December). The first measure provides the full duration of the patient's waiting time experience (from entering to exiting the list). The second relates to an "incomplete" waiting-time measure, since the patient's wait has yet to come to an end (they are still on the waiting list), and oversamples patients with long waiting times.

In several OECD countries, the increase in waiting times of patients still on the waiting list was much more pronounced in 2020 and 2021 than for those who managed to get treatment. This pattern can be explained by a composition effect of the patients treated. During COVID-19, many surgical procedures were cancelled, and some patients became reluctant to undergo surgery because of the risk of being infected. Therefore, both supply of and demand for surgery fell. In turn, this meant that some patients were treated as scheduled – or even more quickly – leading to a waiting-time reduction, while others' treatment was postponed, leading to a sharp increase in the waiting times of patients on the list.

This composition effect was observed in England (United Kingdom), based on the broader measure of referral-to-treatment waiting time. Following the start of the pandemic, fewer patients were initially waiting less than 18 weeks to start treatment – one of the key waiting-time targets for elective care – and this remained below pre-pandemic levels, while the proportion of patients waiting more than 18 weeks and more than one year increased over time (Figure 9.7).

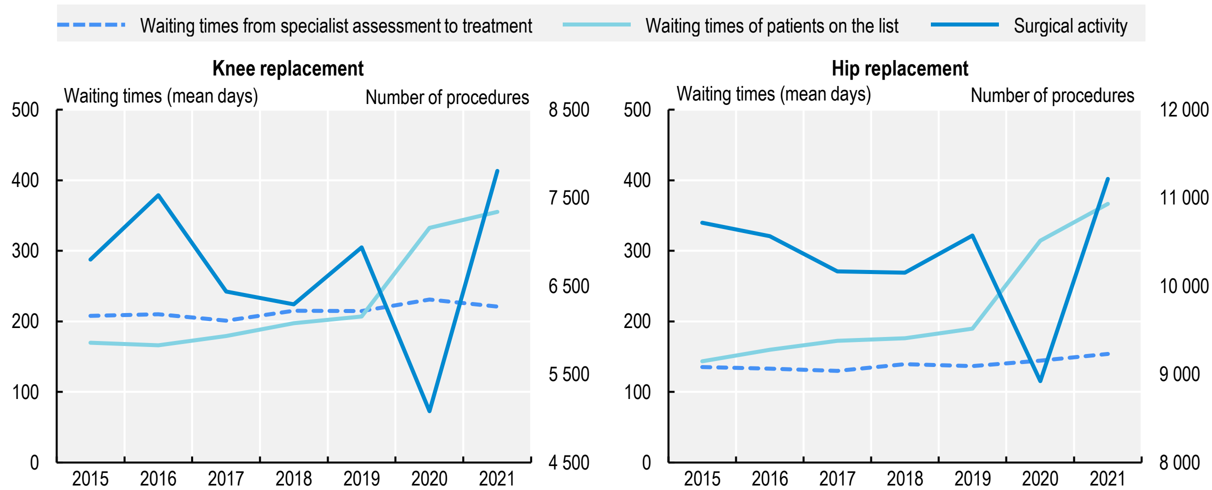
Figure 9.7. Number of patients waiting more than 18 weeks to start treatment, England (United Kingdom), 2019 to early 2022



Source: NHS England and NHS Improvement, monthly referral-to-treatment data collection, https://www.england.nhs.uk/statistics/statistical-work-areas/rtt-waiting-times/.

In Portugal, the volume of hip and knee replacements recovered quickly in 2021, and the number exceeded the pre-pandemic level. The mean waiting times for people who were treated in 2021 remained stable for hip replacements and declined slightly for knee replacements, but the mean waiting times for those still on waiting lists continued to increase (Figure 9.8).

Figure 9.8. Surgical activities rebounded in Portugal in 2021, but did not prevent an increase in waiting times for patients on waiting lists



Source: OECD Health Statistics 2022, https://doi.org/10.1787/health-data-en.

9.1.4. Estimates of how long it might take to clear backlogs are available for some countries

The reduction in surgical activity rates described above can provide a first rough idea of the time countries might need to recover the accumulated backlog. For example, let's assume that the volume of hip replacements in a given country fell by 15% in 2020 (which is close to the OECD average). If the volume returned to pre-pandemic levels in the following year – as was the case in 2021 in countries like Portugal – the volume would subsequently have to be at least 5% higher for three consecutive years to catch up with the initial drop, if the demand for hip replacements remains the same over time. The increase would have to be even higher if the drop in volume extended over two years (2020 and 2021). A reduction in volume of 10% in two consecutive years would require a 5% increase for four consecutive years.

Estimates of the time it might take to clear the backlog are available for a few countries:

- In the United Kingdom, where the drop in elective surgery in 2020 was much more pronounced than in most OECD countries, the National Audit Office estimated at the end of December 2021 that the backlog of people on waiting lists in England (United Kingdom) would continue to be much greater than before the pandemic up to at least March 2025, but the increase would be lower if the supply of elective care was greater than initially planned and if only half of the "missing" patients returned to seek care (NAO, 2021[1]). The Institute for Fiscal Studies reported in 2022 that under a "middle" scenario where only half of "missing" patients return, the waiting list would peak at 8.7 million in October 2023 (Institute for Fiscal Studies, 2022[5]).
- In Canada, where the reduction in health care activities in 2020 was less pronounced than in the United Kingdom, an early estimate from September 2020 was that it could take 84 weeks (over 1.5 years) to clear the backlog in elective surgery following the first disruption in March-May 2020 in the province of Ontario. This estimate assumed an increase in supply of procedures above the pre-pandemic level (20% higher) and assumed that there would be no further interruption of services (Wang et al., 2020[6]). Both assumptions proved to be too optimistic. Up to March 2022, there were a few periods of time when surgical activity levels in Ontario came close to reaching pre-pandemic levels. However, the capacity to surge above pre-pandemic level was not achieved, primarily due to health workforce constraints (particularly nurse shortages). Furthermore, health

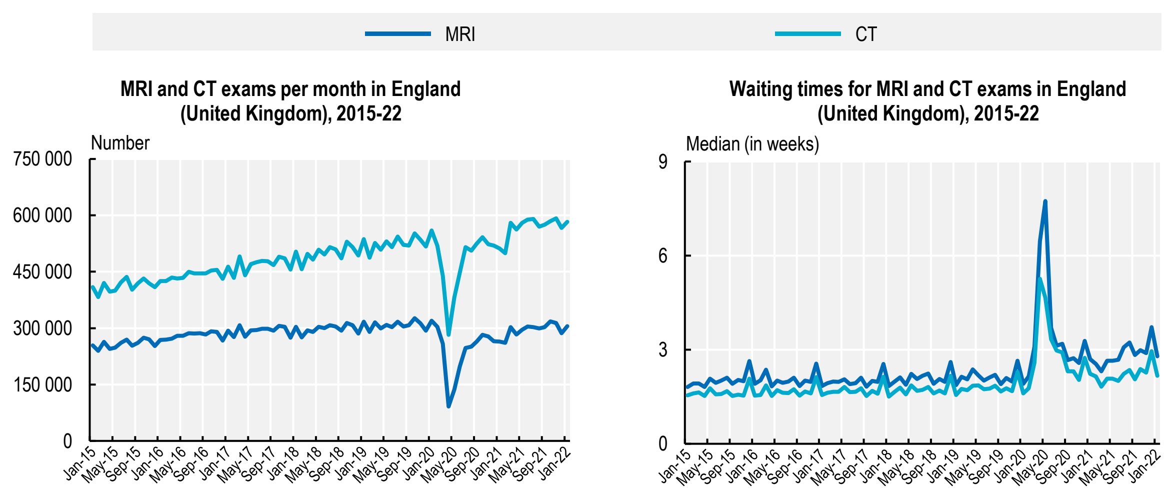
care activities were disrupted again because of peaks in the pandemic later in 2020, during 2021 and in early 2022. In June 2021, the Government of Quebec launched a strategy to clear the backlog of surgeries and reduce backlogs to pre-pandemic levels by 2024, supported by a substantial financial commitment of over CAD 800 million (Government of Quebec, 2021[7]).

- In Slovenia, no precise estimate or commitment has been made about how long it might take to address the backlog, but the expectation is that the increase in waiting times for elective treatments since the pandemic will be prolonged over the next few years. Besides the postponement of many elective surgical procedures due to COVID-19 in 2020 and 2021, demographic changes will also result in higher demand for health services, and consequently in longer waiting times.

9.1.5. Waiting times increased for diagnostic tests also in 2020

The reduction in diagnostic tests, at least during the early stage of the pandemic in 2020, was accompanied by an increase in waiting times in some countries. In the United Kingdom, the number of CT scans dropped by 30% and the number of MRI scans dropped by 50% in March-May 2020 compared with the same period in 2019. The waiting times for these diagnostic tests went up sharply during that period from about 2 weeks to 5 weeks for CT exams and nearly 8 weeks for MRI exams (Figure 9.9).

Figure 9.9. Sharp reductions in diagnostic tests increased waiting times during the first wave of the pandemic in England (United Kingdom)



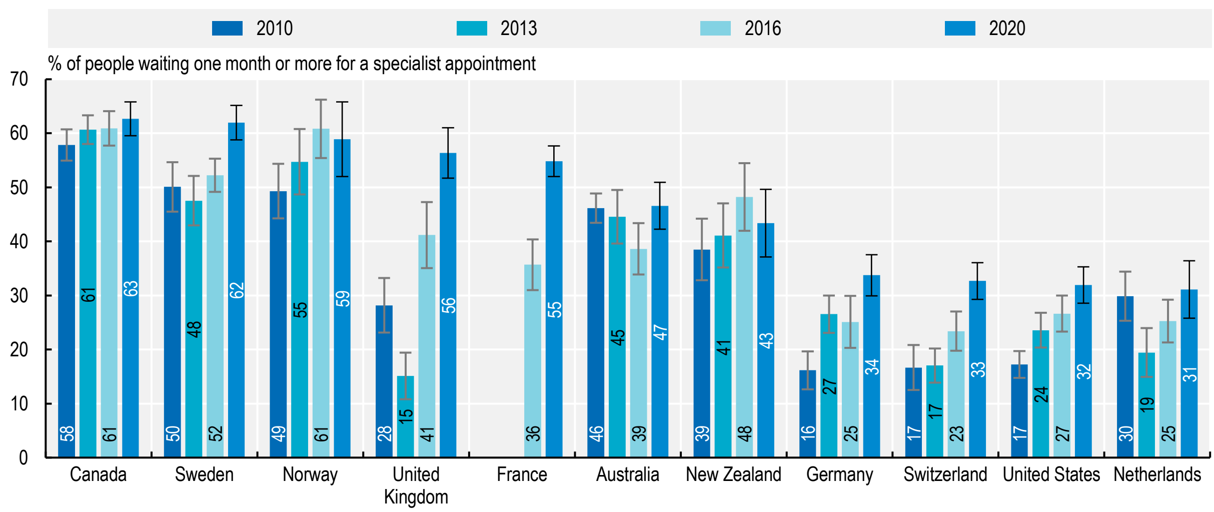
Source: NHS Monthly Diagnostics Data 2021-22, https://www.england.nhs.uk/statistics/statistical-work-areas/diagnostics-waiting-times-and-activity/monthly-diagnostics-waiting-times-and-activity/monthly-diagnostics-data-2021-22/.

In Canada, the volume of MRI and CT exams fell sharply in 2020 compared with 2019 (by over 25% for MRI scans and nearly 20% for CT scans). Most of the increase was concentrated during the first lockdown in March-April 2020, when radiology services experienced a 50-70% reduction in volume (CADTH, 2021[8]). However, waiting times for MRI exams did not increase significantly between April and September 2020 compared with the previous year (only a slight increase from 42 days to 45 days), while there was a slight reduction in waiting times for CT exams (from 13 days to 11 days) (CIHI, 2021[9]). This relative stability in waiting times can be explained by the fact that fewer patients were added to the waiting lists for these diagnostic scans during the initial phase of the pandemic, and many people were also reluctant to attend these exams due to the risk of infection. Thus, both supply and demand fell.

9.1.6. Waiting times for specialist consultations also increased in most countries

Waiting times for a specialist appointment, which is often the first step towards referral for further diagnostic tests and treatments, also increased during the first stage of the pandemic in 2020 compared with 2016 in all countries participating in the Commonwealth Fund survey, except New Zealand and Norway (Figure 9.10). The increase in the proportion of people reporting that they had waited one month or more for a specialist appointment was particularly large in France and the United Kingdom. It was lower or not significant in other countries.

Figure 9.10. The share of people waiting one month or more for a specialist appointment increased in most countries in 2020



Note: The H symbols represent the 95% confidence interval.
Source: OECD calculations based on the Commonwealth Fund International Health Policy Survey. The survey in 2020 was conducted in the early part of the pandemic, from February to May 2020.

9.2. Several policies may address the backlog of elective care and promote health system recovery

Even before the pandemic, waiting times for health services were a high or at least a medium-high priority issue in most OECD countries (OECD, 2020[10]). In several countries (including Canada, Ireland, the Netherlands, New Zealand, Portugal and the United Kingdom), waiting times for elective surgery had already started to rise before the pandemic, indicating that the supply was not keeping up with the growing demand. Policies to reduce the backlog of patients on waiting lists can increase supply, reduce or better manage demand, or both (Box 9.3).

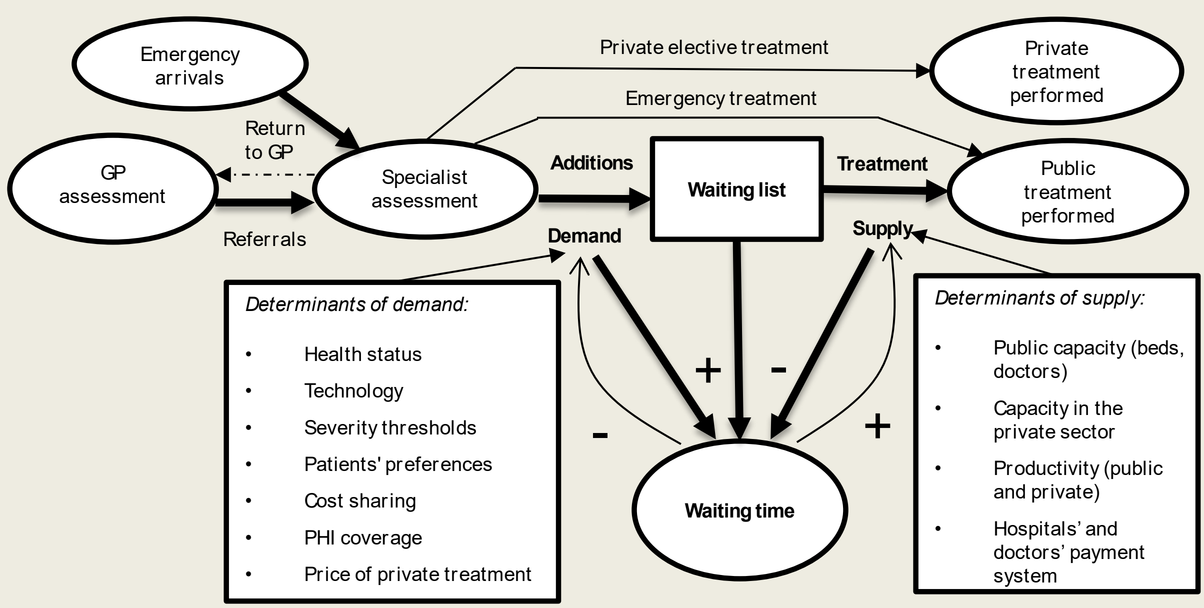
Box 9.3. Demand and supply determinants of waiting lists and waiting times

Waiting lists and waiting times are dynamic phenomena with complex interactions (Figure 9.11). A waiting list increases over time if demand exceeds supply, and reduces if supply exceeds demand. Both demand and supply of health care are likely to grow over time. Demand increases over time because of population ageing, which increases needs; or through technological development, which increases the range of conditions that are treatable. Supply may also increase over time due to technological development – for example, allowing patients to be treated as day cases, freeing up hospital capacity.

Demand for treatments in public systems is also determined by other factors – such as patient preferences for surgery, patient cost-sharing, the extent to which the population holds (duplicative) private health insurance, and the price and accessibility of private care. When patients face longer waiting times, some may choose not to wait and opt for private treatment, provided they can afford to pay out of pocket or hold private health insurance. This may contribute to inequities in access.

Supply of treatments is determined by the overall capacity, which depends on the health workforce and its composition, and infrastructure and equipment (such as the number of clinics and hospitals, and volumes of diagnostic and surgical equipment). Supply also depends on the productivity with which the labour and equipment are used. Productivity depends on contractual arrangements with health workers (hours, number of sessions), payment systems for providers and efficiency in care delivery. Incentives to increase supply are stronger when health workers are paid by fees for service as opposed to salaries or capitation fees, and provider payments are based on activity, although this might also generate some supply-induced demand. Stringent maximum waiting-time targets can also stimulate increases in supply, although they may also stimulate providers to reduce demand by applying more stringent criteria for adding patients on the list (OECD, 2020[10]).

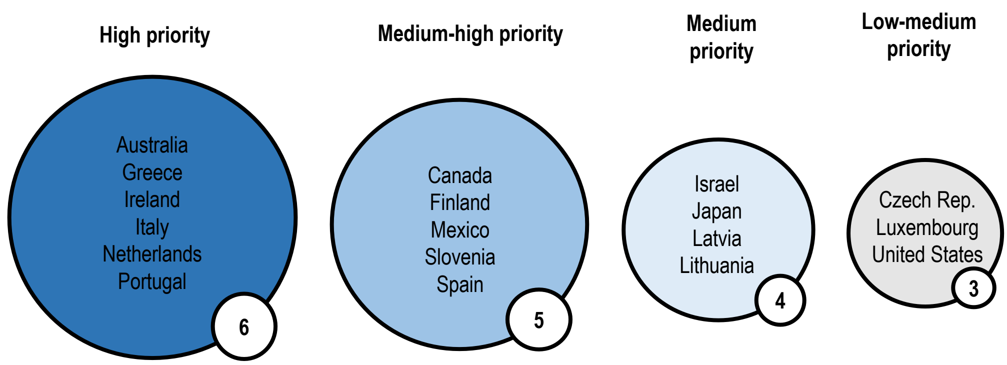
Figure 9.11. Demand-side and supply-side factors that affect waiting times



Source: Adapted from Hurst and Siciliani (2003[11]), “Tackling Excessive Waiting Times for Elective Surgery: A Comparison of Policies in Twelve OECD Countries”, https://doi.org/10.1787/108471127058.

Most countries that responded to the OECD Resilience of Health Systems Questionnaire 2022 reported that addressing waiting times for elective care was a high or medium-high priority following the pandemic (Figure 9.12). On the other hand, waiting times were considered a low-medium priority in the Czech Republic, Luxembourg and the United States. These three countries, however, do not report any statistics on waiting times for elective care.

Figure 9.12. Priority given to waiting times for elective care following the pandemic, OECD countries



Source: OECD Health Systems Resilience Questionnaire 2022 (18 country responses).

Many OECD countries have implemented measures to address the backlog and to reduce waiting times for elective care created by the disruption of services during the pandemic. Most of these policies focus on increasing the supply of services and surgery (Table 9.3). Fewer countries have tried to improve management of the demand for elective care and surgery (see discussion in Section 9.2.10 below). The next sections review the supply-side policies.

Table 9.3. Supply-side measures to increase the volume of elective care, selected OECD countries

Country	Additional funding for health care providers	Expanding health workforce (doctors, nurses, etc.)	Extending working hours of health workforce	Better use of capacity or operating theatres	Involvement of additional providers (e.g., private providers)	Digital consultations
Australia	✓			✓	✓	
Canada	✓	✓	✓	✓	✓	✓
Costa Rica	✓	✓	✓	✓		✓
Czech Republic	✓			✓		
England (United Kingdom)	✓	✓	✓	✓	✓	✓
Finland	✓	✓		✓	✓	✓
France	✓	✓	✓	✓	✓	✓
Greece		✓		✓	✓	✓
Ireland	✓	✓		✓	✓	✓
Israel		✓	✓	✓	✓	✓
Italy	✓	✓	✓	✓	✓	✓
Lithuania		✓		✓	✓	✓
Mexico	✓	✓		✓		
Netherlands				✓	✓	✓
Portugal	✓	✓		✓	✓	✓
Slovenia	✓		✓	✓	✓	✓

Source: OECD Health Systems Resilience Questionnaire, 2022.

9.2.1. Additional or earmarked funding can be provided to increase the supply of elective care, but this may not necessarily result in shorter waiting lists

Some OECD countries have allocated additional or earmarked funding specifically to address the backlog.

- In Canada, the federal government provided CAD 4 billion of additional funding support to provinces and territories to work through the surgical and diagnostic backlogs caused by the COVID-19 pandemic in 2021, and added another CAD 2 billion in March 2022 (Government of Canada, 2022[12]). Health care delivery is the responsibility of provinces in Canada, and several provinces launched strategies in 2021 to respond to the surgical delays caused by the pandemic.
- Finland announced in April 2022 that EUR 110 million of the EU's Recovery and Resilience Plan would be allocated in 2023 to reduce the backlog in treatment and rehabilitation services, and to increase access to care. Additional funding of EUR 90 million in 2024 and EUR 30 million in 2025 will be allocated for the same purposes (Government of Finland, 2022[13]).
- In Ireland, the Waiting List Action Plan was supported by dedicated funding of EUR 350 million for 2022, which was intended to prevent a continued increase of 40% in waiting lists due to pent up demand arising from the pandemic (Government of Ireland, 2022[14]).
- In Italy, the national government provided additional funding to regions, which are responsible for delivery of health care, to address long waiting lists in 2020. Funds comprised EUR 112 million for hospital admissions and EUR 366 million for specialist visits and outpatient care (Government of Italy, 2020[15]). The funding was subject to each region developing a plan to absorb the increase in waiting lists, specifying the organisational models and policy interventions, the timeline for delivery and use of the resources. In 2021 and 2022, the regions were given more time to make use of the additional funding, and the regional recovery plans were adapted to take into account the surge in waiting lists. In September 2021, a working group was created to evaluate the reductions in health services during the pandemic, to assess the regional plans to reduce the waiting lists and to monitor quarterly progress at the regional level.

Additional funding is not a guarantee that supply will increase and translate into a shorter waiting list. For additional funding to be successful in reducing waiting times, it needs to be linked to clear and verifiable objectives at the provider level in terms of increases in volume, and ideally also linked to reductions in waiting times.

9.2.2. Maximum waiting-time targets or guarantees can be maintained or set

Maximum waiting-time targets or guarantees remain common across OECD countries. These are mostly used to set ambitions and objectives at the health system level against which to monitor performance. They can also be used as a management tool to set targets for health care providers or can take the form of maximum waiting-time guarantees to enhance patient entitlement to access. Maximum waiting-time targets or guarantees were lifted temporarily during the pandemic in several countries, while they were maintained in others but not necessarily met (Table 9.4).

Table 9.4. Predefined waiting-time targets or guarantees were maintained in some countries during the pandemic but suspended in others

Country	Waiting times maintained	Waiting times suspended	Waiting-time targets or guarantees
Australia	✓		Australia has adopted elective surgery waiting-time targets for many years, based on three clinical urgency categories: Category 1: 30 days (patient's health has the potential to deteriorate quickly) Category 2: 90 days (patient's health not likely to deteriorate quickly) Category 3: 365 days (patient's health unlikely to deteriorate quickly).
Canada		✓	Any targets related to waiting times are established and maintained by individual provinces/territories. No sanction is applied for not meeting the targets for most jurisdictions. Emergency surgeries and cancer surgeries were maintained during the various waves of the pandemic, while all other elective surgeries were postponed temporarily to preserve hospital resources.
Costa Rica	✓		National goals were generally maintained, although certain surgical cases had to be prioritised, in compliance with sanitary measures.
Czech Republic	✓		Maximum waiting times are established by government decree, but only for a limited number of elective procedures (13). Even though these maximum waiting times were not changed or suspended during the pandemic, they are generally not enforced and attempts to improve their measurement have only been made recently.
Finland		✓	During March-May 2020, waiting times were suspended temporarily for all health care, and during March-May 2021 they were suspended for specialised care (not including psychiatry) in the Helsinki-Uusimaa hospital district.
Germany	✓		The associations of statutory health insurance physicians are required by law to arrange appointments for insured persons for ambulatory care within a certain period. The federal government has no information that these deadlines were not met during the pandemic.
Ireland	✓		Maximum waiting-time targets were recommended in the 2017 Sláintecare Report (12 weeks inpatient/10 weeks outpatient/10 days diagnostics) to be achieved over a gradual period on a phased basis. Interim waiting-time targets were put in place for 2022 in the Health Service Executive (HSE) National Service Plan and Waiting List Action Plan (18 months outpatient/12 months inpatient) as part of the first step of multi-annual reforms to bring waiting times gradually in line with the Sláintecare targets.
Italy		✓	During the pandemic, the National Health Service guaranteed elective hospitalisations for cancer, and elective non-cancer hospitalisations with priority category (30 days). All diagnostic tests and hospitalisations were delivered based on clinical severity.
Lithuania		✓	After the strict lockdown in March 2020, provision of scheduled health services was suspended. Later, measures were taken to restore provision of these services.
Latvia	✓		Waiting times for health services for patient groups, such as patients with cancer, were maintained.
Portugal	✓		During the pandemic, waiting-time guarantees were maintained, and waiting times were monitored to mitigate and achieve pre-COVID-19 levels.
Spain		✓	During the pandemic, less urgent interventions were suspended or delayed. The clinical areas most affected were assessment, monitoring and treatment of chronic conditions in primary care, and elective surgery.
Slovenia		✓	Waiting-time guarantees were not maintained for patients in the "regular" (180-day guarantee) and "fast" (90-day guarantee) urgency categories during the pandemic. However, waiting-time guarantees were maintained for cancer care and patients in the "very fast" (14-day guarantee) and "urgent" (24-hour guarantee) categories.

Source: OECD Health Systems Resilience Questionnaire, 2022.

- In Canada, waiting-time benchmarks have been developed since 2005 through federal, provincial and territorial collaboration, with support from the health service research community (Watson et al., 2007[16]). The benchmark for hip or knee replacements is that the waiting time should not exceed 26 weeks; for cataract surgery it should not exceed 16 weeks; and for cancer radiation therapy it should be within 4 weeks for patients ready to be treated. However, no financial sanction is applied against a jurisdiction or provider if any such pan-Canadian waiting-time standard is not met. During the first waves of the pandemic, cancer surgeries were maintained in most jurisdictions, while all other elective surgeries were postponed temporarily as health systems preserved hospital resources to respond to the pandemic. As a result, only half of patients receiving hip and knee replacements were treated within the recommended time frames between April and September 2020. This proportion increased to about 62% between October 2020 and September 2021, compared with 71% before the pandemic (CIHI, 2022[17]).

- In Ireland, the 2017 Sláintecare Report put forward ambitious waiting-time recommendations to be achieved in the long term, which have been adopted as government targets (e.g. no patient should wait longer than 10 weeks for outpatient care or assessment, longer than 12 weeks for inpatient or day cases or longer than 10 days for diagnostics) (Committee on the Future of Healthcare, 2017[18]). As a phased approach to eventually reach the recommendations of the Sláintecare Report, intermediate objectives such as maximum waiting times of 18 months for an initial assessment and 12 months for any hospital procedure were introduced. Other intermediate targets to be met by the end of 2022 aim that 98% of patients waiting for their first outpatient appointment should be seen within 18 months, and 100% of patients within 36 months. Similarly, 98% of patients waiting for an inpatient or day case procedure should be treated within 12 months, and 100% of patients within 24 months (Government of Ireland, 2022[14]).
- In one region in Italy (Lombardy), a system of penalties and rewards was scheduled in April 2022 to incentivise providers to treat patients within the maximum waiting times for hospital admissions related to cancer surgery (Lombardy Region, 2022[19]).
- In Portugal, the percentage of patients waiting for elective surgery within the waiting-time guarantee of 180 days fell from 41% in 2019 to 36% in 2020, but it returned to its pre-pandemic level in 2021 (Ministry of Health, 2021[20]).
- In England (United Kingdom), the ambition is to eliminate the longest waits of over 2 years by July 2022, and to reduce the number of people waiting for more than 62 days to start their cancer treatment. In the longer term, the ambition is to eliminate waits of over 18 months by April 2023 and waits of over one year by March 2025 (NHS England & NHS Improvement, 2022[21]).

9.2.3. Policies aimed at increasing productivity

Some OECD countries plan to increase productivity through gains in efficiency and better use of capacity and operating theatres. Policy makers have targeted reductions in cancellations and missed appointments, better use of operating theatres, and reducing bed blocking through better rehabilitation services leading to shorter length of stay and thus freeing up capacity. Better use of operating theatres can be achieved through additional sessions during the weekend and by paying overtime or recruiting additional staff.

- In one province in Canada (Ontario), measures to increase productivity include extending operating room hours (with the consent of staff to work during evenings and weekends), and creating centralised provincial surgical waiting lists to reduce scheduling delays and match patients to surgeons (Government of Ontario, 2021[22]).
- In Ireland, the action plan included providing additional funding to public hospitals for extra staff and overtime to treat more inpatients at weekends and providing outpatient appointments out of hours. The plan also included improvements in waiting-list management by validating patients ready to be treated, thereby reducing the proportion who "do not attend" and improving data accuracy, avoiding duplications and lapsed appointments. Reductions in missed appointments (typically at around 11%) are expected to be obtained through new patient-centred booking arrangements with more agile scheduling. The target is to reduce the proportion of missed appointments to 8% by December 2023 (Government of Ireland, 2022[14]).
- In one region in Italy (Lombardy), a regional policy was developed in April 2022 to extend the working hours in which hospitals offer appointments during evenings and weekends. The initial

focus was on diagnostic services (e.g. MRI and CT scans); it was then extended to specialist visits (Lombardy Region, 2022[23]).

- In Portugal, a law adopted in November 2021 extended the use of a previous law from July 2020 to incentivise extra capacity for surgical activity and primary health care. For surgical activity, financial payments are defined as a maximum additional payment of 75% for extra elective surgery activity using the diagnosis-related group fees established in 2015. These extraordinary incentives apply to all forgone surgeries, targeting those with longer waiting lists, and with waiting times beyond the waiting-time guarantees (Ministry of Health, 2021[20]).
- In England (United Kingdom), initiatives to improve efficiency in delivery include plans to increase the proportion of procedures performed in outpatient departments rather than in inpatient surgical theatres. To boost supply, there are also plans to make temporary staffing banks more attractive by making it as easy as possible for staff to take on extra shifts; paying them promptly for working these; and proactively supporting temporary staff, including offering more permanent employment or development opportunities. Efforts are also under way to ensure that providers agree on more consistent rates for waiting-list initiatives, as they have done with rates for collaborative staff banks, and to support local discussions with the private sector about pay rates (NHS England & NHS Improvement, 2022[21]).

Increasing productivity, however, presents possible challenges. In some OECD countries, the health workforce is already overstretched, making staff reluctant to work more overtime or exposing them to higher risk of burnout. Increasing volumes will require careful planning – for example, by identifying personnel who were less affected by COVID-19 and are therefore less at risk of burnout. Contracting beyond normal volumes can also be challenging, as it is difficult to distinguish between regular volumes and the extra volume that goes beyond what would be provided without additional funding. Moreover, while most OECD countries paid hospitals using activity-based financing, during the pandemic these payments were replaced by fixed budgets, to ensure that providers did not face financial difficulties and go bankrupt. A change to fixed budgets may, however, hamper productivity, as the incentive to increase activity is diminished. Therefore, the ambition of stimulating additional activity needs to be aligned with financial incentives, which is likely to involve resuming activity-based financing.

9.2.4. Private providers can be contracted to treat publicly funded patients

Several OECD countries have involved private providers in the past to reduce waiting times, and plan to do so once more to address the backlog caused by COVID-19. The rationale is that contracting private providers increases supply quickly by relying on existing capacity in the private sector. Such contracting generally relates to high-volume elective procedures, with a focus on maximum waiting-time guarantees and patients with long waits. In some countries, patients who have waited above the maximum time can choose a provider in the private sector.

- In Australia, the National Partnership was established to help the states and territories to access the private health care sector to deliver services to public patients (Federal Financial Relations, 2021[24]).
- In Canada, the province of Alberta was planning to involve private clinics to perform hip and knee surgeries, and Saskatchewan was planning to build on existing contracts with private surgical providers (Government of Alberta, 2021[25]; Government of Saskatchewan, 2021[26]).
- In Denmark, patients are guaranteed a maximum waiting time from a GP or specialist referral to treatment, which has been set to 1 month since 2007. If the region cannot ensure that treatment will be initiated within 1 month, patients have the right to an "extended free choice of hospital". This means that patients may choose to go to a private hospital (OECD, 2020[10]).
- In Ireland, the Health Service Executive and the National Treatment Purchase Fund has commissioned extra public and private activity to be delivered through the 2022 Waiting List Fund

to provide an additional 100 000 outpatient appointments, 28 000 inpatient/day case procedures and 30 000 diagnostics. A partnership framework for procurement of services from the private sector will also be established (Government of Ireland, 2022[14]).

- In Italy, several regions have a mix of public and private providers that treat publicly funded patients, and the latter are expected to play a more prominent role to treat elective patients – especially in specialties such as orthopaedics and ophthalmology. One region (Valle D'Aosta) plans to direct more patients to accredited private hospitals for orthopaedic surgery (Valle D'Aosta Region, 2022[27]).
- In England (United Kingdom), there are plans to create additional capacity by increasing the involvement of private providers to treat publicly funded patients. Integrated care systems will be responsible for planning and co-ordinating provision of services locally between public and private providers. Private providers will focus mostly on high-volume and low-complexity conditions, with the aim that this will free up capacity of public providers to focus on more complex work such as cardiac, vascular and neurosurgery for clinically urgent patients. Depending on local needs and capacity, there may be scope for private providers to contribute selectively to cancer pathways and diagnostics or more complex cases. Under the plans, the patient will have the right to choose a first appointment with a private provider if the public waiting list is too long (NHS England & NHS Improvement, 2022[21]).

One possible concern when contracting with private providers is that they often draw from the same pool of doctors employed by public hospitals. Therefore, there is a risk that increased supply by private providers can be offset by reductions in volume by public providers.

A key question is whether private providers should be subject to the same payment system as public providers and, if so, whether they should be reimbursed at the same rate as public providers or a lower one to reflect specialisation in less complex patients. Private providers in many countries tend to treat patients with lower-severity conditions, which are associated with lower costs. If this is the case, a lower payment is appropriate to ensure value for money, in line with most activity-based funding that sets tariffs to reflect the (average) cost of treatment. In some contexts, private providers may also lack equipment to treat patients with more complex needs, and patients may also be transferred back to public providers in case of complications, adding to the cost for public providers. This suggests the need for effective procurement and regulatory frameworks.

9.2.5. Dedicated facilities for elective treatment can be created to avoid disruption

Some OECD countries are planning to create dedicated facilities to treat elective patients exclusively. This is to avoid elective care being disrupted by emergency care, and to maintain these facilities as COVID-19 free with enhanced protocols (for example, ensuring that patients do not have COVID-19 before admission). A second rationale is that these dedicated facilities will be able to achieve economies of scale through learning-by-doing effects, and will have the ability to specialise, leading to quicker discharges and shorter length of stay.

- In Ireland, plans are in place to construct new elective-only hospitals, providing protected capacity for elective care for Cork, Dublin and Galway. Preliminary business cases for each location are at an advanced stage of development. They will be subject to technical review by the Department of Health and the Department of Public Expenditure and Reform, pending favourable reviews under the Public Spending Code (Government of Ireland, 2022[14]).
- In England (United Kingdom), plans are in place to develop elective surgical hubs, which are surgical units that conduct planned procedures only. These can be part of an existing hospital, as a distinct unit or a ring-fenced operating theatre, or can be established on a separate site. Several of these hubs will focus on high-volume low-complexity surgery, following a recommendation by the Royal College of Surgeons. This will allow hubs to exploit economies of scale and streamline

processes, and will lead to earlier discharge of patients, reducing length of stay. These hubs have been piloted in several locations, including London, with a focus on fast-tracking common procedures such as cataract removals, hysterectomies and hip and knee replacements. Additional capital funding has been approved to create new hubs across all regions and expand existing hub sites (NHS England & NHS Improvement, 2022[21]).

One possible concern with the creation of dedicated facilities for elective treatment is that synergies on costs or health benefits between emergency and elective care may be lost. The current rationale for providing elective and emergency care within the same hospital is that specialists can move easily between the two settings (for example, an orthopaedic surgeon can provide an elective hip replacement or an emergency hip replacement following an emergency admission). A dedicated elective hub may have consequences for emergency patients if these remain understaffed as a result.

9.2.6. Diagnostic activity can be boosted

Diagnostic activity acts as a bottleneck on the patient pathway because some patients need test results for doctors to complete their diagnosis and suggest appropriate treatment. Some countries have introduced initiatives to boost the supply of diagnostic services and set maximum waiting times for diagnostic tests.

- In Ireland, additional funding was made available in 2021 to increase diagnostic activity through the GP Structured Access to Diagnostics Programme (EUR 25 million). This saw around 138 000 scans of various modalities delivered in 2021. The scheme enables GPs to refer directly, reducing referrals to the diagnostics waiting list or inappropriate hospital emergency attendances, thereby easing pressure on hospitals (Government of Ireland, 2022[14]).
- In England (United Kingdom), creation of 66 dedicated community diagnostic centres was planned by the end of 2021/2022 to boost diagnostic capacity, with the aim of reaching a network of more than 160 centres and increasing testing capacity by one-quarter relative to pre-pandemic levels. These diagnostic centres will deliver a range of services including imaging, physiological measurement, pathology and (in larger centres) endoscopy services. The objective is to deliver bundles of tests in a single appointment, improving the patient experience and the efficiency of provision by faster diagnosis, and reducing pressure on hospitals. Digital infrastructure investments are also planned to ensure that test results and digital records can be shared swiftly with clinicians (NHS England & NHS Improvement, 2022[21]).

9.2.7. Policies can be applied to expand and retain the health workforce

The health workforce plays a critical role for the success of several policies mentioned above that aim to expand the supply of elective care and diagnostic services rapidly. This is because such policies imply either the current workforce working longer hours or an expanded workforce, in particular nurses. However, it takes time to train new nurses and even more time to train new doctors, so the main options to address the backlog in the short term are either to retrain and redeploy existing staff, or to recruit new staff from abroad. It is also crucial to retain the existing workforce by improving working conditions and pay rates where required.

- In Canada, the plan to expand workforce capacity also includes a mix of greater domestic education and training, and international recruitment – particularly of nurses. International recruitment of nurses reached an all-time high in 2020, and numbers are expected to continue to rise in 2021 and 2022 as the federal and provincial governments are encouraging more foreign nurses to come to work in Canada. The Government of Ontario (the largest province) announced a plan in early 2022 to hire more than 1 000 foreign-trained nurses quickly (Government of Ontario, 2022[28]). Later in 2022, it increased the target to hire up to 6 000 health workers (Government of Ontario, 2022[29]). Similarly, the Government of Quebec (the second largest province) is investing

CAD 65 million to recruit and train nearly 1 000 nurses from francophone countries (Government of Quebec, 2022[30]). Most foreign-trained nurses in Canada come from the Philippines and India, although a growing number of francophone nurses are recruited in France.

- In Ireland, plans are in place to develop strategic workforce planning to enhance capacity by investing in staff, and to recruit staff from abroad to fill gaps in the interim (Government of Ireland, 2022[14]). Recruitment of foreign-trained nurses in Ireland reached an all-time high in 2021, driven mainly by a big increase in recruitment of nurses from India and an increase in recruitment from African countries including Ghana, Nigeria and Zimbabwe (see the chapter on health workforce).
- In England (United Kingdom), plans are in place to recruit new staff, including international recruitment of more than 10 000 nurses in the 2021/22 financial year – particularly those with experience in critical care and operating theatres. This will contribute to the 2019 government commitment to increase the number of nurses in NHS England by 50 000 by 2024. As in Ireland, international recruitment of nurses in the United Kingdom reached an all-time high in 2021/22, driven by strong growth in recruitment of nurses from the Philippines and India, but also from Ghana, Nigeria and Zimbabwe. There are plans to develop new roles for nurses, such as anaesthetic associates. Nurses will also be encouraged to take up training grants to become cancer nurse specialists. To address retention, the Retention Programme supports NHS trusts by focusing on improving flexible working conditions, workplace health and well-being, and by supporting staff at the start and end of their careers. The NHS England will organise regional pension seminars to explain how the schemes work and enable staff to make informed choices, with a view to supporting them to remain in NHS employment. Efforts are also under way to support providers to manage staff absences more consistently, as it is estimated that improving attendance nationally by around 1% could amount to as many as 12 000 full-time equivalent staff (NHS England & NHS Improvement, 2022[21]).

The ambition of several countries to increase the volume of activity rapidly to address the backlog creates a tension, however, between a quicker elective recovery and the additional workload for current health workers. To reduce pressure on the existing workforce, countries need to expand recruitment and investment in education and training. Most OECD countries have increased the number of students in medical and nursing education programmes in recent years (see the chapter on health workforce), but such policies are long term, as the education and training period takes several years. Recruiting health workers from other countries may provide a quicker solution, but it may exacerbate shortages in countries of origin and the “brain drain” from low- to higher-income countries.

9.2.8. Links between primary care and secondary care can be strengthened

In many OECD countries, primary care is the first point of contact for patients seeking specialist services, and some countries have a gatekeeping system that requires a GP referral to access specialist care. Active involvement of primary care providers has the potential to reduce the number of inappropriate referrals and to treat some patients in the less expensive primary care setting rather than within the more expensive specialist and hospital setting. The COVID-19 pandemic has provided an opportunity to facilitate transformation within primary care (see the chapter on care continuity).

- In Ireland, the Enhanced Community Care Programme aims to expand capacity in primary care and reorientate service delivery towards general practice and community-based services, thus supporting the shift from acute hospitals and provision of services closer to home. Innovative pathway designs are founded on the principle of transitioning care closer to home through primary care and/or community services, including an emphasis on self-management and streamlining of acute hospital services. GPs will be provided with structured advice and support, enabling more patients to stay in primary care for management of their condition. The pathways will be supported by a series of capacity-building initiatives, including community-based hubs for management of chronic diseases, obesity, sensory services, gastroenterology and musculoskeletal issues (Government of Ireland, 2022[14]).

- In Italy, some regional plans that aim to reduce the backlog of elective services have emphasised the role of managing demand by improving the appropriateness of specialist services via better prioritisation and co-ordination between primary and secondary care. This is to be achieved with more systematic use of the management tool known as “Homogenous Waiting Time Groups” (AGENAS, 2020[31]), which was developed by the National Agency for Regional Health Services before the pandemic. It is a priority classification system to be used by GPs based on five categories of maximum waiting times: A (maximum waiting time of 3 days), B (not more than 10 days), C (not more than 30 days), D (planned follow-up examinations), E or no letter (no maximum wait). The policy aims to improve the degree of agreement between GPs and specialists on the urgency of the referral, the concern being that GPs tend to categorise patients in need of a specialist referral as more urgent relative to the assessment of the specialist
- (Mariotti et al., 2022[32]).
- In England (United Kingdom), plans are in place to ease primary care access to specialist advice – for example, enabling sharing of images to support clinical teams to undertake more effective triage, while improving the patient experience. One example is teledermatology services to increase access to specialist advice for suspected skin cancers. In 2021/22, GBP 2 million was invested in new dermatoscopes so that GPs can take high-quality photos of suspicious moles and lesions and seek specialist cancer advice, helping to speed up referrals and reducing the number of unnecessary specialist visits (NHS England & NHS Improvement, 2022[21]).

These examples highlight that moving care from secondary to primary care settings requires transformation of health service configuration. GPs and other primary care providers need to be supported with prioritisation tools, infrastructure and resources, if they are to assume more responsibilities.

9.2.9. Investment can be made in digital solutions

COVID-19 has also induced health systems to invest further in digital technologies – notably, to facilitate digital consultations (see chapters on care continuity and digital foundation). Digital technologies can play a role along the patient pathway for routine follow-up appointments or rehabilitation following surgery, which do not require a physical examination by the doctor.

- In Canada, the province of Ontario is creating a centralised provincial surgical waiting-list information system to reduce scheduling delays and improve the match of patients to surgeons (Government of Ontario, 2022[28]).
- In Ireland, the Health Service Executive is implementing a Health Performance Visualisation Platform to provide real-time health data and trends across emergency departments, outpatient services, operating theatres, diagnostic services and bed management to support scheduled care planning and delivery. This is designed to allow clinicians and managers to see where activity is happening across the public health system, to identify bottlenecks and to enable visibility of where urgent real-time interventions are required. The HSE was also planning to develop technology enablers for enhanced information and data to better manage, process and report on waiting lists/times to facilitate improvements in hospital productivity and patient experiences (Government of Ireland, 2022[14]).
- In England (United Kingdom), plans are in place to encourage use of follow-up outpatient appointments with digital tools (via phone or video) to support access to clinical teams, which some patients may find more convenient from home. Technology-supported virtual wards that enable recovery at home for those with COVID-19 have also been extended to a range of other conditions.

These examples show the potential important role of digital solutions in supporting patients in need of elective care and improving communication between providers across different settings.

9.2.10. Carefully designed demand-side measures can be implemented

The policy initiatives outlined so far focus mostly on the supply side. Over the years, several OECD countries have developed a range of prioritisation tools to manage demand for elective care better, with recommended waiting times based on clinical need both across and within treatments. For example, patients in need of hip replacements who are less mobile or have more pain tend to have shorter waits than patients who are relatively more mobile or have less pain (Gutacker, Siciliani and Cookson, 2016[33]). Maximum waiting times for more urgent treatments are usually shorter, which is reflected in shorter waiting times for cardiac care or cancer than for joint replacement, for example.

This prioritisation was maintained during the pandemic. In nearly all OECD countries for which data are available, waiting times for more urgent conditions such as elective cardiac care (coronary bypass or coronary angioplasty) did not increase in 2020 compared with 2019 for patients treated (Table 9.5).

Table 9.5. Waiting times have generally been shorter for more urgent treatments before and during the pandemic

Mean waiting times from addition to list to treatment for selected elective surgery (days), 2020 (2019)

Country	Cataract surgery	Hip replacement	Knee replacement	Hysterectomy	Prostatectomy	Coronary bypass	Coronary angioplasty
Australia	154 (138)	164 (163)	216 (207)	103 (95)	71 (70)	32 (31)	
Canada*	133 (67)	165 (106)	197 (121)		41 (41)	5 (6)	
Finland	121 (113)	83 (84)	101 (100)	73 (81)	84 (71)	25 (23)	32 (37)
Hungary	49 (41)	89 (92)	134 (147)	10 (9)	14 (13)	51 (48)	7 (8)
Italy	58 (62)	81 (80)	81 (79)	63 (62)	82 (88)	25 (23)	25 (24)
Netherlands	58 (52)	70 (58)	79 (63)	47 (43)	38 (39)	27 (24)	11 (12)
New Zealand	85 (73)	121 (103)	134 (113)	115 (96)	84 (76)	44 (54)	55 (52)
Norway	178 (160)	170 (148)	205 (179)	167 (152)	158 (157)	100 (98)	54 (60)
Portugal	133 (129)	144 (137)	231 (215)	115 (116)	152 (124)	62 (50)	
Spain	118 (101)	154 (147)	208 (191)	99 (97)	141 (117)	39 (38)	1 (2)
Sweden	78 (75)	112 (92)	153 (131)	73 (63)	94 (94)	28 (19)	
OECD average	106 (92)	123 (110)	159 (139)	87 (81)	87 (81)	40 (38)	26 (28)

Note: The main value in the cell refers to 2020, while the value in parentheses refers to 2019 (pre-pandemic). * Canada is reporting median waiting time (not the mean); the median waiting time is generally shorter than the mean. The data for Australia for 2019 refer to 1 July 2018 to 30 June 2019; for 2020 they refer to 1 July 2019 to 30 June 2020. The data for Norway are overestimated because they start from the date when a doctor refers a patient for specialist assessment.
Source: OECD Health Statistics 2022, https://doi.org/10.1787/health-data-en.

Most countries maintained prioritisation tools during the pandemic, and in some countries these tools have been implemented more stringently. Several countries also use long or excess waiting times as a criterion to be prioritised on the waiting list, with the idea that if the wait is very long (e.g. over 1 year), the long wait is unacceptable regardless of the clinical need.

- In Ireland, patients with a waiting time of more than 6 months were prioritised in 2022 by the National Treatment Purchase Fund, initially for a subset of 15 high-volume procedures (including cataracts, hip and knee replacements, varicose veins, hernia repair and angiograms). As part of the Advanced Clinical Prioritisation Programme, patients waiting over 18 months will be contacted by a consultant, who will place them on the appropriate pathway of care. There are also plans to modernise patient care pathways – for example through an agreed series of health care touchpoints that will progress care from first presentation until completion of the episode of care. Working groups produced 75 high-level pathways in 2021, and 37 of these were expected to commence in 2022 as part of the Waiting List Action Plan 2022 (Government of Ireland, 2022[14]).

- In Italy, maximum waiting times have been maintained. For hospital admissions, there are four urgency categories: A (within 30 days: health can deteriorate quickly); B (within 60 days: high level of pain and disability with potential to become emergency patients); C (within 180 days: minimal paid or disability with no or limited potential of health status to worsen); and D (within 12 months: no pain, reduced functioning or disability) (Mariotti et al., 2022[32]).
- In the England (United Kingdom), the Clinical Prioritisation Programme published prioritisation frameworks for surgery, diagnostics and endoscopy to support waiting-list management, ensure the accuracy of waiting lists and prioritise patients based on clinical need. The frameworks outline the steps for clinicians to check a patient's condition, establish additional risk factors and understand treatment options. A national Health Inequalities Improvement Dashboard will support local systems to pinpoint disparities in waiting times based on ethnicity and deprivation. In addition to clinical need, there is also a focus on patients with long waits: a new national network is under development, and more support is being provided. Patients who have been waiting longer than 18 months will be re-reviewed at least every 3 months. The general approach will build on the duty to offer an alternative provider, including in the private sector, with the process managed by the NHS team (NHS England & NHS Improvement, 2022[21]).

Waiting-time prioritisation policies redistribute the wait towards those who have more to lose, because they are in more pain, less mobile, or because their health can deteriorate more quickly. Explicit criteria for adding a patient to the list can also be useful to rationalise demand and make sure that referrals are appropriate. In turn, this can improve the efficiency of the health system by avoiding referral of unnecessary treatments or those with very low value. However, policies that aim to contain demand could affect inequalities if individuals with higher socio-economic status are better able to navigate the health system and gain access to health care more easily. This is particularly important given that demand was restricted and volumes dropped significantly during the earlier stages of the pandemic.

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10 Supporting health workforce recovery and resilience

Gaétan Lafortune and Noémie Levy

The COVID-19 pandemic has exacerbated pre-existing health workforce issues in OECD countries, including shortages of doctors and nurses, insufficient investment in education and training, and retention challenges. These shortages have increased workloads and pressures. Many health workers have emerged from the pandemic exhausted and intending to leave their positions. This chapter reviews the health workforce capacity of OECD countries going into the pandemic and strategies used to mobilise additional health workers (surge capacity) to respond to peaks in demand during the absorb stage of the pandemic. It also reviews new strategies implemented by countries to increase health workforce capacity and flexibility in the recovery stage of the pandemic, to avoid future shortages and increase preparedness for future shocks. Addressing health workforce shortages calls for greater investment in education and training, increased staff recruitment to reduce the workload and pressure on existing staff, and increased retention rates by improving working conditions and pay rates for categories of workers that have traditionally been undervalued. At least half of all new investments needed to make health systems more resilient should be directed towards workforce training, recruitment, and retention.

Key findings

Health workers have shown remarkable dedication and resilience, serving at the front line in the fight against the COVID-19 pandemic. The commitment of individual workers needs to be backed by system-level actions to support the resilience of the health workforce overall.

The pandemic exposed serious weaknesses in the health workforce in many OECD countries, revealing that it was understaffed, under pressure and undervalued:

- The health worker shortages faced by many countries were arguably the biggest capacity constraint faced – even more so than the availability of equipment or hospital beds. Shortages of specialised doctors and nurses were particularly acute in hospital intensive care units (ICUs). Many countries also reported scarcities of nurses in other hospital units, of general practitioners outside hospitals and of health care assistants in nursing homes as important constraints in absorbing the effects of the pandemic.
- Pre-existing health workforce shortages meant that the burden of responding to the pandemic fell on already understaffed health systems. Asking staff to work overtime under extreme pressure can only work for a limited time or it results in burnouts and resignations.
- Valuing frontline health care staff – particularly nurses and health care assistants – is vital to avoid a large exodus of health and long-term care workers. A silver lining of the pandemic is that it has shown the potential for greater task sharing and teamwork between doctors, nurses and other health care providers. However, expanded roles and responsibilities need to be financially recognised and rewarded.

Greater investments are needed to strengthen health workforce capacity and flexibility and avoid the risk of entering another public health crisis or other global disruption with these critical structural weaknesses. At least half of the investments to strengthen health systems across OECD countries should be allocated to training and recruitment; improving working conditions; and increasing the flexibility of the workforce to respond to shocks and strains.

Training more health workers: Several OECD countries have increased the number of students in medical and nursing education programmes in recent years to address shortages, although it takes years for these training decisions to take effect. It is heartening that the interest of young people in pursuing a career as a doctor or nurse does not appear to have lessened since the pandemic. In many countries (such as Italy, Spain, the United Kingdom and the United States), the number of applications and admissions to nursing education programmes rose in 2020/21 and 2021/22. However, attracting more male students remains a challenge: over 80% of nursing students in many countries are female, reflecting what is still perceived as "women's work".

Improving working conditions to increase retention: After three years of the pandemic, many health workers are exhausted and demotivated by what they consider to be a lack of recognition for their work. In several countries, about 20% of nurses reported in 2021 that they were considering leaving the profession in the short term. Evidence of high resignation rates among health workers has emerged in the United Kingdom and the United States. Improving working conditions requires reducing the workload and pressure on staff; supporting their health, well-being and safety at work; and reviewing their pay rates. Improved working conditions are particularly necessary for categories of workers that have traditionally been undervalued, such as nurses and health care assistants. They are also especially urgent in countries experiencing significant losses of doctors and nurses because of early retirement or emigration to other countries.

Increasing flexibility to respond to shocks and strains on health systems: The pandemic highlighted the need to mobilise additional health workers quickly to cope with a surge in demand for certain types of care. Most countries were able to mobilise such human resources by reallocating current staff to clinical areas with the greatest need (such as ICUs) and by drawing on retired or other inactive doctors and nurses, medical and nursing students nearing the end of their studies, and military health staff. The pandemic provided an opportunity to expand the scope of practice of many categories of health workers, such as nurses and pharmacists, to contribute to COVID-19 testing and vaccination campaigns and other pandemic responses. These strategies to address staff shortages should be maintained and expanded to respond to growing demands for care – including the evolving implications of "long COVID"– and contribute to a more resilient workforce.

10.1. The health workforce is a crucial component of health system resilience

Frontline health workers are the heart of health systems and are thus pivotal to any effort to increase health system resilience (Box 10.1 provides a general description of the various stages of resilience to a shock). Even before the pandemic, many categories of health workers in OECD countries were in short supply and working at full capacity, causing systems to become overloaded quickly when the COVID-19 pandemic hit. Many health workers are exhausted, several years after the pandemic began. They are contemplating whether they still have the energy and motivation to continue working in the health sector. Health systems will only be able to fully recover from the pandemic if they can support staff to recover from the burnout many have experienced, and if they can increase the capacity and flexibility of the workforce for the future.

Box 10.1. Resilience to a shock involves more than planning and preparation

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 of 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.

Source: Chapter on key findings and recommendations.

Health workforce shortages may be exacerbated by a vicious cycle whereby shortages result in greater pressures and resignations, further exacerbating the underlying shortages. Health worker shortages can have real impacts on both access to care and the quality and safety of delivered care. In addition to the human costs, countries may end up paying significant financial penalties for shortages in the future. These include higher health care costs to manage conditions that have worsened due to poor access to and quality of care, and the significant (and avoidable) economic costs of safety lapses, which increase as workforces become overstretched.

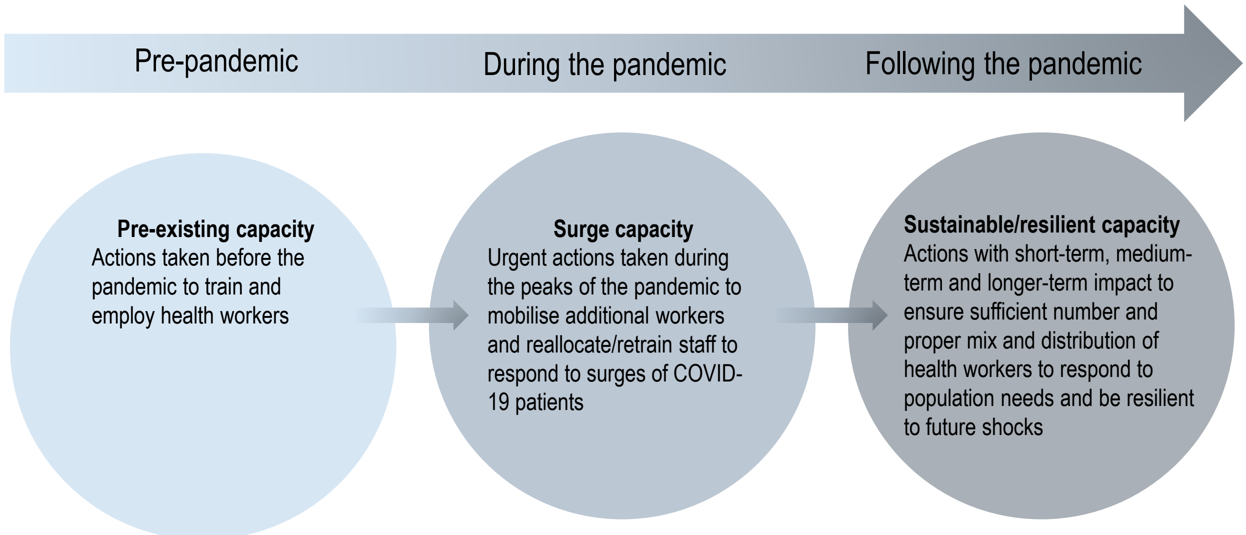
As of 2022, available evidence of high levels of resignations among health workers was limited to a few countries only (e.g. the United Kingdom and the United States). However, many national surveys of nurses and other health workers show a reduction in motivation and an increase in intention to leave current jobs or the profession altogether. One of the key priorities is therefore to increase retention rates of existing staff by boosting recruitment and improving working conditions, while at the same time increasing the flexibility of health systems to respond both to strains arising from population ageing and to future shocks.

Many OECD countries have taken actions to improve the working conditions and remuneration of health workers to increase recruitment and retention rates – particularly for those categories of workers whose remuneration has been relatively low. In many countries, efforts to improve working conditions (for example through more flexible working hours and less requirement for overtime work or night shifts) and pay have focused on nurses and health care assistants working in public hospitals, as well as those working in nursing homes (see the chapter on long-term care).

Many OECD countries have also scaled up their efforts to train more doctors, nurses and other health workers. However, such decisions will only have an impact in the medium to long term, as it takes about 3-5 years to train new nurses and about 8-12 years to train new doctors. Increasing the number of students admitted in medicine, nursing and other health education programmes is key to avoid future shortages. Policy decisions on student intakes need to be based on robust and regular health workforce planning and forecasting, going beyond the traditional silo approach of looking at each profession in isolation.

This chapter follows a chronological assessment of some of the main health workforce issues that OECD countries faced going into the pandemic, experienced through the absorption and recovery stages, and confront as health systems adapt from the pandemic (Figure 10.1). It first reviews the pre-existing health workforce capacity in OECD countries before the pandemic to provide important contextual information about each country's starting point. Section 10.3 explores the health workforce issues that arose after the pandemic began and the strategies used to mobilise additional health workforce capacity to absorb and respond to peaks in demand (surge capacity). Section 10.4 reviews the strategies countries have started to implement to ensure sufficient health workforce capacity and flexibility to respond to growing health care needs arising from future shocks and population ageing. The chapter concludes with policy recommendations for smart investments in the health workforce to drive recovery and make health systems more resilient in the future.

Figure 10.1. Strategies to increase health workforce capacity and flexibility during and following the pandemic



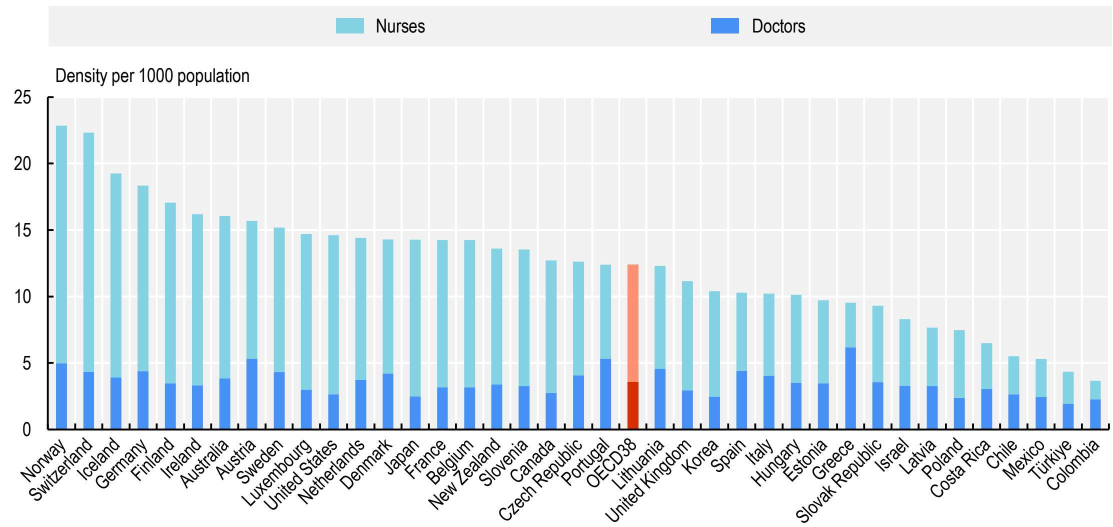
This chapter focuses mainly on health workers in primary care and hospitals. The chapter on long-term care discusses issues related to long-term care workers in nursing homes and in patients' homes.

10.2. OECD countries entered the pandemic with very different levels of health workforce capacity

The number of doctors and nurses per 1 000 population increased in nearly all countries in the two decades before the pandemic (OECD, 2021[1]), but in many countries the increase was insufficient to meet the growing demand for health care driven by population ageing. In addition, the composition of the medical workforce evolved towards a greater number of specialists and fewer GPs, resulting in growing shortages of primary care doctors – particularly in some rural and other underserved areas. This issue is often referred as "medical deserts" in France and other European countries (DREES, 2021[2]).

At the beginning of the pandemic, OECD countries had vastly different health workforce capacities. Several OECD countries in Central and South America (e.g. Chile, Colombia, Costa Rica and Mexico) and in Central and Eastern Europe (e.g. Latvia, Poland and the Slovak Republic), as well as Israel and Türkiye, had particularly low numbers of doctors and nurses (Figure 10.2). Low numbers of health professionals led to increased pressure on a smaller pool of staff to absorb and respond to growing demands during the different waves of the pandemic.

Figure 10.2. Numbers of doctors and nurses across OECD countries before the pandemic (2019)



Note: In Greece and Portugal, the number of doctors refers to all doctors licensed to practise, resulting in a large overestimation of the number of practising doctors (of around 30% in Portugal). In Greece, the number of nurses is underestimated as it only includes those working in hospital.
Source: OECD Health Statistics 2022 (data refer to 2019).

A range of factors affected COVID-19 infection rates and deaths during the first two years of the pandemic (see the chapter on *COVID-19* outcomes). The most important factor in mitigating the mortality impact was the capacity of countries to contain virus transmission effectively during the first year of the pandemic, and then to vaccinate the population at risk during the second year. Nonetheless, other associations can also be found between the number of health and social workers going into the pandemic and COVID-19 mortality rate or all-cause excess mortality rate in 2020 and 2021 across OECD countries (see Box 10.2).

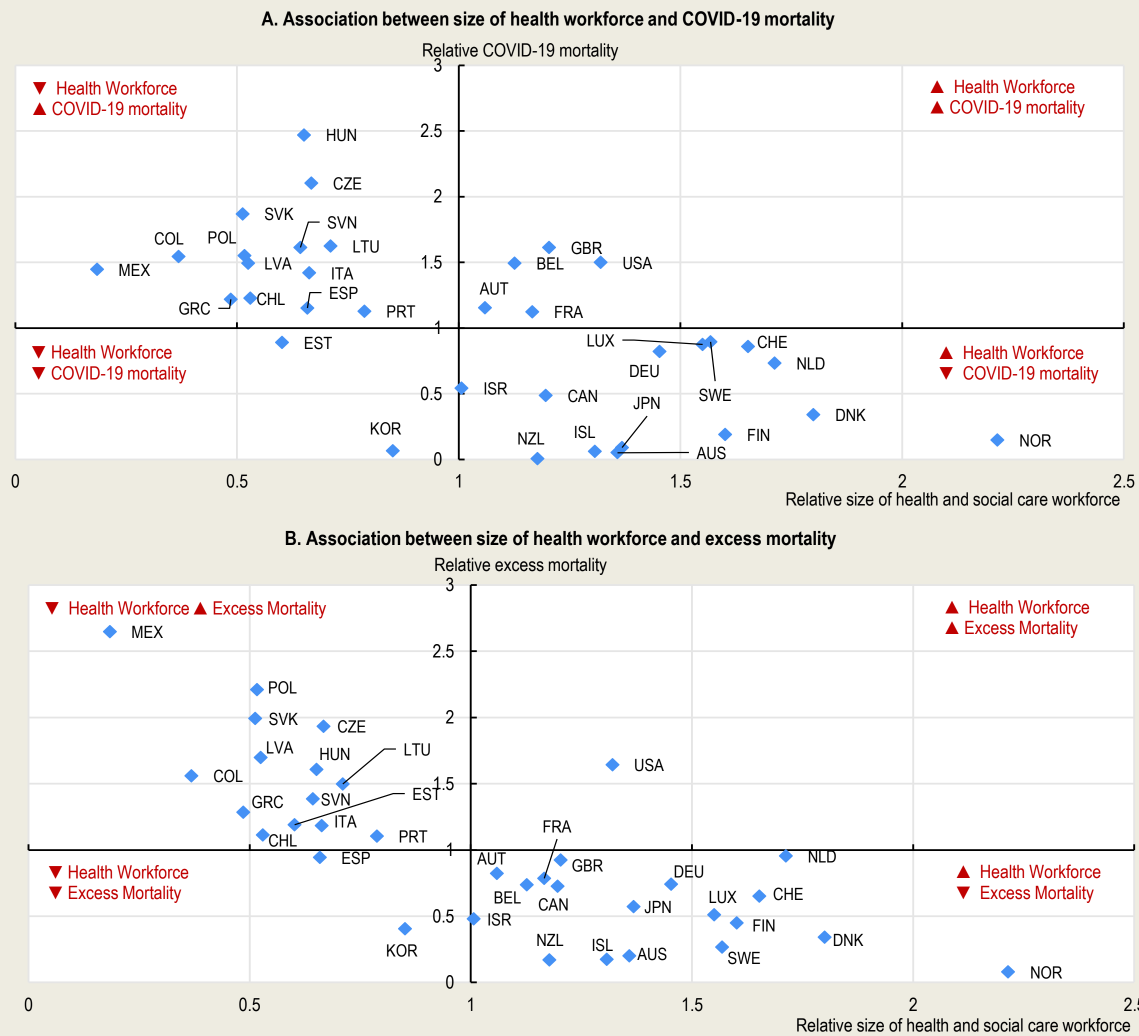
Box 10.2. Associations between pre-existing health workforce capacity and COVID-19 death rates

A wide range of factors can explain why some countries performed better than others in managing the impact of the pandemic and avoiding deaths. As discussed in the chapter on containment and mitigation, many studies have shown the importance of rapid and strong government interventions to contain the spread of the virus to reduce deaths from COVID-19 (Dergiades et al., 2022[3]).

Basic descriptive data suggest an association between the number of people working in the health and social sector per 1 000 population just before the pandemic and COVID-19 death rates across OECD countries, not controlling for other factors. Countries that had higher rates of health and social sector workers in 2019 generally had lower mortality rates from COVID-19 in 2020 and 2021 (Figure 10.3). This was also the case for cumulative excess mortality.

However, these cross-tabulations also show wide variations in COVID-19 mortality and excess mortality among countries that had the same number of health and social sector workers in 2019. For example, Spain and Italy had about the same number of workers in 2019 as Hungary and the Czech Republic, but lower death rates from COVID-19 in 2020 and 2021. Similarly, Australia, Iceland and Japan had about the same number of workers as the United States in 2019, but much lower excess mortality in 2020 and 2021. This indicates that other factors played an important role in COVID-19 deaths, including the strictness of public health interventions to contain the spread of the virus and vaccination coverage in 2021 (Meslé et al., 2021[4]).

Figure 10.3. Associations between numbers of health and social workers and COVID-19 deaths and excess mortality



Note: The quadrant chart shows the association between the health workforce and COVID-19 mortality (Panel A), and excess mortality (Panel B). The x-axis shows how much a country is above or below the OECD average for total health and social employment in 2019 (per 1 000 population); the y-axis shows how much a country is above or below the OECD average on COVID-19 mortality in Panel A and excess mortality in Panel B in 2020 and 2021 (OECD average normalised to 1). This analysis does not adjust for other factors affecting COVID-19 mortality or excess mortality; nor does it necessarily infer causality.

Source: OECD Health Statistics 2022, https://doi.org/10.1787/health-data-en.

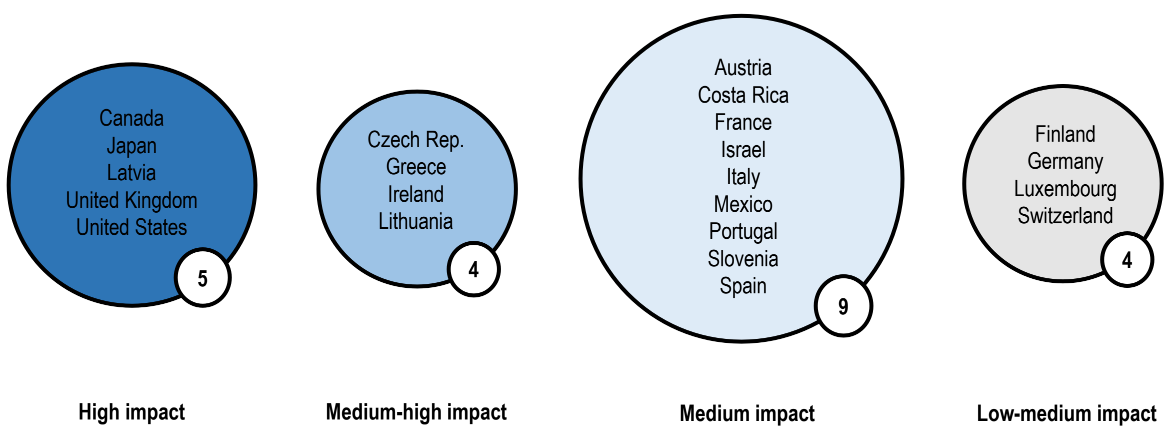
10.3. Health workforce issues played an important role in countries' capacity to absorb the pandemic

10.3.1. Workforce shortages had a crucial impact on countries' capacity to respond

The first wave of the pandemic triggered an abrupt new demand for care for COVID-19 patients in hospital emergency departments and intensive care units (ICUs) (see chapter on critical care surge for further discussion), as well as new needs for human resources to deliver testing, tracing and isolation services (see chapter on containment and mitigation). From the end of 2020 through much of 2021, there was also a need to mobilise the health workforce to implement new population-wide vaccination campaigns.

About half of the countries responding to the OECD Resilience of Health Systems Questionnaire 2022 reported that health workforce shortages had an important impact on their capacity to deal with the pandemic (Figure 10.4). Canada, Japan, Latvia, the United Kingdom and the United States considered that health workforce shortages had a high impact. Conversely, Finland, Germany, Luxembourg and Switzerland considered that health workforce shortages had only a low-medium impact. In the case of Finland, this was associated with better containment of the pandemic than in most other OECD countries in 2020 and 2021, resulting in far fewer cases. Switzerland and Germany were among the countries with the highest numbers of doctors and nurses per 1 000 population going into the pandemic, meaning that they had a greater pool of health workers to absorb its consequences.

Figure 10.4. Level of impact of health workforce shortages on countries' capacity to deal with the pandemic



Note: This figure shows country responses to the question: "On a scale of 1 to 5, please indicate the impact of health workforce shortages in dealing with the pandemic: 1 (low), 2 (low-medium), 3 (medium), 4 (medium-high) or 5 (high)".
Source: OECD Resilience of Health Systems Questionnaire, 2022 (based on 22 country responses).

In Austria, Canada, Italy, Latvia, Portugal, Spain, the United Kingdom and the United States, health workforce shortages were a widespread issue covering a range of health worker categories, including hospital doctors and GPs, nurses in hospitals and nursing homes, and health care assistants (Figure 10.5). In most countries, the shortages of nurses and doctors were particularly acute in ICUs. The vast majority of countries reported that the low supply of nurses in hospitals – those working in both ICUs and other wards – had been an issue in dealing with the pandemic. Two-thirds of countries reported that the lack of health care assistants in nursing homes had also been an issue (see the chapter on long-term care).

Figure 10.5. Health workforce shortages during the pandemic by categories of workers

	Doctors			Nurses			Healthcare assistants (e.g. nursing aides)	
	Hospital (ICU)	Hospital (emergency unit)	GPs (family doctors)	Hospital (ICU)	Hospital (all units)	LTC facilities (nursing homes)	Hospital (all units)	LTC facilities (nursing homes)
Austria	●	●	●	●	●	●	●	●
Canada	●	●	●	●	●	●	●	●
Costa Rica	●	○	○	●	○	○	○	○
Czech Republic	○	○	○	●	●	●	●	●
Finland	●	○	●	●	○	●	○	●
France	○	○	○	○	●	○	●	○
Germany	○	○	○	●	●	●	○	●
Greece	●	○	○	●	●	○	○	○
Ireland	○	○	○	○	○	○	○	●
Italy	●	●	●	●	●	○	○	○
Japan	●	●	○	●	●	○	●	○
Korea	○	○	○	●	●	○	●	○
Latvia	●	●	●	●	●	●	●	●
Lithuania	●	○	○	●	●	○	●	●
Luxembourg	○	○	○	○	○	●	○	○
Mexico	●	○	○	●	●	●	○	●
Portugal	●	●	●	●	●	●	●	●
Slovenia	●	○	●	●	●	●	○	●
Spain	●	●	●	●	●	●	●	●
Switzerland	●	○	○	●	○	○	○	○
United Kingdom	●	○	●	●	●	●	●	●
United States	●	●	●	●	●	●	●	●
Out of 22 countries:	15	7	10	19	17	13	11	14

● Shortage

○ No shortage

Note: This figure shows country responses to the question: "Which categories of health and long-term care workers were particularly in short supply during the COVID-19 pandemic?"
Source: OECD Resilience of Health Systems Questionnaire, 2022 (based on 22 country responses).

10.3.2. Protecting the physical and mental health of health workers was important

Health workers were over-represented in terms of COVID-19 infections at the beginning of the pandemic. The shortage of personal protective equipment (PPE), including basic equipment like face masks, was a key issue in many countries during the first few months of the pandemic, resulting in many health workers becoming infected. In the first few months of the pandemic, over 30 000 health workers were infected by the virus in France, the same number were infected in Italy, over 50 000 in Spain and about 200 000 in the United States (Santé Publique France, 2022[5]; CDC, 2022[6]; Instituto Superiore di Sanità, 2022[7]; Ministerio de Sanidad, 2020[8]).[1] After a few months of acute shortages, countries were able to purchase and stockpile a sufficient quantity of PPE and prioritise distribution to health workers (see chapters on critical care surge and securing supply chains).

The scale, severity and duration of the outbreak became a more lasting issue, taking its toll on the mental health of many health workers. While health workers are generally trained to deal with health emergencies, the pandemic brought unprecedented and acute challenges. A large proportion of nurses and other health workers reported having been affected by mental health issues since the pandemic began, with symptoms of anxiety, depression, burnout and post-traumatic stress disorder (see subsection 10.3.6 for the potential implications of this issue). Some factors seem to have had a particular influence on the mental health of health workers, including working for long hours in a hospital ward and caring for COVID-19 patients (Muller et al., 2020[9]). Family factors, such as having dependent children or infected family members, may also have had a negative impact on health workers' mental health (Awano et al., 2020[10]; Aiyer et al., 2020[11]).

Many OECD countries introduced new services for health care staff (Table 10.1). At least two-thirds of countries reported providing mental health support to health workers through access to mobile applications or websites, dedicated phone lines (hotlines) or consultations with specialists (psychologists or other mental health providers). However, past experience of virus outbreaks – such as severe acute respiratory syndrome (SARS) – showed that mental health problems such as anxiety and depressive symptoms can be detected among health workers more than a year following the event (Kisely et al., 2020[12]). This indicates that long-term support should be provided to all health workers who may need it.

Table 10.1. Psychological support offered to health workers during acute phases of the pandemic

Country	Access to apps or web-based support sites	Access to free phone line	Access to consultation with a specialist
Austria		✓	
Belgium	✓	✓	✓
Canada	✓	✓	✓
Costa Rica	✓	✓	✓
Czech Republic	✓	✓	✓
Finland	✓		✓
France	✓	✓	✓
Greece	✓	✓	
Israel	✓	✓	✓
Italy	✓		✓
Japan	✓	✓	
Korea	✓	✓	✓
Lithuania	✓	✓	✓
Luxembourg	✓		✓
Mexico	✓		✓
Portugal		✓	✓
Slovenia			✓
Spain		✓	✓
Türkiye	✓	✓	✓
United Kingdom	✓	✓	✓
United States	✓	✓	
Total (out of 21 countries)	**17**	**16**	**17**

Source: OECD Resilience of Health Systems Questionnaire, 2022 (based on 21 country responses).

10.3.3. Countries used similar strategies to increase health workforce capacity

Regardless of how many health workers they had when the pandemic started, virtually all OECD countries took measures to mobilise additional workforce resources in response to COVID-19. Three broad types of strategies were used to scale up the health workforce capacity and flexibility to meet the surge of COVID-19 patients in hospitals and to contain and manage the pandemic (Table 10.2).

- **Working harder**: the first strategy was to increase the working time of existing staff by asking them to work overtime, asking part-time workers to work full time, cancelling or postponing leave, and providing staff with day care or school for their children during periods of lockdowns and school closures. However, this strategy has limitations. Prolonged periods of overtime can lead to burnout and a vicious cycle of relying increasingly on a shrinking pool of health workers.
- **Reallocating staff and retraining staff to work in hospitals and units with the greatest needs**: the second strategy was to reallocate and reskill health workers to meet critical needs in ICUs in hospitals that were overburdened with COVID-19 patients in certain parts of the country. This involved cancelling elective surgical procedures and other non-urgent care in hospitals, and bringing private sector workers into public hospitals or using ICU staff in private hospitals.
- **Mobilising additional staff**: the third strategy was to mobilise additional workers – notably to support testing, tracing and isolating activities and vaccination campaigns – and to provide information and advice to the general population. The scope of practice of pharmacists, nurses and other health workers was expanded to respond to the huge demands for these services (see the chapter on care continuity). Most countries also mobilised medical and nursing students nearing

the end of their studies; inactive health workers, including retired doctors and nurses; and others who had moved away from providing direct care. Some countries such as France used pre-existing reserves of health workers, and some complementary mechanisms were also rapidly deployed to match the urgent demands from hospitals with people with the required skills and experience in different regions (Box 10.3). Many other countries also set up reserve lists quickly at the beginning of the pandemic.

Table 10.2. Overview of policies to boost health workforce supply during peaks of the pandemic

Country	Working harder		Reallocating and retraining				Mobilising additional workers		
	Prolonging working hours	Increasing workload	Reallocating health workers to localities/ facilities with greater needs	Reallocating health staff to key clinical areas and reducing non-COVID-19 activities	Providing rapid training in key clinical areas	Reorganising clinical teams to spread expertise	Mobilising medical and nursing students	Calling in retired doctors and nurses	Relying on national reserves of health professionals
Austria	✓	✓		✓	✓		✓	✓	
Belgium	✓	✓		✓	✓	✓	✓	✓	✓
Canada	✓	✓	✓	✓	✓	✓	✓	✓	✓
Costa Rica	✓	✓		✓	✓				✓
Czech Republic		✓	✓	✓			✓	✓	
Finland	✓	✓	✓	✓	✓		✓	✓	✓
France	✓	✓	✓	✓	✓	✓	✓	✓	✓
Germany	✓	✓		✓	✓	✓	✓	✓	
Greece			✓	✓	✓	✓			✓
Israel	✓	✓			✓		✓	✓	✓
Italy				✓			✓	✓	✓
Japan			✓	✓	✓			✓	
Korea			✓				✓	✓	
Latvia	✓	✓	✓	✓	✓		✓	✓	✓
Lithuania	✓	✓	✓	✓	✓	✓	✓		✓
Luxembourg	✓		✓	✓	✓	✓	✓	✓	✓
Mexico	✓	✓	✓	✓	✓	✓			
Portugal	✓	✓	✓	✓	✓	✓	✓	✓	
Slovenia	✓	✓	✓	✓	✓	✓	✓	✓	✓
Spain	✓	✓	✓	✓		✓	✓	✓	✓
Switzerland[1]	✓	✓		✓			✓	✓	
United Kingdom	✓	✓	✓	✓	✓	✓	✓	✓	✓
United States[2]	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total (out of 23 countries)	**18**	**18**	**16**	**21**	**18**	**13**	**19**	**19**	**15**

Note: 1. In Switzerland, the policies ticked are those known to the Federal Office. The list is non-exhaustive, as the Swiss health system is decentralised and the cantons are responsible for health care provision. 2. Due to the decentralised structure of the US health system, policy responses regarding the workforce varied among the 50 states. There was no single, uniform policy response.
Source: OECD Resilience of Health Systems Questionnaire, 2022 (based on 23 country responses).

Box 10.3. Using a health reserve to mobilise additional health workers in France

More than a decade before the COVID-19 pandemic, France established a health reserve in response to the avian influenza pandemic in 2007. Its mandate was to support health workers in the event of exceptional public health emergencies. When the COVID-19 pandemic started, the reserve was mobilised, but only a small proportion of the inactive doctors, nurses and other volunteers registered on the reserve list were called on to provide support during the first wave of the pandemic in 2020 (about 1 500 doctors and other health workers out of the 42 000 registered between March and July 2020).

This reserve, managed at the national level, proved to be less fit to respond to the massive urgent needs of the pandemic than other more decentralised and often informal mechanisms that were designed specifically to respond to the COVID-19 crisis (Pittet et al., 2021[13]). Other mechanisms were quickly put in place by hospitals and long-term care facilities, together with regional health agencies to match their needs with the offer of services from volunteers. For example, in the Ile-de-France region (the national capital region), the platform "*#Renforts COVID-19*" (#Backup COVID-19) dispatched over 16 000 people to hospitals and long-term care facilities during the first few months of the pandemic. At the national level, more than 60 000 volunteers were mobilised between March and July 2020, bringing support to 6 000 hospitals and long-term care facilities.

10.3.4. Countries are implementing a range of strategies to increase health workforce capacity and flexibility as they emerge from the pandemic

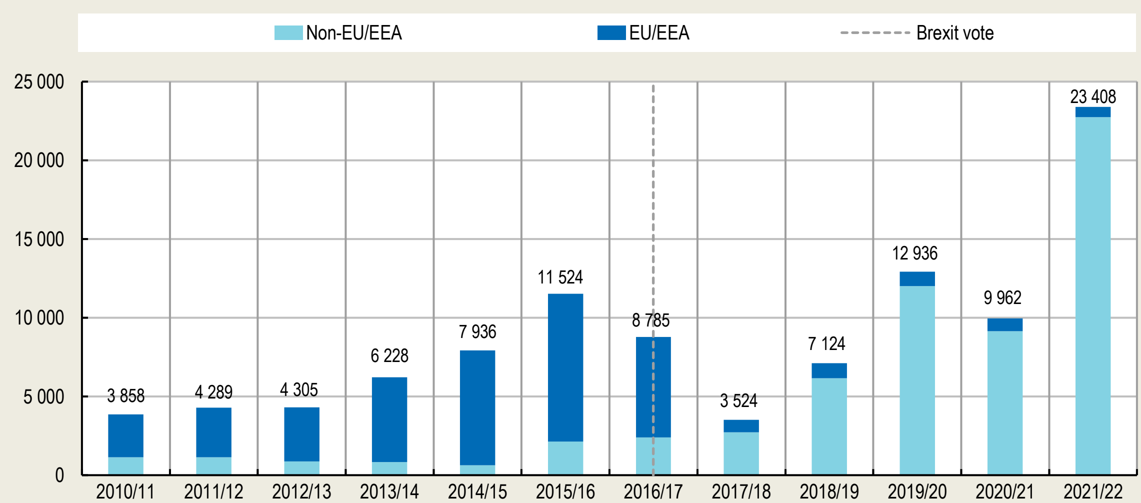
As OECD countries emerge from the pandemic but health systems continue to face multiple pressures, a key priority is to increase the supply of doctors, nurses and health workers by increasing training capacity, recruitment and retention rates. Around 80% of OECD countries reported in November 2021 that workforce shortages in health and long-term care had become more severe since the COVID-19 pandemic (OECD, 2022[14]). However, recruitment may be difficult in the short term if there is no spare capacity as it takes time to train new doctors, nurses and other skilled health workers. Several countries have actively recruited foreign doctors and nurses to fill needs in the short term (Box 10.4), but this may exacerbate shortages in origin countries.

Box 10.4. International recruitment of doctors and nurses to fill urgent needs

While it takes many years to train new doctors and nurses, recruiting them from abroad can provide a quicker solution to address immediate shortages. It is also less expensive, as the costs of education and training are borne by other countries. Several OECD countries, including Australia, Canada, Ireland, Israel, New Zealand, Switzerland, the United Kingdom and the United States, have traditionally relied on international recruitment of doctors and nurses. In some countries, this reliance has increased since the pandemic began.

The United Kingdom is one example. In 2021/22, international recruitment of nurses reached an all-time high, and international recruitment of doctors reached a nearly 20-year high. Over 12 000 new doctors and over 23 000 new nurses were foreign-trained in 2021/22. The countries of origin of foreign-trained nurses in the United Kingdom have changed greatly over the past decade (Figure 10.6). Between 2010 and 2016, growth in recruitment of nurses trained in European Union or European Economic Area (EU/EEA) countries was rapid. However, since the Brexit vote in 2016 and the introduction of new English language test requirements for nurses, international nurse recruitment has fallen from EU/EEA countries but grown substantially from others. In recent years, recruitment has increased rapidly from the Philippines and India, but also from Nigeria, Ghana and Zimbabwe.

Figure 10.6. Foreign nurse recruitment in the United Kingdom, 2010/11-2021/22

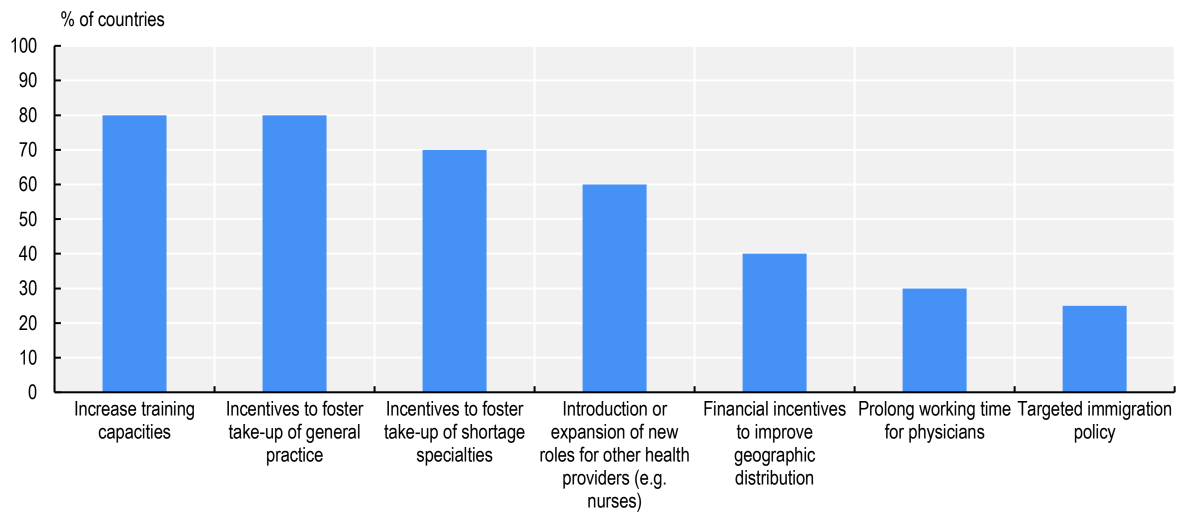


Note: The numbers refer to new nurse and midwifery registrants.
Source: Shembavnekar and Buchan (2022[15]), "How reliant is the NHS in England on international nurse recruitment?", https://www.health.org.uk/news-and-comment/charts-and-infographics/how-reliant-is-the-nhs-in-england-on-international-nurse-recruitment, based on data from the UK Nursing and Midwifery Council.

International recruitment of foreign-trained nurses also reached an all-time high in Canada in 2020. This number is expected to continue to rise in 2021 and 2022 as the federal and provincial governments are encouraging more foreign nurses to come to the country to work. In early 2022, the Government of Ontario (the largest province) announced a plan to hire more than 1 000 foreign-trained nurses quickly (Government of Ontario, 2022[16]). Similarly, the Government of Quebec (the second largest province) is investing CAD 65 million to recruit and train nearly 1 000 nurses from francophone countries (Government of Quebec, 2021[17]). Most foreign-trained nurses in Canada come from the Philippines and India, although a growing number of francophone nurses are also recruited from France.

OECD countries are using a range of policies to increase the supply of doctors and nurses and promote a better skill mix in the future. Most countries (80%) who responded to the OECD Resilience of Health Systems Questionnaire 2022 recently increased student intakes in medical education and training programmes, and a similar proportion of countries provide some incentives to encourage more new doctors to choose general practice to address shortages of GPs. Most countries (60%) have or are planning to introduce or expand the roles of other health professionals like nurses to reduce the workload and pressures on doctors. Many countries also indicated that they have introduced or are planning to introduce new financial incentives to improve the geographic distribution of doctors (Figure 10.7).

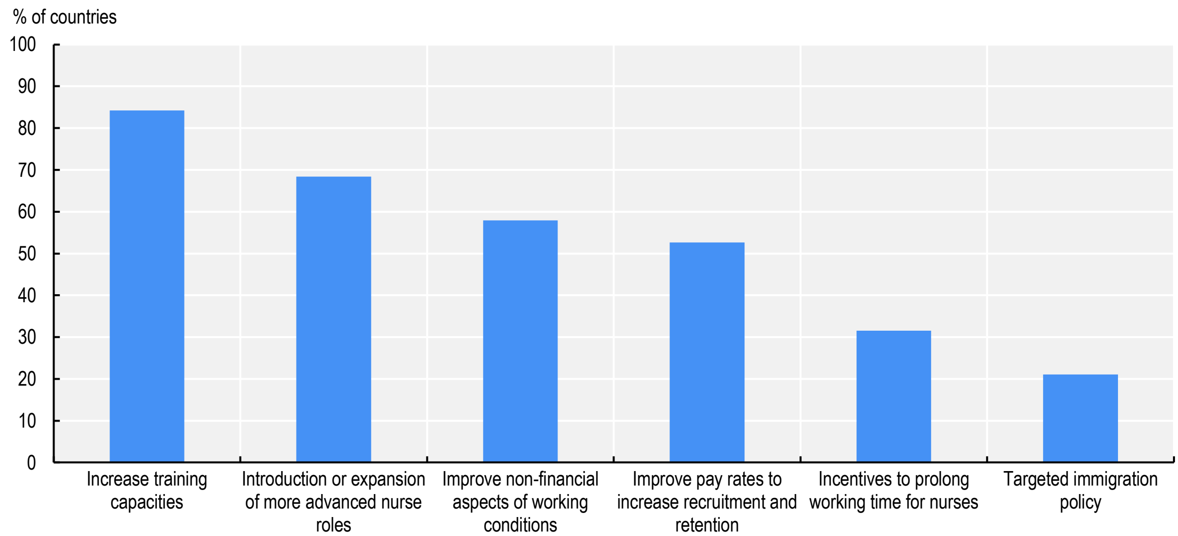
Figure 10.7. Policies used by OECD countries to increase the supply of doctors



Source: OECD Resilience of Health Systems Questionnaire, 2022 (based on 20 country responses).

Figure 10.8 shows that over 80% of countries have increased or are planning to increase training capacities in nursing education programmes. More than two-thirds are planning to introduce or expand the scope of practice to more advanced roles to provide greater career progression. The majority are planning to improve the working conditions of nurses and their pay rates to increase recruitment and retention.

Figure 10.8. Policies used by OECD countries to increase the supply of nurses



Source: OECD Resilience of Health Systems Questionnaire, 2022 (based on 19 country responses).

10.3.5. Countries are increasing education and training capacity

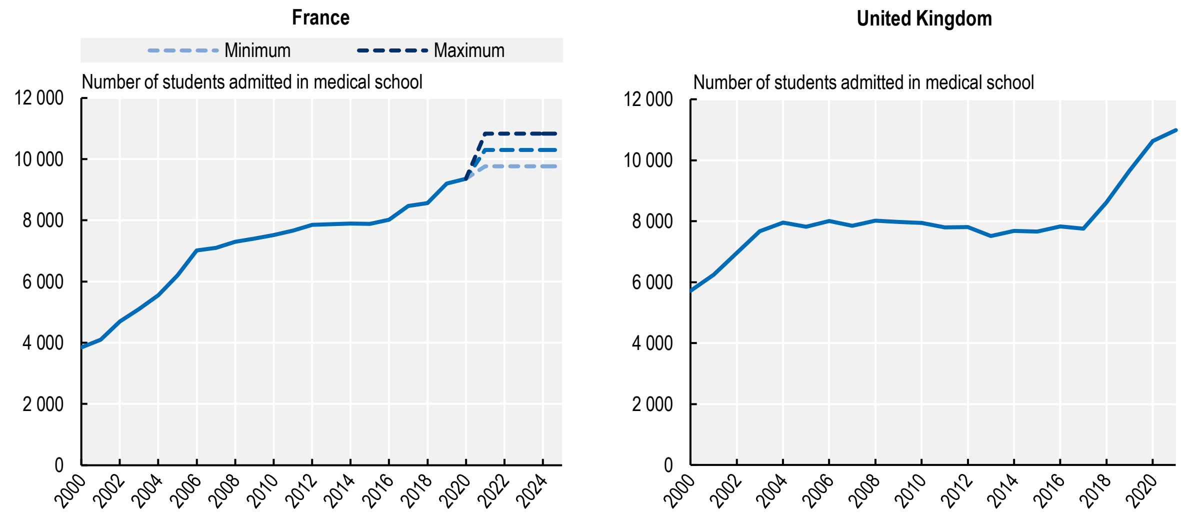
Many OECD countries have recently increased the number of students in medical and nursing education programmes to boost the supply of doctors and nurses, although there is a time lag between such decisions to increase student intakes and when students complete their training (about 8-12 years for doctors and 3-5 years for nurses).

In many countries, decisions to increase domestic training capacity preceded the COVID-19 pandemic. For example, in the United Kingdom, the number of students admitted to medical education programmes started to increase markedly in 2018 to increase the supply of doctors and provide more opportunities for students with the talent and ambition to train as doctors (UK Department of Health, 2017[18]). Between 2017 and 2021, the number of new medical students admitted increased by 35%, from 7 765 in 2017 to more than 10 500 in 2021 (Figure 10.9).

Similarly, France has seen a rapid expansion in the number of new medical students since 2017 to address projected shortages of doctors. Furthermore, in 2021, the French Government adopted a five-year plan for medical student admissions that provides for a further increase of 20% over the period 2021-25 compared with 2016-20 (Ministère des Solidarités et de la Santé, 2021[19]). The new “numerus apartus” also includes an element of flexibility compared with the previous “numerus clausus” policy, as it provides a recommended range for student admissions rather than a fixed number. On average between 2021 and 2025, over 10 000 medical students are expected to be admitted each year, reaching a new all-time high.

The number of students admitted to medical schools in many other countries (e.g. Germany and the United States) also continued to increase before and since the pandemic, although at a less rapid rate.

Figure 10.9. Numbers of students admitted to medical schools, France and the United Kingdom

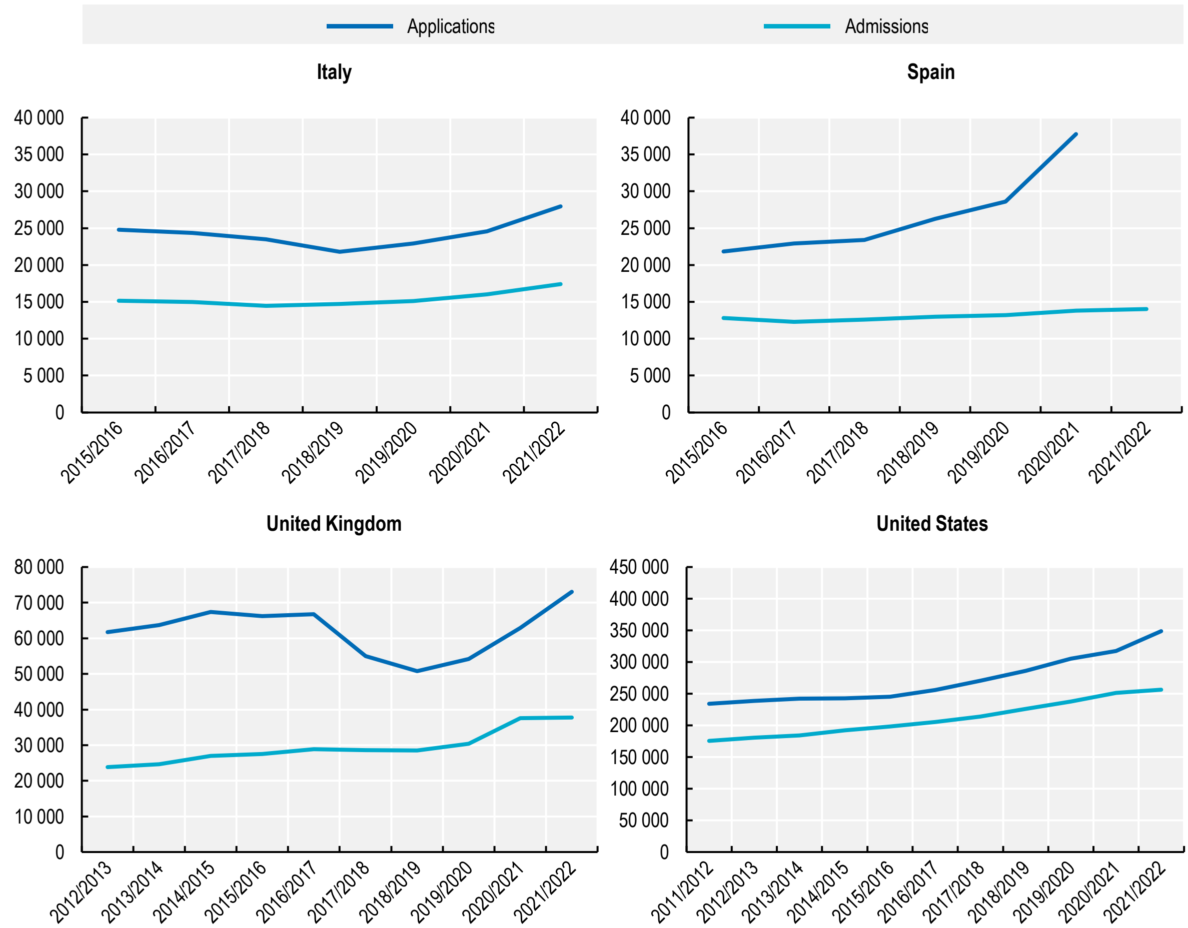


Sources: France: DREES (2021), https://drees.solidarites-sante.gouv.fr/publications/les-dossiers-de-la-drees/quelle-demographie-recente-et-venir-pour-les-professions; United Kingdom: Universities and Colleges Admissions Service (UCAS) (2021), https://www.ucas.com/data-and-analysis/undergraduate-statistics-and-reports/ucas-undergraduate-sector-level-end-cycle-data-resources-2021.

Many countries have also increased the number of students in nursing programmes to increase future supply and avoid shortages. The most recent evidence from several countries shows that young people's interest in pursuing a career in nursing has increased following the pandemic as illustrated by the growing number of applications and admissions (Figure 10.10), despite concerns that fewer might be interested given the work pressure and relatively low pay.

- In Italy, the number of applicants to nursing programmes increased by 7% between 2019 and 2020, and by another 14% in 2021 (total increase of 22% over this two-year period). The number of students admitted also increased albeit at a slightly lower rate (15% over two years) (Mastrillo, 2021[20]).
- In Spain, the number of applications to nursing programmes increased by over 50% between 2019 and 2021, although the number of students admitted only increased marginally (by 6%). This indicates persistent educational capacity constraints (Ministry of Education and Professional Training, 2022[21]).
- In the United Kingdom, the number of applications to nursing education programmes increased steadily in 2020 and 2021, with an overall increase of over 33% during this two-year period. The number of applicants increased across all ages, but the rise was particularly strong among 18-year-olds (39%). The pandemic was a significant factor behind this increase: 69% of applicants said that the pandemic inspired them to apply to study to become a nurse. In addition, the introduction in September 2020 of the NHS Learning Support Fund Programme that provides financial support to students in nursing and other health-related programmes; the promotion of nursing careers through the "We are the NHS" Campaign; and increased investment in practice placements contributed to the application increase (UCAS and HEE, 2021[22]). The sharp increase in applications in 2020 was accompanied by an even greater increase in student admissions (up by 24% compared with 2019), but the number of admissions stabilised in 2021 (with only a modest increase of 0.5% compared with 2020).
- In the United States, the number of student applications in nursing increased by 14% between 2019 and 2021, signalling strong interest in nursing careers. The number of students admitted increased slightly less, by about 8% (AACN, 2022[23]).

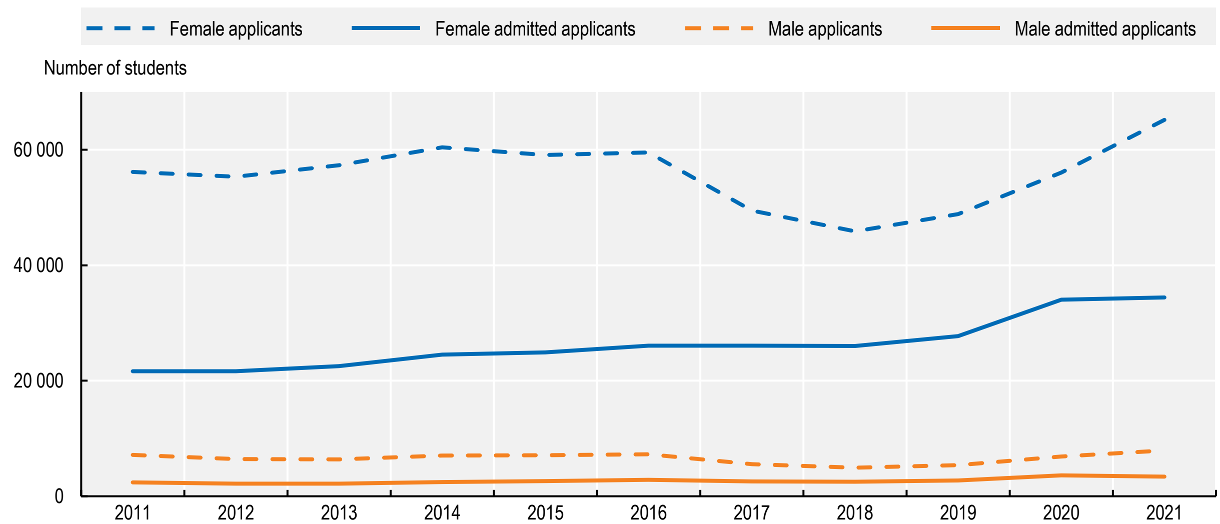
Figure 10.10. Student applications and admissions to nursing education programmes following the pandemic, selected OECD countries



Note: For the United Kingdom, the data relate to applicants who have applied to at least one nursing course (not necessarily their first choice). For the United States, the data relate to entry-level nursing baccalaureate programmes (not graduate programmes).
Source: Italy: Mastrillo (2021), https://www.fioto.it/altreimg/Report%20Mastrillo%202021.pdf; Spain: Ministry of Education and Professional Training (2022), http://estadisticas.mecd.gob.es/EducaJaxiPx/Datos.htm?path=/Universitaria/Alumnado/EEU_2021/GradoCiclo/NuevoIngreso//l0/&file=NI_Grad_Sex_Edad(1)_Amb_Tot.px&type=pcaxis; United Kingdom: UCAS (2022), https://www.ucas.com/data-and-analysis/undergraduate-statistics-and-reports/ucas-undergraduate-sector-level-end-cycle-data-resources-2021; United States: AACN (2022), https://www.aacnnursing.org/News-Information/Press-Releases/View/ArticleId/25183/Nursing-Schools-See-Enrollment-Increases-in-Entry-Level-Programs.

One persistent challenge across most OECD countries is the need to attract more male students to nursing. The general perception remains that nursing is “women’s work”, and that the occupation has a low professional status and autonomy, along with limited career progression opportunities (Mann and Denis, 2020[24]). In most countries, at least 80% of students applying and admitted to nursing programmes continue to be female, reflecting the traditional gender composition of the nursing workforce. In the United Kingdom, nearly all the increase in student applications and admissions in the past few years has come from female students (Figure 10.11). This has also been the case in many other countries.

Figure 10.11. Increases in student applications and admissions to nursing school by gender, 2011-21, United Kingdom



Source: UCAS (2022), https://www.ucas.com/data-and-analysis/undergraduate-statistics-and-reports/ucas-undergraduate-sector-level-end-cycle-data-resources-2021.

10.3.6. Countries are confronted with the challenge of increasing retention rates by improving working conditions

While increasing training capacity is crucial to increasing supply in the medium to long term, another key priority is to increase retention rates of doctors, nurses and other health workers to avoid exacerbating shortages. The combination of pre-existing shortages of health workers before the pandemic and more than two years of COVID-19 has led to many health workers feeling demotivated. Some are reporting an intention to leave their job to find work in other sectors and occupations or to retire early. This has been particularly the case for nurses and health care assistants, who often feel undervalued and underpaid for the work they do, and perceive that there is an imbalance between effort and reward.

Nurses and other health workers report high levels of job dissatisfaction and intend to leave

Table 10.3 shows selected results from surveys of nurses and other health workers carried out in some OECD countries in 2020 and 2021, highlighting the perceived degradation of working conditions during the pandemic and intentions to leave jobs.

- In Belgium, a survey from March 2021 found that close to a third of nurses, caregivers and other health workers reported feeling tired, and over half reported being under pressure or stress. Nearly 40% of respondents reported mental health issues and 19% were intending to leave the profession (Sciensano, 2021[25]).
- In Canada, a survey from late 2021 found that 94% of nurses were experiencing symptoms of burnout and 45% screened positive for severe burnout. Half (50%) of the nurses who responded to this survey reported that they were considering leaving their job over the coming year and 20% were considering leaving the profession altogether (CFNU, 2022[26]).
- In France, about three-quarters of nurses reported in April-May 2021 that they did not feel better recognised than before the pandemic, and 40% said that the pandemic had made them consider changing their profession (an increase of 3% compared with a previous survey in October 2020) (Ordre National des Infirmiers, 2021[27]). A more recent survey from December 2021 found that

over 80% of nurses thought that their working conditions had worsened since the pandemic began, and 15% of all nurses said they wish to change professions over the coming year (Ordre National des Infirmiers, 2022[28]).

- In the United Kingdom, 57% of nurses reported in October 2021 that they were considering or planning to leave their job in the coming year, up from 36% a year earlier. The main reasons for thinking about leaving were feeling undervalued, feeling under too much pressure, feeling exhausted, insufficient staffing levels and insufficient pay (Royal College of Nursing, 2021[29]).
- In the United States, 11% of nurses and nurse managers reported in 2021 that they intended to leave their job, and another 20% were undecided about keeping their job. The proportion of nurses and nurse managers intending to leave their job was particularly high among the most experienced (those with over 25 years of experience) (Raso, Fitzpatrick and Masick, 2021[30]).

Table 10.3. Impact of COVID-19 on nurse working conditions and intention to leave, selected OECD countries

Country	Survey coverage and timing	Key findings
Belgium	Survey of 2 530 health workers and caregivers (including 698 nurses and health care assistants), March 2021	• 59% reported feeling tired. • 51% reported being under pressure/stress. • Nearly 40% reported mental health issues. • 19% are considering leaving the profession.
Canada	Survey of 3 676 nurses, June-July 2020	• 52% reported inadequate nurse staffing. • 47% met the diagnostic cut-off indicative of potential post-traumatic stress disorder.
	Survey of 4 467 nurses, Nov-Dec 2021	• 94% experienced symptoms of burnout. • 45% screened positive for severe burnout. • Over 80% reported insufficient staffing. • 60% said quality of care has declined over the past year. • 50% are considering leaving their jobs over the next year. • 20% are considering leaving the profession.
France	Survey of 30 000 nurses, April-May 2021	• 77% considered that the nursing profession was not better recognised since the beginning of the pandemic. • 51% considered that the nursing profession does not allow career development and prospects. • 40% reported that the crisis made them consider changing profession (+3% compared with October 2020).
	Survey of 60 000 nurses, December 2021	• 82% considered that their working conditions had worsened since the beginning of the pandemic. • 54% of nurses working in public facilities reported to be in burnout, with negative impacts on quality of care. • 15% of all nurses reported wishing to change profession over the next 12 months; 30% over the next five years.
United Kingdom	Survey of 9 577 members of the Royal College of Nursing, October 2021	• 57% were considering or planning to leave their job over the next year (versus 36% the previous year). Commonly cited reasons were feeling undervalued (70%), feeling under too much pressure (61%), feeling exhausted (60%), low staffing levels (59%) and low levels of pay (53%).
United States	Survey of 20 665 health care workers (incl. 2 301 nurses) at 124 institutions, 2020	• 1 in 3 nurses intended to reduce work hours and 2 in 5 nurses intended to leave their practice (burnout, workload, COVID-19-associated stresses and feeling undervalued were associated with those outcomes). • 63% of nurses reported burnout. • 56% of nurses reported work overload.
	Survey of 400 frontline nurses, 2021	• 22% indicated they may leave their current positions. • 60% were more likely to leave since the pandemic began, with insufficient staffing, workload and emotional toll the most reported factors.
	Survey of 5 000 nurses and nurse managers, 2021	• 11% intended to leave their position. • Pandemic impact on intention to leave was rated high overall; it was highest among nurses with over 25 years of experience and managers/directors. • 20% were undecided about keeping their position.

Sources: Belgium: Sciensano (2021), https://www.sciensano.be/en/biblio/power-care-lenquete-sur-le-bien-etre-des-personnes-et-professionnels-daide-et-de-soin-principaux, Canada: Havaei et al. (2021), https://pubmed.ncbi.nlm.nih.gov/33467080/; CFNU (2022), https://nursesunions.ca/wp-content/uploads/2022/02/Viewpoints_Survey_Results_2022_January_EN_FINAL-1.pdf, France: Ordre National des Infirmiers (2021), https://www.ordre-infirmiers.fr/actualites-presse/articles/les-infirmiers-sinterrogent-sur-leur-avenir-et-souhaitent-des-evolutions-profondes-de-leur-metier.html; Ordre National des Infirmiers (2022), https://www.ordre-infirmiers.fr/actualites-presse/articles/resultats-consultation-infirmiere-lordre-national-infirmiers-alerte-de-nouveau-sur-la-situation-de-la-profession.html,
United Kingdom: Royal College of Nursing (2021), https://www.rcn.org.uk/professional-development/publications/employment-survey-2021-uk-pub-010-075, United States: Sinsky et al. (2021), https://pubmed.ncbi.nlm.nih.gov/34901752/; Gretchen et al. (2021), https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/nursing-in-2021-retaining-the-healthcare-workforce-when-we-need-it-most; Raso, Fitzpatrick and Masick (2021), https://pubmed.ncbi.nlm.nih.gov/34519700/.

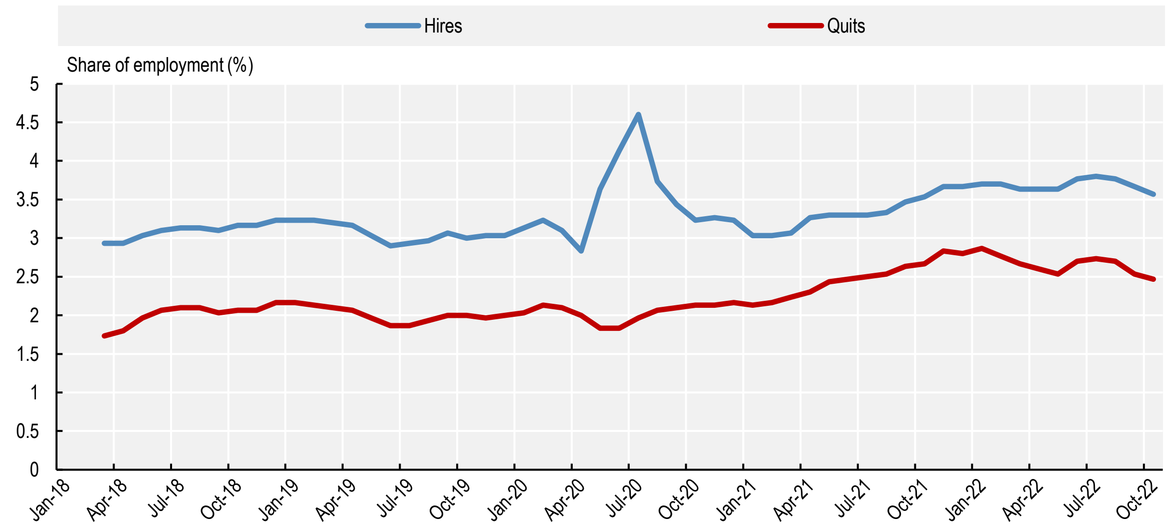
Some evidence has emerged of higher resignation rates among nurses and other health workers

Concerns about a possible “great resignation” of workers in the health sector (and in other sectors) emerged in the United States in early 2021, and a little later (2021 and 2022) in the United Kingdom. The term “great resignation” has been used to refer to the massive numbers of employee resignations from their jobs, because of long-lasting job dissatisfaction, wage stagnation (in a context of rising inflation) and safety concerns in the context of the COVID-19 pandemic.

Since early 2021, the percentage of workers in the health and social sector in the United States who have resigned from their jobs increased to about 2.5% of all workers per month in the second half of 2021 and 2022, up from about 2.0% per month before the pandemic (Figure 10.12). American workers in the health and social sector and in other sectors who left their jobs in 2021 reported as the main reasons that they were dissatisfied with their pay, with opportunities for advancement and career progression, and with the flexibility of their working conditions.

However, the number of workers who were recruited in the health and social sector increased faster than the number who resigned, so the overall number of workers increased.[2] The peak in hiring rates in the sector occurred after the first wave of the pandemic in summer 2020 (following a period of slowdown in hiring during the first wave and strong demand for health and social assistance workers), and remained higher in 2021 and 2022 than before the pandemic. The high resignation and hiring rates since early 2021 reflect a very dynamic job market, with many workers changing jobs to take advantage of better opportunities in a context of a tight labour market and very low unemployment rate. Despite all the job turnover, at the end of 2021, about 500 000 more people were working in the health and social assistance sector in the United States compared with 2020 (BLS, 2022[31]).

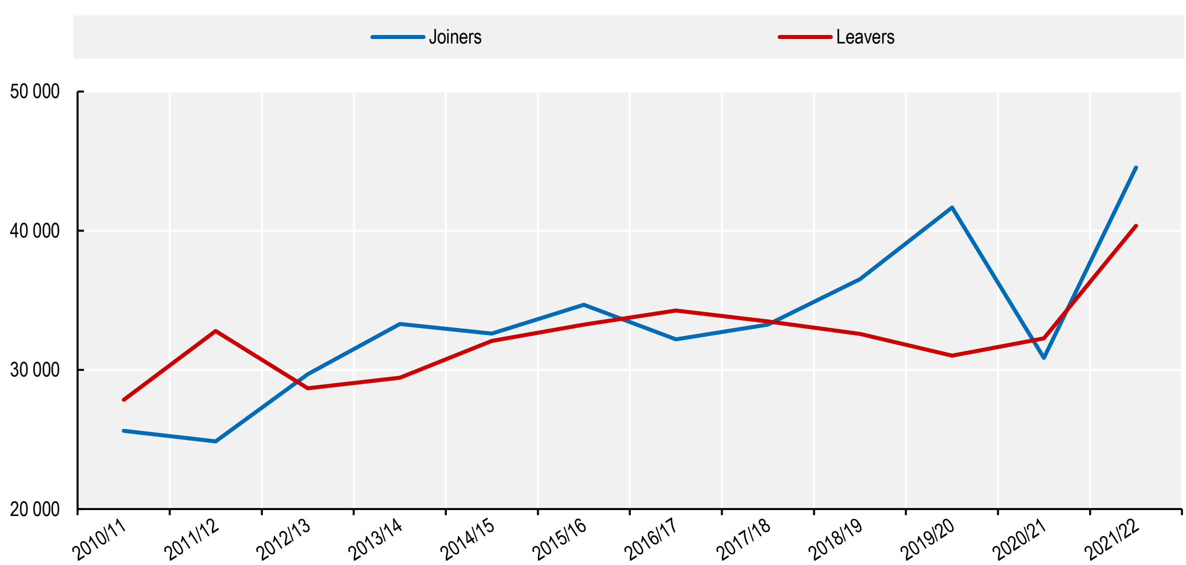
Figure 10.12. Resignation and hiring rates in the health and social sector in the United States, 2018-22



Note: Data are seasonally adjusted. They have been calculated as three-month moving averages to reduce some of the monthly variation.
Source: Bureau of Labor Statistics, Job Openings and Labor Turnover Survey, https://www.bls.gov/jlt/data.htm.

In England (United Kingdom), the number of nurses who have left the NHS reached an all-time high in 2021/22, with over 40 000 leaving active service between June 2021 and June 2022. More than half of leavers were less than 40 years old and therefore still many years away from retirement age (King's Fund, 2022[32]). At the same time, a record number of nurses joined NHS England in 2021/22 (Figure 10.13), driven largely by the international recruitment of nurses that also reached record levels in 2021/22.

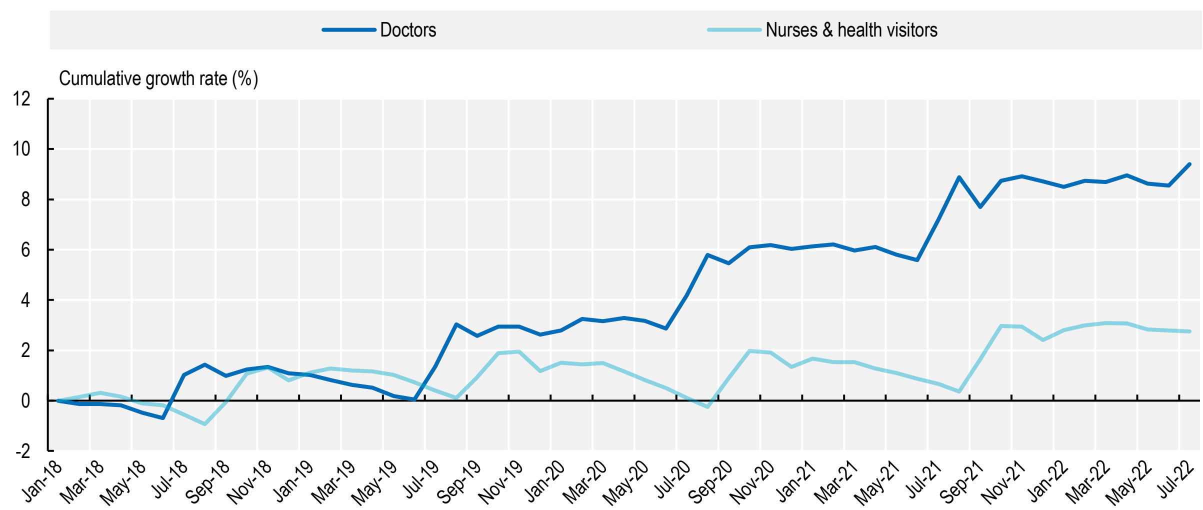
Figure 10.13. Nurses joining and leaving NHS England, 2010/11-2021/22



Note: The growth rate covers the period from June each year to June the following year. The data also include health visitors. Leavers include not only those permanently leaving the NHS but also those going on maternity leave or taking a temporary career break.
Source: Nuffield Trust based on NHS Digital data, https://www.nuffieldtrust.org.uk/resource/peak-leaving-a-spotlight-on-nurse-leaver-rates-in-the-uk.

Taking account of both entries into and exits from NHS England, staff numbers increased slightly during the pandemic. The number of hospital doctors was 5.6% higher in March 2022 than in March 2020, while the number of nurses was 1.6% higher. Focusing only on changes during 2021, the number of hospital doctors and nurses was 3.4% higher in December 2021 than a year earlier, but this growth may not have been sufficient to respond to greater demand (Figure 10.14).

Figure 10.14. Numbers of health workers in NHS England, 2018-22



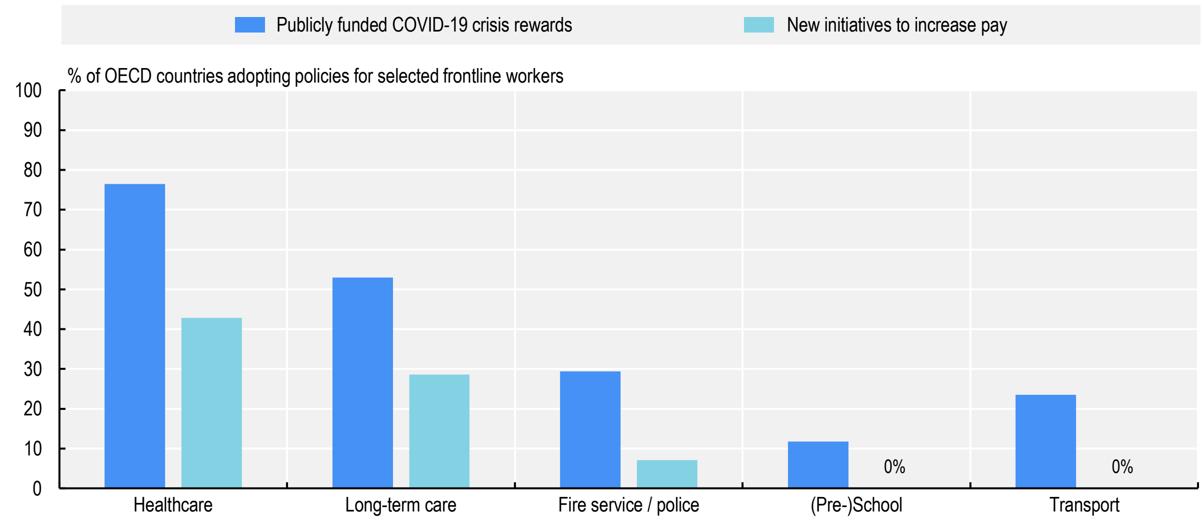
Source: NHS Digital, 2022 Hospital & Community Health Service monthly workforce statistics, https://digital.nhs.uk/data-and-information/publications/statistical/nhs-workforce-statistics.

Health workers in many countries have received financial rewards and pay increases since the pandemic began

Many countries provided one-off COVID-19 rewards (or bonuses) to frontline workers following the first wave of the pandemic in 2020, in recognition of their elevated health risks, additional workload and commitment. Rewards were especially common for health workers (reported in about 75% of the OECD countries surveyed through the OECD Questionnaire on Policy Responses to the COVID-19 Crisis in November 2021) and long-term care workers (about 50%). However, the value of the rewards and the coverage of health and long-term care workers varied across countries.

Permanently higher pay, rather than one-time bonuses, is an even more powerful way to recognise the value of different categories of health and long-term care workers. Up to November 2021, there had been fewer government-led initiatives of this kind, although about 40% of the OECD countries surveyed reported such permanent pay increases for health workers and about 30% for long-term care workers (Figure 10.15). Countries like Belgium, Chile and Slovenia reported initiatives to promote pay increases for health and long-term care workers; Hungary, Latvia and Switzerland for health workers; and the Czech Republic for long-term care workers.

Figure 10.15. One-off COVID-19 rewards and pay increases for health and long-term care workers



Note: For new initiatives to increase pay, data based on 14 country responses (AUT, BEL, CHE, CHL, CZE, FIN, HUN, ITA, JPN, LUX, LVA, NLD, SVN, SWE); for publicly funded crisis rewards, data based on 17 country responses (in addition: DNK, ISL, PRT). Several countries are not included, as these policy areas are the competence of subnational jurisdictions due to the country's federal structure.
Source: OECD Questionnaire on Policy Responses to the COVID-19 Crisis (November 2021).

In many countries, one-off bonuses and pay increases focused on nurses and health care assistants in hospitals and nursing homes. In Germany, bonuses were provided in 2020 for nurses and other employees working in long-term care, and for nurses in hospitals with a minimum number of COVID-19 patients (nearly one-quarter of all hospitals qualified). An additional bonus was provided for nurses in about half of all hospitals in 2021. The national bonuses were in most cases between EUR 500 and EUR 1 500. Some federal states also provided additional bonuses of approximately EUR 500.

In France, payment for overtime work of nurses and other workers in hospitals and nursing homes was increased during the first wave of the pandemic in 2020. In addition, most hospital workers, including nurses and nursing aides, received a COVID-19 bonus after the first wave, ranging from EUR 1 000 to EUR 1 500, depending on the intensity of the pandemic in each region. To improve recruitment and retention, all health workers in hospitals and nursing homes received a permanent pay rise of EUR 183 per month in 2020, followed by another of between EUR 45 and EUR 450 per month, depending on professional categories and years of experience (OECD/European Observatory on Health Systems and Policies, 2021[33]). However, these pay increases have not prevented a growing number of nurses in France preferring temporary jobs from interim companies rather than permanent jobs from hospitals, as they can often earn more as interim staff than regular staff. This is also the case in Belgium (Box 10.5).

Box 10.5. Impacts on hospital functioning and costs of using interim staff to address workforce shortages

The increased use of interim staff to address staff shortages in hospitals in countries like France and Belgium has had serious consequences. It has increased costs for hospitals and generated tensions in the workplace, as workers doing the same jobs are often paid more when employed by an interim company than if they are directly employed by the hospital. The growing use of interim staff has increased costs for hospitals because they must pay more for the same employees and must also pay additional fees to interim companies.

In France, hospitals increasingly relied on interim doctors and nurses to fill vacant posts in emergency departments and other hospital units in the first half of 2022. Interim doctors can earn 2-3 times more than their counterparts who have a regular contract with the hospital, while interim nurses can earn about 30% more. Interim staff also have much more flexibility to choose their working hours than regular staff. Some hospitals have offered financial incentives (such as one-off bonuses) to encourage interim nurses to accept longer-term contracts, but the take-up of these more regular posts has been very limited and has not reduced sufficiently the advantages of working as interim staff.

In Belgium, hospitals and long-term care providers in the Flanders region also increasingly relied on interim staff to fill gaps in their nursing and care workforce in 2022. As interim agencies are not bound by the agreements in the health and long-term care sector, nurses and care workers employed as interim staff can bargain for better working conditions (e.g. higher wages, flexible working hours and extra advantages such as a company car). Thus, hospitals and nursing homes increasingly saw their staff leave to join these interim agencies, which find them positions back in hospitals and care institutions – in some instances, even in the same institutions from which they resigned.

Sources: 20 Minutes (2022), https://www.20minutes.fr/sante/3301347-20220606-hopital-pourquoi-sujet-interim-capital-mission-flash-urgences; VRTnws (2022), https://www.vrt.be/vrtnws/nl/2022/03/28/opstappen-in-de-zorg-en-dan-aan-betere-voorwaarden-terugkeren-al/.

In the United Kingdom, nurses in Scotland, Northern Ireland and Wales received a bonus payment in 2020/21 in recognition of their contributions during the pandemic, but those in England did not. NHS nurses and other staff in England received a 3% pay increase in 2021/22, but this was below the inflation rate, which meant a reduction in wages in real terms. In 2022/23, the British Government proposed another pay increase for NHS employees of 3%, but this is expected to be well below the inflation rate, meaning a further reduction in real wages (Shembavnekar and Buchan, 2022[15]).

In some countries, including Denmark, nurses have not been satisfied by the pay increases received since the pandemic. Members of the Danish Nurses Union went on strike for 10 weeks during summer 2021, demanding higher wages and increased staffing. An emergency law ended the strike at the end of August 2021, providing a 5% wage increase over three years, falling short of union members’ demands.

Rapid increases in the consumer price inflation rate in 2022 and 2023 can be expected to increase demand for higher pay increases from nurses and other health workers to avoid losses in purchasing power. If the pay increase in the health sector falls short of what workers in other sectors receive, this can be expected to incentivise health workers to consider changing jobs. However, the current situation of health worker shortages should be conducive to wage increases.

Interest has been renewed in minimum staffing requirements

Health workforce shortages during the pandemic have sparked renewed interest among professional associations and other stakeholders in setting required minimum staffing ratios. Calls have been made to set such ratios, focusing either on specific hospital units (such as ICUs and maternity wards) or more broadly at a health system-wide level.

For example, the Belgian Health Care Knowledge Centre (KCE) has recommended that Belgian authorities (and possibly also European-level authorities) define minimum safe patient-to-nurse ratios, adapted to the patient acuity levels in specific hospital units (such as ICUs), based on international standards. The KCE recognises, however, that it is not yet possible to formulate precise recommendations because of differences in the definition of ICUs across countries, and differences in patient case mixes (Van den Heede Koen et al., 2022[34]).

At a broader system-wide level, the Standing Committee of European Doctors suggested in November 2021 that the European Commission might issue benchmarks for minimum ratios of health professionals per patient. These would support countries in meeting safe staffing levels – both for baseline universal health coverage and for health emergencies (CPME, 2021[35]).

Experiences of minimum staffing levels date back at least 20 years. In 2001, the state of Victoria in Australia adopted a law making it mandatory for large public hospitals to have minimum nurse-to-patient ratios. These were set at five nurses to 20 patients in acute medical and surgical wards. In 2004, California became the first state in the United States to implement similar nurse-to-patient ratios, depending on the hospital unit (for example, the ratio in paediatric and emergency departments was set at one nurse to four patients, while the minimum in a psychiatric ward was set at one nurse to six patients). More recently, Germany imposed minimum staffing requirements in hospitals in 2019 to increase the number of practising nurses. A maximum number of patients per nurse was defined for hospital units where nursing staff are especially needed, such as in intensive care, geriatric care and cardiac care. A distinction was also made between day and night shifts. For example, in cardiac surgery units, the ratio was set at a maximum of seven patients per nurse on a day shift and a maximum of 15 patients per nurse on a night shift.

The advantages and disadvantages of setting such minimum staffing requirements have been debated since they were first implemented (Buchan, 2005[36]). The main advantages are that this is an effective instrument to increase staffing levels, reduce the workload of existing staff, and improve quality of care and patient safety. As such, minimum staffing requirements increase job satisfaction for nurses and can also increase retention rates. The main disadvantages are that minimum staffing ratios are inflexible, are inefficient if not set at a proper level and raise staffing costs. In Germany, the newly set minimum staffing requirements were lifted temporarily in 2020 to provide greater flexibility to allocate more nurses for COVID-19-related activities.

One practical challenge to implementing minimum staffing ratios is to define precisely what constitutes a “safe” and “minimum” staffing level required in different parts of hospitals or outside hospitals. Different categories of health workers (doctors, pharmacists, nurses and health care assistants) can play various roles in delivering the same health services, and the possibilities of substitutions and complementarities are numerous. As the pandemic experience showed, the implementation of minimum staffing requirements may also need to be adapted under special circumstances, such as public health emergencies, to provide sufficient flexibility to respond to abrupt surges in demand for certain types of care.

10.3.7. Countries are increasing flexibility in health service delivery

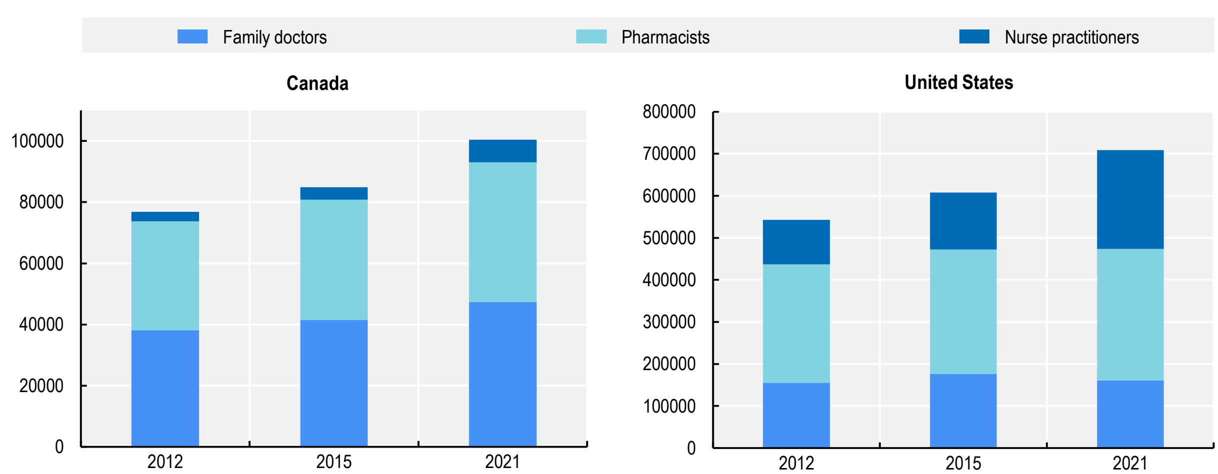
The pandemic provided opportunities to expand the roles of some health care providers like pharmacists and nurses to respond to the surge in demand for COVID-19-related care and to maintain continuity of care for the rest of the population. Beyond contributing to the massive effort of COVID-19 testing and vaccination, pharmacists and nurses (particularly those in advanced practice) in several countries were given new or additional authorisations. These workers were permitted to renew or extend prescriptions for people with stable conditions; to provide advice, treatment and referral of people with common health issues to avoid unnecessary visits to emergency departments in hospitals; and to vaccinate people against other infectious diseases like influenza.

Community pharmacists were granted the opportunity to renew repeat prescriptions in countries including Canada, France, Ireland, Italy, Portugal and the United States. In Belgium, Ireland, Italy, Norway and Portugal, community pharmacists were given expanded roles in dispensing and administering influenza vaccinations for people aged 65 years and over and other at-risk groups. In Belgium, Germany, the Netherlands, Portugal and the United Kingdom, community pharmacists were also granted the opportunity to provide alternative solutions when medicine shortages occurred (PGEU, 2021[37]).

Several countries also expanded the traditional roles of nurses to respond to the surge in demand for care in response to the pandemic. In Italy, the government formalised the role of "family and community nurses" in May 2020 as a new type of advanced practice nurse to strengthen home-based care and support the activity of new special units for continuity of care. The Italian Government allocated EUR 480 million to hire an estimated 9 600 of these nurses in 2021 (Government of Italy, 2020[38]). Most countries who responded to the OECD Resilience of Health Systems Questionnaire 2022 reported that they were introducing or expanding more advanced roles for nurses to tackle persistent shortages of GPs and other doctors, and to make nursing a more attractive profession (Figure 10.7 and Figure 10.8). These included countries with long experience with advanced practice nursing (such as Canada, Finland, the United Kingdom and the United States) and other countries with more recent experience (such as France, Greece and Italy).

In countries like Canada and the United States, where advanced practice nursing has existed for several decades, nurse practitioners represent a sizeable and growing proportion of primary care providers, along with GPs and pharmacists (Figure 10.16). However, in most other countries, they still represent only a very tiny proportion of all primary care providers.

Figure 10.16. Share of pharmacists and nurse practitioners among primary care providers, Canada and the United States, 2012-21



Note: In Canada, only about half of all nurse practitioners work in primary care, while this proportion is about 70% in the United States. A small proportion of pharmacists in Canada and the United States work in hospitals (not in the community). In the United States, family doctors include both family medicine and general internal medicine doctors.
Source: Canada: CIHI, https://www.cihi.ca/en/health-workforce; United States: Bureau of Labor Statistics, Occupational Employment and Wage Statistics data, https://www.bls.gov/oes/tables.htm.

10.4. Conclusions: A stronger, more adaptable health workforce builds health system resilience

A powerful lesson from the COVID-19 pandemic is the crucial importance of the health workforce – and particularly frontline health workers – in treating patients, while often putting their own health and safety at risk. Although countries faced many resource constraints in absorbing the pandemic, the biggest constraint was a lack of health workers to respond to the surge in demand for care.

Greater investments are needed to strengthen health workforce capacity and flexibility, both to achieve universal health coverage and to avoid the risk of another public health crisis occurring with these critical structural weaknesses. Investing in the health workforce is an investment in health system resilience. At least half of investments to strengthen health systems and improve their readiness to address future shocks should be allocated to increasing training and recruitment; improving working conditions; and increasing the flexibility of the health workforce to respond to shocks and strains (see the chapter on investing in resilience).

Increasing training capacity is key to increasing the supply of doctors, nurses and other health workers to foster health system resilience in the medium and long term, especially in those countries where training capacity was low before the pandemic. Increasing retention rates of existing health workers and promoting more optimal skill mix and skill use are crucial to address workforce shortages in the short term, as countries seek to boost their recovery from the pandemic.

Training more health workers is crucial for most OECD countries

Many OECD countries have increased the number of students in medical and nursing education programmes in recent years to address shortages in the medium to long term. In many countries, decisions to increase student intakes preceded the pandemic, but the number of students has continued to increase. Domestic education and training should be designed to train enough new doctors, nurses and other health workers without having to rely unduly on international recruitment to fill domestic needs.

Policy decisions and guidance on student intakes in medical, nursing and other health education programmes need to be based on more robust and sophisticated health workforce planning and forecasting models. Planning should take into account demographic factors, as well as economic factors and innovations in health service delivery that may affect future demands for different types of doctors, nurses and other health workers.

Attracting enough young people into nursing is an important priority to address current and future shortages. It is heartening to see that the interest of young people in pursuing a career in nursing does not appear to have lessened since the pandemic. The number of student applications and admissions in nursing education programmes rose in 2020 and 2021 in many countries (e.g. Italy, Spain, the United Kingdom and the United States). However, the proportion of male students continues to be very low: over 80% of nursing students in many countries are female.

Improving working conditions is key to increasing retention

Increasing retention rates of existing doctors, nurses and other health workers is a key short-term priority to avoid a vicious cycle of growing shortages. Although evidence of a high level of resignations of health workers remains limited thus far, improvements in working conditions are needed to increase worker satisfaction, motivation and retention. These may require reducing workloads and pressure on staff; supporting their health, well-being and safety at work; and reviewing their pay rates. Such improvements in working conditions are particularly necessary for categories of workers that have traditionally been undervalued, such as nurses and health care assistants. They are also particularly urgent in countries experiencing significant losses of doctors and nurses through early retirement or emigration to other countries. While some of these measures may be implemented at a national level, several others need to be tailored at a more local level.

Many countries launched surveys to monitor health workforce safety and well-being during the pandemic. It will be important to continue to measure and address the safety and well-being of health workers regularly as these issues will not go away.

Increasing flexibility is needed to respond to shocks and strains on health systems

A key factor in resilience is how quickly and effectively health systems are able to use current health workers and any additional workers to respond to shocks and strains. The pandemic highlighted the need to mobilise additional health workers quickly to cope with a surge in demand for certain types of care. Most countries were able to mobilise such human resources by providing quick training and reallocating current staff to clinical areas with the greatest need (such as ICUs) and by drawing on retired or other inactive doctors and nurses, and medical and nursing students nearing the end of their studies, to support testing, tracing and isolating activities, and vaccination campaigns.

Health systems not only need to be better prepared to face unpredictable shocks in the future but also to adapt continuously to respond to predictable strains arising from population ageing and the growing burden of chronic diseases, including long COVID. The pandemic accelerated the development of new roles for some health care providers, such as pharmacists and advanced practice nurses, in prevention, testing and management of COVID-19 and other chronic and communicable diseases. However, strategies used to address health workforce shortages during the pandemic were often adopted on a temporary basis. Countries need to assess whether these strategies should become a more permanent feature of their health service delivery models, contributing to a more resilient and flexible workforce in the future.

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Notes

[1] The data for France cover the period from 1 March to end of June 2020, while the data for Italy, Spain and the United States extends to the end of August 2020.

[2] A full account of recruitment to and exits from the sector should also take into account layoffs by employers. However, layoffs from the health care and social assistance sector in the United States were relatively low and stable in 2021 and early 2022, at a rate of about 0.5% of total employment each month, according to data from the Job Openings and Labor Turnover Survey.

11 Securing supply chains

Sébastien Miroudot, Cemre Balaban, Ruth Lopert, Suzannah Chapman and Philip Haywood

The effective functioning of health systems relies on an adequate and reliable supply of equipment and therapeutics, including essential medicines and medical devices. While shortages of both types of products occurred prior to the COVID-19 pandemic, it highlighted some key vulnerabilities in their respective supply chains. This chapter outlines the nature of medicine and medical device supply chains, and presents several case studies – both pre- and post-pandemic. Finally, it identifies policy options for improving the responsiveness and reliability of supply of medicines and medical devices, to support the resilience of OECD countries' health systems and, by extension, their economies.

Key findings

The effective functioning of health systems relies on the availability of adequate and reliable supplies of equipment and therapeutics, such as essential medicines and medical devices (including consumables). Medicines and medical devices are sophisticated products, subject to complex regulatory frameworks and manufactured via long international supply chains.

Before the COVID-19 pandemic, issues of quality, concentration of markets and profitability of some products contributed to supply disruptions and shortages. Supply chains showed considerable elasticity in the face of extreme stress in the initial stages of the pandemic. Nonetheless, disruptions and shortages of key medicines, testing reagents, and personal protective equipment (PPE) were experienced, due to spikes in demand and bottlenecks in supply. For example, almost all OECD countries (23 of 25) that responded to the OECD Questionnaire on Resilience of Health Systems 2022 experienced problems securing PPE early in the pandemic.

Against this backdrop, this chapter presents case studies of three medicines (propofol, low-molecular-weight heparins and macrolide antibiotics) essential for future health crises. A suite of policy options to improve the responsiveness and reliability of medical supply chains follow:

- Promoting the long-term resilience of medical supply chains would benefit from **collaborative approaches** that balance measures best undertaken by the private sector with those more appropriately managed by governments, as well as internationally harmonised and co-ordinated approaches to regulation and stockpiling.
- Difficulties in identifying the suppliers and countries involved in medical device supply chains can undermine assessment and mitigation of risks by governments. Greater **transparency** and improved reporting are needed to ensure resilient and secure supply. Real-time information and co-operation between countries and manufacturers may be required to anticipate and address issues.
- **Quality** issues may be at the origin of shortages of some medicines and medical devices. Rules and standards exist to avert quality issues, but implementation and enforcement can be challenging. Having sufficient manufacturing capacity drawing on diversified sources of supply helps to prevent quality issues from driving shortages.
- Market dynamics and regulatory requirements may discourage investment in production **capacity** and limit **diversification** in supply. Greater supplier diversity and increased capacity require a reassessment of current procurement and pricing practices for some products. While industry policies may support long-term stability and predictability for firms, caution should be exercised to ensure that policy instruments do not disrupt the smooth functioning of international supply chains.
- Trade and transnational production are important to enhance diversification of supply and create additional capacity at the global level. In particular, trade is important for access to technology and equipment. Economies of scale create **efficiencies** that also contribute to the resilience of health systems.
- As a first-tier resilience strategy to mitigate spikes in demand, stockpiling is important. To be efficient and effective, stockpiling strategies should be **planned and co-ordinated** with the private sector and across countries.

Securing supply chains for essential medicines and medical devices will improve outcomes during crises, strengthening overall health system resilience. It will also encourage predictability and reliability between disruptions.

11.1. The COVID-19 pandemic added pressure to medical supply chains

The COVID-19 pandemic was an enormous shock for health systems and the source of massive levels of morbidity and mortality. Dramatic shortages were observed globally for some essential medical devices, such as personal protective equipment (Gereffi, 2020[1]). Supply chains for medicines showed relatively greater resilience in the face of extreme stress. Nonetheless, demand increased significantly for essential medicines[1] used in intensive care units, such as anaesthetics, creating disruptions in supply and local shortages (Choo and Rajkumar, 2020[2]; Dey et al., 2021[3]; Gereffi, Pananond and Pedersen, 2022[4]).

The effective functioning of health systems relies on the adequate and reliable supply of equipment and therapeutics, including essential medicines and medical devices. Transparency regarding available stocks and production capacity between private and public stakeholders, and between countries, would improve co-ordination and predictability.

Medicines are sophisticated products, subject to complex regulation. Medical devices represent a wider spectrum of product types with commensurate diversity in regulation. Shortages of prescription medicines are not unusual; shortages were a growing problem even before the pandemic, with issues of quality, concentration of markets and poor profitability of some products contributing to frequent supply disruptions and stock-outs in many countries (Tucker et al., 2020[5]; Chapman, Dedet and Lopert, 2022[6]; FDA, 2019[7]). Vulnerabilities associated with global supply chains for medical devices were also recognised prior to the pandemic. These vulnerabilities are generally similar to those for medicine supply chains, including concentration of markets, a paucity of incentives to invest in resilience to ensure adequate supply, and poor visibility and transparency.

The pandemic introduced three additional pressures on medicine and medical device supply chains (Fox, Stolbach and Mazer-Amirshahi, 2020[8]; Miller et al., 2020[9]; Socal, Sharfstein and Greene, 2021[10]). First, it led to unprecedented spikes in demand for medicines and medical devices needed to treat COVID-19 patients. Second, lockdown policies and other measures taken by governments to contain the spread of the virus created disruptions in production and international transport networks. Third, export restrictions introduced by some governments exacerbated existing shortages. The compounding effect of these pressures led to extraordinary tensions in the procurement of essential medicines and medical devices at a time when supply chains were already vulnerable.

A supply chain may be defined as the flow of goods and services needed from production to consumption of a product. A supply chain failure is said to occur when supply is unable to meet demand, and may be categorised as the result of one or more of the following:

- demand surges
- capacity reductions[2]
- co-ordination failures (National Academies of Science Engineering and Medicine, 2022[11]).

All three categories of supply chain failure were observed during the COVID-19 pandemic. With this in mind, this chapter identifies policy options to improve the responsiveness and reliability of supply of essential medicines and medical devices, to support the resilience of the health systems and economies of OECD countries. This chapter has two separate, but related, objectives:

- to increase understanding of the structure and exposure to risk of global supply chains, and identify possible approaches to ensuring resilient response capacity
- to improve preparedness for future health crises in which demand surges or interruptions occur on the supply side, by managing and reducing supply chain risk exposure.

Section 11.2 describes the nature and context of pharmaceutical supply chains and identifies some of their particular vulnerabilities. It presents in-depth case studies of three medicines that were essential during the COVID-19 pandemic and are potentially important in future health crises: propofol; low-molecular-weight heparins (using the example of enoxaparin); and macrolide antibiotics (using the example of azithromycin). The products were selected for the case studies because they are:

- essential in the response to an outbreak of an infectious respiratory disease (such as COVID-19 or other viral respiratory infection) – e.g. medical oxygen, endotracheal tubes, pulse oximeters, intravenous anaesthetics, neuromuscular junction blocking drugs, parenteral nutrition
- essential for future health crises, for general health system functioning and required in intensive care settings – e.g. intravenous anaesthetics, heparins, broad spectrum antibiotics, iodine and selected vaccines.

Section 11.3 outlines some of the vulnerabilities of medical device supply chains – particularly those highlighted by the pandemic – and presents the results of the OECD Resilience of Health Systems Questionnaire 2022. Drawing on the medicine and medical device case studies and broader OECD work on the resilience of supply chains, Section 11.4 presents the key policy implications.

11.2. Pharmaceutical supply chains have several vulnerabilities

This section describes some of the vulnerabilities of pharmaceutical supply chains. First, it describes the general nature and context of pharmaceutical supply chains and explores their internationalisation and concentration (at an aggregate level). It presents a schematic of a generalised pharmaceutical supply chain to illustrate its complexity.

The next three sections present in-depth case studies of supply chains for medicines that were essential during COVID-19 and are likely to be important for managing different types of future health emergencies, irrespective of their nature: the intravenous anaesthetic agent propofol; enoxaparin, a low-molecular-weight heparin; and azithromycin, a macrolide antibiotic.

For each product, a stylised supply chain is presented to demonstrate the manufacturing process and potential bottlenecks, referring to the schematic introduced in Section 11.2.1. Stylised supply chains are needed because each product is different – they treat different patient populations and require different manufacturing and distribution processes. The case studies are based on publicly available information and interviews with pharmaceutical companies.

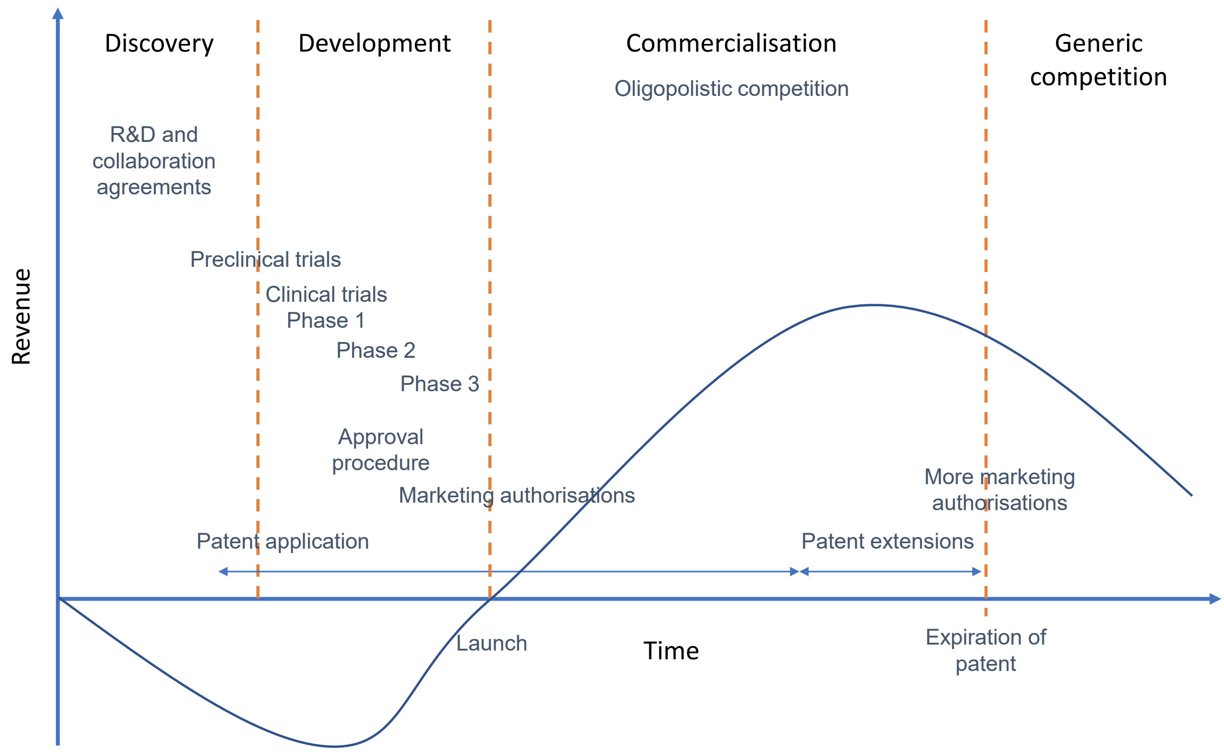
Supply chains differ across products, companies and regions. While the examples included in this section distil some policy implications for the resilience of health systems, they do not reflect the way production is organised for all medicines, or all essential medicines. The three products chosen for the case studies are also no longer patent protected. Although the expiration of patents allows more firms to enter the market, thus increasing the sources of supply, it also often leads to downward pressure on prices that are specific to off-patent markets; this may result in a decline in the number of suppliers over time, with implications for supply security. While not specifically considered in this analysis, patented products may, however, also be subject to a variety of challenges in security of supply.

11.2.1. Pharmaceutical supply chains are complex and internationalised

Most medicines are produced in sophisticated transnational supply chains. While organisation of production is driven in part by cost containment, it also reflects the complexities of production processes and product lifecycles (Lakdawalla, 2018[12]).

The lifecycle of a new medicine typically comprises four steps: discovery; development; commercialisation; and generic competition. Figure 11.1 provides an indicative timeline, illustrating the evolution of revenues for pharmaceutical firms along this cycle and the main regulatory steps to introduce medicines in different markets.

Figure 11.1. Revenues and regulatory steps along the pharmaceutical product lifecycle

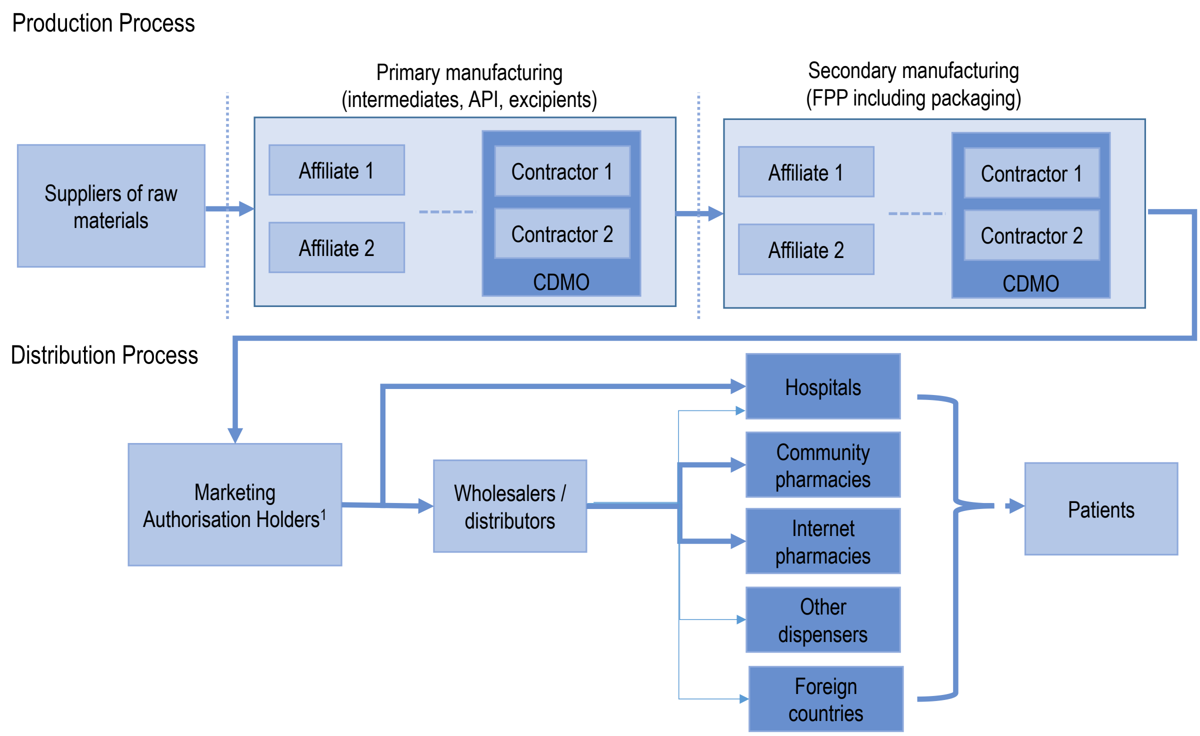


Sources: Based on Prajapati and Dureja (2012[13]), "Product lifecycle management in pharmaceuticals", https://doi.org/10.1177/1745790412445292, and Lakdawalla (2018[12]), "Economics of the Pharmaceutical Industry", https://doi.org/10.1257/jel.20161327.

Developing a new medicine is a complex and expensive process that may take 12-15 years from the discovery of the molecule to the launch of the finished product (Hughes et al., 2011[14]). Research requires expertise and international collaboration, and R&D often involves partnerships and agreements between firms in different countries. The development phase involves clinical trials, authorisations and certifications that are specific to the pharmaceutical industry and have to be carried out in different markets, often involving the experience and expertise of partner firms. Finally, mitigating the risk and cost of developing new medicines with cutting-edge technologies requires access to international capital and large markets.

It is during the development phase that supply chains become important to the manufacture of medicines. The complexity of pharmaceutical supply chains is illustrated in Figure 11.2. They involve a variety of stakeholders and steps that are generally undertaken in different facilities, and often in different countries (Chapman, Dedet and Lopert, 2022[6]).

Figure 11.2. The complexity of pharmaceutical supply chains



Note: Dotted vertical lines represent the possibility of an international border. FPP: finished pharmaceutical product; CDMO: contract development and manufacturing organisation. 1. This includes parallel traders, who are only relevant for distribution of products within the European Union (EU) and European Economic Area market. Parallel traders can act by buying from one wholesaler in one country and selling to another wholesaler in another country. They can supply third country markets, as well as community pharmacies, internet pharmacies and other dispensers.

Source: Chapman, Dedet and Lopert (2022[6]), "Shortages of medicines in OECD countries", https://doi.org/10.1787/b5d9e15d-en.

As an example, the production of a small-molecule medicine begins with raw materials that are chemical compounds used as the base for the extraction of intermediates. Primary manufacturing sites are responsible for producing active pharmaceutical ingredients (APIs) – the chemically active components of a medicine that produce the intended pharmacological effect on the body – from these raw materials. Secondary manufacturing is concerned with taking the API produced at the primary site and using it to create the finished pharmaceutical product. Excipients are added to APIs at this stage. Secondary manufacturing sites are often geographically separate from primary ones, and there are often many more secondary sites, serving local or regional markets (Shah, 2004[15]).

Marketing authorisation holders may rely on contractors (such as contract development and manufacturing organisations) to manufacture their products in the primary or secondary manufacturing stage. These contractors may operate under a development manufacturing contract to ensure appropriate quality along the supply chain. This may give rise to complex supply chain co-ordination issues. Moreover, the techniques used to manufacture APIs may require workers from a variety of disciplines and specialised firms to create economies of scale. Finding the necessary expertise and suppliers of inputs in a single economy is extremely challenging and may not be possible.

Once a medicine is produced and batches are released, they must be transported from the manufacturing site, stored at a wholesaler and distributed to the retail points of dispensing. Here, wholesalers are the principal stakeholders. In many countries, however, hospitals source their products directly from marketing authorisation holders, bypassing wholesalers.

By serving several markets or focusing on very large markets (such as the United States), sales may reach the level needed to recoup the costs of drug development during the commercialisation phase (Figure 11.1). Intellectual property protection (especially patents) plays a role in the financial sustainability of the product lifecycle, guaranteeing oligopolistic competition and higher revenues until the market reaches maturity. Various strategies are also available to firms to extend the duration of market exclusivity.

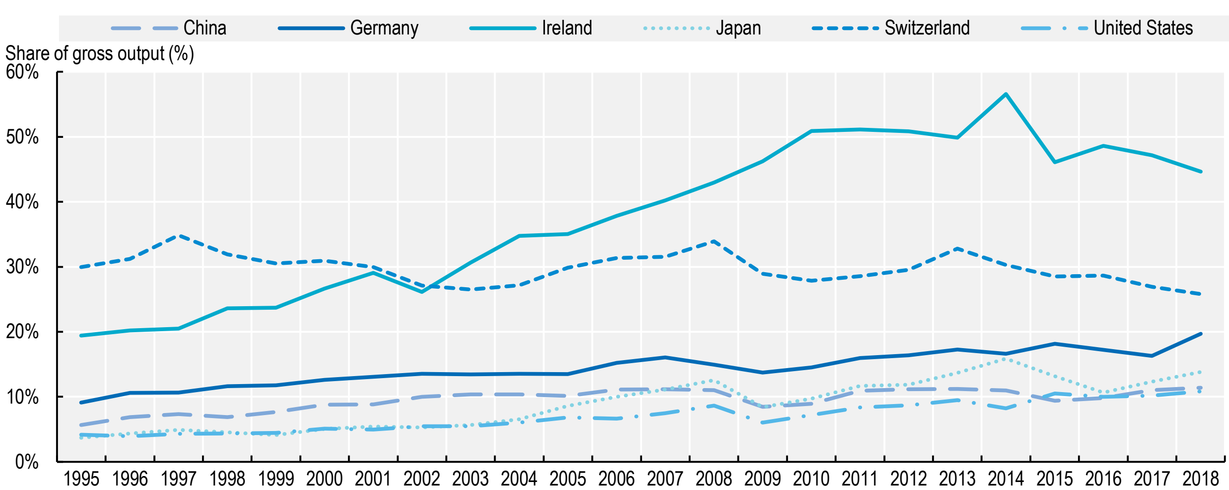
Once patents have expired, another business model is needed to ensure that essential medicines are still produced with sufficient commercial incentives during the generic competition phase. While the production processes of multisource medicines (those no longer protected by patent or market exclusivity, that are marketed or sold by two or more manufacturers) remain similar to those described in Figure 11.2, the firms involved in primary and secondary manufacturing, as well as contractors, are likely to be different once generic competition occurs. The involvement of firms from emerging economies with lower costs often features in this part of the product lifecycle. However, generic medicines are produced in many countries, and firms in emerging economies also participate in R&D and production of novel products.

Pharmaceutical supply chains are internationalised, but the majority of value added remains domestic

The production of medicines, both branded and generic, generally involves imported inputs, but the share of foreign value added in output (i.e. the value that corresponds to the contribution of imported inputs). varies across countries. One determinant is the size of the producing country, as large economies rely less on foreign sourcing than smaller economies. The OECD Trade in Value Added (TiVA) database provides an indication of the extent to which pharmaceutical supply chains are internationalised. Data in this section refer to the production of pharmaceutical products (output of the pharmaceutical industry) and all intermediate inputs needed (goods and services) along the supply chain.

Over the period 1995-2018, there was a slight increase in the share of foreign value added for pharmaceutical products produced in the United States, the People's Republic of China and Germany, but the share declined in Switzerland. In Ireland, it increased substantially in the 2000s before declining after 2014 (Figure 11.3).

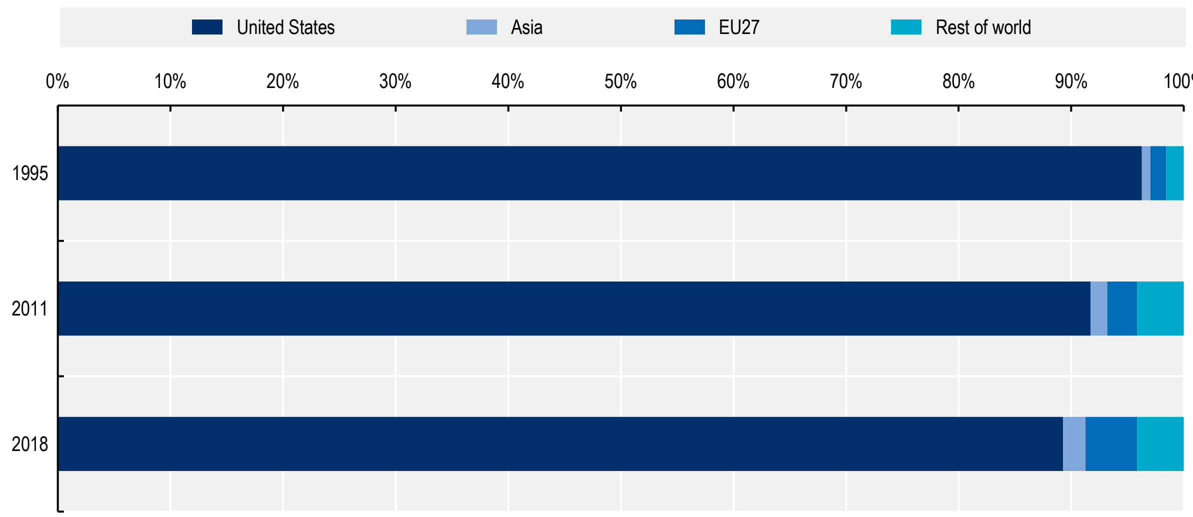
Figure 11.3. Foreign value-added share of production in the pharmaceutical industry, selected countries, 1995-2018



Note: Foreign value added as a share of total output of the pharmaceutical industry in each country. The foreign value added corresponds to value added originating in foreign countries and embodied in foreign and domestic intermediate inputs used by the pharmaceutical industry in each country. Countries included based on the size of their industry in world production of pharmaceutical products.
Source: OECD TiVA database.

When looking at the origin of value added in final demand of US pharmaceuticals (i.e. the consumption of finished pharmaceutical products produced by the US pharmaceutical industry), the additional foreign value added mostly came from the European Union (Figure 11.4). There was an increase in the value added sourced from Asia over time, but this still accounted for a very low share of final demand (less than 3%).

Figure 11.4. Origin of value added in final demand of US pharmaceutical products

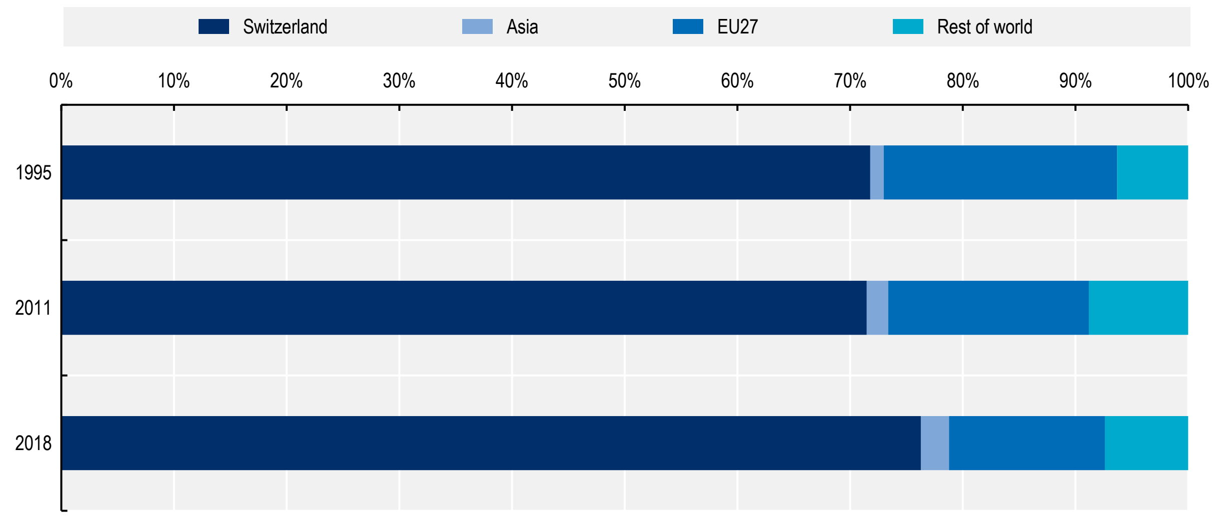


Note: This chart depicts by country of origin the value added in final medicines produced by the US pharmaceutical industry and sold in any destination market.
Source: OECD TiVA database.

In the case of Switzerland, there was an increase in the share of domestic value added between 2011 and 2018 (Figure 11.5).[3] A decrease in the share of value added sourced from the European Union explains the higher share of domestic value added. There was a slight increase in foreign sourcing from Asia, but Asia accounted for a small share of value added in Swiss pharmaceuticals in 2018 (4%).

These data are only available at an aggregate level for the whole pharmaceutical industry. It is possible that specific products have higher shares of foreign value added, but no such trend is seen at the aggregate level.

Figure 11.5. Origin of value added in final demand of Swiss pharmaceutical products



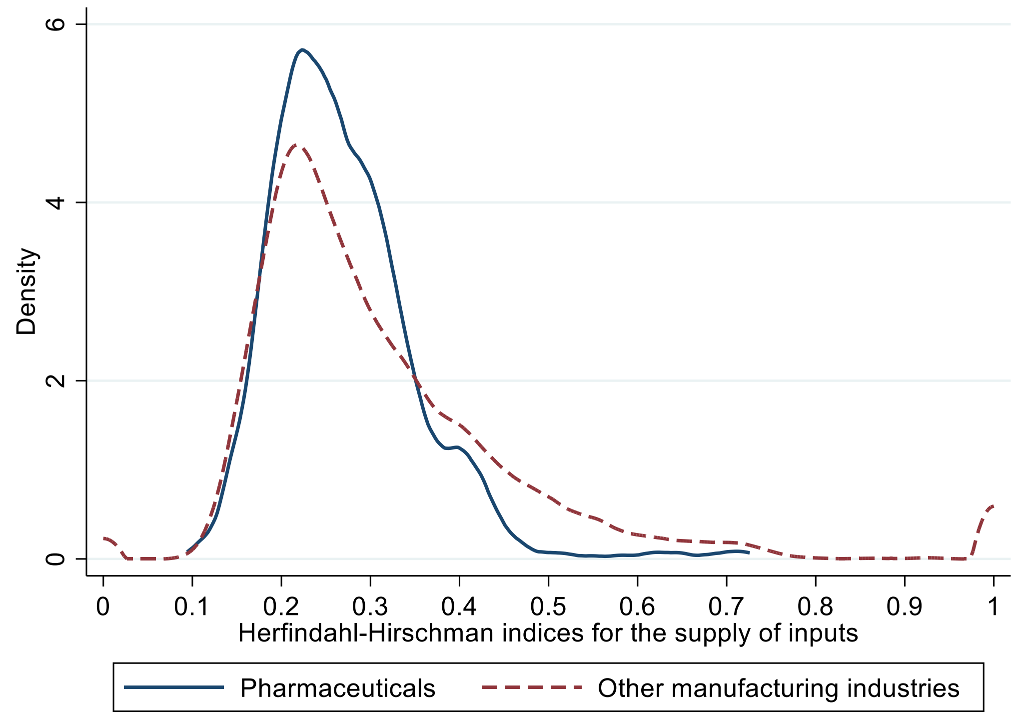
Note: This chart depicts by country of origin the value added in final medicines produced by the Swiss pharmaceutical industry and sold in any destination market.
Source: OECD TiVA database.

At an aggregate level, supply chains seem more diversified in pharmaceuticals than other industries

The OECD TiVA data can also be used to assess the concentration of supply in pharmaceutical supply chains, and whether final producers depend on a limited number of inputs coming from specific countries. The level of concentration is assessed with Herfindahl-Hirschman indices (HHI),[4] which have a value of 1 when there is full concentration (i.e. all inputs in the whole supply chain come from a single supplying country and industry) and a value close to 0 when sourcing is fully diversified (i.e. all inputs come equally from all countries and industries). Compared to other manufacturing supply chains, the distribution of HHI for pharmaceuticals (across producing countries) shows fewer occurrences of concentration (HHI values above 0.4). The peak in the distribution is slightly above 0.2, as most countries have diversified sources of supply (Figure 11.6).

These data are also at an aggregate level and different results might well be observed for individual pharmaceutical products. The diversification measured in Figure 11.6 could be the result of aggregation of imports of intermediate inputs used to make different products, each of which would rely on a limited number of sourcing countries. The case studies presented in Section 11.2 offer some insights into this.

Figure 11.6. Distribution across countries of Herfindahl-Hirschman indices for the supply of inputs, 2018



Source: Authors' calculations based on OECD inter-country input-output tables.

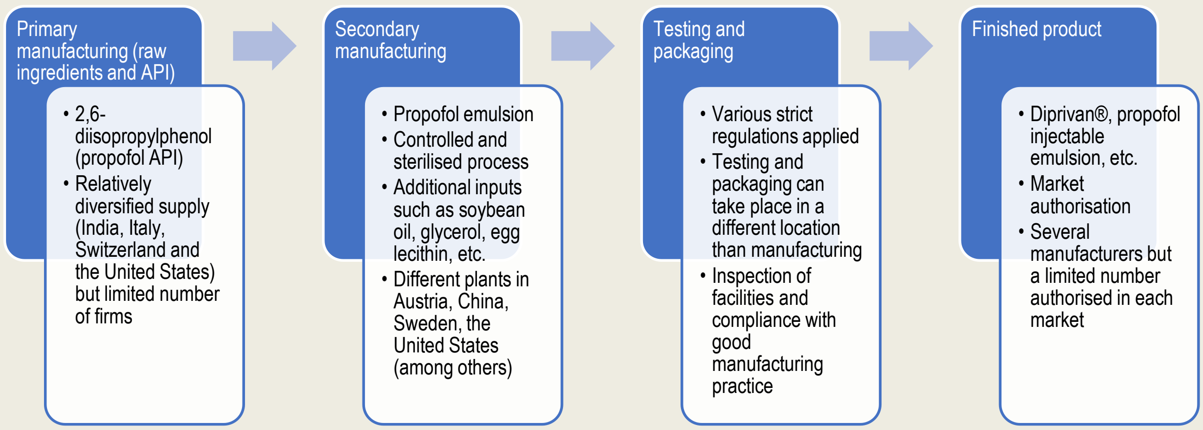
11.2.2. Propofol has a complex manufacturing process and significant global shortages have occurred

Propofol is an intravenous anaesthetic agent that is also widely used for continuous sedation of invasively ventilated patients in intensive care units. Consequently, it was in high demand during the COVID-19 pandemic. Propofol is on the Model List of Essential Medicines of the World Health Organization (WHO) because of its wide use and efficiency in general anaesthesia. Developed in 1977, it is now a multisource medicine. The propofol supply chain is complex, as it involves manufacturing a stable emulsion (Box 11.1).

Box 11.1. The propofol manufacturing process at a glance

Propofol's manufacturing process begins with the production of 2.6-diisopropylphenol, which is its API (Figure 11.7).

Figure 11.7. The propofol manufacturing process



Source: Based on Zhu (2022[16]), "A study of 3 COVID-19 treatment substances' global value chains [Unpublished dissertation]", and OECD interviews with companies.

The primary manufacturing process is complex, as the API has to be part of a stable emulsion. An emulsion is a mixture of two substances that are not normally miscible, such as oil and water. Propofol is a solution, in which small droplets of the API are maintained stably within a lipid emulsion. Supply of the API is relatively diversified, with production capacity in India, Italy, Switzerland and the United States; however, the overall number of suppliers remains low (fewer than 10). Firms interviewed relied on several suppliers and not on single-sourcing in this production stage, as a strategy to mitigate risks.

The secondary manufacturing stage consists of creating the emulsion and preparing the final product to be administered to patients. It is generally done by another firm, either a subsidiary of the brand manufacturer (the company that markets the product and sells it to final consumers) or an independent company through contract manufacturing. Different brand manufacturers may rely on the same suppliers, suggesting a rather concentrated industry. Production remains global, as firms serve different markets from the same supply chain, rather than through specific regional supply chains.

Emulsion instability is the first challenge and a potential quality issue in producing propofol. Due to its high "lipophilicity" (its ability to dissolve in fats, oils and lipids), dispersion of the API in the emulsion requires complex production techniques and rigorous controls along the supply chain. In addition, propofol is sensitive to air exposure, as contact with oxygen can cause impurities to develop. This is another constraint in the supply chain that creates additional costs (for specific storage conditions) and risks. As the number of suppliers is low, quality issues or delays in production may quickly create bottlenecks and shortages. This is the main weakness of the propofol supply chain.

Additional inputs are required to create the emulsion, such as refined soybean oil, glycerol and egg lecithin (phosphatides). These are generally supplied by a large number of firms, but the sterile process requires purified inputs of high quality. As such, switching suppliers may not always be easy. However, this part of the supply chain has not been regarded as a source of bottlenecks by manufacturers.

Once propofol is manufactured, testing and packaging occurs next. This is where brand manufacturers contribute. This involves implementing strict quality checks and dealing with complex regulations to be authorised to distribute the final product to a variety of markets. Authorisations include inspections at facilities and compliance with the code of good manufacturing practice. Testing and packaging generally occurs in locations separate from secondary manufacturing (involving flows of products across countries). While a reasonable number of firms sell propofol, not all products are authorised for sale in each market. This is one reason why there are often delays and sometimes shortages.

A significant shortage of propofol occurred in the United States in 2009-10 (Jensen and Rappaport, 2010[17]; Hvisdas et al., 2013[18]). At this time, three domestic companies were producing propofol for the market in the United States, but two had to recall products because of quality problems. One manufacturer closed its plant temporarily to address the quality issues, while the other ceased production altogether and left the market,[5] leaving a sole manufacturer supplying the entire US market at that time.

About 63% of drug shortages in the United States involve sterile injectable solutions, such as intravenous anaesthetic agents (FDA, 2019[7]). This is largely due to higher barriers to market entry for producing sterile injectable medicines (as opposed to oral solid-dose forms) because of the complexity of the production processes. As such, the pressure on prices may be lower than for other generic medicines when it comes to market competition. However, demand for lower prices may also come from health agencies and hospitals through procurement processes. A lack of economic incentives to produce propofol was cited as the main reason for the regular shortages observed around the world.

During the COVID-19 pandemic, spikes in demand put additional pressure on manufacturers, exacerbating existing tensions in the supply of anaesthetics. Several countries reported shortages and authorised special importations from companies whose products did not have domestic marketing authorisation (but were authorised in foreign countries with similar quality standards). For example, propofol was added to the Canadian list of drugs for exceptional importation and sale in April 2020. In the same month, France decided to centralise procurement of all sedatives and redistribute available supply to intensive care units based on the number of resuscitation beds (Montmeat et al., 2020[19]; Chapuis et al., 2022[20]). In the United States, the American Society of Health-System Pharmacists reported many propofol shortages in its dedicated database, mostly caused by increased demand and shipping delays. Propofol has also been categorised as a drug in shortage since April 2020 by the US Food and Drug Administration (FDA).

11.2.3. The low-molecular-weight heparin supply chain illustrates potential shortages due to unavailability

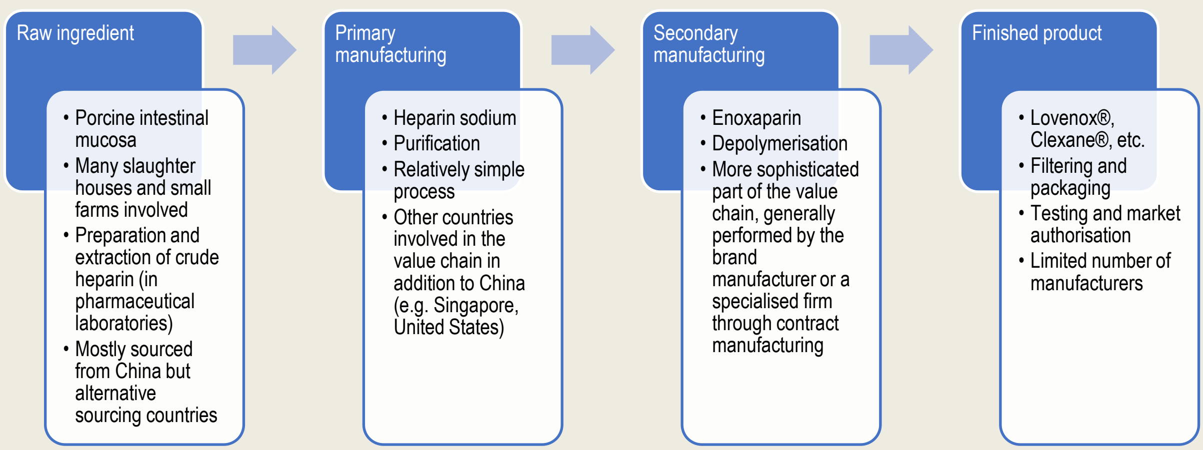
Low-molecular-weight heparins (LMWHs) are a class of anticoagulants derived from unfractionated (full-length) heparin and used in the prevention and treatment of venous thromboembolism and a range of other conditions requiring anticoagulation. This case study focuses on enoxaparin, one of the most widely used LMWHs.[6] Heparin and other anticoagulants have been used to treat COVID-19 patients found to be at a high risk of developing thromboses (Hippensteel et al., 2020[21]). The LMWH supply chain illustrates potential shortages related to the unavailability of a key input (Box 11.2).

Box 11.2. The low-molecular-weight heparin manufacturing process at a glance

LMWHs are derived from unfractionated heparin. Heparin is a heterogeneous preparation of long heparan sulfate and is a natural product extracted mainly from porcine intestines (Chandarajoti, Liu and Pawlinski, 2016[22]). Crude heparin can also be extracted from ovine and bovine lungs, but most production is derived from pigs.

The production process of enoxaparin starts with extracting crude heparin (Figure 11.8). Porcine intestines are boiled and dried to collect mucosal membranes. In the case of China, this process involves small farmers in rural areas. China is an important producer: 60% of crude heparin used to manufacture heparin sodium in the United States is sourced from China (Rees, 2019[23]). Once purified in a laboratory, heparin extracts are transformed into heparin sodium. China is one of the main suppliers of heparin sodium, although production capacity also exists in Singapore and the United States. Bottlenecks in the supply of crude heparin and heparin sodium, often in relation to diseases affecting pork or contaminations, are responsible for most shortages in this supply chain.

Figure 11.8. The enoxaparin manufacturing process

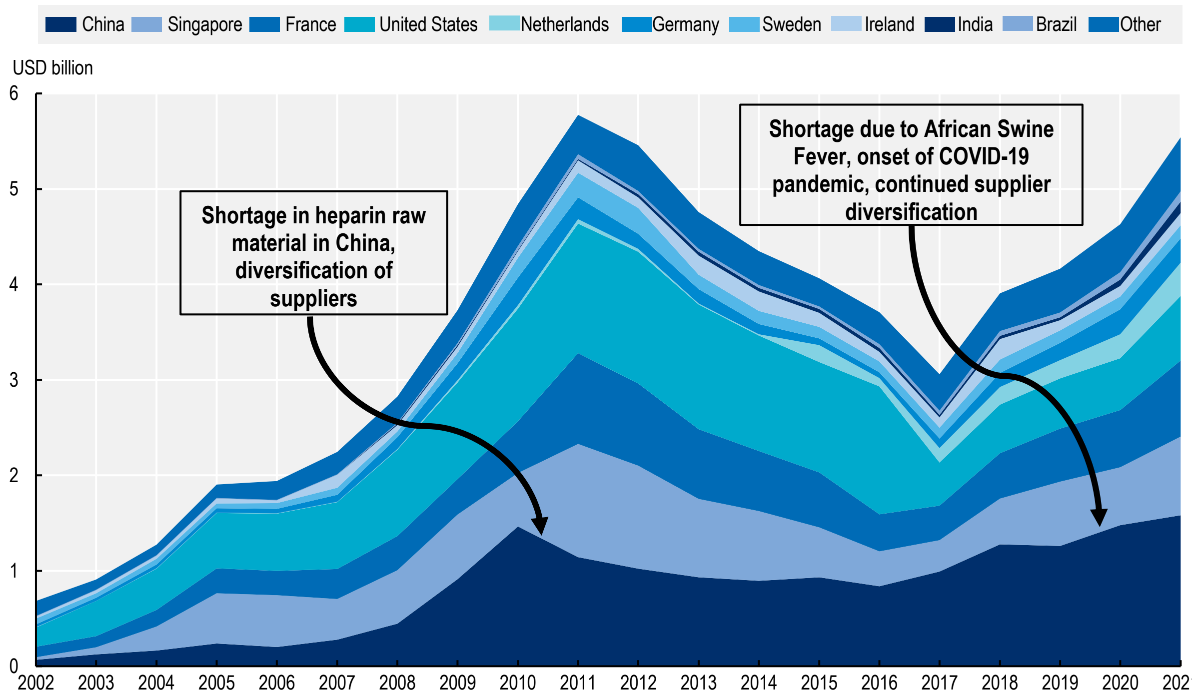


Source: Based on Zhu (2022[16]) and OECD interviews with companies.

The next step in the production process is to transform the full-length heparin into smaller fragments that acquire new chemical properties (the LMWHs). Enoxaparin is obtained through depolymerisation, which involves sophisticated techniques and creates more challenges to ensure the stability and quality of the resulting product. This step is done either by the brand manufacturer or by a specialised firm through contract manufacturing. As with propofol, testing and packaging, as well as obtaining marketing authorisation, constitute the step in the supply chain before distributing the final product.

Production of LMWHs is affected by the size and health of the pig population because porcine intestines are at the beginning of the supply chain. Countries that export crude heparin are also the top exporters of pork meat, such as China in Asia or the Netherlands in Europe. For example, the outbreak of African swine fever in China in 2019 reduced Chinese exports of heparin (Fareed, Jeske and Ramacciotti, 2019[24]). Figure 11.9 shows, however, that lower Chinese exports were compensated by higher exports from other countries, highlighting the existence of alternative sources of supply.[7]

Figure 11.9. Exports of HS 300 190 including heparin and its salts, 2002-21



Note: The Harmonised Commodity Description and Coding System, generally referred to as “Harmonised system or HS”, categorises products according to 6-digit codes. This figure shows exports of HS 300 190, which includes exports of heparin and its salts but is not limited to these products as it also includes other organs of animals for therapeutic use.
Source: Trade Map of the International Trade Center.

Exports of heparin increased significantly during the pandemic, confirming the capacity of the supply chain to meet the spike in demand and the role of trade in achieving this outcome. Economies such as the Netherlands have been increasing their share in the global market. The diversification of suppliers overall is reflected in the decreasing share of the top five suppliers to the global market. China continues to be the biggest exporter, but its share of the global market has been declining.

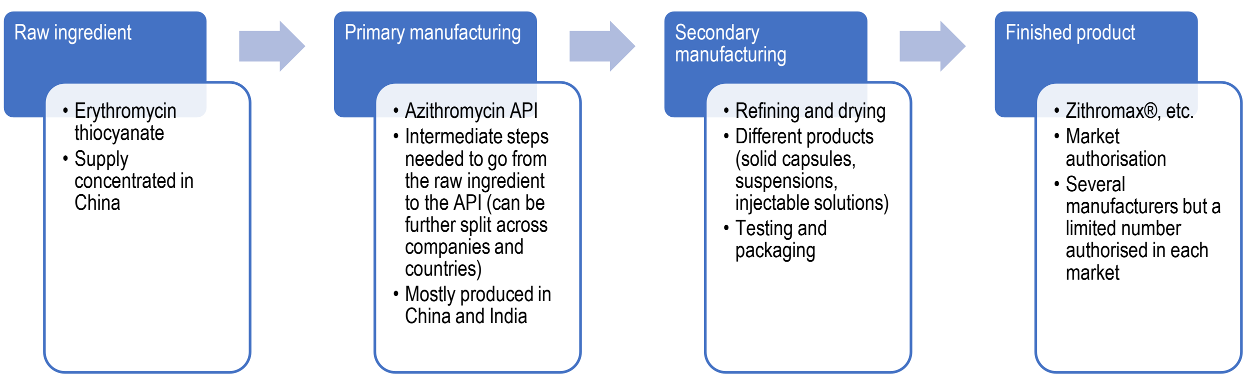
Figure 11.9 also illustrates another important shock that affected production of heparin and initiated this trend towards diversification of supply. In 2008, contamination of heparin sodium produced by a Chinese subsidiary of a US firm caused 150 deaths in the United States and 68 in other countries (Rosania, 2010[25]). Affecting the main supplier of unfractionated heparin in the US market, the contamination also created shortages due to recall of contaminated products and suspicions about the supply chain, with a further impact on health. The crisis was global, as several other countries were affected – including Germany and France, where the contaminant was also found in some batches of LMWHs. In Australia, where the product branded as Clexane® comprised more than 90% of the LMWH market, much of the supply was found to be contaminated and was recalled. The crisis put the emphasis on the responsibility of manufacturers and regulators to ensure the quality of inputs in the pharmaceutical value chain. New chemical tests were devised, and new rules implemented to avoid similar contamination.

11.2.4. Macrolide antibiotics require specialised production, discouraging diversification of supply

Azithromycin is a macrolide antibiotic commonly used for a variety of bacterial infections. It is included in the WHO's Model List of Essential Medicines. During the COVID-19 pandemic, azithromycin was in high demand following studies suggesting that it could be used as a treatment for mild forms of SARS-CoV-2. Randomised controlled trials later established that there was no clinical benefit associated with its use for this indication (Rodríguez-Molinero, 2021[26]).

The manufacturing process for azithromycin requires fermentation techniques (to produce erythromycin) and chemical techniques (to derive azithromycin). A simplified manufacturing process is shown in Figure 11.10. It was confirmed in several interviews with professionals and experts that only China currently has the capacity to produce erythromycin on a large scale. Thus, all macrolide antibiotics depend on China upstream in their supply chains. This type of organisation is referred to as a diamond-shaped supply chain and is known to increase systemic risks (Sheffi, 2015[27]). There are, however, several suppliers in China, located in different regions.

Figure 11.10. The azithromycin manufacturing process



Source: Based on Zhu (2022[16]), "A study of 3 COVID-19 treatment substances' global value chains [Unpublished dissertation]", and OECD interviews with pharmaceutical companies.

The fermentation at the beginning of the manufacturing process is a complex step that requires clean water and a favourable climate, as well as adequate infrastructure to deal with waste. Antimicrobial resistance is an important health issue and action is necessary throughout the antibiotic supply chain to prevent its development. One of the reasons for China's specialisation in production of antibiotic APIs is government support through the creation of biopharmaceutical industrial parks that provide the infrastructure and various services – such as third-party testing – to improve the quality of products (Deloitte, 2021[28]). Government support may also take the form of various types of subsidies (Table 11.1), leading to questions of potential market distortions and the absence of a level playing field that could otherwise promote more diversified supply (International Monetary Fund et al., 2022[29]).

China also produces the azithromycin API derived from erythromycin, although the primary manufacturing of the API is also performed in other countries. India is playing an increasing role in the supply chain of macrolide antibiotics, both as an importer of raw ingredients and as an exporter of APIs. Azithromycin API suppliers are found outside Asia, but the information gathered during the interviews suggests that their location of production might also be in Asia (through subsidiaries or contract manufacturing).

Table 11.1. Chinese government support to three companies in China producing azithromycin API

Company	Type of subsidy	Subsidies in 2021	
		USD equivalent	Proportion of turnover
Guobang Pharmaceutical Co Ltd.	Grants	2 726 173	0.39%
	Tax concessions	15 144 916	2.17%
	Below-market borrowing	1 799 326	0.26%
	Total	19 670 415	2.82%
HEC Pharm Co. Ltd	Grants	10 130 757	7.15%
	Tax concessions	2 295 248	1.62%
	Below-market borrowing	-	0.00%
	Total	12 426 006	8.77%
Shanghai Shyndec Pharmaceutical Co. Ltd.	Grants	18 118 018	0.84%
	Tax concessions	7 114 706	0.33%
	Below-market borrowing	13 141 652	0.61%
	Total	38 374 377	1.77%

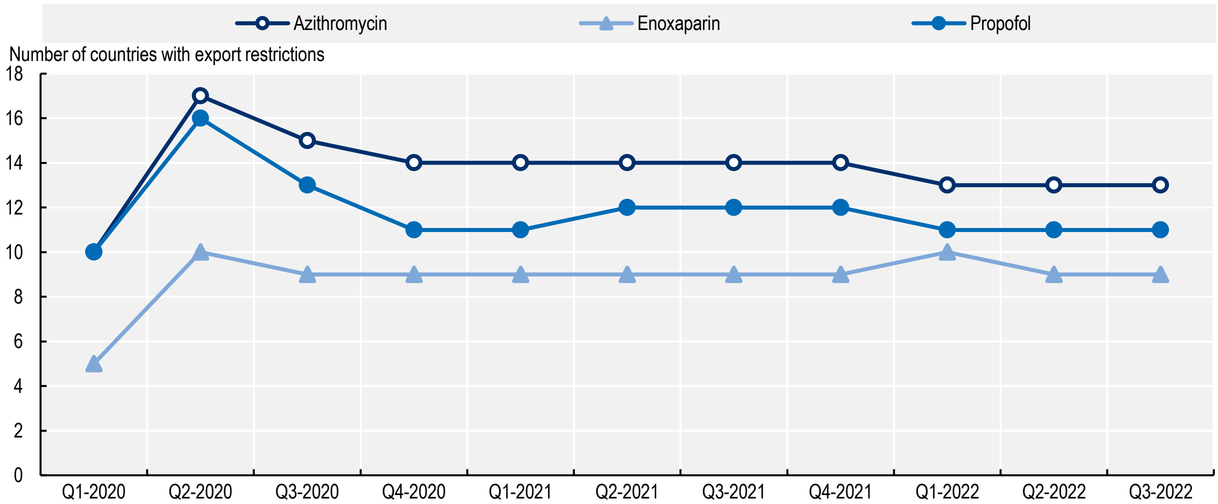
Note: Estimation of government support is based on OECD methodology, see OECD (2019[30]), "Measuring distortions in international markets: the aluminium value chain", https://doi.org/10.1787/c82911ab-en, and OECD (2021[31]), "Measuring distortions in international markets: Below-market finance", https://doi.org/10.1787/a1a5aa8a-en.
Source: OECD (internal database) and Wind (commercial dataset), https://www.wind.com.cn/portal/en/WDS/index.html.

More geographically diversified production is found in the rest of the supply chain at the formulation stage. However, due to pressures on prices in OECD countries and the low profitability associated with the production of generic antibiotics, very few companies produce azithromycin. The product regularly appears on lists of medicines in shortage, as is also the case for other antibiotics. These shortages are often temporary and explained by delays in restocking and increasing production to meet demand. They are not directly related to supply chain issues in the sense of shortages of key inputs.

During the COVID-19 pandemic, azithromycin producers were generally successful in coping with spikes in demand. However, they had to use most of their inventories and lead times increased (from 45-90 days to six months). Antibiotics (and particularly azithromycin) were also subject to export restrictions that further contributed to tensions in their supply (Figure 11.11.) These were either export bans or export licensing requirements aimed at increasing the availability of medicines for the domestic market and preventing parallel exports (exports to third countries of medicines destined for the domestic market).

Even when these restrictions had exceptions for medicines specifically produced for export, they created delays for exporters and additional costs (for approval procedures and additional controls at the border) that exacerbated shortages (Hoekman, Fiorini and Yildirim, 2020[32]). Furthermore, export bans and logistics issues affect some markets to a higher degree than others due to lack of domestic production capacity (e.g. in Canada).

Figure 11.11. Export restrictions imposed on essential medicines during the COVID-19 pandemic



Note: Data relate to export restrictions on azithromycin, enoxaparin and propofol. The dataset covers all countries, but the list of countries with export restrictions may not be exhaustive, based on available information for the specific medicines covered.
Source: Global Trade Alert, Expanded Essential Goods Monitoring Initiative (August 2022 update).

11.3. The COVID-19 pandemic highlighted vulnerabilities of medical device supply chains

This section describes some of the vulnerabilities of medical device supply chains, particularly as they pertained to the COVID-19 pandemic – a context that generated unprecedented demand. First, it outlines the nature and context of medical device supply chains and some of the differences between these and pharmaceutical supply chains. It then presents the results of the OECD Resilience of Health Systems Questionnaire 2022, exploring both the approaches taken and the strategies implemented to improve the security of supply of essential medical products – predominantly medical devices – during the pandemic.

11.3.1. Medical device supply chains are not analogous to pharmaceutical supply chains

Medical devices are products or equipment intended for a medical purpose (European Medicines Agency, n.d.[33]). The term covers a wide variety of goods, from simple tongue depressors to complex scanners and ventilators. They are generally subject to higher levels of oversight than many non-medical products. They are regulated based on their intended purpose and according to the risk of harm they may pose, although classification schemas vary across jurisdictions (TGA, 2021[34]). However, the level of risk is not reflective of the complexity of the supply chains for these products. Many low-risk products have complex supply chains, with multiple steps in several countries (National Academies of Science Engineering and Medicine, 2022[11]).

A key difference between medicines and medical devices is that medical devices may be produced for both health care and non-health care markets. For example, respiratory protective devices, which are a type of mask (Box 11.3), are a component of personal protective equipment (PPE), which also usually comprises gowns and gloves (Chen et al., 2021[35]). Prior to the pandemic, non-medical respiratory protective devices using the same materials were available for use in construction and home repairs. This additional capacity could be used in time of crisis, but it also represents an alternative source of demand.

The product lifecycles of medicines and medical devices also differ, with the latter generally much shorter. The much wider variation in the nature and risk profiles of medical devices renders them subject to a broader range of regulations than medicines. Moreover, while many medical devices are designed for single use, others can be reused. Importantly, the nature of medical device supply chains is very variable: some more closely resemble supply chains for clothing or electrical goods than those for medicines.

Box 11.3. Masks – cloth masks, procedure masks and respiratory protective devices

There are several different types of face masks. During the COVID-19 pandemic, all the various types of masks were used for the public, patients or health care workers to reduce transmission of SARS-CoV-2 and protect against COVID-19 (FDA, 2022[36]).

Cloth masks or face coverings

Cloth masks are made from a variety of fabrics and may have multiple layers. They primarily capture droplets from coughing and sneezing, potentially reducing the chance of those who have SAR-CoV-2 spreading the virus.

Procedure, medical or surgical masks

Procedure, medical or surgical masks consist of multiple layers of non-woven material and have a nose wire. They are designed to be a physical barrier to protect against splashes and sprays. They may capture droplets from coughing and sneezing. They generally fit loosely, as the edges are not designed to form a seal nor to capture very small particles. They are disposable.

Respiratory protective devices

Respiratory protective devices fit more closely, forming an effective seal around the mouth and nose (when worn correctly). They protect against inhalation of hazardous material including small particles and are designed to provide very efficient filtration of particles. Some types of respiratory protective devices can be disposable (e.g. filtering facepiece respirators, such as N95, FFP2 and K95 respirators), while others can be reusable (e.g. elastomeric respirators).

Initially, it was not possible to isolate procedure and surgical masks from respiratory protective devices in trade data, but later in the pandemic it became possible to make the distinction (see Section 11.3.4) (FDA, 2022[37]).

Source: OECD (2020[38]), "The Face Mask Global Value Chain in the COVID-19 Outbreak: Evidence and Policy Lessons", https://doi.org/10.1787/a4df866d-en.

Some of the vulnerabilities associated with global supply chains for medical devices were recognised prior to the pandemic and are like those discussed for medicines. They include concentration of markets, a lack of incentives to invest in capacity to ensure adequate supply, and poor visibility and transparency of the supply chain.

Concentration (or bottlenecks) may occur outside the production and manufacturing process – for example, in transport links, where ports or specific land, air or sea routes without alternatives are potential points of vulnerability. The blockage of the Suez Canal by the Ever Given in 2021 demonstrated this vulnerability to bottlenecks in transportation (Lee and Wong, 2021[39]).

Ensuring access to critical care and protecting health care workers and the public were essential to the response to the COVID-19 pandemic. Critical care (see the chapter on critical care surge) required sufficient supplies of essential medical devices (such as ventilators) and certain medicines. PPE was necessary to protect health care workers, patients and others from infection. Workers employed in other critical sectors and the wider public also relied on protective garments, such as cloth masks, to reduce transmission. Adequate supplies of testing materials were also imperative for containment (test, trace and isolate) strategies (see the chapter on containment and mitigation).

Over the course of the pandemic, demand for certain medical devices increased. Initially, they were used to treat critically ill patients; to prevent transmission and, where this was not possible, to detect and trace infections; and to treat COVID-19 patients in the community. Later, uses included administering the newly available vaccines. Some increases in demand were very substantial and many times that of pre-existing production (for example, of PPE) – a level of demand considered unprecedented (Chen et al., 2021[35]).

As with medicines, production of medical devices also became more difficult during the pandemic. Policies implemented to contain and mitigate COVID-19 – such as physical distancing – and a reduced labour supply increased costs and reduced capacity. The concentration of some production processes exacerbated the impact of this situation. For example, factories in China responsible for most disposable respirator production closed temporarily due to COVID-19 (OECD, 2020[40]).

Other issues included: disruptions to transport and logistics; the combined result of labour shortages due to infections; new regulations for protection and physical distancing; border closures; and a reduction in air cargo with the collapse of passenger transport (OECD, 2021[41]). Further, once health systems received medical devices, there were also distributional issues. Some systems were unable to distribute devices effectively to locations where they would have had greatest value (see chapters on digital foundations and critical care surge).

11.3.2. More than two-thirds of OECD countries reported supply problems prior to January 2022

Shortages of medical device supplies developed quickly during the COVID-19 pandemic, as demand increased drastically, and supply could not meet it. This scenario was repeated numerous times during 2020 and 2021 with different products, including PPE, ventilators, testing components and vaccines.

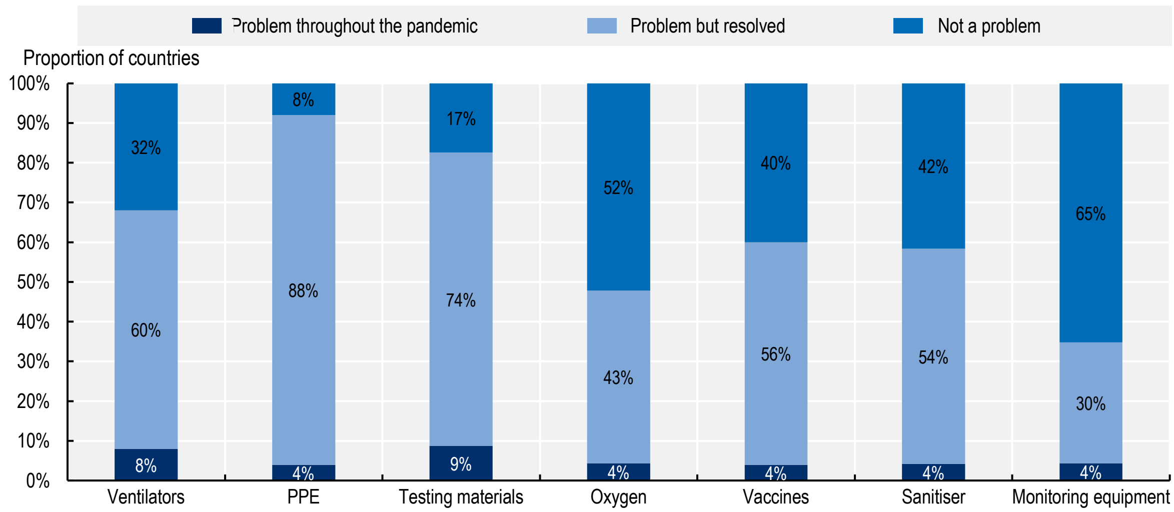
More than two-thirds (70%) of countries responding to the OECD Resilience of Health Systems Questionnaire 2022 reported a problem with supplies of essential medical devices prior to January 2022. Most respondents reported that problems were limited in duration (Figure 11.12). The vast majority stated that supplies of three types of essential medical devices – PPE (92%), testing materials (83%) and ventilators and ventilation products (68%) – were major issues, but most indicated that these were resolved prior to January 2022. Fewer than 10% of countries suggested that problems with the supplies of essential medical products were ongoing.

Problems with the supply of essential medical devices were correlated across the different categories within countries. Countries that identified a problem throughout the pandemic with one type of medical device tended to report it for other categories, while countries without problems with one type of medical device tended not to have ongoing problems obtaining supplies of the other types.

PPE was nominated most frequently (by 67% of countries) as the most important type of medical device subject to shortages. Other product types nominated included ventilators, vaccines and advanced resuscitation equipment such as extra-corporeal membrane oxygenation machines, which extract, oxygenate and pump blood back into the body.

The OECD Resilience of Health Systems Questionnaire 2022 also asked about supply chain visibility – described as knowledge of suppliers, the suppliers of suppliers, supply chain mechanics and logistics. One-third of countries reported that the supply chain for the most important medical device they nominated was not visible.

Figure 11.12. Percentage of countries reporting essential medical product supply problems prior to January 2022



Note: There were 25 respondents; only countries that completed the relevant section are included.
Source: OECD Resilience of Health Systems Questionnaire 2022.

No country reported that problems of supply were primarily the result of local disruptions. More than half (55%) indicated that disruptions were primarily international, while the remainder said that disruptions were both local and international. Many respondents said the international disruptions included both production and transportation. The impact of COVID-19 in reducing staff in domestic distribution and manufacturing was commonly highlighted.

Respiratory protective devices and procedure masks are an example of a basic medical device that is typically cheap to produce but has a manufacturing chain that demonstrated the challenges for supply during the COVID-19 pandemic, when production had to increase significantly in a relatively short time. Respirators require several types of inputs and assembly of different parts in a relatively sophisticated process (OECD, 2020[38]). One of the specialised components – non-woven (melt blown) polypropylene, which is electrically charged so that the virus particles are attracted while air passes through – was a bottleneck in the supply chain. This component requires specialised machinery and is produced in a limited number of countries (Fabra, Motta and Peitz, 2020[42]).

The very significant increase in demand for filtering facepiece respirators meant that all countries required a greater number than they were producing – thus, for a period, every country was attempting to be a net importer of filtering facepiece respirators. This resulted in further bottlenecks in distribution, with many countries introducing export restrictions or compulsory purchasing arrangements. Disruptions in both domestic and international freight exacerbated the supply shock.

Another important example is ventilators. These are durable goods, designed to be used multiple times, albeit in combination with disposable parts (Chen et al., 2021[35]). Demand for ventilators increased by a factor of 20 during the early absorb phase of the pandemic (see the chapter on critical care surge).

11.3.3. Countries employed a combination of strategies to prevent and mitigate shortages

Some OECD countries (Belgium, the Czech Republic, Greece, Israel, Italy, Japan, Slovenia and Türkiye) reported more limited disruptions in supply chains, according to responses to the OECD Resilience of Health Systems Questionnaire 2022. OECD countries identified several different policies as important in averting and mitigating supply chain disruptions, including for essential medical devices. Changed and especially simplified regulation, a multi-stakeholder approach to mount and guide a complex intervention, monitoring and co-ordination, and local production were all nominated as policies that averted supply chain disruptions (Table 11.2). Slovenia noted that sufficient stocks of key materials were important to maintaining normal operation despite issues in supply chains.

Table 11.2. Policies implemented to avoid supply chain disruptions reported by OECD countries

Country	Changes in regulations	Multi-stakeholder approach	Monitoring and co-ordination	Local production
Belgium	-	Creation of a taskforce of authorities and stakeholders to guide appropriate approaches	Stock monitoring system combined with epidemiology forecasting	-
Canada	Introduction of interim orders for expedited authorisation	Creation of a logistics advisory committee, composed of all provinces and federal government leads	-	Made in Canada initiatives for new manufacturers
Czech Republic	Use of national level derogations for entry to the market	-	Internet platforms and other tools to co-ordinate delivery	-
Israel	-	-	-	Development of local production chains
Italy	Issuing of import determinations and simplification of regulations (such as simplification of oxygen management procedures)	Creation of a community of experts and several crisis committees to supervise and intervene as required	Monitoring, co-ordination and guarantee of supply to institutions using real-time information	In case of shortages, providing technological transfer to the Military Pharmaceutical Chemical Plant in Florence for manufacture[1]
Switzerland	Introduction of a compulsory stockpiling system	Creation of a taskforce by the Federal Office of Public Health co-operating with hospitals and the private sector to ensure adequate supply of essential medicines	Stock monitoring system for medicines that were essential in the fight against the pandemic	-

Note: The question was "If 'No' (to experiencing supply chain disruptions of essential medical products), please describe the most effective policies that were used to avoid supply chain disruptions".
1. A collaboration agreement between the Italian Medicines Agency and Agenzia Industrie difesa signed on December 2021, aiming to consolidate production activities to address medicine shortages in the national and European markets.
Source: OECD Resilience of Health Systems Questionnaire 2022; data on Switzerland were added after an interview with the Swiss Federal Office of Public Health (FOPH).

Diversification of supply was a common solution

Most countries engaged in a range of strategies to secure supply of essential medical devices. Diversification of the final source of supply – both international and domestic – was a common strategy to address disruptions in supply chains. This often involved simplification, guidance or acceleration of the regulatory process. For example, Canada used interim orders to allow foreign labelled pharmaceuticals to fill supply gaps until Canadian-authorised products were available – this was later transitioned to a permanent regulation (Health Canada, 2021[43]). Canada also has an exceptional importation framework for medical devices. Rapid approval of ventilator variations increased access in Australia (Productivity Commission, 2021[44]).

Expanded domestic production and manufacture of PPE were widespread, according to responses to the OECD Resilience of Health Systems Questionnaire 2022. Increased international and domestic diversification resulted in large increases in numbers of suppliers. For example, the US Government invoked the Defense Production Act to encourage manufacturers to produce critical medical equipment. The Irish Health Services Executive placed orders with 150 suppliers of PPE in 2020, of which 115 were newly on-boarded as suppliers.

Countries also made changes to governance arrangements for purchasing, often centralising the process (Zhang et al., 2022[45]). Diversification was aided by countries organising and investing in transportation. However, export restrictions made the process of diversification and increasing supplies more difficult. In turn, this made international co-operation more important.

Another common approach was substitution of different products or devices to mitigate shortages. The use of substitution was accompanied by increased information and guidance to minimise risk. For example, Italy issued guidelines on the use of alternative products. In the United States, the FDA issued guidance on use of medical devices to increase their availability – for example, recommending product alternatives where appropriate. However, in some cases, such as Canada, substitute devices recommended by manufacturers facing shortages were not aligned with health care professionals' preferences, which led to continuous disruptions in supply.

As well as substitution, reuse of previously single-use items, such as N95 respirators, was a common strategy, accompanied by risk mitigation guidance (CDC, 2020[46]). The use of substitution was greater for medical devices than for medicines for which reuse is not an option. For example, in a crisis care situation with no common alternatives, substitution could be used (CDC, 2020[47]). Medical devices that were not of sufficient quality for frontline health care use were slated for potential use in low-risk, non-health care settings, according to respondents. Consideration of "ventilator splitting", where one ventilator could be used for multiple patients, was analogous but this was not undertaken at scale (Chen et al., 2021[35]; Beitler et al., 2020[48]).

Most countries took steps towards quality assurance

Assuring the quality of the products might have been an issue during the global shortage, especially given the rapid increase in diversification of suppliers and the urgency of securing supplies. Nonetheless, most countries took steps to assure the quality of products or to mitigate risks. This involved expanded testing and compliance activities, accompanied by increased information provision.

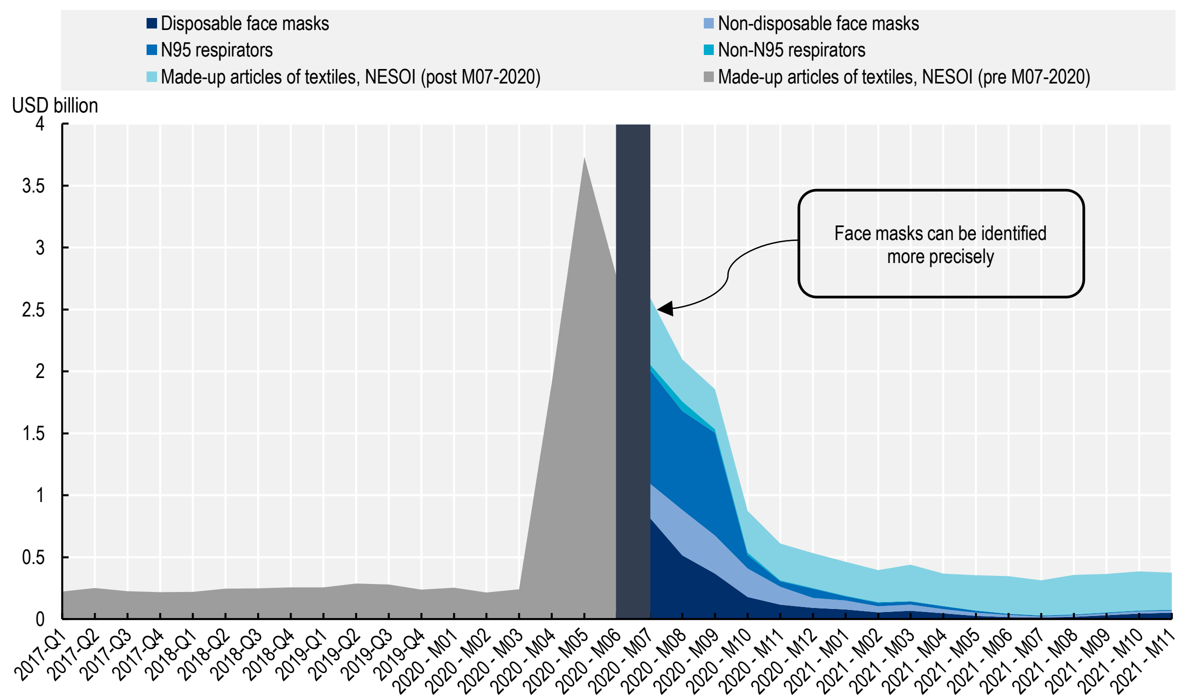
Australia undertook post-market contractual and regulatory compliance testing across stockpiled products. Austria submitted products to additional quality controls. Belgium put in place an alternative testing protocol. Canada developed and delivered information sessions about quality requirements. If the quality of equipment could not be determined through established testing protocols, it was not distributed to the frontline health care response. The Czech Republic and Ireland noted that some products could not be deployed clinically because of poor quality. Italy also conducted a survey about medical devices received during the pandemic to ensure compliance with quality requirements. Lithuania registered all potential suppliers. After three months, Luxembourg undertook a detailed quality analysis of its PPE stock to ensure compliance with quality requirements. Switzerland mandated quality assurance checks.

11.3.4. Increases in supply were underpinned by trade

Medical device supply increased dramatically during the pandemic, albeit with a significant time lag. However, the lack of availability, even for a relatively short time, resulted in significant morbidity and mortality. Increased risk of infection with SARS-CoV-2 because of a lack of PPE was one example (Nguyen et al., 2020[49]). At the early stages of the pandemic, PPE was in extremely short supply worldwide relative to demand, and it was subject to all three categories of supply chain disruption – increased demand, reduced supply and co-ordination problems, including export restrictions. However, even without reduced supply and co-ordination problems, at its peak it would not have been possible to meet the increased demand for filtering facepiece respirators (OECD, 2020[38]).

The importance of trade in overcoming shortages in medical masks and respiratory protective devices in the United States is demonstrable (Figure 11.13). There was a 1 500% increase in importation during the pandemic – from 600 million to 9.4 billion items. This was accompanied by diversification in origin, with increasing imports from Mexico and Korea (OECD, 2022[50]). Similar profiles of increased imports occurred in Canada, the European Union and Japan. With the increased importance of distinguishing different types of masks, greater disaggregation in statistical collection was applied from June 2020, increasing the ability to track products on a granular level.

Figure 11.13. Imports to the United States to overcome significant mask shortages in the face of surging demand



Note: The figure shows imports into the United States from all partners for Harmonised Tariff Schedule of the United States (HTS) code 6307.90.98.89 ("Other made-up articles of textile, not elsewhere specified or included") from January 2017 to July 2020, and imports of textile disposable face masks (6307.90.98.70), textile non-disposable face masks (6307.90.98.75), textile N95 respirators (6307.90.98.45), textile non-N95 respirators (6307.90.98.50), and other made-up articles of textile, not elsewhere specified or included (after July 2020, code 6307.90.98.91). The average quarterly value is shown for 2017-19.
Source: OECD (2022[50]), "Global supply chains at work: A tale of three products to fight COVID-19", https://doi.org/10.1787/07647bc5-en; United States International Trade Commission (USITC) DataWeb (2022).

11.3.5. Countries have a variety of plans to foster medical device supply chain resilience

The consequences of a shortfall in the supply of essential medical devices were substantial in the context of the COVID-19 pandemic. Ensuring that any future shortfall in the supply of essential medical devices is as limited as possible requires a mix of policy responses, given the multitude of potential threats and vulnerabilities.

Many countries are planning to implement policies over the medium term to improve the security of supply of medical devices and medicines. Those outlined in the OECD Resilience of Health Systems Questionnaire 2022 included: increasing knowledge to promote awareness of potential vulnerabilities; reducing the risk of supply shortages caused by disruptions in supply chains through changes in governance arrangements; and absorbing or buffering supply shortages when they occur (Box 11.4).

Box 11.4. Strategies to improve security of supply initiated following the first two years of the COVID-19 pandemic

Awareness – Increasing knowledge and information about supply chains and available stocks

- Improved transparency and monitoring of supply chains (Canada, Italy, Spain, United States).
- Increased knowledge of available stocks (Austria, Belgium, Italy).
- Horizon scanning to anticipate and adjust to changes (Austria).
- Review of difficulties experienced during the pandemic and review of supply chain vulnerabilities (Slovenia, United Kingdom).

Reduction in risk of supply shortages

Changes in governance arrangements around procurement, co-ordination and responsibilities

- Increased co-ordination between levels of government to support procurement activities (Australia).
- Introduction of responsible entities – for example, establishment of an Office of Supply Chain Resilience in 2021 to identify and monitor vulnerabilities in supply chains and to co-ordinate responses (Australia).
- Ensuring sufficient barriers to poor-quality goods in health care (Czech Republic).
- Use of regional procurement (Europe through the European Commission, United Kingdom engaging international partners, building on areas such as PPE and critical medical supplies).
- Centralised procurement – for example the newly legislated National Centralised Health Procurement Authority with a commitment to centralise 40% of total health spending during 2022 (Greece).

Diversification

- Brokers – procuring services to be called upon in the event of supply chain disruption (Ireland).
- Inclusion of backup suppliers for critical products (Spain).
- Inclusion of diversification of supply in decisions with suppliers regarding essential medical devices or pharmaceuticals (Portugal, United Kingdom).

Domestic and regional manufacture and actively strengthening existing supply chains

- Strengthening national and regional value chains of critical products (Austria, United States).
- Long-term contracts (Canada securing long-term contracts with domestic manufacturers to support replacement of its stockpile of PPE; France undertaking work to enable domestic manufacturers to be able to supply for priority products when required; Ireland encouraging on-shore and near-shore manufacturing through contracts).
- Shortening of existing supply chains – for example, geographically local production of active ingredients in medicines (Spain).

- Increased investment (Korea actively investing in development of Korean-made vaccines; United Kingdom identifying long-term opportunities to strengthen supply through increased domestic production; United States increasing domestic production to promote diversification and redundancy).

Increased supplies when disruptions occur

- Increased stockpiling (Germany, Slovenia; Austria establishing a mid- to long-term PPE stockpile; the European Union implementing regional co-ordination and stockpiling; France establishing public stocks of several priority products; Ireland establishing national stockpiles to ensure no lag in availability during crises; United Kingdom fortifying local supply, including through stockpiles).
- Explicit guidelines for procurement and stocks for health and emergency entities – for example, amending the law to require institutions offering personal health care services to have sufficient PPE (and other measures) to ensure performance of their activities for 30 days, placing a similar obligation on municipal administrations, and ensuring that the state reserve should be sufficient for 60 days (Latvia).
- Use of long-term contracts and capacity buffering (Ireland engaging in long-term contracts and contracts for supply in the event of a future incident such as a pandemic; Latvia discussing the potential for the European Commission to conclude advance procurement agreements to secure deliveries of essential medicinal products).

Source: OECD Resilience of Health Systems Questionnaire 2022.

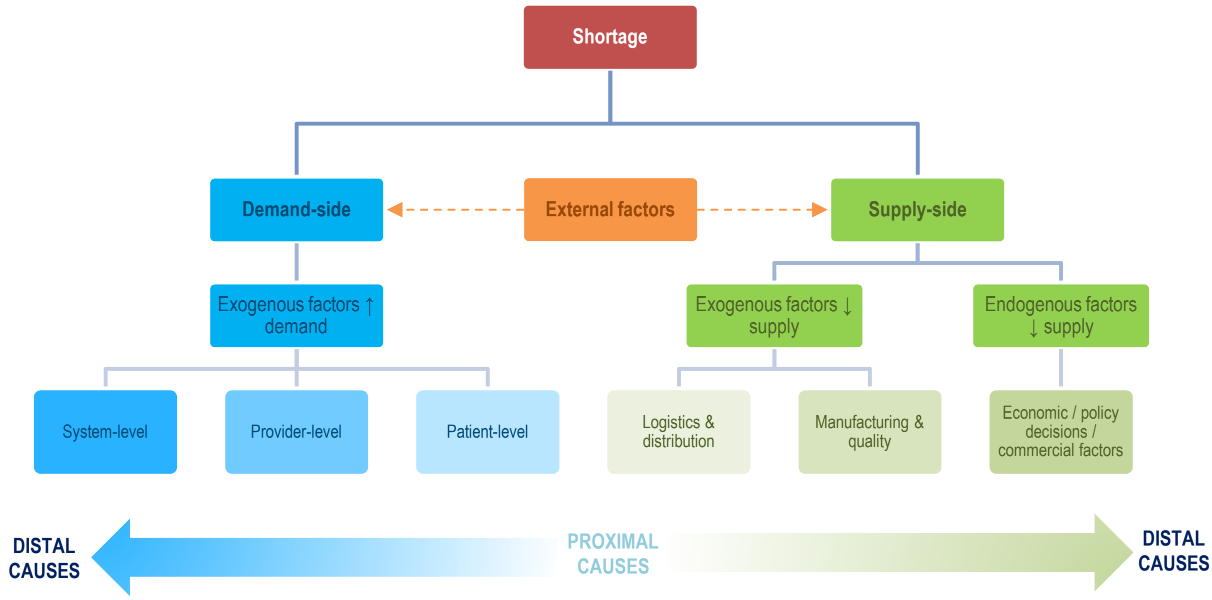
11.4. Policies to secure the supply of essential medicines and medical devices are multi-faceted

The previous sections highlight the existence of broader challenges whose origins lie outside the organisation of supply chains. They illustrate the different issues that need to be addressed to ensure continuity of access to essential medicines and medical devices during health crises, and thereby to contribute to health system resilience. For medicines, while the issues described are derived from analyses of off-patent or multisource products, single-source (or patented) products are also subject to challenges in security of supply, albeit with potentially different root causes. While the debate on access to essential goods during the COVID-19 pandemic has emphasised supply chain issues, the case studies and Figure 11.14 illustrate the complex nature of shortages and their varying root causes.

The international nature of supply chains creates risks when countries resort to export restrictions or when, as seen during COVID-19, international transport networks experience bottlenecks in supply. Medical products that experienced the greatest demand during the pandemic – such as procedure masks and respiratory protective devices – became the subject of export restrictions, further restricting the supply for some countries.

However, the core issues identified in the case studies relate principally to the economic and commercial incentives that would facilitate more diverse and robust production networks, and to the role of regulators and governments in ensuring sufficient capacity and diversity in the production of medical goods. A key question is what policy makers should or can do to ensure that global supply chains run smoothly.

Figure 11.14. Complex nature of medicine shortages



Source: Chapman, Dedet and Lopert (2022[6]), "Shortages of medicines in OECD countries", https://doi.org/10.1787/b5d9e15d-en.

Strategies need to balance different risks and vulnerabilities. The COVID-19 pandemic was an extreme shock to supply chains, but the next shock may not be an infectious disease, and some strategies may increase vulnerability to specific disruptions while decreasing vulnerability to others. Improving supply chain resilience for essential medical devices and medicines needs to consider not only extreme shocks but also less extreme and more common events.

The main policy implications of the analysis, applicable to both essential medicines and medical devices, are summarised in the following sections.

11.4.1. Medical supply chain resilience would benefit from collaboration

Promoting the long-term resilience of medical supply chains in the face of both known and unanticipated threats would benefit from collaborative, internationally harmonised and co-ordinated approaches to regulation and stockpiling.

Strategies need to balance mitigation measures best undertaken by firms within the supply chains with those more appropriately managed by governments (Productivity Commission, 2021[44]). For example, stockpiles should arguably be managed by governments, but could be held by firms.

The stakeholders best placed to improve supply chain resilience may also be determined by the potential scale of the disruption. For instance, prolonged health crises occurring on a global scale may require different policy options from a localised temporary disruption, such as a fire or earthquake.

Private and public actors took steps to resolve supply chain issues during the pandemic, but incentives are needed for private actors to maximise the public good (see the chapter on global public goods). Ensuring the stability and predictability of the trading environment also supports the resilience of supply chains.

11.4.2. Greater transparency and improved reporting are needed

Difficulties in identifying the suppliers and countries involved in medicine and medical device supply chains may undermine the assessment of risks by governments. The COVID-19 pandemic highlighted that governments did not have sufficient information on the origins of medicines and medical devices sold in their domestic markets, the availability of alternative suppliers or countries from which essential inputs are sourced (for domestic or foreign production).

A lack of transparency may hamper co-ordination and collaboration between governments, leading in some cases to excessive stockpiling and in others to preventing early detection of potential shortages. A global information and transparency mechanism on supply chains for essential medicines and medical devices could help governments to assess the concentration of supply, prepare for potential shortages and co-operate with other countries and firms to ensure continuity of supply.

The World Health Assembly resolved to improve the transparency of markets for medicines, vaccines and other health products at an international level in resolution WHA72.8 (WHO, 2019[51]). While focusing on price transparency, this also references the importance of collecting information on inputs along supply chains. Recent OECD publications have also highlighted the issue of transparency in pharmaceutical markets (OECD, 2018[52]; Chapman, Dedet and Lopert, 2022[6]; Wenzl and Chapman, 2019[53]).

To improve government assessments of risks and preparations for crises, more detailed information on supplies (including flows and volumes), suppliers and countries of origin of finished products and key inputs are needed. Regulators could mandate provision of this information,[8] or governments could use public – private dialogue and collaboration with firms through transparency initiatives or platforms to collect such evidence, while ensuring appropriate degrees of confidentiality in the treatment and use of the data.

One issue may be the costs to firms of reporting this information in a setting of low profitability and limited incentives to produce essential medicines or medical devices. This reporting should, therefore, not be overly burdensome or add to cost pressures. Greater transparency could be included in criteria applied in public procurement and pricing processes.

Real-time information about medical devices and medicines can help issues to be anticipated and addressed quickly. Several countries are pursuing diversification, including local manufacturing and use of long-term contracts and relationships to mitigate disruption. This would be aided by being able to predict demand early. Prior to the pandemic, both the availability of real-time data about capacity and usage (see the chapter on digital foundations) and the ability to predict supplies were limited (see the chapter on critical care surge). These limitations are being addressed, and greater confidence in predicting the required supply may provide a lead time for manufacturers to institute capacity buffers (Chen et al., 2021[35]).

Better preparedness by countries and improved resilience in the supply of medicines and medical devices involves effective reporting systems and medicine shortage platforms (Shukar et al., 2021[54]). Most OECD countries have such systems, but monitoring could be improved in several ways (Chapman, Dedet and Lopert, 2022[6]). First, reporting requirements differ widely across countries. Harmonisation would facilitate actions by governments to effectively address shortages through international co-ordination and co-operation. Second, not enough information is generally collected to identify the root cause of the shortage and to implement solutions. Some supply chain information would help to identify exactly where there is a bottleneck and what might help solve the shortage. Third, early warning notices would be more useful for mitigation strategies than gathering information on shortages that are under way.

Reporting platforms could also be improved through developing new information systems and data analytics to detect shortages in advance based upon real-time variations in supply and demand. Some countries already have such stock monitoring systems in place. In Türkiye, the Turkish Medicines and Medical Devices Agency has a national product-tracking system with individual follow-up in the sales, distribution, purchase and usage processes of medical goods from production or import. Through a single tracking infrastructure, the stock status of economic operators and health facilities within Türkiye can be determined on a product group basis.

Volatility in demand for medical products may be unavoidable, but there are different ways to ensure that variations in demand are anticipated, and productions adjustments are agile and responsive. Technologies such as smart labelling may also help to introduce more transparency and traceability in medicine and medical device supply chains. Diprivan® (a brand of propofol) is one of the first medications to benefit from a radio-frequency identification system (Fresenius Kabi, 2022[55]). “Smart labels” may help hospitals with inventory management and allow manufacturers to anticipate changes in demand.

In addition to smart labelling, various supply chain technologies (including digital technologies relying on predictive analytics, artificial intelligence and blockchain) are available to monitor supply chains and anticipate risks (Ye et al., 2022[56]). For example, encrypted blockchain technology can help to build trust along the value chain, while also facilitating exchange of information and collaborative relationships (Hosseini Bamakan, Ghasemzadeh Moghaddam and Dehghan Manshadi, 2021[57]). Governments can assist by ensuring that regulatory environments are favourable to deploying digital technologies, and by addressing specific issues (such as privacy and security in data transmission) which are particularly important in the context of health systems (see the chapter on digital foundations).

Stress testing supply chains to better understand their vulnerabilities over time could also be a useful strategy. This would require quantification of resilience (Linkov et al., 2020[58]) and testing would need to be conducted regularly. Stress tests must, however, take a holistic approach to how health systems respond to health crises and large-scale shocks. Such tests should consider both supply chain vulnerabilities and medical needs, thereby avoiding a restricted evaluation of supply chain resilience without appreciating the changes that will occur in the delivery of medical care in crises.

11.4.3. Quality issues are not limited to international supply, and affect shortages of key inputs

Many of the shortages identified in the medicine case studies were related to quality issues in the production of medicines that led to the unexpected removal of significant quantities of products from the market. The existence of only a limited number of manufacturers (either at the global level or with authorisation for a specific market) accentuates the risk of quality issues leading to severe shortages.

Quality issues are not limited to contamination. They include breaks in cold chains, variations in concentration or changes in stability, defective packaging and poor calibration. These issues may happen throughout the supply chain and may affect one or multiple batches of a product. Quality issues with medical devices may also be associated with the rapid expansion of suppliers at a time of extreme demand.

Offshoring should not be viewed as an additional source of risk to quality, but longer supply chains with multiple suppliers in countries with different regulations or standards may increase the complexity of the supply chains and risks related to quality.

It is, therefore, important for regulators and firms to ensure that the appropriate level of controls is in place. All pharmaceutical manufacturing sites (whether in China, the European Union, India or the United States) are subject to the same standards and inspections (e.g. the code of good manufacturing practice). Thus, the issue is less about the existence of rules and standards and more about the effective implementation of procedures. This involves ensuring that manufacturers have sufficient incentives to invest in quality management and control, including with contractors and foreign suppliers.

As quality issues cannot be fully avoided, and risks will always exist, having a sufficient number of manufacturers relying on a diverse set of suppliers would ultimately help to prevent quality issues resulting in shortages of medicines and medical devices. As discussed in Section 11.3.3, once the pandemic began, most countries took steps to enhance quality assurance of medical devices in the context of a rapid diversification of suppliers.

11.4.4. Market structure and product regulation may discourage investment and limit diversification

Profit margins on generic medicines are generally lower than those on patented products. Where public procurement accounts for the bulk of sales, significant downward pressure on prices can occur. Prices may become too low for firms to have sufficient commercial incentives to manufacture essential medicines or to invest in resilience and capacity. This issue was observed in the three medicine case studies and confirmed by interviews with pharmaceutical firms. Similar issues exist with medical devices.

Having a limited number of suppliers of essential medicines and medical devices may be regarded as a key cause of shortages. As highlighted above, if there are enough suppliers with production capacity in different countries, quality issues in a given facility need not affect the availability of a medicine or medical device. What is not produced in one location can, in theory, be replaced with augmented production elsewhere, if spare capacity exists. Thus, resilience in supply chains in the face of spikes in demand is also influenced by the number of suppliers and economic incentives to add or retain "buffer" capacity. Firms can accept factories and supply chains not running at 100% capacity in "normal" times, with flexibility to increase production during crises, only if their revenue is sufficient to accommodate the excess capacity. At the same time, countries must be able to balance the risks of diversification. A single reliable supplier may, in some cases, be preferred over multiple small suppliers.

More diversified supply chains and increased production capacity for essential medicines and medical devices require procurement practices and pricing mechanisms to be reviewed. Novel procurement and reimbursement models are being explored in some countries for new antimicrobials – for example, in pilot projects conducted by the United Kingdom and Sweden (Gotham et al., 2020[59]). However, new models may also be needed for generic medicines and medical devices. Improving the resilience of health systems is not cost free. Preventing disruptions during future crises involves revising the commercial incentives currently in place for pharmaceutical firms to produce essential medicines, especially generics.

In response to the COVID-19 pandemic began, some firms repurposed existing production capacity to increase the production of essential medicines. Some facilities (particularly in the secondary manufacturing phase) can produce different types of medicines. Anticipating reconversions and integrating them into a contingency plan, discussed in advance between governments and companies, can allow firms to make the necessary investments and have procedures to switch production quickly, when needed. Through upstream agreements with pharmaceutical firms, governments can not only organise such reconversions but also provide economic incentives to guarantee that investments are made. Redundancy in production capacity or supply of key inputs can also be part of such upstream agreements to deal with supply risks.

Industrial policies also play a key role in the production and export capacity of pharmaceutical companies. Domestic firms seek long-term stability and predictability in the economic market of the country concerned. Governments that regulate prices could maintain incentives to continue producing generic medicines and help to create a more diversified supply chain. Caution should be exercised, however, to ensure that industrial policy instruments do not discourage foreign sourcing, as access to medicines produced abroad is a component of mitigation strategies in times of crisis. Policies should aim to increase capacity and diversity without introducing further distortions or disruptions to markets.

Some medical devices are not limited to use in health care settings, as noted previously. PPE and rapid antigen tests, for example, were used by other essential industries to protect from and mitigate against infection in response to the COVID-19 pandemic. Additionally, many components of medical devices may be used in non-medical goods, such as electronics (Chen et al., 2021[35]). This complexity offers both opportunities and vulnerabilities: opportunities because non-medical production processes can be converted to the supply of medical devices, and vulnerabilities because of demand from other sectors.

11.4.5. Trade policy can contribute to efficiency via enhanced supplier diversification and capacity

Trade is important for access to technology and equipment, and for research and development

There are many advantages to relying on international supply chains for medical products (see the recent OECD (2022[50]) report). Efforts to improve resilience should not lead to policies that would be counter-productive, by discouraging international collaboration, specialisation, economies of scale or efficient use of resources across countries. Empirical analysis confirms that open markets and production in international supply chains increase the resilience of production (Arriola et al., 2020[60]; Bonadio et al., 2020[61]; Choudhary et al., 2022[62]). Economies of scale create efficiencies that also contribute to the resilience of health systems.

Evidence at the firm level highlights that international firms were in a better position to address bottlenecks and recovered more quickly than domestically oriented firms during the COVID-19 pandemic. It is also through international production that shortages of essential goods were resolved. Open markets provide adjustment channels to deal with both demand and supply shocks.

Pharmaceutical supply chains involve multiple steps in different countries, some of which require specialised production knowledge and technology, as highlighted in the case studies and the more recent example of COVID-19 vaccines (Box 11.5). For example, the production of APIs – particularly complex antibiotics – involves various stages requiring different types of inputs. Pharmaceutical firms in OECD countries that rely on APIs produced within their domestic economies or own regions are still part of international production networks. They rely on many international collaboration agreements to develop medicines, and on many key foreign suppliers for inputs, equipment or access to specific technologies. Trade is essential to such strategies, as firms need to access technology and know-how that may be unavailable in the domestic economy.

Box 11.5. Vaccine production benefited from international trade

The trade in vaccines increased in 2021, compared to previous years: USD 41 billion for the first six months of 2021 compared to an annual trade in vaccines of approximately USD 32.5 billion in 2020 and USD 31 billion in 2019. The widespread creation of supply chains for the COVID-19 vaccines reflected pre-existing end-stage vaccine manufacturing capacity, including concentration of manufacturing in Asia, Europe and North America. Vaccines are exported by fewer countries than PPE.

Multiple supply chains were developed for most vaccines, and new supply chains had to be developed for specialist components – for example, the lipid nanoparticles in some vaccines. Importation of lipid nanoparticles into Germany from the United Kingdom increased drastically in the first four months of 2021. More generally, global exports of consumable materials used in vaccination manufacture, such as cell culture media, increased by 66% between the first quarters of 2020 and 2021.

The scaling up of manufacturing capacity of vaccines required multiple supply chains to be developed. The scaling up of production (and of the underlying supply chains) was possible prior to regulatory approval because governments provided support, in the form of direct subsidies and advance purchase arrangements (see the chapter on global public goods).

The potential existed for trade in vaccines to be undermined by vaccine export controls, vaccine nationalism and pre-purchase agreements acting as a barrier to export. Additionally, there may have been a reduction in the export by the European Union of other (non-COVID-19) vaccines in the first half of 2021, although this was resolved by the end of 2021.

Trade and global supply chains played an important role in assisting countries to gain access to vaccines and scale up production.

Sources: OECD (2022[50]), "Global supply chains at work: A tale of three products to fight COVID-19", https://doi.org/10.1787/07647bc5-en; Bown and Bollyky (2021[63]), "How COVID-19 vaccine supply chains emerged in the midst of a pandemic", https://www.piie.com/publications/working-papers/how-covid-19-vaccine-supply-chains-emerged-midst-pandemic; Evenett et al. (2021[64]), "The COVID-19 Vaccine Production Club: Will Value Chains Temper Nationalism?", https://cadmus.eui.eu/handle/1814/70363.

The concept of "reshoring" – understood as repatriating all production stages in a single economy – has been discussed by a number of countries as a potential solution to medicine and medical device shortages. Developing domestic production may add capacity, while also reducing risks of supply chain issues that may be linked to internationalisation. This strategy does not appear to be pragmatic, however, when considering the complexity of supply chains especially for pharmaceuticals, as the case studies illustrate.

Interviews with pharmaceutical companies showed that it would be very challenging and take a lot of time (lead times of at least 15-20 years were suggested) and resources to produce the key APIs of the essential medicines previously described in multiple markets. First, raw materials necessary to develop these APIs may not be available in all countries. Second, economies of scale and gains from specialisation would be lost (in both primary and secondary manufacturing), with implications for costs, quality of products and reliability of supply. Complex stages of production involve know-how that is not easily reproduced and technologies that have taken many years to be mastered. Duplicating these stages of production in multiple countries raises questions not only about costs but also about the availability of skills, know-how, supporting services and secondary suppliers in business ecosystems that take decades to be developed.

In practice, reshoring is generally limited to a single part of the supply chain because it is unrealistic to recreate all production stages in one location (Choudhary et al., 2022[62]). Reshoring strategies do not diminish the risks associated with foreign supply but shift them to other parts of the supply chain. In addition, reshoring may compound geographical risks that would only be transferred from one location to another – for example, where an earthquake occurs, increased demand and reduced supply may coincide.

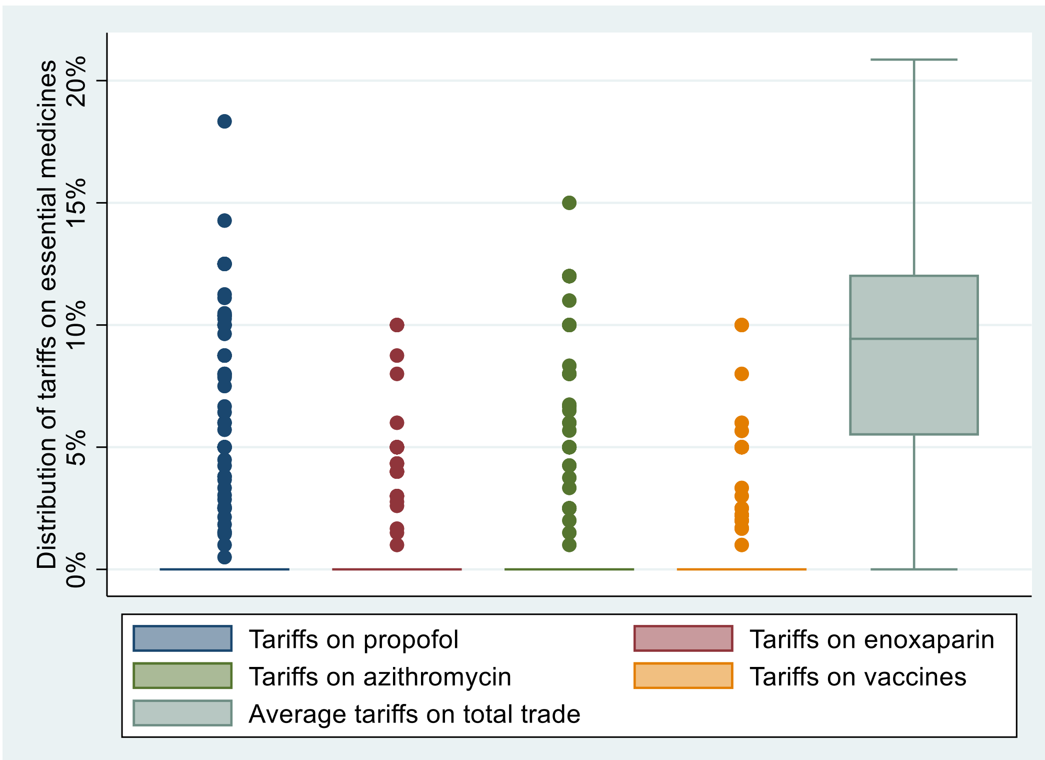
Moreover, reshoring does not address the issue of the lack of economic incentives to manufacture essential medicines or medical devices or to invest in resilience. Empirical analysis suggests that, in the context of essential medicines (where profitability is the main issue), the costs associated with reshoring are unlikely to improve the situation of firms unless subsidies are dedicated to reshored segments of the supply chain (Sodhi and Tang, 2021[65]).

Finally, shifting production across countries does not necessarily increase the overall capacity of the supply chain. For shortages related to spikes in demand, the focus of policies should be on how best to ramp up production and introduce agility and flexibility in supply chains to adjust to fluctuations in demand. Ramping up production is also best achieved through co-ordination across countries, to avoid duplication of effort and ensure that production increases commensurately in all stages at the same time. Co-ordination is even more important in the case of essential medicines, owing to the regulated nature of pharmaceutical markets and the need for suppliers to be authorised and certified.

Trade policy can contribute to resilience via more open trade and by addressing regulatory obstacles

The benefits of trade and international production for access to essential medicines and medical devices are generally acknowledged. Nonetheless, significant barriers to trade persist. For example, the three products examined in the medicine case studies still face significant tariffs (Figure 11.15).

Figure 11.15. Tariffs on essential medicines across countries, 2021 or latest available year



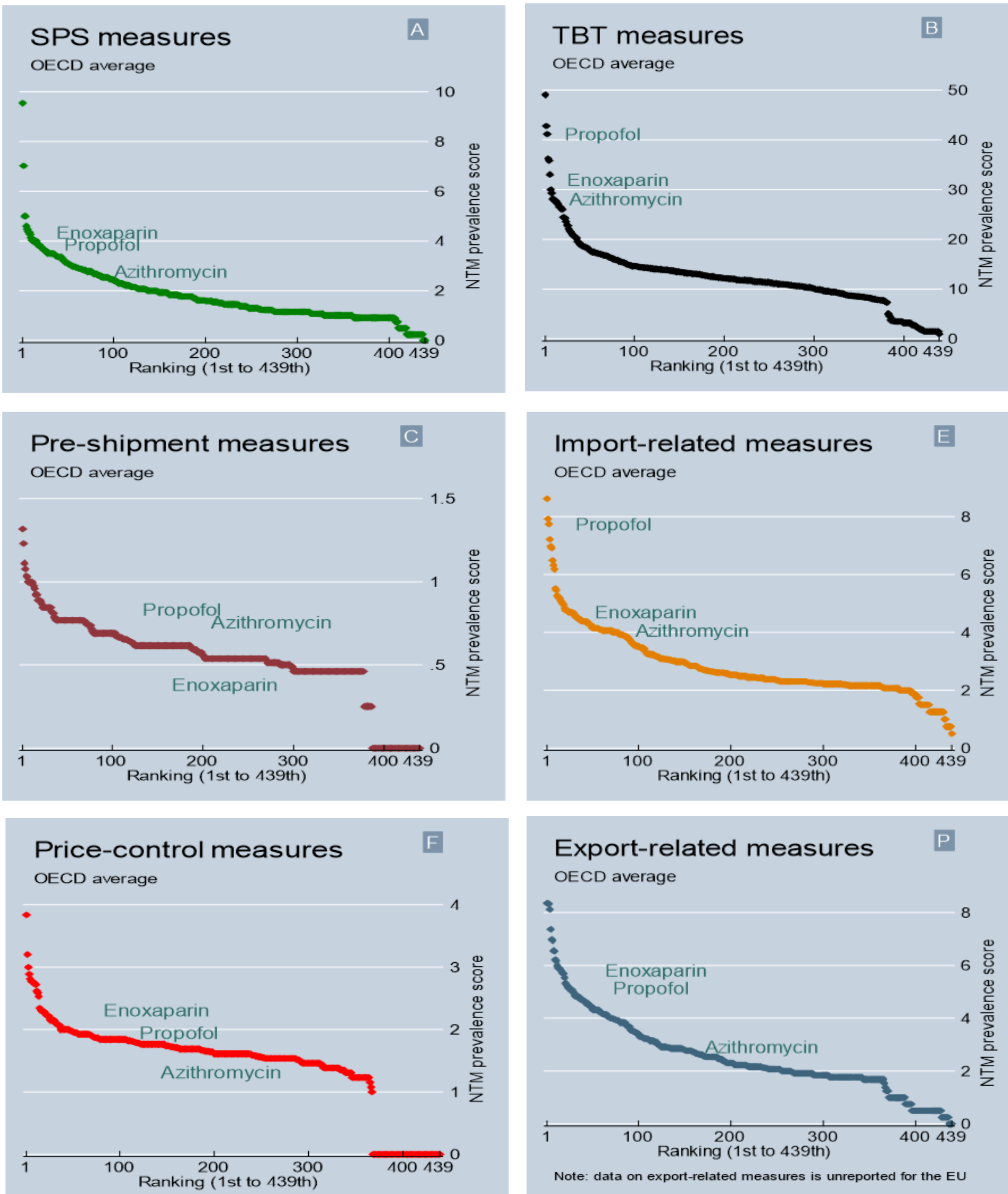
Note: The boxplot shows the distribution of tariffs faced by propofol (HS 300 490), enoxaparin (HS 300 190) and azithromycin (HS 300 420) in 138 countries. Tariffs on vaccines (HS 300 220) as well as on total trade by these same countries are included for comparison.
Source: World Trade Organization (WTO) Integrated Database notifications; Trade Analysis Information System (TRAINS) database.

Non-tariff measures (NTMs) also affect international trade in essential medicines.[9] Propofol, enoxaparin, and azithromycin attract a relatively high number of NTMs relative to other pharmaceuticals and organic chemicals (Figure 11.16). For example, regarding technical barriers to trade (TBTs – Panel B), propofol, enoxaparin and azithromycin must comply with, on average, between 28 and 41 different TBT measures (y-axis). This means that they are the 3rd, 8th and 9th most regulated product (by number of TBTs) of the 439 organic chemicals and pharmaceutical goods with distinct customs classifications in trade statistics (x-axis). TBTs on these goods commonly take the form of: labelling and packaging requirements; requirements concerning safety, performance and quality; or other administrative requirements.

Beyond TBTs, import-related measures, export-related measures and sanitary and phytosanitary measures (SPS) frequently apply to the three products (Figure 11.16 Panels A, E and P). They are relatively less subject to pre-shipment and price-control measures compared to other organic chemicals and pharmaceuticals, although generally above the sector average (Panels C and F).

Figure 11.16. Non-tariff measures applied to propofol, enoxaparin and azithromycin compared to other goods

Number of NTMs applied per good in OECD countries (y-axis), by NTM type, 2018 or latest available year



Note: The figure compares propofol (part of HS 300 490), enoxaparin (part of HS 300 190) and azithromycin (part of HS 300 420) to other goods contained in Chapters 29 (organic chemicals) and 30 (pharmaceutical products) of the Harmonised System nomenclature. In light of differences in reporting years, a combined 2012 and 2017 HS nomenclature is used for the figure. The letter in the top right corner of panels refers to NTM chapters – A, B, C, E, F, P, UNCTAD (2019[66]), "International classification of non-tariff measures – 2019 version". Labels are situated at 3 o'clock relative to data points except in B (enoxaparin at 2), C (azithromycin and propofol at 2, enoxaparin at 5) and F (azithromycin at 4).
Source: World Integrated Trade Solutions (WITS): TRAINS NTM database; TRAINS Online.

In part, the relatively high number of NTMs applied to these products should not come as a surprise; as products directly affecting human health, they should retain a high degree of regulatory scrutiny. At the same time, they appear to attract more measures than other pharmaceuticals and organic chemicals. The high number of NTMs also highlights that the design of administrative requirements is important for trade in these products, as there is a higher potential of overlap and accumulation between different regulations.

These findings highlight the potential benefits of reviewing what national measures are currently in place for trade in medical products – especially pharmaceuticals – to determine whether these measures maximise regulatory effectiveness while minimising potential administrative costs and frictions in cross-border trade. Ensuring interoperability among different regulatory approaches – for example, by reviewing import or export-related measures – has the potential to increase the viability of essential medicines and medical devices on international markets. Ultimately, this would foster resilience in these supply chains and promote broader access to them to support resilient health systems.

The Ministerial Declaration on the World Trade Organization (WTO) response to the COVID-19 pandemic and preparedness for future pandemics (WT/MIN(22)/31) includes commitments to review and build on all the lessons learnt during the pandemic, including with respect to export restrictions and regulatory co-operation, in collaboration with other international organisations. Addressing trade barriers and reinforcing regulatory co-operation would strengthen the resilience of medical supply chains.

11.4.6. To be efficient, stockpiling strategies and capacity buffering should be co-ordinated

Pharmaceutical and medical device firms already have risk management strategies to deal with small-scale variations in demand. Better communication between health authorities, hospitals, pharmacies, distributors and medicine manufacturers could improve inventory management. In particular, the closer monitoring by health authorities of available stocks downstream (e.g. at institutional or sub-national levels) and early notification to companies and other stakeholders when increased demand is expected may help firms to better manage their stocks.

Such strategies are, however, unlikely to address large spikes in demand. For pandemics and global shocks, government-level risk management strategies are required (OECD, 2021[67]). A first layer in mitigation strategies is the organisation of national stockpiles of essential medicines and medical devices (Sodhi and Tang, 2021[65]). The challenge in organising such stockpiles is to create enough flexibility to address all types of health crises and to integrate the national system with the strategies of private firms (Handfield et al., 2020[68]). Several countries are developing national stockpiling mechanisms (e.g. Canada and the Netherlands).

While health authorities should supervise the stockpiling and establish rules for the use of stocks and inventories, stockpiles may be better managed in co-operation with the private sector (Chen et al., 2017[69]). A rolling stockpile from which manufacturers regularly source their products (while maintaining stock at or above a certain threshold) may help to deal with the perishability or short shelf life of some products. This is how stockpiles are organised in Switzerland through a compulsory stock system (Box 11.6) (Federal Office for National Economic Supply, 2022[70]). One advantage is to reduce the cost of inventories and to rely on the management and logistics of private firms. The Canadian Critical Drug Reserve is another example of a "vendor held and managed" approach to increase the supply of key medicines used to treat COVID-19 (Government of Canada, 2022[71]).

Box 11.6. Mandatory stockpiling of essential medicines: the Swiss example

The national economic supply system of Switzerland is backed by a compulsory rolling stockpiling system that covers goods essential to life. This system is based on co-operation between the state and the private sector. The federal government determines which vital goods must be kept in stock and in what quantities. However, the federal government is not the owner of the compulsory stock; it remains the property of the companies (decentralised stockpiling). If the economy can no longer meet the demand for vital goods due to a shortage, stock can be released by order of the federal government.

In principle, the supply of medicines in Switzerland is assured via free market mechanisms. Pharmaceutical companies act in this market as developers, manufacturers and distributors of medical products. In the event of a severe shortage threatening major economic harm or considerable disruption to the national economic supply (as was the case during the pandemic) the National Economic Supply Act allows federal authorities to take preparatory measures to ensure the continued production, processing and delivery of goods (including medicines) that are essential to life.

At the outset of the COVID-19 pandemic, the Swiss Federal Office of Public Health (FOPH) and Federal Office of National Economic Supply (FONES) were informed by public hospitals of a shortage of certain essential medicines (such as propofol) and advised that the private sector was overwhelmed by the number of requests. The FOPH immediately developed a prioritisation strategy, working closely with the hospitals and acting as an allocator of essential medicines. In doing so, it was able to monitor the supply and quantify the needs.

In a second phase, after the first wave in 2020, the FOPH monitored the pandemic situation and developed a catalogue of 30 active ingredients that were relevant for the fight against COVID-19. This list was under strict control/monitoring of stock, demands and deliveries through the FONES, and updated on a weekly basis. Hospitals were also asked to deliver a weekly report on their stock. Although the federal government assumed the lead in distribution, the pharmaceutical industry remained responsible for procuring the products. The industry was also granted a return guarantee for any additional supplies that exceeded the usual level of demand and were not sold.

This mandatory stockpiling system allowed Switzerland to bridge sustained shortages in a rolling manner, limiting waste. Despite this, there have been strong calls for further co-ordination at the international level and better global market oversight in order to avoid massive stockpiling of medicines.

Source: FOPH (2022[72]), "Supply shortages of human medicines in Switzerland. Situational analysis and improvement measures to be reviewed", https://www.bag.admin.ch/dam/bag/en/dokumente/biomed/heilmittel/bericht-sicherheit-mediversorgung.pdf.download.pdf/bericht-sicherheit-mediversorgung-en.pdf.

Another strategy mentioned by pharmaceutical firms during interviews is to focus on stockpiles of APIs rather than finished products. It will not always be possible to predict the types of medicines that will be needed in a future health crisis. An alternative stockpiling strategy consists of ensuring that key APIs can be stored, and medicines produced, on demand. APIs are likely to be less perishable and able to be stored for longer periods of time, allowing the production of different types of medicines.

Given that supply chains are international, co-ordination is essential to develop effective stockpiling strategies across countries. Once a disruption has occurred, expectations of further shortages have the potential to worsen their impact. Widespread anticipation of shortages can prompt increased purchasing to avoid stock shortfalls. Decentralised and fragmented actions at an individual, institutional or sub-national level may worsen this situation. To be efficient, stockpiling strategies should be planned and co-ordinated with the private sector and across countries. Regional stockpiling strategies, where feasible, are likely to be more efficient than duplicating national stocks in several countries. Such cross-country co-operation on stockpiling could also extend to joint procurement strategies for essential medical goods and/or medical devices, reducing the incentive to engage in export restrictions. Vertical co-ordination is also important, both with suppliers upstream and with distributors and users downstream.

Efficient distribution of available stock to hospitals, pharmacies and all patients who need essential medicines and medical devices is an important element in stockpiling strategies. The “last mile” for the distribution of stock was an identified weakness during the pandemic (Handfield et al., 2020[68]).

Stockpiling strategies are one layer in an overall resilience strategy that should combine “inventory, capacity and capability” (Sodhi and Tang, 2021[65]). For example, the key constraint during the COVID-19 pandemic was the number of staff that could use ventilators, rather than the number of ventilators (see the chapter on critical care surge). For larger and more persistent shocks, stockpiling should be expected to be combined with additional capacity. The purpose of the stockpile is to bridge the gap between the supply shock and the increase in supply from capacity buffering and increased capability (Chen et al., 2021[35]; Sodhi, Tang and Willenson, 2021[73]). Stockpiles can help to meet immediate needs in the context of a crisis. However, more capacity is needed when inventories are exhausted, requiring more production from firms. When the crisis is so large that existing production capacity cannot meet the needs (as observed during the pandemic for some essential goods), it is critical to be able to increase capability.

Capability is the potential to expand and alter other manufacturing processes to the medical good of interest – for example, the production of ventilators during the COVID-19 pandemic by non-traditional manufacturers such as car companies (Sodhi and Tang, 2021[74]). In times of shortage (with demand exceeding supply), market forces will result in higher prices; this will encourage suppliers in the market to produce more and others to convert their production facilities. As shown during the pandemic, however, capability needs to increase quickly while preserving quality control. A wider variety of firms may be involved in producing medical devices than pharmaceuticals. There is a potential role for governments and international organisations, in both reducing the time until extra capability is introduced into the system and assuring quality. A range of policies were used to achieve this during the pandemic, including regulatory changes, increased guidance, and testing and pre-purchase arrangements. The sharing of information to maintain quality is very important when non-traditional manufacturers enter a supply chain during a health crisis. Increased research on how to organise this process seamlessly would benefit all.

Capacity buffering or backup capacity is the purchase of additional capacity for products that can be used to increase supply or to resolve reduced capacity elsewhere in the system. This can be done by the supplier to ensure reliability, or it can be purchased by the health system to “reserve” the capacity (Sodhi and Tang, 2021[74]). It is commonly undertaken by use of a contingency contract (Chen et al., 2021[35]) Capacity buffering – increasing the supply in times of crisis – requires some lead time, and may depend on the availability of other inputs in the supply chain. Geographical proximity and monitoring may improve confidence in the ability to increase production and assure supply in a time of global crisis. Diversification and including multiple geographical sources (domestic and international) may, however, offer better protection in increasing capacity (Fabra, Motta and Peitz, 2020[42]).

Resilience in supply chains is first built by firms and other stakeholders involved in manufacturing and distributing essential medicines and medical devices. This chapter highlights that governments have many policy options to support these efforts and to create the right incentives. Investing in more resilient supply chains for essential medicines and medical devices will improve outcomes during crises, strengthening overall health system resilience. It will also encourage predictability and reliability between disruptions and large-scale shocks. The momentum generated by the COVID-19 pandemic offers an opportunity to increase co-operation between governments, and between governments and firms. It should be used to set in motion reforms and initiatives to better prepare health systems for future crises.

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Notes

[1] Essential medicines are those that satisfy the priority health care needs of a population. They are intended to be available in functioning health systems at all times, in adequate amounts, in appropriate dosage forms, with assured quality and adequate information, and at prices affordable both to individuals and the community. Operationalisation of the essential medicines concept is intended to be flexible and adaptable. Precisely which medicines are deemed essential is a national responsibility (WHO, 2022[75]).

[2] Capacity reductions may be the result of issues with manufacturing processes or of disruptions within the distribution chain due to physical problems of infrastructure and logistics, or diversion of products (e.g. due to parallel export).

[3] This means that the pharmaceutical sector is adding more value domestically with a higher value-added share from pharmaceutical firms producing final products and/or additional inputs sourced domestically from other Swiss firms (in the pharmaceutical sector or other industries).

[4] HHI are calculated as the sum of the square of value-added shares for each originating country and industry in the supply chain for a given final product.

[5] Debates about reshoring – understood as repatriating all production stages in a single economy – are ongoing following the shortages observed during the COVID-19 pandemic. Numerous examples confirm that domestic production is not an answer to risks and shortages. Risks can differ between domestic and foreign economies, but all places of production are exposed to risks (disasters, contamination, bankruptcy of suppliers, etc.). Concentration of production – either in the domestic market or in foreign markets – increases the risks of shortages.

[6] Initially sold as Clexane® (in Europe) and Lovenox® (in the United States), and developed by Sanofi-Aventis, enoxaparin is now a multisource product following the expiration of key patents in 2012. Other LMWH products include dalteparin, nadroparin, reviparin and tinzaparin.

[7] The Harmonised Commodity Description and Coding System, generally referred to as “Harmonised system or HS”, categorises products according to 6-digit codes. HS 300 190 includes exports of heparin and its salts but is not limited to these products. With respect to heparin, products at different stages of transformation are covered. For example, Figure 11.9 also shows exports of heparin sodium (e.g. from Singapore) and not just crude heparin. Higher values of exports may also reflect higher prices in capacity-constrained markets.

[8] Discussions in the European Union on the Single Market Emergency Instrument (SMEI) include proposals for mandatory information requests for businesses about their production capacities.

[9] The term NTM refers to a diverse set of measures in terms of purpose, legal form and economic effect – all policy measures other than tariffs that have a more or less direct impact on international trade. They can affect the prices or quantities of traded products, or both. These measures are generally imposed to address market failures, such as information asymmetries or negative externalities. They can provide a signal of quality, strengthening consumer confidence that foreign products abide by domestic regulations, but can also add compliance costs and additional controls at borders (UNCTAD, 2019[66]).

12 Building the data and digital foundations of health systems

Rishub Keelara and Philip Haywood

This chapter discusses the digital and data context in which OECD countries entered the COVID-19 pandemic and their responses, common challenges and lessons learnt. The pandemic accelerated the digitisation of health systems. Improvements in data, data governance, analytics, and digital foundations were required to manage health systems effectively in response to the pandemic. OECD countries improved data reporting and almost all enhanced data timeliness. The chapter outlines how increasing the availability of integrated digital information, underpinned by appropriate governance frameworks, would strengthen health system resilience. Beyond building resilience to address future shocks, improving the use of health data and its governance would aid the functioning of health systems between crises.

Key findings

Modern health systems are built around data and information. These are required during crises, such as the COVID-19 pandemic, and to ensure that health systems are sustainable, effective and efficient over the longer term.

Prior to the COVID-19 pandemic, less than two-thirds of OECD countries (13 of 22) responding to the 2019-20 OECD survey of National Health Data Infrastructure and Governance could link data across multiple health care settings. Half of 22 responding OECD countries had data from any key national dataset available within a week of record creation. Only four OECD countries had data available from five or more key national datasets within a week of record creation.

These data deficits limited early absorption of the impacts of the pandemic. Information was needed at multiple levels across the health system. Countries that lacked basic timely data – on hospitalisations, health care workforce, resources and mortality – risked unintended consequences. Not having sufficient information on vulnerable and marginalised groups was also a weakness. For example, poor data measurement and evaluation in long-term care facilities hampered the early response to COVID-19.

The pandemic accelerated health digitalisation. All countries responding to the OECD Health Data and Governance Changes during the COVID-19 Pandemic Questionnaire 2021 reported improved data reporting and almost all (over 90%) enhanced the timeliness of data. These positive changes facilitated the effective use of resources (for example, supporting co-ordination of intensive care capacity), improved mitigation efforts (for example, through vaccine passports) and protected the public and health care workers (for example, through use of telehealth). Information was used beyond the health system to improve containment and mitigation efforts (for example, daily updates of dashboards were commonly used to communicate with the public). International co-operation and data sharing increased (for example, clinical trials were conducted across national boundaries).

While OECD countries have sought to mitigate data deficits, countries need to build further on the gains made to deliver an information-rich future:

- In 2022, most countries still could not link important markers of vulnerability to health outcomes, benefits and harms.
- Resources and training are required to improve the use of information across health systems, fortifying the evidence base for appropriate action.
- Health data governance frameworks need to preserve trust of populations in how their health data is collected, stored, and used (for example, for contact tracing and vaccine certificates). Preserving trust is vital to responding effectively to large-scale crises.
- Increasing the reliance of health systems on digitalisation also brings risks that need to be mitigated. In 2022, cyber threats and disasters restricted access to digital information in health systems. Furthermore, the benefits of digitalisation may not be spread across the population, entrenching inequality.

Health system resilience would benefit from high-quality timely data, facilitating a speedier and more agile response to shocks. Data from outside the health system will need to be linked to health system data for whole-of-society responses. For example, health data may need to be combined with meteorological data to identify early and mitigate future heat waves.

Updating governance frameworks, ensuring interoperability and enhancing the use of existing data are important to building more resilience into health systems. Policies should both foster the development of data and artificial intelligence-driven tools and sharing of these innovations equitably across the health system.

12.1. Data infrastructure supports resilient and efficient health systems

Health systems continue to be built around data and information in the 21st century. An integrated health information system enables secure exchange and movement of data used to create information and knowledge that advance health systems and broader policy objectives. Integrated health information systems require strong data infrastructure, comprising the assets, technology, agencies and institutions needed to collect, store, maintain, distribute and (re)use data by different end users (OECD, 2022[1]).

An integrated health information system helps countries improve their capacity to get the best performance and value out of their health systems between and during crises in three ways. First, it improves care quality (including safety, effectiveness and efficiency). Second, it improves patient empowerment by enabling people to access their own health information, and for this information to "follow the patient" wherever they seek care in the health system. Finally, it increases the capacity to use health and other data for important secondary purposes, such as informing continuous assessment of health system performance and facilitating learning, from the national level to the clinician's office. Integrated health information systems enable more effective and efficient:

- public health monitoring and surveillance
- resource allocation and reimbursement to reward value
- biomedical research and development
- innovation, such as big data analytics and artificial intelligence (AI) to enhance knowledge-based decisions for patient care and health system governance.

These features make health systems more sustainable as well as more resilient (OECD, 2022[1]). Improved information facilitates improvements in care, which in turn reduce demand on the health care system in times of crisis.

This chapter is divided into five sections. Section 12.1 reviews the crucial role of data and information in shaping modern and robust health systems. Section 12.2 discusses the situation within OECD countries prior to the COVID-19 pandemic. Sections 12.3 and 12.4 outline some of the policies and interventions undertaken within the absorb stage of the pandemic, and some of the adaptations that countries have implemented since or intend to implement. The final section concludes with considerations relevant to building the data and digital foundation of health systems, and how this would improve the resilience of these systems. Box 9.1 outlines some of the common terms and definitions used in this chapter.

Box 12.1. Definitions: Data, information and public goods

It is necessary to distinguish between data and information. Data are raw figures and facts and – in and of themselves – may not be very valuable. Information, on the other hand, is meaning and insights obtained from analysis of data. An information system includes the capacity to convert data into usable information and knowledge. An integrated information system has the capacity to move information around the system to those who require it, supporting decision making.

A useful analogy is an integrated transportation network, which allows passengers to move safely and securely across boundaries within a country, using various transport types. While the physical and technical infrastructure is essential, this system also requires people and institutions to operate it effectively, efficiently, safely and predictably (OECD, 2022[1]).

Data can also be public goods (see the chapter on global public goods) because their use by one actor does not prevent their use by others (i.e. they are non-rival). As multiple actors in the health system (and potentially beyond) can generate valuable information from data, gaps in data and fragmentation limit their potential as a public good. Therefore, investment is required to maximise the usefulness and provision of data (see the chapter on investing in resilience).

Health systems may contain many different types of data and data collections. Digitised information about patients – including electronic health records (EHRs) and electronic medical records (EMRs) – was particularly relevant during the COVID-19 pandemic (Oderkirk et al., forthcoming[2]).

This chapter uses the following definitions:

- Digitalisation is the use of digital technologies and data, as well as the interconnection, that results in new activities, or in changes or adaptation to existing activities.
- An EHR refers to the longitudinal electronic record of an individual patient that contains or virtually links records together from multiple EMRs, which can be shared across health care settings (making it interoperable). It aims to contain a history of contact with the health care system for individual patients from multiple organisations that deliver care.
- An EMR refers to a computerised medical record created in an organisation that delivers care, such as a hospital or physician's office, for a patient of that organisation. EMRs are provider- or organisation-centric, and allow storage, retrieval and modification of patient records.
- Health data comprise individual personal health and other individual level data. They also include data related to the administration and running of health care and the health system, including operational and financial data.
- Interoperability is the ability of two or more systems to exchange information and to make use of exchanged information. It is an essential pre-condition to developing EHRs from EMRs.

12.1.1. Information is needed at multiple levels of the health system to respond to shocks

The response to a shock 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.

Responding to large, fast-moving shocks requires accurate and current information that gives all users the best chance of pursuing action that maximises the functioning of the health system and minimises harm. Such harm can arise from the shock itself, or from the direct and indirect effects of the policies used to respond to it. The COVID-19 pandemic demonstrated these requirements.

In the context of the pandemic, decision makers at institutional, regional and national levels required integration of diverse data collections to provide real-time information to inform their assessments and co-ordinate the health system and actions beyond the system. The impact of the pandemic spread well beyond the health system, with the burden falling heavily on the social care and long-term care sectors (see the chapter on long-term care).

At the individual patient and provider levels, availability of information that follows the patient was useful, given the pandemic's widespread disruption of health care – including rapid changes in how and where health care was provided, and by whom. To target care to those who need it most, information about such needs must be provided to the health system (see the chapter on care continuity). This was a requirement not only in absorbing the pandemic but also in recovering from it, including to address delayed and deferred care (see the chapter on waiting times).

Novel pathogens like SARS-CoV-2 or new threats require knowledge to be generated about vulnerabilities, effective treatments and outcomes. This process is aided by data moving to those who can analyse them to produce information. Integrated data were also critical to the public health response to the pandemic: surveillance of infections and early detection were crucial to limiting spread during the pandemic's absorb stage (see the chapter on containment and mitigation). Later in the pandemic, the ability to gather information from multiple sources contributed to monitoring implementation of policies, their unintended consequences and relative effectiveness in driving recovery.

These issues exist for all shocks: early detection of problems can lead to policy interventions that limit and better absorb disruptions, foster a quicker and less burdensome recovery, and promote adaptability to address future shocks. Surveillance can ensure appropriate deployment of resources and excess capacity to mitigate against cascading failure.

For this to occur, information needs to be timely, comprehensive, appropriate, interpretable and tied to responsibilities for decision making. The response to large shocks, like the pandemic, can involve transformation of the health system (e.g. the move to telehealth), new collaborations (e.g. integration of private and public critical care facilities) and learning feedback loops to address novel and new situations. It is important that data infrastructure facilitates these activities and is not a barrier to using data when needed. The ability to have the information on which to base a decision is fundamental to a resilient health system (Hanefeld et al., 2018[3]).

12.2. The health sector had not harnessed the full potential of digitalisation before the pandemic

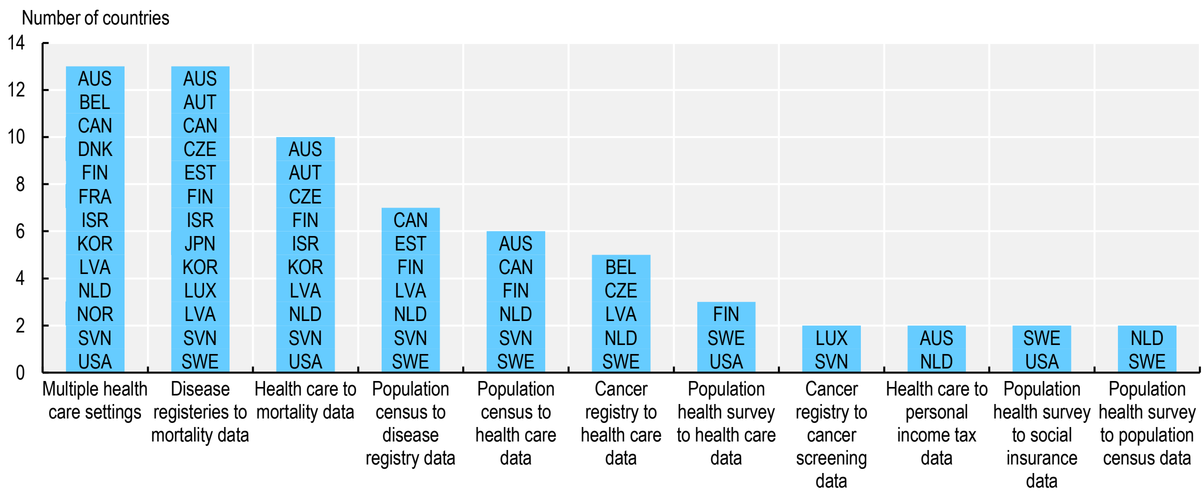
Just months before the start of the COVID-19 pandemic, the OECD released a flagship report entitled *Health in the 21st Century* (2019[4]). This assessed the state of digitalisation in the health sector and the opportunities to bring health systems into the 21st century. The main finding of this work was that, in most cases, the health sector in OECD countries remained "data rich but information poor". The report noted that, despite some promising indications and successes, the health sector was lagging behind other sectors and had yet to harness the full potential of digital opportunities. To gain the benefits of these opportunities, data need to be available, and an appropriate governance structure needs to be in place.

The COVID-19 pandemic highlighted this lag. In many OECD countries, key national health data were kept in silos, fragmented, unstandardised and inaccessible, with a wide range of distinct governance frameworks for sharing and implementing data insights. The decentralisation of data was an impediment to quick and co-ordinated responses to the pandemic.

12.2.1. Datasets were not linked, and quality was not assured

According to the 2019-20 OECD survey of National Health Data Infrastructure and Governance, prior to the pandemic only 13 of 22 responding OECD countries were able to link data across multiple settings within health care (Figure 9.2), and few had real-time data available for some data collections (Oderkirk, 2021[5]). Differences in data linkage capability between countries also grew over time. The survey results suggest that between 2013 and 2020, half of all responding countries (i.e. 22 OECD countries and Singapore) reported improvements in dataset availability, maturity and use, while half reported a drop in capability.

Figure 12.1. OECD countries able to link data across multiple settings before the pandemic



Source: Adapted from Oderkirk (2021[5]), "Survey results: National health data infrastructure and governance", https://doi.org/10.1787/55d24b5d-en.

Few responding OECD countries had real-time data availability before the pandemic. Half (11 of 22) of responding OECD countries had data from any of 13 key national datasets available within a week of record creation. Only four OECD countries had data available from 5 or more of the 13 key national datasets within a week of record creation.

Multiple challenges were experienced when developing national health datasets. These included limitations in data quality (e.g. in content, gaps in population coverage, lack of unique patient identifiers, exclusion of non-reimbursed services, data coding problems, lack of digitisation and lack of timeliness), challenges in policies and data governance, high costs of data access, lack of resources and barriers to linkages and sharing within countries. Two-thirds of OECD countries (14 of 22) responding to the survey reported concerns about the quality of national data that limited their usefulness (Oderkirk, 2021[5]).

Fragmentation of data and information make it more difficult to integrate care around patients. Without systematic data linkages at the individual patient level, health systems lack the ability to monitor poor performance (Barrenho et al., 2022[6]). In 2019, data from the Commonwealth Fund survey of primary care physicians showed that hospitals failed to notify primary health care about patient emergency admissions in up to 86% of cases, and failed to send critical clinical information within 48 hours after discharge in up to 88% of cases (Doty et al., 2020[7]). This situation had worsened since 2012.

The lack of real-time data was not limited to discharge information from hospitals to primary care physicians. Key information for health system management was not available in real-time or near real-time. For example, prior to the pandemic, only two countries reported having weekly mortality data (OECD, 2022[8]). Similar limitations existed for hospitalisation and intensive care data.

12.2.2. Appropriate health data frameworks were not in place across the OECD

OECD research (2019[4]) found that the main barriers to building digital health systems are not technological but rather institutional and organisational. Developing an overarching digital strategy, strengthening governance of health data, and building institutional and operational capacity would reduce these barriers.

It is important for systems to implement clear, comprehensive and consistent health data governance frameworks to facilitate sharing of information and degradation of silos. An integrated health information system does not require all data of a certain type to be kept in a single location. It is quite possible to achieve the three objectives outlined above without central storage or even aggregation.

Capacity building is required in digital skills among health workers. One of the major drivers of adopting digital technologies is the ability to use them. Increased digital capacity in the workforce would aid this, as would engaging end users in the design process to ensure that technologies meet the needs of health workers and patients. Deficits in specialist skills, such as informatics, need to be addressed (Socha-Dietrich, 2021[9]).

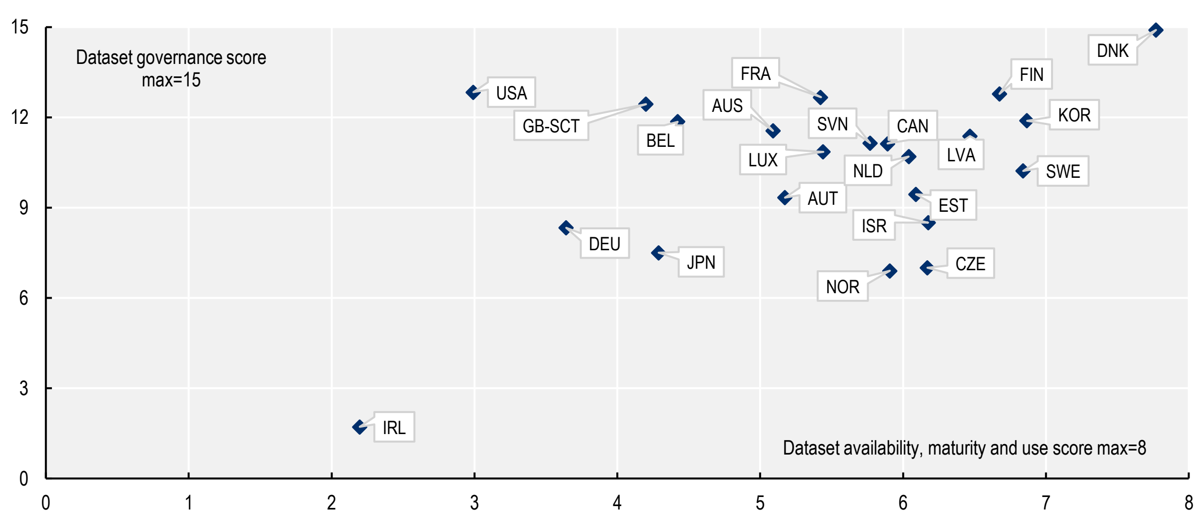
A unified and co-ordinated approach to national data governance can enable smooth information exchange and use for a range of purposes without compromising privacy, security and ownership of data. An integrated health information system requires a data governance framework that avoids overuse of consent to authorise data exchange, in favour of legal authorisation and an approach that protects privacy and ensures data security while enabling data to be exchanged and used for legitimate purposes. The OECD Council Recommendation on Health Data Governance sets out the elements for a national health data governance framework (OECD, 2016[10]; OECD, 2022[1]).

The 2019-20 OECD survey of National Health Data Infrastructure and Governance reported challenges and difficulties in developing health data governance. Virtually all respondents experienced some challenges. Those most commonly experienced were: legal restrictions or policy barriers to public authorities undertaking data linkages (16 respondents); concerns with the quality of data that limit their usefulness (15 respondents); and legal restrictions or policy barriers to sharing data among public authorities (13 respondents) (Oderkirk, 2021[5]).

12.2.3. OECD countries varied in the maturity of their dataset availability and governance

According to the 2019-20 OECD survey of National Health Data Infrastructure and Governance, countries varied in the maturity of their dataset availability and governance. Figure 12.2 demonstrates the relative maturity in Demark, Finland and Korea compared to other reporting OECD countries.

Figure 12.2. OECD country scores for dataset availability, maturity and use, and for dataset governance



Note: The dataset governance score is the sum or the proportion of health care datasets meeting 15 dataset governance elements. The dataset availability, maturity and use score is the sum of the proportion of health datasets meeting 8 elements of dataset availability, maturity and use.
Source: Oderkirk (2021[5]), "Survey results: National health data infrastructure and governance", https://doi.org/10.1787/55d24b5d-en: see Annex B Tables A B.1 and A B.2 in that report for further detail.

Many country respondents to the survey reported policy-relevant projects involving multiple countries in the linkage of their datasets or in the extraction of data from clinical record systems. These projects included parallel studies, where researchers in each country follow a common study protocol, and studies where data were shared across borders. In some OECD countries, data localisation regimes either explicitly prohibited approving the sharing of data with an organisation located outside their country or created obstacles to such sharing, such as a lack of clarity about how data sharing beyond the border might be approved (Svantesson, 2020[11]). Seven respondents reported that de-identified data from all health care datasets could be shared for approved research to take place outside their country. Another six respondents reported that sharing data outside their country was possible for the majority of health care datasets. Cancer registry data were the national data most likely to be shared internationally: 14 countries reported that they could share de-identified national cancer registry data with approved foreign researchers in academic and non-profit organisations.

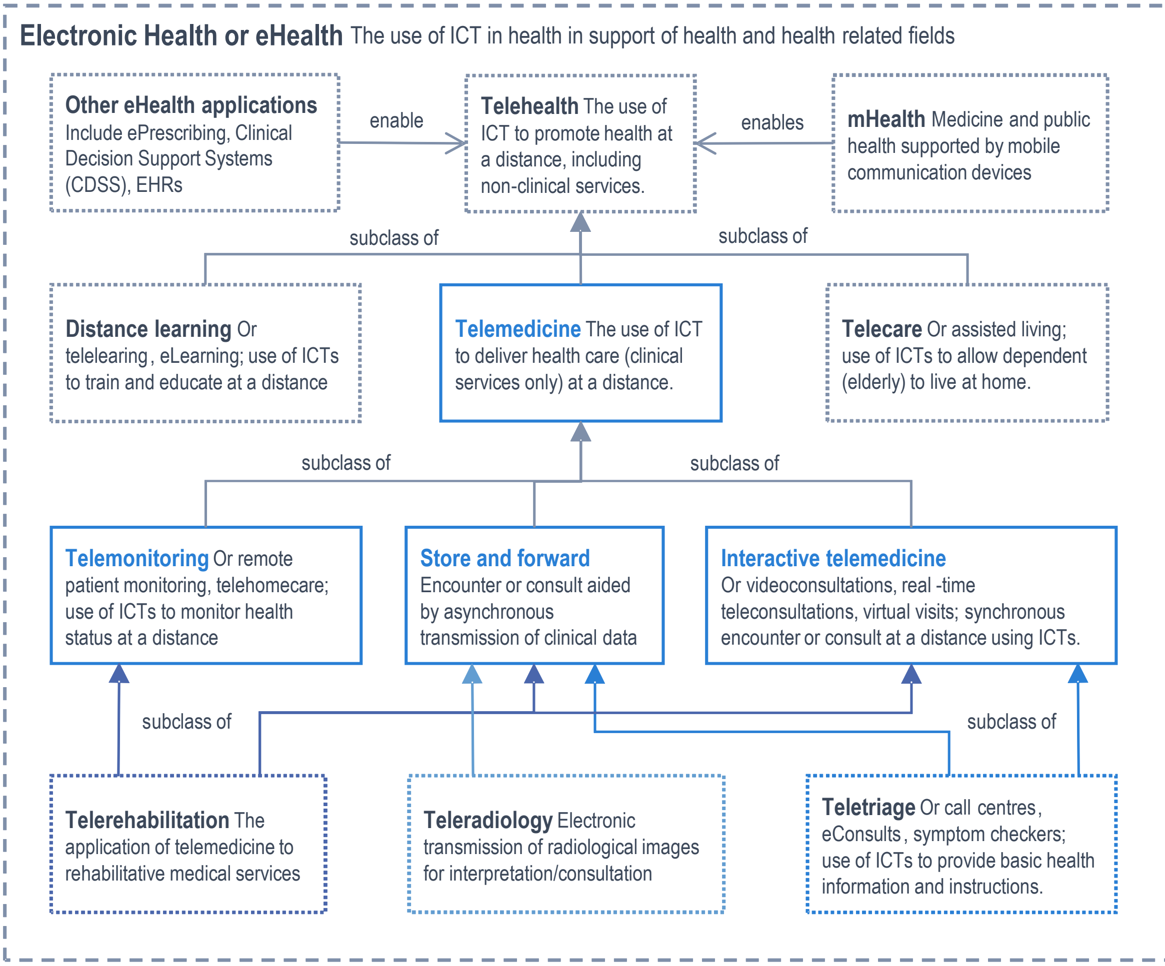
Countries with federal systems also noted the difficulties in transferring information between states or provinces. Canada reported that such sharing is possible at the national level, but only if it is not prohibited by provincial law or by the terms of data sharing agreements with data suppliers. Germany also indicated that, owing to its federal structure, state data protection laws and laws governing hospitals may prohibit data sharing with entities within, and outside, national borders. This illustrates how harmonisation of policy frameworks within countries is also critical.

As the COVID-19 pandemic continued, countries improved data collections and reformed governance to manage population health and inform decisions to respond effectively to the pandemic's impacts, as discussed in Sections 12.3 and 12.4 below. To support health system resilience in the face of future shocks, however, countries can still do more to develop systems to provide the "right information at the right time", both nationally and beyond.

12.3. COVID-19 demonstrated the advantages of digital transformation

Once the COVID-19 pandemic began, many activities undertaken in the health system and beyond benefited from digital transformation and leveraged the value of digitised health information systems. Face-to-face consultations were replaced with virtual alternatives, many processes were automated, new tools and information were provided to the public, real-time data were used to manage the health system, and some barriers to research were lowered. Countries with more developed digital governance and datasets had an advantage. The benefits of digitalisation become reinforcing as the infrastructure can be used for many different applications (Figure 12.3).

Figure 12.3. The benefits of electronic health become mutually reinforcing



Note: ICT stands for information and communication technology.
Source: OECD (2023[12]), *The COVID-19 Pandemic and the Future of Telemedicine*, https://doi.org/10.1787/ac8b0a27-en, compilation building on glossaries from the American and German telemedicine associations, and from ISO/TS 13131:2014.

The pandemic required transformation of health systems, with the ability to deliver services in a safe and physically distanced environment. For example, there was significant expansion in delivery of services using telehealth (see the chapter on care continuity). While changes in financing, physical infrastructure and training were important in expanding the use of telehealth, the digital and data foundation of the health system was essential to its success. Eighteen of 25 OECD[1] countries surveyed in the 2021 OECD Survey on Electronic Health Record System Development, Use and Governance expect the number of telemedicine consultations to increase in the future. Another four countries (Canada, Czech Republic, Denmark and Sweden) expect the number of telemedicine consultations to decrease compared to the peak of the pandemic but still be much higher than before the pandemic began (Oderkirk et al., forthcoming[2]).

E-prescribing was another example of digital transformation of the health system that reduced exposure to the risks of COVID-19. Other examples of digitisation of previously analogue activities included: online booking systems; vaccination appointments; tracking, tracing and allocating COVID-19 tests; sick leave and vaccination certificates; and reporting of test results. New digital tools and information were also provided to the public and patients, and development of public-facing applications that aided COVID-19 tracking was widespread (de Bienassis et al., 2022[13]).

The pandemic demonstrated the wide variety of actors in the health system who need access to appropriate information to make informed and timely decisions, beyond high-level decision makers. These included those making decisions about resourcing at a local level, and researchers and others evaluating the effectiveness of interventions – both medical and societal. A substantially wider group of actors beyond the health system were also using this information, from the social care sector to employers. The public need for information was also critical to promoting trust, and to the effectiveness of containment and mitigation measures (see the chapter on containment and mitigation).

12.3.1. Linked data were required within the health system

The onset of the pandemic made apparent the need for solutions to address deficits in information and communication that were vital for system monitoring and policy action. Many countries found that they lacked basic timely data for decision making within the health system – such as information on health workforce, resources, hospitalisations and mortality. Linking data across multiple datasets and providing information to those who needed it was essential to successful responses. Data from separate silos were required to assess and respond to different requirements across the health system.

A lack of real-time data on resources was a limitation in the early critical care surge, which needed to be remedied to implement effective strategies (see the chapter on critical care surge). Utilising "surge capacity" requires access and integration of data so that resources can be matched to needs. For example, information was required on available and used critical care resources across regions so that patients could be transferred from regions without capacity to those with capacity (load-balancing). In response to this issue, for example, the Australian Government established the Hospital Capacity and Activity Data Sharing System. This ensured availability of real-time patient flow data to monitor public hospital capacity and activity across state borders, collating daily data from every Australian public hospital. Canada also developed a Health System Capacity Planning Tool to support decision makers in understanding expected health resource demands and supply shortfalls related to the pandemic (de Bienassis et al., 2022[13]).

Beyond critical care, linkages of data within the health system improved countries' ability to prioritise resources for those who needed them most and to ensure completeness of treatment. This facilitated implementation of public health monitoring, test reporting and contract tracing systems. In Belgium, for example, linked databases included test results and vaccinations. The linked data were used to: identify priority groups for vaccination and evaluate vaccination coverage in certain target groups; monitor infections in certain professional categories; find contact details to facilitate contact tracing; and adapt contact tracing procedures automatically to the health status (in terms of previous infection or vaccination) of the high-risk contacts identified. Costa Rica also used linked data to underpin its COVID-19 response (Box 12.2).

Box 12.2. Harnessing digital integration: the Costa Rican experience

Investment prior to crises allows transformation

Prior to 2012, medical records in Costa Rica were fragmented, which was an impediment to delivering high-quality health care. Since 2012, a unified digital health records system (EDUS) has been a priority for the Caja Costarricense de Seguro Social – the national social insurance fund that provides universal health services for the population. The aim was to have an information system to link all public hospitals and the primary health services network. Since 2014, there was marked improvement in the information infrastructure supporting providers across Costa Rica. In 2018, it was legally mandated that all levels of health care should be compliant and should have implemented the EDUS.

The health care actions of every provider within the Caja Costarricense de Seguro Social are included in the EDUS. The completeness of the information and the full coverage of the EDUS meant that it was a practical tool in Costa Rica’s pandemic response – especially in providing telehealth, remote patient monitoring and home follow-up of COVID-19 patients.

Complete digital integration combined with multi-disciplinary teams promoted agility

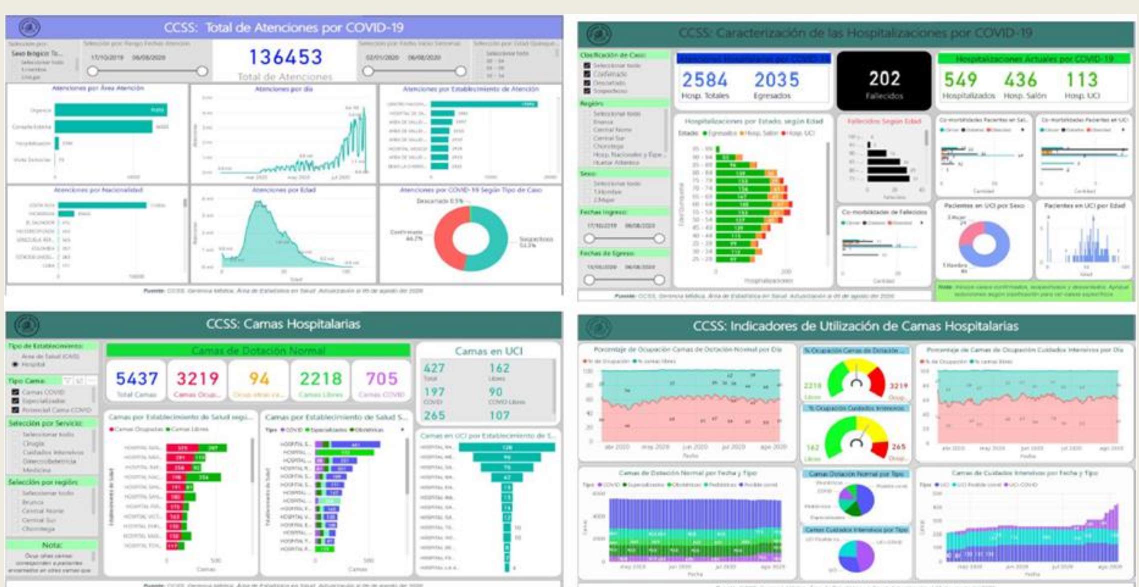
Primary care in Costa Rica is delivered by more than 1 000 multi-disciplinary teams integrated into the community, who use the EDUS remotely. All citizens within Costa Rica are assigned to a team, based on geographical location. Using the information in the EDUS, which is available in both clinics and the community, the teams were responsive to the COVID-19 pandemic. The inclusion of clinical pathways within the EDUS facilitated regular updating of the protocols used by teams, thereby ensuring the most up-to-date evidence-informed health care.

Multiple initiatives aimed at caring for individuals were implemented in response to the pandemic, using the information and functionality in the EDUS. These included:

- a rapid move to telehealth provision
- expansion of the EDUS app to include COVID-19 risk assessment and prioritisation
- identification and follow-up of at-risk families
- virtual visits by families for hospitalised patients
- specialist follow-up of patients
- implementation of vaccination programmes
- home delivery of medicines.

Complementing these initiatives, the data within the EDUS were used for system level organisation, with real-time data and dashboards generating a better understanding of available resources (Figure 12.4). The EDUS also provided the framework for effective use of dedicated facilities for COVID-19, allowing other facilities to continue non-COVID-19 health care.

Figure 12.4. Dashboard of resources and activity to facilitate co-ordination in Costa Rica



Source: Provided by Caja Costarricense de Seguro Social.

Lessons for the future

Comprehensive population level information systems, combined with population level coverage, facilitate agile real-time responses to threats. This requires technological infrastructure to be built and used by health care providers and the community prior to a threat occurring. However, such infrastructure and the data it generates need to be fortified against other risks. For example, in 2022, Costa Rica – like several other countries – was subject to cyber attacks, a key vulnerability of a digital system, leaving patients and providers at risk of data exposure or disrupting care.

Costa Rica demonstrated the benefits of extending information systems beyond simply recording health care. Household and social information are beneficial in such situations because it facilitates efficient management of resources and effective community care and treatment.

Source: Information provided by the Costa Rican Ministry of Health and Caja Costarricense de Seguro Social.

While the impact of the pandemic was predictable on some parts of health systems – such as critical care demand – it was less clear in others, including measuring the impact on non-COVID-19 patients. This gap in accessible information affected planning and co-ordination. When information was required across silos, governance frameworks were often insufficient to co-ordinate sharing and utilisation of data: while COVID-19 and the response to it crossed borders, locally collected data could not always do so. Furthermore, with data siloed, so too were practices and timeliness of inputting and maintaining data. Inconsistencies across different data systems affected the immediate use and reliability of information.

12.3.2. Electronic health records were used to generate information for the COVID-19 response

EHRs – or real-time, patient-centred medical records most often used in direct care settings – provided a robust information system for managing acute symptoms and treatments for SARS-CoV-2, and mitigating further spread of the disease. For example, EHRs supported disease surveillance and contact tracing by linking patient outcomes with contact information and communication channels. This was a key functionality for patient health. It supported broader efforts to model disease transmission and identify pockets of higher incidence. EHRs also enabled mapping of comorbidities and successful treatments to patient subgroups, enhancing care for future patients (Satterfield, Dikilitas and Kullo, 2021[14]).

Of the 25 countries responding to the 2021 OECD Survey on Electronic Health Record System Development, Use and Governance, 14 reported that EHR data were used to facilitate tracking and tracing of patients infected with Sars-CoV-2. For example, in Iceland, a system developed for COVID-19 screening at borders was expanded to be used for all COVID-19 testing in the country. The system is highly automated and fully integrated with the national EHR system and the national patient portal, meaning that all health care providers can see instantly whether a patient has a positive COVID-19 test. Furthermore, the system is integrated with the Department of Civil Protection and Emergency Management and is used to manage the national COVID-19 vaccination programme (Oderkirk et al., forthcoming[2]).

A connection between or integration of EHRs and issuing of COVID-19 vaccination certificates was reported in 16 of the 25 respondents to the 2021 survey. Iceland, for example, was again able to integrate this functionality into national EHRs, the COVID-19 testing system and the national patient portal. Seven days after a person has been completed the initial vaccination schedule with a second shot they can download a valid e-Certificate for proof of COVID-19 vaccination that complies with EU standards and includes a QR code. In Lithuania, all vaccination records (including for COVID-19) are stored in the central e-health system, and the plan is to have electronic/paper vaccination certificates with easy proof of validity compatible with World Health Organization and European Commission recommendations. In some countries, EHRs are used not only to store and communicate vaccination data but also for post-market surveillance of COVID-19 vaccine efficacy and/or adverse effects. Of the 25 responding countries, 11 reported that they are using or planning to use EHR data for this purpose (Oderkirk et al., forthcoming[2]).

12.3.3. Health system performance during the pandemic was improved by linking data from other sectors

Linkages made beyond the health system to other data also improved the performance of the health system response to COVID-19. For example, tracking and tracing was aided by linkages to other data information systems in Korea, including those related to international travellers (Box 12.3).

Information about socio-economic characteristics linked to health information allowed evidence to be generated about the risks of COVID-19 for different groups (see the chapter on COVID-19 outcomes). Some countries promoted linkages between health information and other socio-economic information. For example, Wales (United Kingdom) added linkages to COVID-19 testing, sequencing, tracking and vaccination data to its existing Linkage Databank, and Canada integrated provisional data on long-term care to understand the impact of COVID-19 on long-term care facilities (de Bienassis et al., 2022[13]).

Box 12.3. Data standardisation and integration: The Korean experience

During the first year of the pandemic, the Korean health system's management of the COVID-19 pandemic achieved case numbers and deaths that were among the lowest in the world. This was accomplished through unprecedented collaboration across agencies and sectors, which enabled standardisation and integration (linkage) of data, and use of a secure mechanism to make these data accessible to a range of actors for pandemic management and research.

Prior to the pandemic, Korea had built an epidemiological investigation support system that integrated information from a wide range of sectors to identify cases and trace contacts quickly. Several elements of this system built on Korea's review of experience with the Middle East Respiratory Syndrome (MERS) outbreak of 2015. For example, Korea developed an International Traveller Information System to provide real-time data to health providers about travellers entering from higher-risk countries. This facilitated prioritisation for testing. The 2015 MERS outbreak also triggered amendments to existing legislation so that public agencies could, at the outbreak of a serious infectious disease, collect and share several categories of data, including data outside the health system.

The system was activated in response to the COVID-19 pandemic. It offered the potential to link the data on patients who were infected with SARS-CoV-2 to data outside the health system, such as location data from mobile phone carriers and transactions from credit card companies (Park, Choi and Ko, 2020[15]).

Source: OECD (2022[1]), *Towards an Integrated Health Information System in Korea*, https://doi.org/10.1787/c4e6c88d-en.

12.3.4. Decisions relied upon information from the health system

Information was used beyond the health system in several different ways: to be published; to be integrated with mitigation activities taking place outside the health system; and for research.

Dashboards were used in most OECD countries. Dashboards were a key communication tool for sharing COVID-19-related data with the public. Generally, they were publicly accessible and updated daily. Countries usually reported number of COVID-19 tests, cases and deaths. Some countries also reported other indicators. For example, Canada included information on excess mortality and cases by country for international benchmarking (de Bienassis et al., 2022[13]).

Information on the impact of mitigation efforts needed to be integrated with information on available resources and predictions of future cases (see the chapter on critical care surge). High-level decision makers relied on this integrated information to balance the benefits and risks of their whole-of-society approaches to COVID-19 (see the chapter on containment and mitigation).

The pandemic also required rapid generation of research. At the onset, many aspects were unknown (see chapters on critical care surge, and containment and mitigation). Many countries made data accessible to researchers, producing one-stop data depositories, and improved access to patient-level data (de Bienassis et al., 2022[13]). For example, Ireland developed the COVID-19 Data-hub and introduced the COVID-19 Biobank, standardising collection and making data available for research (University College Dublin, 2021[16]).

Beyond national improvements in access to data, international co-operation and data sharing increased. European countries submitted data systematically to the European Centre for Disease Prevention and Control, and participated in the European Health Data Space, which began in February 2021. There was also a push towards decentralised clinical trials across national boundaries (de Bienassis et al., 2022[13]; De Brouwer et al., 2021[17]).

Nonetheless, fragmentation of information – especially early in the COVID-19 pandemic – resulted in disproportionate impacts on vulnerable populations and services, and particularly on those with poor data accessibility. For example, long-term care had sparse data on outcomes, and a lack of data on infections and mortality hampered early absorption and response to the pandemic (see the chapter on long-term care). These consequences emphasise the importance of an integrated health information system that breaks down silos beyond the traditional health care system to include the most vulnerable sectors of care.

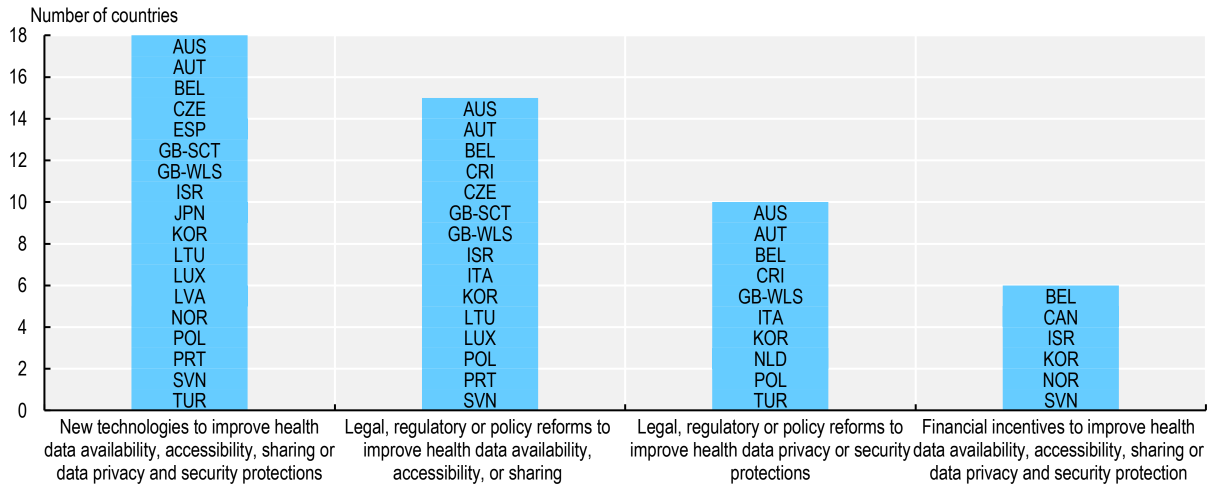
12.4. Reforms were introduced to improve data use and strengthen data infrastructure

When responding to the COVID-19 pandemic, some countries found their existing health data infrastructure inadequate to meet their needs – including systems for public health monitoring, assessment of resource use and availability, and data to monitor the status of non-COVID-19 health needs. These information gaps, some of which were highlighted in Section 12.3, served as a catalyst for new investments to strengthen health data infrastructure. The pandemic also saw countries leverage COVID-19-related reforms in a way that may address longstanding barriers in the structures, policies and institutions that have prevented OECD countries from making full use of health-related data (de Bienassis et al., 2022[13]).

12.4.1. Legislative and financial actions supported health data governance

The pandemic changed the landscape of data required to respond effectively. Countries needed more regular access to more health data, while still protecting the privacy and security of this information. Accordingly, countries instituted a wide range of initiatives to improve health data availability, accessibility, sharing, privacy, and security (Figure 12.5).

Figure 12.5. Introduction of changes to health data governance models as a result of COVID-19



Note: For the purposes of this figure, Scotland (United Kingdom) (GB-SCT) and Wales (United Kingdom) (GB-WLS) are represented independently.
Source: OECD Questionnaire on Health Data and Governance Developments in relation to COVID-19 2021.

For many countries, comprehensive legislative action was required to share and use health data to inform policy responses to the pandemic. In Australia, for example, the Office of the National Data Commissioner pursued a range of legislative priorities to support nationally co-ordinated health data systems that were accessible and could be shared between government agencies to expedite use in emergencies.

- The Data Availability and Transparency Act, which came into effect on 1 April 2022, established a scheme to share government data safely. Its implementation was supported by the addition of digital services to assist in accreditation, submission of data requests and data sharing agreements, among others.
- The Data Inventories Pilot Program developed individual data inventories for different agencies, with common standards, which could be aggregated into a central Data Catalogue to support transparency and quick response in emergencies.
- An Intergovernmental Agreement (2021) on data sharing reflected a commitment for public sector data to be shared securely, safely, lawfully and ethically, where possible. This was an important step in recognising the role of data as a national asset.
- An Addendum to the National Health Reform Agreement (2020-25) specified national actions to enable health data to contribute to long-term health reform and drive health system improvements.

In Lithuania, a new State Data Governance System was implemented to permit each state institution to prepare their data and make it publicly accessible – as such, regulations regarding the right to receive information from state and municipal institutions and bodies were updated. This encouraged state institutions to prepare, merge and analyse their data, and to create a platform to facilitate data sharing for public use. This reform related to ongoing efforts to establish the legal basis for data sharing, and for creating incentives and systems for data owners to share information.

Belgium also experienced challenges related to its existing legal framework to collect and use data for public health crisis management. In response, it created new frameworks, with the approval of many different stakeholders, and new working groups, taskforces and committees were set up to inform decision making. Similarly, in the Netherlands, legal changes were made so that the National Institute for Public Health and the Environment had access to complete and validated data from health care and long-term care (de Bienassis et al., 2022[13]).

Wales (United Kingdom) also recognised that regulatory and policy barriers were hampering timely access to data, and that the expiry of emergency regulations would make access contingent on satisfying the common law duty of confidentiality. Accordingly, Wales (United Kingdom) is monitoring the proposed changes to the legal and regulatory framework that governs the use of personal and confidential data in the United Kingdom to determine if, when and how to use its devolved powers.

Italy also progressed its legislative efforts to facilitate the use of EHRs. These included extending the types of health and social care data that can flow into EHRs, especially those related to: providing services outside the national health system; securing the ability to update and activate health data by giving citizens more ownership of their data; and guaranteeing the "right to know" who has accessed a patient's EHR.

In addition, many countries introduced financial incentives to encourage sharing of data efficiently and to improve data quality. For example, the United States established the Strengthening the Technical Advancement and Readiness of Public Health via Health Information Exchange Program to reward public health agencies for improving health information exchange for communities disproportionately affected by the pandemic. Korea also encouraged exchange of information for policy purposes by reducing or fully exempting data usage fees for COVID-19-related research.

12.4.2. Improvements in timeliness and infrastructure enhanced decision making

Real-time (or near real-time) data were key to informing decision making during the pandemic. Despite limitations in real-time information at the onset of the pandemic (as outlined in Section 12.2), almost all countries (over 90%) improved the timeliness of their data. Specific improvements occurred in mortality data, with many countries moving from an annual release to more rapid updating (de Bienassis et al., 2022[13]).

Some countries also developed new infrastructure to monitor public health. For example, Norway developed Bered'C19 in April 2020 to collect daily data on hospitalisations, primary care and emergency care. This system acts as a "data lake" to link all data sources in real-time at the patient level; this supports public health monitoring and fosters research and preparedness. Implementation of Bered'C19 was supported by existing legislation (the Health Preparedness Act) and development of infrastructure at the individual data source level. As a further example, Australia is replacing its National Notifiable Diseases Surveillance System with a secure cloud-based system that will process data in near real-time.

Change was not only legislative; technical ability and the landscape to facilitate data sharing were also improved in some OECD countries. Managing cases, contact tracing and post-market surveillance of vaccinations were examples of extensions made to existing health data infrastructure, both to monitor public health and to co-ordinate the pandemic response (see the chapter on containment and mitigation).

12.5. Adaptation for an information-rich future is necessary

Timely, comprehensive population wide data are required for an effective response to crises. Such data were missing within numerous jurisdictions at the start of the pandemic. This information may need to be broader than health data and include social and other aspects, so that decision makers can understand where vulnerabilities exist and thus where resources should be prioritised. This is especially important when crises have implications well beyond the health sector and disproportionately affect disadvantaged groups. More mature data infrastructure and governance give countries an advantage when responding to new and novel threats.

In responding to the OECD Health Data and Governance Changes during the COVID-19 Pandemic Questionnaire 2021, OECD countries with the greatest capacity to leverage health information for policy planning, decision making and research during the pandemic were those that already had a digital strategy with three key elements:

- Mature health information systems with key national health data across the health care continuum that are timely and of high quality, and that can be linked with one another and with contextual information.
- Standardised, coherent and accessible national electronic clinical record systems, including EHRs, that address fragmentation of data across health care silos and enable "one patient, one record" for a complete view of health care and long-term care trajectories and outcomes.
- Comprehensive health data governance frameworks with legislation and policies that protect privacy and data security while enabling data about health and health care to be developed, linked, accessed and analysed for uses in the public interest, including cross-border collaborations (de Bienassis et al., 2022[13]).

Fortifying the foundations of the health system (see the chapter on investing in resilience) will require **investment in an information-rich future**. This means investment in both equipment (information technology infrastructure) and ensuring that the information is developed and used well (via software, operational processes, data scientists and technological skills). It is estimated that this may require an investment of over 0.28% of GDP compared to a 2019 baseline. As discussed in Section 12.4, some of this investment has occurred since the pandemic began. Prior OECD work estimated a three-fold return on this investment (OECD, 2019[4]).

12.5.1. Governance frameworks need to be fit for resilience and to preserve trust

The OECD Council Recommendation on Health Data Governance set principles for national health data governance frameworks and called on governments to address unnecessary barriers to the efficient exchange and interoperability of health data (Box 12.4). The pandemic challenged countries to progress data governance reforms, which should adhere to the Council Recommendation. Steps undertaken to track and trace COVID-19 cases may generate concern about violating privacy, and balancing transparently the public health benefits with privacy is important (Park et al., 2020[18]). A policy environment in which respect for privacy and trust is maintained is a key reason for having a health data governance framework (OECD, 2019[4]).

Box 12.4. Development of a national health data governance framework: An OECD recommendation

The OECD recommends that governments establish and implement a national health data governance framework to encourage availability and use of personal health data to serve the health-related public interest, while promoting the protection of privacy, personal health data and data security. Below are the 12 key elements to develop and implement national health data governance frameworks.

1. Engagement and participation, notably through public consultation, of a wide range of stakeholders to ensure the framework serves the public interest and is consistent with societal values
2. Government co-ordination and promotion of co-operation among organisations processing personal health data, whether in the public or private sectors, to encourage common data terminology and interoperability standards, and common procedures to minimise barriers to sharing data
3. Review of the capacity of the public sector to process personal health data for research, statistical and other uses within the public interest – including data availability, quality, accessibility and privacy protection

4. Clear provision of information to individuals about the processing of their personal health data and timely notification of a data breach
5. Processing of personal health data by informed consent or a lawful alternative; and, when processing is not based on consent, the ability for individuals to object to the processing (to opt out), or if opt-out is not possible then to be provided with the reason why and the legal authorisation for the processing
6. Review and approval procedures for the uses of personal health data that assess whether the uses are within the public interest, which should be objective, fair, timely and transparent to the public
7. Provision of public information about the purpose of processing of personal health data, the public interest served, the procedure and criteria to approve data processing and a summary of approval decisions taken
8. Maximising the potential of new technologies to support data use and re-use, protect privacy and manage digital security risks, and support individuals' control of the uses of their own data
9. Monitoring and evaluating whether the uses of personal health data have served the public interest and brought the benefits that were expected
10. Providing training and skills development in privacy and security measures to those processing personal health data
11. Implementing controls and safeguards to:
    a. provide accountability for personal health data processing and mechanisms for audit
    b. provide privacy, data protection and security training for staff members processing personal health data
    c. designate a data protection officer to be accountable for the organisation's information security programme
    d. undertake risk assessment processes that include the risk of unauthorised data linkages and breaches
    e. take technical, physical and organisational measures to protect privacy and data security, including:
        i. mechanisms that limit the identification of individuals while allowing data re-use (linkage)
        ii. data sharing agreements that specify data security requirements and sanction non-compliance
        iii. alternatives to data transfers, such as secure data access centres and remote data access
        iv. identity verification and authentication of individuals accessing personal health data
12. Requiring organisations processing personal health data to demonstrate that they meet national expectations for health data governance, which can include certification or accreditation.

Source: OECD (2016[10]), "OECD Recommendation on Health Data Governance", https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0433.

12.5.2. Planned electronic health record adaptations will help improve resilience

In many countries, pandemic experiences have influenced national EHR and e-health strategies that will allow greater use of information to support health systems resilience. Two-thirds of responding countries

(16 of 25) to the 2021 OECD Survey on Electronic Health Record System Development, Use and Governance reported that the COVID-19 pandemic had changed their EHR system or their plans for further development and use of the EHR system.

For example, based on its pandemic experience, Canada is developing a Pan-Canadian Health Data Strategy that will modernise how health data are managed so that EHR data can flow more easily between health data systems. This will help to ensure that decision makers have the information they need to respond to public health situations.

OECD countries are also considering afresh the potential value of EHRs.

- Italy reported that its COVID-19 experience increased awareness of the strategic role of EHRs for health care and governance, and that an early warning and response system requires EHR data to be linked with other available sources. Thus, the Italian recovery plan contains a project to enhance and accelerate EHR system functionalities and usage.
- Lithuania reported that improvements have been made to the quality of EHR data, the collection of health data and the integration of EHR systems to enable the sharing and publication of COVID-19 information, with the possibility of creating open datasets. This practice is expected to facilitate further improvements related to data used for statistics, research and health care planning.
- In Portugal, the Recovery and Resilience Plan and the pandemic accelerated the digital transformation and use of digital tools in the context of health care and treatment. The Plan aims to respond to current and future weaknesses of the health system by reinforcing the current levels of evolution and standardisation of the information systems of the national health service.
- In Slovenia, the pandemic raised national awareness of the benefits of EHR exchange. As a result, use of the national EHR platform has increased significantly, dedicated financial resources have been provided, and new services and programmes have been implemented.

In the 2021 OECD Survey on Electronic Health Record System Development, Use and Governance, OECD countries also reported several levers to improve the spread and interoperability of their electronic clinical data, as highlighted below (Oderkirk et al., forthcoming[2]):

- A legal requirement for health care providers to meet national standards for EHR interoperability: 13 countries reported having a legal requirement for health care providers to adopt an EHR system (software) that conformed with national standards for both clinical terminology and electronic messaging (exchange).
- Certification of EHR system (software) vendors that requires them to adopt national standards for both clinical terminology and electronic messaging.
- Financial incentives for health care providers to install an EHR system that meets national standards and meets the requirements for national EHR interoperability.

12.5.3. Different risks need to be managed when increasing digitalisation

The pandemic brought about a rapid change in the digital landscape. It is of the utmost importance to understand the political, technological, legal, regulatory and financial implications that result from this.

Increasing digitalisation of the health system has advantages, but it also potentially increases the risks from natural and malicious sources. For example, heat stress resulted in cancellation of operations associated with the failure of servers during 2022 (Building Better Healthcare, 2022[19]). The COVID-19 pandemic also underlined the vulnerability of the health system to malicious actors, including Distributed Denial of Service and ransomware attacks on hospitals in the Czech Republic, France, Germany and Spain. Increasing vulnerability to cyber threats must be mitigated, and the OECD has distilled lessons and made recommendations to strengthen digital security, drawing from the pandemic context (OECD, 2020[20]; OECD, 2022[21]).

Another risk is that the benefits of digitisation may not be evenly spread across the population and may favour advantaged groups. New tools and digital solutions should be accelerated, designed, and tested with vulnerable groups including those living with disabilities. Making use of these tools and solutions also requires OECD countries to continue to promote health and digital literacy (OECD, 2019[4]).

The potential of AI in health is profound but the risks of unintended and negative consequences associated with its use are commensurately high in both crisis and non-crisis contexts, as highlighted in Box 12.5.

Box 12.5. Realising the potential of AI in health while managing its risks

Artificial Intelligence (AI) – technology to simulate intelligent behaviour and critical thinking – has profound potential applications in health (Huang et al., 2022[22]). This is because of the growing volume of health data, the reliance by health systems on quality, timely information to solve problems, and the variability and complexity of how diseases interact with individuals and populations (OECD, 2020[23]). AI applications in health may be physical (e.g. a robotic system for telepresence, enabling a health worker to perform actions remotely from a patient) or virtual (e.g. machine or deep learning, represented by mathematical algorithms that improve learning through experience and may enable "systems thinking" about health care) (Huang et al., 2022[22]).

Several systematic reviews analysed the impact of AI in the context of the COVID-19 pandemic (Isgut et al., 2022[24]). These reviews show the promise of AI, including the use of robots to disinfect remotely to reduce the exposure of health workers to the virus (Teng, Ding and See, 2022[25]) and to assist with medical image screening for COVID-19 diagnosis (Ozsahin, Isa and Uzun, 2022[26]).

These reviews, however, underscore AI's successful validation and deployment was limited in practice. The limitations reported include poor data quality, the challenges of scaling up projects and ensuring proper controls (without which AI could reinforce biases), and the lack of interpretability of the results (with the potential for AI to generate noise instead of real, clinically meaningful signals) (Giuste et al., 2022[27]; Huang et al., 2022[22]; Isgut et al., 2022[24]).

Many of these limitations have been noted beyond the pandemic context – poor health data governance means AI still needs human curation. In this context, governments and other stakeholders may wish to be guided by the 2019 OECD Recommendation on AI, which outlines the principles for responsible stewardship of AI and the policy requirements for trustworthy AI. This Recommendation focuses on ensuring transparency of AI, accountability for the outputs of AI models, regulatory oversight, building capacity among health workers (and the public), and long-term investment. Strong policy frameworks based on inclusive and extensive dialogue among all stakeholders are needed to ensure AI adds value to patients and to society (OECD, 2020[23]).

A final risk to be managed when increasing digitalisation is to recognise its benefits will not occur merely by digitising current processes. A key part of digital transformation relates to how new attitudes and thinking are taken on and adopted. It is important to establish national consensus on digital strategy as well as standards, policy, governance, and social license to take advantage of an integrated health system. Success and improved resilience will depend on ensuring that patients, the health workforce, institutions within the health system and decision makers use information for tangible public benefit.

12.5.4. More high-quality data and more linkages will be required in the future

Adequate data on healthcare needs, prioritisation, waiting times and healthcare delivery are required for countries to move from pandemic response to recovery. Some countries have implemented approaches to co-ordinate this information. For example, in England (United Kingdom), the Clinical Prioritisation

Programme has published prioritisation frameworks for surgery, diagnostics and endoscopy to help manage waiting lists, promote their accuracy and ensure that priority is based on clinical need. These frameworks outline the steps for clinicians to check a patient's condition, establish additional risk factors and understand treatment options (NHS, n.d.[28]).

Data needs for future shocks and to address the longer-term implications of the COVID-19 pandemic will differ from those needs identified and addressed to date. For example, understanding the health and economic implications of "long COVID" will require more high-quality data, and potentially more linkage between health and employment data (see the chapter on key findings and recommendations).

The field of health is yet to realise the full potential of big data analytics, that is, tools and methods to extract and analyse high volume, high variety and high velocity data to produce valuable insights which cannot be obtained from traditional data sources ((OECD, 2019[4]). Big data sources can include data from EMRs and EHRs, data from health monitoring devices and wearable technologies, and genomic, spatial/geographic, environmental, behavioural and economic data sets. In 2021, eight respondents to an OECD survey reported applying data mining to find or extract data within their EHR systems, eight reported applying machine learning/AI algorithms to EHR systems data for patient care or decision making, and six reported national projects to link EHR data with the types of non-health data sets outlined (OECD, 2022[8]).

Nonetheless, "bigger is not always better" when it comes to promoting high-quality data use and linkage. Big data is not necessarily "whole data": the large size of a data set does not necessarily mean it is a representative of a certain population. Therefore, big data requires robust methodologies in place to interpret it and account for biases (OECD, 2019[4]).

Availability of high-quality linked data will help to mitigate future shocks and their impacts on the health system. Co-ordination of data integration can facilitate better disease management through contact tracing, and support research into potential treatments and risk factors. Where these cross-cutting high-quality data are available, and governance frameworks for sharing and protection are in place, health systems can be more resilient and have more information available to prevent long-term consequences.

This is true of the shock that was the COVID-19 pandemic, and it will be true for others. For example, high-quality linked data will aid responses to climate events and disasters. Accordingly, stronger digital foundations may be required to support additional linkages to non-health data, such as meteorological information. Importantly, these linkages will not only support an enhanced response to shocks but improve the functioning of the health system between crises. Building the data and digital future of health systems will benefit their resilience, efficiency and sustainability.

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Notes

[1] Excluding Norway.

13 Incentivising the Development of Global Public Goods for Health

Ruth Lopert, Rohit Malpani, Philip Haywood, David Winickoff, and Hermann Garden

The COVID-19 pandemic revealed that access to global public goods and other essential technologies was far from adequate. Global public goods are those that are of benefit to all, but have traditionally been underproduced, giving rise to a global policy challenge. This chapter discusses current and proposed models for incentivising the research, development, manufacture and distribution of essential health technologies to enable them to approximate global public goods. The policies outlined also aim to ensure the affordable and equitable global dissemination of these technologies.

Key findings

The experience of COVID-19 has highlighted the need for greater focus on the research and development (R&D), manufacturing, distribution and deployment of health technologies to respond to health shocks – notably those technologies (such as vaccines and antimicrobials) related to prevention, control and treatment of communicable diseases. The pandemic demonstrated that the dominant business model for incentivising R&D does not guarantee that these health technologies will be developed, produced and made accessible globally. While massive public sector investment (such as the USD 10 billion investment in Moderna's COVID-19 vaccine by the United States Government alone) enabled the successful development of effective COVID-19 vaccines in record time, access and distribution were – and continue to be – expensive, inconsistent and inequitable.

Furthermore, current frameworks that depend on intellectual property (IP) for innovation and supply of health technologies – such as novel antibiotics, treatments for neglected tropical diseases and vaccines – have failed to deliver solutions for priority public health needs. This is due to a combination of limited market size and financial returns, inadequate infrastructure and co-ordination, and a paucity of developers and investors committed to R&D for priority health needs. For example, a vaccine that reduces both morbidity from and transmission of a communicable disease may not be developed and distributed because of insufficient market size.

Public goods are, by definition, those that are available and accessible to all, without the possibility of exclusion. Many essential health technologies are not universally available or accessible. Yet there is strong global public interest in producing certain. essential goods and making them available affordably, equitably and expeditiously, so that as far as possible they approximate public goods. This would enable countries to prepare for, and respond to, global health threats such as pandemics and increasing antimicrobial resilience.

Appropriate policy frameworks and incentives are required to ensure that such essential goods approximate global public goods (GPGs), by minimising rivalry and excludability. Where global public health interest is strong, but markets alone fail to deliver the desired outcomes, different models are needed. This chapter analyses a variety of existing and emerging mechanisms for incentivising the development of GPGs and other essential technologies that share their characteristics. From the lessons of the pandemic and this analysis, a number of key policy and funding approaches emerge:

- **Delinking research, manufacturing and supply from sales revenue:** delinkage is critical where essential health technologies are underprovided by competitive, revenue-driven markets, as in the case of novel antibiotics. Governments could trial novel pull incentives, such as innovation prizes and market entry rewards, to ensure returns independent of market size.
- **Using blended finance approaches:** leveraging public, private and philanthropic funding can facilitate multi-sector engagement, allowing organisations with different objectives to invest alongside each other while achieving their own objectives, and strengthen long-term commitment to developing essential health technologies.
- **Promoting collective and co-ordinated management of IP rights and know-how:** voluntary licensing, via patent pools or technology access pools – such as the COVID-19 Technology Access Pool led by the World Health Organization (WHO) – is one mechanism for promoting access. Technology transfer hubs, such as the WHO mRNA Technology Transfer Hub, can also expand use of platform technologies. Sharing of IP and know-how can also help to expand the manufacturing and distribution of essential health technologies. For example, voluntary licences for COVID-19 antivirals through the Medicines Patent Pool enables their generic production in low- and middle-income countries.

- **Preserving a degree of ownership of health technologies developed using public funding**, and attaching relevant obligations to public funding or pull incentives. For example, public and philanthropic funders could mandate and enforce clear obligations with respect to access and affordability. Governments could also invest directly in establishing or funding institutions to facilitate the development and production of essential health technologies.

Policy makers could also consider the following:

- **Mandating or encouraging greater transparency of funding and financing agreements** between governments and recipients, and improving overall transparency of financing flows. The costs and outcomes of R&D, production and IP protection, and the prices of products worldwide, should be transparent. Increased transparency reduces uncertainty and allows all parties to make decisions with confidence.
- **Ensuring that advance purchase agreements are as inclusive as possible of countries and populations worldwide:** many high-income countries established these agreements with manufacturers of COVID-19 vaccines. These agreements should also commit recipient companies to share IP and know-how, in exchange for greater certainty of demand.
- **Facilitating the alignment of interests and investments between public, philanthropic and private sector funders:** developing means of encouraging collaboration between such funders could reduce the rivalry and excludability of essential health technology products.

There is no single best approach to solving the development, manufacturing and distribution challenges of essential health technologies needed for health system resilience in the future. Public support will be required in many policy areas, including financing, regulation, manufacturing and even the direct provision of services. Public support should be accompanied by credible obligations to distribute such technologies equitably, especially in times of crisis.

13.1. Health technology innovation underpins resilience

The COVID-19 pandemic exposed how unprepared the world was to deal with a crisis of such scale and intensity. This has prompted extensive consideration of how health systems can be made more resilient to future pandemics or other crises. To be resilient, health systems need mechanisms to support their ability to prepare for and respond to future threats, not only to react to existing issues. It is essential to invest in developing health technologies needed to address future threats, and in ensuring health system capacity to effectively deploy them.

The existing health innovation system tends to be most effective at generating new products when they are demanded in sufficient quantities over long periods of time, or at sufficiently high prices to make markets attractive. However, the effectiveness of this model, which favours the efforts of individual firms and relies largely on the granting of intellectual property (IP) rights, has been more limited for other goods, such as novel antibiotics and drugs for neglected tropical diseases.[1]

Previous OECD research (OECD, 2018[1]) highlighted the paucity of economic incentives for the biopharmaceutical industry to develop and bring to market new antimicrobials, and the gradual drying up of the development pipeline (World Health Organization, 2021[2]). This is because it is not financially viable for pharmaceutical companies to invest in research and development (R&D), given the low return from antibiotics at the point of sale under traditional pharmaceutical funding models. Markets are too small to be commercially attractive. New antibiotics must be used judiciously, in accordance with stewardship principles to prevent the further development of resistant organisms, thus limiting demand. Further, many existing products are old and cheap, which constrains the prices of newer products. In the meantime, resistance to existing antibiotics is a slow-burning crisis whose effects could be devastating in the medium- and long-term (see the chapter on investing in resilience for discussion of the impact of the COVID-19 pandemic on antimicrobial resistance initiatives).

Similarly, prior to the emergence of SARS-CoV-2, there was no market for vaccines against coronaviruses. Vaccines had largely fallen out of favour in the biopharmaceutical industry, with low returns on investment and few big market players. The failure to complete the development of vaccines against earlier coronaviruses (e.g. SARS and MERS) was, in retrospect, a missed opportunity, but these outbreaks were too limited to make the completion of their development viable.

By contrast, the COVID-19 pandemic has been notable for the unparalleled success and speed of vaccine development. This was facilitated by massive public sector push funding for both R&D and manufacturing capacity; the latter enabling vaccine production prior to the conclusion of phase III trials, and in many cases absorbing the full financial risks of R&D failure (OECD, 2021[3]). In many respects, the scientific response to COVID-19 has been one of the more positive aspects of the pandemic response. However, it has exposed weaknesses in how policies support and incentivise the development of knowledge needed to produce effective vaccines.

This scientific success sits in stark contrast to the failure to ensure equitable distribution of and affordable access to COVID-19 vaccines, particularly in developing countries. This challenge has often affected health technologies addressing diseases that are not characterised as pandemics or pandemic threats (UN Secretary General High-Level Panel on Access to Medicines, 2016[4]). As such, the pandemic demonstrated that, absent specific mechanisms for ensuring affordable access and equitable distribution, market forces prevail irrespective of whether global supply is sufficient or not. Supply of COVID-19 vaccines based on bilateral agreements led to preferential access in high-income countries. This was an outcome that was both inequitable and inefficient. It may have resulted in more than 1 million additional deaths in low- and middle-income countries in 2021 (Ledford, 2022[5]).

There is also growing recognition that current policy approaches to incentivising pharmaceutical innovation may, in at least some therapeutic areas, need reconsideration. Despite extensive IP protection afforded to biopharmaceuticals, there is evidence of declining R&D productivity over time – see, for example Ringel et al. (2020[6]). There remains a lack of progress in areas of urgent need, such as new antimicrobials. What can be learned from the COVID-19 experience in terms of potential models? To drive innovation, what kinds of institutional arrangements are needed for agile, equitable, resilient and forward-looking systems? What policy settings and mechanisms will engender strong incentives for innovation and also create effective commitments to equitable, affordable distribution and access? How can we incentivise the development of health technologies to minimise rivalry and excludability? There are strong moral and economic arguments for enhancing the mechanisms and models of health innovation in these areas. These deserve exploration both in theory and practice.

This chapter proceeds as follows. Section 13.2 discusses the concept of global public goods (GPGs) and their characteristics, some of which are common to a broader group of health technologies. It describes the challenges inherent in current models for incentivising the R&D required for the public goods and the broader group of essential health technologies needed for resilient health systems. Section 13.3 describes existing and novel mechanisms for funding R&D, and for ensuring that R&D outputs are deployed affordably and equitably as if they are GPGs, with an emphasis on communicable diseases. Section 13.4 presents the conclusions of the analysis and policy approaches for further consideration.

13.2. The concept of global public goods

The concept of GPGs has gained increasing attention as governments recognise that challenges such as climate change and antimicrobial resistance not only require solutions beyond the remit of individual national governments, but cannot be resolved by market forces alone (Kaul and Faust, 2001[7]). Most health products cannot, in the strictest sense, become "pure" global public goods. Nevertheless, the Secretary General of the United Nations and others have urged that health products like vaccines ought to approximate GPGs as far as possible (UN Secretary-General, 2020[8]). In his view, it is important for public health and equity that this be achieved through appropriate policy and regulation.

This section discusses the nature of GPGs, and by examining the characteristics that affect the extent of a health product's rivalry and excludability, it then highlights potential targets for policy intervention.

13.2.1. What are global public goods?

Reisen et al. (2004) define a "public good" as

> "… *a commodity, measure, fact or service: which can be consumed by one person without diminishing the amount available for consumption by another person (non-rivalry); which is available at zero or negligible marginal cost to a large or unlimited number of consumers (non-exclusiveness); which does not bring about disutility to any consumer now or in the future (sustainability)" Reisen, Soto and Weithöner (2004[9]).*

The requirement for non-excludability means that market-based incentives are neither appropriate nor adequate, and governments, often the providers of public goods, are likely to have limited resources to address competing priorities (WHO Commission on Macroeconomics and Health, 2002[10]).

Although many goods and services are not pure public goods, they exhibit some of their characteristics. At one end of the spectrum are private goods, or goods that are both rivalrous and excludable. So-called "club goods" are those that are non-rivalrous but excludable, such as cable television services. "Common goods" are those that are non-excludable but rivalrous, such as fish stocks and highways (Table 13.1). Public goods that confer benefits beyond national borders are referred to as international public goods, and may be regional or global (Moon, Rottingen and Frenk, 2017[11]). GPGs are thus those that are potentially of benefit to all countries, people, or generations.

The willingness of governments to supply GPGs, either through international co-operation or by their own efforts, can be a response to externalities that cross borders, which no individual country can fully address. GPGs tend to be undersupplied. This may in part reflect concerns about ceding national sovereignty to standard setting bodies or accepting treaty obligations, as well as the difficulties of achieving agreement to collective action by governments with divergent interests and approaches to tackling common challenges, such as climate change. Another factor is the "free-rider" problem; since GPGs are non-rivalrous and non-excludable, an individual country may choose to wait until another provides a public good that it can consume (Hatefi, Marten and Smith, 2020[12]).

Table 13.1. Categories of goods

		Rivalry	
		High	Low
Excludability	High	*Private goods*: food, clothing, automobiles	*Club goods*: theatres, private clubs, cable TV
	Low	*Common goods*: clean air, fish stocks, forests, highways	*Public goods*: knowledge, policy, herd immunity, lighthouses

Source: Moon, Rottingen and Frenk (2017[11]), "Global public goods for health: Weaknesses and opportunities in the global health system", https://doi.org/10.1017/S1744133116000451.

There is no consensus on the classification of GPGs for health. Nonetheless, communicable disease control, pandemic preparedness (Stein and Sridhar, 2017[13]), immunisation, and international disease surveillance are generally considered to be GPGs. Another type of GPG for health encompasses information, standards (such as the International Classification of Diseases), guidelines, and frameworks or treaties intended for the management of cross-border challenges, such as the Framework Convention on Tobacco Control and the International Health Regulations (IHR). A third type of GPG is the production of knowledge through research, potentially including research that ultimately leads to the development of new medicines, vaccines and diagnostics (Love, 2020[14]).

13.2.2. Other essential health technologies have some of the characteristics of global public goods and benefit from similar policies

GPGs related to the production of health technologies are rare, for several reasons (Hatefi, Marten and Smith, 2020[12]). First, many products are developed in and by the private sector: for commercial reasons, they are subject to a range of measures that render them excludable. Second, many public goods funded by one or a few countries may be shared with other selected countries in the form of development assistance (Love, 2020[14]), and countries that supply them may choose not to limit excludability and rivalry. Third, most health technology products are inherently rivalrous with respect to consumption. For example, a dose of medication administered to one person is not available to another. It is straightforward to render a patented health product excludable, for example, via its price, and thus many products are excludable due to lack of affordability.

When potential benefits accrue beyond the person to whom a product is administered, for example administration of a vaccine that limits spread of a disease, it may be difficult for a sufficient market to form. Efforts to stimulate and incentivise the R&D of these health technologies are needed that delink the drivers of investment from the size of the market.

Additionally, for reasons of equity and sound public health policy, it may be desirable for some technologies to be made available as if they were GPGs – that is, to minimise excludability and rivalry as far as possible.

There are policies and investment vehicles that can render health products less excludable and less rivalrous, and thus the extent to which a good is excludable and rivalrous is essentially a “social and political choice” (Hatefi, Marten and Smith, 2020[12]) (Box 13.1). For sound public policy reasons, policy making should focus on ensuring that the outputs of publicly-funded investments are as widely accessible as possible (Love, 2020[14]).

Box 13.1. Product characteristics affecting rivalry and excludability

There are **five** characteristics that affect the extent of a product’s rivalry and excludability. These characteristics are all influenced by the choices of private actors, governments and third parties holding rights to underlying knowledge.

Characteristics that affect product *rivalry* are:

- **Supply**: Increased supply of a health product reduces rivalry. In the early stage of absorbing the COVID-19 pandemic, many products were in short supply (see the chapter on securing supply chains). Later, when vaccines became available, limited supplies were directed preferentially to (and retained by) high-income countries, even after COVAX (the COVID-19 vaccine procurement facility) was launched. The result was that fewer than 10% of people on the African continent were fully immunised by the end of 2021 (Schlein, 2021[15])
- **Appropriate use**: Inappropriate use of antimicrobials can accelerate the development of resistant organisms, rendering them ineffective and destroying their utility for future generations (Morel, Edwards and Harbarth, 2017[16]). However, measures to ensure a health product is non-rivalrous (with respect to benefit for future generations) would render the same products excludable due to restrictions on use.

Characteristics that affect product *excludability* are:

- **Regulation**: Although Governments and international agencies have taken steps to facilitate registration, for example through the WHO Prequalification Program and the Collaborative Registration Procedure, firms that hold rights to health products must also take steps to facilitate this. Many antibiotics are not widely registered; of 17 on-patent products profiled in the Access to Medicines Foundation's Antibiotic Resistance Benchmark, only six had filings in ten or more low- and middle-income countries (LMICs) (Access to Medicine Foundation, 2021[17]).
- **Affordability**: The average cost per COVID-19 vaccine dose ranges from USD 2 to USD 40 (UNICEF Supply Division, 2022[18]). This can represent a significant financial burden for low-income countries where average annual per capita health expenditure may be as low as USD 40 (UNDP Data Futures Platform, 2021[19]), and in middle-income countries that faced potentially unaffordable prices (relative to their governments' ability to pay) (Robbins, 2021[20]). Market exclusivities (patent protection, data and market exclusivity) enable producers to charge prices significantly above the marginal costs of production. Where a health product remains patented, private actors with exclusive rights can reduce excludability by offering affordable prices, providing voluntary licenses, or not enforcing IP rights. Governments can improve affordability, by regulating prices or by applying IP safeguards that facilitate competition.
- **Presentation**: A health product's presentation may be inappropriate for a specific population, country or setting. One critical characteristic is *thermostability*, or the temperature at which a product must be stored, transported, and administered. Several vaccines require cold chains and have very limited shelf-life once removed from storage, but many LMICs have limited or no cold-chain capacity (Das, 2021[21]). Oral medications with once-daily dosing are simpler for administration and adherence than those requiring injection, intravenous administration, or multiple daily dosing (Nolen and Robbins, 2021[22]). Paediatric formulations of adult products are often an afterthought (Morin et al., 2022[23]), and development may be delayed or may not eventuate. For example, while paediatric formulations of COVID-19 vaccines followed soon after adult presentations, there has typically been an eight to ten year gap between the development of the adult and paediatric formulations of antiretrovirals (Penazzato et al., 2018[24]).

Note: The Access to Medicines Foundation's 2021 AMR Benchmark evaluates 17 companies with major stakes in the anti-infectives space, and compares how they perform across a set of 20 metrics, to track progress and gaps in their efforts to keep medicines and vaccines available, despite the rise of antimicrobial resistance.

13.3. Existing and emerging mechanisms for incentivising R&D and supply

It is important for public health and equity that policy makers focus on ensuring publicly funded incentives and investments limit rivalry and excludability as far as possible. This is especially true for technologies, such as vaccines and antibiotics, that are essential for global public health and health system resilience. However, the private sector will necessarily be involved in developing, producing and distributing health technologies. The question, therefore, becomes: what models of innovation can best support a GPG-driven policy approach to delivering those technologies essential for resilient health systems?

These models may be conceptualised in two broad categories: *push* funding and *pull* incentives (Cama et al., 2021[25]).[2] Push and pull mechanisms can be applied to one or more steps in the drug development process. The extent to which a push or pull mechanism can deliver products that approximate GPGs can be measured directly according to the excludability or rivalry of the immediate output or outcome, or indirectly, by assessing its impact on outcomes and outputs of downstream steps in the drug development process.

Sections 13.3.1-13.3.5 address how push and pull mechanisms can affect the excludability and rivalry of health products.[3] Section 13.3.6 examines end-to-end push funding programmes that aspire to develop GPGs. Section 13.3.7 describes “enablers” of R&D, or institutions and entities that facilitate, de-risk, or reduce R&D costs. Section 13.3.8 outlines broader and more inclusive business models before this analysis concludes in Section 13.3.9.

13.3.1. Push funding

Push funding refers to direct funding for specific stages of R&D projects in the form of grants, investments, tax credits or low-interest loans. Push funding may either support a stage of, or an entire R&D project, or contribute to the costs. Governments contemplating the provision of push funding may be seeking to: provide additional support to the private sector to develop or commercialise new products; address an undersupply of health products for unmet needs that reflect a policy priority, but may not be commercially viable; or enable a government, international agency, or other third party to participate in developing or commercialising a new product and/or prioritise specific needs.

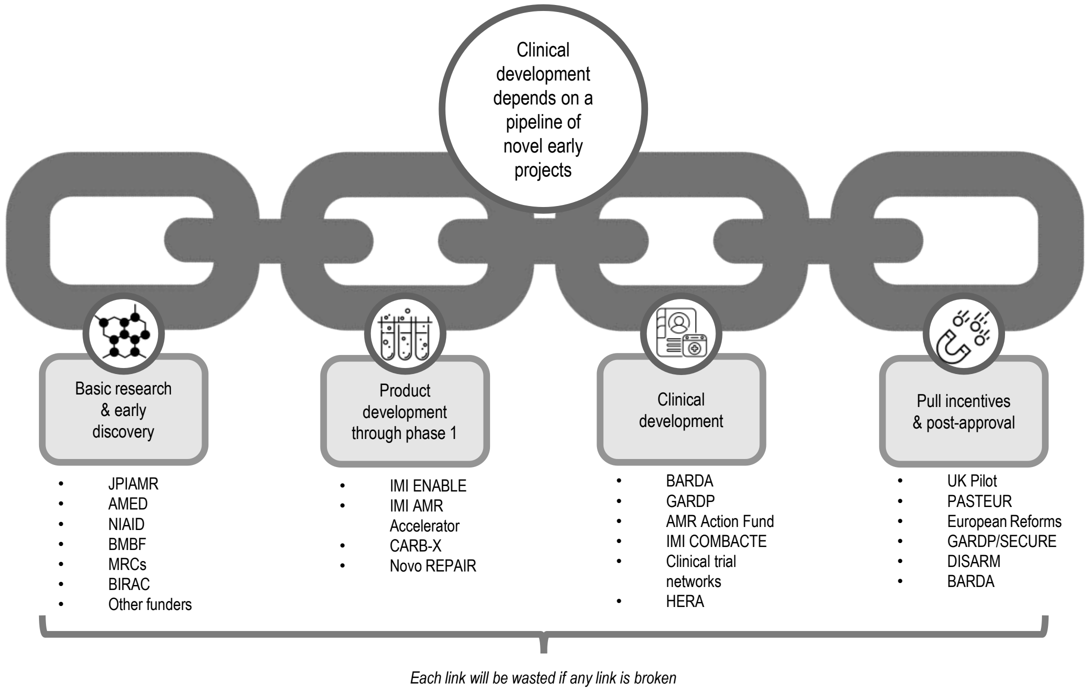
There is substantial push funding by the public sector and philanthropic organisations for all stages of R&D. Røttingen et al. (2013[26]) estimated that of USD 240 billion spent on health R&D in 2009, the public sector and philanthropic sources provided 40% of this funding. Viergever et al. (2016) identified 55 major public and philanthropic funders of health research that collectively spent USD 93 billion (Viergever and Hendriks, 2016[27]). The COVID-19 pandemic attracted new sources of push funding. According to Policy Cures, over USD 9 billion has been provided by the public sector, government investment vehicles, and philanthropic organisations as push funding for COVID-19 R&D (Policy Cures Research, 2020[28]). However, such funding likely reflects a temporary increase and may not be sustained as COVID-19 is increasingly no longer considered a health emergency.

13.3.2. Public-private collaborations

Business models built on novel forms of collaboration can provide push funding for health solutions where markets are insufficient, particularly for vaccines and antibiotics. The Combating Antibiotic Resistant Bacteria Biopharmaceutical Accelerator (CARB-X), the Coalition for Epidemic Preparedness Innovations (CEPI), and Gavi, the Vaccine Alliance, are examples of cross-sectoral collaboration along the trajectory of antimicrobial R&D and delivery (Figure 13.1 and Section 13.3.4).

In addition, the Innovative Health Initiative (IHI, formerly the Innovative Medicines Initiative) facilitates novel collaborations with diverse business models. As the world’s largest public-private partnership (PPP) in life sciences, it is jointly funded by the European Union and the European pharmaceutical industry, with a budget of EUR 5.3 billion over 2008-20. IHI drives collaboration between key players and stakeholders involved in health research, including universities, research centres, the pharmaceutical and other industries, small and medium-sized enterprises (SMEs), patient organisations, and medicines regulators. A cornerstone of the successful partnership is the commitment of dedicated resources, scientists, and expertise to the projects by the private partners (IMI Innovative Medicines Initiative, 2022[29]).

Figure 13.1. Essential links along the antimicrobial innovation chain



Source: Adapted from CARB-X (2021).

In the area of antibiotics, IHI has invested more than EUR 1 billion of its budget in 14 innovative projects tackling AMR. Several new molecular entities coming out of these projects have entered clinical stages. This interdisciplinary IHI project (COMBACTE-NET (2022[30])) is working on 11 clinical trials involving six antibacterial molecules, with a dedicated network connecting over 1 000 hospitals and labs in more than 30 European countries. In the area of vaccines, IHI has demonstrated the value of leveraging public and private R&D efforts in the development of an Ebola vaccine (European Commission, 2019[31]) that now has marketing authorisation in Europe and WHO prequalification (Ishola et al., 2021[32]). The large clinical trial infrastructure developed under COMBACTE-NET has contributed to the collective ability to address the COVID-19 pandemic in Europe and beyond.

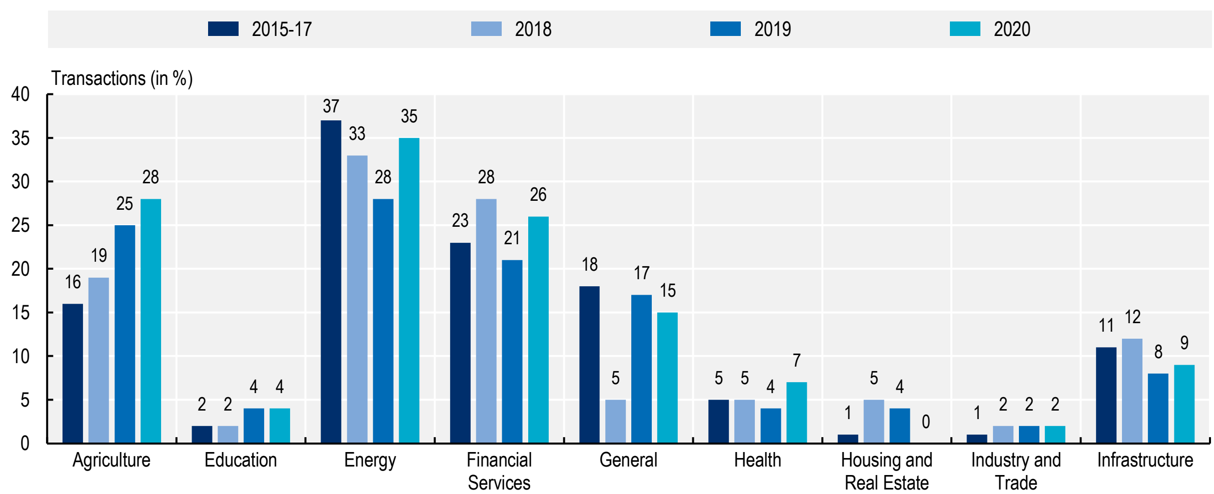
The IHI has, however, been subject to some criticism from patients, consumers, providers, payers, public interest organisations and the European Parliament. Criticisms relate to a lack of inclusivity in the choice of research priorities, adequacy of its governance structures, and the dominance of large industry players. Formal evaluations of IHI initiatives have highlighted an imbalance in the representation of stakeholders and poor standards of transparency, with civil society organisations claiming that they failed to meet the goals that justified them, including overcoming market failure and improving the development and availability of health technologies for unmet medical needs (Global Health Advocates, 2021[33]).

13.3.3. Blended financing

Blended finance is a form of push funding that can leverage public, private and philanthropic funding. It has traditionally featured in international development assistance, especially with regard to the construction of infrastructure. However, global health actors are beginning to explore blended finance in the area of health. The OECD (2022[34]) defines blended finance as "…the strategic use of development finance for the mobilisation of additional finance towards sustainable development in developing countries." The United States Agency for International Development has a six-step roadmap for blended finance transactions. This framework encourages stakeholders to determine the potential for adopting a blended finance approach by evaluating the sustainability of the underlying programme, the potential for increased efficiency by engaging the private sector, and the presence and interest of private sector players (Lin and Sharma, 2019[35]).

Evidence suggests that blended finance can help organise and facilitate multi-sector engagement and strengthen long-term commitment to fund essential health technologies over short-term financial returns. However, despite a moderate increase in blended finance transactions in the health and education sectors in 2020, the use of blended finance for health-related priorities is low compared to the energy, agriculture and infrastructure sectors (Figure 13.2). Private sector support for Sustainable Development Goal 3-related priorities has tended to be smaller than government-led initiatives (Apampa, 2022[36]). Further, the scale of health-related funding initiatives is usually smaller than in sectors such as financial services and energy.

Figure 13.2. Utilisation of blended finance by sector



Note: Proportion of closed transactions by sector.
Source: Convergence (2021).

To increase the use of blended finance for health, public funders, philanthropic organisations, and other donors, could combine to provide a catalytic layer of "funds for funds". Although this approach has been used more to date in the field of international development assistance, the creative pairing of public grants and equity investment has the potential to de-risk and thus incentivise more private investment. In health, blended finance might be useful in helping overcome "valley of death" problems[4] along the innovation chain, supporting market uptake of innovations and increasing deal flows to investors.

Box 13.2. Evaluating push funding mechanisms

The following are helpful in describing and assessing the contribution of push funding mechanisms to the development of GPGs:

- **Source of funding**: This could include: publicly-funded R&D; R&D funded by philanthropic foundations (including large, multi-purpose philanthropies such as the Gates Foundation or Wellcome Trust, as well as disease-focused charities that support or invest in R&D); funding provided by a for-profit private sector entity; or mixed R&D funding (which may combine funding from several sources including governments, NGOs and the private sector).
- **Type of funding**: This includes grants, low-interest loans, investments, or tax credits.
- **Stage of R&D to which funding is applied**: This could include one or more of the following: discovery; translation; development; and/or commercialisation.
- **Direct impact on rivalry and/or excludability**: The extent to which the funding facilitates the partial or complete reduction of the rivalry and/or excludability of the expected output or outcome.
- **Indirect impact on rivalry or excludability**: Whether the push funding indirectly reduces the rivalry or excludability of a downstream output or outcome.
- **Nature and extent of access requirements to reduce rivalry and/or excludability**: This refers to the introduction of specific requirements that affect the rivalry and/or excludability of a health product, and include pricing, regulation, overall and allocation of supply, product presentation/ formulation (e.g. for paediatric use)

13.3.4. Examples of existing push funding mechanisms

This section presents an overview of existing push funding mechanisms and considers the extent to which their outputs are able to approximate GPGs, applying the factors that are helpful in describing and assessing these mechanisms (Box 13.2).

Combating Antibiotic-Resistant Bacteria Biopharmaceutical Accelerator (CARB-X)

CARB-X is a push funding mechanism sponsored by governments and philanthropic entities that provides grants for the early stages of preclinical development and Phase 1 clinical testing for products targeting known drug-resistant bacteria. Two direct outputs are investigational compounds to address a drug-resistant infection, and clinical trial data. CARB-X permits grantees to seek IP rights for compounds developed with its funding (CARB-X, 2022[37]). However, its contracts require grantees to develop stewardship and access plans that include commitments to introduce strategies for responsible stewardship and appropriate access in low- and middle-income countries (LMICs) within 90 days of a product entering Phase 3 clinical development (CARB-X, 2022[38]). Plans are published if the products gain marketing approval.

Stewardship and access plans can reduce rivalry through manufacturing commitments and support sustainability through stewardship planning. Excludability can also be minimised if developers commit to registering products and setting affordable prices in LMICs. Although each grantee is contractually obliged to develop plans (which remains with the product irrespective of ownership or development rights to it), there is no minimum standard (CARB-X, 2021[39]). Moreover, CARB-X does not require grantees to develop formulations or presentations of products for specific populations, such as children and neonates.

Coalition for Epidemic Preparedness Innovations (CEPI)

CEPI is a non-profit foundation with donors from the public, private and philanthropic sectors. It was established in the aftermath of the 2014 Ebola outbreak to develop vaccines to prevent and respond to emerging infectious diseases, and to "secure access to such products for the populations who need them" (CEPI, 2022[40]). CEPI is one of the founding members of COVAX, the international partnership to develop, manufacture, procure and distribute COVID-19 vaccines. Since its establishment, CEPI has focused on three direct outputs: clinical trial data (safety testing in preparation for an outbreak or pandemic, and late-stage testing in response); knowledge (IP) generated through its investments; and investigational vaccines, including support for manufacturing.

Initially, CEPI's equitable access policy introduced obligations for grantees that included:

- requirements for the production of investigational vaccine stockpiles during an epidemic
- requirements for registration, supply, and affordable prices (for example, through prices as low and as close to optimal marginal cost of production as possible for affected populations, with a particular focus on low- and low-middle income countries as well as countries in crisis)
- specifying appropriate data sharing practices that included prompt and public disclosure of all clinical trial results, including negative outcomes
- retaining "step-in" (march-in) rights for IP, backed by "triggers",[5] to ensure that supply and other equitable access obligations were met (CEPI, 2017[41]).

More recently, however, CEPI modified its equitable access policy in three ways: to limit its step-in rights; to require a less onerous commitment to affordable prices for most countries; and to introduce a degree of opacity to the terms and conditions requiring grantees to ensure equitable access conditions are in place and are respected (MSF Access Campaign, 2019[42]).

Since the COVID-19 pandemic began, CEPI has invested in multiple vaccine candidates. Some of these candidates have been approved and are in use, several others did not succeed, and a third group is under development for future use as pan-coronavirus vaccines. CEPI investments include a USD 0.9 million investment in the development of Moderna's mRNA COVID-19 vaccine in January 2020 (for its Phase I clinical trial). While CEPI's investment was both modest and upstream (occurring prior to the WHO's declaration of a public health emergency of international concern), Moderna agreed to CEPI's equitable access principles. These principles were that appropriate products are first available to populations when and where they are needed at prices that are affordable to the populations at risk, especially low- and middle-income countries or to public sector entities that procure on their behalf (CEPI, 2021[43]).

Despite this, Moderna's vaccine has been mainly acquired by high-income countries, and at prices that LMICs may struggle to afford (Rauhala, 2021[44]). CEPI also invested USD 383 million into the development of AstraZeneca's COVID-19 vaccine. However, while CEPI was able to secure 300 million doses on behalf of COVAX (CEPI, 2021[43]) through its agreement, the European Union, United States, Canada, and other countries secured 1.9 billion doses in aggregate (Usher, 2021[45]). Licensing of the IP and know-how used to manufacture the vaccine, for example, to additional suppliers in LMICs, could have yielded larger quantities of vaccine than a supply reservation.

CEPI recently finalised a new Strategic Plan, which includes establishing networks and partnerships to address several objectives including the promotion of equitable access (CEPI, 2021[46]). It has identified several effective interventions to reduce rivalry and excludability of funded vaccines – such as decentralised manufacturing, building R&D capacity in LMICs, and supply reservations. However, CEPI may face significant challenges in adequately addressing excludability and rivalry of new pandemic vaccines, either during the early stages of a pandemic when demand may exceed supply (and thus inequities may arise), or where the vaccines have strong commercial potential.

CEPI has also stated that it will pursue "tiered pricing frameworks", which can deliver affordable prices under specific conditions, including transparency of pricing, price tiers that reflect value for money and capacity to pay, and avoidance of arbitrage. However, CEPI does not mandate technology transfer of vaccine platforms or vaccines from pharmaceutical industry grantees. It will instead seek voluntary solutions that grantees may or may not choose to adopt. Separately, CEPI will seek to engage major R&D funders, such as G20 members, for "adoption of a minimum set of equitable access requirements in all new public funding and procurement arrangements", to be accompanied by increased government funding commensurate with actual need and not limited by what is available within international development assistance budgets (CEPI, 2021[46]).

Global Health Innovative Technology Fund

The Global Health Innovative Technology Fund (GHIT) is an international public-private partnership fund that provides push funding for medicines, vaccines, and diagnostics for malaria, tuberculosis, and neglected tropical diseases. It is a mixed fund that includes contributions from the Japanese Government, Japanese pharmaceutical companies, and philanthropic organisations (GHIT, 2022[47]). It funds projects at every stage of product development – from preclinical discovery through to product registration – though not all projects are funded on an end-to-end basis (GHIT, 2022[48]). It also works with other push funders to complete product development (GHIT, 2022[49]). Three outputs across the GHIT investment portfolio are knowledge associated with investigational compounds, vaccines, and diagnostics; data generated at different stages of the drug development process; and health technology products. GHIT has developed product and data access policies that have both direct and indirect impacts on whether the generated data, knowledge and health products can approximate GPGs (GHIT, 2022[50]).

GHIT's data access policy requires that data should be available transparently and publicly, including in public access repositories or alternatives "that can ensure the transmission of new scientific findings to the larger research and development community globally" (GHIT, 2022[50]). Any data used in a patent application can be disclosed by the GHIT Fund to a third party, although there are restrictions on which data are disclosed, and on the ways in which a third party may share them. Finally, any data generated through funding provided by GHIT can be subject to ownership rights that are negotiated between the different project partners. Thus, while data may be both fully non-excludable (and non-rivalrous), data generated through a partnership or used in a patent application may be excludable.

The GHIT Fund does not prevent project partners from obtaining patents, but they must grant royalty-free licenses to users in least-developed and low-income countries, while licenses for middle-income countries include royalties. The Fund's access policy does not specify licensing arrangements for high-income countries (GHIT, 2022[50]). It is not clear whether licensees may sell products to all countries or a subset of countries, or the terms and conditions that would apply. The extent to which health technology products are non-rivalrous and non-excludable may vary on a case-by-case basis:

- GHIT requires that in least-developed countries and LMICs, entities that market health products must set prices based on a no gain/no loss (cost neutral for the manufacturer) policy (GHIT, 2022[50]). However, it is unclear if developers must offer one low price or can apply tiered pricing, which can adversely affect affordability. The policy does not define a high-income country price.
- GHIT sets out target product profiles for its priority areas that are intended to "align the unique needs of end-users with desired product attributes and performance criteria" (GHIT Fund, 2018[51]). This may ensure that the end-products do not exclude specific populations, such as children. However, the extent to which such products may be non-excludable will vary on a case-by-case basis.
- GHIT works with the UN Development Program to develop an access and delivery strategy for each product which covers demand forecasting, regulatory strategy, manufacturing, procurement, and supply chain (GHIT Fund, 2018[51]). Such strategies, if adopted, would improve non-rivalry and non-excludability of health products. This should be assessed on a case-by-case basis.

AMR Action Fund

The AMR Action Fund is a blended financing mechanism that aims to “invest in the clinical development of novel antibiotics to bring them up to commercialisation” (AMR Action Fund, 2022[52]). The Fund comprises 80% industry funding, with further contributions by philanthropic institutions and development banks, including the Wellcome Trust and the European Investment Bank. The Fund assumes 5 years with capital deployment and a subsequent period of 5-7 years with additional investments as an “engaged owner”. More than 20 pharmaceutical companies are expected to contribute USD 1 billion in additional investments (Garden, forthcoming[53]).

The Fund provides disbursements for clinical development to smaller biopharmaceutical companies that are developing new antibiotics, with an overall objective of the approval of two to four new antibiotics by 2030 (AMR Action Fund, 2022[54]). The primary output of investments provided by the AMR Action Fund is knowledge (IP, clinical trial data, and novel antibiotics). While the Fund has stated that it will select antibacterial treatments that target priority pathogens identified by WHO and the United States Centres for Disease Control and Prevention (CDC), the investments may ultimately focus on antibiotics that can provide a commercial return, even if they do not meet the most urgent global public health needs. This is because decisions on which products to develop are ultimately made by entities that expect a return on investment (ReAct, 2021[55]).

The AMR Action Fund has published several principles and policies that affect sustainability, rivalry, and excludability (AMR Action Fund, 2022[56]). These include:

- ensuring companies undertake clinical trials to pursue indications that reflect the greatest unmet needs, generate data that inform appropriate use in vulnerable populations, and develop formulations that facilitate access
- supporting portfolio companies to develop regulatory strategies that support broad registration
- requiring companies to introduce access and appropriate use plans that are published during Phase 3 clinical trials, and to adhere to principles established through industry declarations, including the Davos Declaration on Antibiotic Resistance and the AMR Industry Alliance.

While the Fund encourages availability and access, it also states that companies can identify countries “where commercialisation is regarded as unfeasible within a reasonable time horizon” and for which new mechanisms, provided by governments, would be required to enable access and appropriate use. This means that for countries that grantees consider commercially non-viable, there may be no pathway for registration, supply, and access for several years. Private companies that provide funding will govern the Fund’s decision making, including with respect to access and appropriate use policies. Except for the European Investment Bank, no governments or government-led institutions participate within or manage the Fund. Even if policies related to access and appropriate use can promote access, such obligations are neither mandatory nor enforceable, and may depend on the sole discretion of the Fund’s investors and recipients.

The Research Investment for Global Health Technology Fund (The RIGHT Fund)

The Research Investment for Global Health Technology Fund (The RIGHT Fund) in Korea aims to ensure that all knowledge and information gained from grants, projects or other investments are broadly disseminated in terms of price, quantity, quality and timeframe. The RIGHT Fund requires awardees and project participants to sign and adhere to global access agreements. In terms of IP and licensing approaches, guiding principles of The RIGHT Fund global access policy are (RIGHT Foundation, 2020[57]):

- Products, data and other innovations resulting from projects should be made available and accessible in terms of price, quantity, quality and timeframe so as to benefit beneficiaries.

- Awardees and project participants may apply for and maintain IP rights to developments of projects. The RIGHT Fund will not take ownership of IP rights to funded developments, provided that it is entitled to royalty-free, irrevocable, and worldwide licenses to access and use IP rights to funded developments.
- Product access policy: when awardees and project participants are granted a patent deriving from project, awardees and project participants will grant royalty-free, irrevocable, and worldwide licenses to users operating for the benefit of the public market in least-developed countries (LDCs).

13.3.5. Pull incentives

Pull incentives encourage private sector engagement by rewarding successful development through creating viable market demand or ensuring future revenue. The following section discusses the advantages and disadvantages of different types of pull incentives.

Box 13.3. Evaluating pull incentives

Pull incentive mechanisms may be classified according to six criteria:

- **Source of pull incentive**: Sources may be public (government), private, philanthropic or mixed. Most pull incentives are sponsored by governments.
- **Stage of development**: This refers to the stage of product development at which the pull incentive is applied. Most pull incentives are applied once a product has been granted marketing authorisation by a regulatory authority.
- **Direct impact on rivalry and/or excludability**: Whether the pull incentive improves the non-rivalry or non-excludability of the anticipated output or outcome.
- **Indirect impact on rivalry or excludability**: Whether the pull incentive indirectly improves the non-rivalry or non-excludability of a downstream output or outcome, such as the affordability of an end product or its availability (production and registration).
- **Health product access requirements to improve non-rivalry and/or non-excludability**: Requirements affecting the non-rivalry or non-excludability of a health product, including its price, registration, overall supply (and allocation), product formulations and presentation.
- **Indirect impact on rivalry or excludability of unrelated health products**: Whether the pull incentive has any impact on the rivalry or excludability of unrelated health products, such as those that allow a recipient to extend market exclusivity for an unrelated health product (which could render the unrelated health product more excludable).

Additional intellectual property rights (transferable exclusivity rights)

Transferable exclusivity rights (TER) provide the recipient with the right to extended exclusivity on another health product, a right which can also be on-sold to a third party.

TERs for antibiotics have been proposed, to be awarded on approval of antibiotics that meet specific criteria. Since a TER provides a recipient (or third party) with additional monopoly rights for another product, it can lead to increased rivalry and excludability, depending on how the additional exclusivity affects price and supply. The costs may be too high for governments. According to Årdal et al., the cost of one new antibiotic to the European Union would be USD 3.2 billion (Årdal, Lacotte and Ploy, 2020[58]). Rome and Kesselheim, through a retrospective analysis of ten antimicrobials that would have secured a TER in the United States between 2007 and 2016, conclude that “while market exclusivity extensions are a politically appealing mechanism to encourage novel antibiotic development, this approach would cost public and private payers billions of dollars” (Rome and Kesselheim, 2020[59]). Moreover, a TER does not guarantee access to an antibiotic; after it is granted, the antibiotic could be removed from the market, for example, as a result of loss of interest by or insolvency of the manufacturer (Årdal, Lacotte and Ploy, 2020[58]). Impediments to improved access may be magnified if a TER does not include other obligations, such as requirements for registration, licensing, production of data to guide use, and affordability.

Patent buyouts

A patent buyout is a purchase by a government (or a private party acting in the public interest) of patents associated with a health technology product, thereby terminating the period of monopoly conferred by them. Conditions of patent buyouts can also preclude the acquisition of subsequent patents (Kremer, 1998[60]). There are currently no patent buy-out mechanisms in place for health products.

A patent buyout could be triggered at any stage of drug development, with the estimated value likely to increase as a product nears (or achieves) regulatory approval. Thus, estimating the optimal value of a patent buyout may be challenging. A buyout could potentially render both the knowledge and data associated with a health technology fully non-excludable and non-rivalrous. When exercising a patent buyout, a government could maintain ownership of the IP, and require any third party using it (for example, through a voluntary licence) to fulfil designated access conditions. These conditions could relate to supply, pricing, availability of certain presentations or formulations, and product registration. Setting an acceptable price may be difficult, however, given likely uncertainty regarding the size of markets and diverse ways of calculating value.

Innovation prizes

Monetary prizes are rewards for achieving a specified outcome. Conceptually, patents (Stiglitz, 2007[61]) and patent buyouts are also forms of prizes. Monetary prizes are likely to be funded by governments, though prizes have been funded by the private sector (InnoCentive, 2022[62]) and philanthropic organisations (XPRIZE, 2022[63]).

Several prize funds for health product R&D have emerged. The United States Government has enacted legislation to establish a framework enabling all federal government agencies to run prize competitions (Legal Information Institute, n.d.[64]). In 2017, the European Commission awarded a Horizon Prize for the development of “a rapid test for health care providers to distinguish, at the point of care, between patients with upper respiratory tract infections that require antibiotics and those that can be treated safely without antibiotics” (European Commission, 2017[65]).

Prizes and prize funds can be awarded at different stages of the drug development cycle. Milestone prizes can be awarded for completion of pre-clinical R&D or completion of any clinical trial phase. End-stage prizes (also known as market entry rewards) can be awarded upon successful regulatory approval (Love and Hubbard, 2009[66]). Since a developer incurs a greater risk of failure and accrues more expenses with each successive stage of drug development, prizes awarded later in the drug development cycle should be larger (Baraldi et al., 2019[67]), although they may be less well aligned with public health needs. Importantly, a milestone or end stage prize could be awarded as an alternative to IP protection. This would mean that the knowledge underlying the health technology product could approximate a GPG if a government chose to introduce appropriate policies and obligations tied to such prize rewards. However, if a prize recipient were to retain some or all its IP rights, then both the knowledge and the health product would remain excludable, and the prize could over-reward the recipient.

There are several potential challenges with prizes. First, governments or other prize sponsors may have difficulty determining the appropriate magnitude of a reward. Second, there can be challenges with allocating prize rewards among beneficiaries, including those entities or individuals that contributed to the development of a health technology product but do not have any formal share or stake in a successful prize submission. Third, the possibility of a prize may discourage potential beneficiaries from sharing of materials, knowledge, or technical know-how (Love and Hubbard, 2009[66]). Several proposals have been developed to address these challenges but to date none have been implemented.

For a health technology product to approximate a GPG, it is not sufficient to simply replace IP rights with a prize. For example, a milestone prize would need to be accompanied by push funding, and there should be one or more developers to develop the product. For an end-stage prize, governments would need to ensure that either the prize recipient or other manufacturers would supply the health product in a manner that would minimise rivalry and excludability.

Regulatory incentives (priority review vouchers and market exclusivity)

Governments can provide additional pull incentives via regulatory frameworks. Two categories of regulatory incentives are the priority review voucher (PRV) and market exclusivities.

The PRV programme, first introduced in the United States in 2007, initially awarded a voucher in exchange for a drug or biological product that prevented or treated a tropical disease (US Food and Drug Administration, 2020[68]). This was expanded in 2012 to include rare paediatric conditions, and in 2016 to include emerging infectious diseases. A voucher permits the recipient to obtain a priority review designation for a subsequent application to the US Food and Drug Administration (FDA) that does not itself qualify for priority review (US Government Accountability Office, 2020[69]). This designation can speed regulatory approval, which, if successful, will extend the effective patent life of a product without extending the actual patent term. A PRV can also be sold to a third party, thereby prolonging the period of monopoly of an unrelated product. A PRV can incentivise an area of R&D that is underserved, however it does not require the recipient to forego exclusive rights to the product, thus the knowledge underlying the product may remain excludable. Furthermore, there are no legal requirements to ensure the target product minimises rivalry or excludability (Médecins Sans Frontières, 2017[70]), whether with respect to affordability, registration, supply, product presentation or formulation.

Although the PRV does not extend the legal term of a patent monopoly for a product that is designated for priority review, it does extend the effective patent life. This means that while a product may come to market earlier than it would in the absence of a PRV, it may be offered at prices that maximise the benefits of the PRV. This may be the case if the PRV is used by a third party that purchases it on the open market and needs to recover its investment for a product that may not earn blockbuster revenues. The PRV, while substantial, is inexpensive compared to revenues for best-selling, on-patent medicines in the United States pharmaceutical market (US House of Representatives, 2021[71]).To date, PRVs have been sold to third parties for prices ranging from about USD 67 million to USD 350 million (US Government Accountability Office, 2020[69]).

Several governments have awarded extended periods of market exclusivity to health technology products that have an orphan designation (Gammie, Lu and Ud-Din Babar, 2015[72]), are deemed a “qualifying” antibiotic (Darrow and Kesselheim, 2020[73]), or are the subject of paediatric trials – often neglected in drug development, but now a mandatory requirement in the United States and the European Union (European Medicines Agency, 2015[74]).

Market exclusivity differs from data exclusivity, but neither is an obligation of the Agreement on Trade-Related Aspects of Intellectual Property Rights. Data exclusivity prohibits reliance on an originator’s pre-clinical and clinical test data in the evaluation of an application for marketing authorisation of a generic or biosimilar medicine, for a specified period, usually a minimum of five years. Market exclusivity prohibits a regulatory agency from granting marketing approval for a period following the initial marketing authorisation of the originator product, even where the generic does not rely on the originator’s dataset (’t Hoen, Boulet and Baker, 2017[75]). Market exclusivity can extend the duration of market monopoly of a product for which patent protection has expired, and thus the period of time in which the recipient can set prices without the possibility of competition (Institute of Medicine, 2012[76]).

Several studies have shown that the net financial benefits accruing to recipients of paediatric exclusivity generally exceed the costs of conducting the additional studies (Sinha et al., 2018[77]). Medicines gaining additional exclusivity by virtue of orphan drug designation in the United States may already be highly profitable in other indications (PCMA, 2021[78]). Moreover, there are no additional obligations imposed with respect to pricing, registration, supply, or presentation (Technopolis Group, 2019[79]). There are also wider concerns as to whether additional market exclusivity is an effective mechanism for addressing unmet needs, or may be awarded without generating a tangible public health benefit:

- Additional market exclusivity may not be the primary driver for developers. Other incentives that accrue from orphan drug designation include substantial R&D tax credits (a form of push funding) (Sarpatwari et al., 2018[80]).
- Market exclusivity may not be an adequate incentive for the development of products to address unmet needs. Targeted market exclusivities for antibiotics, such as the Generating Antibiotic Incentives Now (GAIN) Act 2012 in the United States, have not encouraged the development of novel antibiotics (Darrow and Kesselheim, 2020[73]).
- Market exclusivity may encourage the gaming of regulatory benefits rather than investment in novel product development. For example, one concern with orphan drug designation is that developers are successfully obtaining orphan designation by defining increasingly narrow indications (so-called "salami-slicing") within conditions for which drugs may have already been developed, and targeting ever smaller markets (Burns, 2017[81]).
- A product developer may be rewarded with additional market exclusivity even if the actual study or trial is unsuccessful or inconclusive. Developers can obtain paediatric exclusivity even if the product fails to show efficacy, or the company does not pursue regulatory approval for use, in paediatric populations (Benjamin et al., 2006[82]; Bostyn, 2021[83]).

Advance market commitments

An advance market commitment (AMC) is a binding contract that provides a guaranteed market for a product. AMCs are most likely to be funded by governments or philanthropic organisations. An AMC may be negotiated prior to a product's regulatory approval or following it if focused on reserving or expanding supply for a purchaser (the latter is also known as an advance purchase commitment or APC). AMCs can improve availability and access to health technologies for those on whose behalf they are awarded.

As an example, an AMC for the pneumococcal vaccine negotiated by Gavi, the Vaccine Alliance, increased supply on behalf of Gavi-eligible countries that might otherwise have been underserved, at a price that was lower than that offered to high-income countries (The World Bank, 2009[84]). Under COVAX, an AMC for COVID-19 vaccines was established on behalf of 92 least-developed and low-income countries, prior to approval of any of the vaccines (Berkley, 2022[85]).

An AMC can reduce rivalry and excludability over time for those on whose behalf the vaccine is purchased, but can have the contrary effect for those countries (and populations) not included in the mechanism. The AMC for the pneumococcal vaccine used a two-stage pricing mechanism – a higher price up front to secure supply on behalf of low-income countries, and a subsequent "tail price", negotiated with the manufacturers, that would be lower. Thus, while Gavi was able to negotiate a low tail price for pneumococcal vaccine on behalf of Gavi-eligible countries, countries that were ineligible (particularly middle-income countries) were charged a higher, tiered price. Several were unable to purchase the vaccine (Tricarico et al., 2017[86]; Chen et al., 2019[87]). Furthermore, since the pneumococcal vaccine AMC did not require recipients to either surrender or out-license IP rights, potential additional suppliers that might have competed on price and increased supply were unable to enter the market (Chu, 2017[88]; Liu, 2017[89]). Eventually, the entry of additional suppliers reduced the price of the vaccine to below the tail price negotiated by Gavi (The Pharma Letter, 2019[90]). Thus, a negotiated tail price under an AMC, even if it declines over time, may still be higher than prices achievable through competition (Usher, 2019[91]).

An AMC negotiated by one country or region can also undermine supply to another, and thereby increase rivalry for a vaccine. During the COVID-19 pandemic, many high-income countries signed AMCs (or APCs) for COVID-19 vaccines (Usher, 2019[91]). Pharmaceutical manufacturers that prioritised these AMCs had insufficient supply of COVID-19 vaccines for LMICs, even those where governments (or their donors) had also signed such agreements, either bilaterally or via COVAX or other joint procurement platforms. An AMC for a product required by all countries for which there is limited supply may only avoid worsening rivalry if all countries use such an AMC, and if there is a framework to allocate such supplies equitably, as intended by the establishment of COVAX (Mueller and Robbins, 2021[92]).

Subscription models

A subscription model involves one or more payments to a supplier in exchange for an appropriate supply of a product to treat a defined population for a specified period. This approach has been dubbed the "Netflix model" and differs from payment based on the volume of drugs sold. Subscription-based models can be used both as pull incentives and as a mechanism for managing reimbursement and supply.

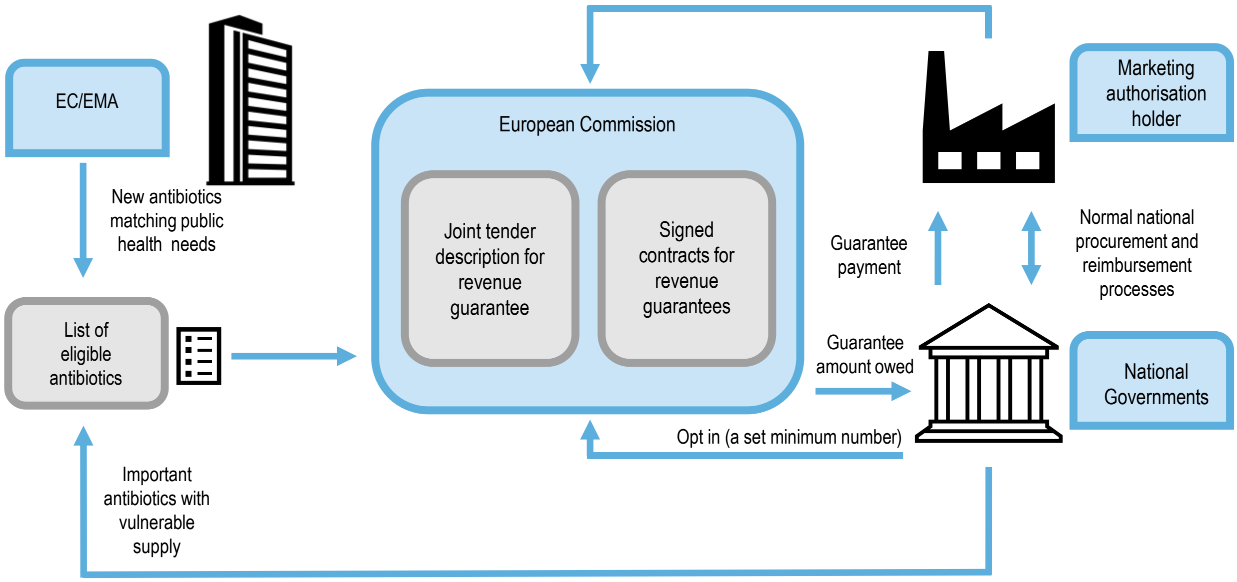
Several countries have either launched or are currently piloting subscription-based reimbursement models as pull incentives for new antibiotics (Gotham et al., 2021[93]). Other countries have them under consideration (Vorperian and Quake, 2021[94]). These subscription models treat the provision of a vaccine, antibiotic, or other medicine, as a service, and delink the payment to the manufacturer from the number of units sold. A fixed annual fee (subscription) means that use is not discouraged by high unit prices and ensures that manufacturers are not incentivised to encourage increased use. A subscription model can thus improve the sustainability of an antibiotic for use by future generations (Gotham et al., 2021[93])

Subscription-based models may not be effective for developing new antibiotics unless one country can provide a sufficiently large pull incentive on its own, or several countries act collectively through pooled procurement. The United States Congress is currently considering the Pasteur Act. If enacted, it could provide rewards for individual antibiotics ranging from USD 750 million to USD 3 billion (Gotham et al., 2021[93]).

One possible complication with a subscription model is that, while it aims to pay a fair price, it is not entirely clear how value should be attributed to new antibiotics. This is because the effectiveness of new antibiotics in reducing AMR can only be measured after sustained use (Glover et al., 2019[95]). Nevertheless, these activities show promise as innovative pull mechanisms for de-risking investment. A number of subscription models have been launched, or are currently being evaluated as proposals or through pilot studies.

- The National Health Service (NHS) England and the UK Department of Health and Social Care recently launched a subscription mechanism for antibiotics. This followed the completion of an initial cost-effectiveness review of two antibiotics (ceftazidime-avibactam and cefiderocol) covered by a pilot antibiotic subscription programme with an annual cap of GBP 10 million and a total of GBP 260 million for two antibiotics over 10 years. Unlike volume-based payments, under a subscription model, manufacturers are paid upfront fees based on the estimated value of benefits to patients and to the UK National Health Service (Cookson, 2022[96]; Gotham et al., 2021[93]; Plackett, 2020[97]).
- The European Union Joint Action on Antimicrobial Resistance and Healthcare-Associated Infections (HCAIs) (EU-JAMRAI) has proposed a multinational initiative to ensure a sustainable supply of antibiotics independent of sales volumes and clinical use (Figure 13.3).

Figure 13.3. EU-JAMRAI proposal for a multinational pull incentive



Note: EU-JAMRAI is the European Union Joint Action on Antimicrobial Resistance (AMR) and Healthcare-Associated Infections (HCAIs).
Source: Adapted from Årdal, Ploy and Lacotte (2021[98]) "D9.2 Strategy for a multi-country incentive in Europe".

13.3.6. End-to-end production of health technology products

Most R&D is based on providing push and pull incentives to private actors to develop and supply health technology products. There are, however, models of R&D that seek to generate GPGs on an end-to-end basis through push funding. Three such models are: product development partnerships; public sector development and production of health technology products; and open-source pharmaceutical development.

Product development partnerships

Product development partnerships (PDPs) are usually not-for-profit entities that enable public, private, academic, and philanthropic entities to partner and aggregate funding and other resources for the development of health technologies. PDPs have been established over the last two decades to target neglected diseases, to develop products on behalf of underserved populations, and more recently to develop products to address drug-resistant infections. These have included treatments for malaria (DNDi, 2019[99]), a vaccine to prevent meningitis in sub-Saharan Africa (PATH, 2018[100]), and a COVID-19 vaccine (Hotez and Bottazzi, 2021[101]).

However, PDPs have limitations. A PDP may be unable to license an investigational compound for all countries, particularly for high-income countries which represent potential sources of commercial revenues. Further, a PDP may not have the resources to develop a product on behalf of all populations or may not have a manufacturing partner that can satisfy demand.

Public sector development and production of health products

Governments can undertake R&D through public sector research institutes or university-sponsored research. The outputs are often licensed to private companies or not-for-profit partnerships. Governments can also conduct clinical trials, either to support the efforts of not-for-profit or private entities, or develop products originating in the public sector. Historically, some governments have also manufactured health products.

Governments could develop new products on an end-to-end basis, and render the knowledge and data GPGs, and introduce policies that enable health technology products to approximate GPGs as far as possible (Sarpatwari, Brown and Kesselheim, 2020[102]). This could be undertaken through one or more government-funded entities or could involve contracting a private sector partner to fulfil certain functions. For example, the United States Army has announced the development of a vaccine against all COVID-19 and SARS variants that is currently in government-funded clinical trials, and has indicated that it will partner with a private sector entity for the eventual vaccine rollout (Copp, 2021[103]).

Open-source pharmaceutical development

Open-source pharmaceutical development is the full end-to-end development and production of a health technology product in the public domain. It includes transparent working practices, such as the pre-publication sharing of data and ideas, the possibility of participation of any person in real-time, and a form of shared ownership that ensures all methods and data are GPGs, and that health technology products can approximate GPGs (Balasegaram et al., 2017[104]).

In 2020, the COVID-19 *Moonshot*, a collaborative open-science project, was launched with the goal of developing an unpatented oral antiviral drug to treat COVID-19. It is likely the first open-science community effort to develop an antiviral drug. It endeavours not only to produce a health product as a GPG, but for all data to be published, including negative trial results. The Moonshot project has a “single and shared vision of no IP protection to ensure any resulting therapeutics are accessible and appropriate for people in LMICs” (DNDi, 2021[105]).

13.3.7. Enablers of Drug Development

Governments can also support drug development by investing in, establishing or funding institutions and entities that can work with private, not-for-profit, or public sector counterparts. Potential enablers include: clinical trial networks, patent pools, regulatory initiatives, data hubs, compound libraries and technology transfer hubs.

Clinical trial networks

Clinical trial networks, often part of PDPs, are collaborations that bring together investigators, ethicists, physicians, and researchers to develop and test the safety and efficacy of health products for one or more diseases. These networks can improve the efficiency and reduce the costs of clinical trials, ensure trial data are publicly disclosed, facilitate R&D in areas of unmet need, and be targeted to optimise or test health products to benefit populations that otherwise are underserved, such as children and pregnant women (Wellcome Trust, 2016[106]).

Patent pools

IP policies, including those concerning the use and licensing of patents, can help create a mix of approaches for leveraging investment for GPGs. As noted above, patent pools are mechanisms for facilitating the sharing of patents and other forms of IP to encourage the development of product combinations and formulations that address unmet needs, or to facilitate competition that can reduce prices of on-patent products.

The Medicines Patent Pool (MPP) signs license agreements with patent holders for both investigational compounds and approved products that can subsequently be out-licensed to third parties for the purposes specified in the in-license agreements (Medicines Patent Pool, 2022[107]; Medicines Patent Pool, n.d.[108]). These patent pools can reduce both rivalry and excludability of knowledge, data, and health products, although the scope of each license agreement depends principally on the preferences of the patent holders, and usually only allows for use of the IP in low- and some middle-income countries. The MPP has signed voluntary licence agreements with Merck Sharp & Dohme (Merck, 2021[109]) for molnupiravir (an oral COVID-19 antiviral), with Pfizer (Medicines Patent Pool, 2021[110]) for the antiviral nirmatrelvir, and with Shionogi for the antiviral ensitrelvir fumaric acid (Medicines Patent Pool, 2022[111]).

Regulatory initiatives

Regulatory initiatives can enhance access to new health technology products by streamlining registration. The WHO Prequalification Program assesses and prequalifies health products against different diseases to facilitate procurement either by international health agencies or by governments and non-state actors that rely upon WHO assessment (World Health Organization, n.d.[112]). The WHO also hosts the Collaboration Registration Procedure (CRP), which accelerates registration of products with WHO prequalification or approval by a stringent regulator, in up to 58 countries that have joined this Procedure (World Health Organization, 2013[113]).

Data sharing hubs

Data sharing hubs collect data from multiple sources for distribution, sharing, and additional use, including for research. Data sharing hubs can play a role to support health R&D, and include data hubs for compounds, clinical trial data, virus data, and health data that is used to train and validate algorithms. The Global Initiative on Sharing Avian Influenza Data (GISAID) facilitates the sharing of influenza virus data and has also facilitated open sharing of COVID-19 virus data (Maxmen, 2021[114]). The proposed European Health Data Space will promote exchange and access to different types of health data (electronic health records, genomics data, patient registry data) for health research, health delivery, and policy making (European Commission, n.d.[115]).

Compound libraries

Compound libraries enable research entities to employ high-throughput screening to select molecules for further screening and pre-clinical research (DNDi, n.d.[116]). Several research entities and pharmaceutical companies have made compound libraries fully or partially open for use by third parties. Compound libraries can play an important role in improving drug discovery for areas of need that otherwise are undersupplied and remove barriers to use of such knowledge.

Technology transfer hubs

Technology transfer hubs can facilitate the sharing of knowledge, data, IP and know-how for the development and manufacture of health technology products. Since the COVID-19 pandemic began, the WHO has announced it intends to establish several hubs, including a first hub in South Africa that will expand the capacity of LMICs to develop COVID-19 mRNA vaccines and scale-up manufacturing. This would include the transfer of a comprehensive technology package, appropriate training and any licenses required to facilitate production and export of mRNA vaccines to LMICs (World Health Organization, 2021[117]).

13.3.8. Broader and more inclusive business models

Health technology innovation must be embedded in population-based functions and frameworks to realise synergies between national health systems and to support global health co-operation. Almost a decade apart, Jamison (2013[118]) and Niang et al. (2021[119]) draw similar conclusions from pressing global health challenges: that enhanced investments to scale-up health technologies and to address socio-economic determinants of health are both critical to achieving long-term societal gains.

Collaborative platforms that aim to drive innovation in public goods often pursue both economic and social returns according to commercial and welfare logics. In this regard, new business models are springing from broader definitions of value. The Economy for the Common Good (ECG) model (Felber and Hagelber, 2017[120]) and the Human-Centred Business Model (HCBM) (Lessidrenska and Boyer, 2020[121]) are examples of frameworks based on a holistic and integrated set of economic and social priorities (Box 13.4).

Box 13.4. Reframing business models to integrate broader definitions of value

The Economy for the Common Good (ECG) model

Developed by the European Economic and Social Committee (European Economic and Social Committee, 2022[122]) of the European Commission, the ECG model proposes a more inclusive approach to Corporate Social Responsibility (European Commission, 2011[123]). The framework positions companies as drivers of delivering shared value and preventing and mitigating possible adverse outcomes.

The Human-Centred Business Model (HCBM)

The World Bank's Global Forum on Law, Justice and Development (The World Bank, 2019[124]; Global Forum on Law, 2022[125]) and the OECD Development Centre (OECD, 2022[126]) have developed a framework through which corporate strategies, public policies and regulations incentivise companies to pursue sustainable development (Lessidrenska and Boyer, 2020[121]). The HCBM brings together diverse stakeholders – academia, private sector and professional associations, civil society, and international organisations – based on principles concerning financial mechanisms, fiscal policies, procurement policies, and stakeholder relationships (OECD, 2019[127]).

A recent report by the WHO (2021[128]) highlights the need to promote common goods for health, based on the convergence of health security, non-communicable and communicable disease risks, social determinants and environmental degradation. Further, achieving the Sustainable Development Goals (SDGs) by 2030 will require solutions that are simultaneously technological and societal, especially whole-of-society approaches that include policy makers, funders, health care providers, researchers and industry as key stakeholders in global health (Lin and Ilona Kickbusch, 2017[129]).

In particular, collaboration and sustainable business models for health innovation must go hand in hand with multi-stakeholder engagement. Otherwise, investment risks and public mistrust of these new technologies could impede research, translation and wide-scale use. A more systematic path to inclusive engagement and a whole-of-society approach could help leverage the convergence between health technology innovation, markets and society (OECD, 2020[130]). For this reason, the UN has urged public health actors to:

> *[a]cknowledge the contribution of and important role played by all relevant stakeholders, including individuals, families and communities, intergovernmental organisations and religious institutions, civil society, academia, the media, voluntary associations and, where and as appropriate, the private sector and industry, in support of national efforts for non-communicable disease prevention and control, and recognise the need to further support the strengthening of co-ordination among these stakeholders in order to improve the effectiveness of these efforts (United Nations, 2012[131]).*

These trends towards a more holistic conception of health innovation have helped give rise to a number of frameworks and approaches to global health and resilience (see the chapter on resilience in other sectors) that explicitly integrate science, technology and society:

- *One Health:* One Health is an integrated, unifying approach that "aims to sustainably balance and optimise the health of people, animals and ecosystems" (One Health High-Level Expert Panel, 2022[132]). This framework has been promoted by, for example, the WHO, the World Bank, the United States CDC, and the Food and Agriculture Organization. By recognising the animal-human-environment as a shared source of public health, well-being, and risk, One Health provides a blueprint for joint responses to COVID-19 (OECD, 2020[130]). It is a core component of the WHO Global Action Plan on Antimicrobial Resistance (World Health Organization, 2015[133]). The One Health approach forms part of the Declaration of G20 Health Ministers (G20 Health Ministers, 2021[134]).
- *Health in All Policies*: The Health in All Policies approach aims to systematically integrate public policies and activities across sectors (Koivusalo, 2010[135]). It takes into account ethical, legal, and social implications, seeks synergies, and avoids harmful impacts in order to improve population health and health equity (Carey, Crammond and Keast, 2014[136]; Pepin et al., 2017[137]).

13.3.9. Analysis of the extent to which push and pull mechanisms minimise excludability or rivalry

The extent to which existing *push funding* mechanisms reduce or limit excludability and rivalry varies, and generally relies on voluntary measures. Many do not require recipients to commit to specific policies or practices to reduce the excludability or rivalry of outputs of the drug development process. Push funding mechanisms, and the obligations they may place on recipients, depend in part on the source of funding, and the nature of governance and decision making. Those mechanisms sponsored in part by governments have introduced specific obligations that ensured affordable prices, encouraged licensing of IP, expanded registration and supply, and required clinical trials supporting use in specific populations, such as children.

Blended finance that brings together the public and private sector may introduce policies to limit excludability or rivalry of a health product, but these policies generally rely on voluntary or contractual obligations that may not address either the underlying causes of excludability or rivalry, or their impacts.

Push funding by commercial entities or private investors may prioritise commercial return on investment, may not extend the benefits of access policies to countries perceived as strong commercial markets, or provide access in countries considered "commercially non-viable". However, some entities, such as the RIGHT Fund in Korea, use contractual clauses in funding grants and IP approaches to help ensure that the resulting products are made available and accessible in terms of price, quantity, quality and timeliness.

Procurement-based *pull incentives* can promote access in included countries but can exacerbate excludability and/or rivalry for omitted countries and populations. Others, such as transferable exclusivity rights and extended market exclusivity, can either exacerbate the rivalry or excludability of one health technology product, or adversely affect the rivalry or excludability of another. These pull incentives may prove significantly more costly to public health budgets than the direct funding of R&D. They have the potential to be "gamed" by recipients for commercial benefit while not necessarily encouraging innovation. Further, they need not include additional obligations on recipients to reduce excludability or rivalry of resulting health products.

A priority review voucher may extend the effective patent life of another health product, without imposing any obligations to reduce the excludability or rivalry of the index product. Advanced market commitments and subscription-based reimbursement models rely on procurement as a means of incentivising the development or ensuring the supply of a health technology product. Furthermore, procurement-based pull incentives do not require recipients to share IP and know-how. This means knowledge and data associated with such health products remain excludable, limiting the entry of additional suppliers that could expand supply and reduce prices through competition. Other pull incentive mechanisms, such as innovation prizes and patent buyouts, are yet to be scaled up for use.

13.4. Conclusions and policy options

The pandemic has underlined the importance of developing health technologies to prepare for and respond to future crises, and ensuring that the resulting products are as widely accessible as possible. Many options for financing and incentivising the development of these products exist, and no single approach will be appropriate in every circumstance. However, it is clear that market forces will prevail, absent specific provisions or mechanisms for ensuring affordable access and equitable distribution. Whichever incentives or financing approaches funders elect to employ, they should evaluate the implications for pricing, supply and access, and consider defining and enforcing clear obligations to minimise excludability and rivalry. These considerations, which are relevant to essential health products for health emergencies, also have salience outside of shocks, and contribute to resilient and equitable health systems.

Appropriate policy and regulation should ensure that certain essential health technologies are able to approximate GPGs as far as possible. Most health products cannot become “pure” GPGs. Nevertheless, it is important for public health and equity that publicly funded incentives and investments are framed to limit rivalry and excludability. Policy makers can address at least five characteristics of health technology products to positively affect a product’s rivalry and excludability: supply; exclusive ownership of IP rights; registration; affordability; and presentation. Push and pull mechanisms that address any of these characteristics can reduce rivalry and/or excludability.

Collaboration, shared financing and IP rights arrangements lie at the heart of models that can provide health solutions where there is market failure. Where health technologies are underprovided by competitive, revenue-driven markets, **delinking research, manufacturing and supply from sales revenues** is critical.

Collaboration is important to balance investment and rewards with societal priorities. Governments, non-profit partnerships, funders, public researchers and the pharmaceutical industry should consider collaborating more to drive sustainable innovation and market development for health technologies. The concept of aspiring for essential health technologies to become GPGs helps to align stakeholder priorities better for shared investment, value creation and appropriation.

Blended financing could facilitate multi-sector engagement and strengthen long-term commitment to developing essential health technologies. Policy makers could support blended finance mechanisms to attract and better integrate private resources, de-risk investment and enable more sustainable innovation where there is market failure. Some companies earned record profits from COVID-19 vaccine sales, even as supply and affordability were critical problem for many countries. Blended finance mechanisms should ensure that future collaborations benefit public and private sectors equitably.

Collective and co-ordinated management of IP rights and know-how could help expand access to essential health technologies. Voluntary licensing via patent pools or technology access pools (such as the WHO-led COVID-19 Technology Access Pool) is one mechanism for promoting access. Technology transfer hubs, such as the WHO mRNA Technology Transfer Hub, can also reduce the excludability of platform technologies. This is particularly important in the context of novel and existing platform technologies, which are increasingly central to the development of health technologies. Even though they are often constructed over decades of publicly funded research, many platform technologies are excludable because IP rights are held by disparate entities.

Policy makers could facilitate **expanding manufacturing and supply of health technology products through IP arrangements and decentralised manufacturing**. Exclusive manufacturing by a patent holder of a health technology product may not be adequate to meet overall demand, thereby exacerbating rivalry. Sharing IP and know-how can be one means of expanding manufacturing and supply. Decentralised manufacturing of health technology products – especially in regions or continents that may otherwise face supply shortages but are able or willing to procure relevant health technologies – can reduce rivalry (see the chapter on securing supply chains). Decentralised or open manufacturing can also foster competition and reduce prices, thereby improving affordability and reducing excludability.

Public funders of health technology products could define and mandate clear obligations to reduce excludability and rivalry. Push funding mechanisms that aggregate or mix public and private sector funding often rely too heavily on voluntary measures that do not address the causes of excludability or rivalry, or neglect such issues entirely. Furthermore, push funding mechanisms governed only by companies or private investors may prioritise commercial markets, or may not address access barriers in markets viewed as commercially non-viable. Where private sector funding either precedes or follows public sector investment, recipients are likely to prioritise commercial returns over minimising rivalry and excludability of a product.

Governments should consider maintaining a degree of ownership of, or interest in, the development or manufacture of a health product when providing public funding or pull incentives for it. Governments could use this interest to require affordable pricing, encourage licensing of IP, mandate expanded registration and/or supply, and facilitate the conduct of clinical trials to ensure that products can be used by specific populations, such as children. While voluntary measures designed with or by recipients can reduce excludability and rivalry on a case-by-case basis, they may not be as far-reaching or rigorous as those mandated by funders.

Governments could trial novel pull incentives, **such as innovation prizes and patent buyouts**, to assess the extent to which these can minimise excludability and rivalry of health products. Pilot projects with prizes or patent buyouts could be used to determine whether prizes are suited to stimulating development of health products to address unmet health needs; whether outputs can approximate GPGs; and whether the technical challenges of determining and administering prizes can be overcome in practice.

Even though push and pull mechanisms are both needed to incentivise the development of novel health technologies, **policy makers may wish to reconsider the value of some pull incentives.** Transferable exclusivity rights and extended market exclusivity can exacerbate rivalry of the index product or another product to which exclusivity has been transferred. These pull incentives may also prove significantly more costly to public health budgets than the actual R&D expenses incurred, and they have the potential to be "gamed" for commercial benefit. In addition, they may not be well suited to supporting commercial operations for smaller firms that require near-term revenues, and they do not impose additional obligations on recipients to minimise excludability or rivalry.

Advance purchase agreements should be as inclusive as possible of countries and populations worldwide, and should require recipients to share IP and know-how. They should not preclude longer-term efforts to reduce excludability or rivalry through other means, including competition**.** Pull incentives such as advance market commitments, advance purchase agreements and buy-down agreements – which can partially de-risk private sector R&D investments – may benefit countries that are included in such mechanisms, but they may worsen the situation for excluded countries or populations. They may also limit the ability of governments to reduce the rivalry or excludability of a health technology product over the long-term. Where appropriate, these instruments should also integrate obligations to avoid misuse or overuse of health technology products that should be conserved for use by future generations.

Governments (and, where relevant, not-for-profit entities) could explore novel R&D models that are designed to prioritise the public interest. Models such as product development partnerships, public sector development and production, and open-source pharmaceutical development may be particularly relevant. Not-for-profit entities have played a valuable role in working with companies to reduce rivalry and excludability of new medicines, including ensuring that such medicines gain marketing authorisation widely, accelerating paediatric drug development to minimise the lag between availability of treatments for adults and children, and improving affordability.

Governments could invest in, establish or fund institutions to improve the supply of GPGs, including patent pools, clinical trial networks, regulatory initiatives, data hubs, compound libraries and technology transfer hubs. Efforts by governments (and companies) to use donations to reduce rivalry or excludability of a health technology product, while well intentioned, may not always be readily usable by recipient countries. As such, donations – in accordance with interagency guidelines for medicine donations issued by WHO and other international health agencies (WHO et al., 2011[138]) – should be used only in exceptional circumstances, be time limited and comport with internationally mandated guidelines and the preferences of recipient countries.

Policy makers could mandate or encourage **greater transparency of funding and financing agreements** between governments and recipients, and improve overall transparency of total GPG-related financing flows**.** Such transparency could improve the ability of all governments and non-state actors to assess whether health technology products, as well as underlying data and knowledge, will be non-excludable and non-rivalrous. Furthermore, funding and financing mechanisms should require greater transparency with respect to the product being funded, the costs of research and production, IP protections, and the prices of the product worldwide. Finally, governments should report on funding and financing of relevant push and pull mechanisms, using the framework of Total Official Support for Sustainable Development, to improve transparency of such funding flows and to increase financing.

Policy makers could facilitate the alignment of interests and investments between public and philanthropic funders. There is currently no permanent governance mechanism by which to ensure that the divergent interests and investments of multiple public and philanthropic funders can be reconciled. For example, the Access to COVID-19 Tools Accelerator, a governance mechanism established to accelerate the introduction of COVID-19 technologies after the pandemic began, was not fully able to encourage such co-ordination and has been disbanded (WHO, 2022[139]). Policy makers could consider encouraging collaboration between such funders to reduce the rivalry and excludability of health technology products, and ensure appropriate dialogue and engagement with private sector funders.

No one policy will resolve the challenges that are the subject of this chapter. The policy options suggested need to be considered alongside measures to estimate the benefits associated with each. The sharing of this information will allow the goal of universal access to essential health technologies to become closer in reality.

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Notes

[1] "Neglected Tropical Diseases" is an umbrella term for several parasitic, viral, and bacterial diseases that cause substantial illness for more than 1 billion people globally, and for which research and development of effective treatments is considered commercially unattractive. Examples include diseases such as Chagas disease, Human African trypanosomiasis, and dengue fever. More than 70% of countries and territories that report the presence of neglected tropical diseases are low-income or lower middle-income economies.

[2] IP rights are a form of pull incentive, intended to encourage R&D by protecting future revenues once R&D milestones are reached.

[3] A full examination of the role of push and pull funding should also examine their impact on the rivalry and excludability of the knowledge resulting from early-stage discovery and development; data (e.g. clinical data) used to inform the development of health technology products; and platform technologies on which health products are increasingly being developed.

[4] The "valley of death" is often used to describe the gap between proof of concept of a potential novel therapeutic and its translation (clinical development, commercialisation). The valley of death is characterised by high risk of failure, significant resource needs, and limited capital (i.e. funding running out prior to financial returns).

[5] With respect to step-in rights, a trigger is one or more defined events or conditions, which, if realised, should lead to the presumptive or automatic exercise of march-in rights by a government or third party related to IP held by an assignee.

14 Investing in health system resilience

David Morgan and Chris James

This chapter identifies a set of priority investment areas needed to strengthen resilience, reinforcing the foundations of countries' health systems and their ability to respond to evolving pandemics and other emerging shocks. It then produces order-of-magnitude estimates of the expected costs of such investments, drawing extensively from existing OECD data and analytical studies. These priority investments represent an estimated 1.4% of GDP, on average across OECD countries (ranging from 0.6% to 2.5%), compared with pre-pandemic expenditure of 8.8%. A combination of targeted spending and measures to reduce wasteful spending could mitigate the overall increases in health spending in the medium to long term.

Key findings

The COVID-19 pandemic demonstrates the cascading health and economic consequences that major shocks can generate when health systems are not resilient enough. It has highlighted that health systems are underfunded in many countries. To avoid the catastrophic effects of future shocks, targeted investments are needed to strengthen resilience, reinforcing the foundations of countries' health systems and their agility to respond to pandemics and other evolving threats.

Priority investments in stronger health system resilience represent around 1.4% of GDP, on average across OECD countries. This broad order-of-magnitude estimate is calculated in relation to the level of spending in 2019, before the pandemic. Only a small proportion of the targeted spending (0.13% of GDP, on average) relates to capital expenditure. However, both the capital and current spending identified refers to permanent financial allocations to specific areas. This would, therefore, result in a step increase in overall health expenditure levels rather than a one-off funding injection.

Some OECD countries have been addressing some measures outlined in this chapter since the pandemic began. However, additional health expenditure in recent years has consisted of unplanned financing of the emergency response to the pandemic, rather than long-term planned investments to strengthen resilience. Therefore, additional spending to improve health system resilience is not purely a matter of spending more – it is also about spending well on targeted, priority investments, in areas where health systems proved insufficiently resourced to withstand the shock of the pandemic, including:

- **Protecting underlying population health** through additional spending on preventive care. This is expected to cost about 0.3% of the GDP, on average (ranging from 0.13% to 0.53% across countries, according to their current profile of funding for health systems). Such spending comprises funds for enhanced preventive care and mass population health programmes.
- **Fortifying the foundations of health systems** by investing in core equipment and better harnessing of health information. This is estimated to cost 0.4% of GDP, on average (ranging from 0.26% to 0.63% across countries), and includes investments in core equipment and infrastructure, and health information systems.
- **Bolstering health professionals working on the frontline**, which accounts for around half of the total additional costs, on average, at 0.7% of GDP (ranging from 0.03% to 1.55% across countries). It includes funds to ensure sufficient numbers of health and long-term care professionals, and the creation of a medical reserve.

If these investments had been made on top of existing health spending, the average OECD health spending to GDP ratio would have reached 10.1%, compared to the actual baseline average of 8.8% in 2019. This increase equates to 9% of total expenditure on health by OECD countries, or USD 627 billion (USD 460 per capita). To put this in context, it is similar to total public funding for prescription drugs across OECD countries in 2019.

The total investment cost ranges from 0.6% to 2.5% of GDP across OECD countries, depending on how much a country is already spending in some of the investment areas. For example, some OECD countries with relatively few human and/or physical resources in Latin America and central and southern Europe are estimated to need an injection nearer the upper end of the range; whereas countries such as Australia, Germany and the Netherlands are expected to require much less.

Irrespective of the exact amount needed, funding such investments requires buy-in from ministries of finance as well as health ministries and social security institutions. In the current context of tight public finances in most OECD countries, a combination of targeted spending and measures to reduce wasteful spending could be used.

14.1. Priority investments are needed to strengthen health system resilience

With the world well into its third year since the pandemic began, COVID-19 continues to have a significant and lasting impact. It is placing more pressure on health systems that were often overstretched even before the pandemic. The health crisis also caused major economic and social disruption, from which many countries are only now emerging.

This chapter identifies a set of priority investment areas needed to strengthen health system resilience. It then provides broad order-of-magnitude estimates of the expected costs of these investments, drawing extensively from existing OECD data and analytical studies.

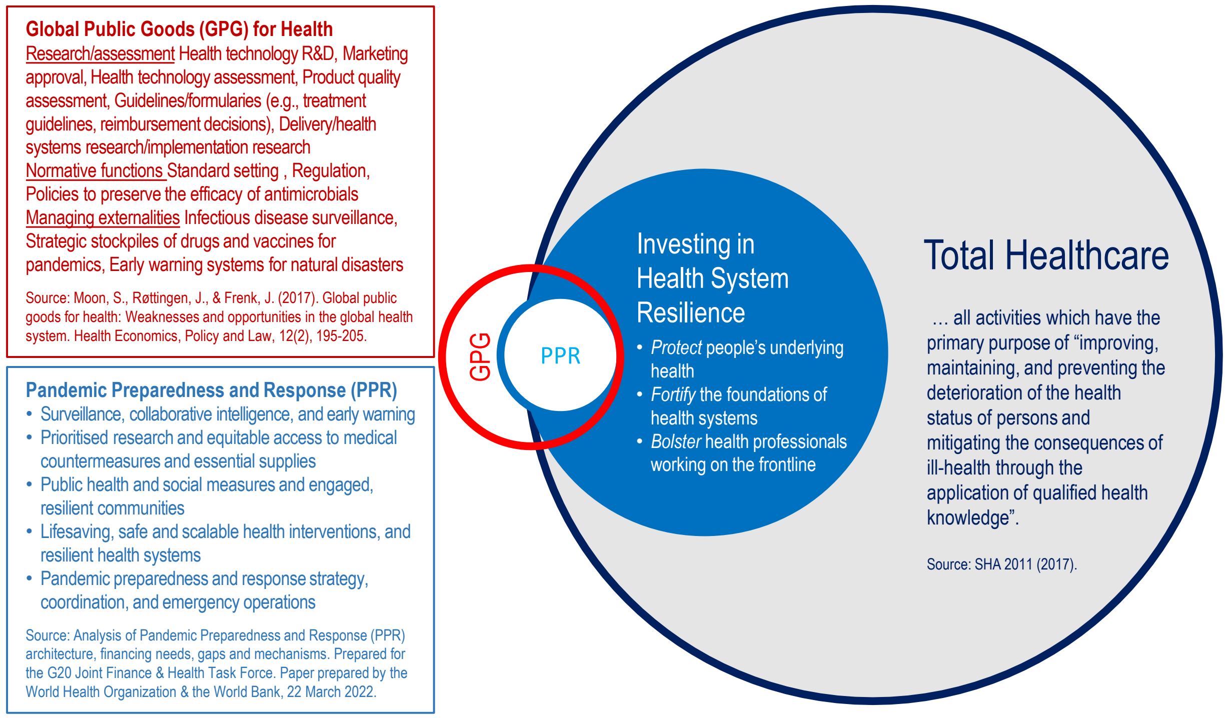
The return from such investments extends beyond the health benefits of fewer lives lost and reduced morbidity. More resilient health systems are at the core of stronger, more resilient societies – enabling substantial economic and societal benefits by avoiding stringent and costly containment measures and the other disruptive effects of future crises.

Previous OECD work highlighted the enormous potential to make savings by tackling wasteful spending and to realise efficiency gains across the health sector (OECD, 2017[1]). Using such savings to help fund more resilient health systems is particularly important, given the current context of tight overall public finances in most OECD countries. Nevertheless, the order-of-magnitude estimates for the priority investments identified in this chapter mean that additional funds are still likely to be needed. Therefore, a combination of targeted spending and measures to reduce wasteful spending could mitigate the overall increases in health spending in the medium to long term. Further, the various investments need to be considered over varying – although in some cases linked – time scales. For example, while increasing availability of medical equipment and infrastructure could in theory be done in the short term, expanding the number of health care professionals to operate such equipment cannot be achieved quickly.

The overall scale of investment identified in this chapter expands beyond the international initiatives to invest nationally, regionally and globally in pandemic preparedness and response and the need to increase spending on global public goods (see chapters on containment and mitigation, and on global public goods). 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[2]). In this report, the concept of resilience embraces but goes beyond the preparedness spending needs of low- and middle-income countries identified by the Taskforce, to analyse more broadly the overall health system investments needed to build resilience, from a national perspective (Figure 14.1).

Resilience is thus understood as the ability of systems to plan for, absorb, recover from and adapt to major shocks such as COVID-19 (OECD, 2022[3]). Resilience is not simply about minimising risk and avoiding shocks: it is also about recognising that shocks *will* happen. Such shocks are defined as high-consequence events that have a major disruptive effect on society. Along with COVID-19, this includes other highly infectious pathogens or emerging diseases, but it also covers natural hazards or human-caused disasters that can lead to massive surges in health care needs. The investment areas and indicative cost estimates are therefore relevant for combatting both COVID-19 and other major emerging shocks.

Figure 14.1. Spending on health system resilience, pandemic preparedness and global public goods



Investments to strengthen health system resilience can be grouped into three overarching pillars (Figure 14.2). These aim to:

- protect people's underlying health
- fortify the foundations of health systems
- bolster health professionals working on the front line.

This chapter identifies the key investments for each pillar. These are based on emerging evidence of the most effective policies in combatting COVID-19, combined with a review of experiences with managing previous major health shocks (see the OECD Digital Hub on Tackling the Coronavirus, https://www.oecd.org/coronavirus). Such investments also have the benefit of making health systems better positioned to combat gradual societal transitions, such as demographic change and the increasing burden of chronic conditions.

Figure 14.2. The pillars to strengthen health system resilience

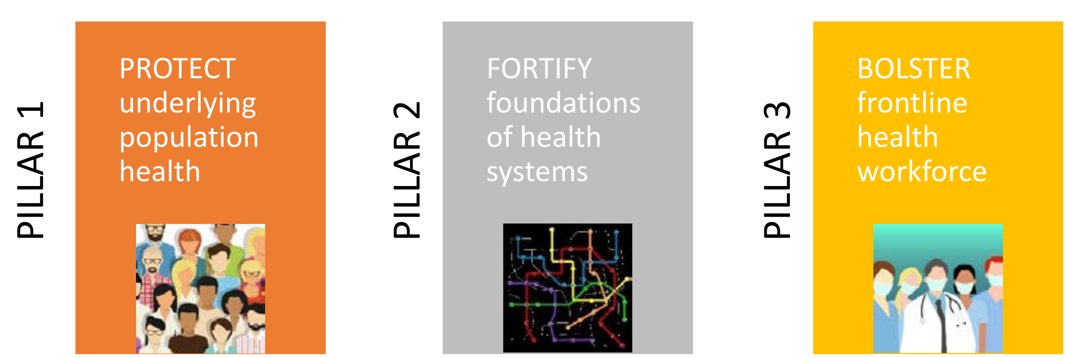


Image credit: Diagram uses images from © Shutterstock.com/Julia Tim; © Shutterstock.com/JMiks and © Shutterstock.com/SanXuan.
Source: Morgan and James (2022[4]), "Investing in health systems to protect society and boost the economy: Priority investments and order-of-magnitude cost estimates", https://doi.org/10.1787/d0aa9188-en.

While investments require resources up front and over time, they offer a substantial return – both during a health shock and during "normal" times. This chapter focuses on the costs of implementing priority investments in health systems resilience. Into the third year of the pandemic, many countries may have already begun addressing some of the gaps in investment identified. The amount of additional investment needed thereby varies by country, reflecting existing capacities. Each country has areas where greater investment is needed and other areas where additional spending may not be required. Such variation is reflected in the range of estimates, notwithstanding that costing reflects broad order-of-magnitude estimates rather than any precise cost-accounting analysis. For further detail on the costing methodology used, see Morgan and James (2022[4]).

14.2. How much will it cost to strengthen health system resilience?

In total, priority investments identified in this chapter are estimated to represent around 1.4% of GDP on average across OECD countries. The total investment cost ranges from 0.6% to 2.5% across OECD countries, depending on how much a country is already spending in some of the investment areas. The trajectory for these investments is based on an increase in the ratio of health spending to GDP of this magnitude being reached at some point in the medium-term future (Figure 14.3).

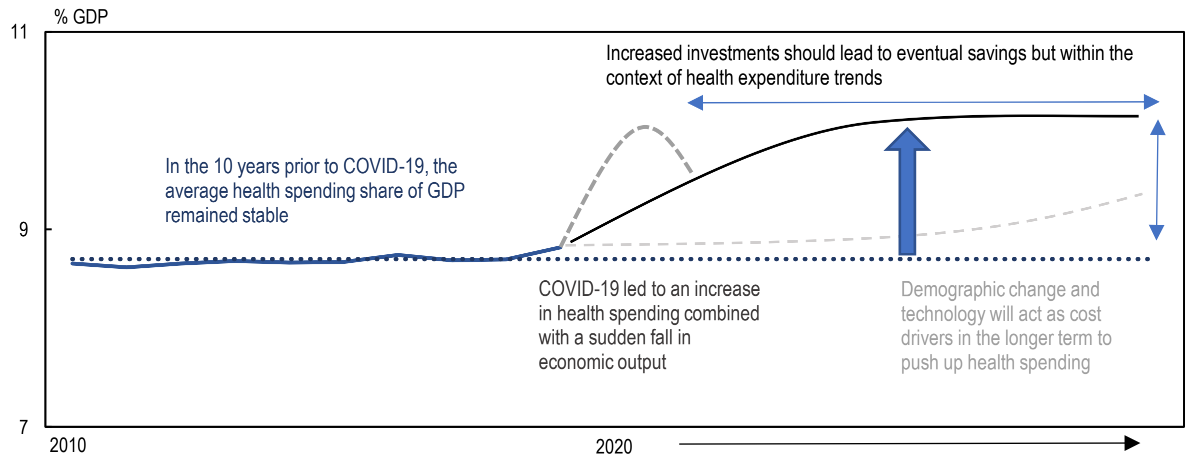
This order-of-magnitude estimate is set in the context of the pre-pandemic situation: the total cost of these investments is calculated in relation to the level of spending in 2019. In other words, if all these investments had been made on top of existing health spending, the average OECD health spending to GDP ratio would have reached 10.1%, compared to the actual baseline average of 8.8% in 2019. This increase equates to 9% of total expenditure on health by OECD countries, or USD 627 billion (USD 460 per capita). To put this in context, it is similar to total public funding for prescription drugs across OECD countries in 2019.

The 0.9 percentage point jump in the ratio of health spending to GDP observed in 2020 and 2021 (with some countries reporting an increase of more than 2 percentage points) could be highlighted as a significant step towards meeting this target. However, this large increase was driven as much by a significant fall in GDP as by the additional funding for the health sector in response to the pandemic.

Some OECD countries have begun addressing some measures outlined in this chapter – for example, increasing salary levels for nurses and care workers, or funding additional intensive care unit capacity. However, an important part of additional expenditure by governments has tended to be unplanned financing to "firefight" the pandemic, rather than long-term planned investments to strengthen resilience.

Only a small proportion of the targeted spending (0.13% of GDP, on average) relates to capital expenditure: that is, core equipment for the health sector covering medical and non-medical equipment and IT infrastructure. However, both the capital and current spending identified refer to permanent financial allocations to the specific areas. For instance, it is suggested that spending on prevention and public health services should in future account for a minimum of 4% of health expenditure. This would, therefore, result in a step increase in overall health expenditure levels rather than a one-off funding injection. For comparison, the last across-the-board increase in the health spending share of GDP occurred during the Global Financial Crisis in 2008-09, when average expenditure on health across OECD countries increased sharply, from about 7.9% prior to the crisis in 2007, to stabilise at around 8.7% of GDP from 2011.

Figure 14.3. A trajectory: Medium-term spending implications of investing in more resilient health systems



Source: OECD Secretariat calculations.

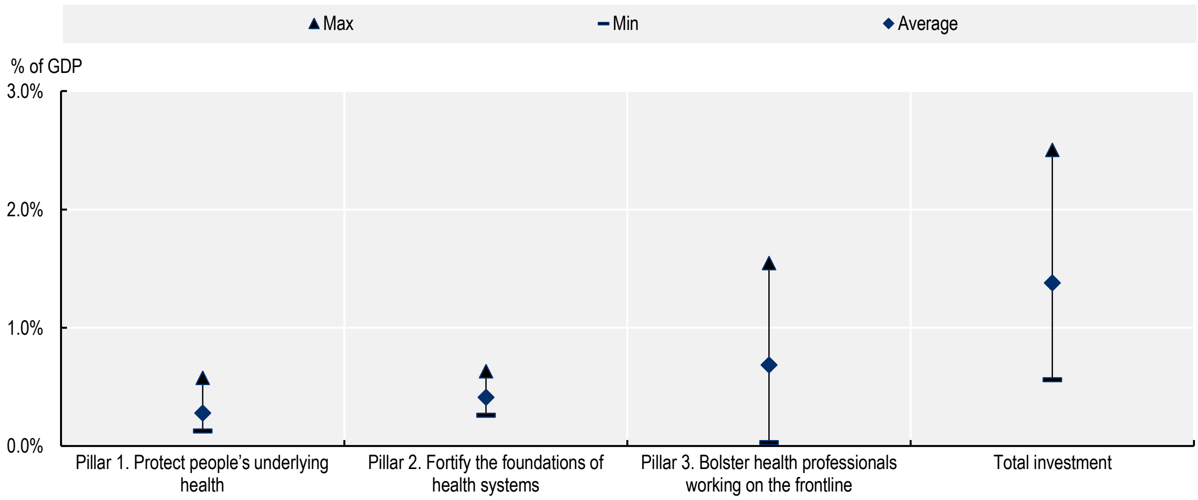
By pillar, bolstering health professionals working on the front line (Pillar 3) accounts for around half of this investment cost, on average, at 0.7% of GDP (Table 14.1, Figure 14.4). Additional spending on preventive care (Pillar 1) is expected to cost about 0.3%, on average. Together, these can be seen as broadly consistent with recent analysis calling for countries to allocate an additional 1% of GDP to primary health care (WHO, 2021[5]). In addition, foundational investments in core equipment and better harnessing of health information (Pillar 2) are estimated to cost another 0.4% of GDP, on average.

Table 14.1. Order-of-magnitude investment cost estimates, as a share of GDP (relative to 2019 baseline)

Investment	Rationale and main cost drivers	Average	Range
Pillar 1. Protect people's underlying health		**0.28%**	**0.13-0.53%**
Enhanced preventive care	Improve public health systems, strengthen peoples' underlying health Public health surveillance, infection prevention and control, combatting major risk factors	0.10%	0.03-0.26%
Mass population programmes	Reinforce people's natural defences, strengthen containment and mitigation Vaccination programmes, extra testing and personal protective equipment during acute periods	0.18%	0.06-0.42%
Pillar 2. Fortify the foundations of health systems		**0.41%**	**0.26-0.63%**
Sufficient core equipment	Enable health professionals to respond to surges in demand Hospital beds and other medical equipment, IT infrastructure	0.13%	0.00-0.34%
Well-harnessed health information	Improve patient monitoring, strengthen containment and mitigation Software, operational processes, data scientists, IT skills of health workers	0.28%	0.18-0.34%
Pillar 3. Bolster health professionals working on the front line		**0.69%**	**0.03-1.55%**
Sufficient health and long-term care professionals	Effective case management for affected individuals, care continuity for others Additional health workers, higher salaries for nurses and care workers	0.66%	0.00-1.52%
Medical reserve	Surge capacity that can be called on in times of high need Recurrent training for health professionals in a medical reserve	0.03%	0.03-0.03%
Total		**1.38%**	**0.56-2.51%**

Source: OECD Secretariat calculations.

Figure 14.4. Investment range by pillar, as a share of GDP (relative to 2019 baseline)



Source: OECD Secretariat calculations.

14.3. How much will it cost to strengthen health system resilience by cost component?

Pillar 1: Protect people's underlying health

Investment 1: Enhanced preventive care

Preventive care is one of the cornerstones of an effective health system (see the chapter on care continuity). In broad public health terms, whether interventions are targeted at individuals or populations, the aim is to enhance health status and maintain a state of low risk for diseases, disorders or conditions. Effective preventive care policies limit the occurrence of new diseases and reduce the incidence of existing communicable and non-communicable diseases.

COVID-19 has demonstrated the importance of strong infection prevention and control policies in health care settings. This includes health and long-term care workers adopting a number of common-sense precautions – notably hand hygiene, environmental cleaning, decontamination of medical equipment, aseptic techniques and injection safety (WHO, 2021[6]). Of particular concern in recent years is an increasing degree of antimicrobial resistance (AMR). The OECD report *Stemming the Superbug Tide: Just A Few Dollars More* showed that the burden of AMR on population health can be drastically reduced through cost-effective policies such as ending over-prescription of antibiotics, offering rapid testing for patients to determine whether they have viral or bacterial infections, encouraging delays in prescribing antibiotics and promoting better hygiene (OECD, 2018[7]). The report concluded that additional targeted spending equivalent to an average of USD PPP 2.0 per capita could halt the superbug tide (see Box 14.1 for a discussion of the impact of the COVID-19 pandemic on AMR initiatives).

Investing more in health promotion and disease prevention also improves people's underlying health. Such investments are critical for health system resilience. Healthier populations are less vulnerable to COVID-19 and are likely to be more resilient to future shocks. Yet despite clear progress in certain areas – such as preventive cancer screening programmes, policy levers to lower smoking and alcohol consumption and improve healthy diets – much more can still be done to reduce the major risk factors for health of harmful alcohol use, obesity, smoking and opioid use. These risk factors not only increase the risk of non-communicable diseases but also make people much more vulnerable to COVID-19, other infectious diseases and certain disasters.

To tackle harmful alcohol consumption, the 2021 OECD report *Preventing Harmful Alcohol Use* identified a package of the most effective interventions, including raising alcohol taxation, regulation of alcohol advertising, sobriety checkpoints to counter drink-driving and alcohol counselling in primary care (OECD, 2021[8]). Additional innovative policies include minimum unit pricing and statutory bans on alcohol advertising targeting children. The study found that a mixed package of the most cost-effective interventions would cost on average around USD PPP 2.5 per capita.

The OECD report *The Heavy Burden of Obesity* listed food labelling, advertising restrictions and mass media campaigns as some of the key policies already implemented – to differing extents – in many OECD countries (OECD, 2019[9]). Additional policy measures that show promise include menu labelling, prescribing physical activity and workplace wellness programmes. This report points to an average per capita cost of USD 9.0.

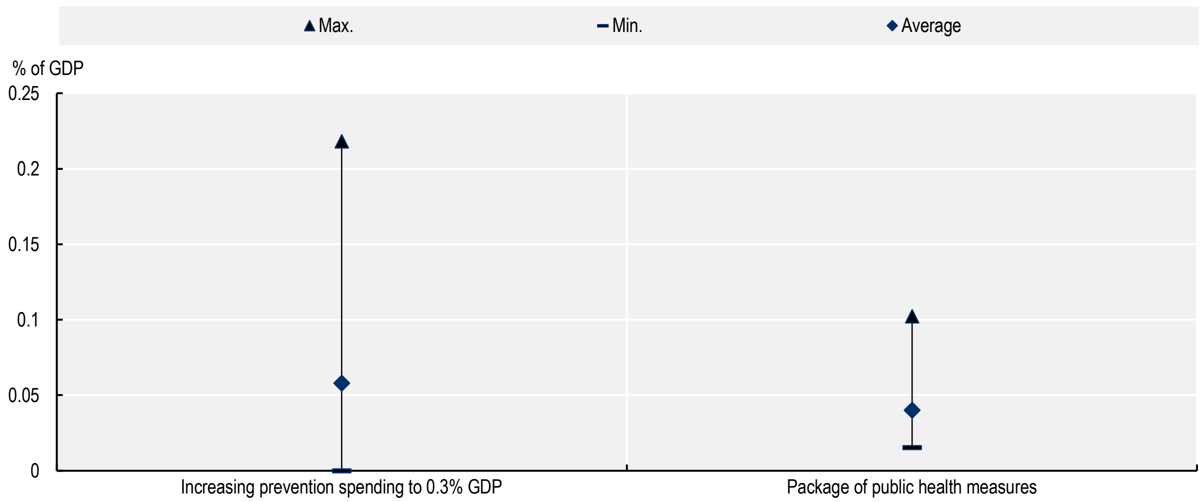
For other public health challenges such as tobacco and substance abuse (OECD, 2019[10]), less work has been done to date on assessing the cross-country costs of a suitable package of measures. Nevertheless, a level of investment similar to the package of measures to tackle alcohol abuse is assumed. Taken together, a package of public health measures – targeting major health risk factors and antimicrobial resistance – would amount to a modest increase of around USD 15 per capita (equivalent to 0.04% of GDP on average).

At a broad population level, experience from the COVID-19 pandemic has shown that an effective public health surveillance system is an important policy lever to improve preparedness – particularly in monitoring and controlling the spread of an infectious disease (OECD/European Union, 2020[11]). This requires a well-functioning national public health system with trained staff, adequate availability of diagnostic laboratory equipment, and the capacity to ramp up testing and monitoring rapidly as future public health crises arise (see the chapter on containment and mitigation).

While a growing body of evidence shows that many health promotion and disease prevention measures can improve health outcomes at relatively low cost, health spending data show that only around 2.7% of overall health spending is allocated to prevention activities (Gmeinder, Morgan and Mueller, 2017[12]). In terms of the share of GDP, spending across OECD countries on prevention activities currently varies from less than 0.1% to 0.6%.

After considering the package of population health measures outlined above (equating to around USD 15 per capita), a conservative spending target for all prevention spending of at least 0.3% of GDP is set. This level of spending would match some of the higher-performing public health systems among OECD countries should see systems adequately resourced to meet future crises. The additional annual expenditure requirements range from zero (for those countries already meeting this target) to 0.22% of GDP, with an average additional cost of 0.06% of GDP (Figure 14.5).

Figure 14.5. Investing in prevention and public health systems, as a share of GDP



Note: The package of public health measures is based on per capita costings in 2019 prices to tackle AMR, alcohol, obesity, smoking and opioids. This is added to currently reported spending on prevention and then raised to a minimum of 0.3% of GDP to represent additional spending needed to strengthen public health systems.
Source: OECD Secretariat calculations.

Box 14.1. Adverse impacts of the COVID-19 pandemic on tackling antimicrobial resistance

Antimicrobial resistance is a widely recognised public health challenge with global implications. In 2015, the international community made a commitment to tackling this challenge in the Global Action Plan to tackle AMR (AMR-GAP). The AMR-GAP urged countries to scale up interventions that broadly aim to promote the prudent use of antibiotics in human and animal health; scale up infection prevention and control measures; strengthen surveillance capacity consistent with the One Health approach; improve AMR awareness and understanding in the general public and among health workers; and invest in AMR-relevant development and research (WHO, 2015[13]).

In recent years, the OECD countries made important strides in developing their own action plans to tackle AMR. In 2021-22, the number of OECD countries with AMR action plan stood at 34, a notable increase from 23 in 2016-17 (WHO, FAO and OIE, 2021[14]). Earlier OECD analysis demonstrated that action plans from OECD countries are well-aligned with the strategic priorities and interventions recommended in the AMR-GAP (Özçelik et al., 2022[15]).

The COVID-19 pandemic disrupted the implementation of AMR-relevant initiatives outlined in national action plans as health workers diverted their attention to responding to the COVID-19 pandemic.

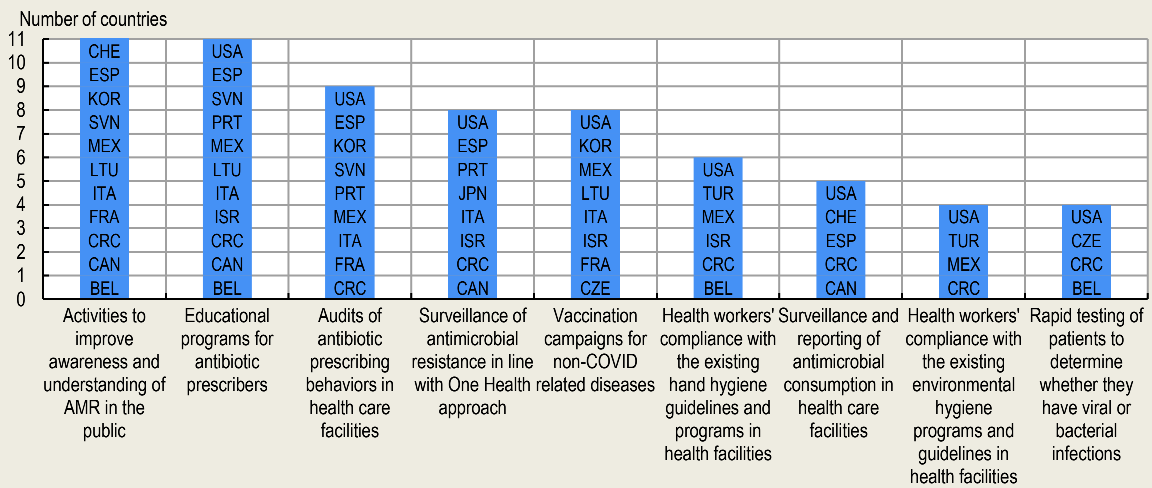
OECD countries experienced a range of disruptions in implementing actions to tackle AMR in their own settings, as highlighted and in Figure 14.6 below:

- Initiatives to improve AMR awareness and understanding in the general public and educational programs targeting antibiotic prescribers were most interrupted by the pandemic, with 11 out of 26 OECD countries that participated in the OECD Resilience of Health Systems Questionnaire reporting some level of interruption in these activities.

- Nine OECD countries experienced interruptions in the monitoring of antibiotic prescribing behaviours in health care facilities.
- Eight OECD countries faced disruptions in the AMR surveillance activities with the One Health framework and vaccination campaigns for non-COVID related diseases.

Many countries also experienced disruptions in compliance with existing hand hygiene and environmental cleaning guidelines in health care facilities and rapid testing capacity. In addition, OECD countries reported delays in efforts to revise/update their AMR action plans. Combined, these findings suggest that the COVID-19 pandemic presents an important threat to tackling the AMR burden.

Figure 14.6. AMR-relevant activities and programs were adversely impacted by COVID-19



Source: OECD analysis on Resilience of Health Systems Questionnaire, 2022.

OECD countries have been deploying diverse approaches to reduce the adverse impact of the COVID-19 pandemic on their AMR priorities

Many OECD countries have pursued a range of strategies to minimise the adverse effects of the COVID-19 pandemic on their AMR burden. For instance:

- In Belgium, additional financial resources were made available for hospitals to reinforce their antibiotic stewardship and infection prevention and control measures.
- In Korea, online education programs were scaled up to avoid lagging behind in AMR management policies.
- In Portugal, efforts to ensure the continuity of AMR-relevant measures relied on maintaining close contact with local hospitals and regional AMR teams.
- In the United States, AMR remained one of the top priorities of the Centres for Disease Control (CDC). Investments have continued in key prevention strategies, such as early detection and containment, infection prevention. Further, additional funding was provided to antibiotic developers to expand the number of clinical study sites to mitigate site closures due to the COVID-19 pandemic.

Building on previous analytical work, the OECD is developing a new publication that will shed light on the effectiveness and cost-effectiveness of One-Health strategies to tackle AMR

Previous OECD analysis found that the health and economic burden of hospital acquired infections and AMR can be stemmed through a package of policies, which are considered as best buys due to their high beneficial impact on population health and affordability (OECD, 2018[7]). These policy packages that combine health care and community-based interventions can cost as little as USD 2 per capita and yield savings of around USD 3 per capita each year, while averting millions of deaths. Infection prevention and control policies significantly contribute to the success of this package. Improving hand hygiene in health care settings saves about USD 16.5 in reduced health care expenditure for every USD invested. In line with the One-Health approach, the new OECD analysis will expand the scope of work to quantity the effectiveness and cost-effectiveness of interventions that go beyond the human health sector.

Investment 2: Mass population programmes, such as vaccination programmes

In addition to stronger public health, countries need to be prepared for mass population programmes that protect people's underlying health, and enable the health systems of countries to absorb and respond to the acute stage of a shock.

In the COVID-19 context, this comprises developing and maintaining vaccination campaigns. This investment includes staffing and other associated delivery costs, as well as the costs of the vaccines themselves. This excludes the expected costs of research and development for new vaccines and treatments for COVID-19 and other emerging pathogens – see Morgan and James (2022[4]) for a further discussion. Testing has proved an important complementary policy prior to and in parallel with vaccination campaigns, particularly during the various stages of a pandemic. For these and other mass programmes, populations that are more trusting of governments, science and the rule of law are more likely to comply with these and other interventionist public health policies (see chapters on COVID-19 outcomes, and on containment and mitigation, for further discussion of trust).

Mass vaccination programmes have reduced the risk of serious illness from COVID-19, and consequently hospitalisations. Most OECD member countries have aimed to administer two or three COVID-19 vaccine doses to the vast majority of their population. There is considerable uncertainty as to how frequently COVID-19 vaccinations or boosters will be needed into the future. Some researchers cite emerging evidence that three doses is sufficient to provide long-lasting protection from new as well as existing variants, while others emphasise post-COVID-19 syndrome or "long COVID" and the need for annual vaccination campaigns against influenza, at least for the more vulnerable groups of the population (Rubin, 2021[16]; Dolgin, 2021[17]; Muecksch et al., 2022[18]).

For vaccines, the purchase cost of a vaccine against COVID-19 – particularly early on in the pandemic – was variable: media reports give a range from as low as USD 3 to over USD 30 (Morgan and James, 2022[4]). As with mass testing, these costs may fall over time. But these figures do not include the associated costs of delivery. A comprehensive study investigating the total cost (including the cost of delivery) of vaccinating against 17 pathogens over a lifetime in seven western European countries gave a five-fold cost range of EUR 44 to EUR 226 per pathogen (Ethgen et al., 2016[19]). Narrowing down these estimates to only vaccination costs for healthy individuals (as opposed to vaccinations for people with health complications) gave a range of EUR 37 to EUR 132 per pathogen.

For testing, data collated from eight OECD countries of the cost of a polymerase chain reaction (PCR) test in 2020, together with associated delivery and laboratory costs, point to an average per capita cost of around USD 80 (ranging from around USD 55 to USD 100). Again, unit costs for testing have tended to fall – for example, as the extended use of antigen tests for COVID-19 provided an initial result without the need for a laboratory process. A conservative approach is taken, whereby such potential cost reductions over time are not accounted for in cost estimates.

To reach an estimate of the level of expenditure required to perform effective testing and vaccination on an annual basis, unit cost estimates are combined with the share of the population expected to need each of these interventions. A one-to-one relationship is assumed for simplicity between mass testing and vaccinations. That is, as vaccinations are gradually scaled up, testing is concurrently scaled down at the same rate.

A range of scenarios is examined, given the uncertainty around vaccine availability and effectiveness in reducing severity of disease, and the needed levels of diagnostic testing. A low scenario assumes 40% of the population aged under 65 years are tested or vaccinated against COVID-19 each year, with 80% coverage for the population aged 65 years and over. A high scenario assumes 80% coverage for people aged under 65 years and 95% coverage for people aged 65 years and over. The mid-point scenario assumes 60% coverage for people aged under 65 years and 80% coverage for people aged 65 years and over. Combining this mid-point coverage with an assumed annual unit cost of USD 100 for diagnostic testing and/or vaccination, the additional spending required is equivalent to 0.15% of GDP on average, ranging from 0.05% to 0.35%.

COVID-19 has demonstrated the importance of ensuring sufficient supplies of personal protective equipment (PPE) to absorb and respond to the acute stage of a health shock. All countries will need to have the capacity to ramp up PPE supplies and testing efforts for future COVID-19 peaks, or indeed for other emerging infectious pathogens (see the chapter on securing supply chains).

To maintain adequate stocks of PPE to absorb and respond to the acute stage of a health shock, estimates of additional spending needs are based on having sufficient supplies in hospitals, primary care and long-term care (LTC) facilities for a 100-day wave of COVID-19 (or other emerging pathogen with an equivalent degree of infectiousness). The quantities of specific PPE needed are based on an epidemiological model developed by Johns Hopkins University – of additional PPE needs over and above what is needed in normal times (Johns Hopkins University, 2020[20]). The calculation is that, on a per capita basis, 10.28 gloves, 0.97 isolation gowns, 0.54 medical-grade masks and 0.17 N95 masks will be needed during a 100-day wave (on average) with sustained suppression measures in place. Added in this report are needs for face shields and goggles. Multiplied by unit cost estimates from the World Health Organization (2020[21]) with a 10% price mark-up, this translates into an average cost of USD 10.75 per capita to provide sufficient PPE within health and LTC settings.

Pillar 2: Fortify the foundations of health systems

Investment 3: Sufficient core equipment

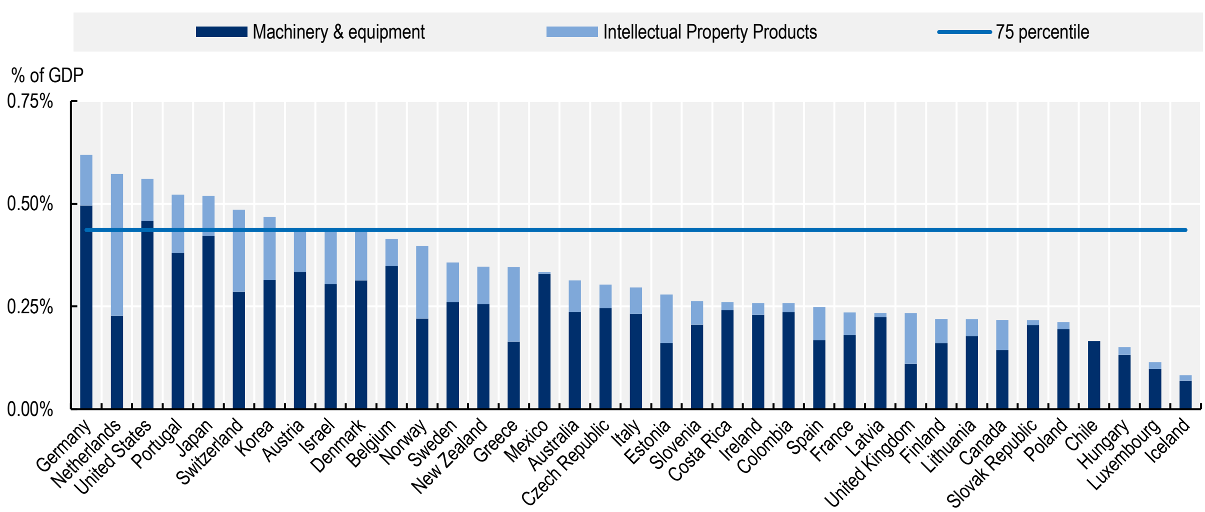
The COVID-19 pandemic saw health care systems, and hospitals in particular, placed under immense strain. Some countries lacked sufficient physical resources – notably in terms of hospital beds and other medical equipment to respond to the sudden influx of COVID-19 patients and their subsequent treatment (OECD/European Union, 2020[11]). Investing to provide a base level of core equipment needs is seen as a prerequisite to strengthening overall health system resilience and continuing to meet standards of care during a shock.

Having sufficient medical equipment in intensive care units and other settings helps avoid potentially catastrophic delays in diagnosing and treating patients, as well as minimising circumstances where there are more patients than beds. However, ensuring that sufficient capacities are available in times of crisis may result in some redundancy in normal times, creating an opportunity cost. There are no hard and fast guidelines or international benchmarks regarding the optimal level of equipment and technology, and variability is wide across OECD countries. Still, the critical importance of maintaining some spare capacity to deal with surges is clear – too little investment in medical equipment will lead to strains in service provision and preventive care efforts, thereby undermining health system resilience (see chapters on critical care surge and care continuity).

Non-medical equipment is also important – notably computers and other IT equipment. An adequate physical IT infrastructure provides the basis for trained health professionals to monitor patient health, both in acute situations and in the long term. Used correctly, telemedicine can make care more responsive, leading to increased quality and efficiency (see the chapter on digital foundations).

On average, OECD countries invest around 0.25% of GDP each year on transport, machinery and equipment (both medical and non-medical) and IT hardware in the health and social care sector. Based on the scenario that all OECD countries should strive to reach the 75th percentile level in terms of annual investment in equipment, this would result in an average increase as a share of GDP of 0.08%. The same approach can determine the level of capital spending needed to maintain responsive health information systems, beyond the physical IT hardware; that is, spending on development of software and databases. Again, an increase in capital spending to bring the level up to the 75th percentile would equate to an average increase of 0.05% of GDP (Figure 14.7).

Figure 14.7. Average investment in machinery, equipment and intellectual property products in the health and social sectors as a share of GDP, 2016-19



Note: Refers to average expenditure on gross fixed capital formation on machinery, equipment and intellectual property products from 2016 to 2019 in the health and social care sectors. Data not available for Türkiye.
Source: OECD National Accounts Table 8A. Capital formation by International Standard Industrial Classification of All Economic Activities rev4.

Investment 4: Well-harnessed health information

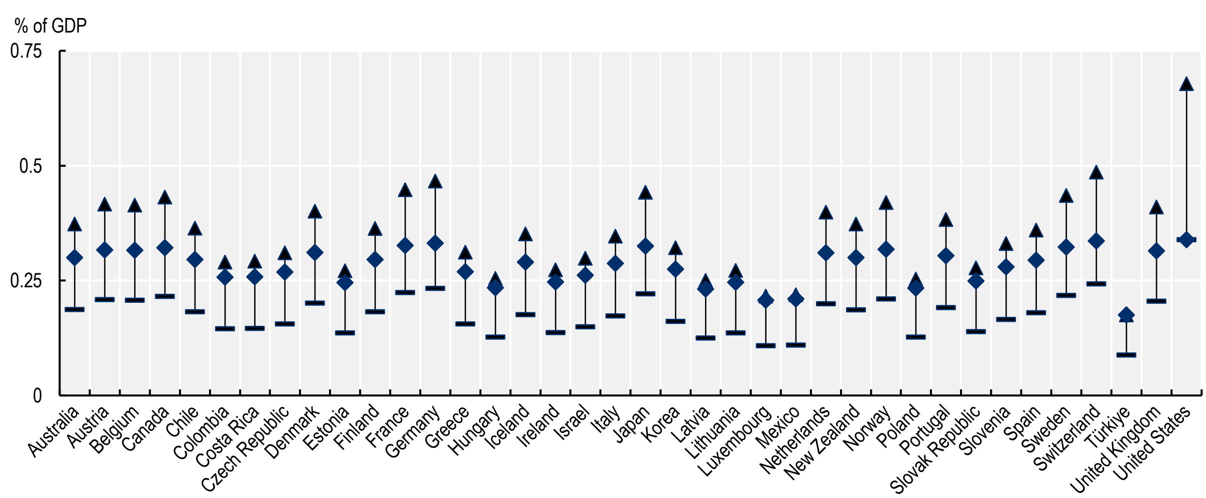
Beyond capital investments, better use of health data is critical (see the chapter on digital foundations). This reflects ongoing deficiencies in the health sector – a sector where correct decisions can have considerable impact, but one that remains "data rich but information poor" (Oderkirk, 2021[22]). Improved IT linkages are needed to move information to where it is needed, not only within the health system but also externally; for example, facilitating whole-of-government decision making by balancing information on health system capacity versus containment and mitigation decisions.

Judicious use of routine health data improves containment and mitigation efforts, including early warning systems, and ensures that patients receive the right care for their needs (including wider adaptation of telemedicine) and are adequately followed up. To strengthen trust in digital health solutions, there is a need to ensure that use of such personal data is responsible and well informed. This includes enabling privacy, ensuring personal data protection and digital security, and promoting the interoperability and governance of health data.

The OECD report *Health in the 21st Century* concludes that health lags behind many other parts of the economy in harnessing the potential of data and digital technology, "missing the potential to save a significant number of lives and billions of dollars" (OECD, 2019[23]). The report notes that a conservative doubling of current investment levels is needed to promote more intelligent use of data for information and knowledge, and that this could equate to a healthy return of approximately three to one.

Assuming that countries with overall higher spending are already more advanced in harnessing their health data and information, an inversely proportional additional investment range of 2-4% of health care expenditure is applied, in line with the OECD report. Thus, for the United States (the highest spender), an increase of 2% of health spending is needed, and for Türkiye (the lowest spender), an additional 4% is needed. Using health spending data across OECD countries in 2019, the level of additional investment would represent around 0.26% of GDP (Figure 14.8).

Figure 14.8. Additional spending to harness health information in OECD countries, as a share of GDP



Note: The arrow represents an additional 2-4% of 2019 health spending as a share of GDP, while the diamond indicates the estimated investment need, based on overall levels of health spending.
Source: Authors' calculations based on OECD Health Statistics 2021.

Pillar 3: Bolster health professionals working on the front line

Investment 5: Sufficient health and long-term care professionals

At the heart of health system resilience is a stronger front line (see the chapter on workforce). Concerns about retention of staff, and associated labour and skill shortages, have been accumulating over recent years. Increased pressure from demographic change, population demands, and added concerns about the upcoming retirement of an older generation of doctors and nurses are expected to exacerbate such shortages (OECD, 2016[24]).

Securing sufficient numbers of skilled health and care professionals – in hospitals, across primary care and in LTC – is essential. A reinforced workforce strengthens service delivery, enabling effective case management of individuals with COVID-19 (or those hospitalised due to other types of health shocks), while maintaining services at all levels of a health system for other health care needs.

The pandemic has heightened awareness among governments and citizens alike that nursing and care staff deserve greater recognition for the skill, responsibility and empathy they demonstrate on a daily basis. During the first and subsequent waves of the pandemic, health and care workers were at the front line, enduring long and difficult working conditions, with increased risk of infection, serious illness and death.

Costing the investment need is broken down into two major cost drivers: the cost of having an adequate number of health and LTC professionals; and the cost of improving the competitiveness of salaries of key cadres of health and LTC workers.

- Building an adequate health workforce

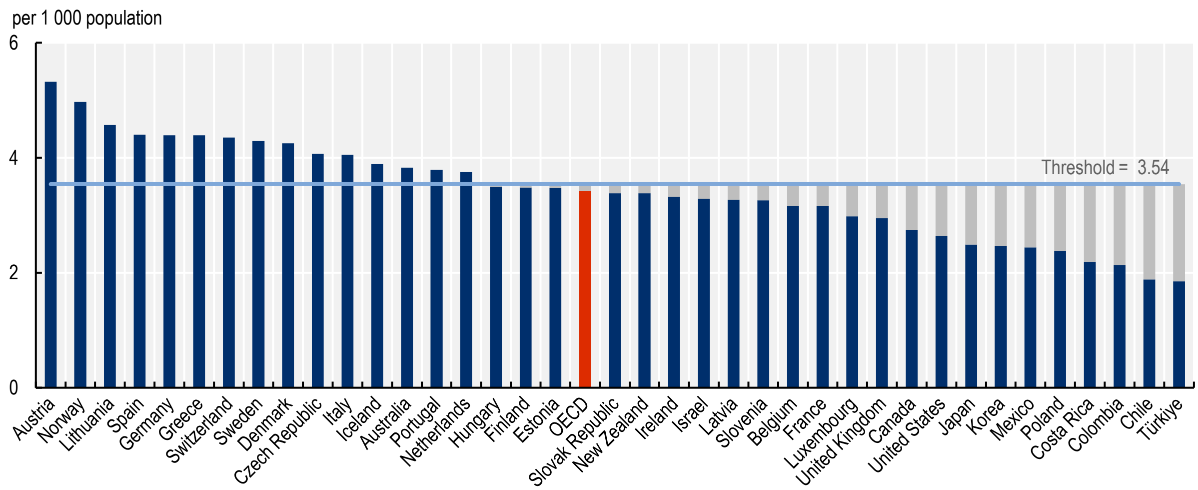
Notwithstanding the many factors determining the optimal density of medical professionals in any one country – such as demographic and disease patterns, geographical and rural/urban characteristics and organisation of care across providers – a simple international benchmarking exercise provides order-of-magnitude cost estimates for increases in staffing required for countries with relatively low numbers of health professionals.

Various thresholds for determining health worker densities have been put forward. The 2006 World Health Report identified a minimum density of 2.3 skilled health workers (physicians and nurses/midwives) per 1 000 population – a figure used to monitor progress towards meeting the Sustainable Development Goals (SDGs) (WHO, 2006[25]). The Global strategy on human resources for health: Workforce 2030 report considered an updated threshold of 4.45 health workers per 1 000 population to reflect the broader range of services targeted by universal health coverage (UHC) and the SDGs, while acknowledging that OECD health systems go beyond provision of essential health services with a density of health workers above this threshold (WHO, 2016[26]). More pertinently in the context of resilience, as part of a systematic analysis for the Global Burden of Disease Study 2019 to measure human resources for health in relation to UHC, the Institute for Health Metrics and Evaluation derived levels of health worker density required to achieve a performance target of 90 out of 100 on the UHC effective coverage index (GBD 2019 Human Resources for Health Collaborators, 2022[27]). The thresholds of 3.54 physicians and 11.45 nurses/midwives per 1 000 population are, therefore, adopted in this chapter (Figure 14.9, Figure 14.10).

Bringing the density of physicians up to this threshold (and assuming current remuneration levels of physicians) for all OECD countries would require an average investment of 0.15% of GDP. The increase in the numbers of nurses and midwives across OECD countries to reach the threshold of 11.45 per 1 000 population would require an average investment of around 0.33% of GDP.

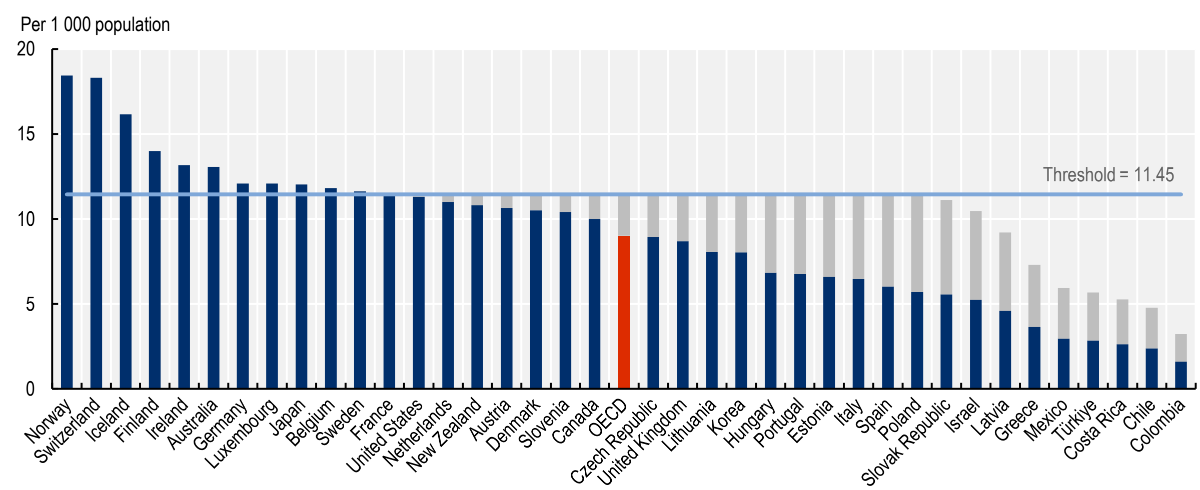
The number of workers in the LTC sector has also proved to be a key factor in mitigating the effects of the pandemic on the elderly population. Even some of the best-staffed high-income OECD countries do not rate the availability of LTC workers in their country as satisfactory (Colombo et al., 2011[28]). A study by the International Labour Organization on coverage deficits in LTC sought to establish a minimum threshold for provision of care, based on the median population-weighted value of selected OECD countries (ILO, 2015[29]). Meeting such a threshold, while recognising the very low levels in some countries, would equate to an average investment of 0.04% of GDP. Taken together with investment in physicians and nurses, this amounts to a net increase of more than 3.5 million health and care professionals across all OECD countries, or a 15% increase overall.

Figure 14.9. Practising physicians (headcount) per 1 000 population, 2019 (or latest year)



Note: Data for countries reporting active or registered physicians rather than practising physicians are adjusted using an OECD average ratio. The grey bar represents the additional physician numbers required to reach the threshold.
Source: OECD Health Statistics 2021.

Figure 14.10. Practising nurses/midwives (headcount) per 1 000 population, 2019 (or latest year)



Note: Data for countries reporting active or registered nurses rather than practising nurses are adjusted using an OECD average ratio. The grey bar represents the additional nurse/midwife numbers required to reach the threshold (with a maximum 100% increase).
Source: OECD Health Statistics 2021.

- Raising the competitiveness of salaries for nurses and care workers

Estimates of the costs of increasing salaries for nursing and personal care workers use OECD data on the current and additional number of health and care workers across various categories, along with reported levels of remuneration for 2019 available for hospital nurses in 35 OECD countries. This is combined with data on the relative salaries of different cadres of nurses and carers. The OECD publication *Who Cares?* provides salary comparisons between carers and broader groups of nurses and health workers (OECD, 2020[30]).

Increasing the wages of nursing and care workers, using as a base the average OECD nurse salary level (relative to average national income), corresponds to an average increase of 0.14% of GDP.

Investment 6: Medical reserve

Boosting and optimising the capacity of health systems to respond to the surge in the demand for care associated with COVID-19 cases has been a major challenge faced by countries – particularly early in the pandemic. As doctors, nurses and other health professionals were mobilised to play the role of first responders, health systems sought ways to increase the number of staff available rapidly. Several countries mobilised inactive and retired health professionals. Other countries turned to military health professionals, to assist in testing, treatment and relocation of patients. Countries also mobilised students in medical, nursing and other health education programmes to provide services to patients or to help in responding to public concerns; for example, staffing telephone hotlines or taking on the non-clinical tasks of key clinical staff (see the chapter on workforce).

Creating a medical reserve can offer a flexible and cost-effective surge capacity that can be called on in times of high need. Costs relate primarily to recurrent training, so people enlisted in a country's medical reserve maintain the necessary skills to support full-time health professionals and can integrate to best effect during a peak in COVID-19 cases or other emerging health shock. Based on the annual budgets for this type of entity, the annualised cost to develop and maintain a medical reserve force are estimated to be in the range 0.02% to 0.04% of GDP. This excludes additional costs associated with deployment of surge capacity during a health shock (such as per diem payments and travel allowances).

14.4. Conclusions: Targeted investments will improve resilience

Targeted investments in health systems strengthen resilience to the ongoing pandemic and emerging future shocks. In doing so, they protect society and stimulate the economy. This chapter identifies six key investments under three overarching pillars that aim to protect people's underlying health; fortify the foundations of health systems; and bolster health and LTC professionals working on the front line.

Taken together, the six investments amount to an estimated 1.4% of GDP on average (compared with the 2019 pre-pandemic baseline), with a cross-country range of 0.6% to 2.5%, depending on how much a country is already spending on each of the targeted areas. These estimates are based on such increases in the ratio of health spending to GDP being reached and then spending in these areas being maintained over time. The numbers reflect broad order-of-magnitude estimates rather than results based on a precise cost-accounting analysis.

Funding such investments requires buy-in from ministries of finance as well as health ministries and social security institutions. In the current context of tight public finances in most OECD countries, a combination of targeted spending and measures to reduce wasteful spending could be used. Moving forward, the return from these targeted health system investments is likely to outweigh the costs substantially. For example, effective interventions in preventive care would eventually reduce the need for health care, with consequent cost savings.

Within the health sector, such investments stop the health system from being overwhelmed. In the medium term, they can also increase efficiency by reducing ineffective and wasteful spending. Beyond the health sector, such investments will boost the economy: a stronger, more resilient health system helps to reduce the stringency of containment and mitigation measures. It strengthens human capital both now, through a healthier and more productive workforce, and in the future, through less disrupted education.

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Annex A. OECD Resilience of Health Systems Questionnaire 2022

Participants in the OECD Resilience of Health Systems Questionnaire 2022

The OECD Resilience of Health Systems Questionnaire 2022 was sent to OECD countries on 3 December 2021, and responses were accepted until April 2022.

The Questionnaire was responded to by 26 countries. Responses were received from: Australia; Austria; Belgium; Canada; Costa Rica; Czech Republic; Finland; France; Germany; Greece; Ireland; Israel; Italy; Japan; Korea; Latvia; Lithuania; Mexico; Portugal; Slovenia; Spain; Switzerland; Türkiye, United Kingdom and United States. Luxembourg responded by completing several modules of the Questionnaire as part of the OECD's Evaluation of its COVID-19 response (OECD, 2022[1]).

Content of the OECD Resilience of Health Systems Questionnaire 2022

This questionnaire is designed to collect information from OECD countries on policy responses to the COVID-19 pandemic and efforts to increase the resilience of health systems. The information collected will support shared learning on the resilience of health systems. The work based on this information will be presented to the OECD Health Committee in June 2022 and then released as an OECD publication later in 2022. An outline of the work was discussed in June 2021 by the Health Committee [DESLA/HEA(2021)5].

The questionnaire is organised into sections, each focusing on a specific area (see table below). If it helps to communicate the information, please include URLs and links as appropriate. The questionnaire has check boxes and areas for text. The grey highlighted areas mark where you are invited to include comments. Important areas such as digital infrastructure have been captured in other surveys and are not replicated here. Other issues that are core to this project, notably on paying for global public goods, are not included in this questionnaire as information is being collected through other methods.

If time does not permit you to answer all the sections, we would be grateful for as many responses as possible.

Section	Focus of the questions
1. Workforce	Short term mobilisation, protecting workers' health and long-term workforce plans.
2. Continuity of care	Primary health care changes and maintaining care for non-COVID patients.
3. Waiting time	Managing the impact of deferred and delayed care.
4. Critical care surge	Modelling the requirement for critical care resources and system level changes to improve use of critical care resources.
5. Essential products/supply chains	Challenges in obtaining products and how your country assured quality or certification when diversifying supply chains.
6. Mental health	Monitoring mental health and service use. Changes in capacity and in crisis preparation.

7. Long-term care	Impact of the COVID-19 pandemic on long term care.
8. Containment and mitigation	Prior pandemic preparedness, public health responses to the pandemic and suggestions for the future.
9. Investing in core public health functions	Understanding the impact of the pandemic on other core public health functions with the goal of enhancing resilience over the medium-long term.

Please send completed questionnaires to Philip.Haywood@oecd.org. **Your response by 31 January 2022 would be greatly appreciated.**

If you would like to discuss any aspect of the questionnaire or the project, please contact the secretariat via Philip Haywood at Philip.Haywood@oecd.org

Contact persons

Please provide the name, affiliation, and email address of the main contact person for this questionnaire (you may also add the names of people who were responsible for completing specific sections).

Country:	
Name:	
Position:	
Organisation:	
E-mail address	

Glossary of terms used in this questionnaire

Term	Explanation
Contingency critical care surge	A surge in critical care that is not consistent with daily practices but has minimal impact on usual patient care (contrast with a crisis critical care surge).
Crisis critical care surge	A surge in critical care that is not consistent with usual standards of care, but rather the best possible care is given the circumstances (contrast with a contingency critical care surge).
Intensive care units (ICU)	An ICU is an organised system for the provision of care to critically ill patients that provides intensive and specialised medical and nursing care, and an enhanced capacity for monitoring. Countries may have their own systems for defining and categorising ICUs and ICU beds.
One Health	The One Health approach recognises that many of the antimicrobial threats to human health are the same as those afflicting the health of animals and plants that share the same ecosystem. It underscores the importance of pairing policies in the human health sector with those that are targeting the drivers of antimicrobial resistance in the animal and plant populations, agricultural production, food safety and security, and the environment sectors.
Primary care worker	Primary care workers go beyond primary care physicians or general practitioners to encompass other health professionals such as nurses, auxiliaries, pharmacists, and community health workers.
Resilience	The ability of a system (such as the health system) to recover from and adapt to shocks or stresses.

Section 1: Planning and investing in the health workforce

Please provide the name, affiliation, and email address of the person who completed the information about planning and investing in the health workforce or would be best placed to clarify answers.

Name:	
Position:	
Organisation:	
E-mail address	

Mobilising the workforce quickly during the pandemic	
Question 1.1. Was or is your country dealing with a problematic **health workforce shortage** during the COVID-19 pandemic? ☐ Yes ☐ No	
On a scale of 1 (Low) to 5 (High), please indicate the impact of the health workforce shortage in dealing with the COVID-19 pandemic: ☐1 (low) ☐2 (low-medium) ☐3 (medium) ☐4 (medium-high) ☐5 (high)	
Question 1.2. Which categories of health and long-term care workers were particularly in short supply during the COVID-19 pandemic? *Check all that apply*	
☐ Doctors (physicians)	☐ Intensive care unit (ICU) specialists ☐ Hospital emergency unit specialists ☐ General practitioners (GPs)/ Family Doctors ☐ Other: (please specify) ______
☐ Nurses	☐ Intensive care unit (ICU) nurses ☐ Hospital nurses in general ☐ Nurses working in long-term care facilities ☐ Other: (please specify) ______
☐ Health care assistants/nursing aids	☐ Health care assistants/nursing aids in hospitals ☐ Health care assistants/nursing aids in long-term care facilities ☐ Other: (please specify) ______
Question 1.3. What policies were put in place to address any shortages of health workers during the peaks of the COVID-19 pandemic and to quickly mobilise additional staff? *Check all that apply* ☐ Prolong working hours (overtime) ☐ Increase workload (e.g., more ICU beds per ICU nurse) ☐ Provide rapid training in key clinical areas (e.g., intensive care, primary health care) ☐ Mobilise medical and nursing students ☐ Call on retired doctors and nurses to return to practice (part-time or full-time) ☐ Rely on national reserves of health professionals (pre-existing before the pandemic or established in response to the pandemic) ☐ Reallocate health workers to localities/facilities with greater needs ☐ Reallocate health staff to key clinical areas (e.g., intensive care) and reduce activities in non-COVID clinical areas ☐ Reorganise clinical teams to spread expertise ☐ Accelerate the recognition of qualifications of foreign-trained doctors and nurses already in the country	

☐ Recruit doctors and nurses from other countries
☐ Other: (please specify) _____

Question 1.4. What are the three key lessons learned from the pandemic for health workforce policies? *Please consider which innovations should be maintained to ensure resilient health systems and provide useful examples from your country*

Please briefly describe the three key lessons in this box
1.
2.
3.
Examples:

Protecting the health and well-being of workers

Question 1.5. Does your country or an organisation in your country currently conduct a **survey** to assess health worker safety and/or well-being?

☐ Yes, nationally
☐ Yes, regionally
☐ Yes, on the level of individual providers
☐ No, but one is in development
☐ Other: (please specify) _____
☐ No

Please briefly **describe and/or provide a link** to relevant documentation.

Question 1.6. Did your country provide specific **psychological support** for health and care workers during acute phases of the pandemic (beyond services that are routinely available to the public)? Select all that apply:

☐ Access to apps or web-based support sites
☐ Access to free phone line
☐ Access to a consultation with a specialist (psychologist or other mental health care worker)
☐ Other: (please specify) _____
☐ No

Please briefly **describe and/or provide a link** to relevant documentation.

Did your country provide additional psychological support services for primary care or long-term care workers during the COVID crisis?

☐ Yes ☐ No

If yes, please briefly **describe and/or provide a link** to relevant documentation.

Did your country provide additional psychological support services for staff in hospital COVID wards, critical care, and intensive care units?

☐ Yes ☐ No

If yes, please briefly **describe and/or provide a link** to relevant documentation.

<table>
<tr><td>Question 1.7. Has your country provided additional guidelines or training on personal protective equipment (PPE), infection control, patient triage, or mental well-being for general practice (including primary care physicians, nurses, auxiliaries, or community health agents in facilities and those home-based)? Check all that apply
☐ Yes, guidelines on PPE
☐ Yes, training on PPE
☐ Yes, guidelines on infection control
☐ Yes, training on infection control
☐ Yes, guidelines on patient triage
☐ Yes, training on patient triage
☐ Yes, guidelines on other safety procedures (please specify below)
☐ Yes, training on other safety procedures (please specify below)
☐ Yes, guidelines on mental well-being
☐ Yes, training on mental well-being
☐ No</td></tr>
<tr><td>Please briefly describe and/or provide a link to relevant documentation.</td></tr>
<tr><td>Persistent health workforce shortages</td></tr>
<tr><td>Question 1.8. What are the policies in place to address any persistent <u>physician</u> supply problems after the pandemic? Check all that apply
☐ Increase in training capacity
☐ Prolong working time for physicians (e.g., incentives for postponing retirement)
☐ Targeted immigration policy (to attract more physicians)
☐ Incentives to increase the attractiveness of general medicine (financial and non-financial)
☐ Incentives to increase the attractiveness of specialties where shortages exist or are expected (financial and non-financial)
☐ Introduction or expansion of non-physician practitioner roles (e.g., nurse practitioner)
☐ Financial incentives to correct perceived geographic maldistribution
☐ Other (please specify) ______
☐ No policy</td></tr>
<tr><td>Please use this box to supply any additional comments or clarifications for this question</td></tr>
<tr><td>Question 1.9. What are the policies in place to address any persistent <u>nurse</u> supply problems after the pandemic? Check all that apply
☐ Increase in training capacity
☐ Increase in pay rates (salaries) to increase recruitment and retention
☐ Improve other aspects (non-financial) of working conditions of nurses (e.g., working time)
☐ Provide incentives to prolong working time for nurses (e.g., incentives for postponing retirement)
☐ Introduce or expand targeted immigration policy (to attract more nurses)
☐ Introduce or expand more advanced roles for nurses (e.g., nurse practitioners)
☐ Other (please specify) ______
☐ No policy</td></tr>
<tr><td>Please use this box to supply any additional comments or clarifications for this question</td></tr>
</table>

Question 1.10. What are the policies in place to address any **persistent shortages of long-term care workers** after the pandemic? *Check all that apply*

☐ Increase in training capacity

☐ Increase in pay rates (salaries) to increase recruitment and retention

☐ Improve other aspects (non-financial) of working conditions of nurses (e.g., working time)

☐ Provide incentives to prolong working time for long-term care workers (e.g., incentives for postponing retirement)

☐ Introduce or expand targeted immigration policy (to attract more long-term care workers)

☐ Other (please specify) ______

☐ No policy

Question 1.11. Are limits set for the number of students accessing undergraduate medical education?

☐ Yes, there are limits only in the form of quotas on the number of students admitted at university level

☐ Yes, there are limits only in the form of budget or capacity constraints

☐ Yes, there are limits in the form of quotas on the number of students admitted and of budget or capacity constraints

☐ No, there are no limits

If yes, please indicate who sets these limits.

☐ Central government

☐ Local levels of government

☐ Universities

☐ Other: (please specify) ______

Have any changes occurred since 2020 in the number of students accessing undergraduate medical education?

☐ Yes ☐ No

If yes, please indicate if the number: ☐ Increased

☐ Decreased

Were these changes related at least partly to the COVID-19 pandemic?

☐ Yes, these changes were presented as a response to the COVID-19 pandemic

☐ No, these changes were already planned before the COVID-19 pandemic or unrelated

Please use this box to supply any additional comments or clarifications for this question

Question 1.12. Are limits set for the number of students accessing post-graduate medical training (i.e., medical specialisation)?

☐ Yes, there are limits only in the form of quotas on the number admitted for post-graduate training

☐ Yes, there are limits only in the form of budget or capacity constraints

☐ Yes, there are limits in the form of quotas on the number of students admitted and of budget or capacity constraints

☐ No, there are no limits, all medical students are provided a post-graduate training opportunity

If yes, please indicate who sets these limits.

☐ Central government

☐ Local levels of government

☐ Universities

☐ Other: (please specify)

Have any changes occurred since 2020 in the number of students accessing postgraduate medical education (i.e., medical specialisation)?

☐ Yes ☐ No

If yes, please indicate if the number:	☐ Increased ☐ Decreased
Were these changes related at least partly to the COVID-19 pandemic? ☐ Yes, these changes were presented as a response to the COVID-19 pandemic ☐ No, these changes were already planned before the COVID-19 pandemic or unrelated	
Please use this box to supply any additional comments or clarifications for this question	
Question 1.13. Is there any limit for entry into nursing education? ☐ Yes, there are limits only in the form of quotas on the number of students admitted ☐ Yes, there are limits only in the form of budget or capacity constraints ☐ Yes, there are limits in the form of quotas on the number of students admitted and of budget or capacity constraints ☐ No, there are no limits.	
If yes, please indicate who sets these limits. ☐ Central government ☐ Local levels of government ☐ Universities ☐ Other: (please specify)	
Have any major changes in nursing student intake occurred since 2020? ☐ Yes ☐ No	
If yes, please indicate if the number:	☐ Increased ☐ Decreased
Please use this box to supply any additional comments or clarifications for this question	
Were these changes related at least partly to the COVID-19 pandemic? ☐ Yes, these changes were presented as a response to the COVID-19 pandemic ☐ No, these changes were already planned before the COVID-19 pandemic or unrelated	

Section 2: Maintaining continuity of care for all

Please provide the name, affiliation, and email address of the person who completed the information about maintaining the continuity of care for all.

Name:	
Position:	
Organisation:	
E-mail address	

Question 2.1. Has your country implemented measures to **recruit additional workers to provide primary health care or expand the role of available primary health care workers to address the peak in demand or maintain care continuity for all non-COVID patients**? *Check all that apply*

☐ Yes, non-health workers (e.g., post-office-workers, firefighters, etc.) have been provided training to provide COVID-19 related care (vaccination, testing)

☐ Yes, pharmacy workers have had an expanded role

☐ Yes, nurses have had an expanded role

☐ Yes, other health workers have had an expanded role (e.g., nursing assistant, midwife, physiotherapist, etc.)

☐ Yes, (please specify) ______

Please specify, and provide example(s) in the box below?

Please briefly **describe and/or provide a link** to relevant documentation.

Question 2.2. Has your country **introduced new service delivery models in primary health care** since the start of the pandemic to maintain care continuity for non-COVID-19 patients? Please indicate new in-person services (such as the deployment of multidisciplinary team practices, or the development of hospital-based programmes), digital health as well as services integrating in-person services and digital health solutions.

☐ Yes ☐ No

Please briefly **describe best examples and/or provide a link** to relevant documentation.

Question 2.3. Has your country **introduced new models to pay** for primary health care services to maintain care continuity for non-COVID-19 patients since the start of the pandemic? *Check all that apply.*

	Incremental changes introduced to existing payment models	New payment model introduced
Yes, additional amounts in salary or additional fee-for-services	☐	☐
Yes, capitation or bundled payment	☐	☐
Yes, pay-for-performance	☐	☐
Yes, payment for coordination with hospital, outpatient care or long-term care	☐	☐
No	☐	☐
Other (please specify) ______	☐	☐

Please briefly **describe and/or provide a link** to relevant documentation.

Question 2.4. Does your country **have digital booking systems** for COVID-19 related services? (i.e., centralised systems to allow people to access services) *Check all that apply* ☐ Yes, for vaccination ☐ Yes, for testing ☐ Yes, for seeing a primary care provider [for a consultation or prescription renewal] ☐ Yes, other (please specify) _____ ☐ No
Please briefly **describe and/or provide a link** to relevant documentation.
Question 2.5. Are any of the following **databases for COVID-19** related services **linked** to national primary health care datasets? *Check all that apply* ☐ Vaccination registry ☐ Laboratory results ☐ COVID-19 related hospital stays ☐ Digital sick leave forms ☐ Prescriptions ☐ COVID-19 Certificates (Vaccination certificates or health passes) ☐ Patient accessible portals for health information ☐ Patient accessible portals for administrative information (managing contact and demographic information, beneficiaries, etc.) ☐ Patient accessible portals for managing contact with the health system (e.g., schedule consultations/exams in primary health care or specialist care, etc.)
Please briefly **describe and/or provide a link** to relevant documentation.
Question 2.6. Do primary health care facilities in your country have the functionality to **identify, track and/or contact specific priority populations**? This data may be used, for example, for targeted follow-up for services (vaccination, routine follow up for chronic care), communication (education for self-management, outreach to high-risk groups) or monitoring of outcomes for particular groups. *Check all that apply* ☐ Economically deprived ☐ Elderly ☐ Those with routine health needs. Please specify which specific populations _____ ☐ Those recently released from hospital care ☐ Children ☐ Pregnant women ☐ Other: (please specify) _____
Please briefly **describe and/or provide a link** to relevant documentation.
Question 2.7. Does your primary health care system have any of the following **enhanced capacities** to reach out to priority populations since the start of the pandemic? *Check all that apply* ☐ Mobile primary health care units/teams ☐ Temporary health clinics for COVID-19 related health needs (testing/vaccination) in public spaces (e.g., libraries, town-halls, schools, conference centres, gymnasiums) ☐ Temporary health clinics for those with chronic care needs in public spaces (e.g., libraries, town-halls, schools, conference centres, gymnasiums) ☐ Home visits for vaccinations ☐ Home visits or digital health consultations for those with chronic care needs ☐ Manage coordination with acute care or long-term care to treat those with chronic care needs ☐ Text-reminders to schedule care

☐ Data sharing with outpatient specialist or acute care ☐ Changes in referral policies between primary health care and social/long-term care, hospital care and end-of-life care ☐ Other: (please specify) _____
Please briefly **describe and/or provide a link** to relevant documentation.
Question 2.8. Has your country been using **digital health (e.g., teleconsultation, health apps, telemonitoring platform, chatbots)** in primary health care to ensure continuity of care to all and better integration with the rest of the health system? ☐ Yes, existing digital health platforms were used ☐ Yes, new digital health platforms have been developed ☐ No
Please briefly **describe and provide a link** to relevant documentation.
Question 2.9. To what extent have non-physician primary health care workers (such as nurses, pharmacists, community health workers and auxiliaries) undertaken the following **COVID-19 related services**? ☐ Tracing and tracking of COVID-19 cases ☐ Vaccination ☐ Following up on information reported from public health systems ☐ Providing surveillance data to public health monitoring system ☐ Care for non-acute COVID-19 cases ☐ Other: (please specify) _____
Please briefly **describe and/or provide a link** to relevant documentation.

Section 3: Managing waiting times

Please provide the name, affiliation, and email address of the person who completed the information about managing waiting times.

Name:	
Position:	
Organisation:	
E-mail address	

Question 3.1 In your country, have waiting times for elective (non-emergency) care become a more prominent health policy issue on which government(s) have taken or are planning to take actions following the COVID-19 pandemic? ☐ Yes ☐ No
On a scale of 1 (Low) to 5 (High), please indicate the level of priority given to waiting time and delayed care issues in your country following the COVID-19 pandemic: ☐1 (low) ☐2 (low-medium) ☐3 (medium) ☐4 (medium-high) ☐5 (high)
Question 3.2. Has your country created a **national plan for addressing care backlogs** that may have been caused by reduced provision of care during the COVID-19 pandemic? ☐ Yes, a national plan exits ☐ Yes, a national plan is in development ☐ No
Please briefly **describe and/or provide a link** to relevant documentation.
Question 3.3. How do you expect the waiting times for elective (non-emergency) treatments to evolve over the next few years? How long is it expected to take to deal with any backlog in treatments (e.g., postponed elective surgery, postponed cancer treatments)?
Please briefly describe the expectations about waiting times in this box and provide any study or relevant documentation
Question 3.4. Did your country have any predefined targets relating to waiting times or maximum waiting time norms or guarantees before the COVID-19 pandemic? ☐ Yes ☐ No
If yes, were these waiting times targets or guarantees maintained or temporarily suspended during the COVID-19 pandemic? ☐ Waiting times targets or guarantees were maintained ☐ Waiting times targets or guarantees were temporarily suspended (please specify in which clinical areas)
Please add additional relevant information about the measures taken in this box
Question 3.5. Has there been any new national strategy or specific policy introduced or planned to reduce waiting times and waiting lists for elective (non-emergency) care in your country following the COVID-19 pandemic? ☐ Yes ☐ No
If yes, please provide the title of the strategy or policy, the date of publication and any link to the document.
Please use this box to give the details, links, objectives, and actions of any policy. Please provide relevant links.

Does the strategy or policy involve any of the following elements to increase the volume of elective care? *Please check all that apply.* ☐ Additional funding for health care providers ☐ Expand health workforce (e.g., doctors, nurses, etc.) ☐ Extend working hours of health workforce ☐ Better use of capacity or operating theatres ☐ Involvement of additional providers (e.g., private providers to treat publicly funded patients) ☐ Digital consultations ☐ Other: (please specify) _____
Please use this box to provide additional information about these policies, if available
Question 3.6 Have any new policies been put in place to ensure that patients on the waiting lists are prioritised appropriately? Please refer to any new prioritisation policy, the corresponding criteria (e.g., condition likely to deteriorate, pain while waiting, mortality risk, etc.) and how these have been implemented (e.g., in the form of guidelines).
Please use this box to briefly describe new prioritisation policies
Question 3.7 If available, please provide any evidence of the impact of the above policies on waiting times (and add a link to any relevant documentation).
Please use this box to briefly describe the evidence on the above policies
Question 3.8 What lessons have been learned so far from policies to deal with waiting times during the COVID-19 pandemic that could be used to make health systems more resilient to future (unpredictable) public health crises?
Please use this box to outline the lessons learned.

Section 4: Implementing critical care surge capacity

This section is about the forecasting of demand or modelling used to identify the required critical care resources. It also seeks information about the health system level changes associated with the critical care surge that occurred during the pandemic. Some questions associated with the critical care staffing workforce were asked in Section 1 (Workforce). Please provide the name, affiliation, and email address of the best person to contact about the implementation and planning of surge capacity in your country for a case study or focus group.

Name:	
Position:	
Organisation:	
E-mail address	
Further discussion	Does your country wish to be involved in a case study or focus group? ☐ Yes ☐ No

Modelling of critical care requirements
Question 4.1. Was forecasting or modelling used to plan for the demand for critical care and hospital resources? ☐ Yes ☐ No Please describe **what** modelling of the demand for critical care and hospital resources was undertaken to aid management of the critical care surge in the COVID-19 pandemic?
Please use this box to **briefly describe the forecasting or modelling.** For example, regional or national level, based on epidemiological forecasting or trends of current usage etc., modelling occupancy and staff requirements etc. Include URLs or documents as appropriate.
Please comment on the most critical shortages that the forecasting or modelling identified during the COVID-19 pandemic.
Please use this box to outline the crucial shortage identified by the forecasting or modelling. For example, the key shortage was trained ICU nursing staff or ventilators.
On a scale of 1 (not useful) to 5 (very useful), please indicate the level of usefulness to your country in modelling the demand for critical care and hospital resources. That is, was the modelling useful? ☐ 1 (not useful) ☐ 2 (slightly useful) ☐ 3 (moderately useful) ☐ 4 (useful) ☐ 5 (very useful)
Please describe how the forecasting or modelling aided decision making in the health system.
Please use this box to **describe how it aided decision making.** For example, improved planning and proactive staff recruitment, consideration of physical distancing restrictions, stockpiles etc.
Please comment on what would be useful to include in the future modelling of critical care based on your experiences during the COVID-19 pandemic?
Please use this box identify what would be useful to include in future modelling. For example, key shortages not identified by the modelling.
Question 4.2. Please describe what long term improvements or changes to the forecasting or modelling of critical care demand and capacity were made or are planned to follow the COVID-19 pandemic?
Please use this box to **describe the improvements.** For example, national centres of excellence, improved data, wider distribution etc.
Question 4.3. What are the expected benefits for the health care system of making these long-term changes?

Please use this box to describe the expected benefits for the health care system of the forecasting or modelling improvements. For example, changes in long term workforce and ICU planning.		
Changes to the health system for a crisis critical care surge		
Question 4.4. Did you country experience a crisis critical care surge? (A crisis critical care surge is when usual standards of care cannot be maintained, but rather the best possible care is provided given the circumstances) ☐ Yes ☐ No Whether or not your country experienced a crisis critical care surge, what systems level changes were implemented?		
Systems level changes	**Yes**	**No**
Organisation of facilities into larger networks	☐	☐
Integration of public and private providers into the same network	☐	☐
Implementation of national or regional real-time data on available and used resources	☐	☐
Development of crisis surge triage protocols for treatment and use of scarce resources	☐	☐
Temporary facilities for admitting and treating patients requiring hospitalisation, e.g., mobile hospitals or hotels	☐	☐
Most important systems level policies		
Question 4.5 What were the three most important systems level policies that were implemented or already in place to ensure that critical care resources were used more effectively and efficiently?		
Please use this box to outline the three most important systems level policies or changes 1. 2. 3.		

Section 5: Securing essential medical products

This section is about understanding the major challenges in securing essential medical products from the perspective of the health system. We ask about "the most important product" to ensure a narrow focus on the most useful policies for the international community. Please provide the name, affiliation, and email address of the best person to contact about the supply chain challenges in your country's health system for a case study or focus group.

Name:	
Position:	
Organisation:	
E-mail address	
Further discussion	Does your country wish to be involved in a case study or focus group? ☐ Yes ☐ No

Question 5.1. Did your country experience supply chain disruptions of essential medical products during the pandemic? ☐ Yes ☐ No			
If "No", please describe the most effective policies that were used to avoid supply chain disruptions.			
Please use this box to describe the most effective policies your country used to avoid supply chain disruptions			
Question 5.2. What medical products were the most difficult to obtain due to supply chain disruptions during the pandemic? Please indicate in the table below whether each of the listed products experienced a supply chain problem, experienced a problem but it got resolved, or was not a substantial problem. Please add additional products in the "other" row, if not listed and important.			
Product	It was a problem throughout the pandemic	It was a problem, but it was resolved	It was not a substantial problem
Ventilators and other ventilation related products	☐	☐	☐
Personal Protective Equipment (PPE)	☐	☐	☐
Testing materials (laboratory reagents, testing devices etc.)	☐	☐	☐
Oxygen	☐	☐	☐
Vaccines	☐	☐	☐
Disinfectants and Sanitizers	☐	☐	☐
Portable monitoring equipment (e.g., thermometer or pulse oximetry)	☐	☐	☐
Other: (please specify) ______	☐	☐	☐
Out of the medical products listed in the previous table, which were you most concerned about obtaining due to supply chain issues during the pandemic? Please specify one.			
Use this box to specify the product you were most concerned about			
Question 5.3. Was your supply chain for the medical product that you were most concerned about visible to the health system? (Supply chain visibility can be described as knowledge of suppliers, the suppliers of suppliers, supply chain mechanics and logistics) ☐ Yes ☐ No			
Please describe the main location of the disruption in the supply chain. For example, manufacturing or transportation? Was the disruption domestic, international or both?			

Please use this box to describe the main location of the disruption in the supply chain. If it was unknown or not visible, then please indicate
Diversification of supply chains
Diversification of supply chains was a common and important strategy following supply chain disruption during the COVID-19 pandemic. **Question 5.5.** If your country experienced an interrupted supply for the medical product that you were most concerned about, were you able to substitute by switching to: a different supplier, a different product with similar action, combining multiple components or a different strategy?
Use this box to discuss how you diversified. If you were unable to diversify, please indicate that.
How did your country assure the quality of the product you were most concerned about after your supply chain diversification?
Use this box to briefly discuss how you assured the quality of supply chain diversification. For example, did you facilitate technology diffusion from existing suppliers to new suppliers? Did you produce guidelines for new suppliers?
Proposed long-term changes to supply chains
Question 5.6. Please describe the main intended changes to supply chains for medical products for the medium-long term (i.e., for the next five years)
Use this box to outline the main intended changes to supply chains

Section 6: Strengthening and managing mental health

Please provide the name, affiliation, and email address of the person who completed the information about strengthening and managing mental health.

Name:	
Position:	
Organisation:	
E-mail address	

Question 6.1. Has your country undertaken any **mental health prevalence surveys** during the COVID-19 crisis (2020 – 2021)?
Please provide **link(s) to relevant survey(s).**
Question 6.2. Did your country introduce any **emergency mental health support measures** for the public during the COVID-19 pandemic? Please only indicate new or emergency services and support. Please note that mental health supports for health and care workers are enquired about in question 1.6.
☐ New phone support lines ☐ New online information, e.g., on staying mentally healthy during the pandemic ☐ New or temporary mental health services or service entitlement, e.g., access to psychological therapies ☐ Other: (please specify) ______
Please use this box to briefly **describe and/or provide an information link** to relevant documentation on new or emergency mental health services and support.
Question 6.3. Has your country tracked the **impact of COVID-19 on mental health service use and delivery?** For example, monthly referral rates to mental health services, rate of delivery of telemedicine mental health services, waiting times for mental health services.
Please briefly **describe and/or provide a link** to relevant documentation.
Question 6.4. Has your country **permanently increased mental health support or capacity** since the start of the crisis? For example, increase in mental health funding, introduction of new services. Please note there is a question of training, including mental health training, in question 1.7
Please briefly **describe and/or provide a link** to relevant documentation.
Question 6.5. In your country, are **mental health considerations included in routine crisis preparedness and planning approaches**? For example, does your country have a mental health crisis response blueprint, are mental health impacts of crisis containment measures routinely considered, or are mental health considerations included in crisis preparedness exercises?
Please briefly **describe and/or provide a link** to relevant documentation.

Section 7: Strengthening long-term care

Please provide the name, affiliation, and email address of the person who completed the information about strengthening and managing mental health.

Name:	
Position:	
Organisation:	
E-mail address	

Question 7.1. Were long-term care workers required to be vaccinated in your country? ☐ Yes ☐ No
Please briefly describe or provide a link to the relevant policies developed for vaccination among the long-term care workforce.
Question 7.2. Are there testing requirements in place for long-term care workers in your country? ☐ Yes ☐ No
Please briefly describe or provide a link to the relevant policies developed for testing among the long-term care workforce.
Question 7.3. In your country, to what extent are low COVID-19 vaccination rates among the long-term care workforce an issue? ☐ 1. Not a concern at all ☐ 2. Something of a concern ☐ 3. A moderate concern ☐ 4. A significant concern ☐ 5. Among the most important issues hampering the COVID-19 response
Question 7.4. Does your country have information on the proportion of the long-term care workforce that has been vaccinated? ☐ Yes ☐ No If yes, please provide the percentage at a given date _____% at _____date
Question 7.5. Was additional financing for long-term care made available during the COVID-19 pandemic? ☐ Yes ☐ No
Please briefly describe or provide link to relevant information, including how much funding was made available and how it was used
Question 7.6. Have any changes occurred since the COVID-19 pandemic in the turnover of long-term care workers? ☐ Yes ☐ No If yes, please indicate if turnover: ☐ increased or ☐ decreased
Please provide any additional comments or clarifications for this question.
Question 7.7. Were additional measures undertaken to recruit additional long-term care workers during the pandemic sufficient to address shortages? ☐ N/A – no additional measures undertaken ☐ No – measures did not make up for pre-existing shortages of long-term care workers ☐ No – measures did not make up for shortages of long-term care workers caused by the pandemic ☐ Yes – measures were undertaken and were sufficient

Please briefly describe or provide a link to relevant information
Question 7.8. In addition to policies to recruit additional long-term care workers, did your country adopt any policies during the pandemic to address worker shortages by increasing the responsibilities and workload of existing long-term care workers? ☐ Yes ☐ No
Please briefly describe or provide a link to relevant information
Question 7.9. Has COVID-19 negatively impacted recipients of long-term care and the delivery of long-term care? *Please check all that apply* ☐ Delays in accessing long-term care services or care packages ☐ Physical or mental impact of COVID-19 and containment policies among long-term care residents ☐ People living with dementia or cognitive impairment ☐ Other impacts, and if, so please elaborate _____
Question 7.10. Has there been an impact of COVID-19 on the delivery of palliative and end-of-life care? *Please check all that apply* ☐ Difficulties in accessing pain management ☐ Delays in palliative care consultation ☐ Delays in hospice transfer
Question 7.11. Has your country tracked the impact of COVID-19 on where people are receiving long-term care? Is there any evidence that the setting for long-term care has changed? ☐ No ☐ Yes – more people than expected are being removed from institutional care ☐ Yes – fewer people than expected are being removed from institutional care

Section 8: Pandemic preparation, containment, and mitigation strategies

Please provide the name, affiliation, and email address of the person who completed the information about pandemic preparation, containment, and mitigation strategies.

Name:	
Position:	
Organisation:	
E-mail address	

Question 8.1. Did your country have a pandemic preparedness plan before the COVID-19 pandemic or January 2020?

☐ Yes ☐ No

8.1.1. If yes, please choose the reason why your country had this plan. *Please check all that apply.*

☐ World Health Organization (WHO) or another international organisation's recommendation
☐ Based on domestic experience of an emerging infectious disease (EID) outbreak
☐ Based on domestic experience of the H1N1(2009) pandemic
☐ Based on an EID outbreak in another country or neighbouring countries
☐ National/political drive/decision for any reason
☐ Other: (please specify) ______

Please offer relevant background or a link to your country's pandemic preparedness plan enactment

Please use this box to include additional details.

8.1.2. If yes, please select what components and strategies are included in the plan. *Please check all that apply.*

☐ Testing & laboratory preparedness
☐ Surveillance & reporting
☐ Case investigation & tracing/tracking
☐ Case isolation protocol and logistics
☐ Hospital and/or other isolation facilities recruitment and allocation
☐ Respirator and other medical equipment supply strategies
☐ Medical care continuity plan for non-pandemic disease patients
☐ Infection prevention and control (IPC) measure training and education for healthcare professionals and/or members of the public
☐ Additional human resources recruited during the pandemic
☐ Human resource training and education before and/or during pandemic
☐ Personal protection equipment (PPE) production and/or trade
☐ PPE procurement & logistics
☐ Vaccine and other medication stockpile
☐ Vaccine and other medication emergent approval process
☐ Vaccine and other medication logistics during the pandemic
☐ Vaccine and other medication research and development
☐ Social/Physical distancing measures and implementation
☐ Psychological support for pandemic cases (see mental health section)
☐ Psychological support for the public (see mental health section)
☐ Financial aid and/or support plans
☐ Social support strategies
☐ Emergency operational government system or organisation
☐ Role of ministries other than the ministry of health

☐ Managing death care services and the handling of dead bodies ☐ Managing information and data infrastructure ☐ Sharing information and statistics ☐ Managing privacy & ethics issues ☐ Engaging civil society ☐ Risk communication ☐ Border control measures ☐ International cooperation strategy ☐ Research for emerging virus characteristics and its surveillance ☐ Research for pharmaceutical interventions (PI) including vaccine and medicine ☐ Research for non-pharmaceutical interventions (NPI) including social distancing strategies ☐ Other: (please specify) ______
Please describe any further additions regarding the composition and components of your country's pandemic preparedness plan
Please use this box to describe additional details of the pandemic preparedness plan.
Question 8.2. Does your country have an external evaluation of your pandemic preparedness plan or your response capacity for pandemics that was prepared prior to COVID-19? ☐ Yes ☐ No
8.2.1. If yes, describe when it was and whether it was helpful in your country's COVID-19 pandemic response
Please use this box to describe when your plan was evaluated and whether this was helpful.
8.2.2. Whether yes or no for 8.2., did your country do any internal or external evaluation of your national response during the COVID-19 pandemic? ☐ Yes ☐ No
8.2.3. If yes for 8.2.2., describe when it was and share your experience with the result (e.g., link to final report etc.)
Please use this box to describe to share your experience
Question 8.3. Did your country have an annual budget dedicated to pandemic preparedness before 2020? ☐ Yes ☐ No
8.3.1. If yes, give the annual budget amount from 2015 to 2019, as applicable, and advise whether it increased or decreased during this time period.
Please use this box to describe your annual budget for pandemic preparedness
8.3.2. Whether yes or no for 8.3., has your country now established or increased its annual budget for pandemic preparedness? If yes, please give the budget amount and describe what it consists of.
Please use this box to describe your new budget for pandemic preparedness
Question 8.4. What top three challenges and opportunities were revealed for your country's pandemic preparedness plan as a result of COVID-19? What are your country's future priorities for pandemic preparedness?
● (Challenges) ● (Opportunities)

- (Next steps/future priorities)

8.5. Did your country do any simulation/modelling to estimate the impact of the non-pharmaceutical interventions (NPIs) including lockdown measures, "stay-at-home" orders, school closures, public space closures, gathering/event cancellations and/or other COVID-19 response policies?

☐ Yes ☐ No

If yes, please describe to what extent that simulation/modelling has been used and whether it was useful to implement/adapt the policies. If there are any available reports, please share the files or the links.

Please use this box to discuss the simulation/modelling.

Question 8.6. Did your country respond to the COVID-19 pandemic through a whole of government approach?

☐ Yes ☐ No

8.6.1. If yes, please provide your national level governmental response structure and key decision-making process during the COVID-19 pandemic. (Please specify if there is a special agency dedicated for public health emergency preparedness and response at the national level)

Please use this box to briefly respond to the above question.

8.6.2. Please describe how your local governments/health authorities had a key role in the whole of society response scheme.

Please use this box to briefly respond to the above question.

Question 8.7. Beyond the development of vaccines and other COVID-19 tools, has there been any example of good practice public-private partnerships in managing the COVID-19 response?

☐ Yes ☐ No

If yes, please share your country's examples (e.g., development and distribution of essential equipment, organising healthcare, supporting social care services, development of testing and/or tracing/tracking process technology, data collection and processing etc.)

Please use this box to briefly respond to the above question.

Question 8.8. Were there crisis communication strategies already in place that were used during the pandemic?

☐ Yes ☐ No

Please describe these crisis communication strategies.

Please use this box to briefly respond to the above question.

Question 8.9. Has your country engaged with social media companies or news media to deal with mis- and dis-information during the pandemic? *Please tick all that apply*.

☐ Yes, Direct engagement with social media companies

☐ Yes, Direct engagement with news media

☐ No

If yes, did this engagement begin during the pandemic, or was it part of ongoing efforts to combat mis- and dis-information?

☐ Engagement with social media began during the pandemic; or

☐ Engagement with social media predated the pandemic.

☐ Engagement with news media began during the pandemic; or

☐ Engagement with news media predated the pandemic.

Please use this box to briefly provide further information and/or a link to relevant documentation.

Question 8.10. Has your country established a **system of communication** to respond to the population´s concerns and questions about vaccines? ☐ Yes, a system of communication exists ☐ Yes, a system of communication is in development ☐ No If so, who is responsible for this communication, and what are the means of supporting the communication?
Please briefly **describe and/or provide a link** to relevant documentation.
Question 8.11. Did your country include citizen or patient participation in key COVID-19 taskforces or decision-making groups involved in your government's response? ☐ Yes ☐ No
If yes, please briefly describe and/or provide a link to relevant documentation
Please use this box to briefly describe the issues.

Section 9: Investing in core public health functions

The COVID-19 pandemic has been documented to impact efforts to tackle antimicrobial resistance (AMR). This section aims to gather information on the extent to which the pandemic may have interfered with the implementation of national action plans to tackle AMR, as well as the measures that were put in place to mitigate the adverse effects. Please provide the name, affiliation, and email address of the best person to contact in the event of further questions or clarifications.

Name:	
Job Title:	
Organisation:	
E-mail address	

Question 9.1. Which types of activities highlighted in the national action plan on antimicrobial resistance have been adversely impacted by the COVID-19 pandemic? *Please check all that apply.*

☐ Activities to improve awareness and understanding of antimicrobial resistance in the public (e.g., social media campaigns)

☐ Educational programs for antibiotic prescribers

☐ Health workers' compliance with the existing hand hygiene guidelines and programs in health facilities (e.g., WHO's 5 moments for hand hygiene model)

☐ Health workers' compliance with the existing environmental hygiene programs and guidelines in health facilities (e.g., decontamination, disinfection, cleaning and sterilisation of the environment and equipment, safe disposal of items that have potentially come into contact with infected patients)

☐ Rapid testing of patients to determine whether they have viral or bacterial infections

☐ Audits of antibiotic prescribing behaviours in health care facilities

☐ Surveillance and reporting of antimicrobial consumption in healthcare facilities

☐ Surveillance of antimicrobial resistance through involvement of multiple sectors in line with the One Health approach

☐ Vaccination campaigns for non-COVID related diseases (e.g., childhood diseases, influenza)

☐ Other: (please specify)

Question 9.2. What mitigation measures have been put in place to ensure the implementation of the national action plan on antimicrobial resistance is not adversely impacted by the COVID-19 pandemic?

Please provide short answers in this box

Please send your responses by 31 January 2022 to the OECD Secretariat via Philip.Haywood@oecd.org

References

OECD (2022), *Evaluation of Luxembourg's COVID-19 Response*, OECD Publishing, Paris, https://doi.org/10.1787/2c78c89f-en. [1]

OECD Health Policy Studies

Ready for the Next Crisis? Investing in Health System Resilience

The COVID-19 pandemic had massive consequences for societies and health systems across the OECD and beyond. Health systems were not resilient enough. Resilient health systems plan and are ready for shocks, such as pandemics, economic crises or the effects of climate change. They are able to minimise the negative consequences of crises, recover as quickly as possible, and adapt to become better performing and more prepared. Smart, targeted investments in health system resilience are needed to improve health and ensure the next shock is less disruptive and costly. This report reviews the lessons of the COVID-19 pandemic and applies them to build policy recommendations to ensure the global community is ready for the next crisis. The reviews and recommendations cover health system issues – including workforce, digitalisation, continuity of care and mental health – and other topics, including long-term care, supply chains and international co-operation.

PRINT ISBN 978-92-64-79463-4
PDF ISBN 978-92-64-83087-5

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