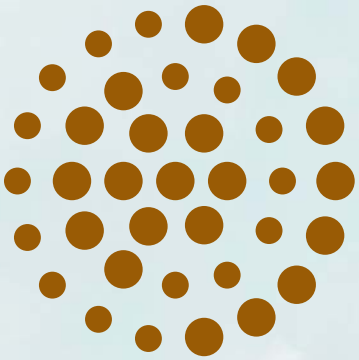

Drawing light from the pandemic

A NEW STRATEGY FOR HEALTH AND SUSTAINABLE DEVELOPMENT

A REVIEW OF THE EVIDENCE

for the Pan-European Commission on *Health and Sustainable Development*

Edited by Professor Martin McKee

European Observatory on Health Systems and Policies
MAKING SENSE OF THE EVIDENCE

Drawing light from the pandemic: A new strategy for health and sustainable development

A review of the evidence

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Table of contents

Foreword

Mario Monti

Chair
Pan-European Commission on
Health and Sustainable Development

Aleksandra Torbica

Special Adviser to the Chair
Pan-European Commission on
Health and Sustainable Development

In 2020 Hans Kluge, the World Health Organization Regional Director for Europe, asked Mario Monti to lead a Pan-European Commission on Health and Sustainable Development. Dr Kluge and Professor Monti invited a small number of former heads of state and government, distinguished life scientists and economists, heads of health and social care institutions, and leaders of the business community and financial institutions from across the European Region to bring together their outstanding expertise and experience to "rethink policy priorities in the light of pandemics".

We were fortunate to draw on the high academic reputation and policy experience of Professor Martin McKee as Chair of the Scientific Advisory Board, and Professor Elias Mossialos as Scientific Coordinator. Mario Monti adds his own and the Commission's acknowledgement for the competent and dedicated contribution of Professor Aleksandra Torbica as Special Adviser to the Chair of the Commission.

The mandate of the Commission was to draw lessons from the ways in which different countries' health systems have responded to the COVID-19 pandemic and make recommendations on investments and reforms to improve the resilience of health and social care systems. The strength and distinguishing feature of this Commission is in its focus on health in its entirety – not just pandemics – recognized as being critical to both sustainable development and social cohesion.

While fully embracing the framework of One-health, we seek to further uncover interactions between health and sustainable development, elevate health and social care policy in relation to others as societal and political priorities, not just advising on better preparedness and equipment for the next pandemic.

This evidence review has been prepared to inform the work of the Commission. It reflects on the experiences of the pandemic and the legacy that COVID-19 has left us, which is our starting point for building back better. It reminds us of the many reasons why we must invest in One-health in order to achieve sustainable development, presents a new way of thinking about health and its determinants and consequences of the lack of it. It sheds light on a number of things that need to change, from our societies' views on health and social care, to whether financial systems take environmental and health risks adequately into account, and how global governance responds to the increasingly key role of public goods. In a nutshell, the evidence base presented constructs building blocks that the Commission has used in reaching its conclusions and shaping the strategy that it recommends in its final report

The Commission's chair is grateful to those who have contributed to this review through outstanding collective effort and to the members of the Scientific Advisory Board, who have advised the work of the Commission, drawing on their wide experience from across the pan-European region.

Foreword

Dr Hans Henri P Kluge

Regional Director
WHO Regional Office for Europe

When I decided to convene the Pan-European Commission on Health and Sustainable Development in September 2020, my aim was to elevate health and social care to the top of the political agenda. The aim was to take stock of the lessons learned from the COVID-19 pandemic and to elicit actions by policymakers to protect us from future health threats and to make progress in health and sustainable development across the pan-European region. This evidence review complements the work of the Pan-European Commission by capturing the information necessary to ensure that the recommendations proposed by the Commission are backed by evidence and actionable.

Its importance is thus twofold. Firstly, it constitutes the scientific backbone to the Commission's final recommendations, signposting the importance of evidence-informed policy and design. Secondly, it reminds us all about the central role that science and scientific evidence plays in identifying the root-cause of societal issues and sustainable and adaptable policy solutions.

The COVID-19 pandemic has reasserted the central role of science, scientific knowledge and research in protecting humankind from health threats. The evidence review extensively reflects on the legacy of the COVID-19, highlighting the issues the pandemic has unleashed, which is our starting point for building back better.

I am very delighted with the outcome of this work and confident that it would be a foundation for fruitful discussions in both the scientific and policy space for health and sustainable development. Moving forward, the WHO Regional Office for Europe is committed to working with this excellent resource to further improve and tailor support to countries in their journey to achieve the health-related Sustainable Development Goals through the European Programme of Work 2021–2025 United Action for Better Health.

I remain most grateful for the extensive work by the Commission's Scientific Advisory Board, its chair and co-chairs, Professor Martin McKee, Dr Natasha Azzopardi Muscat and Dr Josep Figueras, the Commission's Scientific Coordinator, Professor Elias Mossialos, and the Adviser to the Commission Chair, Professor Aleksandra Torbica, and all contributors.

Foreword

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The impact of the COVID-19 pandemic in our societies cannot be overstated. Its effects on the health of our populations, on the economy and on the overall societal well-being are staggering. The, almost existentialist, question in front of us now is whether we are going to truly learn from the pandemic, or more to the point, whether our policy-makers are ready to translate the lessons into practice. There is a political window of opportunity to implement the range and depth of reforms needed in our health, social and economic systems. Are we going to take advantage of it? Are we going to be able to harness the range of health and social innovations; the commitment of our heroic health workforce or the support of the civil society that emerged during the pandemic, and build better systems? Are governments willing to pool some sovereign decision-making and allow stronger international governance mechanisms to tackle future pandemics and to manage health public goods better?

This collection of evidence mines the experience of the pandemic in the hope that, in the words of the much-quoted maxim we do not "let a good crisis go to waste". It reviews the insights gleaned from our mistakes and draws valuable lessons so that we can take action rather than waiting passively for the next crisis. More than that it reflects on the fact that many of the observed failures in responding to the pandemic were no surprise. COVID-19 brought to the forefront a series of existing structural problems in our health systems and our societies many of which were already well known from prior (economic and refugee) crises. The evidence gathered here guides decision-makers through the issues and implications so that COVID-19 can be understood not as just another external shock to our systems, albeit a very powerful one – but as a reminder that if we failed to address the fundamental challenges it is just a matter of time before the next crisis overtakes us.

This volume offers an original framework that links human, animal and environmental health to understand health determinants; examines the One Health concept; and puts forward strategies to implement it at all levels. It makes a powerful case for sustainable investment in health and health systems, the health workforce, and social care; and maps how improved systems for learning and adaptation, more transparent public–private partnerships and stronger incentives for innovation can support change. It also looks well beyond health system boundaries and considers the importance of the social sector, exploring a range of multisectoral policies to support the most vulnerable populations. The evidence gathered here and the thorough and authoritative analysis capture how our systems responded to the pandemic in the health, social, political and economic domains. It has underpinned the Commission's work and some of its central recommendations. The lessons it captures apply to future pandemic responses and broad health system shocks. They also pave the way for a more lasting recovery so that the legacy of the pandemic spurs us to tackle the deep-seated problems of our health systems and our societies.

We are very grateful to the intellectual leadership of Professor McKee who has been the driving force of this analysis which was delivered in a record time; and to the authors, many of them from our WHO and Observatory Secretariats, who contributed to the various chapters. We are also indebted to the members of the Scientific Advisory Board for their guidance and reviews of the draft chapters.

We hope this evidence review will enable policy-makers, professionals and civil society as they seek to ensure stronger and more equitable systems and societies. The WHO Regional Office with its health policy guidance, knowledge and country support, together with the Observatory partnership with its evidence and knowledge brokering, stand ready to work with them as they pursue this endeavour.

Acknowledgements

I am grateful to Mario Monti for entrusting me with the responsibility for preparing this evidence review and his leadership of the Commission. I am also grateful to Hans Kluge for his constant support and wisdom but also his respect for the independence of the work of the Commission.

I have benefited from many fascinating discussions with my fellow Commissioners in our different working groups, all of which I was able to participate in. However, I must make special mention of Louise Fresco, Jim O'Neill, Sylvie Goulard and Suma Chakrabarti, who made especially valuable contributions, supported by members of their teams, Bieneke (Gebbiena) Bron, Erlan Le Calvar and Tom Hart.

I was helped with individual chapters by a number of co-authors, each named in the respective chapters. Additional material was provided by Oliver Razum, Trish Greenhalgh, Yudit Namer and Dame Sally Davies. I also benefited from many conversations with Dina Balabanova, David Stuckler and Gauden Galea. My understanding of many issues related to the pandemic has been helped greatly by insights from my colleagues on Independent SAGE in our Thursday evening discussions, as well as a wider network of colleagues, too many to name, who have worked tirelessly to advocate for evidence-based responses to the pandemic.

Additional support was provided by Gabriele Pastorino and Naomi Nathan at WHO and Selina Rajan, May van Schalkwyk and Victoria Kirkby at LSHTM, all of whom reported on Working Group meetings and contributed valuable insights and material. I have learned much from them.

Aleksandra Torbica, Natasha Azzopardi Muscat and Josep Figueras provided support throughout the process and commented on a near-final version of the entire manuscript, which was also reviewed by the members of the Scientific Advisory Board, each taking lead responsibility for one or more chapters. Clare Wenham also read the chapters she was not directly involved in. Any remaining errors are, of course, my responsibility.

Jonathan North and Lucie Jackson demonstrated, once again, their responsiveness and efficiency in taking a manuscript through the publication process, while Andrea Kay was a pleasure to work with as copy editor. The graphic designer Gavin Roberts, who prepared numerous revisions of the figures, and the typographer, Nick Gorman, who typeset the text, were both remarkably responsive and professional.

Finally, I am grateful to my wife, Dorothy, and daughters, Rebecca and Charlotte, for their tolerance as much of the work of producing this book had to take place in evenings and weekends, fitted around a very busy day job.

Martin McKee

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List of figures, tables and boxes

Figures

Tables

Boxes

List of abbreviations

ACT-A	Access to COVID-29 Tools Accelerator
AMR	Antimicrobial resistance
ASEAN	Association of Southeast Asian Nations
BARDA	Biomedical Advanced Research and Development Authority
BMGF	Bill & Melinda Gates Foundation
BSE	Bovine spongiform encephalitis
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COVID-19	Coronavirus disease 2019
CSR	Corporate social responsibility
DFI	Development Finance Institution
ECDC	European Centre for Disease Prevention and Control
EIB	European Investment Bank
EOC-NET	Public Health Emergency Operations Centre Network
ESG	Environmental, social and governance
ESRI	Economic and Social Research Institute
EU	European Union
EU-SILC	EU Survey of Income and Living Conditions
FAO	Food and Agriculture Organization
FSB	Financial Stability Board
GDP	Gross domestic product
GDPR	General Data Protection Regulation
GHSA	Global Health Security Agenda
GOARN	Global Outbreak Alert and Response Network
GPMB	Global Preparedness Monitoring Board
HERA	Health Emergency Preparedness and Response Authority
ICESCR	International Covenant on Economic, Social and Cultural Rights
ICU	Intensive care unit
IFC	International Finance Corporation
IF-HT	Integrative framework for assessing health threats
IFRC	International Federation of Red Cross and Red Crescent Societies
IHR	International Health Regulations
IMF	International Monetary Fund
IP	Intellectual property
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IPPPR	Independent Panel for Pandemic Preparedness and Response
JEE	Joint External Evaluation
JIREP	Joint Initiative on Research in Epidemic Preparedness and Response
LSHTM	London School of Hygiene & Tropical Medicine
MDB	Multilateral development bank
MERS	Middle East respiratory syndrome

NGO	Nongovernmental organization
NUTS	Nomenclature of Territorial Units for Statistics
ODA	Official development assistance
OECD	Organisation for Economic Co-operation and Development
OIE	World Organisation for Animal Health
PHEIC	Public Health Emergency of International Concern
PIP	Pandemic Influenza Preparedness
PMI	Purchasing Manager Index
PMIE	Potentially morally injurious event
PODD	Participatory One Health Disease Detection
PPE	Personal protective equipment
PREZODE	Preventing Zoonotic Disease Emergence
PRI	Principles for Responsible Investment
PTSD	Post-traumatic stress disorder
R&D	Research and development
SADC	Southern African Development Community
SAEPP	Smart Ambulance European Procurers Platform
SARS	Severe acute respiratory syndrome
SDG	Sustainable Development Goal
SHA	System of Health Accounts
SHARE	Survey of Health Ageing, and Retirement in Europe
STEM	Science, technology, engineering and mathematics
TRIPS	Trade-Related Aspects of Intellectual Property Rights
TTC	The Trinity Challenge
UHC	Universal health care
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Emergency Fund
UNSC	United Nations Security Council
WHO	World Health Organization
WMO	World Meteorological Organization

Chapter 1

What went wrong in the COVID-19 pandemic, and what can we learn from it?

Martin McKee

A pandemic on the scale of COVID-19 (coronavirus disease 2019) was not only predictable. It was predicted (Garrett, 1994; Preston, 1995; Quammen, 2012; Struyf et al., 2020). Historians had long warned of the threat posed by infectious disease. They had many examples to draw on. In Europe, they included the Plagues of Athens and Justinian and the Black Death (McNeill, 1977). In the post-Columbian Americas, the European conquest owed as much to the spread of infections to susceptible indigenous populations as it did to superior military technology. One lesson from these examples is that infectious diseases can spread rapidly, inflicting enormous harm on the societies they spread through. The 1918 influenza pandemic killed between 20 and 50 million people worldwide, more than had died in the First World War. Another lesson, perhaps less obvious, is that pandemics have often had profound consequences for the affected societies (Box 1).

There is no reason to believe that COVID-19 will be any different. Our lives have been changed by the pandemic. We have discovered new ways of doing things and asked whether the things we did before were necessary, appropriate or fair. The post-pandemic world will inevitably be different. The challenge is to ensure that the changes that will inevitably take place in its aftermath create a world that is safer and more secure from a health perspective. As history tells us, that is not inevitable.

Box 1 *Plagues and politics*

The Plague of Athens (430 BCE) arose in the midst of a war against Sparta, during which large numbers of people from the surrounding countryside sought safety within the city walls. The overcrowding and poor hygiene created the ideal conditions for the spread of an infection that killed an estimated 25% of the population. Thucydides, who became infected but survived, described how "the catastrophe was so overwhelming that men, not knowing what would happen next to them, became indifferent to every rule of religion or law". Athenian democracy would never fully recover; Athens lost the war against Sparta and its weakened state paved the way for the rise of Macedonia, from whence Alexander the Great invaded India and central Asia, leaving a legacy that extends to this day.

The Plague of Justinian (541–549 AD), which spread throughout the Mediterranean basin and Near East, is reported by contemporary sources to have reached to Constantinople via rats on ships from Egypt. It was particularly devastating for agricultural communities, leading to shortages of grain, at a time when the Emperor Justinian was struggling with the costs of wars, against the Vandals and Ostrogoths, and large-scale constructions, such as the church of Hagia Sophia. As in Athens, this led to military reverses, allowing the Lombards to conquer the remaining Byzantine army in Italy, ensuring the lasting division of the Roman Empire.

The Black Death (1347–1351 AD) spread from the Crimea on ships travelling to Italy and, from there, throughout western Europe and north Africa. It killed an estimated one third of the population. The resulting labour shortages challenged the existing feudal societies. Peasants in several countries revolted and agricultural wages increased. Faith in the established church diminished, contributing to the Reformation, again with consequences that persist until today.

The 1918 influenza pandemic, which killed an estimated 20–50 million people worldwide, cast a shadow over the first half of the 20th century. Like any crisis, there were winners and losers. Research in the United States suggests that it led to a sustained increase in growth but inequalities widened (Brainerd & Siegler, 2003). The 1920s were characterized by both the hedonism and conspicuous consumption, as portrayed in The Great Gatsby, and poverty coupled with industrial unrest. Although the consequences are difficult to disentangle from those of the First World War, and counterfactuals in history are always problematic, it has been argued that the pandemic and its consequences contributed to events that influenced the course of the 1920s and 1930s (Barry, 2020).

To understand what went wrong in the pandemic and what we can learn from it, we first need to go back to basics. COVID is a zoonotic infection, caused by a virus that jumped the species barrier, almost certainly from bats to humans. It was not the first virus to do so. Several diseases, such as measles for example, are believed to have spread to humans in the earliest days of agriculture in the Neolithic period (Brüssow, 2009). In the 1980s, the global health community encountered the first cases of HIV outside Africa. In this case, the virus is believed to have spread from primates to humans in the early 20th century (Sharp & Hahn, 2011) with profound consequences for society and, especially, for health care worldwide.

Many more zoonotic infections would emerge in the late 20th century, such as Lassa fever, Marburg disease and Ebola. In 1992, the United States Institute of Medicine published a report entitled *Emerging infections: Microbial threats to health in the United States* (Oaks Jr et al., 1992). It highlighted several reasons for concern. These included evolution of microorganisms, allowing them to infect new hosts and to evade existing antimicrobials; increased geographical spread, facilitated by the intensity of modern travel; changes in human activity, including personal behaviour and food production; and changes in the environment, including deforestation and intensive agriculture that change the relationship between humans and animals. Soon afterwards, these concerns were brought to a wider audience in a series of popular books (Brüssow, 2009). In the following three decades there have been further warnings of the risks from infectious disease spreading globally, including severe acute respiratory syndrome (SARS) in 2003 and influenza H1N1 in 2009, with other regional outbreaks, such as Zika in the Americas in 2016.

As researchers and commentators began to highlight the importance of developments at the interface of human, animal and environmental health, they developed the term "One Health" (see Chapter 5). As we have seen, this interface is where many of the seismic threats to health have emerged from. Yet in marked contrast to its importance in creating disease with such enormous potential for harm, this interface remains relatively neglected with respect to both research and policy. Researchers still tend to operate in silos, with those specializing in human, animal and environmental health traditionally working in isolation from each other. They have also tended to work within their own disciplines, even though the knowledge needed to understand One Health, and the interventions necessary to tackle the problems that arise there, often demand multidisciplinary approaches. As to policy, both within governments and at the international level, the structures responsible for the different elements are usually separate. While the World Health Organization (WHO) focuses on the health of humans, the Food and Agriculture Organization (FAO) concentrates on crops and domesticated livestock, and the responsibilities of the World Organisation for Animal Health (OIE) and the United Nations Environment Programme (UNEP) are clear from their names (although noting that these institutions have a joint programme for antimicrobial resistance (AMR), which falls within the One Health mandate).

Despite these many warnings, the international community was largely unprepared for the emergence of the SARS-CoV-2 virus when it was first detected in Wuhan, China, in late 2019. By the time the initial cases in Wuhan were recognized, the virus had spread far beyond China. Within weeks it had reached Europe and, soon after, almost all parts of the world. The response was mixed. There were some spectacular successes. Its genetic code was analysed rapidly by Chinese scientists, paving the way for diagnostic tests. However, this speed was not matched by our understanding of its transmission. At first, many assumed that it would behave like influenza, generally understood to be transmitted by droplets and contact with infected surfaces, posing a risk only to those who were close by. It was only later that it became clear that it could be transmitted by individuals who were asymptomatic via the airborne route, conveyed in aerosols generated by individuals who were speaking or singing (Greenhalgh et al., 2021). This created a risk of superspreading events in any situation where people gathered in large numbers indoors. However, the delay in understanding the importance of this route of transmission meant that, at least in the early months, the focus of preventive efforts was misplaced, underplaying the importance of indoor settings in transmission and the role of face coverings.

Similarly, there was uncertainty about the appropriate response. Some countries, especially in the Asia-Pacific Region that had recent experience of SARS, moved rapidly to suppress transmission, closing borders and imposing strict lockdowns (Han et al., 2020). Others, often drawing mistakenly on plans for pandemic influenza, viewed global spread as inevitable and sought to mitigate the impact of the disease, seeking to protect

those considered especially vulnerable and to avoid health systems becoming overwhelmed. In many of these countries effective responses were delayed. There were several likely reasons. One was concern about the economic consequences of restrictions, especially when politicians were being asked to consider measures on a scale that were far beyond anything that they had contemplated previously. The idea that a government would order its citizens to stay at home other than for essential purposes seemed incomprehensible. Equally unimaginable was the scale of the pandemic that would ultimately unfold. High-income countries in particular had become complacent in their risk assessment of infectious disease pathogens, having not suffered a major epidemic for many decades. Even those governments that did conduct pandemic planning exercises did not always follow-up on the lessons that emerged (Scally et al., 2020).

COVID-19 has caused the premature death of several million people worldwide. One study in the United Kingdom found that each death led to loss of about 10 years of life on average (Hanlon et al., 2021), although the figure may be different elsewhere depending on which age groups were most severely affected. It has also left large numbers with the sequelae of COVID-19, including what has been termed Long COVID, a combination of conditions affecting many different body systems that is often disabling but which was not anticipated (Rajan et al., 2021). The wider effects include the many children who have been orphaned and those who have missed out on education at a vital period in their development, the loss of family businesses, and the cost to societies in terms of lost economic activity, particularly among women, health care and support for individuals, families and businesses. A few historians had reminded us of the consequences of the 1918 influenza pandemic but that was in a different era, before the achievements of modern health care (Krishnan et al., 2020).

Something else was not widely anticipated, by policy-makers although again there were clear warnings from academics who have studied the broader determinants of health (Bambra et al., 2020; Douglas et al., 2020). The virus, and the responses to it, have fallen unequally within societies. The Second Report of the Independent Panel for Pandemic Preparedness and Response (IPPPR) noted how inequalities, both within and between nations, have worsened with vulnerable and marginalized people being left without access to health care, both to treat COVID-19 and other conditions (Independent Panel for Pandemic Preparedness and Response, 2021). COVID-19 has shone a light on existing inequalities as those already disadvantaged were more susceptible to infection, to severe disease and to death (see Chapter 6). They were least able to reduce their risks, often living in crowded homes and employed in public-facing jobs. They were impacted most by policy responses, dependent on jobs in the informal economy.

Over a year after the beginning of the pandemic, we now understand much better the many mistakes that were made. We can say with confidence that these were often avoidable. We know this because some countries, as diverse politically and geographically as New Zealand and Viet Nam, avoided them in the first year of the pandemic, although many have since struggled with the much more transmissible Delta variant.

Fortunately, there is now a light at the end of the tunnel. The development of a portfolio of innovative vaccines, coupled with improved understanding of the transmission of this virus, offers hope. Yet the pandemic is far from over and there are ever-present risks of new variants of the virus. This is apparent from how the Alpha variant spread rapidly across Europe from its origins in England in early 2020 and the even more transmissible Delta variant, which has now replaced it in many parts of the world. Particularly worrying is the potential for vaccine escape, as seen partially with the Beta and Gamma variants first isolated in South Africa and Brazil, respectively, that can partially evade vaccine-induced immunity. This will remain a threat as long as the virus is circulating anywhere in the world, something that will continue for far too long given the challenges of getting vaccines to large parts of the world, an issue discussed further in Chapters 9 and 10.

Just as concerning, there is a continuing risk of other novel threats to health or increases in existing ones. These include communicable diseases, with the resurgence of traditional infectious diseases, such as tuberculosis, as well as new ones, and in particular antibiotic-resistant bacteria; and noncommunicable diseases, encouraged by marketing of harmful substances. They also include the conditions that give rise to these threats, such as global warming, environmental degradation and loss of biodiversity. And they include societal changes that leave communities vulnerable to these threats, including growing numbers of people leading precarious existences in situations where traditional social safety nets have been eroded (see Chapter 6). If we are to create societies that are healthy, safe and secure,

and which minimize the risks of another pandemic or other catastrophic threats to health, then we must find ways to address all of these threats.

In the next section we ask what we can learn from the experience of the pandemic and what we can do to prevent making the same mistakes again.

Lessons learned

An effective response to a virus that crosses borders with ease demands a coordinated international response. Yet an international response is only as good as the national responses that contribute to it. In seeking lessons to be learned, we begin with what happened within national borders before looking at the international response, and how these two interrelate. Our analysis below draws heavily on the work of the IPPPR, submitted to the WHO executive board in January 2021 (Independent Panel for Pandemic Preparedness and Response, 2021) (Table 1), on descriptions by those who were involved in the response, either from their own accounts or as described to journalists (Calvert & Arbuthnot, 2021; Farrar & Ahuja, 2021), and on analyses by health policy researchers (Bosa et al., 2021; Luyten & Schokkaert, 2021; Or et al., 2021; Wallenburg et al., 2021).

When the pandemic came, many countries were inadequately prepared (McKee et al., 2020). In some cases, the risk of a pandemic was low on their lists of priorities or there may have been a sense of complacency. Previous assessments, such as those used to generate the Global Health Security Index, gave false reassurance, with some countries scoring highly on the index faring poorly in the response (Baum et al., 2021).

Some political leaders had diverted their attention to other things. Many had the wrong plan, using one designed for pandemic influenza, while in other parts of the world it was one based on the experience of SARS. Health, social care and other essential workers were insufficient in number, were working in fragmented organizations or were inadequately equipped, the consequence of long-term underinvestment in health and social care, and lacking in equipment, such as emergency supplies of personal protective equipment (PPE) or ventilators. As soon became apparent, mobilizing essential staff and procuring necessary supplies is difficult in a crisis. In many cases, social support systems were far from sound. Too many people were living in precarity, working in the informal economy or living in overcrowded homes (McKee et al., 2017). For these people, employment was likely to be in a public-facing role that exposed them to greater risk of infection. If they showed signs of becoming infected, they had to choose between getting tested and isolating and putting food on the table for their families. Even when some countries did recognize these challenges and implement measures to address them, they were often delayed or inadequate.

Table 1 *Key messages from the Independent Panel for Pandemic Preparedness and Response*

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

Source: Independent Panel for Pandemic Preparedness and Response (2021).

There are, however, exceptions, that show how this situation was not inevitable. Countries that managed to suppress the spread of virus both reduced death rates and protected, in relative terms, their economies (Oliu-Barton et al.). These countries vary in many ways. Some, such as New Zealand are islands but others, such as Viet Nam and Rwanda, are not. Some are wealthy and some are poor. But, collectively, they do offer certain lessons for the world, each of which we now consider in more detail.

Lesson 1: Decisive leadership is essential

One thing about the response to the pandemic is already clear. Countries that took decisive action early were able to reduce the spread of infection and thus the burden of severe disease and premature death. This is as expected with an infection that spreads exponentially, such as SARS-CoV-2. Others delayed and, when they did act, it was inadequate to the challenge they faced.

There were many reasons for delay, not all of which were due to failures of political leaders, some of whom may only recently have assumed office. First, governments needed to be able to detect potential cases and confirm the diagnosis. This required access to tests in sufficient quantities. Second, it was important to have a plan that had been rehearsed, in which a range of policy responses were set out, where those responsible knew what they were meant to do, resources were available, and the plan had been tested in simulation exercises or in previous epidemics. However, it was also important that any lessons learned were actually implemented, which was not always the case (Scally et al., 2020). We discuss this further in the next lesson. Third, it was necessary to have access to appropriate scientific advice, recognizing that this is inevitably a challenge for some countries, especially where highly specialized knowledge is required. Fourth, it was necessary to have a well-functioning decision-making mechanism, which identified and assembled all the key actors, and which could react in a timely manner. This is more complicated in some countries, such as those with a highly decentralized system of government, than in others. However, while many countries faced these challenges, to a greater or lesser degree, some could overcome them while others did not. Notwithstanding these many challenges, some political leaders were able to respond effectively. They tended to be those who were focused on the emerging threat, putting other issues to the side, were engaged with the science, and prioritized the threat to health.

Problems with leadership were similarly apparent at the international level. The IPPPR recalls how previous pandemics have prompted many evaluations and reports, with numerous recommendations for strengthening preparedness and response (Independent Panel for Pandemic Preparedness and Response, 2021). Yet few were acted upon. The IPPPR describes a wholesale failure to take seriously the existential risk to humanity and its place in the future of the planet posed by pandemic threat. The collective reaction of the world so far is portrayed as wishful thinking, rather than a far-sighted assessment and action. It argues that another failure by the international community would be unconscionable. Yet, as the pandemic has revealed all too clearly, there are still major weaknesses in the structures for international governance, something we will return to in Chapter 11.

As the lead international agency for health, WHO has the constitutional mandate for leadership during health crises. Yet, as the IPPPR notes, its power to confirm and respond to disease outbreaks remains "gravely limited" (Independent Panel for Pandemic Preparedness and Response, 2021). WHO depends on the active engagement of its Member States, yet the incentives for cooperation are inadequate to ensure the effective engagement of Member States with the international system in a timely, transparent and accountable manner. It is clear that the lessons of the 2014 and 2019 Ebola outbreaks have not been learned. Sharing of information about disease outbreaks is not straightforward. It requires attention to both the lack of incentives to do so, as a country reporting an outbreak gets little reward in the form of funds or health resources for doing so, and the disincentives, such as the adverse impact on trade and tourism and distrust arising from the legacy of colonialism, exacerbated by previous experiences when shared virus samples were used to generate intellectual property (IP) held by Western companies (Smallman, 2013) and when microorganisms were named after the locations from where they emerged (Saliba et al., 2016). It also requires attention to the lack of incentives to share information, with existing mechanisms for providing support, such as the World Bank's Pandemic Emergency Financing Facility, seen to have failed to deliver (Brim & Wenham, 2019), and other collective measures having fallen far short of delivering what is needed (Wouters et al., 2021).

However, the experience of the pandemic highlights wider issues of global leadership. COVID-19 emerged at the interface between human, animal and environmental health, or One Health (Chapter 5). Clearly, an optimal response should bring these elements together at a global level. Yet the existing global architecture is fragmented, with responsibilities divided among the United Nations' FAO, UNEP, WHO and the OIE, with others, such as the European Union (EU), playing a role at regional levels.

Lesson 2: We need a plan

The threat of a pandemic has long been high on many governments' lists of serious risks. Many had implemented detailed plans as to how they should react and some even rehearsed them in simulated exercises. However, others had not. Even those that had developed plans and rehearsed them had not always taken the actions needed to ensure that they worked. Yet there was another problem. Many of the plans had

been developed in response to a threat from pandemic influenza, not unreasonably given the ever-present threat that it poses, and especially after the experience with swine flu in 2009. However, SARS-CoV-2 was different. It was substantially more lethal, with estimates suggesting an approximately tenfold higher infection fatality rate than seasonal influenza (Pastor-Barriuso et al., 2020). It was also being transmitted by infected individuals several days before they developed symptoms, so that conventional guidance that people should self-isolate if they had certain symptoms was insufficient. However, the greatest problem related to the mode of transmission. Precautions against influenza are based on its spread through droplets and contaminated surfaces. It took a long time before it was widely accepted that SARS-CoV-2 was being spread by aerosols. Therefore, the increased risks of indoor spaces, that could give rise to superspreading events, and the importance of face coverings, were only belatedly recognized. Some of the responses that were adopted at haste, such as the closure of schools and shops for prolonged periods, were unprecedented so there was very little evidence to inform measures to mitigate their worst effects. Finally, a comprehensive response required effective communication of complex and, often unwelcome, messages. Although concepts such as the reproduction number (R0) soon became a topic of discussion in the popular media, other concepts, such as exponential growth, were much more difficult to communicate. This problem was exacerbated by disinformation being spread by individuals with a diverse range of motivations, accompanied by some misleading messaging from researchers at eminent academic institutions. Communicating information in this environment has required a skill set that many scientists and politicians lack and which is especially challenging when the evidence is uncertain or changing.

Given these challenges, it is understandable that individual governments and the international community struggled to develop coherent plans. This was made more difficult by the existence of a range of cognitive biases, such as groupthink, whereby those asked to advise brought their own framing to the table, in this case applying principles used to tackle other infectious diseases, and especially influenza, to a different situation. This applied both to plans developed by individual governments and some public health agencies, which continued to minimize the risks of aerosol transmission in the face of evidence to the contrary (Greenhalgh et al., 2021; Tang et al., 2021).

Assuming that the plan is the correct one and is comprehensive, including provision for the necessary resources and a process for communicating it, it is only effective if it is implemented. The IPPPR observed that a pandemic response requires whole of government and whole of society responses and noted that high-level coordination has been a key determinant of the success of national responses. This points to the importance of mechanisms within governments and, as noted above, at the global level, to bring together all of those actors that are necessary for an effective response. In particular, this requires the closest possible cooperation between finance ministries and corresponding regional and global organizations and their equivalents in health, agriculture and the environment, among others.

Lesson 3: An early warning system linked to effective governance mechanism is essential

No plan will work if it is not triggered by information that a threat has arisen. Yet a surveillance system is only as strong as its weakest link. Although a test for SARS-CoV-2 had been developed within days of the virus's genome being decoded, many countries struggled to scale-up capacity. In some cases, this reflected a lack of existing laboratory capacity. In others, it was a failure to make full use of the capacity that already existed, for example, in university and veterinary laboratories. The challenge was further complicated by the complex logistics involved in testing on a large-scale, including transport of samples and supplies of laboratory reagents and equipment. A second issue was the difficulty that many countries experienced in scaling-up their contact tracing. In some, it was decided that this was no longer feasible because of the magnitude of the task. As with laboratories, there were two reasons why systems failed. One was a lack of investment in a workforce that could undertake contact tracing, in some cases, reflecting caps to public health services following the global financial crisis. Another was a failure to use the existing workforce, in tuberculosis and sexual health clinics, for example. In one or both cases, some countries resorted to outsourcing these activities, creating new stand-alone laboratories or engaging with companies more used to providing telephone helplines. There are two types of contact tracing, forward and backwards. Forward contact tracing involves identifying those infected, in this case, by virtue of a positive test result, and asking them and their household contacts to isolate to avoid further infections. Backward contact tracing involves searching

for the source of an outbreak, such as a restaurant or religious service, and contacting those present. This has the advantage of reaching more potentially infected people, but is considerably more labour-intensive and cannot be done using the outsourced model. The result, in many countries, was a failure to implement rapid and effective surveillance systems, allowing the pandemic to spread out of control.

Well-functioning arrangements for data sharing, as part of a public health surveillance system, are essential (Box 2).

The existing global surveillance architecture, centres on WHO, which can deploy a number of instruments and resources (Kuznetsova, 2020). These include the International Health Regulations (IHR); the Global Outbreak Alert and Response Network (GOARN), a partnership between WHO and over 200 public health institutions established in 2000; the Public Health Emergency Operations Centre Network (EOC-NET); the Contingency Fund for Emergencies; and the Pandemic Influenza Preparedness (PIP) Framework. Collectively, these have had many successes. For example, the GOARN was able to deploy experts to the field during the Ebola outbreak. However, they have also been criticized, most recently by the IPPPR, which stated starkly that the global pandemic alert system is not fit for purpose. As its report notes, critical elements of the system are slow, cumbersome and indecisive. Although it is based primarily on reports by Member States, an increasing number of alerts concerning outbreaks come to WHO via the news or social media. The Panel contends that procedures and protocols in use seem to come from an earlier analogue era and have failed to adapt to the digital age. However, its criticism goes beyond the procedural and technical, and it is for a "political step change in the willingness of countries to hold themselves accountable for taking all necessary actions". These criticisms may be considered surprising given that the system was overhauled in 2005 when the third revision of the IHR was agreed, and WHO was permitted to take reports from non-state sources.

Originating in a series of international sanitary conferences in the 19th century, the first version of the IHR were agreed in 1969 and revised in 1995 to address a number of limitations, including the overly restrictive list of notifiable diseases, the dependence on official notification by governments, and the lack of a formal international coordination mechanism (see Chapter 3). The third revision, undertaken in 2005, in the light of the experience with SARS, expanded the scope of the regulations considerably, including an all-risk approach to pathogens and a provision for the WHO Director-General to declare a Public Health Emergency of International Concern (PHEIC) (Table 2).

It soon became clear that, while a considerable advance on the previous situation, the experience with the 2014 Ebola outbreak in West Africa demonstrated that the 2005 IHR had important limitations. In particular, although the IHR require countries to ensure that their disease surveillance and response capacities are adequate to meet their obligations, fewer than half are fully compliant with the IHR. Monitoring remains very

Box 2 *Seven principles for international public health surveillance*

1. **Building trust:** Trust is essential for successful surveillance. It provides reassurance that the data will be stored safely, will be accurate and will not be used for purposes other than those it was intended for. Trust is difficult to build and easy to lose.
2. **Articulating the value:** Those responsible for surveillance must explain the rationale for collecting data, what it will be used for, and how it will benefit everyone. Conversely, those who withhold data that could benefit others should be required to justify it.
3. **Planning for data sharing:** Public health surveillance data should be collected with potential sharing in mind. This requires considerable work to agree standards for data collection, processing, and transfer, including safeguards throughout its journey.
4. **Achieving quality data:** Surveillance systems should be evaluated for relevance, accuracy, timeliness, accessibility, interpretability and coherence.
5. **Understanding the legal context:** Data collection and sharing must be undertaken within the prevailing legal framework.
6. **Creating data sharing agreements:** In some cases, as with the EU's General Data Protection Regulations (GDPR), there are existing provisions for cross-border data sharing. In others, alternative arrangements should be agreed in advance.
7. **Monitoring and evaluation:** Surveillance arrangements must constantly be evaluated to ensure that they remain fit for purpose in a changing world.

Source: Edelstein et al. (2018).

Table 2 *Declarations of a Public Health Emergency of International Concern*

Year	Disease	Geography
2009	Swine flu (H1N1)	North America
2014	Polio resurgence	Afghanistan, Pakistan and Nigeria
2014	Ebola	Western Africa
2016	Zika	The Americas
2019	Ebola	Democratic Republic of the Congo
2020	COVID-19	Global

weak. Countries self-report on the eSPAR system but WHO has no mandate to verify submissions. Following experience with Ebola, the Joint External Evaluation (JEE) scheme, based on peer review with countries assessing each other, was introduced, but this remains voluntary although most countries have bought into it. However, these arrangements have obvious weaknesses that should be put right in the future. A further limitation was that some countries were delaying or withholding reports on suspected outbreaks, while there was limited operational or financial support for those that did report in a timely manner. This latter point led to the creation of the World Bank's heavily criticized Pandemic Emergency Financing Facility.

In response to concerns expressed in 2017 in the United Nations (UN) Secretary-General's Global Health Crises Task Force, an independent Global Preparedness Monitoring Board (GPMB) was established the following year by WHO and the World Bank. The aim of the GPMB is to independently appraise global preparedness and response capacity for disease outbreaks, aiming to highlight critical gaps in preparedness, identify potential mechanisms for addressing such gaps and to mobilize its influence with leaders and policy-makers to increase preparedness activities and ownership at the global, national and community levels. It is led by Dr Gro Harlem Brundtland, former Prime Minister of Norway and former WHO Director-General, and Elhadj As Sy, Chair of the Kofi Annan Foundation Board and former Secretary-General of the International Federation of Red Cross and Red Crescent Societies (IFRC). It reports annually monitoring emergency preparedness across national governments, UN agencies, civil society and the private sector and assessing whether financing is adequate, and monitoring progress on research and development (R&D) and the strength of health crisis-preparedness at the global, regional and national levels. It released annual reports in September 2019 and 2020. However, it does not provide the detailed needs-based assessments that could inform governments of what they should do and how.

Given these concerns, the pandemic has provided an opportunity to revisit the global health surveillance architecture. However, it is already clear that an effective system must include mechanisms for:

- global monitoring and forecasting of novel infectious disease risks;
- global surveillance of infectious disease outbreaks and global preparedness and response; and
- assessment of country-level surveillance, preparedness and response capacities.

The first must be able to monitor and understand long-term risks from infectious diseases, particularly to understand the drivers and risks of the emergence of novel infectious diseases. The second must deliver rapid, comprehensive global surveillance of preparedness and response (drawing on country-level assessments) and of infectious disease outbreaks. The third is responsible for assessing country-level surveillance systems and preparedness and response capacities.

Lesson 4: A trained, motivated and equipped workforce is essential

The pandemic made enormous demands on many sectors. Health systems in some countries came close to being overwhelmed, as did providers of residential social care. Staff struggled with very intensive workloads, some encumbered by PPE while others lacked adequate supplies, their ranks depleted by ill and, tragically, pre-maturely dying colleagues. For many, there was the ever-present risk of running out of beds, ventilators, drugs and even oxygen. Those countries that had become accustomed to running their health systems at maximum occupancy faced particular difficulties as there was no capacity to respond to the surge in demand. In these cases, the focus of the authorities was on how to protect the health system, diverting attention from other aspects of the pandemic response (see also Chapter 7 where we discuss the need for sustained investment in health systems in detail).

Many countries responded by bringing new people into the health and social care workforce. These included volunteers, health professionals diverted from the

non-urgent specialties, recent retirees, armed forces and others. Often, this required people to take on new roles; for example, when nurses from other areas were transferred into intensive care units (ICUs). A few countries built completely new facilities, containing large numbers of beds and corresponding equipment, but these failed to take account of the critical limiting factor: workforce shortages.

Many countries also faced severe shortages of equipment. In some cases, existing stockpiles had been run down. In others, they had never existed. Governments, individually and within the EU, collectively, engaged in massive procurement exercises. Some were successful, but many were not. There were numerous examples of profiteering and some of outright corruption. In some cases, personal connections to politicians were more important than an ability to deliver what was contracted. One of the clear lessons of the pandemic is the need to take measures to improve existing systems of public procurement.

For several decades, health systems in many countries have faced severe pressure to cut costs (see also Chapter 10). Often, they have done so by reducing capacity to a level where they are just about coping. However, as the pandemic has revealed, this may be a false economy. It is important that this is recognized by finance ministries and their equivalents at the regional and global level. These organizations have, in recent years, taken a much broader and longer-term approach to fiscal and economic policy, most notably by including environmental, social and governance measures (ESG) in their assessments of progress and policies. Indeed, central banks have played a leading role in developing the concept of Greening the Financial System. There has also been a growing recognition of the importance of differentiating spending for investment from that for maintenance and other current spending. Again, these are issues that we will return to later, noting that they have implications beyond the creation of a trained and equipped workforce, including a wide range of global public goods, but for now we simply flag them up as key issues that must be addressed moving forward.

Lesson 5: A strong society underpins a strong pandemic response

The pandemic has shone a light on the weaknesses in many societies (see also Chapter 6). It has impacted most on individuals and communities who are already disadvantaged in many ways. They include those who work in public-facing jobs, with no possibility of working from home, those in the informal economy who cannot afford to get tested or take time off if they suspect that they have been infected, and those living in multigenerational housing with little opportunity to isolate. If they do become infected, they are more likely to have coexisting conditions that place them at greater risk of severe illness or death. Their inability to isolate means that they pose a risk not only to their own communities, but to others who may come in contact with them. Thus, whether out of altruism or self interest, there is a compelling case for society to take measures that reduce their many risks.

The scale of the inequalities is only visible in those countries that systematically collect data on socio-economic status, ethnicity and other characteristics linked to health. In many countries, the communities at greatest risk are, in epidemiological terms, invisible. Where data are collected in a way that can reveal these inequalities, they often reveal multiple disadvantage. Ethnicity, education, gender, migration status and income all intersect. Added to this is the discrimination that some groups face, both from other individuals and from a system that is directly or indirectly discriminatory. Inevitably, some of these communities are suspicious of the states in which they live. Migrants who lack documentation may fear detention or deportation (Hargreaves et al., 2020). Others, like Roma in some countries, may have a well-founded fear of persecution.

These inequalities did not have to exist. They are often a product of government policies over many years, including failure to provide services, in health, education, employment and other sectors to overcome existing patterns of disadvantage. In some countries, governments have pursued policies that remove previous protections, moving people into the informal economy. Some have also weakened the social safety nets that provided protection in times of crisis, or the labour market programmes that helped those who had lost jobs to re-enter the workforce, in some cases with new skills, programmes that had proven their worth in the aftermath of the global financial crisis. As a consequence, there are growing numbers of people in some countries are leading precarious lives, uncertain as to whether they will have income, employment, housing or even food from one week to the next.

There were, however, many responses that sought to address these problems. Some governments intervened

on a massive scale to pay the wages of those who might otherwise be made redundant. They provided grants and loans to the small businesses that are the engines of economies and they prohibited evictions. These measures very likely contributed to the absence of increases in suicides during the pandemic, in contrast to the global financial crisis, when it was shown that investment in active labour market programmes and generous unemployment benefits, such as the furlough and small business loan schemes adopted during the pandemic, could minimize the consequences of job loss for mental health (Cylus et al., 2014; Stuckler et al., 2009). They also seem likely to have contributed to the emerging signs of a rapid economic recovery as vaccine programmes are rolled out.

These findings point to the importance of policies that are inclusive, ensuring that everyone benefits from growing prosperity and no one is left behind, with strengthened safety nets that ensure that those who are most vulnerable are protected. They also point to a need to engage with communities in co-producing solutions that take account of the challenges they face (Turk et al., 2021). However, they also emphasize the importance of data systems that capture not just average values within populations but also their distribution, with sufficient detail and disaggregation to identify those suffering multiple reinforcing disadvantages and inform policies that reflect their needs. These will be especially important as vaccine programmes roll out, as the need to achieve population immunity means that no one is fully protected until everyone is, a principle that applies as much within as among countries.

Summary

This analysis points to several issues that must be addressed going forwards. First, individual countries must ensure that they have governance arrangements that enable them to respond rapidly and appropriately to emerging threats to health. The nature of these arrangements will, inevitably, vary according to their constitutional arrangements, for example whether their administrative structures are centralized or decentralized. They must also ensure that they have the technical capacity to identify and characterize emerging threats, as laid out in the IHR. Some will require international support, either in the form of development assistance or, typically in smaller countries, sharing of expertise. In the former case, this points to a need for engagement by international and regional finance organizations as well as bilateral and multinational donors. Second, there is a need to look again at the global framework to identify ways in which it fails to address the incentives and disincentives for international cooperation to prevent the emergence of severe threats to health and to mitigate their effects. This points to a need for measures in several areas. One is a mechanism to better anticipate emerging threats, perhaps by drawing on examples such as the Intergovernmental Panel on Climate Change (IPCC). Another is a new legal framework that would revisit the rights and responsibilities of governments in relation to emerging health threats, based on an analysis of the weaknesses of the existing IHR, but also the political obstacles to change, including the incentives and disincentives that exist. A third, and related, measure would be a mechanism to support preparedness and, when a threat becomes apparent, to enable resource is to be channelled to those in most need. Here, there may be scope for learning from the response to the 2008 global financial crisis.

The remainder of this book

We will explore these issues in the rest of this book. In Chapter 2 we explore the legacy of the pandemic. Its consequences will be felt for decades. Millions of people have lost relatives, including large numbers of children who have been orphaned. Others have been left with life changing damage to their health, whether as the direct consequences of the infection and the hyperimmune response to it, or the condition that we now know as Long COVID. Many young people have also had their education interrupted, something that is also likely to have consequences for the rest of their lives. We have all changed the way we live, doing things in ways that we could never have imagined before. Many of the readers of this book will have spent hundreds of hours looking at others on conference calls. What does this mean for the future of work? The pandemic has also had political consequences, changing the relationship between the individual and the state. What will this mean for the future?

In Chapter 3 we will remind ourselves of the case for investing in health and sustainable. Arguably, we would not need to do this. The cost of failing to do so is now apparent to all. However, memories fade, and it will be important for those involved in health policy to be

able to articulate the arguments for health, as a human right, as a contributor to economic growth, as a means of achieving security, and as a manifestation of the solidarity that binds us together.

One lesson from the pandemic has been the need to move out of our disciplinary silos to take a holistic approach to health. In Chapter 4, we offer a new framework for understanding the many factors that influence our health. We begin with the interface between humans, animals, and the natural environment. We then look at the many things that can promote and protect health, from peace, shelter, and nutrition through to digital access, a healthy built environment, and access to justice. However, we also identify the need to act against those things that threaten health, including trade and harmful commodities, racism, non-state violence, crime, corruption, and disinformation. All of these act within a broader planetary system which is itself threatened, both by those things that we cannot control, such as cataclysmic cosmic events, and those things that are in our own hands if we are willing to tech responsibility for them, such as environmental degradation and climate change.

This book has been written to inform the deliberations of the Pan-European Commission. So, having set the scene in the first four chapters, it then looks at the themes that the Commissioners have chosen to focus on as they seek ways to achieve health and sustainable development going forward.

Chapter 5 takes us back to the origins of the current pandemic, and the conditions that allowed a virus to jump species into humans and spread worldwide. It examines the concept of One Health, describing why we cannot ignore it. This chapter looks at zoonotic infections, AMR, and threats to biodiversity before looking at the structures that are necessary to embed this concept in policy at a national and global level.

Chapter 6 recalls how the pandemic has shone a light on the fractures that have existed in our society is far too long. Both COVID and the responses to it have impacted most on those who are already disadvantaged. In many countries, a growing number of people are living lives that are precarious, uncertain whether they will have jobs, money, or even food from one week to the next. Women have been particularly hard-hit, carrying a double burden of work inside and outside the home. Many of those who have been worst affected, both now and in the past, have lost trust in democratic processes. This poses a danger to our society going forward.

Health systems have faced enormous pressure during the pandemic. Not all have coped. And even those that did have often struggled. Health workers have been the heroes throughout these events. Chapter 7 makes the case for sustained investment in strong, resilient, and inclusive health systems. It looks at the types of infrastructure we need going forward and ways in which the health workforce can be supported as they take on new and, in many cases, more flexible rules. It also looks at the often overlooked provision of social care, the setting for so many avoidable deaths during the pandemic.

Innovation has been crucial in the response to the pandemic. Chapter 8 reviews what has been learned in respect of information systems, diagnostics, treatments and vaccines. It then examines the importance of a well-functioning innovation system, the opportunities and challenges that arise with public–private partnerships, and the importance of translating innovation into policy and practice.

Chapters 9 and 10 look at some of the things that must be done at a pan-European and global level to ensure that we never have a crisis on this scale again. Chapter 9 looks at what governments can do collectively to create a more secure and resilient world. These include creating an international legal framework for pandemics and mechanisms for scanning the horizon for emerging health threats. This chapter also looks back at the lessons of the global financial crisis, reflecting on the initiatives taken by the G20 that, as we can now see, meant that the international financial system was far better prepared for this pandemic than it might otherwise have been. Chapter 10 examines how governments can be encouraged to prepare better for the next crisis, supporting investment in preparedness and recognizing that none of this will be possible without money. It looks at how we can improve the incentives to invest in health systems, for example by changing accounting methods and putting into practice the recognition by the international financial institutions that pandemic preparedness is essential to protect the global economy.

Finally, Chapter 11, asks how the countries of the world, along with other key actors, can work together to make all of this happen. It argues that governments, even if in some cases, reluctantly, have agreed that they must pool their sovereignty from time to time for

the greater good. The experience of the pandemic has reinforced the importance of doing so. It concludes by reflecting on the scope of the work of the Commission. Its geographical focus is pan-European, which brings certain implications, recognizing that almost half of the region is a member of a major political block with a global presence. All of the countries in this region are also members of other multinational systems. Their relationships with them vary. This creates challenges but also opportunities. The question now is how we can all maximize those opportunities.

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Chapter 2

The legacy of the COVID-19 pandemic

Martin McKee, Clare Wenham

As with earlier large-scale disease outbreaks, COVID-19 can be expected to cast a shadow over the next few decades. The pandemic has brought about profound changes in the way that we live our lives. To take one example, we have seen a dramatic shift from office to home working. This report has been developed by Commissioners meeting not in person but via online platforms, with considerable implications for how we have collaborated. These platforms have allowed us to meet virtually more often than we might have, spared the time and expense of travelling to a meeting venue, but have also precluded the rich exchange of views and ideas that take place in the corridors and during the coffee breaks. Many people have experienced dramatic changes in their lives and livelihoods. City centres have emptied. The future of expensive office blocks has been questioned. The viability of the infrastructure, such as coffee and sandwich shops and public transport, that supports pre-pandemic ways of working is uncertain. There have been major consequences for health and health services, beyond the immediate challenges of responding to the pandemic. The diversion of resources to treat those with COVID-19, coupled with concerns of patients about risks of infection and health facilities, has left a legacy of unmet need for care. Health services have, however, adapted. In many countries, there has been a shift to online consultations, welcomed by many but potentially disadvantaging those who are digitally excluded. Education has also been affected, with children missing out on schooling at a critical stage in their development, with potential long-term consequences. Yet while all of these issues pose challenges, there is some reason for optimism. Although the cost of the pandemic has been enormous, with falls in economic output on an often unprecedented scale, economic forecasts do suggest that there may be a somewhat faster recovery than after previous shocks, in particular the 2008 global financial crisis. We now look at some of the key ways in which the pandemic has affected societies during the pandemic and the implications for the future.

Health

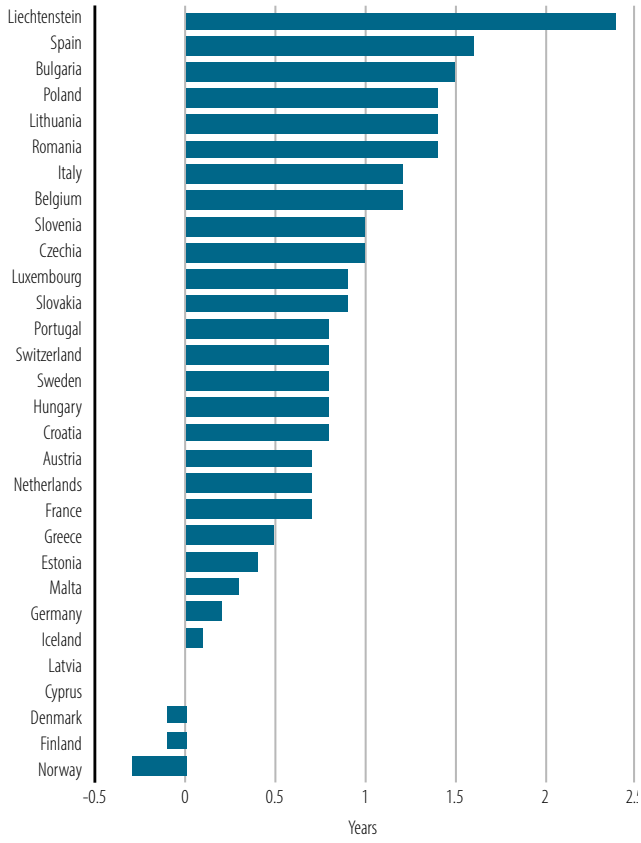
COVID-19 has, as of July 2021, caused over 4 million deaths worldwide, with some estimates that take account of under-registration in some countries suggesting a figure that is much higher. Although the death rate from COVID-19 increases rapidly with advancing age, one study from the United Kingdom estimated that those dying have lost approximately 10 years of life on average (Hanlon et al., 2021). Another study estimated that, by February 2021, over 37 000 young people in the United States aged 0–17 years had lost at least one parent (Kidman et al., 2021). Applying the same calculations to the WHO European Region produces an estimate of over 70 000 young people so affected, with important consequences for their future health and development. A subsequent paper, using data from 21 countries and extrapolating worldwide, estimated that over 1 million children had lost a primary caregiver (a parent or custodial grandparent), of whom 29 724 were in Russia, 8 866 in the United Kingdom and 4 371 in France (Hillis et al., 2021).

Within the EU, life expectancy at birth declined between 2019 and 2020 in nearly every country (Figure 1), falling by a year or more in Belgium, Bulgaria, Czechia, Italy, Lithuania, Poland, Romania, Slovenia and Spain (Eurostat, 2021). Other studies have examined the impact of the pandemic using the concept of excess mortality, which takes account of all of the ways in which the pandemic impacts on mortality by comparing numbers of deaths during the pandemic with an earlier reference period, finding large differences among countries (Kontis et al., 2020).

Another element of the health legacy is the condition known as Long COVID (Rajan et al., 2021). Approximately 15% of those who have had COVID-19 continue to experience symptoms 12 weeks later. It is a multisystem disorder, characterized by symptoms such as fatigue, shortness of breath, and problems of memory or

concentration (so-called brain fog), among others. There is growing understanding of the mechanisms involved, but many questions remain unresolved. At least some of the symptoms appear to be the result of the direct effect of the virus on cells, increased propensity for blood clotting, and an enhanced immune response. It is not yet possible to say with certainty how long these problems will persist, although in some cases, such as those individuals who have sustained tissue damage because of blood clotting, it will be lifelong. It is also possible that, as with Parkinson's Disease following the 1918 influenza pandemic (Ravenholt & Foege, 1982), some problems may take much longer to become apparent. What is clear is that health systems will have to implement appropriate multidisciplinary services for a potentially large number of people in the medium to long term. A number of these services are now being implemented and experience in the management of this condition is growing, including the importance of including patients in the development of care pathways.

Figure 1 *Decline in life expectancy at birth (both sexes) 2019–2020*



Source: Eurostat (2021).

The COVID-19 pandemic, and its associated control measures, is also believed to have had deleterious consequences for mental health globally, although the picture is complex and far from clear. A recent study found evidence of substantial neurological and psychiatric morbidity in the 6 months following COVID-19 infection; however, the mechanisms behind this association are not yet understood (Taquet et al., 2021). Among the general population, numerous systematic reviews and meta-analyses suggest that the public have experienced high levels of psychiatric symptoms during the current pandemic (Cénat et al., 2021; Krishnamoorthy et al., 2020; Luo et al., 2020; Phiri et al., 2021; Salari et al., 2020; Wu et al., 2021; Xiong et al., 2020). However, the cross-sectional design of most studies on this subject often precludes the attribution of causality, and, due to heterogeneity in the measurement instruments used to determine psychological suffering, it is often not known whether participants' symptoms would have necessarily met the diagnostic threshold for mental illness. Nonetheless, the high prevalence of psychological symptoms reported by the general public is, in and of itself, concerning. Longitudinal research will be needed to understand the long-term impact of the pandemic on population mental health and its differential effect on subgroups, particularly those thought to be at increased risk, such as front line health care workers and those with pre-existing mental health conditions (Holmes et al., 2020).

An additional consideration is the way in which measures to reduce the transmission of SARS-CoV-2 have impacted differentially on groups within the population, indirectly leading to adverse consequences for both physical and mental health. A notable example of this can be observed in the variable disruption caused by the pandemic, and its control measures, to the labour market (Lee et al., 2020). Generally, those in low-skilled occupations and low-wage earners have been hit particularly hard by the pandemic, resulting in an exacerbation of existing inequalities – although this has varied substantially across countries and between sectors. Job prospects and hours worked have been most reduced in the service sectors affected by social distancing and other restrictions (Garrote Sanchez et al., 2021). Total hours worked have fallen particularly sharply for lower-skilled workers and for workers at the bottom end of the earnings distribution in many countries, thereby increasing inequalities in earnings. In the EU, the jobs most vulnerable to COVID-19 are concentrated in lagging regions, tend to be low paid and less secure, and are disproportionately held by young, poorly educated workers and migrants (Garrote Sanchez et al., 2021). Other research has also highlighted that

women and those employed in small businesses are particularly at risk from the economic disruptions of COVID-19 (Adams-Prassl et al., 2020). In the United Kingdom, the pandemic has been described as a so-called U-shaped crisis, with younger and older workers disproportionately affected, compared with those in the middle of their working lives (Cominetti, 2021). Many young people have been unable to enter the labour market, with entry level jobs – especially in the service sector – not hiring during the pandemic, thereby denying them valuable experience at a formative stage in their careers. However there is also considerable evidence that those who lose jobs in late middle age often struggle to re-enter the labour market and face considerable reductions in earnings if they do. Moreover, substantial disparities in unemployment rates can be seen *within*, as well as between, generations. In the United Kingdom, the rise in youth unemployment is significantly skewed towards Black and Asian groups (Henehan, 2021). It is well recognized that employment and job security are protective of both physical and mental health, whereas unemployment contributes significantly to poor health, in excess of the economic effects it has on households (Barnay, 2016; Marmot et al., 2010). When developing policy responses, it is necessary to take account of the labour market conditions in each country and the specific needs of different groups.

Health care

The pandemic has transformed certain aspects of health care delivery. In a world where many transactions, such as banking, travel booking and shopping, have increasingly moved online, interactions between patients and health professionals had remained in an analogue age. This has changed dramatically in many countries as previous assumptions about what was or was not possible have been challenged.

Among these assumptions are rules about who can undertake particular roles and tasks in health systems. Despite growing evidence that many tasks can be undertaken by other professional groups, by patients and their carers, and more recently by machines, change has often been slow, especially where it threatened existing hierarchies and financial flows (van Schalkwyk et al., 2020). Of necessity, in areas such as the need to respond to increasing demand for hospital care at the height of the pandemic, or in the rollout of the vaccine programme, roles traditionally the preserve of one group have been undertaken by others. In other cases, patients and carers have taken on responsibilities that were previously undertaken by health professionals. Many face-to-face consultations have moved online.

Most research on remote consultation services was undertaken before the pandemic (Campbell et al., 2014; McKinstry et al., 2010; Hammersley et al., 2019); its relevance to a post-pandemic world is questionable. A key driver for earlier research had been the hypothesis that remote models would increase efficiency of care and "free up" clinicians for other work. For this reason, trials of remote modalities typically emphasized measures of efficiency including repeat appointments, staff workload (including knock-on workload for other sectors), length of consultation, and the proportion of remote appointments that were converted to face-to-face (thereby double-handling a problem). Participants for such trials had been carefully selected, focusing on people with chronic stable conditions and excluding anyone considered high-risk. This earlier research usually showed that patients randomised to remote care did no worse and were no less satisfied than those randomised to usual care but that cost savings were hard to identify (McLean et al. 2013; Downes, 2017; Newbould 2019). But it largely failed to capture the operational complexity, potential clinical risks (e.g. missed diagnoses, loss of information richness), impact on inequalities (creating barriers for the digitally excluded and data-poor, for example) and limited transferability of remote consultations across a wider range of settings once these modalities move from a tightly-controlled trial setting to contributing a major part of mainstream services. Healthcare organisations vary widely in digital maturity, and both staff and patients vary in their competence and confidence. There is a notable bias in published research towards video consultations whereas both before and during the pandemic most remote consultations occurred by telephone. E-consultations have been little studied. A recent article reviewed both pre-pandemic and in-pandemic research on remote consultations and proposed a new framework, Planning and Evaluating Remote Consultation Services (PERCS), which treats the remote consultation as a complex intervention in a complex system, and as an ethical as well as a technical choice (Greenhalgh 2021).

A particular challenge for data collection, and for researchers on this topic is that sophisticated methods will be required to capture consultation events that either do not happen, or that are unsafely delayed, or

present elsewhere (such as emergency departments) due to a patient's digital exclusion to health care.

Helping people to access and use digital health services can improve their health literacy, offer better choice and convenience of services, improve communication between clinician and patient and reduce the cost and burden on front line services (NHSE, 2021). A particular intervention of note is the United Kingdom's Good Things Foundation's Widening Digital Participation project that focused upon hyperlocal and informal "digital health hubs", adopting a whole person and partnership approach to supporting digital access (Good Things Foundation, 2021). It is estimated that there was at least a £106 million benefit to the English National Health Service in reduced general practice and emergency department attendances via the scheme, and 90% of those attending the scheme reported an improvement in their own well-being.

During the first months of the COVID-19 pandemic, it was recognized that the shift to remote consulting was "imperative to reduce contagion" and had been successful, with a focus maintained on vulnerable patients, but "post-pandemic, the model will need adjustment" (Murphy et al., 2021). Future models of health care will need to balance the convenience of digital modalities for some with the barriers that these modalities engender for others.

There are other ways in which health services may change. As discussed earlier in this report, the situation in which many health systems operated at close to maximum capacity is likely to be revisited, given the resulting inability to respond to surges in demand. Similarly, and drawing on the experience in Asia following the 2003 SARS outbreak, there is a strong argument for exploring ways in which the design of health facilities might be adapted to provide flexibility in their responses and a separation of clinical pathways followed by those potentially infected and others, so as to minimize the adverse effects of a future pandemic on routine health care (Gomersall et al., 2006; Lee et al., 2005). These issues are explored in more detail in Chapter 7.

Education

The closure of schools in many countries, necessary to interrupt transmission of infection, has had severe consequences for the education of children and adolescents who have missed face-to-face teaching for many months, and for their parents, many of whom have had to take on caring and educational roles in addition to their other responsibilities.

While many schools have invested substantial efforts into remote online learning, the quantity and the quality of this provision have varied. A review undertaken for the European Commission identifies a number of mechanisms by which young people are likely to be disadvantaged by a loss of education (Di Pietro et al., 2020). First, there is evidence that they spend less time studying than when schools are open. Second, being confined at home may increase stress levels, reducing the ability to learn. Third, physical closure of schools and loss of in-person contact may reduce motivation to engage in learning activities. The authors note that the shift to online learning is likely to exacerbate existing inequalities, reflecting the increasingly recognized phenomenon of digital exclusion, discussed in more detail later in this report. They also make a series of recommendations, including improved access to the Internet, provision of computers where necessary, improved virtual learning environments, enhancements in broadcasting, education, specific measures for children with special educational needs and disabilities, and support for teachers and parents. So far, there are relatively few data on the impact of school closures; a recent study undertaken in the Netherlands is an exception (Box 3) (Engzell et al., 2021). Another study, in England, found that by autumn 2020 all year groups in primary schools had experienced a learning loss in reading of 1.7–2.0 months, with the corresponding figure for secondary schools, 1.6–2.0 months (Department for Education, 2021). Learning losses in mathematics in primary schools were even greater. These figures were greater in schools in disadvantaged areas.

Of course, the impacts of school closures have been even more profound in households that do not have stable Internet access and in areas in which education budgets have long suffered from cuts and underfunding.

In autumn 2020, the OECD released estimates that students who were in grades 1–12 during the COVID-19 pandemic might expect to earn around 3% less over the course of their working lives on average, and these losses could yield an average of 1.5% lower annual gross domestic product (GDP) for countries in the rest of the 21st century. For students from disadvantaged backgrounds, the learning and potential lifelong earning losses are likely to be deeper. To avoid such

Box 3 *The impact of school closures in the Netherlands on educational performance*

A study in the Netherlands, based on data covering 15% of Dutch primary schools between 2017 and 2020, included data on characteristics of students and schools, as well as biannual test scores in core subjects. Of note, this study was undertaken in a country that has among the highest levels of broadband penetration in the Organisation for Economic Co-operation and Development (OECD), and where the government, early in the pandemic, took measures to increase access to home learning devices. Also, school closures were shorter than in other countries, so the authors argue that their findings represent a "best case" scenario. On average, performance declined by just over 3 percentage points. The authors estimated that this equated to a loss of 8 weeks of education, the same as the duration of school closure. However, there were substantial differences among students. Those with parents in the two lowest categories of education, accounting for 8% of the population, suffered losses that were 40% larger than the losses of the average student.

Source: Engzell et al. (2021).

consequences, schools do not just need to return to where they were in 2019, but they need to be significantly improved with a teaching force equipped to handle video-based instruction and individualized learning programmes (Hanushek & Woessmann, 2020).

The economic losses for individuals and societies at large resulting from school closures will have impacts that seep beyond the education system and will likely fall back to the health system eventually. Poor educational attainment is associated with poorer health, with the relationship between education and health involving three pathways: (1) economic, social and psychological; (2) interpersonal; and (3) behavioural health (Raghupathi & Raghupathi, 2020).

Moving forward, it is clear that governments will need to put in place measures to enable children to catch up with the education they have missed, with a particular focus on those who have been most disadvantaged during the pandemic. It is also clear that the educational needs of children must be included in plans for any future pandemic.

Box 4 *Recommendations for recovering lost education*

- Implement a new continuous professional development scheme for teachers.
- Extend schools.
- Implement summer wellness programmes.
- Fund schools to provide mental health workers.
- Increase funding for schools with high numbers of disadvantaged children.
- Increase salaries for teachers in challenging locations.
- Issue new guidance on inclusion and well-being.
- Enable pupils to repeat a year if needed.

Source: Education Policy Institute (Crenna-Jennings et al., 2021)..

An evidence review undertaken in England, with a focus on educational recovery after previous crises, informed a set of policy recommendations (Crenna-Jennings et al., 2021) (Box 4).

The economy

The impact of the pandemic on the global economy has been catastrophic. It has been estimated that global output fell by 3.3% in 2020, driven by drops in consumption resulting from prolonged lockdowns in countries that acted too late to contain transmission early on. This figure dwarfs the 0.1% decline in the 2008 global financial crisis. At the same time, some capital markets soared, especially those such as the NASDAQ that were dominated by technology companies. The impact also varied across the world. While the euro area and Latin America experienced large contractions, some countries in other regions, especially in Asia, grew. China, the only country in the G20 to experience growth, saw a 4.9% increase in GDP in the third quarter of 2020. However, many lower-middle-income countries were especially severely affected.

At the beginning of 2021 there were, however, some encouraging signs of an economic recovery, powered by optimism about the rollout of vaccine programmes and other measures, not to mention massive monetary and fiscal stimuli in many parts of the world. In particular, results from a number of surveys, such as Purchasing Manager Indices (PMIs), pointed to very strong performance in a number of leading indicators. These results are consistent with the scenario in which the pandemic-related lockdowns have contributed to high levels of personal savings for some, and pent-up consumer demand.

Looking ahead, the International Monetary Fund (IMF)'s 2021 World Economic Outlook paints an

optimistic picture (International Monetary Fund, 2021). It projects 6% growth in the global economy in 2021, reducing to 4.4% in 2022, with both figures increased from earlier projections. It takes the view that the scale of the policy response to the pandemic will lead to a much faster recovery than after 2008. This overall picture does, however, conceal marked variations among and within countries. During the pandemic, some of the worst hit countries were those dependent on tourism, commodity exports or with limited scope for policy responses. Within countries, young people, women, workers with lower levels of educational attainment, and those in informal employment were worst hit, leading to widening income inequality even where savings rates rose overall.

How each country fares will depend on the future course of the pandemic, the choices it made during the pandemic, the structure of its economy, and the policies it pursues going forward. Blanchard and Pisani-Ferry (2021) have reviewed three major issues. The first is border restrictions. Beyond the obvious consequences for tourist income, they show, using findings from natural experiments, that any restrictions will have adverse economic consequences but, in particular, for sectors where there are global value chains (Delpeuch et al., 2020). Other adverse effects could stem from any impact on mobility of researchers and from the loss of tacit knowledge if there are fewer in person meetings (Coscia et al., 2020). The second is further lockdowns, although here they find, interestingly, that the economic consequences in seven European countries were much less in the second than in the first wave of the pandemic, an observation they attribute to those involved finding new ways of working. The third is the so far uncertain long-term consequences of the pandemic on changes in demand and supply.

The IMF does, however, caution that there is still considerable uncertainty. This reflects the potential for new variants of the virus to emerge; the extent to which policy responses during the pandemic enable businesses to bounce back, for example, where measures were designed to retain staff or prevent insolvency; and the willingness of those with savings to spend them. Other uncertainties include investor sentiment, in particular in relation to bond markets, and the risk of inflation. However, the message that can be taken away is that although the pandemic was a massive shock to the global economy, there are good grounds to believe that it will have been short lived and the recovery will be rapid and sustained. If so, it will be important to avoid a return to the austerity that, in some countries, undermined national resilience and weakened the ability of governments to respond effectively (see Chapter 6). It also points to a need to ensure that the benefits of any economic recovery are distributed fairly leaving no one behind, and investments in those systems and structures necessary to minimize the risk of a future pandemic are not postponed or ignored.

Gender

Although it is difficult to separate the consequences of the 1918 influenza pandemic from those of the First World War, together they had profound implications for the position of women in society. In many countries, women moved into the formal workforce in unprecedented numbers. In the United States, the number of women in the workforce was 25% higher than before the war (US Department of Labor, 2020). These women took on many roles for which they had previously been excluded, challenging long-established norms; a process that would, in many countries, change their role in society, most obviously in the right to vote.

In the current pandemic, while caution is required in generalizing, men have disproportionately tended to experience the most serious health outcomes of COVID-19 infection, suffering increased rates of hospitalization and death (Global Health 50/50, 2021). This is assumed to be a results of a combination of biological and social factors (Sharma et al., 2020). At the same time, women have experienced the majority of the secondary effects of pandemic, including social, economic, and non-COVID-19 related health impacts of the non-pharmaceutical interventions introduced to limit disease transmission (Wenham et al., 2020). This occurred in multiple ways:

1. Women have absorbed the majority of the paid labour associated with responding to the pandemic. Women represent 70% of the global health workforce, and thus have been on the front lines of the pandemic, directly caring for those infected with the disease, with many health care workers in low-income settings being under or unpaid (Boniol et al., 2019). This has not only led to disproportionate infections among women in the health and social sectors (Bandyopadhyay et al., 2020) but also women have suffered the indirect effects of working

in such circumstances, including increased rates of burnout and mental health concerns (Greenberg et al., 2020), increased health care worker aggression and violence (Lotta et al., 2020), and having to live separately from their families to reduce risks of onward transmission. This will have long-term effects of health care worker retention within health systems, and on the mental health of these women. These experiences have served as a reminder of the gendered nature of the health care workforce, leading to calls for the additional risks on women performing these roles to be recognized and mitigated through access to PPE and financial and personal security for them to perform their work safely.

2. Women have also absorbed the majority of the unpaid labour associated with reducing disease control or living with the societal effects of the pandemic. As schools shut, women have disproportionately shouldered the additional domestic load. On average, globally, women have increased their unpaid household work by 6.1 hours per day compared with men's 4.9 hours (UN Women, 2020). While there have been increased contributions by men, further interrogation of the data shows a difference between the types of domestic labour men and women are performing in dual-parent households: men have increased their developmental care – that is, home school, playing etc. – while women have disproportionately assumed the non-developmental care load, that is, the things that parents do in a household to keep a child alive, such as cooking and cleaning (Office of National Statistics, 2020). This represents a form of household bargaining and demonstrates the re-entrenchment of conservative gender norms across global societies as women continue to do, and have increased, the domestic care work done in homes. Beyond caring for children, women have also disproportionately assumed broader care roles within society – being those caring for the elderly or sick, forming mutual aid groups or ensuring neighbours have supplies when shielding (Matthewman & Huppatz, 2020).

This unpaid care role during the pandemic has had significant impact on women's employment: women have been forced out of the workforce as a consequence of this additional domestic burden (Adams-Prassl et al., 2020). A combination of entrenched cultural norms, which have become increasingly conservative during the crisis (Rosenfeld & Tomiyama, 2020), and a widening gender pay gap have led to women assuming this role (Qian & Fuller, 2020) and having to leave paid employment as a consequence. Women in employment in the USA dropped 6% during 2020 compared with male counterparts, and in the United Kingdom this was 4.9% (Adams-Prassl et al., 2020), a trend replicated across much of the world. As women are disproportionately employed in the informal sector in low- and middle-income countries, they have seen their work (and economic security) lost during the pandemic (Webb et al., 2020). Employers must recognize this impact and ensure that strategies are put in place to facilitate women's return to work, and offer greater protection against future shocks (or pandemic waves). This has revived discussion about paid leave for parents, universal basic income, or job security protections for parents/carers, as well as provision of affordable childcare, all increasingly seen as a cornerstone of any recovery plan.

Women have also lost their jobs because of the sectors that they work in – including highly feminized industries globally such as retail, hospitality, tourism, education and childcare. It is these sectors which have been most vulnerable to closure as a consequence of lockdown measures (Wenham, 2021). The EU has estimated that 84% of women are employed in such services (European Parliament, 2020b). As these remain closed, women have disproportionately been placed on social protection measures (e.g. furlough) where such schemes exist, or have lost their jobs (Cook & Grimshaw, 2020). It remains to be seen how these industries will recover in the post-pandemic period, and whether these jobs will exist, or whether women will remain out of the workforce for longer or be required to retrain for other work options. However, evidence from previous outbreaks demonstrates that women have remained out of work for considerably longer than men in the post-epidemic period. One year after the Ebola shock in Sierra Leone, 63% of men had returned to work compared with only 17% of women (Bandiera et al., 2019). Similarly in 2021, 5 years after the Zika outbreak in Brazil, 90% of women with children born with congenital Zika syndrome remain out of work (Ryu, 2020). Efforts must be made to ensure that any bail out of economies does not just focus on male-dominated sectors of the economy, such as construction or manufacturing, but also include those where women dominate the workforce, such as childcare.

Beyond the socioeconomic sphere, women have also suffered in specific ways from restrictions required to reduce virus transmission. Two examples are domestic violence and access to sexual and reproductive health care and maternity services. Domestic violence is notoriously hard to measure, as it is underreported. However, proxy measures such as calls to domestic violence helplines have skyrocketed globally (Peterman et al., 2020). Reports have come from Brazil, China, France and South Africa, each showing alarming trends in the volume of these calls, with a 50–300% increase on 2019 (Graham-Harrison et al., 2020). This has been one area where governments have sought to intervene to reduce occurrence, and many governments have introduced some form of protection to support women, with varying effects (Bradbury-Jones & Isham, 2020; Leslie & Wilson, 2020). This has ranged from provision of safe shelter in unused hotels or universities; to increased counselling, to working with abusers online to tackle the causes of violence in men (European Parliament, 2020a). Such services should not just be available during the pandemic, but must be retained in the post-pandemic period.

Women and girls have also been affected by reduced or altered access to health care provision, including access to maternity services, and sexual and reproductive health care. The result of this has been an increase in unwanted pregnancies as women have struggled to access contraceptives (Ashish et al., 2020; Lin et al., 2021), and an increase in unsafe abortion practices, as service providers have reduced capacity because of the effects of the pandemic (Moreau et al., 2020). Maternity care alterations have also led to increased maternal mortality and stillbirths in different parts of the globe, there is less confidence in maternity services, and women in multiple locations have reported feeling unsafe with their peri-partum experiences (Ashish et al., 2020). Maternity provision must remain during pandemics to ensure women are able to safely deliver babies. Contraception and abortion must remain readily accessible to women, through community services.

While these effects of the pandemic have been somewhat universal, as women across the world are experiencing similar impacts of both COVID-19 and governmental policy, women are not a homogenous group and some women have been hit harder than others. For example, single parents, the majority of whom are women, have faced the full effect of being required to do simultaneous paid and unpaid work during lockdown, are more likely to have lost their jobs than dual-parent households who are in a couple, and are experiencing poorer mental health outcomes (Gingerbread, 2020). Similarly, women in lower socioeconomic groups are more likely to have lost their jobs than women in higher socioeconomic groups, due to the nature of the work and whether it is possible to do it at home, and are also more likely to be essential workers on the front line. Women who are Black, Roma, Asian, or from another minority ethnic group, are also disproportionately likely to have lost their jobs, or to work as essential workers. Moreover, non-binary groups have also suffered significant effects of the pandemic, often having to live with families who do not accept their identity, or being unable to fulfil their identity needs due to government restrictions. Intersectional (feminist) methods allow for such exposures to be seen in real time – or to be anticipated in advance – to reduce the impact on these groups, yet such data collection and consideration has been notably absent throughout the pandemic.

What has been most alarming is that these effects were not new; similar trends were witnessed during Ebola and Zika (Harman, 2016; Wenham, 2021) and in many ways these gendered effects reflect broader social trends. Yet, this evidence was not incorporated into policy-making at the start of the pandemic, and in many instances it has yet to be considered by government decision-makers. This is a problem not just for pandemic response, but for the recovery from COVID. It is vital to understand how different social groups are affected, so meaningful policy can be introduced to minimize further impacts.

There are a number of lessons which can be learned for future health and pandemic provision. Much has been said about equal participation of women in decision-making in all levels of society, and such gender parity should be commonplace in all efforts for gender equality. Research has shown that women are more likely to focus on the human element of the epidemic (van Daalen et al., 2020). Women leaders are also more likely to invest in health and social care, and thus have systems in place to manage any emerging infection as early as possible (Abras et al., 2021) but "adding women and stirring" does not always equate to greater gender mainstreaming or minimizing the gendered effects of an epidemic. For this you need gender advisers and feminist methods (Davies et al., 2019).

Feminist methods and gender advisers must be involved in pandemic preparedness and response efforts at local, national and global levels. As is required in other areas

of crisis governance, such as for humanitarian events and climate change development, gender advisers must be involved in the development and implementations of plans. Such expertise would allow for intersectional disproportionate impacts to be pre-empted, rather than become evident retrospectively. Policies could then be adjusted to ensure equity in the effects of a particular intervention, and/or additional measures put in place to support the most vulnerable.

Alongside this, beyond the epidemiological data paramount to pandemic response, all data must be sex-disaggregated and disaggregated along other lines of marginalization. This will allow for trends between impacts to be identified in real time. This will facilitate research on gender biases relating to access to and uptake of health care, and on how sex differences on symptoms and evolution of COVID-19 may contribute to inequities in access to services, treatment and experiences of services. A study in Japan found that asymptomatic women with COVID-19 experienced longer health care-related delays, of 6 days or more, than men (Ogata & Tanaka, 2020). As with other conditions, such as cardiovascular disease, men and women may present differently, leading to underdiagnosis of women when criteria are based on men's symptoms. Thus, pneumonia as a consequence of COVID-19 is more frequent among men while women are more prone to digestive, dermatological and neurological problems.

Alongside the epidemiology, gendered quantitative and qualitative data must be incorporated into decision-making to understand the everyday lives of those impacted by the pandemic and policy introductions, to understand how the impacts are manifesting, which is often invisible with a focus purely on case data.

Pandemic policy must also be mainstreamed, to ensure that gender considerations are made at each level of policy. This should, for example, include gender provision in the IHR and any future pandemic treaty (Asthana et al., 2020). Governments, within their obligations during epidemics, must minimize the disproportionate impact of epidemics on women, and must include data on such effects within WHO reporting (Asthana et al., 2020). Governments, within their obligations during epidemics, must take account of the gendered impacts of infections and responses to them and include data on such effects within their reporting, including to WHO. In most studies, case fatality has been higher, in some cases over threefold, among men, although this is not universally so and was higher among women in, among others, India, Nepal, Slovenia and Viet Nam (Dehingia & Raj, 2021). The more common male disadvantage is, to some extent but not entirely, explained by greater exposure to known risk factors. The female disadvantage seen in some low- and lower-middle-income countries may reflect known differences in access to health care.

Gender differences are also apparent in other outcomes. Thus, a systematic review found that being female was associated with a higher risk of distress during the pandemic (Xiong et al., 2020), with those who were pregnant, postpartum, or miscarrying, or experiencing intimate partner violence at particular risk (Almeida et al., 2020).

More broadly, we need to find a way to recognize the care economy and the unpaid care work which exists across all societies and predominantly relies on the efforts of women. Governments seeking to build back better must introduce mechanisms to recognize this and ensure fair payment for health and care workers. There is currently a shortfall of 18 million health care workers globally, but the lack of recognition (and pay) for these health care workers despite the conditions of the pandemic makes it an unattractive offer to many. This will not only support pandemic preparedness, but In Health for All and universal health care (UHC) progress. Investing in care is not only good for the health and well-being of a population, but is also good for economic growth: creating jobs in the health care sector has a multiplier effect and creates a macro level stimulus greater than that of investing in the construction sector (Women's Budget Group, 2020). Unpaid care work also needs to be recognized. The UN estimates that 2.35% of global GDP is unpaid care work – equating to US$1.5 trillion unpaid in the health sector alone. The majority of this work is performed by women. This care burden is only going to increase with the growing number of older people worldwide.

The nature of work

Although the COVID-19 pandemic has led to the sharpest economic contraction since the Great Depression, effects on unemployment have so far been more muted because of the widespread use of job retention measures and wage subsidies, although unemployment is forecast to rise by nearly 2% across OECD Member States (OECD, 2020).

As already noted, the 1918 influenza pandemic led to major changes in the workplace, in particular the increased participation of women, but also in areas such as factory design, for example, with improved ventilation. The Black Death (1347–1351 AD) had even more profound consequences for the workforce, with labour shortages encouraging peasants' revolts in some countries.

The current pandemic is also likely to lead to changes in the nature of work. Technological changes have created "job polarization" as technology replaces tasks, or allows them to be offshored, in middling relative to high-skilled and low-skilled occupations. The result is that the distribution of jobs is "polarizing" with faster employment growth in the highest and lowest-paying jobs and slower growth in the middling jobs. Such trends have been documented across many countries, including in western Europe, which has seen rising employment shares for high-paid professionals and managers, and for low-paid personal service workers, but falling employment shares for manufacturing and routine office workers.

The creation of the gig economy is also changing the nature of employment in some sectors, and this is likely to be compounded by COVID-19 with, for example, a shift from the high street to online shopping. This means that many low-wage, low-skill jobs may have weaker social security protection and, especially in countries that link employment and paying contributions to health care coverage, barriers to accessing health care. The increasing use of zero-hour contracts and the use of electronic platforms for short-term, intermittent work has created rising pressure on the long-established categories used in tax and employment law which specify employment and social security rights and duties (Adams et al., 2018). The tests determining into which category an individual falls are often unclear and easily manipulated, weakening social security protection for a growing number of workers with non-standard arrangements in low-paid jobs. There also may be deleterious effects on health system revenue generation in countries that rely heavily on formal labour markets for health financing (Cylus et al., 2019).

An increasing proportion of insecure, low-wage jobs may give rise to long-term health effects. Employment is associated with a positive effect on health but the poor quality of stressful jobs can be more detrimental to both mental and physical health than being unemployed (Marmot et al., 2011). This can include work with little autonomy or managerial direction, as well as low paid and insecure work.

Many of these occupations may have also faced a greater risk from COVID-19. In the United Kingdom, several categories of generally low-waged jobs have the highest death rates at working age (64 and under) people. This included carers, those who work in the leisure and service industries, and taxi drivers, bus drivers and security guards (Marmot et al., 2020). In many countries, people from ethnic minorities were disproportionately represented in these occupational groups.

Looking ahead, addressing these effects is likely to require actions across governments; for example, on macroeconomic policy; on higher investment in STEM (science, technology, engineering and mathematics) to create a future workforce for high-skilled jobs; on improved active labour market/welfare-to-work programmes, such as retraining, job search assistance and wage subsidies; stronger minimum wages; and better social security protection for gig economy workers (Goos, 2018). There will also need to be measures that respond to changes in sectors such as retail and hospitality where, at present, the workforce often has a high proportion of women, including many working part time as they balance work with family commitments. These policies must take into account the health effects as well as their economic effects so it will be important for health policy-makers to engage with their development.

The built environment

In part because of changes in the nature of work, there are likely to be important changes in the built environment. Ten of these were identified in an exercise that examined the changes that have already taken place as a result of the pandemic as well as other developments such as responses to climate change (Cheshmehzangi, 2021). Some of these are technical, such as increased use of digital technologies in design of individual buildings and city-level projects, enabling developments to take account of a wider range of factors than has been the case previously, and greater use of off-site construction and engineering, with final assembly on site, a process that could encourage the use of new materials. Others have consequences for health, such as a decline in car-based transportation infrastructure, with a shift to facilities that encourage walking and cycling, with

the city of Milan being cited as an example. Another, reflecting the increasing amount of working from home, involves upgrading the performance of buildings with improved sound and heat insulation, again including the use of innovative materials. A third is a challenge to recent trends, promoting high-density accommodation, assuming that people will spend most of their waking hours somewhere else, something that no longer seems to be the case. A fourth relates to interior design of facilities for work, recognizing that use of offices is likely to be reduced because of remote working, but also the need to build in safety measures, and in particular improved ventilation to reduce the spread of respiratory diseases. Finally, they envisage a greater focus on shared community facilities, including green spaces and other local amenities.

The importance of ventilation has been set out in a paper in Science that calls for a new paradigm in the approach to respiratory infections (Morawska et al., 2021). It challenges the widespread acceptance of high levels of illness and death from these infections, which it contrasts with the robust action taken in recent decades to combat water- and foodborne infections. It notes the remarkable advances in understanding of airborne infection during the pandemic, resulting from transdisciplinary working by epidemiologists, engineers and others that have challenged previously widely held views. In this paradigm, building standards, including the WHO Indoor Air Quality standards, would include measures of ventilation, would be extended beyond their current focus on chemical pollutants to include airborne pathogens and should include standards for the volume of outdoor air delivered to indoor spaces and research into new technologies for making the indoor environment safer and monitoring air quality.

The changing role of the state

Governments in most countries continue to face mounting pressures following disruptions caused by the COVID-19 pandemic and measures taken to address them. Health system inadequacies, in addition to economic constraints, a mix of demographic, environmental and other challenges continue to test state's capacity and resilience, adding to the complexity of governing in COVID times. This has not only left governments struggling to close a growing gap between public demands and what governments can deliver, leading to raised tensions and increased political volatility, but has paved the way for new adaptive approaches to governance. As predicted by the Global Trend Report 2040 (National Intelligence Council, 2021), this mismatch between what the public expects and what governments can deliver, could spur a new social contract, with new or shifting sources and models of governance, as witnessed during the pandemic.

While many European governments struggled with limited resources, equipment and capacity to meet the health needs of their populations, protests against COVID-19 measures began to erupt in some European cities, signalling distrust in government institutions, political turbulence and ongoing public dissatisfaction. In addition to this ongoing pressure, governments had to increase their use of technology, implementing policies that harness the benefits and mitigate the risks and disruptions, within a short period of time in efforts to address the pandemic. Decisions and actions had to be taken swiftly by the state, which required embracing new adaptive approaches to governance.

These new approaches surfaced with more actors providing support to the government with a wider range of services in response to the pandemic. These broader set of actors outside government institutions and includes private sector companies, non-governmental organizations (NGOs), civil society groups, religious organizations and others. We have witnessed philanthropies, technology companies, research and academic institutions working in concert with governments to produce breakthroughs at record speeds. Elsewhere, civil society organizations all over the world have filled gaps in government responses, providing humanitarian relief and welfare services.

We are also seeing the re-emergence of discussions about "strategic industries". This was already happening pre-pandemic, for example when Germany blocked Chinese purchases of German companies developing "sensitive technologies", but this thinking may increase in the future. More generally, there will be demands to rebuild state capacity after decades of shrinking the state, reflecting the observation that hollowed-out states cannot respond to health or economic crises, nor manage the necessary environmental transition.

The roles and relationships between state and non-state actors does depend on their relative capacity, penetration and alignment with population expectations. And in most cases, the role of non-state actors in governance extends beyond providing services;

for example, technology companies wield significant power in their control over information flows and networks with the ability to shape political discourse. Another development is the strategic relationship between universities, pharmaceutical companies and governments to develop vaccines. For example, the United Kingdom government, in addition to providing funding for development of the Oxford-AstraZeneca vaccine, also brokered the university/industry partnership, in part because it seemed concerned about the risk of a potential United States export ban should Oxford have partnered with Merck. While the United Kingdom avoided this risk, the decision did, however, create problems as AstraZeneca was comparatively less experienced in vaccine development.

As such, the pandemic taught us that the role of the state keeps evolving and non-state actors will continue to complement, compete with and, for some functions, replace the state. However, the provision of governance outside state institutions does not necessarily pose a threat to central governments, nor does it diminish the overall quality of governance for the population, as seen with joint efforts to fight the COVID-19 pandemic. In many ways, this could be further consolidation around the idea of shared sovereignty whereby states recognize the value of non-state actors and that their input can greatly improve broader governance, and in turn state capacity. In this way, governments are willing to cede some of their sovereign power to non-state actors to share this power to further bolster competences, and indeed their own overall power. State sovereignty is redefined as the power to be able to decide to enter into such arrangements, and indeed when to withdraw from them.

The role of non-state actors continues to expand and prove beneficial for the state, due to a combination of factors including, the increasing resources and reach of the private sector, NGOs and individuals because of technology; and the growing complexity and number of public policy challenges that require multiple stakeholders to address, as in the case of the COVID-19 pandemic. Yet it is important to remember that not all non-state actors are the same, and they interact with the functions of government in varied and divergent ways. Some larger non-state actors, including the private sector and philanthropists such as the Bill & Melinda Gates Foundation (BMGF), increasingly play an important role in advising governments and implementing policy programmes. In this way such institutions become a function of the state shared sovereignty, providing services that the state would otherwise be unable to provide. Yet this is quite different to civil society groups and activists which scrutinize government policy and seek to hold governments to account for their decisions. These latter organizations are a vital part of the democratic process. Interestingly, despite these new adaptive approaches to governance, populations will continue to view the state as ultimately responsible for addressing the challenges faced due to COVID-19 and demand that their governments deliver solutions that are favourable to ensure their livelihoods are secured.

It is obvious that states and non-state actors will continue to look for ways to adapt to mounting governance challenges; this include experimenting with novel tools and techniques for the development and application of technologies to improve the speed, efficiency and precision of governance. It is therefore vital for governments take the leading role and develop well-defined relationships with non-state actors in the light of future pandemics and uncertainties.

Summary

The COVID-19 pandemic has already brought about large-scale changes in society. While predictions should always be undertaken with caution, it is clear that the post-pandemic world will be different from before. There will be immediate challenges; for example, in responding to the burden of unmet need for health care and lost education. There is also likely to be a questioning of existing economic models and, especially, the role of the welfare state. There will also be opportunities, with new ways of working and a recognition of the importance of policies that enhance societal resilience, leaving no one behind.

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Chapter 3

The case for investing in health and sustainable development

Martin McKee, Clare Wenham

Introduction

For many people, the need to argue the case for investing in health may seem unnecessary. While classical scholars might quote Cicero, "*Salus populi suprema lex esto* (the health of the people shall be the highest law)", others may draw on the advice, often from elderly relatives, that when you have health nothing else matters. Yet, as the pandemic has reminded us, when decisions are being made about how to spend money, health is often not the highest priority. This chapter does not take it for granted that everyone will agree on the importance of investing in health. Rather, it seeks to make the case for doing so from a variety of perspectives.

The first stems from long-established ethical principles, including the Golden Rule that appears in various forms in the main religions of the world. This is that one should treat others as one would wish to be treated oneself. The second, which flows from the first, is based on international norms on human rights. The WHO Constitution states that "The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition". In 2015 world leaders committed to 17 Sustainable Development Goals (SDGs). One, SDG 3, focuses specifically on health. The third perspective is that health, along with education, infrastructure and knowledge, is increasingly being recognized as a contributor to economic growth. The fourth is the contribution that health makes to security of nations and the international community. Finally, and more recently, health is being recognized as a contributor to the social and political solidarity that underpins democracy.

The ethical argument for Health for All

Why should one person, or the government of one country, have an interest in the health of others? This raises issues of rights, which may be positive and negative. Health is a positive right as it requires provision of health-related services, for example by a government, and requires active agency by another. Negative rights exist independently of provision, such as the right to life or right to freedom of expression, which do not require provision, but can be taken away.

Three main arguments for the positive right to health have been advanced (Wolff, 2012). First, it may be in one's own best interests; for example, by taking measures to prevent the emergence of a disease with pandemic potential. It may also serve one's interests if providing support for others creates a sense of fulfilment. Second, it has been argued that there is a humanitarian duty to save the life of another if one can do so without sacrificing anything of importance (Singer, 1972). Third, it has been argued that those who lack resources have a right to expect assistance from others to ensure their right to health, an issue that is developed further in the next section.

These views are not, however, universally shared. In particular, there are those that argue against what they term "rights inflation". They contended that by setting out a right to health, we devalue the currency of human rights. Thus, given that many countries have not faced any sanction for failing to implement the right to health, then why should they be criticized if they pay no respect to other rights, such as those against arbitrary arrest or torture?

Another argument is that enforcement of any right, such as the right to health, may require litigation, a process that is intrinsically combative and may undermine the solidarity on which health should be based. A third criticism is that asserting a right is meaningless if it is not possible to identify who has the duty to uphold it. This becomes a particular issue in respect of those individuals who are undocumented or stateless. A final criticism is that a rights-based argument is, intrins-

ically, individualistic. This means that it is most likely to be successful whenever those who have the loudest voice seek to exert it. A well-known example is when pharmaceutical companies support campaigns by patient groups advocating for public funding for innovative medicines that incur high costs, but bring little benefits.

In a few countries, most notably South Africa, the right to health has been included in the constitution. This has given rise to case law that illustrates the arguments that courts are likely to take into account (Heywood, 2009). In brief, the South African courts supported the argument that health care should be provided where it did not impinge on the availability of resources to others but, where an individual made a claim that would require others being denied treatment, that claim would not be upheld. This is similar to the arguments that have been included in decisions by the European Court of Justice on the internal market in goods and services (Kanavos et al., 1999). In summary, there is a strong ethical argument for the right to health, but there are limits to the extent to which it can be upheld in law.

Health as a human right

As noted above, the right to health was first set out in the 1946 WHO Constitution, and restated in the 1948 universal declaration on human rights: "Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control" (Article 25). It has been developed further in the International Covenant on Economic, Social and Cultural Rights (ICESCR) (United Nations General Assembly, 1966), which establishes "the right of everyone to the enjoyment of the highest attainable standard of physical and mental health". This is elaborated on in General Comment No. 14, which interprets the ICESCR as meaning that states have minimum core obligations, irrespective of resource constraints, as well as a requirement to pursue progressive realization of the right to health, according to the resources available to them (United Nations Committee on Economic Social and Cultural Rights, 2000). This document has generated considerable discussion, especially because the general comment is somewhat imprecise in setting out what comprises the core obligations (Forman et al., 2016). These obligations do, it notes, include ensuring non-discriminatory access to health facilities, goods and services, especially for vulnerable and marginalized people; access to food, shelter, housing, sanitation and water; provision of essential drugs, and equitable distribution of health facilities; and a national public health strategy and plan of action to address the concerns of the entire population. However, beyond that, there is considerable room for interpretation. The ICESCR is underpinned by a commitment to burden sharing, where the international community will assist a country that is unable to meet its core obligations. However, it does not establish a mechanism by which this can take place. However, notwithstanding the lack of detail and implementing mechanisms, the ICESCR firmly established the principle of the right to health in international law. This principle has been restated in numerous other forums, including the UN General Assembly (United Nations General Assembly, 2012), which in 2012 stated that "[a]ll people have access, without discrimination, to nationally determined sets of the needed promotive, preventive, curative and rehabilitative basic health services and essential, safe, affordable, effective and quality medicines, while ensuring that the use of these services does not expose the users to financial hardship, with a special emphasis on the poor, vulnerable and marginalized segments of the population".

In 2015, the SDGs restated the international commitment to health, especially in SDG 3, to "Ensure healthy lives and promote well-being for all at all ages". However, reflecting the lengthy debate that led up to agreeing the SDGs, and especially the often politicized commitment to achieving universal health coverage, there are differing views about the extent to which this SDG includes the right to health (Brolan et al., 2017). On the one hand, the SDGs are based on "universal respect for human rights and human dignity" and grounded in human rights treaties. On the other, the right to health is not explicitly stated in SDG3. However, there is a widespread view that it is implicit in the SDGs as a whole.

Notwithstanding this debate, the SDGs set out a clear commitment to investing in health. SDG3 includes a series of explicit targets to be achieved by 2030 (Box 5). Of direct relevance to the work of this Commission, they include "Strengthen the capacity of all countries, in particular developing countries, for early warning,

Box 5 *Targets contained within SDG3*

Target 3.1: By 2030, reduce the global maternal mortality ratio to less than 70 per 100 000 live births.

Target 3.2: By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1 000 live births and under-5 mortality to at least as low as 25 per 1 000 live births.

Target 3.3: By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, waterborne diseases and other communicable diseases.

Target 3.4: By 2030, reduce by one third premature mortality from noncommunicable diseases through prevention and treatment and promote mental health and well-being.

Target 3.5: Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol.

Target 3.6: By 2020, halve the number of global deaths and injuries from road traffic accidents.

Target 3.7: By 2030, ensure universal access to sexual and reproductive health care services, including for family planning, information and education and the integration of reproductive health into national strategies and programmes.

Target 3.8: Achieve universal health coverage, including financial risk protection, access to quality essential health care services and access to safe, effective, quality and affordable essential medicines and vaccines for all.

Target 3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

Target 3.a: Strengthen the implementation of the WHO Framework Convention on Tobacco Control in all countries, as appropriate.

Target 3.b: Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all.

Target 3.c: Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States.

Target 3.d: Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.

risk reduction and management of national and global health risks".

Health is also intrinsically linked to many of the other SDGs, such as SDG1 ("End poverty in all its forms everywhere") or SDG6 ("Ensure availability and sustainable management of water and sanitation for all"). The Institute for Health Metrics and Evaluation has developed a composite index of progress towards 41 indicators that capture key elements of the health-related targets in the SDGs (GBD 2017 SDG Collaborators, 2018), accompanied by an interactive data visualization tool that can be used to track progress at national level (https://vizhub.healthdata.org/sdg/). This shows that, while progress is being made, many countries will need to adopt policies that go beyond "business as usual".

In summary, the right to health is well established in international law and world leaders have committed to investing in health, and to achieving explicit targets by 2030.

Health and economic growth

Economic historians have long argued that health has been a major contributor to economic growth (Box 6). In a 1994 paper Fogel concluded that improvements in health and nutrition had accounted for about 30% of income growth in the United Kingdom between 1780 and 1980 (Fogel, 1994). In 2001 Arora undertook a similar study in 10 industrialized countries in the century following the latter part of the 1800s, reaching broadly similar conclusions (Arora, 2001). Around the same time, a number of other studies sought to explain more recent differences in the pace of economic growth in a larger sample of countries, both rich and poor (Barro, 1996; Bloom et al., 2001). Although there are a number of methodological challenges, most of these studies have obtained similar results, especially in low- and middle-income countries. There are a few contrary results in high-income countries, largely due to issues related to data and methods (Bleakley, 2010; Cervellati & Sunde, 2011). One study has also found that the introduction of public health systems in Europe between 1820 and 2010 was associated with subsequent increased economic growth, mediated through better health (Strittmatter &

Sunde, 2013), and a very recent study, which addressed the outstanding methodological challenges found a clear association between lower disease burden and economic growth (Rocco et al., 2021).

These academic studies reached the global policy mainstream in 2000 with the publication of the Commission on Macroeconomics and Health (World Health Organization, 2002). Focused on low- and middle-income countries, this concluded that poor health was acting as a brake on development and that relatively small investments in improving health would yield substantial economic benefits. However, its applicability to high-income countries was questioned. The ability to perform the physical work involved in agriculture and extractive industries may, it has been argued, be less relevant for the knowledge- and office-based economies of high-income countries, countries that had experienced dramatic reductions in the share of the workforce engaged in agriculture in the 1950s and in mining in the 1980s, as well as more recent large-scale mechanization. Other questions about the generalisability of research in low- and middle-income countries related to the scope for implementing the cheap but effective measures, such as vaccination and clean water, that were so important in those countries, but which had already been achieved in high-income countries, as well as the shift in the burden of disease to those at post-retirement ages, based on the widespread but misleading assumption that such people contributed little to the economy.

This question was addressed in a major study undertaken for the European Commission, published in 2006 (Suhrcke et al., 2006). It noted the existing evidence for a bidirectional relationship between health and economic development, and thus the potential for positive feedback, whereby investments in health and the economy would be mutually reinforcing. It also noted that, while there are many differences between living conditions in high- and low-income countries, even in some of the wealthiest countries there are communities where health indicators are similar to those in poor countries, with well-known studies comparing Glasgow in Scotland with India (Marmot, 2017) and parts of New York with Bangladesh (McCord & Freeman, 1990). It then identified four pathways by which health could contribute to economic growth. First, people in better health would be more productive, with research typically seeking to capture this by comparing hourly wages. Second, healthier people would be more likely to participate in the labour force, measured by hours worked each week, or by not exiting the labour force prematurely, for example, on grounds of ill health or early retirement. Third, those in better health and thus with prospects for a longer life, would be more likely to invest in their education, and thus their potential to contribute to growth. Finally, such people would be more likely to invest in capital for the future, for example in small and medium enterprises such as family businesses, that would bring them and society later rewards. The last two of these are supported by evidence that those living in disadvantaged circumstances who, based on their observations of those around them, believe that they have few prospects of living a long and healthy life, have time preferences that mitigate against investment in a future that they believe they are unlikely to see.

This study found evidence to support all these mechanisms. In the following paragraphs, only a few examples will be used to illustrate the general point. Turning first to productivity, a German study covering the period 1995 to 2005 found that increased satisfaction with one's health increased hourly wages of men and women (Jäckle & Himmler, 2010) while an earlier American study highlighted the importance of context. Poor health was associated with a reduction of 6.2% in total earnings, although African American males were more likely to drop out of the labour force or work fewer weeks while white males were more likely to remain in

Box 6 *The historical association between health and economic development*

In a 1996 study using data from approximately 100 countries, covering the period from 1960 to 1990, Barro found the most powerful predictors of subsequent economic growth to be lower initial GDP, better initial levels of health and education, low fertility, lower government consumption, the rule of law, terms of trade and low inflation. Life expectancy, the indicator of health used in the study, was found to have a larger effect than even education. Holding other factors constant, a rise in life expectancy from 50 to 70 years would raise the economic growth rate by 1.4 percentage points per year. Importantly, Barro found evidence of a positive feedback, whereby economic development encouraged further improvement in health. A more recent study by Bloom, Canning and Sevilla, with a similar number of countries and over the same period, but including additional variables came to a similar conclusion. It estimated that a 1-year improvement in life expectancy contributed an increase of 4% in GDP.

Source: Barro (1996) & Bloom, Canning & Sevilla (2001).

work but experience reductions in hourly wages (Luft, 1975). Mental ill health, although often less visible, can have particularly serious consequences over prolonged periods (Bartel & Taubman, 1986). However, in interpreting these studies, it is important to take account of context and, especially, the link between employment and health insurance coverage in the United States.

There is extensive evidence that people in poor health are less likely to be in the labour force. For example, in an Irish study, men with a chronic illness or disability that severely hampered their daily activities were 61% less likely to be in employment, with the corresponding figure of 52% for women, after controlling for age, education and marital status (Gannon & Nolan, 2003). However, an American study found considerable differences by race and gender (Chirikos & Nestel, 1985). Those experiencing a "health shock" in middle age are especially likely to leave the labour force (Hagan et al., 2009), with the impact increasing after the first year following the onset of illness. Other research has found that those in poor health are more likely to retire earlier, in one study by 1 to 3 years (Sammartino, 1987), although again this varies by gender. Men caring for a chronically ill wife were more likely to retire early while women caring for a chronically ill husband were more likely to remain in work (Sammartino, 1987).

The evidence that good health is associated with better educational outcomes is more limited and there are problems with the direction of causality and the potential for confounding. However, there is some longitudinal research that points to the importance of this relationship, such as an American study finding that adolescents in poor health are less likely to complete secondary education and enter higher education (Haas & Fosse, 2008). The fourth pathway, which considers the association between health and savings, is also dominated by literature from the United States, in particular looking at the role of ill health on bankruptcy (Himmelstein et al., 2005).

In summary, there is a substantial body of research showing that investment in health, as with education, knowledge and infrastructure, makes an important contribution to economic growth in countries at all levels of development.

Health and security

Thomas Hobbes argued that people gave up certain liberties so that their government would protect them "from the invasion of foreigners, and the injuries of one another … so that they may nourish themselves and live contentedly" (Hobbes, 2017). This argument can also be found, with some variations, in the works of John Locke (1967) and Jean-Jacque Rousseau (2003) who invoke the concept of a social contract between the governed and the governors.

There has been a recognition that infectious diseases, in particular, pose a threat to the ability of the state to function that may be as severe as the consequences of a military attack. Together, these considerations have given rise to the argument that the protection of health is justified as a matter of national security.

Health security is subject to many definitions and interpretations, but a summarized definition is "activities focused on preventing, detecting and responding to infectious disease threats of international concern to limit the socioeconomic impact of transborder disease" (World Health Organization, 2007).

Health and security have been increasingly connected in the policy space for the last 20-plus years. This began amid the broader "bonfire of the certainties" at the end of the Cold War and the increasing attention paid to non-traditional security threats (McInnes, 2015). In relation to health, this began with the reconceptualization of HIV/AIDS, whereby actors increasingly recognized the threat posed to governments and societies, beyond individuals, if there were high levels of HIV prevalence among militaries and security forces. This would mean the traditional security sector may be less able to defend borders or tackle civil unrest with a sick workforce (McInnes & Lee, 2006) and thus this could threaten state integrity and security. This began to be of concern to Western governments, and notably was raised to the highest level of security concern with UN Security Council Resolution 1308 (2000) which denoted HIV/AIDS a threat to international peace and security.

This opened the door for greater securitization of health, catalysed by the 9/11 attacks and heightened securitization of all sectors of society, and compounded by the SARS outbreak in 2003 which demonstrated the global vulnerability to emerging pathogens, and the impact that a virus in one part of the world can have on global populations and the global economy. In the early 2000s, it became apparent that globalization's

effect on reducing distance between geographically diverse parts of the globe was problematic for disease control, compounded by the very real perceived risk of bioterrorism in the American/global psyche (Rushton, 2011).

Yet, it important to remember that not all issues in health are conceptualized as health security concerns. Issues which have been securitized within the health space have common traits – they tend to inspire human dread (as with a new disease, or a disease appearing in a new location), demonstrate unfamiliar symptoms to clinicians or scientists, involve involuntary exposure and the impacts of the disease's spread generate societal and/or economic disruption (Enemark, 2007). Importantly, what has become apparent from the ways in which we have seen issues become securitized within the health sector is that the objectivity of the threat is less important than how someone with decision-making power presents the issue. Thus, according to securitization theory, any issue can be considered a security issue if it is presented as such and there is an audience, for example the public, willing to accept that a particular pathogen is causing a significant threat to their lives or livelihoods (Buzan et al., 1998).

Health security has been conceptualized at multiple levels of governance:

- Global Health Security refers to the risks posed by infectious disease across all global locations. This understanding conceptualizes that all countries around the world share mutual vulnerability to the risks posed, and therefore must respond collectively to any shared threat. In this way, all governments and the global community must work together to mitigate the transborder spread of disease in an effort to protect global populations and the global economic system from contagion. Such understanding began with SARS in the early 2000s, further propelled by H1N1 (2009) and Ebola in West Africa. This approach to global disease control, and the focus on "diseases know no borders" and our surveillance system "is only as good as its weakest link" as mantras have facilitated increased expenditure on health care systems, capacity-building for enhanced global surveillance, rapid response facilities and mechanisms to regulate population behaviour to prevent global spread.
- National Health Security is concerned with the risks posed by infectious disease to national populations, or more likely the national economy. Thus, instead of the referent object of the threat being the global community, in this understanding it is the nation state (Rushton, 2011). This appears in policy through border control protection and the use of national security forces to implement restrictions on risky communities, for example.
- Human or Individual Security reconceptualizes the location of the threat at the individual level. In this way it is highly linked to human rights understandings of health, but perceives that any health concern, whether an infectious disease outbreak or noncommunicable disease, for example, which impacts on an individual's security, could be conceived as a security concern. This opens the space for consideration of hunger, crime, social conflict, poverty and violence, all of which contribute to the concept of structural violence, whereby that who are most marginalized in society are most likely to experience individual insecurity (Tadjbakhsh & Chenoy, 2007). While it is easy to see the appeal of such an understanding of security in terms of equity, it is harder to get policy-makers to recognize this level of security, as recognizing that responding to health security needs at this level requires whole-scale changes across the broader social determinants of health than simply infectious disease control.

Health security is most clearly epitomized in global health policy within the IHR (2005), and associated policy tools such as the Joint External Evaluation (JEE) – and mirrored in normative efforts such as the Global Health Security Agenda (GHSA) an Obama administration health security coordination effort. Such efforts of the IHR seek to pursue a global health security approach to thinking about infectious disease control, but are continually challenged by state conceptions of health security at the national level (Gostin & Katz, 2016). For example, instead of a list of notifiable diseases, the IHR takes an all-risk approach to disease, whereby any potential pathogen could pose a potential concern to global health security, and thus WHO as epidemic coordinator should be made aware (Fidler & Gostin, 2006; Kamradt-Scott, 2011). Such an effort was introduced to try and increase routine reporting of disease, so as to avoid the challenges experienced during SARS of the failure to notify WHO early in the outbreak. To challenge national failure to report outbreaks, the IHR also permit non-state actors

to report disease outbreaks to WHO. Secondly, the IHR require states to implement efforts to prevent, detect and respond to health emergencies within their borders, explicitly making requests of sovereign decision-making within health systems. At the same time, it requires governments to think beyond national health security and to support states elsewhere in the world to improve their surveillance and response infrastructure, and to support them at a time of health crisis, something which many states have failed to undertake during COVID-19. Moreover, WHO, as the global health coordinator of health emergencies, can declare a PHEIC, which implies that the global need for awareness of a disease outbreak is more important that sovereign information sharing. Regardless, of these tensions between global and national health security, it is important to remember that the focus of the IHR remains on the balance between trade and public health "to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade" (World Health Organization, 2005).

As a policy pathway, securitization is particularly attractive to policy-makers. Securitizing a health issue, whether at a national or global level opens up a number of opportunities to the astute decision-maker. Firstly, it allows the issue to move from routine activity to an emergency footing – this allows a suspension of normal politics and for the introduction of extraordinary measures (such as the lockdowns and changes to society that we have seen during COVID-19). This can also include financial assistance, and importantly the move of a health issue from low politics to high politics – for discussion and decisions at cabinet level nationally, or at the United Nations Security Council (UNSC) at global level. This can allow for new governance arrangements, and a proximity of power and money that otherwise many not be available for the issue area. In effect, securitizing an issue gets things to happen, and opens up the coffers from beyond the ministry of health to defence ministries and central financing.

Yet health security is not without its criticisms, many of which have become increasingly evident during COVID-19.

- While global health security claims that we are all mutually at risk of the spread of an infectious disease outbreak, we know that exposure and vulnerability to emerging pathogens are neither global nor universal – and certain locations with weak health systems are more likely to be infected, and certain population groups are more likely to be exposed and suffer the more severe outcomes both in health and economically. Health security, as a policy area, has been designed and promoted by Western governments. The result of this is that there's a clear undertone that health security is designed to protect Western governments from the threat posed by outbreaks which appear in low- and middle-income settings with weak health systems, which might not be able to mitigate national or international disease transmission. While COVID-19 has shown that the development of a health system is not the only determining factor in how able a country is to be able to respond to a global pandemic, the structure of much policy assumes it is. This has clear post-colonial challenges within global health security, with an inside/outside dichotomy whereby the west is seen to be "secure" from the disease whereas the rest of the world is seen as of risk, linking into historical narratives of sanitation and disease (King, 2002).
- The approach to health security issues leads to a short-term parachute response from the global community. What we have seen in previous health emergencies has been global commitment to tackle an outbreak, for example Ebola or Zika, which leads to states, NGOs and international organizations deploying finance, clinical equipment and human resources to tackle the outbreak. Once the outbreak is over, these teams leave – and the root causes of health concerns are not addressed. This leads to a wholly unsustainable approach to global disease control. In recent years, there has been an increasing connection made between global health security and universal health coverage. The argument suggests that strong health systems and equitable, affordable access to quality health care is the bedrock of being able to detect and respond to any health emergency (Wenham et al., 2019). While this has been brought into question by COVID-19, where even health systems with robust UHC have been brought to the verge of collapse, the majority of global health security response activity remains in the short term, rather than working on health interventions which could meaningfully provide more sustainable health security to a population in the long term.
- Securitized health policies can lead to the distortion of health systems. Connected to the short-termism

that characterizes many responses to health emergencies, when a securitized policy pathway is implemented to respond to an outbreak, it appears that this becomes the only priority within the health sector, to the detriment of other conditions. As has become ever apparent during the COVID-19 pandemic, the focus on COVID-19 and the manner in which COVID-19 patients took over hospitals, as well as mechanisms for social distancing and disease mitigation, had a direct effect on other areas of health. Cancer waiting lists increased, public health screening reduced or ceased, outpatient care diverted to telephone or online appointments, where they continued, and maternity and sexual and reproductive health services significantly reduced. These all have knock-on effects on patient outcomes for other conditions and raise significant ethical questions for prioritization within health systems, a question which is often only identified retrospectively.

- Securitizing health facilitates the encroachment of military and security sectors into health activities. Given "security" issues are usually mandated to the armed forces and police sectors, upon securitization it is routine to see such involvement. During COVID-19 this has included military research for vaccines, military-enforced quarantines, police-enforced social distancing and even military absorption of clinical activities in responding to the pandemic. While in some parts of the world the involvement of the military in health may be routine, and the military may well have greater resources than health units to be able to respond in a crisis, this is not a panacea. In other parts of the world, the security forces remain as combatants, and their involvement in health delivery may lead to hesitancy of some communities to utilize health services, which could in turn be detrimental to health security. Moreover, there are also connections between the securitization of health and the increased attacks of health care workers, such as the attacks on polio workers and the arson attacks on Ebola Treatment Units in the Democratic Republic of the Congo.

A fundamental fault line with health security is the tension between the levels of analysis, and in particular between the global and national. In a globalized world, the most efficient mechanism to manage transnational health security concerns is at the global level (with an actor such as WHO managing the global response). This would allow for coordinated response activities which do not cause transborder spread and would ensure consistent global policy. However, security policy is dominated by state decision-making – thus the securitization of health tends to favour state protection of the security of the global population. This is in tension, and leads to failed securitized responses at the global level. This is most apparent in COVID-19 whereby governments have, in many instances, ignored the advice of WHO and pursued national policies focused on national control of the epidemic rather than coordinated activity. This has ultimately been seen to be flawed, as most countries have experienced second (and third, fourth) waves linked to the reintroduction of cases linked to travel. The pandemic will not be over within nation states until it is over globally.

In summary, threats to health are now well recognized as threats to national and international security. In this respect, many of the arguments used to justify, for example, spending on defence are equally applicable. This is especially relevant to investment in preparedness. However, of all the arguments for investment in health, this is potentially the most problematic, for a number of reasons set out above.

Health and solidarity

The final argument for investing in health stems from the recognition that, in several countries, an increasing number of people are being left behind by economic and social progress and are turning away from the social solidarity that underpins the European social model. This is not new; although many other factors played a part, austerity measures implemented by the Weimar Republic were associated with geographical differences in increasing support for the National Socialist Party in the late 1920s and early 1930s (Galofré-Vilà et al., 2021). More recently, parts of the United States experiencing worsening health, and especially what have been termed the "diseases of despair" (deaths from suicide, drug overdoses etc.), were more likely to shift from supporting the Democrats to voting for Donald Trump in the 2016 presidential election (Bor, 2017). A similar picture was seen in the United Kingdom's referendum on EU membership the same year. Areas that had experienced higher drug-related deaths and suicides were significantly more likely to vote for Brexit (Koltai et al., 2020). Finally, an analysis using data from the

European Social Survey, covering the period 2002–2020 found that voters reporting poor health were significantly more likely to vote for populist right-wing parties, with the effect even greater than that associated with income and self-reported economic insecurity (Kavanagh et al., 2021).

These findings are important for many reasons, mainly political, but for the present purposes it is especially important to note the evidence that political parties of the populist radical right are associated with policies that deprioritize health, preferring to spend money on, for example, criminal justice (Falkenbach & Greer, 2018), which can exacerbate the situation in many countries where police and prisons pick up many of the pieces resulting from failures in the health system. They also tend to follow exclusionary policies, with consequences for groups already vulnerable, while doing little to improve the health of those whose support they seek. Consequently, there is a danger that worsening health can lead to a downward spiral mediated by support for policies that are themselves damaging to the overall health of society.

A duty to protect?

The preceding sections make a case, on several grounds, for investing in health. What can or should be done if these arguments are unheeded? Arguably, this is a matter for individual governments. Politicians must make difficult choices about how to spend their often limited resources. However, as the pandemic has reminded us, a failure by one country to invest in health, and in particular the resources necessary to suppress a pandemic, has profound implications for others.

The international community developed many agreements with implications for health. Examples include the Paris Agreement on Climate Change, the UN Convention on the Rights of the Child, the Ottawa Treaty banning landmines, the Framework Convention on Tobacco Control and, as described above, the IHR among others. They differ in their legal mandates, the extent to which they include goals and obligations, the number of countries that have signed up to them, mechanisms for monitoring implementation and the extent to which they can be enforced. Their operation also depends, to varying degrees, on features of the state that has ratified them. Thus, the extent to which citizens of a country can seek remedies based on treaties will depend, for example, on whether that country has acceded to the Vienna Convention on the Laws of Treaties, on whether the state adopts a monist approach, whereby international law has direct effect, in some cases, overriding domestic legislation or a dualist approach, whereby treaties must be translated into domestic legislation (Carver, 2010). There are also a number of regional structures, such as the EU, the Eurasian Economic Union, MERCOSUR, the Association of Southeast Asian Nations (ASEAN), the African Union and others, as well as bodies with historical connections, such as the Commonwealth, some of which have a significant role in health policy. Finally, there are numerous intergovernmental agreements.

At the risk of generalization, these instruments have had greater force in some areas than others. Some of those with the strongest mechanisms for enforcement include security (e.g. the Nuclear Non-Proliferation Treaty and the Chemical Weapons Convention, with their inspectorates) and trade/the economy (the World Trade Organization, with Disputes Settlement procedures). Those with a primary focus on health tend to have much weaker provisions. For example, it has been noted that international law contains stronger provisions against counterfeit banknotes than counterfeit medicines (Attaran et al., 2012), even if, as noted above, this is changing, exemplified by the IHR (2005). Previously, reporting of outbreaks was the prerogative of the national government. It was difficult for WHO to act where that government denied the presence of an outbreak, with several well-known examples of where this happened. The new Regulations enable WHO to draw on other sources of disease notification and, where necessary, to name and shame governments in denial.

For the present purposes, the important point is that there is an extensive range of international instruments that have implications for health and there are many areas where governments have, to greater or lesser extent, surrendered a degree of sovereignty. In most cases, governments consent to provisions in international agreements. However, where they do not, there is the potential of sanctions. Conventionally, these can be imposed for several purposes:

- those designed to force cooperation with international law, such as the sanctions on Iraq in Resolution 661 after the invasion of Kuwait, an act that violated the sovereignty of Kuwait;

- those designed to contain a threat to peace within a geographical boundary, such as the Iran nuclear deal;
- those that condemn a specific action or policy of a government, as with those following Rhodesia's Unilateral Declaration of Independence in 1965.

These examples illustrate how the international community is willing to act, but primarily where there is a threat to security in military terms. Thus, the case for concerted action in the face of nuclear proliferation is easy to make (leaving aside the many anomalies including the rights of the original nuclear states). The same arguments apply, although arguably even more so, to the Biological Weapons Convention. However, in a post-pandemic world, there is at least an argument that there should be some mechanism for collective action in the situation where a government pursues policies that encourage the spread of a pandemic disease, placing not just residents of that country but also its neighbours at risk. A further question is whether the international community should act in situations where a government adopts policies that pose a grave risk to its own population. These issues are examined further in Chapters 9 and 11.

Summary

There are several reasons why governments should invest in the health of their population and others. The first is that health is a fundamental human right and the world's governments have committed to securing and promoting it, most recently in the SDGs. A second is that there is now strong evidence that investing in health, as with education, knowledge and infrastructure, promotes economic growth. A third is that health is a key element of national and international security. The fourth is that health is part of the social contract between governments and their people, underpinning the solidarity on which the modern welfare state is based, and which is necessary for trust in democratic institutions. However, despite these arguments, it is clear that not all governments accept them. This poses a conundrum for the international community. Their failure to act to safeguard health is a threat not only to their own people, but to others and it is one where the international community has yet to find a solution.

This is something that we return to later chapters. For now, however, it is important to understand the changing determinants of health and the influences on them, both positive and negative, drawing lessons from the current pandemic. This we do in the next chapter.

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Chapter 4

Present and future threats to health

Martin McKee, May van Schalkwyk, Victoria Kirkby

Introduction

The origins of this Commission lie in the COVID-19 pandemic. Thus, it is understandable that attention continues to be focused on ways of exiting the COVID-19 pandemic, on measures to recover from its many consequences, and on ensuring that the world is better prepared for a similar event in the future. However, while the risk of a pandemic has been high on the list of global risks for several decades, it is not the only threat to global health and the economy. Indeed, the range of threats is potentially almost infinite.

One of the clearest lessons from the current pandemic is the need to improve our ability to anticipate future threats to health. Given the many threats outlined above and their interconnectedness, a first step in developing this ability is to create a framework for analysis, which is the purpose of this chapter. First, however, we reflect on one of the greatest challenges facing humanity, the relationship with the planet we share with so many other species.

A fragile planet

It is salutary to recall that, in cosmic terms, our very existence is both serendipitous and fragile. Earth is the only one of the eight planets in our solar system that can sustain life. It inhabits what has been described as the Goldilocks Zone, not too hot and not too cold for water to remain liquid (Lineweaver et al., 2004). Remarkably, from its beginnings as a barren rock with pools of liquid water, it has evolved into a self-sustaining system in which different organisms interact to make life possible. This life exists within a shallow layer, stretching approximately 20 kilometres above and below sea level. Within the biosphere, animals convert atmospheric oxygen into carbon dioxide; plants, using energy derived from sunlight, reverse this reaction. Meanwhile, long-established weather patterns, driven by the rotation of the Earth and by temperature differences, allow the water that is essential for life to circulate, flowing from the land into the oceans from where it evaporates to fall as rain in the mountains. From time to time, these patterns have been disrupted. The impact of an asteroid in the Yucatan Peninsula 65 million years ago led to the extinction of the dinosaurs and the ascent of mammals, eventually including the hominids from which *homo sapiens* would evolve. It is believed that changes in rainfall associated with the geological changes that gave rise to the Great Rift Valley in Africa contributed to the emergence of modern humans. The ending of the Ice Age in Europe ushered in the migration of Neolithic farmers from the Middle East. More recently the El Niño phenomenon in the Pacific Ocean has been linked to outbreaks of cholera in Bangladesh and malaria in southern Asia and South America (Kovats et al., 2003).

As one small rock in an infinite universe, the Earth will always be vulnerable to cosmic events, such as asteroid collisions and geomagnetic storms, and, as in the past, life on Earth will continue to be no more than a passive observer of such events should they occur. This is not, however, the case for many other threats, where humanity now has the power to change the world, for better or worse, taking the world into what has been termed the Anthropocene Era. Given the risks of positive feedback with some of these changes, such as rising CO_2 levels, the long-term survival of the human race cannot be taken for granted.

The impact of humanity on a global environment is a function of both growth in the numbers of people and in the things that they do. In 1800, the world's population was estimated to be about 1 billion. By 1930 it had doubled to 2 billion and doubled again, to 4 billion, by 1974. Current projections estimate that it will stabilize at between 9 and 11 billion by the end of the 21st century, up from the current 8 billion. This growth has been accompanied by remarkable increases in standards of living, driven by numerous technological

advances. However, these advances have come at a cost. They have involved depletion of the Earth's natural resources; in particular, petrochemicals created over millions of years during the Carboniferous period, with the resultant release of vast quantities of greenhouse gases and, especially, carbon dioxide. At the same time, the Earth's capacity to reabsorb the carbon dioxide, to a substantial degree dependent on tropical rainforests, is diminishing as those rainforests are destroyed to increase agricultural produce. The resulting global heating is melting polar ice sheets, reducing the amount of solar radiation reflected back into space, increasing the risk of forest fires and, through melting permafrost, releasing methane, an even more potent greenhouse gas, into the atmosphere.

The impact of increased use of resources by a growing population has created a situation in which an estimated 75% of ice-free land on Earth has been changed by human activity, as has an estimated 41% of the Earth's oceans (Ellis & Ramankutty, 2008). There have been similar changes in the animal and plant kingdoms. The vast majority of mammals on Earth are now domesticated, while artificial selection and controlled reproduction of crops have transformed the world's plant life. It is not just the natural environment that has changed. The built environment has been transformed, with more than half of the world's population now living in urban areas, which now account for an estimated 70% of global CO_2 emissions. The large-scale engineering that this involves is influencing climate, animals (creating new environmental niches that are rapidly filled, for example, by urban foxes) and social interactions among humans.

These changes bring opportunities and threats. However, if the international community is to prepare for potential future threats it must first anticipate and understand them. It must make decisions about what to prepare for, and how, using many different criteria. Inevitably, this will include estimates of the probability of something happening coupled with its impact if it does. But it must also include considerations such as timescales and the potential to prepare. We can already say with confidence that in approximately 5 billion years the sun will become a Red Giant and engulf the Earth. Even though this is a certainty, there seems little point in investing resources now.

An obvious complication is that many of the threats are interconnected. Although there have always been examples of events having consequences at a distance – for example, the European adoption of gunpowder and paper invented in China, leading ultimately to the cannons that rendered the walls of city states obsolete and the medium for the transmission of ideas that shaped the Reformation – the situation now is very different. It is characterized by the rapid high-volume movement of goods, money, ideas and, at least for some, people across the world. Many aspects of this process of globalization are good. International trade allows producers to send goods to market in another continent where buyers can benefit from them. Knowledge, such as the genetic sequence of the SARS-CoV-2 virus, is available to researchers anywhere in the world within seconds of it being decoded. Yet the mechanisms that allow these benefits to accrue are not always so benevolent. They enable not only trade in goods but in "bads". Trade liberalization policies do not distinguish between food that is highly nutritious and that which is, as described by a now widely used term, junk food (energy-dense, nutrient-poor) (Stuckler et al., 2012). A ship transiting the Suez or Panama canals may have containers full of essential medicines or cigarettes. The information transmitted via the Internet includes both crucial scientific research and child pornography. In many cases, this increased movement reinforces existing power imbalances and, while the benefits are reaped by one party to the transaction, the costs are borne by society as a whole.

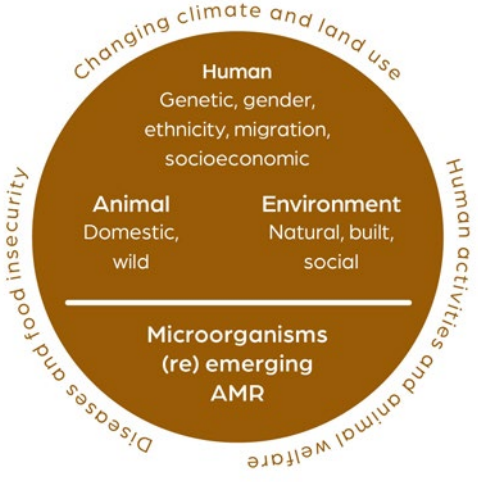
This interconnectedness also means that a problem beginning in one country can rapidly affect its neighbours and, beyond that, the whole world. In these cases, solutions must also be developed and implemented at an international level. In these circumstances, concepts of national sovereignty rooted in 17th-century Europe are no longer appropriate. This principle has long been recognized. An example is the need to share water, without which many parts of the world would be uninhabitable. There have been treaties to govern the use of water in the Nile since at least 1902 (A bebe, 1995). Yet, even if the need to address this issue is recognized, the many failures, such as the shrinkage of the Aral Sea in central Asia following the diversion of water resources to grow cotton, and similar changes in Lake Chad, in western Africa, remind us that knowledge does not always translate into action.

Creating a framework for the threats to health

In seeking to make sense of the range of current and future threats to health, and in particular their interconnectedness, we draw on three bodies of scholarship, the biosphere and One Health, global catastrophic risks and the broader determinants of health.

We began with the origins of the pandemic, with SARS-CoV-2 jumping from animals to humans. Humans, animals and the natural environment they inhabit comprise the biosphere (Figure 2). The health issues emerging at the interface between them is termed One Health. The interactions between these three domains will influence the risk of many diseases, especially those due to infectious agents. Thus, changes in behaviour, for example, entry by loggers or hunters into forested environments previously devoid of human habitation, may enable a microorganism to spread from animals to humans. This is especially likely where humans have contact with species that are normally undomesticated. Such events have happened throughout history, with some once common human infections, such as measles, jumping species when the first animals were domesticated in the Neolithic period (Pearce-Duvet, 2006).

Figure 2 *The biosphere*



AMR, antimicrobial resistance. *Source:* Authors' compilation.

The second body of scholarship relates to global catastrophic risks, events that have the potential to damage health worldwide, including some that are existential, and that they could lead to the destruction of civilisation as we know it, or even to life on the planet (Box 7).

By their nature, these risks are difficult to predict and, in some cases, as with a large asteroid impact, there is little or nothing that could be done to prevent them. The annual World Economic Forum survey of global risks provides an attempt to prioritize these risks. Based on a consultation with global stakeholders, it examines uncertain events or conditions that, if they occur, can cause significant negative impact for several countries or industries within the next 10 years. In undertaking this exercise, respondents are asked about the likelihood of an event occurring and the scale of its impact. Risks are categorized as economic, environmental, geopolitical, societal and technological. In 2006, its Global Risks Report highlighted the risk of a "lethal flu", whose global spread would be facilitated by the growing volume of international travel and by inadequate surveillance systems. The following year it identified the potential for the impact of such an event to be exacerbated by disinformation, or, as it put it, "infodemics". More recent reports have highlighted the threat from AMR (2013), Ebola (2016) and overstretched health systems (2020). However, assessed by potential impact, infectious diseases only featured once in the top five risks between 2012 and 2020, in 2015. Financial crises occupied the leading position between 2012 and 2014, while weapons of mass destruction led between 2017 and 2019.

The top risks identified in the 2021 Global Risks Report are shown in Figure 3 (World Economic Forum, 2021). Both in terms of likelihood and impact, these are dominated by environmental risks, with extreme weather events most likely, a ranking justified by events

Box 7 *Global catastrophic risks*

Anthropogenic risks

Environmental
Global warming, including conditions incompatible with life
Environmental (especially soil and water) degradation
Loss of biodiversity, including pollinators
Crop failures
Ozone depletion

Technological
Hostile artificial intelligence
Destructive biotechnology and nanotechnology

Governance
Nuclear war
Bioterrorism
Cyberterrorism

External risks
Asteroid impact
Volcanic eruptions
Gamma ray burst
Geomagnetic storm

Source: Compiled from Ripple et al. (2017) and Bostrom (2002).

Figure 3 *Top risks identified in the 2021 Global Risks Report*

Position	Top risks by likelihood	Top risks by impact
1	Extreme weather	Infectious diseases
2	Climate action failure	Climate action failure
3	Human and environmental damage	Weapons of mass destruction
4	Infectious diseases	Biodiversity loss
5	Biodiversity loss	Natural resource crises
6	Digital power concentration	Human environmental damage
7	Digital inequality	Livelihood crises

Environmental | Geopolitical | Societal | Technological

Note: "Livelihood crises" refers to structural deterioration of work prospects an d/or standards for the working-age population: unemployment, underemployment, lower wages, fragile contracts, erosion of worker rights, etc.

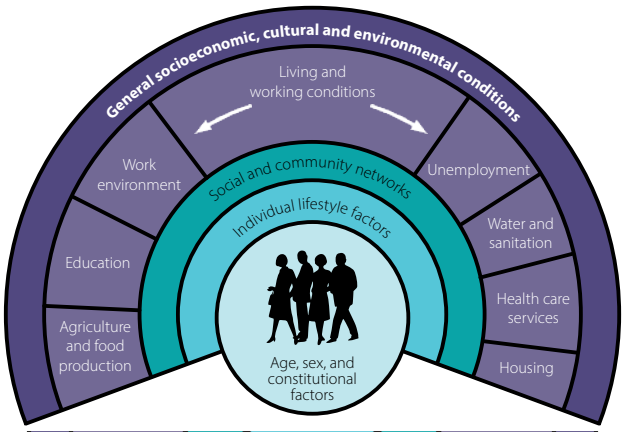
Source: World Economic Forum (2021).

in many parts of the world in the northern hemisphere summer of 2021, and infectious diseases ranked as having the greatest impact, no doubt influenced by the experience of the pandemic.

A more detailed analysis looks at the plausible timescale for the various risks identified in the report. The top five risks in the short term (0–2 years) are infectious diseases, livelihood crises, extreme weather events, cybersecurity failure and digital inequality. Medium term risks (3–5 years) are an asset bubble burst, IT infrastructure breakdown, price instability, commodity shops and debt crises. Finally, the longer-term (5–10 years) risks include weapons of mass destruction, state collapse, biodiversity loss, adverse technological advances and natural resource crises.

A third contribution comes from the evolving work by WHO on the prerequisites for health, beginning with the 1986 Ottawa Charter and restated and developed at many subsequent conferences, as well as the literature on the determinants of health, both positive and negative, with the latter having expanded in recent decades from the physiological and pathological determinants, including the role of microorganisms, to include the social, political, environmental and commercial determinants.

Figure 4 *The broader determinants of health*



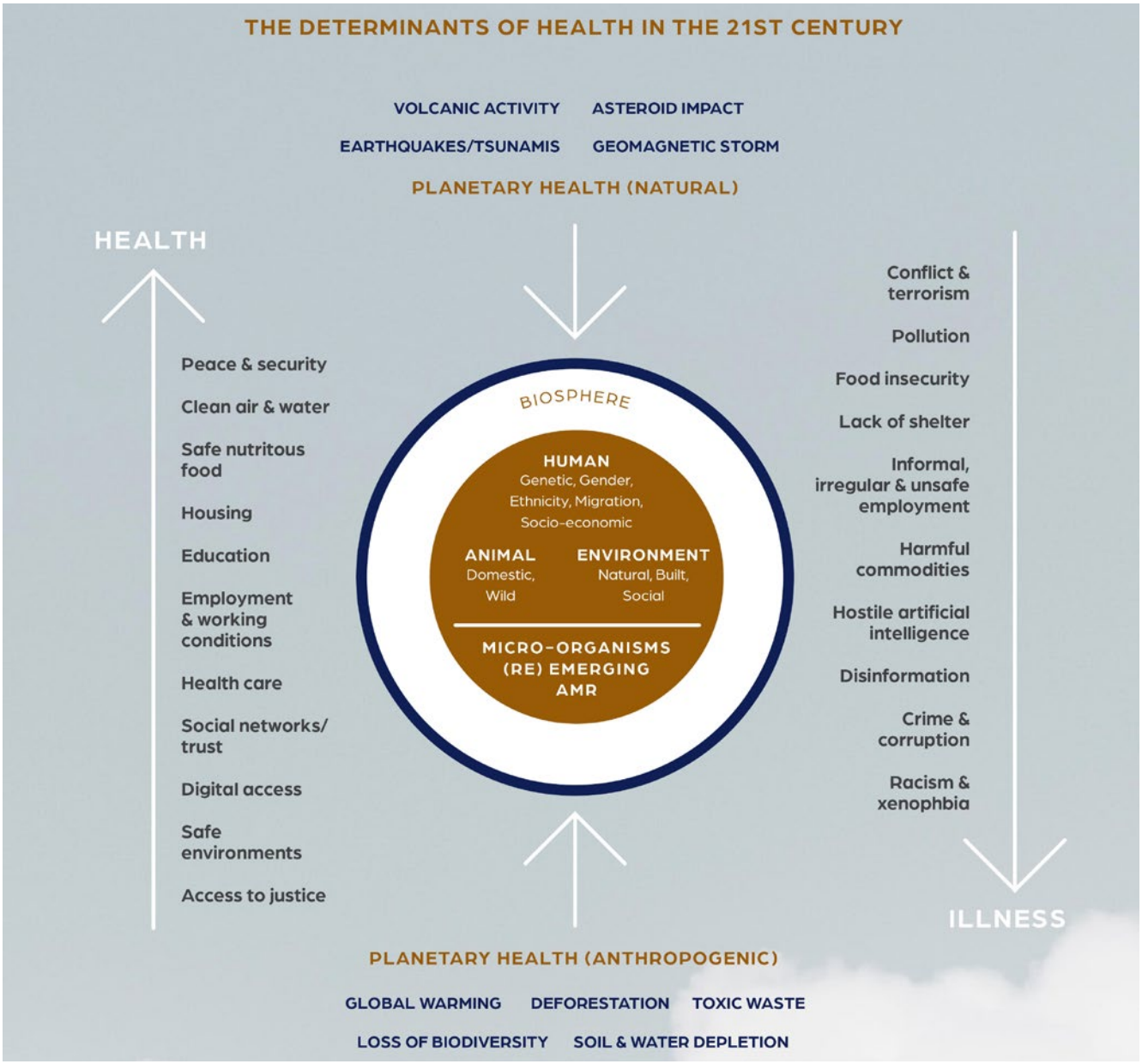
Source: Whitehead & Dahlgren (2006).

Perhaps the best representation of these interlinked factors is that portrayed in a classic diagram developed by Whitehead and Dahlgren (2006) (Figure 4). This places individuals at the centre, with their health impacted by their key characteristics, such as age, gender and genetic composition. Their health is also influenced by lifestyle factors, which in turn are influenced by social and community influences, and then by living and working conditions and, ultimately, by the wider socioeconomic, cultural and environmental conditions.

We have used these insights to generate a framework that captures what we believe are many of the most important issues that must be considered by anyone seeking to prepare for future threats to health. It cannot hope to be exhaustive; rather, the different topics included should be seen as illustrative of the things that ought to be taken into account.

As in that by Whitehead & Dahlgren (2006), our framework places the health of individuals at its centre but goes beyond that to recognize the importance of interactions between humans, animals and the natural environment in the biosphere (Figure 5). These three groups, individually and collectively, act upon and are acted on by a range of other factors. Those on the left side include those that have traditionally been considered the prerequisites for health, such as peace, food and shelter, as well as newer ones, such as access to the Internet and to justice. Those on the right recognize that some human actions, either by their primary purpose or incidentally,

Figure 5 *Integrative framework for assessing health threats (IF-HT)*



AMR, antimicrobial resistance

Source: Authors' compilation.

harm health. Again they include traditional ones, such as the manufacture and trade in harmful communities, with tobacco the best known example, but also new ones, such as disinformation and hostile artificial intelligence. Finally, health is threatened at the planetary level, either by natural events that lie outside human control, or by anthropogenic forces, such as greenhouse gas emissions or deforestation, many leading back to the loss of biodiversity, which itself has damaging consequences for the health of humans, animals and the environment.

Using the framework

The purpose of the framework shown in Figure 5 is to provide a basis for anticipating and responding to threats to health in the future. By placing the biosphere at its centre, it emphasizes the importance of a system of health governance, from local through to global levels, that brings together those involved in the health of humans, animals and the natural environment that they share. In reality, this is the exception rather than the rule. This is not the place to set out how this should be done, but rather to stress the importance of doing it.

The experience of the pandemic has highlighted the importance of the perquisites for health listed in the

left-hand side of Figure 5. Those individuals and communities who lack the prerequisites for health have been the most vulnerable. Although, in theory, testing for the presence of SARS-CoV-2 may have been available to them, in practice, it was often inaccessible because of the choice they had to make between taking time off work, and thus losing income or getting tested. They faced similar obstacles should they be found to be infected or be a contact of someone who was and then needed to isolate. Often, they lived in multigenerational houses that created the conditions for the rapid spread of infection. In a world where information is increasingly online, whether in relation to access to testing or health care or to education, they find themselves cut off. Consequently, a comprehensive assessment of future threats to health cannot ignore the importance of these prerequisites for health, and especially the extent to which there are pockets within society that lack them and thus undermine the resilience of the entire population.

Meanwhile, those topics on the right-hand side of the figure represent things that exacerbate the impact of a crisis. They include policies that increase the precariousness of groups within the population, disinformation that undermines public health messaging, and crime, such as the corruption surrounding purchases of PPE. Again, these are topics that must be taken into account in preparing for a future crisis.

Finally, there are those threats to the planet, some of which are unavoidable, such as an asteroid collision, and those where humanity has some degree of control, such as deforestation and global heating. These in turn feed back to their impact on the biosphere, most notably by virtue of their influence on biodiversity.

It is a cliché to say that generals are always fighting the last war. At a time when our attention is focused on the conditions that gave rise to the COVID-19 pandemic, it would be reasonable to concentrate our efforts against future threats on the conditions that gave rise to this one. This would involve measures that address the interactions between humans and animals in food production and distribution, and the growth of global travel that allowed the infection to spread. However, it would be too easy to overlook the policies that created the conditions for the infection to take hold in disadvantaged and marginalized communities. Crucially, these conditions also render societies vulnerable to many other threats. Poor quality, overcrowded housing creates vulnerability to both pandemics and earthquakes. For these reasons, despite the great temptation to focus on the immediate causes of the pandemic, it is important to take a holistic approach to population health. This we now do in the following sections.

Table 3 *Prerequisites for health*

• Peace
• Shelter
• Education
• Food
• Income
• A stable ecosystem
• Sustainable resources
• Social justice and equity

Source: The Ottawa Charter

Prerequisites for health

One of the most important lessons to emerge from the pandemic has been the importance of health and security of populations. An effective response to COVID-19 requires people to take certain actions, such as to get tested when they feel unwell or isolate when they have been diagnosed with the infection. Yet, many people find this difficult. They lead precarious lives, working in the informal economy and are just about coping. If they take time off to get tested or to isolate, they risk losing their jobs, their income or even their housing. They may also face difficulties in obtaining the basic information about how they should respond; for example, by virtue of their exclusion from the increasingly important digital resources that convey such information. The information that they do obtain may be misleading to the extent that it undermines the response to the pandemic. For all of these reasons, those who lack the prerequisites for health are multiply disadvantaged. They are at greater risk of contracting infections and of transmitting them to their friends and families, and when they do become ill they are at greater risk of dying. However, they are also more likely to suffer harm from the effects of the necessary responses to the pandemic. They are more likely to be employed in public-facing roles, less likely to be able to work from home, and have fewer resources to support their families, for example, in remote education of their children.

The traditional prerequisites have been set out repeatedly in a series of statements at international

conferences. Thus, the 1986 Ottawa Charter on health promotion listed eight prerequisites (Table 3). All of these prerequisites can interact, in different ways, with the interrelationship between human, animal and environmental health, and their complex relationships with microorganisms. For example, those who are homeless or living in substandard accommodation are at increased risk of many infectious diseases, including the classic disease of poverty, tuberculosis. Ongoing conflicts pose a threat to responses to outbreaks of infectious disease, including COVID-19 (Gugushvili & McKee, 2021).

Peace

Even though the threat of conflict on the scale of the World Wars that ravaged Europe in the 20th century has receded, it is unfortunately the case that, even now, the use of armed force on a smaller scale has continued in parts of the region up to the present.

Conflicts provide many opportunities for the emergence and spread of infectious disease (Connolly & Heymann, 2002). These include new forms of exposure to sources of infection and breakdown of existing disease control programmes, with contemporary examples including cholera in Yemen (Federspiel & Ali, 2018) and tuberculosis in Syria (Abbara et al., 2020).

There are also a number of so-called frozen conflicts, where active conflict has been brought to an end, but no peace treaty or other political framework has been agreed, so that the risk of hostilities remain, with consequences for the ability to mount effective responses to the pandemic (Gugushvili & McKee, 2021). Moreover, Europe has experienced the consequences of conflict beyond its borders, in the Middle East and northern Africa, for several decades as those displaced by war have migrated, often at great risk to their lives, to the relative safety of Europe. In addition, there is the ever-present threat of cataclysmic nuclear conflict, especially where such weapons are held by countries that are not subject to the provisions of the Nuclear Non-proliferation Treaty.

While the complex factors that give rise to conflict within and among states fall within the responsibilities of ministries other than health, the experiences of the resulting violence serve as a reminder that, as is so often the case, the health system must pick up the pieces of failure in other sectors. Consequently, the ever-present risk of conflict and the political and other conditions that give rise to it must be considered when seeking to anticipate future threats to health.

Air, water, food and shelter

One of the more unexpected observations during the current pandemic has been the apparent association between air pollution and the incidence and severity of COVID-19, although similar associations have previously been described for other respiratory viral infections. A recent review identified a number of mechanisms, including ways by which exposure to NO_2, ozone, and particulate matter can affect different stages of the viral life-cycle, including the ability to clear the virus from the upper respiratory tract, changes to viral receptors, changes to the innate immune system, and promotion of spread of the virus through the body (Woodby et al., 2021).

The importance of clean water supplies for basic hygiene is self-evident. However, even now, there are parts of the pan-European region where the security and quality of water supply is inadequate (Roberts et al., 2012). This creates the conditions for spread of infectious diseases.

Inadequate nutrition is also recognized to be associated with susceptibility to infectious diseases. Food insecurity has increased in a number of European countries since the global financial crisis, exemplified by the rise in use of food banks in some of them (Loopstra et al., 2015b). By 2013, an estimated 11% of the population of the then 27 EU Member States was experiencing food insecurity (Loopstra et al., 2015a). This is closely associated with economic hardship and can largely be avoided by provision of adequate social protection programmes (Loopstra et al., 2016). The current pandemic has impacted on food security in both the demand and the supply sides. Falling incomes, especially for those without access to government protection schemes, have reduced the amount of money that some families have to spend on food. At the same time, disruption to food production and distribution has reduced the amount of food available in shops. The impact of these two factors can be seen from a study in the United Kingdom that has the number of people reporting difficulty accessing affordable and nutritious food, with the impact falling greatest on those whose incomes are lowest (Koltai et al., 2021).

As with food, many people in Europe experience housing insecurity. Importantly, data on the number of homeless people greatly underestimate the scale of

what is a dynamic situation with many people moving in and out of homelessness on a regular basis, using shelters, couch surfing, and other coping mechanisms. Housing insecurity, as indicated by mortgage and rent arrears, for example, is associated with worse physical and mental health (Clair et al., 2016). However, poor quality overcrowded housing creates perfect conditions for the spread of infectious diseases, especially in homes occupied by multiple generations, in which younger people going to work or school infect their elderly relatives (Nafilyan et al., 2021). Both food and housing insecurity are linked to employment conditions, as those who spend a high proportion of their income on these necessities and whose employment is irregular face major difficulties if they are required to isolate as a result of coming into contact with someone who is contagious.

Although access to clean air and water, to safe and nutritious food, and to shelter might be thought of as basic rights, the reality is that many people in all parts of Europe lack of them. This renders them vulnerable to many different threats to their health, including not just pandemics but also extreme weather events, earthquakes and economic crises. A comprehensive approach to future health threats cannot ignore these essential contributors to population resilience.

Education

Often, epidemiologists adjust for differences in education when seeking to explain health. In effect, they do not see it as a modifiable determinant of health. This is understandable because most people complete their formal education within or just after their first two decades of life. However, this ignores the importance of lifelong learning, something that will be increasingly important with the accelerating pace of technological change.

Education has proven to be an important determinant of how well people have coped during the pandemic. Education is a pathway to greater security of income and employment and there is now an extensive body of research from life-course epidemiology demonstrating how better education improves life chances and enhances security of income and employment. This is especially the case for early years education, as demonstrated in the United States' Head Start programme, launched in 1965. Children who participated in this programme showed stronger academic performance, were more likely to complete tertiary education and were less likely to commit crime or suffer from poor health (Deming, 2009). There is an extensive body of research showing a link between education and health, including data from across European countries (Gumà et al., 2019), although the magnitude of the educational gradient varies (Mackenbach et al., 2008). Other relevant findings come from a large multicountry study of over 140 000 people that has shown how the cumulative effect of low levels of education and of lower levels of wealth, the latter in part a consequence of the former, is associated with substantial differences in a measure of health ageing at the age of 70 (Wu et al., 2020). Another study, from England, found that better education was strongly associated with a larger number of years of being sufficiently healthy to work after the age of 50 (Parker et al., 2020).

Unfortunately, as described in Chapter 2, children's education has been impacted severely in the pandemic. This will require a major effort to support those affected to catch up. Failure to do so will have consequences that will ripple through society for decades.

Employment and working conditions

The association between unemployment and ill health is well established. Those who lack jobs are likely also to lack the resources necessary to cope in a crisis. However, in recent decades, there has been growing recognition of the situation faced by those people who experience informal employment and in-work poverty. Of course, there are many people who do work part time, on contracts, out of choice. However, there are many that do not have a choice. A study in France found that those working in the gig economy during the pandemic experienced a 20 percentage points greater decrease in income than other workers (Apouey et al., 2020). They were also more likely to have continued to work outside the home, placing them at greater risk of infection.

Certain types of employment may also place people at greater risk during a crisis, such as a pandemic. There have been numerous accounts of superspreading events associated with certain types of employment, typically where people have to work for long periods of time in crowded and poorly ventilated facilities, such as food production plants (Ramos et al., 2020). The workforce in such facilities is often dominated by groups who are already disadvantaged, including migrant workers.

Health care

As with food and housing, the association between health care and the many threats to health is bi-directional. A lack of health care, and particularly inadequate treatment of chronic conditions, leaves people vulnerable to the effects of the crisis. For example, it rapidly became clear that those with conditions such as diabetes were at greater risk of developing severe disease, being hospitalized, and dying from COVID-19 (Barron et al., 2020). However, it is not just the risk from infectious disease. Those who lack adequate access to health care are a greater risk of permanent disability; for example, amputations as a consequence of diabetes or strokes as a consequence of uncontrolled hypertension. Such individuals are obviously at greater risk in the event of a natural disaster, such as an earthquake, or a disaster of human origan, such as conflict.

A crisis can also impact adversely on access to health care and supplies of life-saving medicines. For example, one prominent feature of the post-Soviet economic and political crisis in the 1990s was a steep increase in death rates from diabetes (Telishevka et al., 2001). It is often forgotten that many people living in areas affected by natural disasters and conflict now are living with conditions that in the past would have been incompatible with survival. As a consequence, there are many more people in such situations who are dependent on regular supplies of medicines than would have been the case previously. Even in some of the richest countries, health facilities have often been overwhelmed during the current pandemic. And in those that were less severely affected, staff often have of been diverted to other roles, while many face-to-face consultations have been stopped. One study from the United Kingdom described steep declines in consultation rates in primary care for almost all conditions except acute alcohol-related problems (Mansfield et al., 2021). In contrast to the situation in Europe, some eastern Asian countries had redesigned their health facilities in the aftermath of SARS in 2003, creating separate pathways for patients who were potentially infected. In this way, they were able to enhance the resilience of the population.

The role of the health system when society is faced with a major threat to health is obvious, whether it involves caring for those with infectious disease, with trauma or otherwise. This means that those responsible for health systems must ensure that they have put in place the capacity necessary if they are to respond to an emergency. This is not possible if they are operating at over 95% capacity, as is the situation in many countries. Similarly, it is essential that they prepare for such crises, with regularly updated plans, informed by exercises that assess their effectiveness and identify any weaknesses. However, it is easy to overlook the role that the health system plays in strengthening the resilience of society, ensuring that the population is as healthy as possible and thus better prepared for whatever might happen.

Social networks

The saying that "there is safety in numbers" has its roots in evolutionary biology. Animals collaborate for mutual benefit, with the advantages especially evident at times of crisis. Humans also derive benefits from working together. Social isolation increases the risks of a number of adverse health outcomes, including cardiovascular disease (Naito et al., 2021).

In recent decades there has been growing recognition of the importance of what is termed social capital as a determinant of health and well-being (d'Hombres et al., 2010). Often measured using questions on group membership or the ability to obtain assistance from someone in a crisis, greater social capital has been shown to correlate with wide-ranging of positive health outcomes. Social networks bring a number of tangible benefits. These benefits can arise during a crisis; for example, through the exchange of information on threats and on possible responses or mutual assistance in an emergency (Bhattamishra & Barrett, 2010). Social capital may also influence behaviour during a crisis, as in a study from 2015 that found that those with higher levels of social capital were more likely to receive a vaccine, wash hands more frequently, and be willing to wear a face covering (Chuang et al., 2015). They can also arise prior to an emergency, supporting community resilience; for example, through formal arrangements such as microfinance systems or pooling of resources to obtain public goods that benefit the entire community. Social capital can compensate for weaknesses in formal systems. For example, people with higher levels of social capital achieve better blood pressure control in countries with weak health systems (Palafox et al., 2017).

These observations become important because social capital varies. A study using Eurobarometer data measured the strength of formal associations, for example through sports or religious organizations or trade unions, and informal associations, based on social and family networks. Levels of social capital were

highest in the Scandinavian countries and in the Netherlands and involve both forms of social capital, whereas informal social capital was more important in south and east Europe, especially so with families in southern Europe (Pichler & Wallace, 2007). Social capital can also be influenced by a wide range of policies. These include those which encourage or discourage trade unions and policies affecting the design of new housing developments, and in particular the incorporation of shared community facilities (Lang & Hornburg, 1998).

Once again, a bidirectional association may operate during a crisis. The current pandemic has necessitated physical distancing, with many people unable to interact with their friends and relatives. Inevitably, this will impact adversely on their coping strategies, both in practical terms, such as the ability to go to shops or essential services, and psychologically through the resulting social isolation. The extent to which individuals can overcome these obstacles will, to a considerable extent, depends on their digital access, an issue explored in the next section.

The implications of these observations are that social networks are important element of societal resilience, both prior to and during a crisis. To a large extent, whether an individual participates in them will depend on their beliefs and attitudes, but there are things that can be done to make this easier, such as by designing shared spaces within new housing developments, providing grants for community organizations, and other forms of support. As with the other prerequisites for health discussed here, this should be part of any comprehensive approach to threats to health.

Digital access

Digital technology has played a crucial role in the response to the COVID-19 pandemic. It has facilitated surveillance of the spread of infection, enabling data to be collected, synthesized and reported in near real time. In marked contrast to the pre-pandemic situation, in which health data, such as mortality statistics, were often several years out-of-date when they were published, it is now possible to view up-to-date data on the spread and impact of the pandemic from across the world on websites such as the Johns Hopkins Coronavirus Resource Center or the Our World in Data site, as well as on the websites of national authorities and international agencies, such as the WHO Coronavirus (COVID-19) Dashboard (World Health Organization, 2021). Digital technology has also facilitated the public health response, allowing people to book COVID tests and vaccines online. It has also contributed to the rapid exchange of knowledge, within the scientific community, among patient and self-help groups, and in communication with the public. The extremely rapid growth of preprints has challenged the traditional publishing model, with its long delays between submission and publication. Many people, including researchers, obtain much of their knowledge via social media platforms, such as Twitter, and through email and WhatsApp groups. Digital platforms, such as Zoom or Microsoft Teams, have facilitated business continuity and indeed may have increased productivity by reducing the time spent in travelling to meetings. Digital data have also been used to provide new insights into attitudes and behaviour that can inform policy responses to the pandemic. Examples include the use of sentiment analysis to track the public mood, linking these data to interventions such as lockdowns, and mobility tracking, using the location data provided by mobile phones to monitor the effectiveness of restrictions on movement. However, while these developments have brought many benefits, there are also some downsides that need to be considered as we look ahead.

For many people, easy and rapid access to the Internet, for example on smartphones, is now taken for granted. Yet for large numbers of people across the world, this remains at best an aspiration. There are many reasons. Some people live in locations that lack the necessary infrastructure, most obviously in many remote parts of the world, but even in some parts of high-income countries that lack mobile phone or broadband coverage. Others are unable to afford the necessary equipment, such as smart phones or the charges for data necessary for them to operate. In some countries, especially at times of political upheaval, there may be limits on access to certain websites or to the Internet more generally, even though such measures have been condemned by the UN.

In societies where access to information, services and support is increasingly via online portals, a lack of Internet access risks excluding substantial numbers of people (van Deursen, 2020). Research in the United Kingdom has shown how those at greatest risk of digital exclusion overlap substantially with those vulnerable to poorer health outcomes from COVID-19 (Sounderajah et al., 2021). Digital exclusion also exacerbates the impact of policy responses to the pandemic. For example, as schools in many countries moved lessons online,

children in families without broadband access or computers faced major barriers to participation. For example, a United States study found that while online searches for learning resources doubled in the early months of the pandemic, these were concentrated in areas with higher income, better Internet access, and fewer rural schools (Bacher-Hicks et al., 2021).

A key area to consider is the potential exclusion of certain groups in predominantly "digital access first" models of health care. Examples of digital access to health care include completing online forms or booking a telephone call as part of a health care "triage" process before a decision is made about a face-to-face consultation; booking appointments for referrals or vaccines via online platforms; or an expectation of accessing health-related information online, such as symptom checkers. There is also telehealthcare that involves the use of information and communication technologies to deliver health care at a distance and to support patient self-management through remote monitoring and personalized feedback (McLean et al., 2013).

The main determinant of digital exclusion is age but often other significant factors – including disability, learning difficulties, ethnic origin, location, culture and language – are present, often combined with low income (Office of National Statistics, 2019; Poverty and Social Exclusion, 2021). Other particular groups at risk of digital exclusion include refugees, people seeking asylum, people who have been trafficked, people experiencing homelessness, sex workers, migrants with insecure immigration status, and Roma, Gypsy and Traveller communities (Doctors of the World, 2020).

Digital exclusion is a major driver of inequality. High levels of digital exclusion and digital health literacy in people from deprived and excluded communities are also at greater risk of poorer health outcomes (NHSE, 2021). In the United Kingdom, it is estimated that 11.9 million people do not have the essential digital skills to use online health information and tools (Good Things Foundation, 2021).

The built environment

The importance of the built environment in promoting resilience to threats to health is well established in relation to natural disasters. Buildings in many parts of the world are constructed to be resistant to earthquakes. However, there is also a large and growing body of research on the contribution of the built environment to health, and thus to the resilience of the population. Obesity is one of the major determinants of severe illness, hospitalization and death among those with COVID-19 (Yates et al., 2020). While there are many factors that contribute to levels of obesity in a community, characteristics of the built environment influence the potential for physical activity.

The built environment also influences the potential for transmission of infection. It has long been recognized that cold, damp and crowded dwellings provide the conditions that encourage the spread of respiratory diseases such as tuberculosis. Now that the important role of airborne transmission in the spread of COVID-19 is recognized, it is important to consider how to design new buildings going forward, in particular by incorporating efficient systems of ventilation (Morawska et al., 2020).

Access to justice

Until recently, health researchers and socio-legal researchers often operated independently of one another with distinct paradigms even when researching the health impacts of social problems with legal dimensions – an area directly at the intersection of health, law and justice. While it is widely acknowledged that social and environmental factors such as wealth, living conditions, education, employment and working conditions contribute to health status, the legal dimensions have largely been ignored in the social determinants of health discourse. In attempts to rectify this, a growing body of research evidences the links between law and health – demonstrating that unresolved legal problems can contribute to poor health outcomes and vice versa (Burris et al., 2016). This relative lack of attention to the effects on health of access to justice is surprising considering that the law is often designed to protect "rights and entitlements [and] to shield the vulnerable from most of the of the factors known to harm health and well-being" such as violence, inappropriate housing conditions, inadequate welfare benefits and wrongful termination of employment, among other threats. This section draws extensively on a recent paper by Professor Hazel Genn (2019) on access to justice and health.

Stress-related or physical ill health can arise from social, family and employment crises for which there may be legal remedies; and, as a result, interest in the integration of health and legal services is growing. Early evidence

suggests that access to legal services can indeed improve health outcomes (and conversely, lack of access can worsen them). For example, the only service that has been found to be effective in reducing domestic violence to date is the provision of legal advice and a positive association has been found between the prevalence of justiciable problems in a population and the incidence of physical or mental illness.

The pandemic has exacerbated health problems that may require legal remedies. The most vulnerable populations in societies were hit the hardest by a slew of factors which compounded upon one another: loss of employment due to widespread closures, threats of eviction when tenants could not make ends meet to pay rent, unsafe working conditions, domestic violence, poorly ventilated and overcrowded housing, and difficulties seeking welfare benefits because of immense pressures on the system. Stressors like these can cause allostatic overload, which then can lead to physical and mental illness, poor health behaviours and even perpetuating cycles of deprivation. Thus, COVID-19 has emphasized the importance of embedding law in health (and vice versa) since all of these factors involve legal dimensions and can potentially be improved through legal interventions.

Genn and colleagues have developed a model that takes a holistic approach, integrating legal advice and support with health protection (Genn, 2019). Not only could integration and efforts to provide legal assistance to disadvantaged and vulnerable populations improve health outcomes at the individual level, but there are likely broader benefits to a society. One example Genn highlights is that "automatic provision to cancer patients of advice on financial issues and employment rights supports recovery and retains employees living with cancer within the labour market". Furthermore, Genn describes how austerity measures in England and Wales in 2010 that reduced the supply of free legal services were associated with increased costs falling on those in need and even though spending on legal aid decreased, it rose for public services overall, particularly for the National Health Service, attributed to mental and physical health deterioration among those facing health-harming social and welfare problems.

In addition, as discussed in the section on Corruption, legal action, including by pro bono public lawyers, has played an important role in exposing malfeasance in procurement during the pandemic (Good Law Project, 2020).

As with other essential services, access to legal advice and to courts has been reduced as a consequence of restrictions imposed during the crisis. As with health services, there has been a shift to remote consultations but these exclude or disadvantage many of the most vulnerable people (The Law Society, 202).

Access to justice is increasingly recognized as a determinant of health, enabling individuals and communities to assert their rights. Hence, access to legal services must be included within planning for crises, even if there is still limited evidence on what interventions are the most effective in reducing health inequities.

Human generated threats to health

Our conceptual framework also recognizes that there are certain human generated threats to health. Many different ones could have been included here, but we focus on four that are of particular importance for the future of health. One is the production and marketing of harmful commodities, most obviously, tobacco but also energy dense and nutrient poor food and beverages, alcohol, and firearms (Arulrajah & Flecknoe, 2019; World Health Organization, 2001), as well as other products that pose less direct threats to health, such as gambling. Another is the promulgation of racist and populist messages by politicians that seek to divide communities, undermining the solidarity that is crucial for an effective response to health threats. A third, and one that is less commonly considered in health terms, is crime, and particularly organized crime, including exploitation of vulnerable people, for example by people traffickers, production of counterfeit goods allowing unsafe products to reach the market, and corruption to reduce the resources available for an effective response to a health threat. Finally, another as yet poorly recognized threat to health is the potential risk posed by artificial intelligence, allowing individuals to be discriminated against on different grounds.

Harmful commodities

Actions taken by the commercial or private sector have considerable implications for health and equity and the role of the corporation in people's lives, while going back hundreds of years, has undergone considerable transformation in recent decades (Wiist, 2010). The power held by corporations and the diverse forms in which this power can be executed to forward

their interests can have detrimental impacts on health globally: the tobacco, alcohol and ultraprocessed food and beverage industries serve as stark examples of the ways in which transnational corporations can contribute to the emergence of global health threats leading to millions of premature deaths and disability, and undermining economic progress and health system sustainability (Kickbusch et al., 2016; McKee & Stuckler, 2018; Moodie et al., 2013). Recognition of the diverse mechanisms through which commercial products and practices can influence public health and policies has led to the emergence of a research field and body of literature referred to as the commercial determinants of health (Mialon, 2020).

This literature suggests that efforts to change in ways favourable to people and the planet have and will continue to be resisted by vested interests who both profit from the status quo and act to ensure that when change does occur it is favourable to their agendas (Van Schalkwyk et al., 2021a). Adopting a commercial determinants of health lens helps to expose the strategies adopted by industries and powerful economic actors to promote their interests and the ways in which their activities threaten public health and undermine systems and structures that are central to building healthier and more resilient societies. Often referred to as the industry playbook, decades of literature have revealed that, when faced with evidence and regulation that threatens profits and public legitimacy, corporations adopt a number of strategies. These strategies are often multifaceted, elaborate and substantially resourced and serve to cast doubt on the evidence about the harms of certain commercial products and practices. Corporations create and spread doubt by funding research favourable to their interests while undermining the robustness and credibility of independent research. They seek to influence research agendas, standards-setting and policy-making processes; they engage in the cherry picking of data and the promotion of false experts, helping to create an illusion of scientific debate; as well as suppressing the publication or release of data threatening to commercial interests. Diverse corporate actors, from the fossil fuel, tobacco, sugar and alcohol industries to the pharmaceutical, food and pesticides industries, supported by the work of research institutions, public relations, marketing and legal teams, adopt different forms and combinations of these activities with profound implications for public health and public policy-making.

Policies known to save lives and promote health, such as bans of harmful products including leaded petrol, DDT and trans-saturated fats, requiring cigarettes to be in plain packaging and tobacco taxation, minimum unit pricing and restricted access and availability of alcohol, reduction of exposure to hazardous substances at workplaces, and other evidence-based policies and interventions have all been contested and delayed by corporate actors who seek to maintain conditions favourable to maximizing profits.

The resources possessed by some corporate actors also enable rapid adaptation to, and exploitation of, changing situations to forward their interests. Corporations, particularly those who produce, market and sell harmful products, have embraced the concept of corporate social responsibility (CSR). This trend has emerged as corporate actors have adopted CSR initiatives when faced with mounting concerns surrounding the safety of their products and dwindling public and political legitimacy. This was observed in the wake of the litigation taken against the tobacco industry, who adopted elaborate CSR programmes to rebuild public opinion and gain access to policy-makers. CSR is also used to exploit issues of public interest to burnish the corporate image. A clear example of this has been observed in the corporate response to the pandemic (van Schalkwyk et al., 2021b). This has implications for public health and policy-making as such activities deflect from the harm incurred from the sale of unhealthy or environmentally damaging products and the efforts by such actors to block or delay the adoption of policies intended to protect and promote health and environmental sustainability. Corporate actors known to contribute to the very public health crises now faced by governments globally, and which have in turn worsened the impacts of the COVID-19 pandemic and their inequitable distribution, are recast as "part of the solution" through the promotion of their CSR activities employed during the pandemic. This has implications for future policy-making and the recovery agenda given the legitimacy this may have afforded corporations with commercial conflicts of interest in relation to human and planetary health.

Racism and xenophobia

The inclusion of corporate or commercial power among the determinants of health, as described in the preceding section, has been accompanied by a growing focus on what are termed the political determinants

of health. These include the concept of Health in All policies, recognizing that decisions made by many different government ministries can have an important impact, both positively and negatively, on health. They also include political activities that impact on health, of which one of the most important contemporary examples is the promotion of racism and xenophobia.

In his seminal work in the United States, Alberto Alesina showed that racial or ethnic fractionalization provided one explanation for the failure of that country to create a European welfare state (Alesina et al., 2001). To simplify his argument, while Europeans, especially following the Second World War when so many, regardless of social status had suffered, were willing to pool resources in the knowledge that those now wealthy might fall on hard times, in the United States, white people were unwilling to pool their resources to support their Black neighbours as they would never be in their situation (Alesina et al., 1999). Ethnically divided societies are less likely to invest in public goods. Subsequent research has shown that ethnic, religious and linguistic fractionalization can partially explain differences in the adoption and implementation of public health policies in Europe (Mackenbach et al., 2013).

Racism impacts on health in many ways. One is directly, whereby direct or indirect discrimination, such as decisions on where to locate health facilities, may lead to inequalities in access to prevention or treatment. Even in countries where strenuous efforts are made to promote inclusion, there are large ethnic disparities in COVID-19 outcomes and, now, vaccine uptake. Both have consequences for the ability to exit the pandemic.

Racist policies can also impact on mental health. In an elegant study in the United States, Bor and colleagues showed how a police shooting of an unarmed African American was associated with a measurable deterioration in mental health of African Americans in the same state, but these incidents have no effect on mental health if the person shot was armed (Bor et al., 2018). Another is less direct, with racist messages undermining support for collective resources, such as health systems, which can lead disadvantaged members of the majority community to support policies that are against their own interests. This is especially likely in situations where people's prospects seem to be diminishing, as with the white working class in areas experiencing deindustrialization. In this context, the evidence linking geographical variations in austerity during the Weimar Republic and increasing support for the National Socialist Party is instructive (Galofré-Vilà et al., 2021).

The importance of racism also became apparent during the COVID-19 pandemic. The public use of the term "China virus" was associated with an upsurge in attacks on Asian Americans (Viala-Gaudefroy & Lindaman, 2020). However, arguably the most important consideration is that politicians promoting division in society undermine efforts to create inclusive health systems that address the fractures in society described earlier that allowed the SARS-CoV-2 to spread, thereby reducing the resilience of society as a whole.

Non-state violence

Terrorism is defined as "the unlawful use of violence and intimidation, especially against civilians, in the pursuit of political aims". This is clearly a problematic term, as one person's freedom fighter can be another's terrorist. However, whatever this phenomenon is called, it has killed an average of 21 000 people each year in the decade to 2017 (Ritchie et al., 2019). It is recognized as an important public health issue (Lindert et al., 2018).

Non-state violence must be considered in any crisis. Although there have been no major incidents related to the pandemic, they were always a possibility, especially given the strong emotions expressed by some groups opposed to COVID-19-related restrictions.

A report from researchers at University College London identified three issues relevant to the current pandemic, which may or may not apply in other crises (Salman & Gill, 2020). First, COVID-19 responses have involved restrictions in movement, making it more difficult for perpetrators to travel to undertake reconnaissance of potential targets or attack them unnoticed, while the reduced number of gatherings has reduced targets. Attackers may also avoid travel because of the fear of becoming infected (Stubley, 2020). However, these changes might have led to displacement to other crowded places, such as hospitals or food outlets.

Second, people are spending more time at home, leaving some vulnerable to radicalization. This risk may be exacerbated for those who are either socially isolated, leading to boredom or who are experiencing family of financial stress. Research on lone-actor terrorists shows that they are extremely diverse but social isolation is a common feature in their background (Gill et al., 2014). Being at home, with the accompanying increase in

time spent online, may increase exposure to harmful messages, with evidence that far-right forums have used COVID-19 to reinforce anti-migrant sentiments and conspiracy theories. However, it may also be the case that movement restrictions reduced scope for gatherings where radicalization takes place or increase exposure to positive and supportive family impulses.

Finally, anti-terrorist measures that depend on school teachers and others to identify those at risk of radicalization may be impaired because of the reduced in-person engagement.

Digital threats

Digital technology creates new ways in which those already disadvantaged can be further discriminated against. This can be inadvertent, for example, when an algorithm replicates human behaviour that, consciously or unconsciously, discriminates on grounds of, for example, gender or ethnicity. For example, a computer that was programmed to learn English by trawling through large amounts of text learned to associate male names with career-related terms and female names with family-related terms, European names were associated with pleasant terms and African American names with unpleasant ones (Caliskan et al., 2017). Problems can also arise when unrepresentative data are used to generate algorithms. A database used to develop commercial facial recognition tools in the USA underrepresents females and people with dark skin so that the tools perform much worse with the faces of dark-skinned females (Buolamwini & Gebru, 2018). This can lead to some individuals being excluded from services and facilities that depend upon facial recognition, or even innocent individuals being mistaken for wanted criminals. When Google Translate is used to translate languages, such as Hungarian, that lack gendered pronouns into English, it shows a female pronoun in sentences referring to domestic activities and a male one into those associated with prestige and work outside the home.

However, even more worrying is the scope for intentional discrimination. The investigative journalism organization ProPublica showed how they could restrict advertisements for attractive rental properties in New York on Facebook to exclude African Americans, Jews, and those who had expressed an interest in aids for disabled people (Angwin et al., 2017). In these ways, characteristics of the digital environment can further disadvantage those who are already vulnerable, thereby undermining societal resilience as described in earlier sections.

A related issue is the concept described by Zuboff (2019) as behavioural surplus, in her detailed account of the impacts and strategies of major technology firms such as Facebook and Google. Behavioural surplus is the data that are generated by consumers in their day-to-day use of products with Internet capabilities, from smart phones and apps, to fridges, televisions and home security systems. This data in turn can be used by technology companies to predict and direct behaviour in ways that align with their and their customers' interests, a situation that is further complicated by privacy laws and regulations that are limited, inaccessible to the individual customer, and/or falling behind technological advancement. The scale, and nature, of data available to private interests such as Facebook and Google has considerable implications for privacy, public health and as evidenced in recent years, for the integrity of democratic structures.

A third threat related to the digital environment is that of cyber attacks. These are offensive operations that target computer systems, infrastructures or digital networks. They have been undertaken by individuals, criminal networks and government agencies, and for a variety of purposes, including ransom seeking, with hospitals being particularly attractive targets (Owens, 2020), and attacks as part of wider conflicts between states. They can have important consequences for health in several ways. One is when they lead to a denial of service in critical systems. For example, in 2000, the "I love you" virus paralysed organizations ranging from the US Department of Defense to WHO (Hajioff & McKee, 2000). They can also be used to target critical national infrastructure, such as energy grids, with obvious consequences for health facilities or those dependent on consistent power supply, such as people on dialysis. The same approach can be used to attack telecommunications networks or transport systems.

In May 2021, the Irish health system was hit with distributed denial of service attacks by criminals seeking a ransom (Irish Times, 2021). This led to the cancellation of hospital appointments, inability to request COVID-19 tests online and delays in obtaining results, and a breakdown of the COVID-19 vaccine booking system.

For these reasons, a comprehensive assessment of future threats to health cannot ignore those that exist

within the digital realm, both in terms of their ability to undermine societal resilience and the potential to pose direct threats to health.

Crime

Crime, particularly that which is organized, is a significant yet *preventable* threat to global health (Reynolds & McKee, 2010). Organized crime unites criminal groups from across the world; apparently disparate criminal activities, ranging from the commerce of counterfeit goods to the trafficking of people and their organs, are often controlled by the same individuals, utilizing well-established international networks, supply chains and trade routes. Although a transnational problem, organized crime is especially able to thrive in countries where legislation, regulation and enforcement are weak. The true scale of organized crime is, inevitably, unknown but its profits are notoriously lucrative and its corrupt practices have proven capable of infiltrating both public and private sectors. Organized crime is increasingly sophisticated and able to exploit profit opportunities wherever they arise; taking advantage of both the freedoms and restrictions that result from the process of globalization, capitalizing on political and social instability, and, where necessary, displacing their activities to those with less regulation or inadequate legislation.

Organized criminal groups, and the heterogeneous illicit activities they engage in, are responsible for many direct and indirect harms to human health. Clearly counterfeit medicines which contain none, or too much, of an active ingredient can cause harm to the individual, but fake drugs, particularly antimicrobials, containing subtherapeutic doses, may also lead to the emergence of AMR with much wider implications for health. Moreover, the cost of lost public trust in health authorities when counterfeit pharmaceuticals such as vaccines permeate legitimate supplies – and the resultant consequences for population health – is difficult to quantify. However, the Infectious Disease Data Observatory has created an online Medicine Quality Monitoring Globe that collates reports of falsified and substandard medicines (Infectious Disease Data Observatory, 2021). The Oxford Statement, a consensus statement published in 2019, sets out a series of detailed recommendations to address this issue (Newton et al., 2019). This includes calls for investment in national systems for monitoring substandard and falsified medical products, research on their impact on health, strength and laboratory capacity and improved reporting, as well as some more detailed proposals.

Organized crime further entrenches pre-existing inequalities both within and among countries; the victims of organized crime – such as women and children trafficked for sex work or domestic labour, and communities ravaged by drug addiction – are mostly already socioeconomically disadvantaged, and the countries deprived of valuable revenue from untaxed counterfeit goods are often those where economic development has been slow. Through its violation of human rights and undermining of the rule of law, organized crime should be understood as an important, avoidable barrier to health and sustainable development, which necessitates concerted international action and an evidence-based, multisectoral approach, to avoid the unintended consequences which have impaired response efforts to date.

Crime and criminal justice also feature in planning for crises. Do major crises inevitably lead to a breakdown in law and order? This question attracted considerable attention in the aftermath of Hurricane Katrina. Media reports described widespread looting and violence but it was later realized that these accounts were false. In fact, communities mobilized to provide mutual support. Instead, many criminal acts were traced to the heavily armed police, some of whom engaged in looting, as well as a shooting of innocent people in which two, one mentally disabled, were killed (U.S. Department of Justice, 2012). The subsequent research confirmed that, in many crises, most people do behave altruistically but there is a risk to health from overzealous responses by law enforcement (Trainor et al., 2006).

Given the centrality of One Health in the framework being discussed here, there is one area of criminal activity that justifies particular attention. This is the illegal trade in wildlife (Aguirre et al., 2021; Daszak et al., 2020), defined as the unauthorized commerce of wild animals and plants and their derivatives (Bezerra-Santos et al., 2021), often involving live animals sold as exotic pets, and wildlife products consumed primarily for food, medicine, clothing and ornamentation (Travis et al., 2011). The illicit trade of wildlife is known to be a significant transnational problem (UNDOC, 2020), and, although the picture is complex and consumption patterns vary markedly between regions, in general, wildlife trade flows from developing to developed countries (Can et al., 2019; Travis et al., 2011). Due to its covert nature, it is difficult to quantify the scale

of the illegal wildlife trade and most estimates are extrapolated from seizure data, which is subject to detection and reporting biases (Sas-Rolfes et al., 2019). However, in 2014, the illegal wildlife trade was estimated to be worth up to US$23 billion annually (Nellemann et al., 2014), and while the profits from the commerce of illegal wildlife are thought to be comparable to that of the illicit drug trade, the penalties are much less severe (Travis et al., 2011). The illegal wildlife trade is known to be associated with adverse outcomes for global health, socioeconomic development, security, climate change and biodiversity (UNDOC, 2020). This is discussed in more detail in Chapter 5.

Corruption

Until recently the health community paid little attention to corruption as a threat to health (Hutchinson et al., 2019). Yet, Transparency International has consistently found that health care is among the most corrupt sector in many countries. Its 2013 "corruption barometer" revealed that over 50% of citizens, in 42 of 109 countries surveyed, considered their health systems as corrupt or very corrupt (Transparency International, 2013). Corruption diverts scarce resources from the delivery of essential care and distorts clinical practice, encouraging unnecessary interventions. It also undermines the trust that underpins effective, equitable, and responsive health care (Berger, 2014). One study, in 2011, estimated that about 140 000 child deaths annually could be attributed to corruption (Hanf et al., 2011). A recent analysis argued that corruption posed a major barrier to the achievement of several of the health-related SDGs, although it also argued that measures in pursuit of other SDGs, such as SDG 16 (Peace, Justice and Strong Institutions) and SDG 17 (Partnerships), provide an opportunity to address this problem.

One immediate problem is defining corruption. The UN Convention against Corruption does not define its subject but rather lists a number of corrupt practices (United Nations, 2003). The Cochrane Collaboration, in a review of measures effective in reducing corruption did (Gaitonde et al., 2016), defining corruption as "the abuse or complicity in abuse, of public or private position, power or authority to benefit oneself, a group, an organization or others close to oneself; where the benefits may be financial, material or non-material". There is, however, some blurring at the margins. Irregularities in procurement of medical consumables and equipment, especially where this involved bribes, is generally accepted as corrupt. However, there may be less agreement about the widespread practice of inducements, often of little monetary value, such as pens, by pharmaceutical sales representatives (Fadlallah et al., 2018), even though this is associated with increased prescribing of the brands concerned (Fickweiler et al., 2017). Similarly, informal payments intended to secure faster or better treatment (Balabanova & McKee, 2002; Gaal et al., 2006; Lewis, 2007) would widely be seen as corrupt but not unsolicited small tokens of gratitude. Theft of drugs or equipment from public facilities to be used in private ones is clearly corrupt, as it denies them to those in the public facilities, but absenteeism or late arrival or early departure from work in the same public facility, which also denies patients an essential component of care yet is often not perceived as a form of corruption (Garcia-Prado & Chawla, 2006; Lindelow & Serneels, 2006).

There is considerable resistance from many quarters to tackling corruption. Frequently, doing so would challenge long-established hierarchies and powerful vested interests. Some, from a particular political perspective, portray it as a manifestation of neoliberal attacks on the public sector (Bedirhanoğlu, 2007), pointing to its prioritization by development agencies in the 1980s when many public health systems were being dismantled. It is also extremely difficult to study, especially as many corrupt transactions take place behind closed doors.

As with so many of the other threats to health, the pandemic has highlighted the importance of corruption in a crisis. This should not have been a surprise. Crises have always provided much scope for activities that, whether or not they are defined as corrupt, involve opportunistic diversion of public resources for private gain. A notable example was the cornering of the market in transport capacity at the beginning of the second Gulf War (Akam, 2021).

Many individuals were able to exploit the confusion in the early stages of the pandemic as authorities scrambled to obtain essential supplies, such as PPE. Many of the normal safeguards that exist in public procurement rules were set aside. Companies, some only a few weeks old and with negligible assets, were able to negotiate multi-million euro contracts, despite no track record in the sector (Bauldry, 2020). Huge sums of money were wasted on equipment that never arrived or was unusable and, in some cases, there was clear evidence of criminality and fraud (Cavallaro, 2020; Europol,

2020). It is now clear that, in some countries, those with political connections enjoyed an advantage in winning such contracts (Good Law Project, 2020).

As litigation and other enquiries continue, it is difficult to say with certainty what the motivations where for this activity. Undoubtedly, some contracts that failed to deliver were the consequence of inadequate capacity in public procurement, leading to innocent mistakes. Others were blatant criminality. However, many fell in between these two ends of the spectrum. The dividing line between the convenience of relying on personal contacts in an emergency and corruption is blurred. However, it is clear that this is an issue that must be resolved going forward. For the present purposes, what is important is that those involved in planning for crises take the scope for corruption fully into account.

Disinformation

A healthy society is increasingly underpinned by the right of individuals to accurate information that will enable them to make healthy choices. While the Internet has opened up many new opportunities, as with all forms of progress, there is a downside. The invention of the internal combustion engine, and with it modern, vehicular transport, has had many positive consequences for economic development and social empowerment. However, it has also led to the premature deaths of large numbers of people in traffic accidents and has contributed to pollution and global warming. Similarly, Alfred Nobel's development of explosives has contributed to the construction of our transport infrastructure and to the wealth generated by extractive industries but has also made possible modern warfare and the millions of deaths that have followed. By allowing anyone to post anything, the Internet has democratized the exchange of information. However, not all of that information can be depended upon. We have seen a growth of disinformation, propagated for different reasons, including financial rewards, in the form of clickbait, the undermining of democratic processes, and the dissemination of misleading fringe views by conspiracy theorists and others.

Misinformation is information that is false and disinformation is false information, which in addition is generated and disseminated with the intention to deceive. During the pandemic, there have been many examples of information being conveyed that is demonstrably false, as when former President Trump advocated the administration of bleach or ultraviolet light internally to treat coronavirus (McKee et al., 2020). In a world in which health policy proceeds by the adoption of evidence-based policies, the growth of disinformation is a serious threat to health that is only now being recognized by the term "infodemics" (Gallotti et al., 2020).

Many people are receptive to and believe misinformation and disinformation that is disseminated. Surveys in many countries find that the general public are often extremely misinformed. In the United Kingdom, people vastly overestimate the share of the population who are immigrants, religious minorities or old, the percentage of teenagers who become pregnant, and the scale of foreign aid welfare fraud (Ipsos MORI, 2014). Widely used information sources provide factually inaccurate information, with numerous examples of United States' television networks showing maps that place Hong Kong in Brazil and Ukraine in Pakistan, among many others. Even accurate information can be misinterpreted, with an extensive literature on the role of cognitive biases (McKee & Stuckler, 2015), for example, showing that when individuals with different political affiliations, such as registered Republicans and Democrats in the USA, are shown the same information they take contradictory messages from it (Gollust et al., 2009). Related phenomena include groupthink, where those sharing the same views reinforce an incorrect message (Janis, 1971), and the Dunning–Kruger effect, where those who know least about a topic have most confidence in their knowledge (Dunning, 2011).

Misleading information often spreads rapidly. Allport and Postman, writing in 1947, set out a "basic law of rumour", whereby the amount of rumour circulating varied with the importance of the subject to the individuals concerned times the ambiguity of the evidence pertaining to the topic in question (Allport & Postman, 1947). Hence, it is understandable that false messages about risks to health are especially likely to spread rapidly. It is, however, necessary to distinguish misinformation, which is shared without intent to cause harm, from disinformation, which involves false information knowingly being created and shared to cause harm (Wardle & Derakhshan, 2017).

This phenomenon is widely termed "fake news". However, to quote Humpty Dumpty in Lewis Carroll's *Through the Looking Glass*, "when I use a word … it means just what I choose it to mean" (Carroll, 2003). A parliamentary committee in the United Kingdom

argued that this term "is bandied around with no clear idea of what it means, or agreed definition" (Digital Culture Media and Sport Committee, 2019). Post-truth is a related concept, where absolute lies are propagated by politicians, who inhabit a world in which they can lie without facing condemnation (Higgins, 2016). This is different from the perception that politicians often lie, making promises they often have no intention of keeping.

Given how the term fake news has been debased, it is preferable to stay with disinformation. However, misinformation and disinformation lie on a spectrum, from satire or parody, where there is no intention to cause harm but which can undermine trust in authority, through to messages that are entirely false and are designed to deceive and do harm. It can also be difficult to differentiate them without information on motivation. Thus, anti-vaccine propaganda may be spread by those who have a genuine concern, however misguided, about safety and by those who are using the issue as a tool to undermine trust in particular governments.

The deliberate spreading of disinformation is not new. One famous example was the publication by English pamphleteers of accounts of the alleged sexual proclivities of Marie Antoinette prior to the French Revolution (Hanrahan, 2008). A few years later, Thomas Jefferson argued that "nothing can now be believed which is seen in a newspaper. Truth itself becomes suspicious by being put into that polluted vehicle" (Jefferson, 1807). In these cases, the spread of disinformation had been enabled by the invention of the printing press. Now, the transmission of (dis)information is on a vastly different scale, with the Web 2.0, introduced in the early 2000s, allowing user-generated content.

This has enormous consequences for health. A recent systematic review reported a substantial growth in research on disinformation related to health, dominated by studies on vaccines and communicable diseases (Wang et al., 2019). Common findings included how material containing misleading information was liked and forwarded more than material that was consistent with the evidence (Donzelli et al., 2018). There were many examples of beliefs in conspiracies to conceal the truth. For example, West Nile Virus infections were attributed to causes as diverse as alien warfare, a shift in the North Pole, and fulfilment of a biblical prophecy (Dubey et al., 2014).

The harms that arise from disinformation have been divided into four categories, disengagement in democracy, interference in democracy, economic harm, and risks to life. All of these can impact on health (Full Fact, 2020). Thus, while public health builds on the principle of solidarity, disinformation frequently seeks to sow divisions. A prominent example is the use, by former President Trump, of labels such as the Chinese Virus or Kung Flu. There are many examples of social media campaigns to encourage attacks on minorities, such as the Rohingya in Myanmar (Siddiquee, 2020). It has been suggested that disinformation played a role in both the 2016 Brexit referendum in the United Kingdom (Cadwalladr, 2018), and in recent US elections (Allcott & Gentzkow, 2017), both with a myriad of consequences for health (Fahy et al., 2019; McKee et al., 2017). Attacks on reputations of companies can undermine their profits and thus their ability to employ people. Messages that undermine vaccine confidence have obvious implications.

So what is the motivation for generating and spreading disinformation? Three sources have been identified. Some state-sponsored trolls conveyed messages that were for and against vaccination, and many other issues. It is believed that they seek to generate discord more generally and thus undermine trust in politics. Content polluters used the vaccinations to attract individuals who will forward tweets, spreading malware or ransomware or generating funding by acting as clickbait to direct readers to websites that generate revenue. A third category had diverse but often unclear motives, but often including strongly anti-vaccination messages.

While social media has been the most important vehicle for spread of disinformation, it is important not to overlook the role of the mainstream media. In the United States, some outlets have played an important role in disseminating misleading messages, with Wikipedia removing one major station from its list of sources deemed "generally reliable" (Cohen, 2020).

Finally, any examination of disinformation should also include a recognition of the challenges faced by those who work to provide accurate information, such as investigative journalists. They play a crucial role in exposing some of the other threats to health described in this book, such as organized crime and corruption. Unfortunately, many work in settings where they face considerable restrictions on their activities, as documented in the annual Press Freedom Index compiled by the organization Reporters Without

Borders (Reporters Without Borders, 2021). Even worse, a number of journalists have lost their lives in Europe in recent years, in some cases with alleged involvement of politicians (Council of Europe, 2021). Another worrying development is the use of social media to attack investigative journalists, and female journalists can find themselves exposed to relentless misogynist abuse and sexualized threats (Posetti, 2021).

Planetary health

The complex and dynamic interrelationship between the health of humans, animals and the environment in which they live, has been at the heart of this review. In previous sections, we have looked at this set of relationships at the level of individuals and communities, for example, the potential for unsafe infection control in an individual hospital to allow a resistant bacterium to emerge and spread, or poor hygiene on an intensive farm or wet market to allow a virus to jump species. However, for the first time in the history of our planet, these relationships are now playing out at the global level. Human activities are now on a scale sufficient to change the global environment. This has ushered in a new era in the history of the Earth, the Anthropocene. The changes that are taking place threaten the survival of humanity itself (Folke et al., 2021).

Human activity, leading to the release of greenhouse gases, has already heated the world to 1.2°C above preindustrial levels (World Meteorological Organisation, 2020). It has also, through its impact on the land, for example, canalization of rivers, deforestation and desertification, reduced the resilience of the biosphere. These changes are unprecedented. The world is now warmer than it has been for several million years and is continuing to heat up. Current projections envisage a rise of a further 2–4°C by the end of the 21st century. This, according to some estimates, could mean that up to 3 billion people may be living in parts of the world that will by then have become uninhabitable.

So far, the Earth has managed to compensate in several ways to the increasing emissions of heat and greenhouse gases, absorbing them into the sea, or, in the latter case, into vegetation. However, this is now being threatened. Forest fires in Australia, Indonesia and the Amazon generated emissions equivalent to almost 40% of the amount of carbon normally captured by these mechanisms in a single year (Global Fire Emissions Database, 2021).

Scientists have identified a number of so-called tipping elements, or "sleeping giants", that play a critical role in stabilizing the global climate (Steffen et al., 2018). These include the polar ice sheets, forests in North and South America, Alpine glaciers, permafrost in Siberia and the Sahel. However, while until now, these have provided negative feedback, there is a danger that they could transition to a situation in which they gave rise to positive feedback. For example, there are concerns that the Amazon basin could soon move to a state in which it is a net producer of carbon dioxide.

Beyond the changes in global temperature noted above, there are other mechanisms by which areas of existing settlement could be rendered uninhabitable. Respiration by plants in tropical and temperate forests contributes up to one fifth of annual rainfall, and in some places much more. One estimate suggests that up to 19 of the world's megacities may depend on this source of rainfall for a substantial share of their water supply. Loss of mountain glaciers, such as those supplying the rivers of northern India and Bangladesh, threaten the lives of many millions of people.

In 2009, a group of environmental scientists identified nine "planetary life support systems" essential for human survival (Rockstrom et al., 2009). Within each, they identified a safe operating space, within which life could continue as normal; zones of uncertainty, where there is an increasing risk of reaching a tipping point; and high-risk zones where there is a threat to survival. The safe operating spaces for four of the nine systems are now estimated to have been breached. These are climate change, biosphere integrity (genetic diversity), land, system change and biogeochemical flows, the last of these, involving environmental phosphorus and nitrogen.

Ecologically, footprints are a means of expressing the biologically productive area that an individual, a community, a country, or a region uses relative to the area that can supply, in a renewable way, the resources being used. In 2014, it was estimated that, at contemporary levels of consumption, humanity was using the equivalent of 1.7 planet earths. In other words, each person was, on average, consuming more resources than could be replenished. However, as would be expected, ecologically, footprints are not the same everywhere. People living in high-income countries

have much larger ecological footprints than those in low-income countries. The rich have larger footprints than the poor.

The inequalities made visible by ecological footprints lie at the heart of both the causes of and responses to the phenomena described in this section. The natural resources on which the world depends are distributed very unevenly (A bebe, 1995). This is perhaps most obvious in relation to petrochemicals, with countries controlling oil and natural gas deposits accumulating what would, a century ago, be unimaginable wealth. Yet the way in which this wealth has been used varies greatly. Some countries and territories, such as Norway or Alaska, have created sovereign wealth or community funds to benefit their populations. In others, the gains have concentrated in the hands of a small elite.

In the same way, climate change is impacting most severely on those already disadvantaged. Subsistence farmers are especially vulnerable to the extreme weather events associated with climate change and to other climatic changes, such as new patterns of rainfall. When the land on which they have lived for many generations becomes uninhabitable they often face insurmountable barriers to moving elsewhere.

It is now clear beyond any doubt that climate change and loss of biodiversity are closely linked manifestations of the increased pace of human activity on a global level; itself a consequence of widespread social and economic changes. The chains of causation, linking a choice made by someone in one part of the world to the actions of others on a different continent, are complex. This complexity poses a challenge to our understanding of these phenomena. While it is easy, at a conceptual level, to make a link between the decision of a family in Europe to purchase an item of furniture made from wood taken illegally from a forest in South-East Asia and, from that, to make a link to the loss of the habitat necessary for the survival of an endangered primate, it is much more difficult to quantify with certainty the associations that link the choice of a particular chair or table in a shop in London or Paris to the death of a community of orangutans in Borneo, for example.

This situation is changing. A growing body of research, taking a multidisciplinary approach and drawing on complexity theory, is beginning to unravel these connections. Examples include the evidence linking demand for natural resources, such as the Coltan ore used in mobile phones, to conflict (Lalji, 2007) or the role of mines in Africa in the spread of tuberculosis (Stuckler et al., 2011). A related body of work is exploring the concept of the syndemic, which focuses on the biosocial complex consisting of interacting diseases and the social and environmental factors that promote and enhance the adverse effects of disease interaction (Singer et al., 2017). Rutter and colleagues have explored the relationship between three major threats to planetary health, communicable diseases, noncommunicable diseases and the climate and environmental emergencies, noting how they have common underlying causes, including unsustainable systems of agriculture, subsidies for harmful products, and overcrowded cities (Rutter et al., 2020). They illustrate this with the example of COVID-19, noting that while the emergence of the virus can be traced to interactions at a local level, in a crowded market where wild and domesticated animals were being kept closely together, its global impact reflected spread, fuelled by global hypermobility and urbanization, coupled with increased susceptibility of many of its victims brought about by high levels of noncommunicable diseases and associated risk factors, including air pollution and aggressive marketing of harmful commodities such as junk food. A comprehensive response to the pandemic will involve tackling all of these factors.

Summary

This chapter is written to inform efforts to anticipate future threats to health. It is written in response to the COVID-19 pandemic, a threat that arose at the intersection between human, animal and environmental health and which then spread rapidly throughout the world, taking advantage of global trade routes, and which took root in those communities where many of the most vulnerable in society lived and worked. SARS-CoV-2 will not be the last microorganism to cause a pandemic. However, zoonotic infections are only one of many possible threats, some of which can be prevented or mitigated, while others cannot be. The experience of the pandemic doors, however, point to a general principle. This is the importance of taking account not only of the threat, but also the factors that enhance the resilience of our societies and those that exacerbate the consequences of a threat. Both of these are, to a greater or lesser extent, under our control. The policies of governments can strengthen or weaken societal resilience. A comprehensive approach to the analysis,

avoidance and mitigation of threats to health must take all of these factors into account. However, it is not just the health of the population that must be considered. It is also the health of the planet. An individual who becomes ill and dies is a tragedy. It is not the end of the world. But there are other threats that could be.

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Chapter 5

One Health – a concept needed at all levels

Victoria Kirkby, Gebbiena Bron, Louise Fresco, Martin McKee

What is One Health?

One Health is both (1) an approach and (2) an outcome. It seeks optimal health for people, animals, plants and their shared environment and sees this as a public good (see Chapter 9), a benefit shared among all living beings on the planet, humans, wildlife, domesticated animals and plants. Like any public good, those who invest to create it cannot exclude others from those benefits so it is likely to be under-produced if left to the actions of the market, thus it will only come about if someone, typically a government or public authority, provides the necessary investment.

A holistic but pragmatic approach

There are many definitions of a One Health approach. This reflects the multiplicity of actors involved in promoting health of humans, animals and, to varying degrees, the natural or built environment. These were illustrated in Figure 2. For our purposes, the WHO definition of a One Health approach works well. It is "an approach to designing and implementing programmes, policies, legislation and research in which multiple sectors communicate and work together to achieve better public health outcomes" and adds that "the 'One Health' approach is critical to addressing health threats in the animal, human and environment interface" (World Health Organization, 2020). However, this provides little guidance as to what needs to be done to develop and implement this approach.

While a One Health approach is, by definition, holistic, this can be a barrier to its development because of the challenge of engaging with, and involving, so many different groups with diverse interests and, in some cases, terminology. Consequently, in practice, those promoting One Health often take a pragmatic approach, involving those with a stake in the issue being addressed.

This is illustrated by a recent review of literature that cited One Health in relation to SARS, Middle East respiratory syndrome (MERS) and COVID-19 and identified two broad approaches (Schmiege et al., 2020). The first, which they termed the classical One Health approach, addressed the "management of the disease threats to humans and animals" (Zinsstag, 2012). The second, which they referred to as an "extended One Health approach", looks more broadly at the interrelationship between humans and animals with ecosystems, environmental health, pathogens and broader social, cultural and economic factors (Woldehanna & Zimicki, 2015). Beyond that, the authors found that the concept of One Health was used in three broad ways:

- for institutional coordination and collaboration, as a way to communicate, coordinate and collaborate among stakeholders across sectors to solve complex health challenges;
- for action and implementation, with One Health as a framework for actions proposed or implemented to prevent and control a disease outbreak, for example, by means of surveillance and monitoring;
- as a comprehensive approach that emphasizes the role of the environment (built or natural) and the complex interactions at the human–animal–environment interfaces as well as social, structural and ecological changes.

The studies employing the classical approach, focused on the human–animal interface, included measures to decrease the risk of viral shedding between and among humans and animals, understanding of pathogen reservoirs and raising awareness of zoonotic infections. Some of the examples they used were at the household level; for example, concerning the storage and preparation of meat and milk (Ramadan & Shaib, 2019); at the production level, the rapid identification and isolation of sick animals on farms and the safe use of

abattoirs (Hemida & Alnaeem, 2019); and at the regional and national level, the restrictions on the mobility of livestock, improvement of laboratory capacity, and improvements in surveillance and monitoring (Awaidy & Al Hashami, 2020).

Extended One Health approaches considered environmental aspects, such as measures to monitor animal trade in the context of the food environment, measures to promote hygiene in occupational settings (Hemida, 2019) and bio surveillance in wet markets (Sun et al., 2020). However, as the authors note, those studies that look at One Health within a broader social and environmental framework are the minority. This is despite clear evidence that such factors are important in the emergence of infectious diseases. They cite Crameri et al. (2015), who wrote "that when dealing with an emerging infectious disease with a complex epidemiology, conventional outbreak investigations may not resolve key questions, and thus there is a need for studies which might appear tangential". However, the extended approach is challenging, for several reasons. It requires collaborations among researchers from a wide range of disciplines, in the biological, social and political sciences and the humanities, who must often overcome disciplinary and organizational barriers. For example, in many universities, promotion criteria often emphasize contributions to a discipline above impact on policy. The same barriers exist among those who must use the knowledge generated. Thus, promotion of extended One Health approaches requires ministers who will set aside their personal ambitions and whose progress is often measured in terms of the funding for their department or the extent of media coverage they attract, both of which are at risk of dilution by collaboration. There may also be important differences in cultures and norms in different ministries. Thus, historically, the tobacco industry has sought to influence governments by working with ministries such as agriculture, whose officials are often less familiar with their tactics (Lencucha & Thow, 2020).

A brief history of One Health

The importance for the health of populations of the relationship between humans, animals, the environment and the microorganisms that surround them has long been recognized, for example, in dietary rules in ancient religious texts. Rudolf Virchow first coined the term zoonosis to denote diseases transmitted between animals and humans (Schultz, 2008). In the postwar period, several writers drew attention to the importance of these relationships, but in the early 2000s the term One Health began to be used to describe them, stimulated to a considerable degree by a recognition of the need to tackle animal health as part of a strategy to address the threat of pandemic influenza but, also encouraged by the growth of the environmental movement (Gibbs, 2014). This was accompanied by a growing number of exchanges among physicians, veterinarians, wildlife specialists, environmentalists, anthropologists and social scientists. At a seminal meeting in 2004, hosted by Rockefeller University, a group of health experts from across the world endorsed the Manhattan Principles, which have provided a basis for subsequent thinking on this issue (Box 8)

The COVID-19 pandemic has brought a renewed interest in One Health by highlighting the fragility of human health and its interconnectedness with the health of animals and the wider environment. As was noted earlier, COVID-19 is a zoonotic infection, caused by a virus that jumped the species barrier, most likely originating in bats. However, it is human activities, such as habitat destruction (e.g. deforestation), the trade and consumption of wildlife and international travel, and an increasing density of human and animals that are believed to have led to the insurgence of COVID-19 and facilitated its global spread. Its further spread within communities is influenced by the built environment, with overcrowding and multigenerational households independent risk factors for infection (Ghosh et al., 2021) while improved ventilation offers a means to reduce risks (Morawska et al., 2020). This interconnectedness is a reminder that when one element of One Health is at risk, the others are also in danger. One Health issues transcend national, ministerial, organizational and professional boundaries and so too must the approach to tackling them.

Selected themes in One Health

As the preceding sections show, the scope of One Health is vast and it is impossible to cover it all in a single chapter. Consequently, we have selected three of the many issues that fall within its remit to examine in more detail. These are the transmission of microorganisms between humans and animals, or zoonoses, a process that is often facilitated by human actions that change the natural environment; AMR, an evolutionary process that is also influenced by human action that creates

Box 8 *The Manhattan Principles for One Health*

We urge the world's leaders, civil society, the global health community and institutions of science to:

1. Recognize the essential link between human, domestic animal and wildlife health and the threat disease poses to people, their food supplies and economies, and the biodiversity essential to maintaining the healthy environments and functioning ecosystems we all require.
2. Recognize that decisions regarding land and water use have real implications for health. Alterations in the resilience of ecosystems and shifts in patterns of disease emergence and spread manifest themselves when we fail to recognize this relationship.
3. Include wildlife health science as an essential component of global disease prevention, surveillance, monitoring, control and mitigation.
4. Recognize that human health programmes can greatly contribute to conservation efforts.
5. Devise adaptive, holistic and forward-looking approaches to the prevention, surveillance, monitoring, control and mitigation of emerging and resurging diseases that take the complex interconnections among species into full account.
6. Seek opportunities to fully integrate biodiversity conservation perspectives and human needs (including those related to domestic animal health) when developing solutions to infectious disease threats.
7. Reduce the demand for and better regulate the international live wildlife and bushmeat trade not only to protect wildlife populations but to lessen the risks of disease movement, cross-species transmission and the development of novel pathogen-host relationships. The costs of this worldwide trade in terms of impacts on public health, agriculture and conservation are enormous, and the global community must address this trade as the real threat it is to global socioeconomic security.
8. Restrict the mass culling of free-ranging wildlife species for disease control to situations where there is a multidisciplinary, international scientific consensus that a wildlife population poses an urgent, significant threat to human health, food security or wildlife health more broadly.
9. Increase investment in the global human and animal health infrastructure commensurate with the serious nature of emerging and resurging disease threats to people, domestic animals and wildlife. Enhanced capacity for global human and animal health surveillance and for clear, timely information sharing (that takes language barriers into account) can only help improve coordination of responses among governmental and nongovernmental agencies, public and animal health institutions, vaccine/pharmaceutical manufacturers, and other stakeholders.
10. Form collaborative relationships among governments, local people, and the private and public (i.e. non-profit) sectors to meet the challenges of global health and biodiversity conservation.
11. Provide adequate resources and support for global wildlife health surveillance networks that exchange disease information with the public health and agricultural animal health communities as part of early warning systems for the emergence and resurgence of disease threats.
12. Invest in educating and raising awareness among the world's people and in influencing the policy process to increase recognition that we must better understand the relationships between health and ecosystem integrity to succeed in improving prospects for a healthier planet.

Source: One World One Health (2004).

the conditions in which resistant organisms can thrive; and loss of biodiversity, increasingly recognized as a public good in its own right and an insurance policy for humanity.

Zoonoses

Microorganisms spread between species in both directions. For example, while SARS-CoV-2 most likely spread initially from bats to humans, it has subsequently spread onwards to cat species and minks. Often, these transfers arise as a consequence of changes in the nature of the interaction between humans and animals. For example, collaborations between scientists using sophisticated genomic methods and historians have provided evidence of the likely spread of brucellosis from goats to humans when goats were domesticated in the Neolithic period (Fournié et al., 2017), and the establishment of measles as a human infection when it spread from cattle suffering from rinderpest about 2500 BCE in the earliest cities (Düx et al., 2020). Often, these events are associated with changes in human behaviour that create new opportunities for microorganisms, such as the pools of stagnant water in discarded car tyres that have allowed mosquitoes to extend their range and, consequently, the distribution of dengue fever (Reiter & Sprenger, 1987). Other human activities that contribute to these species jumps include old forms of close contact

such as wildlife hunting, and activities that bring humans and animals into new forms of close contact; for example, through logging and deforestation, invasion of natural areas for living, and, more generally, the illegal trade in wildlife, which increases both the spatial and temporal likelihood of zoonotic pathogen generation and transmission (Aguirre et al., 2021; Halbwax, 2020; Travis et al., 2011).

As noted in Chapter 4, the trade in wildlife requires particular attention in a One Health approach, addressing, among other things food safety, animal welfare and biodiversity. The process of housing animals for trade often involves unnatural groupings of species in high-density conditions, facilitating the spread of cross-species transmission of both known and unknown pathogens (Pavlin et al., 2009), a process that may be aided by the infliction of multiple stressors during capture, transport and containment, leading to immune compromise and subsequent enhanced shedding and excretion of pathogens (Walzer, 2020). The multiple opportunities and instances of cross-species pathogen exchange apparent in the wildlife trade under these conditions should be considered an important cumulative risk for the emergence of zoonotic infections, even if the individual risk of each contact is low (Gómez & Aguirre, 2008; Walzer, 2020).

While history is replete with examples of failures that have allowed zoonotic transmission to occur, there are also examples where a One Health approach has been successful. We now consider three of them, rabies, Q fever, and bovine spongiform encephalitis (BSE).

Rabies was widespread in the dog population of Europe until the 1920s, when a combination of measures, including vaccination, was introduced. However, in the 1940s, it became established in the red fox population in the area between Poland and Russia, later spreading across much of western and central Europe (Müller & Freuling, 2018). Later it became established in raccoon dogs, introduced to Russia from Asia for fur production. Canine rabies is transmitted to humans through the bite of an infected, or rabid, animal and is invariably fatal in an unvaccinated and untreated individual. Each year about 60 000 people die from rabies worldwide, about half of whom are children. In 1989, the EU adopted a co-financing programme for rabies elimination that extended to neighbouring countries, including the Russian Federation and Belarus. The elimination of rabies in the western half of Europe, with the exception of occasional imported cases, represents a success of a One Health approach, including measures such as raising awareness, implementing surveillance, oral vaccination of wildlife and injectable vaccination of humans and dogs, and access to post-exposure prophylaxis at an affordable cost (Müller & Freuling, 2018). However, the threat remains, with rabies continuing to be endemic in much of Africa, including Morocco, from where cases regularly spread to the Spanish enclaves of Ceuta and Melilla (Darkaoui et al., 2017).

Q fever is an infection that mainly affects cattle, goats and sheep and causes a flu-like illness in humans. In late spring 2007, physicians in the Netherlands saw an increase of patients with respiratory illnesses. That year, 168 people were diagnosed with Q fever, which is a notifiable disease, in the Netherlands (Roest et al., 2011). In May 2008, human cases started rising again, clusters of abortions were reported on goat farms, and the Ministry of Agriculture implemented reporting and hygiene measures on goat and sheep farms. In 2009, the Ministry had to conduct a vaccination and culling campaign to curb the outbreak. The experience of this outbreak contributed to the creation of a national zoonoses structure to: (1) improve communication (e.g. monthly exchanges among relevant actors); (2) provide a clear definition of responsibilities; (3) allow provision for effective and timely decisions when signals are alarming; and (4) encourage timely action.

The emergence of BSE in the 1980s, initially in the United Kingdom, had profound consequences for agriculture, medical practice (for example, rules on reusable surgical equipment), the economy and politics, when the EU implemented a ban on the worldwide sale of British beef (McKee & Steyger, 1997). At first, the British government denied the possibility of any link between BSE and reports of cases of a rare neurological disease in humans, variant Creutzfeldt–Jakob disease, discouraging government scientists working on human and animal health from collaborating. This is an example of a failure to adopt a One Health approach to a problem where it was needed, coupled with prioritization of commercial interests over health (McKee et al., 1996). Eventually it became clear that BSE and vCJD were related and that the disease had originated in the use of animal-derived protein as cattle food, allowing the transmission of prions. In 1994, a complete ban on animal protein in livestock feed was introduced in the EU to stop the transmission cycle. As of 2011, the BSE transmission cycle appears to be halted.

In each of these examples, a One Health approach was eventually adopted, allowing the problem to be addressed effectively. However, in the second and third examples, this took some time to achieve.

Antimicrobial resistance

Although it can be considered as one aspect of transmission of microorganisms between humans and animals, the phenomenon of AMR requires special attention. Human action, in the form of inappropriate use of antimicrobials, for example, in medicine, agriculture and aquaculture as well as the release of antimicrobials into the environment in waste from factories and health facilities, has created evolutionary forces that encourage the emergence of antimicrobial resistant bacteria (Bloomer & McKee, 2018).

Antimicrobial resistance (AMR) occurs when microorganisms, such as bacteria, viruses, parasites and fungi, evolve ways to survive treatment with antimicrobials. Resistance can spread swiftly and unpredictably between microorganisms through a variety of mechanisms, including via the transfer of genetic material coding for resistance (Ali et al., 2018). Although AMR is a naturally occurring phenomenon, anthropogenic activities exert an additional selective pressure on microorganisms which facilitate and accelerate the development of novel drug resistance mechanisms.

Increasing resistance threatens to reverse the progress achieved by modern medicine. Effective antimicrobials are *essential* for the prevention and treatment of infectious diseases (World Health Organization, 2015). Without them, routine procedures would become potentially life-threatening once more and common infections more difficult, or even *impossible* to treat, precipitating untold human and economic costs (O'Neill, 2016). Already, 700 000 people are estimated to die from resistant infections every year, and, if left unchecked, AMR is predicted to claim 10 million lives annually by 2050 with a cumulative economic cost of US$100 trillion. While arguably less visible than COVID-19, AMR has been referred to as a "slow" pandemic (Wellcome Trust, 2020) and one that equally poses a profound threat to global health security and sustainable development worldwide (O'Neill, 2016).

AMR can be conceptualized as *both* a supply and demand problem (O'Neill, 2016). Currently, there are insufficient numbers of innovative antimicrobial agents, particularly antibiotics, and other tools in the R&D pipeline to counter rising levels of drug resistance and few incentives exist for investment in this area. In particular, the high cost and low returns associated with the development of novel antimicrobials often make it a commercially unattractive enterprise for pharmaceutical companies. The development of new antimicrobials will be necessary but *not* sufficient to tackle AMR: further research is also needed to better understand how we can preserve the effectiveness of our existing and future supplies of antimicrobials – lest they suffer the same fate (Charani et al., 2021). On the demand-side, available stocks of antimicrobials are often misused; at times, both squandered on patients and animals who do not need them and inaccessible to those who desperately do (O'Neill, 2016). Both the over- and underuse of antimicrobials can create the conditions for AMR to emerge. Consequently, a fundamental change in the way antimicrobials are consumed is necessary; a balance must be struck between reducing the inappropriate use of antimicrobials and improving their timely access where a legitimate need exists (Charani et al., 2021). Efforts to tackle AMR *must* thus include the realization of universal health coverage. Prudent antimicrobial stewardship will, in turn, reduce the urgency to find novel agents (O'Neill, 2016). The demand for antimicrobials can also be decreased through preventive measures, such as improved hygiene and sanitation, more widespread use of vaccines, and attention to the quality of clinical practice to reduce the overall burden of infectious diseases (Saxena & Bhatnagar), thereby avoiding the need for antimicrobial treatment.

While there is widespread recognition of the need to curb the inappropriate use of antimicrobials in human populations, controversy continues to surround calls for a reduction in the use of antibiotics in animal production (Bloomer & McKee, 2018). In this setting, antibiotics are often used to both promote animal growth and, preemptively, to prevent infections, rather than treating them when they arise. Additionally, there are concerns that antibiotics are being used to compensate for keeping animals in substandard, insanitary conditions. Unfortunately, a lack of transparency, associated with powerful commercial interests, limits our understanding of the extent of these harmful practices in agriculture and aquaculture. What is apparent, and of grave concern, is the capacity for resistant microorganisms to spread readily from animal to human populations in this setting and to threaten global food security. What is more, the global consumption of antimicrobials for use in food animals shows no sign of abating; it has been

predicted to increase by 67% between 2010 and 2030, driven by growing global demand for animal protein for human consumption (Van Boeckel et al., 2015).

Another important potential source of AMR, where progress has, once again, been stifled due to vested interests, results from anthropogenic environmental contamination with antimicrobials. Antibiotics, and their derivatives, are able to enter the environment through domestic, industrial and agricultural waste (Bloomer & McKee, 2018). Once in the environment, antibiotics interact with the pathogens they encounter, such that contaminated soil and water can act as reservoirs for AMR. Human exposure may subsequently occur through a variety of mechanisms, including via the ingestion of contaminated water or crops grown on adulterated land. Mounting evidence suggests that the risk posed by environmental contamination may be significant, warranting urgent further study and comprehensive precautionary measures to reduce the efflux of antibiotics into the environment.

While *no one* is immune from the threat of AMR, like so many other risks, the burden of AMR is unequally distributed; its impact falling disproportionately on socioeconomically disadvantaged populations, worsening existing inequalities globally (Jonas et al., 2017; O'Neill, 2016). Already, prior to the COVID-19 pandemic, it was estimated that between 40% to 60% of infections in Brazil, Indonesia and Russia, were caused by drug-resistant pathogens, compared with an average of 17% in OECD countries (OECD, 2018). Rates of AMR are projected to increase more rapidly in low- and middle-income countries, and low-income countries are predicted to experience far greater falls in economic growth, due to AMR, than wealthy countries (Jonas et al., 2017). The impacts of AMR are set to derail, and in some cases *undo*, progress made towards many of the SDGs, rendering them unattainable.

Even before the COVID-19 pandemic, there were concerns that the AMR agenda had been losing momentum (Wellcome Trust, 2020). While the impact of the pandemic on AMR is not yet known, there are reasons to believe that it may be deleterious overall. In particular, the pandemic is thought to have led to an increase in the inappropriate use of antibiotics to treat patients with the SARS-CoV-2 virus, particularly in inpatient settings, and pandemic control measures have caused significant disruption to AMR research globally (Charani et al., 2021). Conversely, measures such as physical distancing are likely to have reduced the transmission of other respiratory infections in the community, leading to a corresponding decline in the use of antimicrobials. It is hoped that pandemic-associated advances in our understanding of the transmission of respiratory infections, both in the community and in health care settings, will lead to sustained improvements in infection prevention and control practices (Tomczyk et al., 2021). The global response to the COVID-19 pandemic – in particular, the unprecedented mobilization of resources associated with the development and distribution of COVID-19 vaccines – has demonstrated what might be possible if such efforts were committed to other global health challenges, such as AMR (Murphy et al., 2021). The coming years will be critical: the extent to which AMR is prioritized and addressed in the pandemic preparedness and recovery agenda will determine its longer-term trajectory and success (Wellcome Trust, 2020).

Much like the SARS-CoV-2 virus, aided by travel and trade, resistant microorganisms do not recognize geopolitical or ecological borders and therefore measures to combat AMR necessitate cooperation and coordination at *every* level, from local to global (Charani et al., 2021; O'Neill, 2016). Action on AMR is considered highly cost-effective and, while *all* countries stand to benefit from AMR containment, it is thought to be especially beneficial for the economies of high- and upper-middle-income countries (Jonas et al., 2017). The uniquely complex nature of AMR demands a One Health approach, which recognizes the need for multifaceted, cross-sectoral and transdisciplinary solutions that are contextually appropriate and span the interface between human, animal and environmental health (Charani et al., 2021). The interventions necessary to counter AMR have been understood for some time, yet progress in implementing them has been slow. Important research gaps remain and, while most countries have now developed national action plans to address AMR, few have identified appropriate funding sources for them (FAO/OIE/WHO, 2021). However, there are *some* reasons for optimism. Innovative subscription payment models, for example, are being piloted in the United Kingdom and considered elsewhere, aiming to incentivize the development of new antimicrobials by remunerating pharmaceutical companies for novel agents based on their overall value to the health system, uncoupled from the quantity consumed (Gotham et al., 2021). There are also some innovative approaches to stimulate new thinking, such as The Trinity Challenge (Box 9). Future efforts must urgently and comprehensively address

Box 9 *The Trinity Challenge*

The Trinity Challenge (TTC) is a new global health initiative that is accelerating the use of data and analytics to better identify, respond to and recover from health emergencies by sourcing, rewarding and supporting innovative tools and solutions.

TTC brought together a global coalition of more than 40 world-leading public, private and academic partners and launched a global public challenge in September 2020 to better prepare for future health emergencies. The inaugural grand prize winner, Participatory One Health Disease Detection (PODD) in Thailand, uses data and analytics to support farmers to form a front line surveillance system, preventing disease spillover from animals. Other winners include Blood Counts!, which uses machine learning algorithms to turn complete blood count tests into a broad disease surveillance network, and The Sentinel Forecasting System, which predicts the emergence of new diseases by integrating real-time data on viruses circulating in animals, land use and past spillover incidents.

Winners will receive funding from a pot of approximately £6 million and catalytic support from coalition partners which will help solutions move faster and increase scale. Rapid deployment of challenge methodologies, such as The Trinity Challenge, which source global innovation and facilitate diverse collaboration, offer an innovative mechanism to safeguard the lives and livelihoods of billions.

Source: The Trinity Challenge (2021)

the many interacting factors which influence AMR in different settings and acknowledge its universal and constant nature: as long as there are microorganisms, there will be opportunities for resistance to develop.

Biodiversity – a safeguard in a changing world

This chapter has set out how our health, well-being, livelihoods and economies are inextricably linked to the natural world: humanity relies upon the goods and services it generates (Dasgupta, 2021). Yet, in many ways our actions are damaging the ecosystems we inhabit and denying us the ability to benefit from them.

Many of these benefits stem from the relationship between humans and individual species. Professor Alice Roberts, in her book, *Tamed*, has described nine species that have been domesticated that, along with humans, the tenth in her book, have changed the world. They include animals, such as dogs, cattle and chickens, and plants, such as wheat, rice and apples (Roberts, 2017). However, beyond these individual species, there is a growing understanding that biodiversity, the diversity within species, between species and of ecosystems (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2019), has a value in itself and is essential for the health of ecosystems, enabling the natural world to be productive, adaptable and, of increasing importance, resilient to shocks and change.

Yet biodiversity is being lost at an unprecedented pace: current extinction rates are estimated to be up to 1 000 times higher than baseline rates and are set to increase further (Pimm et al., 2014). Many now accept that society has failed to engage with the natural world in a sustainable way such that we, and our descendants, now face a precarious future unless urgent remedial action, in the form of transformative change across social, economic, political and technological determinants, is taken (Dasgupta, 2021; Daszak et al., 2020; Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2019).

The role of biodiversity in the natural world is varied and complex. Biodiversity has been shown to increase ecosystem resistance to a range of extreme climate events (Isbell et al., 2015), and is associated with increased production, and greater stability of yield, of fish, fodder and wood (Cardinale et al., 2012). The impact of declining biodiversity is under-researched and, reflecting the complexity of ecosystems, can be difficult to predict; however, evidence suggests that while initial losses of biodiversity in diverse ecosystems may have a relatively small impact on ecosystem function, as a result of compensatory mechanisms, increasing losses of biodiversity lead to accelerating rates of change (Cardinale et al., 2012).

Biodiversity is increasingly being seen as an insurance policy against environmental change. The diversity of vegetation in tropical rainforests means that when climatic conditions disadvantage one type of plant, another can grow into the gap that has been created. In this way, the process of absorbing atmospheric carbon dioxide can continue. This is much more difficult when the original forests have been replaced with a monoculture of food producing plants or when the remaining islands of jungle become fragmented and isolated from one another. In the same way, the selective breeding that underpins intensive meat production has created flocks and herds that are genetically

homogeneous. Yet in the natural world, genetic diversity offers protection against the emergence of a new pathogen, as it is likely that some individuals will be less susceptible than others. This loss of genetic diversity undermines the resilience of agroecosystems to future hazards, such as pests, pathogens and climate change, and, therefore, represents a significant threat to global food security (Daszak et al., 2020).

Biodiversity is also important because of the interdependence of species. Modern production of fruits and vegetables is only possible because of the existence of pollinators yet, in many parts of the world, their numbers are falling dramatically, due to a combination of climate change, habitat loss and the widespread use of toxic chemicals. Between US$235 billion and US$577 billion in annual global crop output is at risk due to pollinator loss (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2019).

Of particular pertinence, biodiversity is both a potential source of, and solution to, emerging infectious diseases. The majority of emerging infectious diseases, and almost all recent pandemics (including influenza, HIV, Ebola and COVID-19), are thought to have originated in animals but been driven to emerge by a range of ecological, behavioural and socioeconomic changes (Calistri et al., 2021; Di Marco et al., 2020; Jones et al., 2008; Morse et al., 2012). While natural areas of high biodiversity may serve as a source pool for new pathogens, biodiversity loss – through a number of complex mechanisms – tends to increase pathogen transmission and disease incidence (Keesing et al., 2010) and is thought to have facilitated the insurgence of the COVID-19 pandemic (Platto et al., 2021). In particular, land conversion – a key driver of biodiversity loss – can lead to spillover of zoonotic pathogens through human encroachment into species-rich areas (Faust et al., 2018; Karesh et al., 2012; Plowright et al., 2021; Wilkinson et al., 2018). Outbreaks of emerging infectious diseases are thought to be increasing in frequency as a result of the growing anthropogenic impact on the natural world (Schmeller et al., 2020), highlighting the intersectionality of environmental and animal well-being with that of human health (Aguirre et al., 2021). While pandemics may originate from the innate microbial diversity found in the natural world, so too does their treatment (Daszak et al., 2020). The diversity of organisms, molecules and genes found in the natural world are essential for the development of vaccines and other therapeutics, and an estimated 4 billion people rely on natural medicines for their health care (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2019).

Biodiversity loss is a development issue as much as an environmental one (Reyers & Selig, 2020; Roe et al., 2019). The deleterious consequences of our present exploitation of the natural world disproportionately affect lower-income communities – that are often more dependent upon natural resources – and, therefore, exacerbate existing socioeconomic inequalities both within, and between, countries (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2019). Biodiversity loss leading to food and water insecurity and the unequal distribution of natural resources can contribute to social and political instability, conflict and mass migration. It is thought that current trends in declining biodiversity and ecosystem degradation will undermine progress towards 80% of the SDGs' assessed targets pertaining to poverty, hunger, health, water, cities, climate, oceans and land. Moreover, biodiversity loss is likely to also affect progress towards the Goals for education, gender equality, reducing inequalities and promoting peace and justice; however, the current formulation of the targets fails to make their connections to the natural world explicit.

The most significant direct drivers of declining biodiversity are land- and sea-use change and the direct exploitation of animals, plants and other organisms, which, together, account for more than 50% of the global impact on land, freshwater and sea (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2019). Other direct drivers of biodiversity loss, which are becoming increasingly influential, are climate change, pollution and the invasion of alien species (Daszak et al., 2020; Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2019). These five direct drivers of declining biodiversity result from a broad range of indirect drivers which include human population dynamics, production and consumption patterns, trade, technological innovations and governance. The drivers of biodiversity loss have accelerated over the past 50 years and biodiversity is set to decline further, in response to continued population growth, unsustainable production and consumption of resources, and associated technological development.

Recovery of biodiversity may still, to some extent, be possible but will require urgent and drastic action to address the many interacting drivers of biodiversity and ecosystem loss (Daszak et al., 2020; Intergovernmental Science-Policy Platform on Biodiversity and

Ecosystem Services, 2019). A strong economic case has been made for radically transforming the way we engage with, and value, the natural world and recognizing that our economies are indivisibly embedded within it (Dasgupta, 2021). Such an approach necessitates a fundamental restructuring of global consumption and production patterns, changes to the way societies measure economic success, and transformation of the institutions and systems that shape the way we interact with the natural world, particularly our financial, food, agricultural and education systems.

Embedding One Health at all levels

A key message from this chapter is that a One Health approach necessitates breaking down the traditional environmental, plant, animal and human health silos to bring relevant expertise and authorities together. Successful operationalization of the One Health approach is dependent on decisions and processes at every level. Consequently, it is essential that all those involved in health and sustainable development develop a common understanding of the interdependence of human, animal and environmental health.

Nations as prime actors

While no nation can achieve One Health alone, nations are the building blocks for the implementation of a One Health approach. This will require mechanisms for cooperation across governments, such as inter-departmental task forces that can facilitate horizontal coordination of One Health approaches and development of national strategies for One Health. An immediate priority is close collaboration between the human and veterinary medicine sectors. Specifically, national human and veterinary public health authorities will have to institutionalize national zoonotic emergency prevention and intervention programmes using a One Health approach. Such programmes allow for appropriate countermeasures to be taken in a timely and coordinated manner. Countermeasures can be direct (e.g. quarantine, hygiene standards) and indirect (e.g. use of financial disincentives and incentives), but must take into consideration sociocultural considerations, availability of resources, costs and potential unintended consequences. Implementation of actions will only be successful when they are clearly communicated and understood by all.

Valuable lessons can be learned from national governments adopting a One Health approach outside of Europe. Rwanda offers an example. The Rwandan Government's One Health strategic plan is said to reflect their conviction that complex, shared health challenges are best solved through integrated policies and practices that tackle the multiple, interacting causes of poor health, such as poverty, food insecurity and gender inequality (Nyatanyi et al., 2017). Its stated objectives are to promote transdisciplinary and intersectoral collaboration to foster One Health at the government level; to strengthen prevention, surveillance and response to zoonoses at the community level; and, through training and education, to build capacity and encourage applied research in One Health. However, this is not without its challenges. Reported barriers have included competition over limited resources, communication problems and the need for additional infrastructure. Nonetheless, progress towards institutionalizing One Health is being made and Rwanda is said to be influencing its African neighbours to adopt a One Health approach.

A global response

A number of intergovernmental organizations exist, both inside and outside the UN system, that have long recognized the need to take a One Health approach to address health risks at the animal–human–ecosystem interface. In particular, the FAO and the WHO, both UN specialized agencies leading international efforts to support food security and universal health coverage, respectively, together with the OIE, established in 1924 to improve animal health, have been working cooperatively for several decades (FAO/OIE/WHO, 2017). In 2010, the FAO–OIE–WHO collaboration, termed the Tripartite Alliance, was formalized and, since then, it has employed an explicit One Health approach, working together on several technical topics, including AMR, rabies elimination and zoonotic influenza, demonstrating the value of multisectoral collaboration for effective management of shared risks to health. However, there is scope for more to be done; for example, by building on existing instruments such as the Codex Alimentarius to cover the entire food chain or expanding the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to cover all trade in wildlife. There are also several important initiatives in the area of One Health that are supporting capacity-building to

Box 10 *Examples of recent One Health initiatives*

Launched in 2021 at the One Planet Summit on biodiversity and conceived in France, Preventing Zoonotic Disease Emergence (PREZODE) is an international initiative that aims to prevent the emergence and spread of zoonotic infectious diseases (Peyre et al., 2021). Taking a One Health approach, the initiative seeks to integrate and coordinate research from the fields of human, animal and environmental health, in order to support the development of improved prevention strategies and more effective surveillance and early warning systems for emerging zoonoses (PREZODE). Through serving as a platform for sharing knowledge internationally, PREZODE intends to support capacity-building and inform evidence-based public policies to help mitigate the risk of zoonotic disease emergence worldwide.

Started in 2018, the Joint Initiative on Research in Epidemic Preparedness and Response (JIREP) is the result of a collaboration between the United Kingdom's Foreign, Commonwealth and Development Office and the Wellcome Trust (2021). This 5-year global research funding initiative aims to provide improved evidence on the prevention and management of disease outbreaks, in order to inform more effective preparedness and response activities worldwide. The initiative focuses on supporting countries most affected by outbreaks and, in particular, seeks to integrate social science research in epidemic response activities and translate evidence into policy.

support policy development, especially in relation to pandemic preparedness (Box 10).

Summary

If we are to limit the negative health impacts of our increasing human footprint, we must rethink health as a *system*. A system-based One Health approach recognizes the interdependence of human, animal and plant health and the health of the environment they share, considering among other things the impact of climate change, changes in land use and biodiversity loss for the health of living beings. A One Health approach can contribute to, and benefit from, current initiatives on climate change and efforts to reach the SDGs, maximizing co-benefits and investments. This approach must, therefore, be the basis to implement preventive as well as curative human health programmes. This will require that all countries invest in an explicit One Health approach to deal with threats to human health such as zoonotic and related diseases, AMR and plant pests and diseases. Raising awareness on the benefits of a One Health approach, focused on prevention of large-scale disease outbreaks, is the first step in the journey towards One Health at all levels, from building local capacity to global governance

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Chapter 6

Take action at all levels of societies to fix the fractures that left so many people vulnerable to the pandemic

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Leaving no one behind

One of the most concerning impacts of the COVID-19 pandemic is not that it has laid bare the inequalities and inequities which blight our societies, which it clearly has, but rather that it has exploited them (Paremoer et al., 2021). It has taken advantage of societal fractures – between individuals, groups and communities – and shone the most tragic of lights on our consistent failure to look after those most vulnerable. A saying, generally attributed to Thomas Jefferson, is that "the measure of society is how it treats the weakest members", and it is these groups who have been hardest hit by the disease and the wider impacts of the pandemic (Ahmed et al., 2020).

This should not have been a surprise. As soon as people began to collect and analyse data on patterns of disease it became clear that some groups faced an especially high risk of contracting infectious diseases. There are many reasons. Their underlying state of health, and thus their vulnerability to infection, may be compromised by their living conditions, including cold, damp housing and poor nutrition, both now and when they were growing up. They are also more likely to be exposed to many infectious agents. They are disproportionately represented in public-facing jobs, they may face difficulties in taking time off work without losing pay if they have to get tested or to isolate if they have come into contact with a case. They may face economic, physical and information barriers to obtaining health advice and care, with the challenges exacerbated by a shift to remote and online delivery of services.

Some face multiple disadvantages, including those who exhibit characteristics that lead to discrimination in some societies, such as race or religion. There are also those who society has, implicitly or explicitly, decided have little value. They include frail older people living in care homes, those with learning difficulties, too many of whom are still in institutions, and those with mental health problems, a group that is disproportionately represented among the homeless. All of these groups have suffered greatly during the COVID-19 pandemic.

One recent study, from the United Kingdom, has highlighted significant inequalities in access to health care experienced during the COVID-19 pandemic (Maddock et al., 2021). It utilized data from 12 United Kingdom population-based longitudinal studies to investigate whether sociodemographic characteristics were associated with disruption to medication access, procedures and/or clinical appointments. While the probability of disrupted access to care varied across studies, there were clear differences in the experiences of different groups within society. In particular, problems were more likely to be experienced by females (compared with males), older adults (compared with younger age groups), and ethnic minorities (compared with their white counterparts). Where more granular data on ethnicity was available, Black ethnic minority groups were at particularly increased risk of health care disruption compared with white ethnic groups. Differences in health care disruption were also observed among occupational classes, with those employed in routine/manual occupations or "other" (including those unemployed) being more likely to report experiencing disruptions compared with those in managerial/professional roles. Such disruptions to health care may have long-term consequences for the physical and mental health of patients. Of particular concern, these disadvantaged groups are already known to generally experience worse health outcomes, such that disruptions associated with the pandemic may sustain, or even worsen, pre-existing inequalities in health.

It is reasonable to ask how it can be that, in some of the wealthiest countries of the world, this could have happened? How was it that older people living in long-term care facilities, after having contributed to society throughout their lifetimes, died in the numbers they did at the beginning of the pandemic, some in terrible

circumstances and denied the support of their families? (Rajan et al., 2020). How was it that the pictures of health workers dying from COVID-19 in some countries were overwhelmingly from ethnic minorities even though these were people who many would count among the privileged in society? To answer these questions we need to understand the nature of contemporary societies and the fractures that run through them. These include high rates of wealth and income inequality; underinvestment in social protection, and especially in health and social care (including mental health); unequal opportunity for all; widespread precarity around jobs and wages; continued discrimination and stigma towards different groups; in some cases the persistence of class divides; an erosion of community in favour of individual status; and a pre-occupation with the "ideal" rather than the "real". These all, in their own ways, have contributed to the difficulties governments across the world have faced in responding to COVID-19, and they are contributory factors to why, despite the warnings, they were not adequately prepared.

There is an almost infinite number of ways in which societies are fractured, many of which have contributed to the poor outcomes during the pandemic. Consequently, it is necessary to be somewhat selective when examining priorities for policies. This chapter explores four of the many issues that could be considered.

The first is our ability to identify the different groups within society that are, to a greater or lesser degree, disadvantaged and to understand the scale and nature of that disadvantage and what might be done about it. This poses a number of challenges, technical, legal and ethical. In many countries, it will be necessary to invest in new systems of data collection, but also to address concerns about the use to which the data will be put.

The second is the changing nature of divisions within societies. Traditionally, health researchers have focused on characteristics of individuals that are either immutable or change rarely. For example, for most people, the level of completed education is already established by their mid twenties. As a consequence, much research has been cross-sectional, documenting what are often large differences in health, health-seeking behaviour and outcomes of care. Yet a growing body of evidence has identified the importance of precariousness as a determinant of health, especially since the global financial crisis, demonstrating how those leading precarious existences, uncertain about their employment, income, housing, or even food supply from one week to the next, are both particularly disadvantaged and missed by many conventional measures of social position. These groups have been especially vulnerable during the pandemic, facing many financial challenges during lockdowns and other restrictions. Every decision they make, such as whether to take on a role that places them at risk, involves balancing risks and benefits in ways that those with greater security can avoid.

A third fracture in society, again, with implications for the response to the pandemic, is between those who have trust in authority and those who lack it. Of course, trust is contingent on many things, not least what one is being asked to trust, but when it is necessary for society to come together for the common good, the existence of a minority of people who lack trust creates inevitable challenges.

Finally, it is necessary to consider gender. Women have been especially disadvantage during the pandemic, often bearing the larger share of domestic responsibilities or being in the least secure employment.

We now look at each of these in turn.

Diversity, inequality and inequity

The first challenge involved in tackling the social and economic conditions that have created the conditions in which SARS-CoV-2 has been able to spread is to understand the divisions in society. This requires an understanding of diversity, inequality and inequity.

Starting with diversity, it is clear that every person is different. Even identical twins differ in some ways as a consequence of their different experiences. Sometimes these differences are visible, taking the form of height, weight, physical disability or skin colour. Others are not, including genetic make-up or sexuality (in most cases). Others may be inferred from verbal or visual clues, with varying degrees of accuracy. These include education or social class. A very few of these matter for health in their own right, such as certain genetic traits. Some do not matter at all, such as the colour of one's eyes. Some do, for biological reasons. Thus, possession of male or female reproductive organs and the associated hormonal differences give rise to differences in some diseases. Many diseases are associated with age. Thus, cancers, ischaemic heart disease and dementia are much more common at older ages, reflecting in part

the cumulative effects of degenerative processes. Thus, there are age- and gender-related inequalities in health. However, such differences only become inequities if they arise from processes that are unjust, for example, where there are ways of reducing or eliminating their health consequences but these are applied differently to those with particular characteristics, such as rich and poor.

Whether this happens depends on the norms and regulations of the society in which one lives. People are defined by themselves and others on many different grounds. The 1726 satire *Gulliver's Travels*, by the Anglo-Irish writer Jonathan Swift, describes a country deeply divided among two groups, one that insisted in breaking open their eggs at the rounded end and the other at the pointed end. This dispute had led to several major conflicts and was a commentary on the religious disputes of the time. Even now, those adhering to certain religions can face discrimination in certain societies, and even within recent decades one's religion could determine whether one lived or died in some parts of Europe beset by conflict. Even today both gender and sexuality continue to influence the opportunities available to people.

The role of society in creating inequities can be illustrated by reflecting on the concept of race as a determinant of health. Researchers and politicians interested in this topic intuitively consider "race" as a social determinant of health. By race they understand a combination of various visible attributes of humans such as skin colour or hair texture. This interpretation is controversial and is problematic in several respects (Namer & Razum, 2021).

There is no biological or genetic correlate of "race". Genomic analysis has shown an enormous diversity within groups living in particular places and with what some see as shared physical characteristics. Instead, there is now a widespread acceptance among scholars and, increasingly, by those engaged with policy, that race is entirely socially constructed. However, the term "race" is still used by persons falsely postulating biological differences between people and ascribing values to them, often when promoting arguments that are racist or in support of an ideology of racial superiority. Thus, the discussion should not focus on race as such but on the process of ascribing it to people and thereby "othering" them in ways that attach a value judgement to them. This is the process of "racializing".

When racialized groups use the term "race", they usually refer to a social descriptor of lived experiences of such groups, which could better be replaced by "being racialized". Racialization as a process often starts at birth and can become institutionalized in a way that may appear permanent and essential. It is a process that incorporates stigmatization and exclusion. Hence, it is not race which is a social determinant of health but "being racialized".

Individuals are often racialized based on more than one attribute, and not all of these attributes are necessarily visible; examples include racialization based on religion or sexual orientation. Hence, an intersectional perspective of racialization that takes into account ethnicization, sexualization, minoritization and gendering is required (Ahmed et al., 2020). Importantly, racializing is not only a phenomenon at the individual level; that is, one person racializing another one based on particular markers. Even more important is the racialization that occurs at a structural level. Examples of racialization at the structural abound, for example in medical sciences (racialization of certain diseases) and in health services. Inequities are driven by racialized segregation (Reskin, 2012), and institutional, structural and interpersonal racism (Nazroo et al., 2020). This leads to access barriers and/or entitlement restrictions for racialized persons that are "in-built" in the health care system. Such barriers and restrictions generate, or amplify already existing, inequalities in health, thus making a(nother) major contribution to racialization as a social determinant of health.

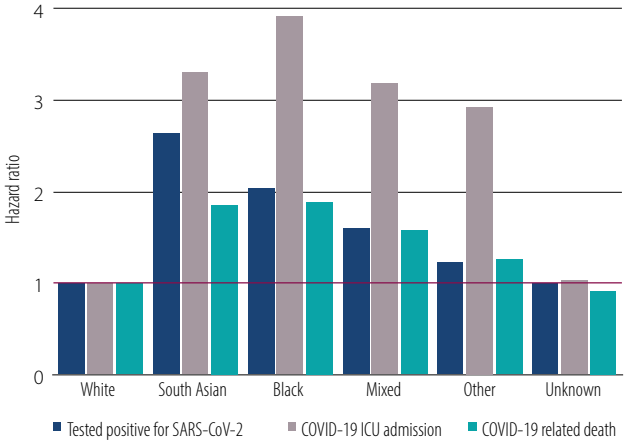
Racialization as a social determinant of health has direct and indirect consequences on health. Thus, being exposed to racism is significantly associated with poorer general, physical and mental health. Ethnicity is a moderator of the relationship between racism and health and its effects are stronger for some ethnicized groups than others (Paradies et al., 2015). Racialized minorities are more likely to receive severe mental health diagnoses (e.g. psychosis) than majority groups (Halvorsrud et al., 2018). Their pathways to care are more likely to be through the civil detention system, with more contact with the police and criminal justice systems.

In these ways, inequalities in health associated with race can be seen to be inequitable, or unfair, as they are the consequences of the rules and norms of society rather than the intrinsic characteristics of the individuals affected (Bastos et al., 2021). This is equally true of those whose health is damaged by the unequal application of other policies and norms, such as those associated with

socioeconomic differences, recognizing that these often correlate with race.

The first step in developing a policy response to these fractures in society that the SARS-CoV-2 exploited is to describe them. Yet, in many countries, long-standing and deep-seated inequalities are effectively invisible. This is apparent from inspection of reports on the progress of the pandemic. While most countries report cases in relation to population, it is often difficult even to obtain figures broken down by age or sex. Some report data by region, but fewer with the level of granularity that make it possible to visualize small area differences that can point to particular risk factors, such as a concentration of cases in areas in which people live in crowded multigenerational dwellings. Even fewer include a measure of socioeconomic status or ethnicity. Indeed, reporting of race or ethnicity is rare even in scientific research on COVID, with European studies worse than those undertaken in North America (Raghav et al., 2021). Where they do, they often reveal stark differences (Figures 6 and 7).

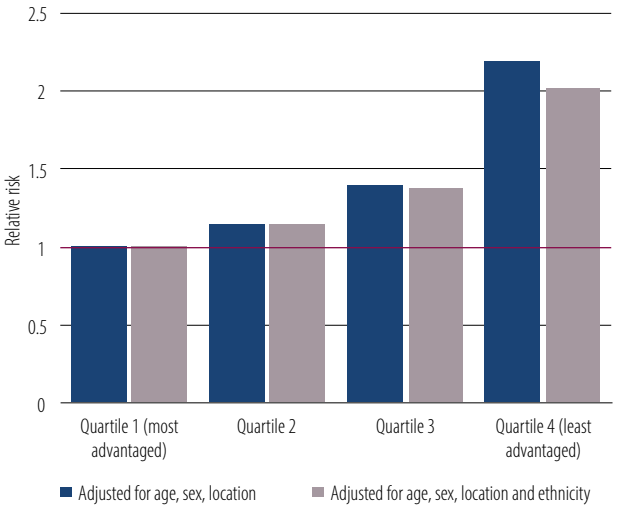
Figure 6 *Association between ethnicity and outcome of COVID-19 in England by ethnicity*



Source: Mathur et al. (2021).

Race and ethnicity are different from migration status. Recent migrants are often especially disadvantaged, especially if they lack documentation or are unfamiliar with procedures in their adopted country. A systematic review of studies that had examined COVID-19 outcomes, including several from European countries, identified multiple disadvantages, almost always linked to worse outcomes (Hayward et al., 2021).

Figure 7 *Association between socioeconomic status and probability of testing positive for SARS-CoV-2 using UK Biobank data*



Source: Niedzwiedz et al. (2020).

Details matter in seeking to understand the nature of disadvantage in a pandemic or other health crisis. Thus, while many governments have sought to protect those who were affected by the pandemic and responses to it, the extent to which they succeeded often depended on the precise nature of entitlements. For example, survey data identified an increase in the number of people in the United Kingdom who experienced difficulty obtaining healthy and nutritious food during the pandemic, but the increase was greatest in those who fell outside what was an extensive salary replacement scheme (Koltai et al., 2021). These people could only be identified by including questions on participation in this scheme in the survey instrument.

As noted above, those seeking to understand the fractures that the virus has exploited must take account of the changing nature of society and, in particular, the growth of precariousness, with many people living lives characterized by uncertainty. Consequently, it is necessary to develop new measures that capture this, asking not just about employment, for example, but about the terms and conditions that apply (Matilla-Santander et al., 2021). The need for granularity is also apparent from an understanding of differences in the risks associated with different working environments, with some, such as meat packing plants, posing a particular risk during the pandemic (Ramos et al., 2020). Similarly, while it is obvious that homelessness is an important risk factor, there are many who are not formally homeless but whose housing status is precarious (Clair et al., 2016).

As these examples show, it is not possible to obtain an adequate understanding of a health crisis, such as a pandemic, including its direct and indirect effects, without the ability to analyse data in relation to characteristics that, in a particular society, lead to disadvantage. However, as the range of characteristics that may be important will vary according to the existing norms in a particular society and the nature of the threat, as well as the logistic challenges involved in collecting everything that may be needed, it is necessary to make choices about what should be included in routinely collected data sets, such as health care utilization data, and what should be collected in regular surveys, where it is possible to vary the questions according to the circumstances. It is also important to ensure that there are longitudinal data among the portfolio of surveys to capture peoples' changing circumstances.

For these reasons, pandemic preparedness should include a clearly worked-out strategy for data gathering, starting from the answers that are needed to inform policy and working back to determine how to collect them, with a particular focus on the divisions in each society that are important.

At this point it is necessary to address a major barrier to gathering the necessary data. In many societies there are concerns about privacy and how the data might be used (Rahu et al., 2020). Within the EU those collecting and analysing data are bound by GDPR, which provides strong safeguards, while recognizing the importance of data used for public health purposes. However, authorities may have to work hard to gain trust, especially in those countries where there have been previous abuses or even just lapses in the application of data protection rules. A related barrier relates to reluctance to collect certain types of data, in particular that relating to race or ethnicity. This is understandable in some countries, given events in the 1930s and 1940s. However, it has the effect of making the health effects of racial inequalities, which as noted often result from racism and discrimination, visible. Where such data are not currently collected, which includes most European countries, there is a clear need to commence a dialogue, engaging with community and faith leaders to build trust. This will not be easy but the disproportionate impact of the pandemic on some disadvantaged communities is unacceptable in societies where there are commitments to "leave no one behind". A 2017 report for the EU provides a detailed examination of the situation in EU Member States, including the applicable legal frameworks, noting that no Member State imposes an absolute prohibition of ethnic data collection (Farkas, 2017).

This will require major investments in many countries where such data are not yet collected and, as noted above, will raise some delicate and potentially controversial political questions. However, it is important to see these developments as part of a wider information strategy that will allow policy-makers to understand the problems they are seeking to solve, in particular the disproportionate impact of threats to health on groups within their population, the differential impact of the countermeasures they adopt, and the extent to which any unintended consequences are being mitigated. Box 11 lists some of the key elements of such a strategy.

Box 11 *Elements of a comprehensive information strategy in a pandemic*

Data on the virus:

- Daily numbers of reported cases (primarily from laboratories), hospitalizations, deaths (both from ad hoc data collection systems to ensure rapid reporting and from vital registration systems)
- Weekly or monthly sero-surveillance surveys, to track the spread of the virus in a representative population sample
- Sequencing of viruses from positive samples (target approximately 10% of all cases)

As far as possible, these data should be generated in sufficient detail to feed into the ongoing modelling work that is essential to anticipate the development of the pandemic and estimate the impact and optimal timing of possible responses

Data on the population:

- Monthly surveys of socioeconomic conditions of the population, along with information on behavioural responses, that is able to be disaggregated by relevant variables including sociodemographic and economic situation, health beliefs and attitudes to policy responses.
- Mobility monitoring, using data from mobile phones.
- Surveys of social media to identify and respond to disinformation and to undertake sentiment analysis."

Meta data

- Data on the data, sufficient to enable users to evaluate its validity and relevance

Source: Authors.

As the preceding section shows, all countries should have systems in place that can quantify the impact of disease, and the responses to it, on different groups within their population so that they can identify those who are most vulnerable and take actions to address their vulnerability. However, this should only be the beginning. There is much that can be learned from international comparisons, which can serve to identify good practice that can be emulated elsewhere. As important, information on the consequences of a government's policies is essential if it is to be held to account by its people. Evidence that it is underperforming relative to other countries can make an important contribution to bringing about change for the better. There are many examples. Thus, governments place a high priority on delivering economic growth, assessing their own performance against those of other comparable countries. In the area of social policy, the PISA rankings of educational achievement have been important in encouraging reflection on how children are taught. In health, comparative data on cancer survival, such as that provided by the CONCORD study (Allemani et al., 2018), have influenced reforms in some countries that were seen to be underperforming.

While these sources of data capture aggregate performance, few capture its distribution. Those data sources that do have relevant measures typically record data by age group, or by geographical differences, a task that has become easier in those countries that have adopted the Nomenclature of Territorial Units for Statistics (NUTS) system, to enhance comparability. Countries also record the distribution of income, measured using the Gini coefficient. However, those seeking to compare social and health variables across countries have much less to work with. One of the few internationally comparable measures is completed education, which has been used as the basis of most of the research on health inequalities across Europe (Mackenbach et al., 2008). This is a very important measure of social position, with a number of advantages, including how it is established early in life, thus reducing the risk of reverse causality, and also because education is a very important determinant of opportunity, especially in an increasingly technological society. In some countries it is also becoming an important determinant of political views, especially where identity politics is replacing traditional right/left divisions, with important implications for inclusive policies.

Some countries also report data by occupational class, using the International Standard Classification of Occupations, which can be used to generate a five-point classification using the Erikson–Goldthorpe–Portocarero scheme (Erikson et al., 1979). However, even when these data are available, they have a number of limitations, in particular because they exclude people who are not in current paid work, who in many countries are disproportionately female, and include the growing number of pensioners.

A few countries also report on the variation of characteristics of the population by income, but this is also subject to a number of technical challenges; for example, the increasingly diverse ways in which people obtain income, for example, from salaries, welfare benefits and investments, as well as the distinction between gross and net income, with the latter taking account of taxes and transfers, and the challenge of allocating income within households.

A further challenge is the need to consider intersectionality, whereby the importance of, for example, education, income or occupation, as a determinant of health will depend on other characteristics of the individual, such as sex or ethnicity. Finally, as noted above, it is increasingly apparent that it is not just one's position in the social or economic hierarchy that is important but the uncertainty that comes with precariousness, discussed in the next section. An individual may appear privileged on the basis of their occupation at a particular point in time, but that can change rapidly in some circumstances. Education and income, or more importantly, wealth, can reduce the risks of instability but not completely.

There are of course many existing surveys that do provide some information about divisions in society. EU countries, along with Iceland, Norway and Switzerland administer the EU Survey of Income and Living Conditions (EU-SILC) (Arora et al., 2015), which has provided valuable insights on, for example, the impact of the global financial crisis. However, while the questionnaires used in each country are broadly comparable, there are some differences. The Survey of Health Ageing, and Retirement in Europe (SHARE) is another valuable resource, tracking 140 000 people aged 50 or older from 28 European countries and Israel (SHARE, 2021). The Eurobarometer surveys provide regular reports on a range of issues but are limited by small sample sizes and the ad hoc nature of the topics covered. However, there is a clear need for comparable data from the rest of the pan-European region, some-

thing that could most easily be done by expanding these existing surveys.

For all of these reasons, it will be important to develop internationally comparable measures of sociodemographic and socioeconomic status that can be used to understand the scale and nature of resilience of populations who have experienced different government policies and as a basis for cross-national learning about ways to enhance this resilience. Until this is achieved, governments should ensure that the data they do collect and publish is disaggregated to the extent possible using characteristics that are already collected.

Precariousness and why it is important

Throughout the pandemic, some groups have fared especially badly in many countries. These comprise individuals and families who are in insecure employment, working in what is termed the gig economy. Many have been unable to benefit from financial protection schemes, such as furloughs, that have provided wage replacement for employees unable to work when their employer had to cease operating, as they lacked the documentary evidence to establish entitlement. As a consequence, they have been more likely to continue to work, many in public-facing jobs (Apouey et al., 2020).

This has obvious consequences for the well-being of those affected but is also important for controlling the pandemic. Those who risk losing employment or income if they are required to isolate, for example because they have been in contact with a case or test positive, have a powerful incentive not to draw attention to themselves (Ahmed et al., 2020; Smith et al., 2021).

The importance of precariousness has attracted growing attention in the Anglophone literature since the global financial crisis but has a much longer history in Francophone scholarship, where French researchers studying the nature of work discussed *précarité de l'emploi*. There was a broad political consensus that this was to be minimized. Pitrou (1978) identified a set of defining characteristics, including aspects of employment, such as low skills, low wages and harsh working conditions, but also economic insecurity, inadequate housing, health problems and lack of social networks. Crucially, precariousness was recognized as differing from poverty, although most living precarious lives were also poor. Other French writers developed this concept further, introducing ideas such as *précarité de travail*, affecting employees engaged in activities that generate little value, are tedious or repetitive, and attract few rewards, intellectually or financially (Paugam, 2002). More recently, the concept has extended to a description of societies where irregular and uncertain employment dominate (Kalleberg, 2009).

English-speaking scholars were also concerned about the changing nature of work but tended to talk of flexibility. While many politicians considered this an inevitable result of technological change in a globalized world (Rodrik, 2012) some also invoked the term precarious (Reich, 2002; Sennett, 2011).

The publication of the results of the Great British Class Survey in 2013 changed the discourse (Savage et al., 2013). It sought to update concepts of class, which had until then mainly used a classification developed in the 1920s. It derived class from an individual's economic capital, defined as income and assets; cultural capital, derived from cultural interests and activities and social capital, based on the quantity and social status of friends, family and business contacts. This drew on Bourdieu's theory of social distinction (Bourdieu, 1984), and identified seven contemporary classes, with the Elite at the top and what was termed the Precariat, a term combining the words precariousness and proletariat, at the bottom. Standing popularized it, seeing it as the inevitable consequence of information technology and concentration of power by those accumulating an increasing share of global wealth (Standing, 2011). The term has entered the official lexicography with the International Labour Organization noting how "precarious work is a means for employers to shift risks and responsibilities on to workers" (International Labour Organization, 2011). The United Nations Development Programme (UNDP), in 2014, noted a "widespread sense of precariousness in the world today – in livelihoods, in personal security, in the environment, and in global politics" (UNDP, 2014). Although precariousness is not actually defined, a search of the report yields many examples of how the term "precarious/precariousness" is used to describe the circumstances in which many people live, including informal employment; the threat of conflict or natural disasters; lack of civil, economic and social rights; and exposures to food price hikes. Although the report does not refer to the literature cited above, it is clear that the ideas are closely aligned.

Precariousness can cut across traditional classifications of social position or class. Individuals can be in a state of precariousness even if they are well-educated and

in employment if that employment is insecure and they lack assets on which to fall back. It can also be perceived, even if not objectively demonstrable, but is nonetheless important and may affect health and well-being. Indeed, while job loss is bad for health, there is also considerable evidence that the harmful effects can appear much earlier, coinciding with the anticipation of future problems, regardless of whether those anticipated difficulties ever materialize (Perlman & Bobak, 2009).

The conditions that give rise to precariousness are, largely, the result of official policies and thus so are their solutions. As Vives and colleagues note, "a strong welfare state protects workers" from the consequences of employment precariousness (Vives et al., 2013). This lesson was relearned during the global financial crisis, which provided many natural experiments. For example, while suicides increased in many countries (Barr et al., 2012; Reeves et al., 2014; 2015), this was not inevitable. No such relationship was seen in Sweden, for example. This was found to be a function of the strength of the welfare state and, specifically, investment in active labour market programmes (Stuckler et al., 2009) that help people get back into work, providing information and retraining and support for people with disabilities and, in these ways, telling them that those in authority care.

We now look at different types of precariousness, starting with employment. Greeks experiencing job loss in 2009, before the worst of the austerity package, and in 2011 when it was in full force and when many were living precarious lives, found a decline in mental health in both periods but much more so in the later period (Barlow et al., 2015). Thus, both the probability of losing one's job, and the resulting adverse effects were exacerbated by the wider economic situation.

People may also feel precarious because of concerns about having somewhere to live. A Spanish study compared patients attending primary care centres in 2006–2007 and 2010–2011, before and during the economic crisis (Gili et al., 2013). There was a significant increase in mental illness, with large increases in depression and anxiety and alcohol-related disorders. As expected, job loss was a major factor but so was getting into housing arrears or the threat of eviction, independent of employment status. Another study covering the then 27 EU Member States identified respondents to the EU-SILC survey who had no housing arrears in 2008 and followed them to 2010, when many more were facing situations that were precarious because of job losses and cuts to social protection (Clair et al., 2016). Those getting into arrears experienced worsening mental health, but only if they were renting their accommodation. Those who owned their accommodation were spared. Crucially, the effect of falling into rent arears was independent of, and greater than job loss. Once again, the effect varied among countries. In some, people were relatively protected. In others, such as Belgium, Austria and Italy, the effect was substantial.

In some countries there have been growing numbers of people whose ability to feed themselves is precarious (Loopstra et al., 2016a). A study using data from 21 countries found that food insecurity increased between 2004 and 2012, associated with both job loss and income reduction (Loopstra et al., 2016b). However, where there were strong social protection policies, the impact of rising unemployment or stagnating wages on food insecurity was reduced.

Looking ahead, precariousness will assume increasing importance as a consequence of what has been termed the fourth industrial revolution, driven by advances in artificial intelligence, robotics and nanotechnology. Traditional manufacturing is giving way to 3D printing and shopping is moving from the high street to online platforms. This will have profound implications for traditional models of employment, with some estimates suggesting that up to 50% of existing jobs could be at risk, although the more likely figure is in the 15–20% range. As with previous technological revolutions, the loss of some jobs will be compensated for by the creation of new ones and some skills, such as those involving human interaction, especially in areas such as health and social care and those that cater to the needs of ageing populations are likely to increase. There will also be new jobs that have not yet been thought of.

While there are reasons for optimism about the long term, the transition is likely to be traumatic for many people. These changes have been accelerated by the pandemic. As online meetings replace those in person, the need for transport workers is likely to be reduced. Online streaming services are likely to reduce the demand for some forms of entertainment, such as cinemas. Restaurants will be challenged by online food delivery services. These changes are likely to concentrate even further the power of global corporations that operate these services at the expense of workers. Thus, local taxi services will struggle to compete with ride-hailing services, and small shops, unless they are catering for

niche markets, will struggle to compete with the ease of clicking to order from online retailers.

Ultimately, governments must support the transitions that are required. In some respects, this is easier than it might have been given that many are intervening in their economies on a scale that was never anticipated. Rather than simply withdraw these measures, they have an opportunity to transition to the new context with new ideas rather than perpetuating obsolete models of the past.

One way of doing this is to recognize the value of investment in this future, separating it out on government balance sheets, an issue that will be returned to in Chapter 10. Another is to look at ways in which employment programmes can be used to support workers rather than jobs; for example, by supporting retraining programmes that develop the digital skills needed for the new economy. Another idea is that of universal basic income, which was, in effect, implemented in many countries during the pandemic. However, outside a crisis, it is extremely controversial. A systematic review of its use in low- and middle-income countries found some evidence that it had certain beneficial health effects but the quality of the evidence was poor (Pega et al., 2017). The key message, however, is that the conditions that led so many people to lead precarious existences, and thus created a situation that SARS-CoV-2 could easily exploit, are likely to assume greater importance in the future and will require some innovative thinking about how to respond.

A more immediate priority is to recognize that those living precarious lives, who may not be captured in conventional data gathering exercises or who may be especially prone to fall through social safety nets, are at particular risk during a pandemic, both of being in situations where they have greater exposure to infection and experiencing adverse consequences from the restrictions necessary to control the spread of infection. Their needs should feature prominently in any pandemic plan.

Trust

The effective implementation of policies to protect health depend on high levels of trust in institutions. Several studies undertaken during the H1N1 pandemic showed how those who trusted governments were more likely to adopt behaviours recommended to control the spread of infection or to be vaccinated (Gilles et al., 2011; Prati et al., 2011). This is especially important when the threat is complex, calling for specialist knowledge to understand it (Siegrist & Zingg, 2014). This is referred to as social trust, distinct from general trust, which relates to how one views other individuals and society.

Although there has been widespread public support for and compliance with measures taken to restrict the spread of SARS-CoV-2, with public opinion frequently ahead of government actions, there are small but vocal minorities in many countries that have promoted distrust in public health messages and promulgated conspiracy theories. Those involved come from both ends of the political spectrum.

Their views have spread and gained prominence in some countries as a result of the growth of partisan media, illustrated by the finding that those who trust Fox News in the United States are less likely to adopt preventive behaviours than those who trust CNN (Zhao et al., 2020), and globally through the now ubiquitous use of social media, a subject of increasing attention for public health researchers.

False information comes in two forms: misinformation, which is simply factually wrong; and disinformation, where it is not just wrong but is generated and promoted with the intention to deceive. Inevitably, the border is often blurred. It is now clear that both forms spread faster and wider than information that is true (Wang et al., 2019). Those promoting these messages may have one or more motives, which go beyond the desire to spread a message that an individual, mistakenly, believes in. These include the ability to monetarize messages, for example by attracting advertisements or directing viewers to certain pages, the distribution of malware, and efforts by certain organizations to create divisions in society and undermine trust in institutions.

Clearly, public health authorities must be aware of messages that are being promoted on social media and other platforms so that they can tailor their own messaging to address the concerns generated, something that some now accept as they take down posts that undermine public health messaging, even when they are from government ministers.

Governments do, however, have responsibilities in relation to the reasons why many people are disaffected. There is now considerable evidence, both historically and in more recent times, that those who believe that they have been "left behind", and especially those in

communities experiencing what have been described as "diseases of despair", provide fertile ground for divisive and xenophobic attitudes and distrust in authority (Bor, 2017; Koltai et al., 2020). Consequently, it is easy to create a vicious downward spiral in which worsening health feeds into distrust of public health messaging and so on. This points to a need to take action to break this cycle; for example, by directing investment to locations and communities that are experiencing economic decline. However, politicians can also help by avoiding the temptation to exploit divisions in society by blaming others, most often those, such as some migrants, that are visibly different.

This is not just an issue of what individuals on a personal level choose to believe or not. It has fundamental implications for the types of society that will flourish. With equal voice and attention given to what is conjecture or opinion and what is genuinely scientifically provable, one can see a denial of science, an undermining of the role of experts and, worryingly, policies being designed and implemented not on the basis of what is known but rather what is hoped for. In warning about the dangers of forgetting the lessons of history, Timothy Snyder has written that "to abandon facts is to abandon freedom" (Snyder, 2017). And yet, it is ostensibly in pursuit of freedom – or in response to what is perceived as an impingement on freedom – that facts have been denied and trust is declining. COVID-19 has, with devastating and tragic consequence, shown what making false equivalence between fact and opinion can lead to.

The increasing lack of trust in facts and expertise is mirrored in growing scepticism towards political leaders and systems of governance. This has hindered the pandemic response in many settings. And while in some countries, the view of the political classes as a so-called elite who are self-serving, engaging in cronyism and ruling in favour of their own interests, has not been without foundation, this has been to the detriment of engendering the necessary public support for and commitment to the response measures. It is clear that this lack of trust reflects a societal fracture in its own right, and one that demands a new form of leadership and approach to decision-making, one that can strengthen the trust that is necessary for effective public health policies.

Those in authority must understand the scale and nature of distrust in their societies, why this distrust exists, and, with the help of experts in communications, work out what can be done to overcome it. This is likely to require targeted research, with a number of examples across Europe that can be drawn on (Siegrist et al., 2021), including one multinational study that applied a new instrument to capture public perceptions of government responses during the pandemic, the COVID-SCORE-10, in which scores correlated with trust in government (Lazarus et al., 2020).

In general, there is more trust in scientists than in politicians, a consideration that must be taken into account in developing a public health response. While politicians must ultimately decide what policies to adopt, there may be dangers if public health figures are seen as lacking independence; for example, by appearing with politicians in media briefings.

In summary, trust is an essential element of a comprehensive response to major health threats. The challenge is that trust is difficult to build up and easy to lose. Each country will be different, both in levels of trust in government in general and in specific individuals in authority. There is an extensive body of research on health communication. It includes the importance of ensuring that complex messages are understandable without sacrificing accuracy; an understanding of the major role played by cognitive biases that mean that different people may take a completely different meaning from the same message (McKee & Stuckler, 2010); and the challenge of communicating uncertainty (Hartwell & McKee, 2021). When trust is squandered or neglected, it creates a major fracture in societies that undermines responses to a health threat, leaving some groups inhabiting a different cognitive environment and placing them and others at risk.

Women in a pandemic

Societal emergencies, whether public health specific or those with a less direct health impact (such as the global financial crisis), have a gendered impact, affecting women and men differently. What is consistent, however, is that the socioeconomic impact of such emergencies on women is disproportionate, stemming from long-standing social, economic and political inequalities. COVID-19 is (yet another) clear case in point.

A key aspect of this differential socioeconomic impact relates to gendered employment. Only marginal gains in narrowing the gender gap in employment have been made since the 1995 Beijing Declaration and Platform for Action (Fourth World Conference on

Women, 1995), as it remains the case that women's traditional care-providing responsibilities affect their educational and labour market opportunities (International Labour Organisation, 2019). One direct consequence of this is occupational segregation, with women under-represented in higher paid positions and higher profile sectors (Das & Kotikula, 1995; Gradín, 2020; Hegewisch & Hartmann, 1995; International Labour Organisation, 1995). A second is that, especially in higher-income countries, women are more often employed in precarious types of work, characterized by less stability, lower pay and benefits (Buckingham et al., 2020). With women in wealthier countries thus over-represented in sectors such as hospitality, tourism and education and in the main occupying lower level positions with fewer possibilities for home working, they were immediately more vulnerable to the shut-downs and restrictions imposed to control COVID-19 (Fernandes & Kerneïs, 2021; Zarrilli & Luomaranta, 2020). The knock-on effects for women's physical and mental health (low self-esteem, increase in gender-based violence, disproportionate assumption of household duties including home-schooling) are further cause for concern, with the prospect of undermining much of the progress on gender equality (UNFPA, 2020). So while governmental provision of bailouts and stimulus packages for the economy have understandably been targeted primarily towards these service sectors, this is a response to the immediate crisis and will not change the gendered dynamics of employment going forward.

What is needed is a real commitment to gender equality in policy design and decision-making, and this is reflected in the Commission's call to ensure that women participate effectively in decision-making bodies and ensure that their rights and needs are equally recognized and reflected in policies.

Demands for an explicit gender dimension in post-COVID-19 recovery plans abound, with the G7 group of countries promising investment in girls' education and women's employment (G7 Research Group, 2020), but this can only bring long-term dividends and structural change with women actively participating in setting the specific agendas themselves – this is true at all levels of decision-making from the local, through the municipal, national and international. One of the Beijing Platform's commitments to change was for the institution of measures for women's equal access to, and participation in, power structures and decision-making. This commitment – still not met – takes on renewed importance today. For we know that gender equality in decision-making has positive economic consequences (Elborgh-Woytek et al., 2013) and brings myriad benefits, with women in leadership positions shown to prioritize issues of social importance: health, education, welfare, rights and social cohesion ahead of their male counterparts (Profeta, 2017). International comparisons suggest that female leaders have often led the way when it comes to inclusive and effective COVID-19 responses (Coscieme et al., 2020).

It is precisely on these areas that any post-COVID-19 planning must focus; for this goes beyond health and is at the heart of healing the societal fractures discussed. Unsurprisingly, therefore, across the globe, from the front lines of health service delivery to heads of state, women are being credited with leading the way when it comes to inclusive and effective COVID-19 responses (UN Women, 2021). This should provide additional evidence to make the case for more gender-representative decision-making bodies, should any be needed.

It is perhaps instructive that when asked why the recently established WHO Council on the Economics of Health for All is made up only of women, the joint response from Professor Mariana Mazzucato, Chair of the Council, and Dr Tedros Adhanom Ghebreyesus, WHO Director-General, was: "why not?" (UCL, 2021).

Summary

In seeking to understand how the pandemic has affected countries differently, it is necessary to understand the inequalities that left too many people vulnerable to its effects. As governments seek to build back better they must, of course, address the conditions that allowed SARS-CoV-2 to emerge, taking action in the area of One Health, and invest in systems that can anticipate and detect emerging threats. However, this will not be enough. It will also be necessary to act on the conditions, such as changes in employment rights, that caused so many to lead precarious lives that left them so vulnerable in the pandemic. To do this, however, governments must first determine who is vulnerable and why, and they cannot do that unless they collect the appropriate data.

At the same time, they must address the loss of trust in authority that, in many countries, has undermined the response. Trust must be earned so there is a need, in many countries, for more effective leadership than has

been the case so far. However, there is also a need to recognize that there are those who seek to undermine trust, for various reasons, facilitated by the growth of social media.

Finally, too often the gendered nature of a health crisis and the responses to it have been overlooked. Women are often affected most, reflecting the traditional division of household labour. Yet they are also often excluded from the policy process, even though there is some evidence that their inclusion leads to better outcomes.

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Chapter 7

Invest in strong, resilient and inclusive health systems

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Introduction

The pandemic delivered an unprecedented shock to health systems. In those regions worst affected the numbers of patients needing intensive care soared, far exceeding the available capacity. Television coverage from several countries portrayed severely ill patients being treated in corridors by health workers who were struggling against almost impossible odds. There were shortages of almost everything. There were too few beds into which the patients could be admitted, too few health workers, too little equipment, especially ventilators, and, in some cases, problems in ensuring consistent supplies of oxygen. In these circumstances, the priority became saving the lives of those with this new and, for too many of those affected, lethal virus.

These pressures threw into sharp relief the failures, in many countries, to invest in all elements of the health system. Initially, it was hospitals that were in the spotlight. Few had sufficient flexibility to respond to the crisis that so many had been warning about for decades. This was quite different from the situation in some Asian countries, where hospitals had been redesigned with the threat of a pandemic in mind, including having the capacity to separate those suffering from the pandemic disease from those needing routine care.

All sectors of health and social care systems were affected

Hospitals in Europe responded as well as they could. Wards normally used for other purposes were converted into high dependency or ICUs where possible. Staff were redeployed, in some cases undergoing rapid conversion courses to enable them to care for patients with unfamiliar conditions. Many worked longer hours and minimum staffing rules were suspended. Additional staff were recruited, including those who had recently retired and medical and nursing students. In some cases this required legislation on issues such as malpractice and had implications for pensions.

These measures were accompanied by a massive diversion of resources away from non-urgent care. Much routine outpatient activity and non-urgent surgery was halted. Over 3 weeks in May 2020, WHO conducted surveys in 155 countries, finding that COVID-19 had dramatically curtailed the provision of health services for noncommunicable diseases (Dyer, 2020). The care of patients with time sensitive conditions, such as cancer, was especially badly affected in the first wave; for example, with a 25% drop in new cancer diagnoses in the Netherlands (Dyer, 2020) and a 63% fall in urgent referrals for suspected colon cancer and 22% fall in those referred for treatment in England (Morris et al., 2021). Another study from England found short-term increases in deaths of patients with cancer in the first wave of the pandemic but also estimated that many more patients would die over the subsequent year due to delayed or deferred care, with estimates of between 7 000 and 17 000 (Lai et al., 2020). Yet despite excluding so many people in need of care from hospitals, some still did need to be admitted and they then became at risk of infection with COVID-19. One study based on a pre-existing cohort of older people, traced 12.5% of infections to stays in hospitals (Carter et al., 2020). Although the precise reasons remain unclear, it seems plausible that fear of coming to hospitals that were full of infected patients may have played a role in the marked decline in admissions of people with acute coronary syndrome and emergency department attendances (Lazzerini et al., 2020; Mulholland et al., 2020).

Despite these responses, the enormous pressures that hospitals faced did impact on quality of care. A study undertaken in the United Kingdom found that the death rates among patients requiring ventilation found that case fatality rates were 20% higher in ICUs operating at 85% occupancy or higher compared with those at the

more usual 45–85%, after adjusting for a large number of patient characteristics (Wilde et al., 2021).

There were also widespread changes in primary care, although the available evidence comes mainly from a few countries. In France, the first wave of the pandemic saw 80% fewer visits to dentists, 40% fewer to physiotherapists and midwives and 30% fewer to general practitioners (European Observatory on Health Systems and Policies, 2020). Childhood vaccinations against measles, mumps, and rubella fell by 20% during the first 3 weeks of the lockdown in England (McDonald et al., 2020). Finnish data from spring 2020 also revealed a decrease in visits to child health and maternity care clinics by between 10% and 40% while school health visits fell by 60% to 80% compared with the previous year. As the Permanent Secretary in the Finnish Ministry of Social Affairs and Health noted, on 28 April 2020, "what is more worrying than the adequacy of intensive care capacity at the moment is the ability of our health care and social welfare system to respond to service needs other than those associated with the Coronavirus" (European Observatory on Health Systems and Policies, 2020).

In many countries there was a shift to online interactions. This was, arguably, hardly surprising. In recent years there have been enormous advances in the functionality of online platforms. Outside the health sector individuals and organizations had already made the transition to online meetings, using software, such as FaceTime, Skype, Teams or Zoom, with relative ease. A new online etiquette has developed, although not without problems and this way of working is now widely accepted as having many advantages, not least the ability to avoid time-consuming journeys to meetings. However, until recently the health sector in many countries has tended to be slow to adopt new technology been slow to adapt and prior to the pandemic the vast majority of patient contacts were still conducted face to face. There were a number of reasons for this. First, there was a sense that online consultations could not replace the physical interaction between health professionals and patients, even in consultations where no examination was required. Second, especially in health systems based on a fee-for-service model, there were questions about how health workers would be remunerated, with the added issue, in some countries, of the disincentive to shift to online working where there is an expectation of informal payments. Some countries recognized the financial disincentives; for example, by introducing fees for remote consultations, as in Denmark and Estonia, or making it easier to reimburse these consultations, as in the Czechia, Germany, Luxembourg, the Netherlands, Sweden and Switzerland.

The scale of the changes has been reported in several studies. A report from a single general practice in England described a 92.5% reduction in face-to-face consultations in the 2 weeks before and 2 weeks after national guidance was issued to reduce consultations, accompanied by an 85.6% increase in telephone consultations in the same period (Gray et al., 2020). Forty-seven general practices in a deprived part of northern England reported reductions in consultations for circulatory disease, common mental health problems, type II diabetes and cancer compared with levels over the preceding decade (Williams et al., 2020). In a study from Oxford, United Kingdom, between February and May 2020 the rate of telephone and video consultations by patients aged 65 years and over increased by over 100%, while face-to-face consultations fell by 65% and home visits by 63% (Joy et al., 2020). Those who did continue to consult, whether face to face or remotely, were much more likely to be taking 10 or more medicines or to suffer from frailty. As in the study from northern England, the change was extremely abrupt, coinciding with the changing national guidance. The most extensive study used data on 10 million individuals participating in the English Clinical Practice Research Datalink database, finding very large reductions in contacts for all conditions after restrictions on movement were introduced. By July 2020, none, except for unstable angina and acute alcohol-related events, had recovered to the previous level. The largest reductions were consultations for diabetic emergencies, depression and self-harm, all falling by 50% or more (Mansfield et al., 2021). In Belgium, a study of attendances at out-of-hours primary care centres found an initial increase in attendances followed by a dramatic decline. There had been no telephone consultations in previous years but these soon comprised 40% of all interactions (Morreel et al., 2020).

Moving consultations online does, however, have important consequences for the patient doctor relationship. A qualitative study of general practitioners in Belgium, conducted by medical students unable to complete their internship as normal, is especially enlightening (Verhoeven et al., 2020). The study identified several issues, including a need for greater team working, linked to new ways of redistributing fees within the team, challenges imposed by the loss

of non-verbal cues during remote consultations and communication difficulties in different languages and across cultures, the difficulty of undertaking simple physical examinations, such as pulse rates, and the impact on the traditional role of Belgian general practitioners certify sickness absence because, as they could no longer examine patients, they felt that they were acting, in effect, as a rubber stamp.

At the same time as hospitals and primary care teams were adapting to the new, another tragedy was unfolding in facilities providing long-term care, predominantly for frail and elderly people. In some countries, the imperative to empty hospital beds by discharging those who were already in hospital introduced infections into these facilities. A combination of factors, including the low priority that they were given for supplies of PPE, the informal employment of many staff, so that individuals might work in several facilities, and a lack of testing, allowed infections to spread rapidly, causing the avoidable deaths of large numbers of vulnerable residents and, in some cases, those caring for them (Rajan et al., 2020).

Such a situation cannot be allowed to happen again. The enquiries that are being undertaken in some countries are providing many lessons that must be learned. These lessons will reflect the particular circumstances and, especially, the resilience of each health system at the onset of the pandemic. However, there are some general lessons that are likely to be applicable, to some degree, everywhere. These relate to the infrastructure of health systems, including the design of health facilities, the health workforce, that has played such an important role in responding to the crisis, and the relationship between health and social care.

Health system infrastructure

It has long been recognized that there is great variation in the level of investment in health systems across the European region. A recent study that gathered data from selected countries in western Europe found that the ratio of intensive care beds to population varied by a factor of five (Bauer et al., 2020). Unsurprisingly, those countries that had the lowest levels of provision struggled and the attention of policy-makers was diverted to the need to protect the health system. In the end, many health providers did cope, but only through the heroic efforts of their staff and by imaginative approaches to reconfiguring services and redeploying health workers. General wards were converted into ICUs, with staff undertaking rapid training that allowed them to monitor, under supervision, the most severely ill patients.

There was, however, a cost, as described above, as staff who were redeployed could not care for the patients they would normally look after and much routine activity, especially in areas such as primary care and mental health services, effectively ceased.

The most important lesson to learn from this experience is that the practice, in some countries, of running health facilities at over 95% occupancy, with no mechanism to deliver surge capacity, is short sighted. While this may seem to be efficient in the short term, it brings a substantial cost in the long term. This is, however, not just a problem of physical capacity. Several countries demonstrated that they could expand the number of hospital beds rapidly; for example, by taking over venues such as unused conference facilities. However, in most cases, these were of little use because it was not possible to obtain the staff needed to look after any patients.

Addressing this challenge will not be easy. Clearly, governments, especially those facing financial pressures, will be reluctant to invest in the additional capacity necessary to respond in a crisis although this argument is perhaps less tenable, given that they are willing to invest in armed forces, whose role is somewhat analogous. In both cases, it is to be hoped that the additional capacity will not be needed but, in the latter case, there is widespread support for the necessary investment. Yet, even when there is not a crisis, it has become apparent that there is a need for greater investment in health systems in many countries. It is inappropriate and unnecessarily divisive to separate out different parts of the health system. All are necessary to deliver care and taking resources away from one sector to support another is unhelpful. However, there are some areas that have historically been under resourced, in particular primary care, which has often suffered from a package of financial incentives that have made it less attractive than specialist care in hospitals, and mental health services, which have come under additional pressure in many countries because of the effects of austerity, employment policies that increase insecurity, and especially the role that the services have played in responding to the failures of the criminal justice system (Her Majesty's Inspectorate of Constabulary Fire and Rescue Services, 2018).

Flexibility should be a principle that underpins future investment. Health needs are constantly changing and health services have been responding to those changes (McKee et al., 2020). Opportunities to intervene are also changing. For example, orthopaedic surgeons responded to the decline in cases of spinal tuberculosis and polio, which at one time formed part of their work, by developing joint replacements. The development of short-acting anaesthetics and minimally invasive surgical techniques has changed surgical practice completely, accompanied by the emergence of new specialities, such as interventional radiology, cardiology and gastroenterology. These developments, as well as others, such as new imaging techniques, near patient testing and even robotic surgery, are enabling treatment to be moved to new settings. Yet, too often, health facilities and, especially, hospitals, are built to meet the needs of the past (Rechel et al., 2009). Physically, they may be difficult to change, especially because it may cost more initially to include flexibility. The problem is exacerbated in some countries where they have been funded through public–private partnerships in which the private provider has negotiated a contract that minimizes the risk that they might have to make changes over the life of the contract, leading to buildings that are obsolete as soon as they open (McKee et al., 2006). This will require new ways of thinking, recognizing that something that is cheap at the beginning may be more expensive in the long run, a principle that also applies to aspects of design, such as environmental considerations (McGain & Naylor, 2014). In other words, a life-cycle perspective is essential.

The health workforce

Health workers have been the heroes of the pandemic. They have gone above and beyond the call of duty, working for long hours in arduous conditions. They have faced physical and mental discomfort, spending long hours in hot and uncomfortable PPE, with risks of overheating and dehydration, as well as the consequences of placing a physical barrier between themselves and their patients (Sharifi et al., 2020). In too many cases, health workers have given their lives in the service of others, although in many countries the scale of their sacrifice has been unrecorded (Kursumovic et al., 2020).

There have been particular concerns about high levels of burnout. Even in normal times, health care workers are susceptible to burnout. Many have high workloads and their work can be emotionally challenging as they must deal with patients and families facing emotional trauma. Many struggle to respond with empathy when faced with inadequate resources and time pressures. The pandemic has added considerably to these demands on them.

Most studies of the prevalence of burnout during the pandemic have found elevated rates but many lack appropriate controls to compare with the pre-pandemic period and some studies comparing health workers on the front line of the COVID-19 response with others who are not have been conflicting. It does seem that some individuals are at particular risk because of their personal circumstances, such as those with children or those who have family members over the age of 65 with a chronic illness (Sahin et al., 2020); women, in some cases associated with concerns about their families (Luceño-Moreno et al., 2020); those working in conditions with inadequate PPE (Morgantini et al., 2020); and those working longer hours, especially if redeployed away from their usual place of work (Tan et al., 2020).

Any increase in burnout has important consequences for health. A systematic review of longitudinal studies found it to be a predictor of three sets of adverse outcomes: physical illness, including type 2 diabetes, coronary heart disease, musculoskeletal pain, prolonged fatigue, severe injuries and mortality under the age of 45; psychological conditions, including insomnia, depressive symptoms, use of psychotropic and antidepressant medications, and other mental disorders; and occupational consequences, including absenteeism and presenteeism. A recent paper from Gulf Cooperation countries found that presenteeism associated with seven major noncommunicable diseases cost 2.2% of GDP, substantially more than direct medical costs (0.6%) and losses due to absenteeism (0.5%) (Finkelstein et al., 2021).

There is also an extensive body of research, in particular drawing on experience in Magnet hospitals (American Nurses Credentialing Center, 2021), recognized for having created cultures that attract and retain nursing staff, that hospitals with lower levels of burnout among nurses achieve better patient outcomes, often by virtue of lower levels of what is termed "failure to rescue", where a deterioration in a patient's condition remains undetected (Aiken et al., 2002; 2012).

Another concern relates to what has been termed moral injury, which gives rise to a sense of guilt when health

workers are unable to provide the care they wish to because of constraints of time and resources. Although there is no consensus definition of the term, it has been conceptualizes as "a character wound that stems from a betrayal of justice by a person of authority in a high-stakes situation" (Shay, 2014). Others define a potentially morally injurious event (PMIE) as one that entails "perpetrating, failing to prevent, bearing witness to, or learning about acts that transgress deeply held moral beliefs and expectations" (Litz et al., 2009). Much initial research was on moral injury in military personnel and veterans but the concept is now attracting much wider interest from different disciplinary perspectives (Griffin et al., 2019; Litz et al., 2009).

Moral injury is not a mental illness itself, but those who experience it are likely to experience negative thoughts about themselves and others (Greenberg et al., 2020), and these symptoms can contribute to mental health issues such as depression, post-traumatic stress disorder (PTSD), anxiety and suicidal ideation (Williamson et al., 2018).

There is an overlap between moral injury and PTSD, for example if the event to which the individual was exposed is both potentially life-threatening and morally injurious (Stein et al., 2012). Most times, however, they differ with respect to the trigger event. In PTSD, it is actual or threated death or serious injury, while in moral injury it is acts that violate deeply held moral values.

The difference between burnout and moral injury is also important (Dean et al., 2019). Burnout has traditionally suggested that the problem resides within the individual, who lacks the resources or resilience to withstand the work environment, although this view is now giving way to a recognition that it often arises from problems in the work environment. In contrast, moral injury is seen from the outset as a problem with the organization and its leadership (Dean et al., 2019).

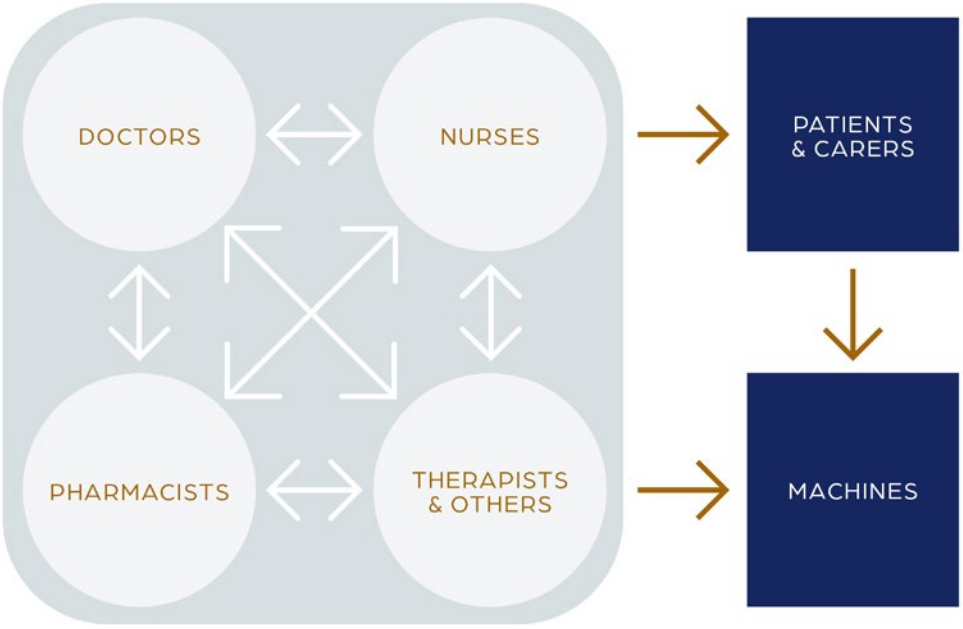
Moral injury is likely where health workers perceive those in authority as engaged in "a betrayal of what is right" (Walton et al., 2020), and where those workers experience lack of resources, inadequate guidance and insufficient training, perceived as signifying that their employers are failing to consider the health of their staff (Williamson et al., 2020). They may also experience "anticipatory guilt", seeing health care colleagues in other countries already experiencing the adverse effects of the pandemic (Senior, 2020). Health care workers who are required to quarantine may feel guilt about the additional burden placed on those still working and the risk they pose to their own families (Brooks et al., 2020; Tomlinson, 2008).

The struggles of health workers have been recognized; for example, by politicians offering public thanks and other gestures of appreciation. However, this is not enough. In many countries, health workers are poorly rewarded. Their salaries are lower than those with similar levels of education and, in some countries, there is a tacit understanding that they will supplement their incomes with informal payments. Their prospects for career progression are limited, with rigid hierarchies. As a consequence, many leave the health systems in their countries, for better prospects abroad, for opportunities in other sectors, or simply to exit the workforce altogether. This is not just a problem of wasting scarce skills and expertise. There is also compelling evidence that health facilities that attract and retain staff, such as the Magnet hospitals, provide better quality care, including, crucially, fewer hospital-acquired infections.

There is a clear need to improve working conditions for health workers for several reasons. This is likely to increase job satisfaction, attract new entrants and talent to the health workforce, and reduce staff turnover by retaining experienced professionals. Measures to address real and perceived pay gaps between the health workforce and equivalent professionals in other sectors are needed, especially for those who are especially poorly paid including, in many countries, nurses, health care assistants in hospital and ambulatory settings, and staff working in long-term care settings. Improving working conditions also requires a range of additional policies such as allowing for more part-time work, flexibility, reformed rota systems and support with childcare arrangements.

It is also necessary to recognize that the roles that health workers undertake are changing. This is yet another process that has accelerated during the pandemic. There is a growing body of evidence on what is termed task shifting in the health sector (van Schalkwyk et al., 2020). This seeks to ensure that those who are best placed to undertake a role do it. The fact that something has been done by one group of workers for decades is not a sufficient justification for continuing in this way. Thus, many health workers have taken on additional responsibilities, in particular to support the needs of patients who were much more severely ill than those they normally care for.

Figure 8 *The relationships involved in task shifting*



Source: van Schalkwyk et al. (2020).

Task shifting involves three elements: health and care workers, patients and carers, and technology (Figure 8). The historic medical paternalism is, in many countries, giving way to a recognition that the patient, in some cases assisted by their carer, should work in partnership with their health worker, setting shared goals and deciding how best to achieve them. Advances in scientific knowledge and in technology have created many new roles for health workers, such as changing ways of accessing the body's internal organs. This has created new opportunities for different groups of health workers. It is important that deeply entrenched historic boundaries do not obstruct progress. However, it is also important to stress that change should be about improving health outcomes and not simply saving costs.

It is also important that change is informed by evidence, which can be counterintuitive and context dependent. Thus, there are many examples of how non-physicians perform at least as well as physicians, and sometimes better, especially when assessed in terms of patient satisfaction and quality of communication. This is especially so when processes can be standardized. Examples include pharmacists managing anticoagulant therapy (Macgregor et al., 1996; Radley et al., 1995), expanded roles for midwives (Colvin et al., 2013), and in certain situations, prescribing by nonmedical prescribers (Weeks et al., 2016). In other cases, especially where the tasks being shifted are more complex, more caution is needed. Thus, while nurse-led clinics are often associated with better results than those conducted by physicians where the conditions treated are straightforward (Vrijhoef et al., 2000), this may not be the case if the conditions are severe or complex (Wong et al., 2012). Some changes that seem intuitive, such as an enhanced role for ambulance workers, have given mixed findings (Mason et al., 2007; Nicholl et al., 1998; Wilson & Gangathimmaiah, 2017).

Change may require new approaches to regulation of the health workforce, in particular scope of practice, allowing for more latitude in distributing and sharing of skills and tasks. It will also require changes to training curricula, which is needed anyway because of changes in the settings in which care is provided, with a greater emphasis on primary care. It may also entail changes to payment mechanisms to make sure that the money reflects the new distribution of tasks and responsibilities, especially within multidisciplinary teams.

While many countries are revisiting ideas of self-sufficiency of health workers, it will still be the case that there is a global market in those with certain qualifications. The pandemic has served as a reminder of the interdependence of countries worldwide so it will be important to support the global code of practice on the international and ethical recruitment of health personnel. This code seeks to avoid international recruitment in countries known to have critical health workforce shortages, unless there is a bilateral agreement between the governments of the sending and receiving countries specifying issues such as categories of workers

covered or limits on numbers recruited and the terms and conditions of work in the host country. However, it is important not to ignore the benefits of staff mobility so there is much to commend improved system of international collaboration in health workforce training that can share best practices and to allow professionals in countries with limited training capacities to travel abroad to gain new skills before returning to their country of origin. Closer European collaboration will also benefit patients, especially those afflicted with rare disease. Expertise in diagnostics and therapy can be shared across Europe with new digital innovations allowing the expertise to travel instead of the patient.

All of these measures do, however, depend on accurate and timely data, yet there are still many gaps. While there has been great progress with the timeliness and availability of health workforce data there are still issues with the availability of key indicators, uneven reporting and the willingness to share data between countries.

Social and long-term care

The avoidable deaths of so many people living in residential facilities will, for many families, be remembered as a defining characteristic of the pandemic. For too long, social care has been the poor relation of the health system. Few governments have put in place systems to fund it adequately, despite clear warnings from demographers about the impact of ageing populations (Doyle et al., 2009). The necessary decisions can no longer be postponed, especially given evidence from several countries of further declines in birth rates during the pandemic.

This will require a comprehensive approach to ageing populations, recognizing that existing structures pose a formidable challenge. Social care covers a broad canvas, including social work, community care, personal care and social support services. All of these are crucially important to people with chronic conditions, including frailty, and play a major role in allowing them to lead lives that are as independent as possible. Most countries deliver social and health care as different systems, funded from different budgets, in some cases overseen by different ministries, all of which creates fragmentation and discontinuity of care. Patients and their carers struggle to navigate the different health and social care providers, encouraging gaps through which people fall and waste, in the form of duplication of services and polypharmacy. Continuing provision of care in this way is inefficient and it leads to waste and overspending.

Such a comprehensive approach should begin with measures that promote healthy ageing, in particular, policies that ensure that those in middle age are as healthy as possible and that older people are given opportunities to remain socially engaged; for example, through community facilities, free public transport schemes and other mechanisms (Doyle et al., 2012). Looking ahead, the pandemic has introduced many older people to online platforms which could provide further opportunities for engagement, although this should not be taken for granted. Some of these policies have already borne fruit. The prevalence of dementia at different ages is falling in several countries, thought, in part, to be a consequence of improved management of traditional risk factors such as high blood pressure (Wu et al., 2017).

Yet, despite these improvements, there will still be many people who need long-term care. Beyond them, there are others living in the community, with support from social services, many of whom have suffered greatly as a result of the necessary restrictions during the pandemic. Both of these groups include many people who require increased support from health services. Both the residents of care homes exposed to COVID-19 or those in the community whose complex needs made it difficult for them to adhere to the measures implemented to reduce the spread of infection, were failed by the system. For these reasons, governments should prioritize reviews of the funding and delivery of health and social care in the light of experiences during the pandemic.

Summary

Health and social care systems have been put under unprecedented stress by the pandemic. Those delivering front line care have responded marvellously, in difficult conditions. However, as in other areas, the pandemic has shone a light on long-standing weaknesses. Sustained investment will be required, in infrastructure and in the workforce. But this investment must be used to ensure that health services become more resilient in the face of changing health needs and future threats.

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Chapter 8

Support innovation in health systems

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Innovation is a constant central challenge for health systems. Medicine is characterized by constant progress and innovation; our ability to diagnose and treat conditions has been expanding continuously since the Enlightenment. This process has always balanced both opportunities and risks; not all innovations turn out to be as promising as they first seem, and the increased costs from our expanded scope of action for health must be offset by increasing efficiency from what we already have or costs will rise overall (as has been the case since the establishment of modern health systems). Health systems have thus put in place a range of checks and balances in order to steer the innovation process and to manage the adoption (and eventually abandonment when they are superseded or become obsolete) of innovations in clinical practice. Where the balance is struck depends on the time and place; in times of financial pressure, the balance is more towards limiting additional costs. During COVID-19, the balance has been heavily towards a need for innovations to help address our immediate problems, such as new vaccines, the scaling of existing technologies, such as diagnostic tests, or new ways of monitoring and predicting the evolution of the epidemic. In this chapter, we look at what we can learn from innovation during this crisis, and what conclusions we should draw for our health innovation systems for the future.

Information

The early days of the pandemic were characterized by a lack of information about the new COVID-19 virus, a situation that persisted and, in some ways, grew as the epidemic spread. The modern world is more often described as being saturated with information, from online profiles to surveillance cameras and data-driven applications providing details of everything from supermarket offers to train tickets. Gathering information about a new virus might therefore appear straightforward, but the reality was very far from that. From the start of the COVID-19 pandemic, information has been contested, ambiguous and limited, in many cases revealing inadequacies in national health information infrastructure (Pisa, 2020). Information from the countries earliest affected was patchy and took time to emerge, and it was often unclear how to interpret it given unfamiliarity with different settings. As the pandemic progressed, existing surveillance systems were frequently overwhelmed.

The extent of these difficulties is illustrated by the gaps between mortality reported through surveillance systems and excess mortality attributable to COVID-19 (Vestergaard et al., 2020). New data systems and platforms were created hastily during the pandemic, often cobbled together manually or using increasingly unmanageable spreadsheets (Fetzer & Graeber, 2020). For example, a simple spreadsheet error led to the temporary loss of data on 16 000 COVID-19 cases in one country (Kelion, 2020). Even in today's highly interconnected world, contact tracing was not an automated technological process, and despite much investment in digital apps for contact tracing, it still is not. Rather, contact tracing depended on traditional methods used by staff who were rapidly overwhelmed in many countries, often revealing long-term underfunding of this vital service.

Modelling played a crucial role in shaping policy from the start, providing a basis for guiding policy in an uncertain environment and with only limited data, although the modelling was inherently limited precisely for those reasons (Adam, 2020a). As noted above, it proved difficult to gather timely and accurate data in a way in order to help improve the accuracy of models, with small changes in input variables sometimes leading to large projected differences in outcomes (Adam, 2020b).

One of the key areas of uncertainty was how the public would respond to restrictions related to coronavirus. Initial concern that the public would rapidly cease

to follow instructions for social distancing proved unfounded, with relatively high rates of compliance across many countries that have been sustained over long periods of time. This experience illustrated of the importance of behavioural science and its insights into how best to promote certain types of behaviour among the population, as many behavioural scientists had challenged the concern about public fatigue at the time (Bonell et al., 2020). The need to monitor behaviour also highlighted the need to draw on data sources beyond those typically used for public health surveillance within health systems, such as clinician reports and laboratory analysis. Countries made use of a much broader range of data, such as from online tools, such as Google, mobile phone providers and transport providers, in order to better understand adherence to movement-related restrictions (Oh et al., 2021; Szocska et al., 2021; Vannoni et al., 2020). Additional data sources such as the surveillance of viruses in wastewater have also been explored (Farkas et al., 2020).

This is an illustration of broader trends towards the use of a wider range of sources of data to generate more useful and timely insights for health and its determinants. While traditional data sources used in health research and practice place a high premium on reliability and accuracy, this can result in data that is robust but not timely, and which is slow to adapt to rapidly changing situations. The potential of complementing such sources with sources of data such as social media (Arora et al., 2019), news reporting, secondary use of data from clinical records (Bhaskaran et al., 2021) and broader population-level datasets has already been explored in areas such as pharmacovigilance (Salathé, 2016; Sloane et al., 2015). The COVID-19 pandemic has illustrated the need to think more broadly about our information infrastructure as an essential contributor to the resilience of our health systems.

Diagnostics

Part of the challenge with gathering the timely data described above concerned diagnostics used to identify cases of COVID-19. This was helped initially by the rapid release of the genetic sequence of COVID-19 in January 2020 by scientists from China, which enabled development of accurate laboratory-based tests around the world (Huggett et al., 2021). However, the scale of demand for these tests led quickly to laboratory capacity being overwhelmed (due in part of the supply of necessary consumables, such as reagents). This was in part due to the nature of COVID-19 infection; because of the relatively large numbers of people who are asymptomatic throughout their illness or who are infectious for several days before falling ill, testing could not rely on an intermediate filter of patient or clinician assessment based on symptoms. Rather, testing was needed as a primary mechanism to identify cases, which required testing on a much larger scale. This has led to the development of a wide range of tests using different platforms. This has included greater reliance on rapid point-of-care tests such as lateral flow tests. These are well-established tests, built on technology that has been developed over decades, and which have the advantages of being quicker and easier to manufacture, distribute and use, and providing much quicker results (Kierkegaard et al., 2021). However, there have been widespread difficulties concerning the accuracy of different tests for COVID-19 and determining their most useful role (Crozier et al., 2021). Evaluating the different tests available and ensuring their appropriate use has been a persistent challenge for public authorities, and illustrated the need for a strong safeguarding role for public authorities in a situation where many new private providers, some with limited experience of compliance with good practice and regulatory systems (case study provided in Box 12).

As the pandemic has progressed, the importance of identifying and tracing different variants of COVID-19 has become clear, to aid in understanding of their different characteristics. This has required genomic sequencing of samples of the virus identified during testing, combined with rapid epidemiological data. Genomic sequencing had been identified as a key tool for public health surveillance well in advance of the COVID-19 pandemic, having already being used for some years for surveillance of tuberculosis, bacterial foodborne diseases and influenza variants (Armstrong et al., 2019). However, the use of sequencing to monitor COVID-19 has been patchy at best, with just a few countries such as the United Kingdom and Denmark making disproportionate contributions to knowledge. This is not due to a lack of access to the technologies as such; a survey of European countries shortly before the pandemic found that most European countries had access to sequencing to support public health functions, and were using it to support surveillance and outbreak investigations (Revez et al., 2017). It may rather be a lack of resources and capacity to make use of sequencing for surveillance at the necessary scale for the COVID-19

Box 12 *Portugal: Public and private sectors working together for COVID-19 diagnosis*

As with many countries, early in 2020 Portugal was faced with the challenge of not only developing diagnostic capacity to identify the new pathogen, but doing so at sufficient speed and scale to support national efforts to contain the disease. Veldhoen and Zuzarte-Luis (2021), describe how this was done, starting in academic laboratories developing the relevant tests. Faced with shortages of supplies including reagents, they established a partnership with a local biotech company to develop their own viral RNA extraction kit and adapt reagents available within Portugal. To overcome the limited capacity of their own laboratories, they developed a standardized operating procedure which enabled nearly 30 universities and other research facilities to join the effort and expand national capacity. A serology laboratory was established, drawing on links with researchers in other countries, such as the Netherlands and the United Kingdom. Although academic institutions are typically publicly funded, these efforts also mobilized donations from the private sector and civil society. This is an example of innovation in practice, not only in the innovative science involved in developing COVID-19 testing, but also in how people, organizations and sectors worked together in novel and flexible ways to produce a public good.

pandemic, similar to the constraints on laboratory capacity for testing more generally. Even in those places making the greatest contribution to sequencing, the infrastructure being employed did not exist before the COVID-19 pandemic. The idea of a genomic sequencing surveillance mechanism for the United Kingdom was developed at speed in March 2020, accompanied by significant risks, with some arguing that there would not be sufficient variations in the COVID-19 coronavirus to justify the necessary investment (Peacock, 2021). However, building on existing experience with sequencing for surveillance in the United Kingdom, it has clearly proven its worth, and demonstrated the value of establishing sequencing infrastructure on the necessary scale throughout Europe to make it an integrated part of public health.

Vaccines

Although vaccines are one of the great success stories of modern medicine, this has also long been a problematic area for innovation (Oyston & Robinson, 2012). The successes of eradicating smallpox and the enormous reduction in the burden of infectious diseases, such as diphtheria, tetanus, pertussis, polio and measles, illustrate the power of vaccines to improve health. However, despite these successes, there remain infectious diseases that generate a huge burden of disease but which remain without vaccines, such as HIV, although there are now promising candidates for malaria (Ledford, 2021), or where vaccines offer only partial protection, such as tuberculosis, and progress towards developing vaccines addressing these conditions has been slow. This is partly due to the scientific complexity of the challenges, with traditional vaccine platforms being superseded and progress depending on novel technologies linked to improvements in understanding the immune system. However, it is also in part due to inappropriate imbalances within the overall health innovation system. Although basic research in areas such as immunology is overwhelmingly publicly funded, the development of specific products such as vaccines typically relies upon private companies to build on the results of that basic research to develop viable products. Yet the development of vaccines is problematic for companies for a variety of reasons, including the complexity of the science involved, the risks and potential liabilities involved in giving vaccines to healthy individuals, and the potential lack of return on complex products where the primary markets are in low- and middle-income countries. There have been some active efforts to redress the balance, such as through establishing advance market commitments for vaccines against neglected diseases (Berndt et al., 2007), but these have yet to produce the breakthroughs that had been hoped. The extremely rapid development of vaccines for COVID-19 does show, however, that it is possible to produce innovations on a much quicker timetable than we have accepted as normal up until now, and for the public and private sectors to collaborate effectively in pursuit of overriding goals (Box 13). This suggests the potential for a substantially more ambitious approach in the future to both how long it should take to develop new treatments and how the public and private sectors can work together in meeting key societal challenges.

An innovation that had already shown promise before the COVID-19 pandemic was the mRNA vaccine technology, and is one that alleviates some of the concerns with previous approaches such as the use of attenuated agents. However, at the beginning of the pandemic there was still much work to be done to address safety and regulatory issues (Knezevic et al., 2021). The successful

Box 13 *Public–private partnerships for COVID-19 vaccines: The Oxford-AstraZeneca vaccine*

One of the most high-profile public–private partnerships to address the vaccines challenge for COVID-19 was the Oxford-AstraZeneca vaccine. The funding for the research underpinning the vaccine was nearly all from public funding sources including the United Kingdom and EU (Cross et al., 2021). The Oxford vaccine itself built on many years of prior research to develop an adaptable platform for what WHO calls "disease X", the aim being to be able to respond rapidly to previously unknown pathogens, precisely as in the case of COVID-19.

To help bridge the traditional gap between public sector basic research and private sector development and to accelerate the process, uniquely for an academic setting, the Oxford Jenner Institute is able to manufacture its own vaccines for phase I and II clinical trials as an authorized Clinical Bio Manufacturing Facility. In the case of the COVID-19 vaccine, Oxford University made an agreement with AstraZeneca to help with the development, licensing and distribution of the vaccine on a largely non-profit basis; this remains the only one of the principal vaccines for COVID-19 being provided on such a basis. For this vaccine and others, the United Kingdom government also provided up-front payments to manufacturers to help them develop their manufacturing capacity, before the vaccines were licensed, accepting the risk that in the end the products might not materialize (Baraniuk, 2021).

development and large-scale adoption of mRNA vaccines for COVID-19 has shown their potential, including the scalability of the technology involved, and is also likely to propel progress on the use of this platform more widely as well as providing real-world data on their long-term safety and efficacy. There is a role for international cooperation in establishing clear and consistent standards for mRNA vaccines and their licensing in order to facilitate their development and appropriate use in the longer term.

New and effective treatments

At the beginning of the pandemic, the disease entity caused by SARS-CoV-2 was largely classified as a respiratory condition, linked to the immediately obvious symptoms from the respiratory tract and perhaps the experience from previous coronavirus outbreaks (MERS and SARS). As time progressed and observations of COVID-19 patients accumulated, it became increasingly clear that a SARS-CoV-2 infection severely impacts other organ systems as well, and after more than 18 months of clinical experience, the disease is now recognized as a complex disorder (Gupta et al., 2020; Roberts et al., 2020), both in its acute phase and in what is now termed Long COVID (Datta et al., 2020). While the first cases of COVID-19 were reported in December 2019, the first comprehensive evidence review on the effects of the virus on other organ systems did not emerge until July 2020 (Gupta et al., 2020). It summarized evidence from a range of clinical reports mainly from China, Italy and the United States; it also highlighted the importance of common definitions and data standards for research on COVID-19 and the value of regional, national and international collaborations of clinicians and scientists.

The relatively long lag between the first description of the disease entity and the current understanding of COVID-19 as a complex condition is understandable given the unprecedented strain the pandemic put on front line health workers, limiting their capacity to invest time and resources outside day-to-day patient care. However, it also meant that there were delays in implementing effective therapy, for example the administration of anticoagulants (Wise & Coombes, 2020), or in rejecting measures that were ineffective or harmful, such as ventilating patients too early (Prkachin, 2021). This experience also highlighted the importance of multispecialty collaboration, with clinicians retaining a focus on the patient as a whole during treatment rather than seeing them from the perspective of a single body system. Looking ahead, there is scope for reflecting on the nature of undergraduate and postgraduate training to avoid confining clinicians in cognitive silos.

Especially in the first months of the pandemic, researchers and regulators were working under conditions of extreme uncertainty with a pressing need for knowledge about how best to manage a disease caused by a new pathogen. It is therefore not surprising that much research on COVID-19 therapeutics was uncoordinated and of limited validity (Bugin & Woodcock, 2021; Janiaud et al., 2020; Park et al.), perhaps in the light of the necessity for swift results. This was a phenomenon already observed during previous outbreaks, such as the H1N1 influenza pandemic in 2009, or the 2013–2015 Ebola epidemic in western Africa (Thielman et al., 2016), where meaningful and valid trials for therapeutics were either not performed or yielded results too late. Against the backdrop of this

experience, the European Medicines Agency prompted EU funds to be directed to coordinated research activity in the form of large, platform trials instead of individual small trials (Committee on Medicinal Products for Human Use, 2020); however, large EU-level trials of therapeutic candidates have not materialized. WHO's Solidarity trial (ISRCTN83971151) and the Randomised Evaluation of COVID-19 Therapy (RECOVERY) trial (NCT04381936), led by researchers at Oxford University, are two examples of large-scale, adaptive trial designs that are evaluating potential COVID-19 therapeutics in the setting of care (at multiple sites internationally, and in the United Kingdom, respectively).

The RECOVERY trial is the largest of the two, having enrolled more than 40 000 patients by summer 2021 (amounting to approximately 10% of hospitalized COVID-19 patients in the United Kingdom) compared with almost 12 000 patients enrolled in over 30 countries for Solidarity. RECOVERY is a randomized adaptive platform trial comparing different potential therapeutics to standard care. The adaptive design allows for trial arms to be dropped or added as results emerge. The trial integrates a factorial design which enables testing therapeutics alone and in combination to better mirror the reality of care. So far, RECOVERY has demonstrated the potential of dexamethasone and tocilizumab to reduce deaths among hospitalized COVID-19 patients, while contradicting previous conclusions based on observational data, finding no effect on survival for aspirin, convalescent plasma and hydroxychloroquine, among others.

One of the leading principles behind RECOVERY's design is simplicity for clinicians and patients, starting from the process of randomization, to streamlined data collection processes focusing on necessary outcomes. This was based on the recognition that more complicated trial protocols would be unsupportable under the circumstances of care during the pandemic and seems to have been an important contributing factor to the trial's success (Wise & Coombes, 2020). Another major contributor was access to a robust data infrastructure across sites, which enables researchers to tap into data on hospitalizations, ICU admissions data, prescribed medications and deaths and vastly reduces the resources necessary for data collection and analysis. This is a substantial asset, and is more easily achievable for trials taking place within an integrated health system such as the National Health Service in the United Kingdom. Initiatives at the European and global level, such as the European Health Data Space and Digital Europe, or the placement of digital health at the core of WHO's European Programme of Work, can help with advancing such trials across borders in future. However, there is a clear need for many governments across Europe to ask why so few patients were offered the opportunity to participate in a clinical trial, thereby delaying the ability of others to benefit from therapeutic advances or, worse, to avoid treatments that were harmful. Such enquiries should examine the scope for pre-specified protocols to be agreed, subject to detailed adaptation when required, ethical approvals to be agreed in principle subject only to consideration of the treatment in question, standardized consent processes and data and information systems.

The complexity of international trials extends to regulatory issues, such as marketing authorization for studied medicines. At the outset, RECOVERY explicitly targeted medicines that were already approved for other uses and could be repurposed for COVID-19 treatment, not least because this meant that they already had established safety profiles and could therefore be used broadly with reduced potential for patient harm. On the other hand, one of the main concerns voiced about the design of COVID-19 platform trials has been how far their protocols would generate data that would meet standard regulatory requirements for approval and by consequence the extent to which they could be used to test novel therapeutics. Nevertheless, the successes of platform trials during the COVID-19 pandemic clearly demonstrate that a reconsideration of the criteria for (publicly funded) research, as well as evidentiary requirements for regulatory approval and best practice guidelines is warranted and timely (Janiaud et al., 2021; Park et al., 2021).

Lessons learned

Strong health innovation systems

The health innovation system involves a combination of public, private and professional endeavour. It has provided continuing wide-ranging improvements in health over many decades. However, it includes certain fundamental misalignments and vulnerabilities, some of which have been painfully highlighted during the COVID-19 pandemic. As Europe seeks to rethink its priorities in the light of the pandemic, the overall strategic approach towards the generation and uptake of innovations in health should be a central focus.

Most public funding for health research funding goes towards basic research – that is to say, scientific research into better understanding of biomedical processes, without being linked to a specific health application (Chalmers et al., 2014). Promising discoveries and inventions are then typically taken up by the private sector, which seeks to develop them into viable, marketable innovations and to bring products to market. Another key source of innovations is clinical innovation; practising doctors (and other health professions) who seek to develop solutions to specific problems that they encounter in their clinical practice. In Europe, as health systems are predominantly publicly funded, this work often also originates with public funding, though again frequently through long-term collaborations with private sector partners (Consoli et al., 2015).

Much less effort goes into research that addresses a specific health need, and only a tiny fraction into processes of organizational change and uptake in practice. Even if much basic biomedical research led to a subsequent therapeutic application that generated innovation and achieved implementation, the lack of downstream investment would seem likely to hinder the overall effectiveness of the process. But in practice, the vast majority of discoveries from basic research, even those that are heralded as likely to have clear benefits for health, do not lead to successful application in practice (Contopoulos-Ioannidis et al., 2008), and even when they do, they take decades to do so. Applied research has a much stronger track record of having an impact on health and on wider social and economic issues, but receives much less research funding.

The effective functioning of the health innovation system thus depends on the combined support and rewards for a complex mix of researchers, clinicians, and private sector companies of many different types, and these do not align well. Funding for academic research rewards academic excellence; but what is academically excellent and what is useful in practice are frequently not the same thing. For the private sector, rewards come through returns from marketable products, but these returns are unpredictable and are not well aligned with health needs. In particular, one market dominates private sector incentives: the United States. The American health care market is the largest health care market in the world. Indeed, it accounts for more than the total health expenditure of all EU countries put together. This creates a paradoxical set of perverse incentives for health innovation. On the one hand, as the largest health care market, the United States is naturally the reference point for the commercialization of health care innovations and thus plays a central role in shaping the kinds of innovations that become available for health systems around the world. On the other hand, in health policy terms, the United States is an outlier; the United States' health system is relatively indifferent to price (as shown by its much higher expenditure on health per head than for other countries (OECD, 2019)) and less concerned with equity or the needs of the population as a whole than are health systems in European countries. So the flow of health innovations is oriented around the rewards available within a highly atypical system, which does not reflect the typical values or needs of other health systems, such as those in Europe.

The balance of research funding in relation to health needs is also problematic. Research funding is disproportionately available for some high-profile disease areas such as cancer, with the intellectual attraction of sophisticated approaches to understanding molecular mechanisms, for example, while there is underinvestment in other areas such as mental health (Kinge et al., 2014), or AMR. More generally, the processes of how research priorities are set do not routinely involve either patients or wider health system stakeholders. When actors such as patients are involved in setting research priorities, the priorities that they set are typically quite different from what researchers or funders select without their input (Chalmers et al., 2014).

Finally, there is an imbalance between funding to generate new innovations, and support to support their adoption in practice. How implementation of innovations can be achieved in practice in the complex environment of health systems is a field of research in its own right, but one that is especially poorly funded, with the funding for research into health systems and policy only a tiny fraction of funding for health research as a whole (Walshe et al., 2013). This is particularly relevant for European health systems, which represent the world's largest group of health systems with shared values of universal and equitable access to high-quality health care funded on the basis of solidarity. This offers European health systems a unique opportunity to learn from each other regarding organizational and system change for which there is currently only limited support.

This health innovation model has generated many innovations, but it has also left persistent imbalances and inequities. There is scope to better align the innovation system with real needs through a strategic approach

Box 14 *Actively managing the innovation process for health: The United States Biomedical Advanced Research and Development Authority (BARDA)*

An example of how government can take a more active approach to directing innovation towards public goals is BARDA in the United States. Established in 2006, the agency aims to provide an integrated approach towards the development of the necessary medical countermeasures for public health emergencies. In contrast to the typical process leaving the development of specific innovations to the private sector, BARDA plays a similar role to private sector investors in actively supporting the development of particular early-stage innovations towards their practical application, but does so in pursuit of the public policy objectives of preparedness for public health emergencies rather than in pursuit of market rewards. BARDA also plays an active role in making sure that relevant supplies are actually available through procurement and stockpiling.

As part of its European Health Union proposals, the European Commission plans a similar European Health Emergency Preparedness and Response (HERA) agency modelled on BARDA, with the aim of enabling the EU to rapidly make available the necessary countermeasures for health emergencies by covering the whole innovation chain from conception to distribution and use (European Commission, 2020). The proposal for the new European agency is expected in late 2021.

to health innovation that more actively promotes and steers innovation towards key health needs, and which involves all relevant stakeholders to align them around a key central objectives. This would, for example, seek to redress the alignment and balance of incentives more towards unmet health need and equity throughout the health system; and more towards the implementation challenge of organizational and system change to realize the potential of existing innovations in practice, and reduce unwanted variations in care.

In the longer term, there is also scope to explore the potential for fundamentally different approaches to the innovation system. This could involve solutions such as models of open innovation, using mechanisms such as prizes and early public investment to provide an alternative route to development and application than commercialization, thus enabling a different set of incentives to be created. Other alternatives would include the public sector taking a much more engaged approach, actively steering and shaping the innovation process towards key areas, seeking to bring together the different actors involved in funding and developing innovations in order to more actively target particular long-term objectives. Health systems should also consider the scope for incentivizing organizational innovation. As the primary mechanism through which health innovation is rewarded is monopoly IP rights, this means that there are much greater rewards for those kinds of innovation which can be patented or copyrighted, such as pharmaceutical products. Creating a new and more efficient way of organizing care provision, in contrast, carries much less reward under current systems. Consideration should be given to how to redress this balance and create rewards for the improvements in efficiency in care that our health systems very much need.

Public–private partnerships

The public and private sectors have both been part of the response to the challenge of the pandemic. Essential supplies such as PPE have not only been supplied by the private sector, but manufacturers have reshaped production and processes in order to help meet wider needs. The private sector has helped to provide additional skills and capacity to the public sector across virtually all aspects of response. Perhaps most striking has been the central role of the private sector in developing the vaccines against COVID-19 which are helping to bring the pandemic under control.

However, the vaccines also illustrate the intertwined nature of cooperation between the public and private sectors. While the Oxford-AstraZeneca vaccine is unusual in having been a formal public–private partnership (Box 13), like all the vaccines it is based on research which has benefited from extensive public funding (Cross et al., 2021). This is an illustration of how the health innovation sector works more generally, with the public sector taking the lead in risky basic research leading to critical insights that are then developed into commercial products by the private sector and brought to market, where in European health systems the public authorities once again step in as the principal purchasers (Mazzucato, 2015). Public–private partnerships are typically thought of as formal agreements, with risk-sharing and contracts, such as for long-term developments like hospitals. In fact, the whole health innovation system is a public–private partnership, though one in which the objectives of different actors are not always

well aligned. The pandemic has created a situation where overriding objectives were accepted across all sectors and public and private actors have worked together to achieve them, almost entirely without formalized agreements. Indeed, the complex processes of normal procurement and risk-sharing have typically been reduced or entirely removed, with highly streamlined processes used instead (Sanchez-Graells, 2020).

On the one hand, this has been highly productive, with the private sector making vital contributions to wider public goals, and doing so in record time. The sheer speed with which multiple vaccines against COVID-19 have been developed is remarkable, and highlights the potential of public–private partnerships to achieve shared goals in more flexible ways. On the other hand, the abandonment of many normal processes around such partnerships raises concerns about equity and value for money and there is widespread evidence in some countries of serious abuses of processes, for example where certain providers were privileged by virtue of their links to politicians (McKee, 2021), as well as fraud and corruption (Expert Panel on Effective Ways of Investing in Health, 2021).

The success and failures of different aspects of public–private collaborations during the pandemic suggest the potential to learn lessons about how to collaborate more efficiently and effectively in the future, but this must be done in ways that sustain public trust.

One key dimension is transparency. Even when things are done quickly or through streamlined mechanisms, ensuring full transparency allows scrutiny and builds trust, whereas the combination of less rigorous procedures and lack of transparency undermines confidence (National Audit Office, 2020). One way to achieve this might be to make a condition of using emergency or expedited procurement procedures that all such agreements must be published in full, a requirement that is already included in the EU Procurement Directive.

More positively, though, the flexible character of public–private collaboration may suggest scope for more effective ways of working in the future. Before the pandemic, there have already been examples of flexible ways of promoting collaboration, such as pre-competitive procurement of innovations. This enables public sector bodies to create an alternative pathway to market for solutions to address a particular identified need, drawing on several different solutions and helping them to be developed from research to practical application (European Commission, 2007). For instance, the SAEPP (Smart Ambulance European Procurers Platform) Consortium brings together specialized vehicle manufacturing experts to develop an innovative ambulance prototype, to enable front line health workers to treat patients effectively on-scene and avoid unnecessary hospital admissions.

Thus, the widespread and flexible public–private collaboration during the pandemic may suggest better ways of working together in the future. In the same way as the pandemic created a shared purpose and unifying objectives, high-profile missions may provide a similar focus to address other health crises, such as HIV, tuberculosis and malaria or the unmet needs of mental health. However, for such more flexible models of cooperation to be sustainable, they must also work in ways that sustain public trust that the collaboration is a fair one that provides fair value for all those involved. How to do this requires further research and engagement across all the stakeholders involved.

Improved systems for learning and adaptation

Ensuring constant learning and improvement is key to productivity keeping pace with innovation and ensuring the resilience of systems overall, but it receives far too little support. This is a key driver behind the continued cost increases in health care. Our ability to adapt and change is not keeping up with the pace of innovation itself. Addressing this requires a fundamental shift in support for learning and improvement throughout the health system. As described above, how to do this is an active area of research and innovation in its own right, but three key components are already clear: realizing the potential for learning across Europe; rebalancing resources; and realizing the potential of digital health to support learning and improvement.

Europe provides enormous potential for mutual learning between health systems in close proximity and with similar values and goals. There is a key role for European cooperation to support this, and for the WHO and the EU to actively facilitate this work. Within countries, it is vital to rebalance resources related to information, time and funding to support learning and improvement. The constant pressure on health system budgets tends, over time, to concentrate resources on the most immediate needs and the highest-profile new innovations. However, this leads to a long-term lack

of learning and improvement across European health systems. Rebalancing resources to support learning, improvement and resilience is vital for the long-term sustainability of our health systems.

A key opportunity now is the greater use of digital health tools, which have the potential to deliver a fundamental change in our ability to generate and share the information that can support learning and improvement. The pandemic has shown the enormous potential of these tools to change how we provide care, and to radically broaden and accelerate the information and evidence that we have within our health systems. However, in many countries information systems are designed for financial purposes or holding providers to account and while both are legitimate purposes they should be balanced with investment in learning and innovation. There is now an opportunity to build on the momentum behind the use of digital health tools that has been generated during the pandemic and make the necessary investment to make a step change in the use of digital health tools to support learning and improvement and thus the long-term sustainability and resilience of our health systems.

In particular, there is great potential for advances based on artificial intelligence, for example to generate algorithms that can improve diagnosis (Huang et al., 2020). However, there are also risks, for example when algorithms reproduce decisions that are inherently discriminatory (Ledford, 2019). This will create major governance challenges.

Summary

As with so many other issues, the pandemic has shone a light on successes and failures. There have been some remarkable achievements, bringing new vaccines, using innovative technologies, to market and mounting large-scale clinical trials, such as RECOVERY, both in record time. However, there have also been weaknesses, such as the large numbers of patients denied the offer to participate in a trial, thereby delaying the generation of essential knowledge.

These experiences highlight the importance of an innovation system that is much more closely aligned to the health needs of populations, both in normal times and that can be anticipated in a future emergency. This calls for a closer alignment between the key actors in the public and private sectors, based on transparency and on sharing of risks and of benefits.

They also serve as a reminder of viewing innovation as a process, from discovery to development to implementation. Yet too often it is the last step that is overlooked, even though it is essential to achieve the health gains that justify the investment in the previous steps.

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Chapter 9

Promote global public goods for sustainable improvements in health

Martin McKee, Clare Wenham, Rebecca Forman

Introduction

The global lack of preparedness for the COVID-19 pandemic can be considered an example not just of a failure of public policies but also a market failure. Certain things that would have helped to prevent the emergence of the SARS-CoV-2 and reduce its worldwide spread were not in place. In some cases this is because they have the characteristics of a public good (Samuelson, 1954).

A public good is something that is non-rivalrous, in other words, when someone uses it, they do not reduce the supply to others. It is nonexcludable, so that it is impossible to stop those who have not paid for it from making use of it. Public goods differ from private goods, which include, for example, domestic equipment such as washing machines, which someone else can only use if they have access to your house and, if they are using it, you cannot wash your clothes at the same time. A club good has high excludability but low rivalry for consumption. An example would be a satellite television service. Individuals can be excluded by use of a code to obtain access to it but one person using it does not deny it to others. There are also common pool goods, where no one can be excluded (or at least not easily without expensive enforcement measures), but where one person's use could, at least in theory, reduce the ability of others to benefit from them. Here, an example would be fish stocks, where a very large trawler could deplete stocks below the level of sustainability. An example of a public good is the building of lighthouses by states, serving to reduce the risk of ships foundering on their coasts.

Something becomes a global public good if these considerations act on a worldwide scale (Kaul et al., 1999). Thus, a global public good can be defined as "a good which is rational, from the perspective of a group of nations collectively, to produce for universal consumption, and for which it is irrational to exclude an individual nation from consuming, irrespective of whether that nation contributes to its financing" (Smith et al., 2003).

Traditional public goods for health include knowledge generated by R&D and communicable disease control (Smith & MacKellar, 2007). However, the Lancet Commission on Investing in Health (Jamison et al., 2013) has taken a broader perspective. Thus, it includes:

- traditional global public goods for health (as above);
- managing a broader range of negative cross-border externalities, including control of epidemics and pandemics and tackling AMR, but also curbing the spread of risk factors for noncommunicable diseases, such as smoking, alcohol and sugar-sweetened beverages;
- fostering global leadership or stewardship, such as global convening to develop consensus and global policies, or cross-sectoral advocacy (trade, education, etc.) to improve health.

Following from this, global public goods include pro-health laws, regulations and standards. They include research findings and development of methodologies, policy review and analysis. They also include sharing of IP, as in the Medicines Patent Pool. Decisions on which global public goods to prioritize should then follow from an assessment of present and future challenges, with commentators pointing to AMR (Laxminarayan et al., 2013) and climate change (Ahluwalia et al., 2016) as especially important challenges, as well as an assessment of where there are gaps in the international architecture. It is very clear that these gaps exist, not just from the failings during the COVID-19 pandemic but also from previous crises. Thus, it has been noted, in particular in the 2014–2016 Ebola outbreak in western Africa, how earlier failures to invest in the knowledge required to develop diagnostics and vaccines severely inhibited international response efforts (Balasegaram et al., 2015).

Even though the benefits of international collaboration to create certain global public goods are well established (Barrett, 2007), there is little incentive for any single country to devote resources to producing global public goods. If they do so, they will bear the cost while others reap the benefits; the classic free-rider problem. As a consequence, unless deliberate actions are taken to produce them, there will be underinvestment in global public goods. Thus, there is a need for a mechanism that can ensure that the funding necessary to produce global public goods is made available, either from domestic or international resources. Moon and colleagues have noted how much development assistance for health is allocated to the delivery of goods and services (Moon et al., 2017), and how little is devoted to global public goods. There are, however, examples that can be emulated. These include product development partnerships to create technologies for neglected diseases and interventions in global markets to reduce the cost of medicines (Moon, 2009). WHO is a major provider of global public goods; for example, through the publication of standards, such as the International Classification of Diseases, guidelines, assessments of therapeutic products, development of plans of action, convening of coordinating structures and international law, such as the Framework Convention on Tobacco Control. It is important to remember that many of these global public goods for health are not costly, but simply require government commitment to global law or norms.

Returning to the COVID-19 pandemic, as outlined in Chapter 1 and in the report of the IPPPR (Independent Panel for Pandemic Preparedness and Response, 2021), while the international community can draw on some very important systems for identifying health threats as they arise, such as the Global Outbreak Alert and Response Network (GOARN) (World Health Organization, 2021b) and ProMED (ProMED, 2021), there are other problems. In particular, there was a failure to create the institutional structures that would have allowed states and international organizations to scan the horizon for mid- and long-term health threats, or to make rapid decisions, take concerted actions and release the resources necessary for effective responses, and, most recently, to ensure that the benefits of the newly developed vaccines reach everyone, wherever they live in the world, as rapidly as possible.

Given the characteristics of a public good, this raises the question of who will pay and what sanctions are needed if they fail to pay. Within countries, there are often well-established mechanisms for ensuring the provision of public goods. For example, individuals must pay taxes to support the provision of street lighting, even though only some of them may benefit. If they fail to do so, the domestic courts can take action against them to recover what they should have paid. There is no global taxation system, so it is necessary to develop separate systems for raising funds. Nor is there any global system for sanctioning those who fail to contribute, unless it is explicitly created. Thus, it is necessary to establish such mechanisms. These can take different forms, with differing levels of legal underpinning, ranging from ad hoc voluntary agreements to treaties, which can differ in the extent to which they impinge on sovereignty and the mechanisms for enforcement that are adopted. Although the nations of the world have agreed to the principle of joint action to combat threats to health, as WHO Member States, and thus, in turn, to the requirements of the IHR, this has proved to be inadequate. And simply creating a new international pandemic treaty is not enough. There is a further need for at least two institutional innovations: a mechanism that can observe the world and anticipate emerging health threats; and a structure that supports the resilience of states and their ability to respond to crises, ensuring that they have invested in preparedness before an emergency and that the necessary resources can be made available when one occurs. In the following sections, we develop these ideas further.

An international legal framework for pandemics

The case for a new pandemic treaty has already attracted widespread support, from the IPPPR, which advocates a Framework Convention, analogous to the Framework Convention on Tobacco Control (Independent Panel for Pandemic Preparedness and Response, 2021), and in a statement in March 2021 from some world leaders, including the WHO Director-General (World Health Organization, 2021a), although others have been less supportive, at least for now. This section reviews the existing proposals and discusses some issues that should be considered in taking this process forward.

Starting with the IPPPR report, this notes how its proposed Framework Convention could clarify responsibilities of states and international organizations and, crucially, establish or reinforce legal obligations

and norms. It also envisages that such a Framework Convention could support mechanisms to generate a range of global public goods, including finance for R&D, arrangements for technology transfer and capacity-building. The IPPPR proposes that this should be established rapidly, using powers under Article 19 of the WHO Constitution, in a way that complements the IHR. The IPPPR envisage that the Framework Convention would be facilitated by WHO, with clear involvement of the highest levels of government, scientific experts and civil society.

The March 2021 statement by world leaders has many similar aspirations. It envisages such a treaty as fostering an all-of-government and all-of-society approach, strengthening national, regional and global capacities and resilience to future pandemics. It would create the means to enhance international co-operation and coordination to improve alert systems, data sharing, research and local, regional and global production and distribution of medical and public health countermeasures, such as vaccines, medicines, diagnostics and PPE. It also sees such a treaty as bringing greater political compliance by states (and non-state actors) to health security measures, filling the gaps that became apparent in the IHR during COVID-19. Solidarity remains a key component of the March 2021 statement referred to above, a key value that dominated global health security discussions and policy over the past 20 years, but which seems to have almost evaporated during COVID-19, with very few governments either adhering to their obligations for domestic disease control activity, as stated by WHO, or seeking to support other states with less capacity to manage outbreaks elsewhere.

The European Council, which initiated conversations on the proposed treaty, has elaborated on the goals to be achieved (Box 15). This sets out the scope that such a treaty might cover.

In developing a new treaty/convention, one of the first questions to consider is what it might add. It can be argued that the core tenets of what is being suggested already exist within the global health architecture. For example, the IHR requires governments to share information about emerging pathogens, implement public health measures to reduce disease transmission and ensure that health systems have the capacity to prevent, detect and respond to emerging health threats. Despite this, there have been numerous instances of governments disregarding their requirements under the IHR during COVID-19.

Thus, there are key questions which must be addressed through research prior to drafting of this treaty.

Box 15 *Potential scope of a pandemic treaty*

- Better surveillance of pandemic risks
  - Increased laboratory and surveillance capacity required to identify animal diseases in all countries
  - Enhanced collaboration between research centres globally
  - Better coordination of international funding for core capacities
- Better alerts
  - Introducing more levels of alert commensurate to the degree of health threats
  - Digital technologies and innovative tools for data collection and sharing and predictive analytics
- Better response
  - Health supplies and services
  - Global supply chains and stockpiling
- Research and innovation
  - Ability to rapidly scale-up manufacturing
  - A globally coordinated approach to discovering, developing and delivering effective and safe medical solutions.
  - Sharing of pathogens, biological samples and genomic data and development of timely medical solutions
- Better response mechanisms
  - Draw on the experiences of the Access to COVID-19 Tools Accelerator (ACT-A), COVAX and other collective instruments to more equitably address global needs in future pandemics
- Better implementation
  - More robust country-reporting mechanisms, with widespread use of joint external evaluations and better follow-up
- Restoring trust in the international health system
  - Greater transparency, accountability and shared responsibility in the international system
- Better communication and information by public authorities to citizens

Source: European Council (2021).

- Why did what we have in place already, a normative agenda for global health security (see Chapter 3) alongside legal requirements under the IHR (2005), fail during COVID-19?
- What can the new treaty offer to address these failures (when identified), and how will it be designed to avoid simply replicating the same gaps in global emergency preparedness?

An editorial in *Nature* has considered these questions and set out four conditions that would have to be met for such a treaty to be effective (Nature, 2021). First, it must include as many countries as possible. Unfortunately, neither China nor the United States signed up to the March 2021 statement, but their participation will be essential. A further risk with a framework convention model is that there is likely to be a scenario whereby some countries ratify certain parts of the treaty and not others, exposing weaknesses in the treaty architecture itself. Second, researchers and NGOs should be actively involved in its development, in the same way that they have contributed to previous international treaties on ozone depletion, climate change and biodiversity. Their contributions will be essential if the treaty is to achieve widespread acceptance. Third, a new treaty should be informed by a detailed analysis of the issues that limit the effectiveness of existing arrangements, including the IHR and the COVAX scheme. Finally, acceding governments will have to agree to give WHO, as the proposed custodian of the Treaty, sufficient authority to act and to accept its decisions, something which they have notably rejected during the COVID-19 pandemic. A significant effort for trust and relationship building will be required for this.

There are three other potential hurdles to an effective pandemic treaty.

- **Compliance:** the current legal and normative architecture of global health security contains no mechanism by which governments can be forced to implement the IHR, or be held to account for their failure to comply, other than "naming and shaming" (Worsnop, 2017). This clearly has not been enough to ensure compliance (Katz & Dowell, 2015; Kluge et al., 2018). Any future treaty must consider mechanisms to incentivize or sanction governments to comply with global agreements (Duff et al., 2021). A *Lancet* review written by leading scholars in global health goes as far as to argue that WHO should have the power, when necessary as in a crisis, to be able to supersede other authorities and bypass existing regulatory structures, including national jurisdictional authorities (Duff et al., 2021). There are a number of potential models this could draw on, but essentially this would involve at least one of two possibilities. The first is some mechanism for resource mobilization to support increased compliance, such as financial incentives for reporting or release of funds immediately available upon discovery of an emerging pathogen threat or a PHEIC declaration. The second is some mechanism for castigating governments that fail to comply, such as economic, political or trade sanctions for failing to share data transparently or actively putting other states' health security at risk through failed disease control interventions. As such a treaty will need to be agreed upon by governments, it seems unlikely that they will agree to the potential for sanctions to be placed on them. This being so, it seems more likely that there will be a need for an incentive to be created. This will require consideration as to how this mechanism might be funded. This is discussed further in Chapter 10.
- **Determining the right scope:** The proposals by world leaders contain a vast array of content for a potential pandemic treaty, from sharing data, to affordable vaccines, to equitable processes, alert systems and resilience. This is a lot for one treaty to achieve. It also creates more options for tensions during the negotiation processes. Governments will have to think strategically as to what has to be in this treaty, and what other areas can be placed into other forms of governance regulation (such as described elsewhere in this report). The risk of trying to fit too much into one treaty is that non-compliance becomes more likely, or governments only agree to particular parts. On the other hand, the Lancet review has argued that a treaty should have sufficient flexibility to respond to what could be a very wide range of scenarios at different jurisdictional levels (Duff et al., 2021).
- **Sovereignty:** The success of any pandemic treaty, and indeed any international law or policy is determined by how willing governments are to pool sovereign decision-making for any one area of policy-making to the global body responsible, and/or to allow global norms to prevail over domestic prioritization. Despite the widespread acceptance that a global approach to tacking COVID-19 would not only have resulted in a more coordinated,

> equitable response mechanism, but also may have heavily reduced the global toll of the pandemic, governments chose to ignore cosmopolitan global priorities, law and norms and, at the peak of the crisis, a realist logic of state survival prevailed. While this is, to a certain extent, understandable in that the social contract dictates that governments must respond to the needs of their electorate or other supporters before all else, such an approach is short sighted with regard to the longer-term effects of the pandemic and the ongoing global circulation of the pathogen. It is hard to imagine that future governments will not prioritize their own domestic needs and the presumption of sovereignty first unless there are very strong incentives for doing so.

A key step must be to understand the motives behind government decision-making and the retrenchment to nationalism, moving away from multilateralism. This will require extensive work with governments and politicians during times when a crisis is not underway to promote globalist approaches to effective pandemic preparedness and response, and to address concerns governments may have in anticipation of future events. Such trust building exercises have been common in other areas of planning for potential global crises, such as nuclear control and conflict prevention. These need to be normalized. In this respect there is much to be learned from the defence sector, which invests considerable resources in multinational simulation exercises, both table top and in person, to test strategies and align procedures, linked to measures to exchange knowledge and understand the comparative strengths of institutions.

The treaty will, given its content, also involve non-state actors, such as international organizations (WHO), the private sector (pharmaceutical actors), foundations (e.g. BMGF) and civil society. These actors are not traditionally governed by international law, but consideration needs to be made as to how they should be held to account within any treaty, and what their obligations must be and by whom. To do this, they need to have a role in helping to shape the treaty to ensure it is feasible.

In summary, while calls for an international pandemic treaty have attracted widespread support, there are several important issues that need to be addressed, especially in relation to methods to ensure compliance, the scope of what should be included, and the extent to which signatories will be willing to pool sovereignty for the benefit of all.

Scanning the horizon for emerging health threats

The 2014 Lancet–University of Oslo Commission on Global Governance for Health advocated for an Independent Scientific Monitoring Panel on Global Social and Political Determinants of Health, drawing on experience with the Intergovernmental Panel on Climate Change (IPCC) or the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IBPES) (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2021; Ottersen et al., 2014). The Lancet Commission envisaged that such a Panel would call for, receive, assess, analyse, debate and communicate multiple lines of independent evidence, across disciplines, and provide independent and transparent strategic information to the UN and other actors that affect global governance for health. They believed the Panel should have access to adequate information to enable its monitoring activities to inform decisions before they are made, as well as tracking the effects of such decisions. Such a Panel would require data that complement existing systems of information about health and health systems, including a political analysis of the social and political determinants of health. It would be able to challenge the status quo, strengthen and broaden the evidence base, and address the power disparities that characterize the present system of knowledge production, recognizing diverse sources and types of knowledge and investing in capacity, especially among people whose health is most directly affected by the global social and political determinants of health.

Drawing on this thinking, the Pan-European Commission on Health and Sustainable Development called for the establishment of both a Pan-European Network for Disease Control and a Pan-European Health Threats Council.

The EU already has several apparatuses for communicable disease control and health emergency preparedness. For example, the European Centre for Disease Prevention and Control (ECDC) was established in the early 2000s, and a specific European Health Emergency Preparedness and Response Authority (HERA) is currently under development. The EU is also boosting funding towards pharmaceutical development, civil protection (through

the RescEU programme) and health systems (through the EU4Health programme). Despite these existing efforts, we have witnessed the major complications that arose in the region during the pandemic in producing comparable and useful data, both within the EU and in the pan-European region more broadly. These challenges arise in the context of a fragmented and conflicted global governance arena, in which multiple forums and agencies influence health policy with different agendas. We envisage that a Pan-European Network for Disease Control, convened by the WHO Regional Office for Europe, would provide a mechanism to strengthen early warning systems, epidemiological and laboratory capacity and interoperable data systems. As the convener, the WHO Regional Office for Europe would serve as the Secretariat and bring together technical agencies in Member States and the supranational specialist health emergency and surveillance agencies of the Region. Such a network would help avoid duplication of efforts and strengthen coordination in the Region to enable monitoring activities and inform evidence-based decision-making for health.

In addition to the above, a Pan-European Health Threats Council convened by the WHO Regional Office for Europe should also be established to further enhance coordination and collaboration and increase solidarity, multilateralism and accountability across the pan-European region. Ideally, this Council would convene regularly at the level of ministers of health, but with the option of participation at the level of heads of state during times of crisis. In cooperation with the previously proposed Pan-European Network for Disease Control and existing organizations within and outside the pan-European region, the Council would aim to enhance political commitment to pandemic and health-threat preparedness and ensure maximum complementarity, cooperation and collective action across the pan-European region. Such a body would be responsible for assuring data interoperability and, as much as possible, the harmonization of public health and social measures for preparedness and response; sharing resources and equipment for emergency response; and promoting accountability and cooperation in the pan-European region.

The Lancet Commission envisaged that such a Panel would call for, receive, assess, analyse, debate and communicate multiple lines of independent evidence, across disciplines, and provide independent and transparent strategic information to the UN and other actors that affect global governance for health. It should have access to adequate information to enable its monitoring activities to inform decisions before they are made, as well as tracking the effects of such decisions. It will require data that complement existing systems of information about health and health systems, including a political analysis of the social and political determinants of health. It would be able to challenge the status quo, strengthen and broaden the evidence base, and address the power disparities that characterize the present system of knowledge production, recognizing diverse sources and types of knowledge and investing in capacity, especially among people whose health is most directly affected by the global social and political determinants of health.

It is useful to reflect on the structure and operation of organizations whose experience these bodies might draw on. The IPCC was established in 1988 by the World Meteorological Organization (WMO) and UNEP, and was subsequently endorsed by the UN General Assembly (Intergovernmental Panel on Climate Change, 2021). Its mission is to provide objective scientific information on the scientific basis of risks associated with human-induced climate change, its natural, political, and economic impacts and risks, and possible responses. It produces regular reports that feed into the work of the UN Framework Convention on Climate Change, a treaty intended to support measures to stabilize greenhouse gas concentrations at a level that would prevent anthropogenic damage to the climate system.

The IPCC does not conduct its own original research or surveillance of climate change and its effects, but rather it assesses evidence, primarily from peer-reviewed literature. However, by identifying gaps in knowledge, it contributes to the research agenda on climate change and its impacts. The IPCC shared the 2007 Nobel Peace Prize.

The Panel is composed of representatives appointed by governments who should have appropriate expertise. However, nongovernmental and intergovernmental organizations participate as observers. The opening meeting and some other sessions are open but, in general, the meetings of the Panel are closed. The work of the IPCC is funded mainly through a Trust Fund established by the UNEP and WMO, with both organizations supporting the Secretariat. Chapters in IPCC reports are written by a team of authors, typically comprising two coordinating lead authors, 10–15 lead authors and additional contributing authors. Once

written, reports undergo peer review and review by governments, with review comments placed in the public domain. Inevitably, given the existence of powerful vested interests, such as the petrochemical industry, the IPCC has been subject to an exceptional degree of scrutiny and criticism but, with a very few exceptions, its reports are viewed in the scientific community as credible and authoritative. However, because of the attacks it has faced, some have expressed concern that it may have tended to understate the scale of the threat (Waldman, 2018).

IPBES has attracted less attention. It was established by UNEP in 2010 following a resolution by the 65th session of the UN General Assembly. Its mission is to synthesize, review, assess and critically evaluate information and knowledge on the contribution of biodiversity and ecosystem services to sustainability that has been generated by governments, academia, scientific organizations, NGOs and indigenous communities. It has produced reports on scenarios and models of biodiversity and ecosystem services, on pollinators, pollination and food production, and on land degradation and restoration, among other topics. These reports are produced by a group of leading experts conducting assessments of the information and knowledge in a transparent way. IPBES also seeks to strengthen capacity for effective use of science in decision-making at all levels. It also feeds into multilateral environmental agreements related to biodiversity and ecosystem services, building on existing processes, such as the global environmental conventions and development policy dialogues.

There are three issues to be considered in creating these bodies: scope, governance and composition. As described in Chapter 4, network and Council members would need to consider a broad spectrum of influences on health, both natural and of human origin. This is well illustrated by the COVID-19 pandemic. Given the potentially limitless range of threats to health, it will be important for these bodies to focus on those threats that arise at the interface between the health of humans, animals, and the natural environment, drawing on expertise in basic human, veterinary and plant science (One Health), and epidemiology, modelling, ecology and the integrating contribution of public health. However, it will be important not to repeat the mistakes made by some countries during the pandemic of taking a narrow reductionist approach to science, and failing to take account of insights from social, behavioural and political science. While the species jump by SARS-CoV-2 can be understood from a One Health perspective, it is only possible to understand its subsequent spread and the failure to contain it by considering all the things that foster inclusive, engaged and empowered societies that have proven relatively resilient to the impact of the pandemic, as well as things that have undermined this resilience, such as the spread of disinformation, corruption in procurement of essential equipment, and cyberattacks, such as that which paralysed the Irish health system (Irish Times, 2021). Thus, the range of expertise required will be substantial.

In terms of governance, both IPCC and IPBES were created within the UN system and their secretariats are provided by UN specialized agencies. However, both have a high level of independence. The IPCC is an autonomous intergovernmental body, with participants appointed by governments and attending both as scientists and representatives of their governments, with international agencies and NGOs attending as observers. However, this means that its meetings are very large; its 2018 meeting was attended by 290 government officials and 60 representatives of observer organizations. The IPCC reports are agreed by consensus of all participating governments. The Pan-European Network for Disease Control and the Pan-European Health Threats Council envisaged here would both have to be much smaller and would not be able to include representation from every country. By analogy with the other two bodies, we envisage that the Network's and the Council's secretariats would be hosted by the WHO Regional Office for Europe.

There are certain issues to consider concerning the composition of such a network or council. It should be large enough to include an adequate breadth of expertise, including basic, social, behavioural and political science, as well as diversity in gender, geography and disciplinary backgrounds. While individuals would be expected to have detailed knowledge of particular fields, they would ideally be individuals who have demonstrated their ability to work in an interdisciplinary way and respect different types of evidence.

Drawing on the experience of the IPCC, it will be important for Panel members to recognize the nature of health threats, which involve complex adaptive systems, characterized by path dependency, non-linear associations and feedback loops. Also, to be of optimal use to policy-makers, their reports should be able to include both health and economic outcomes.

This would address concerns about the trade-offs that policy-makers must take account of (Eichenbaum et al., 2020). They should also, to the extent possible, seek to incorporate behavioural changes in response to both threats to health and responses to them, and in particular how these vary among different groups within societies, for example by gender, income, education, or ethnicity; something that should, in turn, stimulate research in this largely neglected area as well as in systems to gather the necessary data.

A mechanism to promote resilience and respond in a crisis

Although the impact of the COVID-19 pandemic, measured in lives lost and economic impact, is on a much greater scale than anything in the postwar period, it is the second major crisis the world has faced in just over a decade. The global financial crisis, beginning in 2007, was the most severe global recession since the Great Depression in the 1920s. Economic activity declined in half of countries, globally, and in some countries, decreased by almost 10%. An analysis carried out in 2018 by the IMF found that output remained well below levels predicted from pre-crisis trends (Chen et al., 2018). There were also consequences for population dynamics and health (Karanikolos et al., 2016). Birth rates fell, with consequences for future labour forces, and, in some of the worst affected countries, there were increases in deaths from suicide and outbreaks of infectious disease (Karanikolos et al., 2013; Reeves et al., 2014). Much has been written about the causes of the crisis but it can be argued that there are certain similarities with the current pandemic. Both can be dated to a specific event, in one case, the bursting of the housing bubble in the United States, in the other, the first reports of human-to-human transmission of the virus in Wuhan, China. However, the consequences of these events were magnified by serious weaknesses in systems that should have prevented the effects spreading worldwide. In the case of the financial crisis these included deregulation of many aspects of the global financial system, associated with a loss of structures that could anticipate emerging problems and mitigate them, delayed and uncertain political decision-making, and populations living precarious lives because of their reliance on high levels of household debt. In the case of the pandemic, they included weaknesses in the global surveillance and response system, delayed and uncertain political decision-making, and populations leading precarious lives that made some of the necessary responses, such as isolation when infected, difficult.

Recognizing the problems in the financial sector, in 2009, the G20 nations created a Financial Stability Board (FSB). This was a successor to the earlier Financial Stability Forum, created in 1999 by the finance ministers and central bank governors of the G7 nations, subsequently expanding to include several other countries, such as Australia, the Netherlands and Singapore, as well as international financial institutions (Financial Stability Forum, 2008). A 2008 report by the Financial Stability Forum to the G7 made a series of recommendations.

- Strengthen prudential oversight of capital, liquidity and risk management.
- Enhance transparency and valuation.
- Change the role and uses of credit ratings.
- Strengthen the authorities' responsiveness to risks.
- Make robust arrangements for dealing with stress in the financial system.

The new FSB, created following the 2020 G20 summit, expanded the Financial Stability Forum to include emerging economies. By 2021, the FSB included 68 member institutions from 25 countries, 10 international organizations and standard-setting bodies, such as the Basel Committee on Banking Supervision, and six Regional Consultative Groups, which provide links to a further 65 countries.

Subsequent reforms, in 2012, established the FSB as a permanent body based in Switzerland and hosted and funded by the Bank for International Settlements. A 2016 review (Financial Stability Board, 2016) set out a series of priorities to:

- promote a coordinated programme of reforms to deliver resilient sources of market-based finance, including addressing structural vulnerabilities associated with asset management;
- develop robust financial market infrastructure, including assessing policies on central counterparty resilience, recovery and resolvability, and recommending any necessary improvements;
- support effective macroprudential arrangements by drawing lessons from countries that have applied macroprudential policy frameworks and tools,

working in partnership with the IMF and Bank for International Settlements.

It also pursued the implementation of post-crisis reforms while tackling unintended consequences, sought to identify new and emerging vulnerabilities in the financial system, including those associated with climate change, and monitored the implications of innovations in financial technology and risks of disruptions of operations.

There is a widespread consensus that the FSB has strengthened the resilience of the global financial system substantially. It has ensured that the world's major banks have capital ratios that enable them to respond in the event of plausible future financial shocks. This was apparent during the current pandemic when the improved capitalization of many banks enabled them to distribute state-guaranteed loans in a way that might not have been possible previously. It also provided a forum for discussion of responses to major threats of all kinds. Thus, for example, its 2021 work programme (Financial Stability Board, 2021) includes activities that have implications for health and sustainable development, such as:

- COVID-19, including vulnerabilities that the pandemic has created in the global financial system, exchange of information and policy responses, and coordination of their future unwinding;
- implementation of recommendations by its Task Force on Climate-Related Financial Disclosures;
- convergence of regulatory reporting of cyber incidents.

What can account for this success? In his recent book *Value(s)*, Mark Carney, who played a leading role in the creation of the FSB and chaired it between 2011 and 2018 identified three factors (Carney, 2021).

- A clear mission with political backing. The FSB was charged with identifying and addressing the risks to global financial stability, a mission that was simple yet hard. Its requirement to account to the annual G20 cycle maintains focus, as does the requirement for all proposals to be endorsed by the G20.
- The right people are around the table. The FSB is not a large international bureaucracy, but has a Secretariat of 30 people. Its strength lies in its membership: representatives from central banks, regulators, and finance ministries.
- An approach based on consensus to instil ownership. The standards agreed at the FSB do not have direct force in national jurisdictions. Carney argues that it confronts what Rodrik has termed "an impossible trinity" of sovereignty, economic integration and democracy (Rodrik, 2000). This recognizes that common rules are required for trade, but these cede sovereignty, so decisions must be rooted in democratic accountability.

While recognizing the differences between global financial stability and public health, there are striking similarities: the disruptions in 2008 and 2020 caused immense losses in human, economic and social terms; control and prevention of future global health crises will require not only greater international coordination but also effective engagement at the highest political levels, embracing both the health policy and the economic and financial policy perspectives.

By analogy with the FSB, which has, for example, been assessing the threats posed by cryptocurrencies and cybercrime, the goal of a Global Health Board would be to assess emerging threats to health. It would explicitly adopt an upstream approach that includes threats arising from other sectors; in this case the environment, agriculture and international trade and travel. However, as threats come from many sectors, so must responses. These responses will be critically dependent on support from finance ministries. These considerations mitigate against placing it within existing international health frameworks, but rather in structures that engage all of government. A further consideration is that while a Global Health Board might attract widespread support, it is unrealistic to think that every government in the world would sign up to it. This would mitigate against situating it within the UN system. This would then point to a case for situating it within an intergovernmental body such as the G20, which would have the added advantage of consistency with the FSB.

Framing the Global Health Board in accordance with the FSB, starting from its membership up to its organization and governance structure, would enhance its reliability as international body, while granting its flexibility and responsiveness as a member-driven, multi-institutional and multidisciplinary institution. This flexibility is essential if the Global Health Board is to be able to assess vulnerabilities affecting global health (informed by other initiatives such as the pan-European Panel on Health Threats discussed above), to promote coordination and

information exchange among authorities responsible for health and sanitary resilience, to encourage cross-border cooperation in times of crisis, to advise on best practices and to promote improved assessment of economic and financial health-related risks.

The Global Health Board must be an inclusive body. The FSB has shown that it is possible to include countries that are outside the G20. This will require, and recognize, the key roles of other global health actors in addressing health challenges. The G20, in creating governance arrangements for the FSB, has shown that it has a high level of adaptability, allowing it to engage diverse stakeholders as noted above. For example, in 2012 it created a High-Level Panel on the Governance of the FSB, whose members came from, for example, Colombia, Kyrgyzstan and Uganda. Of relevance in the pan-European space, it is important to ensure involvement of regional networks and organizations, which, as with the FSB, provides a mechanism to ensure interaction of the Global Health Board's members with non-G20 countries.

While it will clearly be essential for a Global Health Board to have access to expertise in health, complemented by high-quality timely data on health and its determinants, following from previous points, it will be essential for finance ministries to have ownership as they are the custodians of the resources to make anything happen. Again, drawing on the analogy of the FSB, which includes the international financial institutions and regulatory bodies, it will also be necessary to develop strong institutional links with those agencies concerned with One Health (FAO, OIE, UNEP and WHO).

It will be important that there is clarity about the boundaries of competence of a Global Health Board. It will be essential that it respects the responsibilities of other organizations, avoiding anything that could create confusion about responsibilities. Consequently, it will need to be made very clear that the roles of a Global Health Board are primarily to assess risk and to ensure that the conditions exist to incentivize preparedness for a crisis and to facilitate appropriate responses, including the release of necessary resources. It is not to design or manage such a response. Thus, WHO must retain the ability to declare a PHEIC, although the processes may change following the adoption of a new pandemic treaty. However, such a declaration does not lead to the mobilization of financial resources. A Global Health Board, as envisaged here, would make this possible, perhaps by working with the IMF to facilitate release of member countries' Special Drawing Rights, created in 1969 to supplement a shortfall of preferred foreign exchange reserve assets held in gold and United States dollars and providing a mechanism to provide liquidity when needed.

A global vaccine policy

Vaccines in themselves are not public goods. However, when developing policies on vaccines there are at least two issues where public goods are involved. First, there is the knowledge generated from vaccine R&D, such as the technological platforms for producing them. This knowledge can be adopted by others, subject to revelation of trade secrets and relaxation of IP rights, to make further advances, thereby providing a positive externality. Second, if vaccines lead to population immunity or eradication of a disease, they again produce positive externalities. Thus, there is a double externality issue: producers do not capture all the knowledge spillovers from their R&D efforts and patients do not capture the wider benefits like population immunity from their choice to vaccinate (Xue & Ouellette, 2020). The development of vaccines for emerging infectious diseases is particularly challenging as the pathogen responsible for the disease may be unknown and the time and location of future outbreaks is difficult to predict. In addition, many emerging diseases affect poor countries most while the costs of vaccine development are borne by rich countries.

COVID-19 set the stage for the most efficient vaccine R&D feat in modern history, following the discovery and publication of the SARS-CoV-2 genome in January 2020. The drive to develop therapeutics, diagnostics and vaccines for COVID-19 has led to about 80 vaccines in clinical trials and 70 more in clinical development (Zimmer et al., 2021). Several vaccine technology platforms have been employed, ranging from viral vector-based and protein-based technologies to mRNA and lipid nanoparticle technology (Gaviria & Kilic, 2021). Despite these incredible scientific achievements, there are huge inequities in the availability of and access to COVID-19 vaccines around the world. There is an urgent need to scale-up availability of vaccines, not just in the year 2021, but in 2022 and beyond. This would ensure that most of the global population is vaccinated, which could in turn enable economies to reopen and prevent the emergence of new, more dangerous strains of the virus. As such, the debate has opened around

whether to waive IP rights for COVID-19 vaccines so that manufacturers all over the world could produce vaccines themselves.

Current manufacturing and supply capacity is not equipped to deal with the global demand for COVID-19 vaccines. Only a handful of companies are producing and supplying COVID-19 vaccines around the world, and to date none have shared their IP or technology via WHO's COVID-19 Technology Access Pool or any other mechanism. These companies claim they can scale-up production to meet demand themselves; but so far, they have systematically overpromised and underdelivered. There is no reason to assume these predictions are reliable, particularly because of vested pharmaceutical interest in maintaining the status quo of its monopoly control. Many low- and middle-income countries are heavily dependent on the Serum Institute of India, which has announced that it will prioritize domestic supplies throughout 2021.

IP rights are one important barrier to scale-up of vaccine manufacturing to ensure equitable access; an IP waiver could thus be a first step to create a suitable environment where companies can manufacture and supply authorized vaccines to meet global demand without threats or lawsuits over IP infringement. However, beyond patents, IP also includes know-how, trade secrets, regulatory data and more. Vaccine manufacture is typically covered by tens or and even hundreds of patents.

IP waivers are strongly contested by the pharmaceutical industry and some in the financial services sector, arguing that they will disincentivize future R&D investment and innovation and that they will not be enough to ensure that vaccines become available in adequate amounts. The first argument is challenged by those who point out that a very high proportion of the cost of developing the existing COVID-19 vaccines was from public sources, with substantial support from the United States (Moderna), United Kingdom (Oxford-AstraZeneca) and EU (Pfizer BioNTech) (Dyer, 2021).

The second argument has also been challenged. Advocates of waivers accept that the removal of vaccine patents alone is insufficient to solve all the world's manufacture and supply problems. Unlike many medicines, vaccines are complex biologicals and "manufacturers need access to the developer's 'soft' IP – the proprietary recipe, cell lines, [and] manufacturing processes" to produce these immunizations – and will likely also need the originator's cooperation to help with their initial scale-up efforts (Silverman, 2021). A large part of vaccine technology transfer will therefore depend upon the technological capacity of the manufacturer in question and the vaccine type. While manufacturers with limited capacity today may need support; manufacturers such as Virchow Biotech and Bharat Serums and Vaccines in India, Biomanghuinos in Brazil, and Biolyse Pharma in Canada are already likely to be equipped with the capacity necessary to scale-up vaccine production if they have access to IP. Thus, when considering IP waivers, it is important avoid all-or-nothing, one-size-fits-all discussions and acknowledge that capacity to produce quality vaccines exists in various parts of the world.

Key players in global health, such as the United States government and the BMGF, have recently shifted their stances and joined supporters of IP waivers such as the WHO Director-General, Dr Tedros Adhanom Ghebreyesus. The shift by the United States is particularly momentous as a political signal and public acknowledgement that IP does indeed represent a barrier to access that, in an emergency, can be removed. So far, though, the ambition is narrowly focused on vaccine patents (Kay et al., 2021). Other technologies (diagnostics, respirators and even future treatments) are also critical tools for preventing, treating and minimizing the effects of COVID-19 and would be much easier to produce if IP restrictions were lifted. Thus, it would be a mistake to focus only on vaccine patents, given that we need access to other types of IP and to lift monopolies on data (regulatory dossiers and related data exclusivity) and trade secrets.

All available evidence suggests that authorized COVID-19 vaccines are very safe and effective, and will play a critical role in ending the pandemic. If there is appropriate will, access to technology and financial investment, mRNA vaccine manufacturing capacity can be built and/or scaled up in 6–12 months, as Pfizer/BioNTech and Moderna have done. So while these three ingredients do not bring immediate solutions to problems of access to vaccines, together they can achieve, relatively quickly, substantial progress. As noted above, many countries have found themselves at the back of the global COVID-19 vaccine procurement queue and are only able to secure doses after the wealthiest nations have already received theirs. Therefore, it is not only legitimate, but also morally imperative that countries are enabled to establish their own manufacturing lines to produce vaccines in the fight against COVID-19 and

other future epidemics/diseases. As is repeatedly noted, in a pandemic, nowhere is safe from the disease until everywhere is safe.

With COVID-19 vaccines in particular, there is a strong case to make platform technologies such as mRNA vaccines into global technologies which everyone can build upon. These mRNA platforms are the result of 20 years' research by scientists around the world, often financed publicly, and have potential applications in many diseases beyond COVID-19. Of course, this is one reason why pharmaceutical companies wish to keep monopolies on the platforms, but it also serves as an argument to make them available to all as a means to stimulate follow-on innovation (e.g. overcome cold chain/stability issues, or adapt to locally circulating strains for specific boosters) and adapt to diseases outside the interests of so-called big pharma. Thus, making mRNA technology platforms available globally could address short-term needs for combating COVID-19 as well as long-terms needs for better preparedness and response.

Aside from IP waivers, some other proposals to scale-up and ensure equitable access to COVID-19 vaccines have been made. For example, some experts recommend that instead of using compulsory licensing to force IP waivers, implicitly accepting the industry argument that this may discourage ongoing and future private investment in R&D, organizations, such as the G20, UNITAID and WHO, could pool funds from governments to buy patent rights and/or licenses covering COVID-19 technologies so that these could be treated as global public goods (Mossialos, 2021). Contributions by national governments could be based on both the ability to pay and the technology's expected impact on the population, with investment in manufacture and distribution systems reflecting need. Ideally, coordination of this process would be led by a global oversight committee which would assess patent value fairly and consider multiple factors including potential future value, expected societal benefit, and level of public investment for the product during the R&D process.

Summary

The pandemic exposed serious gaps in the system of global governance for health. Some of this was because the things that were needed had the characteristics of public goods and, as such, tend to be underinvested in. This chapter has identified four of these gaps, sets out the case for creating solutions to fill them, and explores how these solutions might be designed and how they might operate. These solutions are a new pandemic treaty, a mechanism to scan the horizon for emerging health threats, a mechanism to ensure an appropriate financial response in a crisis, and a global policy on vaccines. Collectively these would provide a clear legal basis to act in a crisis, with clarity on responsibilities, a horizon scanning mechanism that can anticipate health threats, a structure that can monitor preparedness and facilitate rapid responses, and a system to ensure that countries can obtain the resources they need to mount an effective response.

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Chapter 10

Global actions to support investment in health

Tom Hart, Martin McKee

Introduction

It is widely accepted that one of the reasons why the impact of the pandemic was so severe was the failure of governments to invest in preparedness. When it became clear that SARS-CoV-2 was spreading rapidly across the world, many countries realized that their systems for surveillance, outbreak investigation, and delivery of health care and social support were inadequate. Yet this was part of a much larger problem. Over the past decades, many governments have reduced their level of investment in all forms of infrastructure (International Monetary Fund, 2020). This was already apparent in areas such as education, transport networks and digital access. Consequently, the lack of preparedness for major health threats such as pandemics should be seen as part of a more general problem of inadequate investment in economies the reversal of which will be required to face up to the challenges of the future. These challenges include climate change, public expectations and the many technological developments that will change the nature of employment.

Pandemic prevention and management cannot be left to private markets nor just to individual countries as, left to their own devices, neither the market nor individual governments will necessarily produce the goods and services needed for the long-term good of society. There are many reasons for this, including the existence of negative externalities, where the costs of a decision fall on others (Carande-Kulis et al., 2007) and short-termism, influenced by factors such as temporal myopia and hyperbolic discounting (Frederick et al., 2002).

Actions to enhance pandemic prevention, preparedness and response, or to tackle AMR and environmental challenges relevant for health, have large external benefits. Provision and financing of any public good suffers from a free-rider problem: private markets will not finance a sufficient amount because the benefits accrue to the public at large. For a global public good, individual countries will under-invest, as at least part of the benefits of successful prevention and management will accrue to others. Finally, pandemic preparedness as well as pandemic management suffer from the problem of the weakest link. The weakest link in a chain determines the strength of the entire system. The weakest link in fighting a pandemic is the country that is unable to contain the virus and becomes a source of new infection and variants. Together, these spillovers and interdependencies mean that financing and governance of pandemic prevention and management need to be a common concern for the global community.

If one of the problems contributing to the adverse impact of the COVID-19 pandemic was a failure to invest in preparedness and in those things that increase the resilience of society, then it is necessary to examine ways in which this can be rectified. In the following sections we examine ways in which investment in preparedness, and sustainable development and health, can be promoted by actions at the global level. We group these actions into two broad categories.

The first set of actions aims to improve the information, incentives and norms that influence the allocation of resources by both national governments, and by the private sector more broadly. First, improvements in health systems' accounting practices are needed to draw attention of decision-makers towards deficient areas of public health and health systems, particularly prevention and innovation, which too often receive inadequate investment. Second, routine monitoring of health and health systems by multilateral organizations is needed to identify health risks ex-ante and assess public health and health systems so that domestic and donor funds can be directed to fill gaps. Third, incentives should be put in place that encourage investment to be socially responsible and mitigate, rather than increase, the risk of future health threats.

The second set of actions involve increasing investment from international sources into the health sector, and especially into the parts of the health system which are necessary to manage cross-border and global externalities, such as the public health functions for surveillance of infectious disease outbreaks, preparedness and response, and responding to AMR. First, multilateral development banks (MDBs) should increase support to the health system functions that are necessary to manage cross-border and global externalities. Second, development finance institutions (DFIs) should increase investments in R&D, innovation and development of new health products and support private sector firms in key parts of the supply chain for medical supplies such as PPE, diagnostics, therapeutics, vaccines. This may mean, for example, supporting increased manufacturing capacity to ensure that supply chains are "pandemic proof" and do not result in the kinds of shortages of medical products seen in the COVID-19 response.

Improve health systems accounting to promote investment

Over the past century there have been numerous efforts to institutionalize the systematic measurement of economic activity at national levels (Kuznets, 1942). The main purpose of these efforts has been monitoring and evaluation, support for evidence-based decision-making, as well as to facilitate international comparisons. Since 2000, the health sector has had its own specific framework for health expenditure tracking – the System of Health Accounts (SHA) – which serves as the basis, globally, for reporting aggregate health care spending across a wide range of dimensions. There have been revisions to the SHA to take on learned experiences in health accounting as well as to make health accounts more useful and relevant for policy.

National accounting frameworks, such as the SHA, have important implications for policy and planning. The way that expenditures are captured by these frameworks, including the variables collected and the level of dis-aggregation, is of utmost importance. Given the role of national accounting practices in priority-setting and policy-making, it is necessary to consider whether there is scope for further adjustments to improve the way health expenditure data are recorded. This is the basis for the Monti Commission recommendation to more appropriately differentiate consumption and investment in national and international health accounting systems.

Health expenditure can serve many purposes, and indeed, the SHA already classifies health expenditure by function with the aim of differentiating between various objectives of health spending (e.g. curative, rehabilitative, etc.). However the current approach to capturing the function of health spending is not fit for purpose because it fails to distinguish between health spending which is "routine" (i.e. which has a contemporaneous and direct impact on health) and health spending which is "frontier-shifting", that is, expenditure which does not necessarily have a contemporaneous impact on health but which either delays or prevents the onset of disease (prevention) or which improves the efficiency of care delivery (technological progress).

The current approach to health accounts is deficient as evidenced by the fact that while there is wide recognition that "prevention is better than cure", the average country in the EU reported just 3% of current health expenditure was on prevention in 2018 – although it should be noted that many preventive activities may not be adequately captured in this figure due to the way data are collected (Eurostat, 2021). Additionally, although R&D is considered a memorandum item of the capital account, it is not sufficiently disaggregated to provide useful information on the extent to which countries invest in innovations. For example, capital expenditure on innovations such as e-health records cannot be separated out from more routine spending on assets such as ambulances.

By changing the way health expenditure data are captured so that there are clearer distinctions between consumed health expenditure and investments, countries will be incentivized to invest more in preventive services and are likely to support much-needed innovation that improves the efficiency of care.

Enhance surveillance of health systems to promote investment in health

Multilateral surveillance of health systems and fiscal policies is an established feature of the international order. Multilateral organizations – including WHO, the European Commission, the IMF and the OECD, among others – play an important normative role in shaping national policy through routine country surveillance exercises. For example, the European Commission,

through the European Semester, engages in an annual cycle of budgetary and macroeconomic surveillance of its Member States; the IMF, through Article IV consultations, regularly assesses economic and financial policies and developments of its 190 Member States and holds discussions with governments, central bank officials and other key stakeholders about its findings and lessons from international experiences; and the OECD also conducts country reviews when requested to do so.

The pandemic has revealed the costs of underinvestment in health, and the links between surveillance of health systems and fiscal policy should be strengthened. Although some health and health systems are assessed through the European Semester, as well as by the OECD, health does not generally feature in IMF Article IV consultations beyond considerations of fiscal pressures attributed to health spending and calls to increase health system efficiency. This is a missed opportunity for the international financial institution, as the pandemic has revealed that inadequate health investment, especially in public health systems, can itself constitute a source of macro-critical risk, not just to the country in question but to the world.

The IMF's recent review of its surveillance has recognized the need to better identify and assess spillovers, including from health policy, but also from other sources, such as climate (International Monetary Fund, 2021). It also committed the IMF to providing policy advice on how to mitigate and pre-empt such spillovers.

However, the IMF is predominantly staffed by macro-economists and fiscal policy specialists and it may not be reasonable to expect the IMF to develop deep expertise in health policy. As such, as well as IMF surveillance of health expenditure being strengthened, WHO will also need to develop strengthened health systems surveillance powers. The JEE to assess emergency preparedness and response capacity and compliance with the obligations set out in the 2005 IHR revision is currently voluntary (Talisuna et al., 2019). This contrasts with the IMF's Article IV consultations, which are mandatory for all countries which are members of the IMF. The institution's staff visit governments and analyse and discuss risks to fiscal and financial stability and provide a final report, which is also usually made public. An alternative model would be the Universal Periodic Review used by the UN Human Rights Council to review the human rights records of UN Member States.

Such reviews could feed into IMF surveillance, enabling it to take a judgement on whether levels of health spending on public health functions are so low as to make the level or efficiency of health spending macro-critical. These reviews could feed into needs assessments and programming more generally and guide both domestic and donor priority-setting.

This will not only be useful for high- and upper-middle-income countries, which are likely to finance health primarily from domestic revenues and could benefit from external evaluation and recommendations, but will also be useful to monitor whether lower-income countries are receiving sufficient support from MDBs and other external financing sources for public health. The reviews could feed into the capacity-building work of WHO and the programming of the World Bank, regional development banks and other agencies related to One Health, such as FAO and OIE.

Improved surveillance by the IMF also has the potential to support countries to better understand the risks and uncertainties from health threats, and to prepare for worst case scenarios (International Monetary Fund, 2021). Over the past 18 months, significant progress has been made on modelling the interaction between infectious disease outbreaks and the economy. For example, in their biannual report on the Danish economy, the Danish Economic Councils utilized the model of Eichenbaum et al. (2020) to set out the trade-offs the authorities face when responding to a virus (De Økonomiske Råd, 2020; Eichenbaum et al., 2020). Such models can help policy-makers understand both the health and economic impacts of taking (or not taking) public health measures (Vassall et al., 2020).

Optimal policies may differ according to demographic characteristics, the structure of the economy and the extent of government safety nets in place, and the ability of the government to finance increases. A common finding has been that measures should be less strict in developing countries due to characteristics such as younger populations, less fiscal capacity, lower incomes, a larger informal sector and weaker health systems (Alon et al., 2020; Hausmann & Schetter, 2020; von Carnap et al., 2020). This demonstrates the need for careful analysis of policy options, tailored to country circumstances. The challenge is now for improved IMF surveillance to help countries take into account health risks and assess appropriate policy responses.

Ensure that the financial system and private investment takes account of health risks

Just as public investment must address health risk, so must private investment take account of the negative externalities it could create by exacerbating health risks. While the need for green investment is widely accepted, similar analysis and action is needed to ensure health-compatible investment. Examples of activities with negative externalities for health include investment in intensive livestock practices that could exacerbate risks of AMR or investment in farming that leads to deforestation which could promote further risks of zoonotic spillover.

There are broadly three sets of instruments that can bring about a change in the way in which markets operate, changing the incentives to those that promote sustainability. Dubbed the three Rs, these relate to reporting, risk and returns (Carney, 2021).

In 2012 and 2015, the FSB, created in the aftermath of the financial crisis under the auspices of the G20, established an industry led Task Force on Climate-Related Financial Disclosures. Its members, drawn from the private sector, include major companies and investors, banks, insurers and credit rating agencies. It has established a mix of objective, subjective and forward-looking metrics, including disclosure of governance, strategy and risk management, consistent and comparable metrics across different sectors, and scenario analyses that can consider the potential impact of the risks and opportunities of transition to a low carbon economy. This reporting is increasingly being used to inform investment decisions, as investors look to the broader social goals of companies. Although they are currently voluntary, there are precedents for making them mandatory; for example, the detailed provisions contained in international financial reporting standards or the Non-Financial Reporting Directive in the EU (European Union, 2014).

National, European and global regulators should define disclosure and reporting standards that can raise awareness and ensure transparency on the impact of investments on health and exposure to health risks. Currently, there is very limited information on the positive or negative impact that some activities have on health and, in return, how they may be affected by a health crisis. There have been increasing efforts by public authorities or private initiatives to ensure transparency considering environmental factors, through labels (e.g. the EU's Green Bond Standard and Ecolabel); classifications of economic activities (e.g. "taxonomies", such as the European Commission (2021) taxonomy of sustainable economic activities) and recommendations by the FSB's Task Force on Climate-related Financial Disclosure. Extending disclosure by companies and financial institutions to health-related information would help increase transparency and awareness. As for climate, such actions would benefit from efforts conducted at regional the level (in particular by the EU) and beyond (by global standard-setting bodies and the International Platform on Sustainable Finance) to harmonize standards, on the basis of a common understanding at global level.

The second element is risk management. Banks were required to undertake stress tests by modelling the impact of events such as a rise in interest rates or a crash in equity markets, following an amendment to the Basel Capital Accord in 1996 (Quagliariello, 2009). However, the results remained internal to the bank concerned. Since the global financial crisis, central banks and others with regulatory roles, such as the European Banking Authority, are increasingly using stress testing; for example, to ensure that there is sufficient liquidity. However, there are concerns that the methods used, and especially the scenario analyses, are poorly developed and the assessments lack rigour.

To ensure the financial system takes account of health risks, these should be incorporated into risk management strategies and frameworks. The Network for Greening the Financial System has shown how climate change may translate into financial risks and has been developing scenarios to assess such risks (Network for Greening the Financial System, 2019). This contributes to better risk pricing and to aligning financial flows with climate targets, as required by the Paris Agreement. Just as financial decisions should take into account climate change risks, and the negative externalities from investing in activities that lead to carbon emissions, so they should also take into account health risks and negative health externalities. Activities that are detrimental or beneficial to health ("negative" or "positive externalities", respectively) are not properly priced and tend to be over- or under-produced. These include activities that increase risks of greater AMR, such as intensive agriculture and deforestation, and land use changes that increase the risks of zoonotic spillover. The first step will be to develop a common understanding of, and standard information on, health risks that will

Table 4 *Examples of environmental, social and governance indicators*

Environmental	Social	Governance
CO_2 emissions	Data protection	Anticorruption measures
Air and water pollution	Employee engagement	Whistleblower schemes
Deforestation	Community relations	Political contributions
Energy efficiency	Labour standards	Audit mechanisms

Source: Carney (2021).

allow companies and financial institutions to assess the risks and opportunities associated with health. The example of environmental risks shows that awareness and ownership by the financial sector takes time and requires evidence. Financial institutions, supervisors and regulators are only starting to investigate this area; for example, in the insurance sector, where the question of insuring pandemic-related business interruption arises (European Insurance and Occupational Pensions Authority, 2020), or factoring health aspects in to climate-related financial scenarios (ACPR - Banque de France, 2020).

The third financial technology relates to returns. Given the experiences of the pandemic, it seems prudent that a prospective investor would wish to consider a company's resilience to a future pandemic or other major health threat and to price that into its offer. The challenge is to obtain the necessary information. This has given rise to the development of indicators of the performance of companies beyond narrow measures such as share price and yield. The new indicators include environmental, social and governance (ESG) measures (Table 4).

These build on a long tradition of activist investment. For example, pension funds operated by trade unions have long used their funds to invest in areas such as affordable housing. During the 1970s, an international campaign was launched to promote disinvestment in companies operating in apartheid South Africa. In the 1990s, Elkington (1998) coined the term the "triple bottom line", referring to financial, environmental and social factors that, he argued, should be included when assessing a company's value. More recently, campaigns for disinvestment have targeted the arms and fossil fuel industries.

Investors are increasingly using ESG indicators when making decisions, and over one third of large asset owners have signed up to the UN's Principles for Responsible Investment (PRI), which promotes investment based on ESG considerations (Principles for Responsible Investment, 2021). It is possible to identify a growing number of examples where the application of these principles has been successful in steering capital away from certain activities, with one recent example being the failure of the Initial Public Offering of the company Deliveroo following concerns about the working conditions of its employees. Another example is the NGO Tobacco Free Portfolios, created by an Australian doctor, Bronwyn King, when she discovered that her pension fund was investing in the tobacco products that contributed to the premature deaths of many of her patients (Tobacco Free Portfolios, 2021). Her work has attracted extensive high-level support and led to large-scale disinvestment in the tobacco industry by pension funds.

This growing interest reflects, in part, evidence that companies that score highly on ESG are more likely to survive in the longer term, and to generate higher average returns (Carney, 2021).

The evidence of superior performance has been attributed to several possible factors, including the possibility that ESG performance is a proxy for high-quality management for the companies that perform well on these measures, meaning that they are better able to attract and retain more talented individuals. However, it is important not to take too narrow a perspective, seeing value only in stock-market performance, and also to recognize that companies may have different motivations. Thus, companies with high transport costs will seek to reduce expenditure on fossil fuels as a matter of self interest, whereas others may engage in activities such as promoting biodiversity that have no immediate benefit to them that are good for society.

It is also necessary to recognize that, as with any indicators, there is scope for gaming ESG measures; for example, by overperforming on some as a means of compensating for underperformance in others or by manipulating definitions. However, for the present purposes, what is important is that the growing literature on ESG indicators provides a rich body of evidence on ways in which companies and governments might

be held to account for investing in ways that promote sustainable health and protecting against health threats.

The One Health framework can be used to identify ESG indicators that can encourage ethical and sustainable investment. Much work is already underway to incorporate ESG factors, especially environmental factors such as climate change, and to a lesser extent, other issues such as biodiversity loss. The ESG concept should be refined to include health and One Health-related considerations with a view to minimizing risks and maximizing opportunities, and to make greater progress towards the Sustainable Development Goals (SDGs). Indeed, the impact of investment on health may already be seen as part of the social dimension, and analysis of the impact on the environmental dimension can be adapted to also capture impact on One Health. Doing so could help increase transparency and awareness of each stakeholder's impact on health and exposure to health risks, and shift the priorities and activities of prospective borrowers.

Increase public investment in prevention of health threats and preparedness and response

Thus far this chapter has discussed how improvements in information and incentives can increase investments in health. But actors at the global level also have a role to play in directly financing prevention, preparedness and response to prevent future pandemics.

As highlighted by the report from the IPPPR, the COVID-19 crisis was preventable (Independent Panel for Pandemic Preparedness and Response, 2021). To stop future health crises, we must invest now to urgently address the manifold weaknesses that have been identified in our systems for preparedness and response internationally. We now know that the projected costs of activities to prevent pandemics amount to only a small fraction of the costs that can already be attributed to the COVID-19 pandemic.

In the USA alone, the estimated economic costs of COVID from lost GDP and health losses from death, and impairments to mental and physical health could reach over US$16 trillion (Cutler & Summers, 2020). Actions to reduce the risk of disease spillover, such as halving the rate of tropical deforestation, monitoring and controlling the spread of pathogens in wildlife and domesticated animals and stopping the illegal wildlife trade would cost around US$22–31 billion per year, but these costs over a 10-year period come to only about 2% of the costs of the COVID-19 pandemic (Dobson et al., 2020). Reduced deforestation would also create around US$4 billion per year in co-benefits from reduced greenhouse gas emissions.

The costs of comprehensive pandemic preparedness actions have been estimated at between US$25 and US$72 billion per annum, depending on the exact assumptions made or scope of services included.

In response to a request from the G20 to assess gaps in pandemic preparedness, WHO estimated the cost of common goods for health related to health security (Yazbeck & Soucat, 2019). This drew on previous estimates of both global functions; for example, global coordination, regional surveillance, R&D (Yamey et al., 2019) and country-level preparedness costs such as emergency planning and early warning systems (Peters et al., 2019). This resulted in a cost estimate of US$72 billion per year, driven by estimated costs in high-income countries which contribute 66% of the total.

At the lower end of estimates, Georgetown University and Talus Analytics have used the IHR costing tool to estimate the cost of implementing the IHR (2005) at around US$25 billion per year, or around US$3–4 per capita per annum (Katz et al., 2012; 2018; Lee et al., 2020). While the estimated costs for low- and middle-income countries are comparable with WHO estimates, the estimate costs for high-income countries are much lower.

McKinsey & Co. has provided a further set of estimates for "always on" systems (such as border health), disease surveillance, prevention, health system strengthening for preparedness and R&D at US$36 billion per year, or US$5 per person per year (Craven et al., 2021). The country-level estimates are largely comparable to those made by Georgetown University, but additional costs come from estimating US$10 billion per year needed in global activities such as investment in R&D and global manufacturing capacity.

All these estimates suggest that significant increases in prevention and preparedness are needed. While an amount of US$3–4 per capita additional spending per person may not appear huge, the average health spending per capita in low-income countries was only US$7 in 2018, and US$35 in lower-middle-income countries, suggesting additional financial support for health security will be needed. In line with the

arguments that such spending has significant positive spillovers, and that global pandemic prevention and preparedness is only as strong as the weakest link, there is a rationale for substantial international public financing of these activities. As taking action against health risks such as pandemics and AMR are global public goods, individual countries may under-invest in this, and there is a case for global support, not just for low- but also for middle-income countries (Kaul, 2017). If international surveillance of health systems can be improved as proposed above, this would provide a sound basis to guide such increases in support.

Currently, MDBs, in particular, provide little financing for health for the 19 low- and middle-income Member States of the WHO European Region. Only 5% of official development assistance (ODA) flows in 2018 were allocated to the health sector, and less than 1% of other non-concessional resources were allocated to the sector (calculated from the OECD DAC CRS database) (OECD, 2018).

Both bilateral and multilateral providers of ODA will thus need to increase the amount of resources which are directed to building prevention and preparedness capacity, in line with long-standing arguments that this is needed. The Lancet Commission on Investing in Health argued that most low- and middle-income countries will have sufficient resources from economic growth over the next two decades to invest sufficiently in preventing infectious disease and maternal and child deaths to create a "grand convergence" in health across all income levels. It thus argued that there should be a substantial reallocation of development assistance for health towards global functions such as R&D into medicines and vaccines for diseases prevalent in poor countries and for managing cross-border externalities including pandemic preparedness and tackling AMR (Jamison et al., 2013).

As well as sufficient public financing in for prevention and preparedness, fiscal policy more broadly can be aligned with One Health strategies. As set out in Chapter 5, governments will need to develop coherent cross-government One Health strategies and operational plans. Fiscal policy will need to be aligned with these. Doing this should also demonstrate the interdependence of the drivers and variables of One Health and the environment. Climate change will increase the risk of extreme heat events that threaten human health in some areas. Actions to reduce deforestation or intensive farming may benefit environmental and biodiversity goals, but will also reduce the risks of zoonotic spillovers and AMR. Fiscal policies will need to recognize these multiple externalities and the co-benefits of taking action. There could be a case for setting Pigouvian taxes on externalities, or other types of financial incentives. Actions to promote One Health can build on existing tools such as ecological fiscal transfers, which are intergovernmental fiscal transfers from national to subnational governments based on ecological indicators. This funding effectively compensates subnational governments for the costs of conserving ecosystems, and can thus provide them with incentives for greater conservation activities (Busch et al., 2021). At the global level, a similar mechanism is REDD+, the "reducing emissions from deforestation and forest degradation" mechanism, which offers developing countries results-based financial incentives for preventing deforestation and forest degradation. Evaluation and learning are made difficult by the different approaches and interventions used in each country, as well as the limited number of studies thus far (Duchelle et al., 2018). The research thus far is encouraging with evidence of reduced deforestation rates in Brazil (Simonet et al., 2019), Guyana and Uganda (Jayachandran et al., 2017). While REDD+ has been used with a focus primarily on preventing deforestation with carbon emission goals in mind, it could aim to reduce the risk factors for the emergence of new infectious diseases. Designing the schemes with One Health goals in mind would have implications for targeting and design parameters, such as performance criteria and level of payments.

Supporting private investment in the health sector

As well as action by international financial institutions to increase public investment in health, there is also a clear role for them in supporting the private firms acting in the health sector. This should be focused on R&D and innovation and in strengthening supply chains, rather than the direct provision of health services. There are positive examples of where DFIs (specialized development banks or subsidiaries set up to support private sector development, including the private sector window operations of multilateral and regional development banks) have invested in R&D and innovation. The European Investment Bank (EIB) backed BioNTech, which, together with Pfizer, led the development of the first mRNA vaccine ever approved.

The International Finance Corporation (IFC)-backed Global Health Investment Fund (also supported by the BMGF and Swedish International Development Cooperation Agency) has supported the R&D of drugs, vaccines and new technologies for neglected diseases, which disproportionally affect developing countries. These examples show successful DFI investment in innovation and R&D is possible, and should be scaled up.

The COVID-19 pandemic has shown the need for resilient supply chains, suggesting a role for supporting private sector firms in key parts of the supply chain for medical equipment and consumables, such as PPE, diagnostics, therapeutics and vaccines. By investing in private companies operating in these sectors, DFIs can create jobs and take a significant role in "pandemic proofing" the supply of PPE, diagnostics, therapeutics, vaccines and other medical supplies. This type of investment can prevent shortages that were observed in the early days of the pandemic and build health system resilience at a more local level. CDC Group founded MedAccess, a social company that uses volume and procurement guarantees to secure lower prices and sustainable supply of medical products for people in underserved communities. MedAccess partnered with UNICEF in the early days of the COVID-19 pandemic to accelerate procurement of COVID-19 medical supplies on behalf of low- and middle-income countries. Proparco has provided technical assistance to health manufacturing investees so that these companies can meet WHO's Good Manufacturing Practices. As most pharmaceuticals in Africa are imported (around 95%), there is little existing manufacturing infrastructure, and the existing infrastructure does not meet these standards. Building local capacity that meets global standards increases the resilience of these supply chains when another disruption occurs.

However, despite these positive examples, in aggregate, DFIs currently undertake little investment in the health sector. From 2013 to 2018, less than 3% of DFI investment went to the health sector and less than 1% of this 3% went to low-income countries (Attridge & Gouett, 2020). Even this investment is heavily concentrated in health infrastructure (i.e. building/refurbishing hospitals) and in a handful of middle-income countries (notably India and Turkey). Much of the DFI investment in Turkey's health infrastructure came in support of the Turkish Health Public–Private Partnership Programme to increase capacity of public hospital infrastructure.

There is thus a clear need to for these institutions to prioritize and increase investments in supporting health research and innovation and strengthening supply chains, rather than just in the direct provision of health services. This is needed both worldwide, but also in the low-middle-income countries and low-income countries in the WHO European Region, where the European Bank for Reconstruction and Development and the IFC will have a particularly important role.

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Chapter 11

International governance

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A broken system

This volume has been written to inform proposals for health and sustainable development in the pan-European region. Europe, a highly interconnected part of the world, is particularly exposed to health threats that even some of its most well financed and organized health systems are hard pressed to manage. This means that changes to regional and international governance are necessary if Europe is to manage its own problems and engage effectively with the global epidemiological and public health situation.

Governance is how societies make and implement decisions (Greer et al., 2016; 2020). In the absence of a global society, the problem is how to identify who can make and implement even decisions that are in the interests of all concerned.

These problems and challenges arise in the context of a fragmented and conflictual global governance arena, in which multiple forums and agencies influence health policy with different agendas. In particular, they exist in the context of the well-rehearsed problems of WHO financing and complex rivalries with other international organizations that affect health. The World Health Assembly, in particular, operates on a one-country one-vote rule, which works to the benefit of (more numerous) lower- and middle-income countries. In response, a number of rich countries in the 1980s started to systematically cap WHO budgets so that it would become dependent on donors, rather than the World Health Assembly, for direction. At the same time, they substantially displaced WHO from the centre of health policy, turning instead to the international financial institutions (the World Bank, IMF) and promoting the "Washington Consensus" on good international policy (Rodrik, 2006). Later, the impact of philanthropy, especially the BMGF, shifted the direction of global health again, towards the substantive priorities of those donors. Intellectually, the academic fields and approaches involved also changed as power shifted – from the medical doctors who led WHO to triumphs such as the eradication of smallpox, to the government-focused economists of the Washington Consensus era, to the management consultants and finance specialists who often shaped and led BGMF-supported initiatives.

Although, as has been noted above, the inadequacy of the core budget of WHO is well known, it would be remiss if a book such as this failed to say something about it. At present, the obligatory contributions of Member States cover only 16% of what it spends. The additional amount comes from a wide range of donors and is frequently earmarked for specific purposes. As a consequence, spending linked to these additional sums is poorly aligned with the disease burden (Stuckler et al., 2008). There have been many proposals for reform but there is a growing consensus that decisions cannot be put off indefinitely, a view clearly articulated in the IPPPR report. The challenge will be how to decide how much each country will contribute. Among the more interesting proposals is one by former British prime minister Gordon Brown, which takes account of the benefit to each country of restoring international trade, the privileges it gains from its international status, for example membership of the G20 or the board of the IMF, or permanent membership of the UN Security Council, as well as the country's gross national product as at present (Brown, 2021).

While the WHO budget has been inadequate for decades, the impact of the economic crisis of 2008 led to even more austere conditions. WHO's response was largely to argue for the economic benefits of its actions, which made it hard to justify work that in retrospect could have helped prevent disasters such as COVID-19 or, before that, the failures in Ebola response (Chorev, 2012; 2020). The changes in the WHO environment are mirrored by other shifts and pressures among UN agencies as powerful middle-income countries such as Brazil, India and China press for more of a role. One strategy states

can adopt is to develop their influence over one or more of the large and diverse set of organizations under the UN umbrella, so one UN agency can have a different membership and geopolitical role than another. The result is that global health governance, if it can be called that, is ever more fragmented and shifting, often dependent on changeable domestic politics (as with the USA and WHO), diplomatic strategies or even, what should be, private matters. That is not a formula for resilience.

This chapter examines three issues related to international and regional governance for better health. First, it steps back to look at the case for countries to work together for the common good. Political leaders, understandably, want to be in control and to have the freedom, albeit within the national constitutional settlement, to act as they see fit. Yet when confronted with a regional or global threat from an infectious agent, a fragmented response with each country acting in isolation, will simply be exploited by that agent. This means that they must accept constraints on their freedom of action, conceding individual sovereignty for collective power. There are many situations in which this happens and the next section will examine the issues involved.

Second, although this book focuses on Europe, it will be clear from previous chapters that the issues that face Europe cannot be tackled in isolation from what is happening at the global level. This is true of all of WHO regions. However, the pan-European region has a unique characteristic. Half of its Member States are members of a political union which is itself a major regional and global actor, and which has extensive responsibility for health and its determinants. The WHO European Regional Office must find ways of working within this set of relationships.

Finally, we return to the regional level, looking at the specific governance structures that are needed here to address the risks of future pandemics and other threats to health.

What are the limits to national sovereignty in a post-pandemic world?

In 2015, the leaders of the world's governments committed to an ambitious agenda of sustainable development. In a series of 17 goals, operationalized in 169 targets, they committed to actions to achieve a better and more sustainable future for all. One of these goals, SDG 3, focuses explicitly on health, calling on governments to ensure healthy lives and promote well-being for all, at all ages. Many others include targets that will contribute, in different ways, to better health. These include alleviation of poverty and hunger, improvement of education, promotion of gender equality and action on climate change, all underpinned by peace, justice and strong institutions. The SDGs are, however, aspirational. They form a political declaration that imposes no legally binding obligation on governments to make their best efforts to achieve them. There are no sanctions for failing to make progress and, indeed, even if there were, it is not obvious what mechanism might judge them or otherwise hold them to account. The 2030 Agenda, from which they have arisen, speaks of "accountability to our citizens" and of review processes at all levels that will be "open, inclusive, participatory and transparent for all people" as well as being "people-centred, gender-sensitive, respect human rights and have a particular focus on the poorest, most vulnerable and those furthest behind". The question of how these aspirations can be realized remains unanswered.

Beyond the SDGs, there are many other international agreements, with implications for health. Examples include the Paris Agreement on Climate Change, the UN Convention on the Rights of the Child, the Ottawa Treaty banning landmines, the Framework Convention on Tobacco Control, the IHR and many others. They differ in the extent to which they include goals and obligations, the number of countries that have signed up to them, mechanisms for monitoring implementation and the extent to which they can be enforced. Their operation also depends, to varying degrees and features of the state that has ratified them. Thus, the extent to which citizens of a country can seek remedies based on treaties will depend, for example, on whether that country has acceded to the Vienna Convention on the Laws of Treaties, on whether the state adopts a monist approach, whereby international law has direct effect, in some cases, overriding domestic legislation or a dualist approach, whereby treaties must be translated into domestic legislation. There are also a number of regional structures, such as the EU, MERCOSUR, ASEAN, the African Union and others, as well as bodies with historical connections, such as the Commonwealth, some of which have a significant role in health policy. Finally, there are numerous intergovernmental agreements.

At the risk of generalization, these instruments have had greater force in some areas than others. The former include security (e.g. the Nuclear Non-Proliferation Treaty and the Chemical Weapons Convention, with their inspectorates) and trade/the economy (the World Trade Organization, with Disputes Settlement procedures), than in health. For example, it has been noted that international law contains stronger provisions against counterfeit banknotes than counterfeit medicines. This situation is, however, changing. Thus, in the pre-2005 IHR, reporting of outbreaks was the prerogative of the national government. It was difficult for WHO to act where that government denied the presence of an outbreak, with several well-known examples of where this happened. The IHR (2005) enable WHO to draw on other sources of evidence and, where necessary, to challenge governments in denial (Davies, 2019; Fidler, 2004; Fidler & Gostin, 2006).

For the present purposes, the important point is that there is an extensive range of international instruments that have implications for health and there are many areas where governments have, to greater or lesser extent, surrendered a degree of sovereignty. In most cases, governments consent to provisions in international agreements. However, where they do not, there is the potential of sanctions. Conventionally, these can be imposed for several purposes.

- Sanctions designed to force cooperation with international law, such as the sanctions on Iraq in UN Security Council Resolution 661 after the invasion of Kuwait, an act that violated the sovereignty of Kuwait.
- Sanctions designed to contain a threat to peace within a geographical boundary, such as the Iran nuclear deal.
- Sanctions that condemn a specific action or policy of a government, as with those following the Rhodesia's Unilateral Declaration of Independence in 1965.

These examples illustrate how the international community is willing to act, but primarily where there is a threat to security in military terms. Thus, the case for concerted action in the face of nuclear proliferation is easy to make (leaving aside the many anomalies including the rights of the original nuclear states). The same arguments apply, although arguably even more so, to the Biological Weapons Convention. However, in a post-pandemic world, there is at least an argument that there should be some mechanism for collective action in the situation where a government pursues policies that encourage the spread of a pandemic disease, placing not just residents of that country but also its neighbours at risk. A further question is whether the international community should act in situations where a government adopts policies that pose a grave risk to its own population.

As with all debates in the WHO European Region, identification of common solutions is complicated by the differences between Member States in EU/European Economic Area (including the accession countries) and those that are not. Obviously, those in the former group have already accepted the importance of pooling sovereignty in many ways and the opportunities for joint or coordinated action are substantial, even if in practice, they are not always realized. The remaining countries in the Region do not have the same opportunities available to them.

Making the case for international organizations always involves confronting the problem that they frequently have poor reputations, with critics accusing them of everything from excessive politicization to hidden agendas to low-grade corruption. Part of the problem, which must be squarely confronted, is that some of the key functions of international organizations are not ones that are good for morale or effectiveness. Notably, they are arenas for diplomatic activity of all sorts. One result is that staffing them is difficult, since some Member States seem more interested in promoting their citizens into key positions than in filling jobs effectively. They are also, and this is very important, easy to blame for policy failures. Blaming WHO for inadequate or late pandemic response, for example, is an obvious and easy strategy for all sorts of actors. *Absorbing blame is a key function of international organizations*, whether or not they match the blame with the autonomy and power to make blameworthy decisions (Greer, 2016). In many cases, the reason the UN is involved in intractable conflict is precisely because the problem is intractable. The implication is that designing any new international organization, or trying to reform an existing one, involves a full appreciation of the less palatable functions these organizations serve. In particular, decisions about their roles and functions should be taken with full understanding that one role is to be blamed for Member State mistakes, and decisions about their organization and staffing should reflect a realistic understanding of what staff and Member States are actually trying to do when they create and fill jobs.

One issue that requires particular consideration in the context of the post-COVID-19 debate is the extent to which the IHR have proven adequate to the challenge of the current pandemic and whether there is a case for strengthening them. Another issue for consideration is the extent to which there is a need for harmonization, or at least better coordination, of health data internationally, potentially including support for countries who are struggling with timely and accurate vital registration systems. Legal compliance with the IHR has, it seems, often outpaced state capacity or the incentives for politicians to comply. Is there a case for either a mechanism to take concerted international action were a government is failing to take effective measures to control the spread of infectious disease beyond its borders? Does the international community have a responsibility or duty to protect those living within the borders of a country that is failing to protect its population? The "Responsibility to Protect" doctrine has been abused by governments that use its language to justify actions taken for other reasons, but there are arguments for it on the level of individual rights (preventing crimes against humanity) and global public goods (preventing pandemics).

In general, critics tax international organizations, laws and regimes with hypocrisy, pointing out selective application of any and all international norms. But it is worth remembering that the norm of state sovereignty itself has always been breached as much as any other (Krasner, 1999). Countries truly adhere to a doctrine of non-interference with the same lack of regard for consistency as they adhere to other doctrines – creditor states, for example, rarely interpret respect for others' sovereignty as including respect for their debtors' autonomy. This pattern has held as long as there has been anything resembling international debt, and has shaped the behaviour of creditor state governments regardless of their politics or espoused ideals (Dyson, 2014). In short, respect for sovereignty is just as often breached as respect for any other norm.

The political geography of Europe in the world

Interconnectedness has many benefits but has always carried the risk of disease transmission. The European region contains a large number of highly interconnected countries. According to the 2020 DHL Global Connectedness Index, 19 of the 25 most connected countries in the world are in Europe (the other six are in Asia) (DHL, 2021). Five of its airports were among the world's 20 busiest in 2017, and international travel at them (Amsterdam, Frankfurt, Istanbul, London, Paris) makes up a larger proportion of their aircraft movements than busy but largely domestic airports in the USA or China (Airports Council International, 2021). On the one hand this means that Europe is especially exposed to any threat to health, and the world to any threats that appear in Europe; on the other, it means that the consequences to Europe and the world of a reduction in connectedness could be dramatic.

The European region is also extremely diverse, with variation in wealth, population size, political regime, interconnectedness, demographics and population health. This produces a variety of coordination and policy problems: the issues affecting health in Kazakhstan or Andorra are quite different to the ones in Norway or Austria. The EU is a powerful force in its own right, shaping its Member States' behaviour even outside its (increasing) formal competencies in health.

In particular, there is very little standardization in the handing of health data across Europe, with governments collecting and publicizing personal and population data in very different ways (a surprising number of countries published their daily COVID-19 reports in 2020 and 2021 only as images on Facebook, which was a major challenge for basic situational awareness, let alone policy advice or learning). A look at the scale of the effort it has taken to produce any comparable and useful data within the EU or the OECD shows the nature of the problem. This means that the widely reported problems of IHR compliance, for example, occur in Europe as well as other regions of the world (Davies et al., 2015).

Unlike other regions, the EU has tightly integrated 27 of the Member States with a health policy that became much more ambitious in 2020. While other regional groupings of the world, such as ASEAN or Southern African Development Community (SADC), affect health and health policies, none has so a strong a health profile as the EU (Greer et al., 2021).

The governance challenges of the broader European region can be divided into three categories of action: action within the EU; action in the European region among states that are not members of the EU, a very diverse group; and European action in the world.

Action in the EU needs to be precisely targeted if the goal is to avoid duplication of efforts. The EU already has an

apparatus for communicable disease control, including the ECDC, and will be developing a specific European Health Emergency Preparedness and Response Authority (HERA). The EU is also investing large amounts of new money in pharmaceutical development, civil protection (through the RescEU programme), and health systems (through the EU4Health programme) (Greer et al., 2019; Greer & Jarman, 2021). These agencies and actions are enmeshed in broader networks of state-level agencies, experts and governments. While on one hand those networks can be an asset to policy-makers at any level, they are also substantially developed on an EU basis (de Ruijter, 2019). EU Member States generally coordinate their stances in regional and international meetings and are extremely important donors, which means their views have weight. Any effort to work in the EU must be sensitive to the need to develop a division of labour that recognizes and builds upon the existing EU activities; duplication and conflict will waste energy and almost certainly end on terms set by the EU.

Action in the Region but outside the EU means engagement with the 26 countries that are not EU Member States. This is a diverse group, including Israel, Norway, Turkey, the United Kingdom and the central Asian and Caucasus republics. They have different capacities, political systems and policy priorities but can all benefit from broader coordination and knowledge brokerage at the regional level. There is less obvious scope for institutional duplication than there is in the EU. Importantly, regional action might also be considered to include relationships with neighbouring countries that have broad health implications for health in Europe, such as Syria.

Global action means European Member States coordinating to shape global futures in reflection of the intrinsically global nature of effective action in areas such as finance, science or pandemic response.

This is an area where all manner of rivalries and duplication can happen, since every Member State has the sovereign right to define and advocate for its own priorities, and the space of international organizations is notoriously crowded and difficult to keep coordinated. It is also one where European Region countries, including EU Member States, the EU itself and non-EU countries such as Norway, Switzerland and the United Kingdom can play a major role as donors to international organizations and all manner of governments and civil society organizations. Many European countries wield a great deal of power in global health on the basis of their role as donors and some use global health as a tool of their general diplomatic and political strategies, which can mean anything from building soft power to deterring immigration.

European countries, more or less formally coordinated, could bring ideas onto the global agenda and act together in negotiations. They are powerful as donors and intellectual leaders whose budgetary decisions, NGOs, universities and volunteers affect global health thinking and policy. They also are necessary to implementation of any preparedness and response agenda, as was shown by their importance in the supply chains for vaccines against COVID-19.

Towards sustainable health and protection from communicable diseases in Europe

The experience of the pandemic has served as a reminder of the importance of structures involved in disease control engaging beyond their political borders. There is a clear need to address the gaps in the pan-European region with a system that builds on, complements and cooperates with existing structures. The ECDC provides a strong basis for such a system but only covers half the countries in the pan-European region (although inevitably it does have mechanisms, albeit constrained by regulations on data exchange, with others).

The goal of such a system would be to remedy the flaws of existing surveillance and international reporting, and develop the forecasting ability to predict threats to the region. It would have to be developed with recognition of the need to collaborate with others: with Member States, obviously, but also with the EU's increasingly established public health and global surveillance structures. Europe's international connectedness means any health problem in the world can rapidly become a health problem in Europe.

Within that context, a new system could address problems of *capacity*, particularly in countries outside the EU. The pandemic has shown *surveillance* in particular to be highly variable and reflective of capacity and political orientation of different Member States, which limits our collective ability to address problems (as with the very limited amount of genomic surveillance in most countries, which makes vaccine production and modelling of predictions difficult). It could also address problems of *data exchange and coordination*, working with WHO in Geneva, the EU and other agencies to

identify and understand threats and risks. On the most basic level, it is inexcusable that so many government data releases, including from very wealthy countries, committed basic mistakes such as only publishing quantitative data in PDFs, issuing data only via social media, presenting snapshots of data without time series, leaving coding unclear, or changing what they present (all problems that recur in the European region). Perfectly good data were lost in PDFs, social media and unusual presentation. Support for web developers might be a cheap and effective policy in itself. Our World in Data and Johns Hopkins University, in particular, deserve tremendous credit for their identification, standardization and presentation of data, but what if they had not chosen to do it or had faced serious funding problems? Standardizing epidemiological reporting and supporting basic data-literate government websites might be a very cost-effective intervention; better data does the world little good if it can only be found as images on social media.

Addressing the propensity of governments to hide bad news has been on the global public health agenda for decades, and one of the more effective ways to do it has turned out to be diversification of networks and the ability to rely on multiple sources of information (Fidler, 2004). Europe might be a more manageable context for work in that area than the whole world.

Finally, a pan-European system could enter into useful dialogues with other regional organizations, such as ASEAN or SADC, as they learn their own lessons from the COVID-19 pandemic and develop regional approaches. The EU is hard to compare with other regional organizations because of its relative depth of integration, but there might be scope for useful exchange of models and knowledge with actors such as the African Union. Given that every global communicable disease threat can eventually become a European communicable disease threat, and that many threats are best dealt with before they spread, dialogues about the role of world regions can be an opportunity to combine learning about process with substantive collaboration on emerging threats.

Summary

The pandemic has taught us many lessons. The existing system needs to be fixed. For this to happen, countries must recognize that they will have to work together more closely for the common good. Yet, far too often, they have pursued their own short-term objectives and the virus has exploited the fragmentation that has resulted. For some, and especially those that have placed the principle of national sovereignty on a pedestal, this will be challenging. Yet there is no alternative. At the time of writing, it looks like this pandemic will be brought under control, thanks to the remarkable progress made by scientists in many countries and the efforts of millions of ordinary people, including many workers and essential services, who have made things happen in incredibly difficult circumstances.

This book is primarily about the situation in Europe. Yet the challenges that the pan-European region faces cannot be seen in isolation from developments elsewhere in the world. Viruses do not stop at the borders of the region. Events in neighbouring countries have consequences for others, a lesson that should have been learned. Following the conflict in the Middle East and north Africa and the subsequent migration crisis. In addition, several European countries are major actors on the global stage, whether through the UN Security Council, with three of the five permanent members from this region, the international financial institutions, or other groups such as the G7 and G20. Some of the smaller countries, such as Norway, also wield substantial soft power as major donors. Individually and collectively, they have the ability to shape the world in ways that promote health and sustainable development.

Yet there is also much to do within this region. There are still enormous inequalities of wealth, health, and technical capacity. The challenge facing us all is to find ways to narrow these many gaps.

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