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Lessons from the Pandemic

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The COVID-19 Pandemic and Its Impact

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus. Most people infected with this particular virus experience mild to moderate respiratory illness and recover without requiring special treatment. In some cases, the disease is more severe, requiring hospitalisation, oxygen and medical interventions. The elderly and people with underlying medical conditions such as heart disease, diabetes, chronic respiratory disease, or cancer are more likely to develop severe disease. However, anyone can get sick with the COVID-19 infection and become seriously ill or die at any age. According to the World Health Organization (WHO), as of May 24, 2023, more than 766 million people have been infected with the virus, and over 6.9 million people have died from COVID-19 (World Health Organization 2023d). These numbers are underestimates because of the lack of access to diagnostics and under-reporting. Excess mortality during the pandemic was already 18 million by the end of 2021. This tragic death toll is a global failure at different levels.

Impact of COVID-19 on Health Systems

The pandemic has affected health systems worldwide. According to the WHO global pulse survey, significant health service disruptions were reported: nearly 50 per cent of countries with disruption in routine immunisation services, more than 50 per cent of countries with disruption in routine primary and community care and 30 per cent of countries with disruption in elective and operative care provision in the last quarter of 2021 (World Health Organization 2022d). Lower-income countries generally reported more disruption to services than high-income countries (HICs) due to closures or postponement of services (40 per cent of countries), staff shortages, lack of essential medicines and diagnostics, and inadequate space in health facility infrastructure (36 per cent of countries). The pandemic has wiped out years of gains in infectious disease programmes like HIV and TB. At least 25 per cent of HIV prevention services were disrupted in 17 per cent of countries in the last quarter of 2021 (World Health Organization 2021b).

Similarly, the pandemic has significantly disrupted TB control efforts as TB diagnostic infrastructure was repurposed for COVID-19, with a global reduction in newly diagnosed and reported cases of TB, from 7.1 million in 2019 to 5.8 million in 2020 and 6.4 million in 2021 (World Health Organization 2022b). The pandemic also disrupted non-communicable disease (NCD) service provision, and ironically, people with existing NCDs are at increased risk of severe illness and death due to COVID-19 (Mahamat-Saleh *et al.* 2021).

One of the key reasons for disruptions in health service delivery during the pandemic was the unprecedented pressure on health systems' capacities, particularly health workforces. Owing to persistent health workforce shortages, many countries were already struggling to provide essential health services even before the pandemic. In 2016, WHO had already projected a global shortfall of 18 million health workers by 2030, especially in the WHO African and South-East Asia regions (World Health Organization 2022d). The pandemic caused further health worker shortages and burnout with reduced capacity to provide essential health services (Boniol *et al.* 2022).

WHO estimated that between 80,000 and 180,000 health and care workers may have died from COVID-19 between January 2020 and May 2021, a figure that may be *underestimated* by about 60 per cent (United Nations 2021). Therefore, WHO Director-General, Tedros Adhanom Ghebreyesus, highlighted that 'COVID-19 is a powerful demonstration of just how much we rely on these men and women, and how vulnerable we all are when the people who protect our health are themselves unprotected' (United Nations 2021).

Because so many health workers' themselves lost their lives, many countries were unable to rebuild back the depleted workforce, which, as noted earlier, was already under strain. The pandemic has caused an additional burden of burnout and illness, including long COVID (European Commission 2022). Many health workers felt lacking in motivation or exhausted as they have watched their colleagues die or become sick, leading to a loss of trust and interest in their professions (Kluge *et al.* 2023). Their situation was compounded by the loss of public trust in health workers, as some were attacked during the pandemic, especially by the people who did not accept the public health and social measures (PHSM) to control the transmission of the virus. This was worsened by misinformation and disinformation from social media, which in turn undermined trust in government officials (Wang *et al.* 2022). Health workers began to reassess their work-life balance, many migrating to places that offer better working conditions or taking premature retirement (World Health Organization 2022c).

Though the pandemic was caused by a virus and was primarily a health emergency, its impact was felt on whole economies, food systems, supply chains, nutrition, and family relations, as outlined in the following section.

Impact of COVID-19 on the World's Economy, Nutrition and Food Security

The International Monetary Fund (IMF) World Economic Outlook 2022 reported trillions of dollars in global economic losses due to the COVID-19 pandemic. The pandemic caused significant divergence between advanced economies' economic recovery and emerging and developing markets (International Monetary Fund 2022). Recoveries in HICs are faster, while those in low- and middle-income countries (LMICs) have been slow (International Monetary Fund 2023). Frequent and more wide-ranging lockdowns in China—including in key manufacturing hubs—also slowed activity there and continue to cause bottlenecks in global supply chains (International Monetary Fund 2023).

COVID-19's impact on the world's economy had a detrimental effect on nutrition and food security, disproportionately affecting populations with low socio-economic status due to its consequences on employment, income-generating activities, purchasing power, availability, and access to food (Picchioni, Goulao and Roberfroid 2022).

Even before the pandemic, 690 million adults in the world were malnourished, 144 million children under 5 (U5C) were stunted, 47 million U5C were wasted, 38 million

USC were overweight, and almost three billion people were unable to afford a healthy diet in 2019 (Carducci *et al.* 2021; UNICEF 2020). World Bank estimated that an additional 83–132 million adults could be undernourished due to the pandemic (UNICEF 2020). The Intergovernmental Panel on Climate Change (IPCC) noted, ‘Food systems support the livelihoods of 1 billion people globally’ (Mbow *et al.* 2019). Lockdowns at the onset of the pandemic led to the closures of different formal and informal workplaces, with significant job losses. This was compounded by the sudden reverse migration in some regions (Ratha *et al.* 2020). The situation has been further worsened by climate change, war and conflicts in some regions, worsening food and livelihood security (FAO 2020).

These impacts highlight the importance and urgency of having strong multilateral, multisectoral, cross-disciplinary cooperation to mitigate the consequences of any future pandemic or global health threat.

Rationale and Objective of the Chapter

In this chapter, using the three pillars of the global health emergency framework (HEPR): (a) preparedness, (b) response and (c) resilience, we reflect on the lessons from the COVID-19 pandemic for their implications for global governance in this area. The rationale for using the framework is that it results from more than 300 recommendations discussed and debated through several international processes such as the Intergovernmental Negotiating Body (INB) and Working Group on Strengthening WHO Preparedness and Response to health emergencies (WGPR), G7 and G20. The framework is also informed by recent reports from the Independent Panel for Pandemic Preparedness and Response (IPPR), the Global Programme Monitoring Board (GPMB), the Independent Oversight and Advisory Committee (IOAC), the International Health Regulations (IHR) Review Committee on the functioning of the International Health Regulations (2005) (World Health Organization 2016) during the COVID-19 response, and many others. Using the three pillars of the framework: governance, systems and structure and financing, we reflect on lessons for the future.

The first part highlights key governance issues *during* the pandemic and challenges to working collectively within and across countries, sectors and communities. This is followed by lessons on systems and structures to prepare for, prevent and respond to health emergencies at the global level. Thirdly, financing health emergency preparedness and response architecture requires innovative financing in addition to more funding. The chapter then ends with a broad proposal for the way forward to ensure a significantly more prepared world for future pandemics. The chapter highlights how the COVID-19 pandemic has exposed the importance of global health governance, which is dominated by power distribution, geopolitical tensions, populist nationalism and ideological competition.

Lessons from the Pandemic

Governance

The devastating impact of the COVID-19 pandemic has highlighted the complexity of the global health ecosystem, the governance of which is weak and lacking in coordination. The extent of enforcement of both formal and informal rules governing the global

health architecture, such as regulations, accountability and leadership, had a major influence on the response to the COVID-19 pandemic. The IHR is the only multilateral legal instrument among WHO member states, first adopted in 1969, with the last amendment passed in 2005 after the outbreak of severe acute respiratory syndrome (SARS) in 2003. The SARS outbreak reinforced the need for a more effective legal international framework to cover ‘all events potentially constituting a public health emergency of international concern (PHEIC)’, not only for infectious diseases. The SARS outbreak accelerated the revision of IHR 2005, which came into effect in June 2007.

IHR 2005 (World Health Organization 2016) was transformative in these aspects, bringing a shift in emphasis from a disease-specific approach that focused on three diseases to be included in all public health threats, the passive to the proactive use of real-time surveillance and cross-border control for detection and containment at the source.

The IHR 2005 (World Health Organization 2016) gives the WHO the power to designate a PHEIC. The IHRs recognise the interconnected nature of the world and how vulnerable it is to the rapid spread of diseases, not limited to infectious diseases but other potential public health challenges as well, including environmental challenges, chemical hazards and radio-nuclear threats.

The IHR 2005 (World Health Organization 2016) has a set of ‘core capacities’ necessary for the member states to effectively detect, assess, notify, and report events and respond to public health emergencies of national and international concern. The IHR facilitates the communication and reporting processes between WHO Country Offices and national IHR focal points in relevant member states to promote proactive risk management through early detection of potential international health threats and to prevent unjustified border closings to prevent unnecessary economic loss. Member states are responsible for maintaining their IHR core capacities while WHO provides technical assistance. Since they were revised in 2005, the IHRs have been a valuable global framework for international health coordination and collaboration for global health security, including seven PHEIC declarations, beginning with the H1N1 influenza pandemic in 2009, polio and the West Africa Ebola outbreak in 2014, the Ebola and Zika viruses in 2016, COVID-19 in 2020, and MPox in 2022.

However, several areas were identified for improvement with the IHR during the COVID-19 pandemic, as they failed to ensure a robust global response to the emergence of SAR-COV2. Although the IHR document was a formal, legally binding instrument, governing the IHR was challenging during the pandemic due to a lack of enforcement, and WHO did not have adequate financing, a coherent mandate or strong political backing. During the pandemic, instead of complying with IHR and delegating some responsibility for decision-making to a global coordinating body like WHO, countries chose to collaborate or cooperate (or not) according to their leaders’ choice and national interests (Duff *et al.* 2021). Moreover, there is no penalty for non-compliance, although all WHO member states are legally obliged to follow the IHR (20). As Gustafsson (1998) stated, ‘[I]nstitutions without enforcement are not institutions at all’; thus, the outcomes of an institution or rule (in this case, the IHR) depend on how these rules are *enforced* (Pyone and Mirzoev 2021).

The situation was further complicated by the increasing political tensions among some major nations, and WHO ended up being the victim of their differences. Indeed, the role of WHO is constrained by the rivalry among strong geopolitical actors, who, by virtue of the veto and state practice, are not held accountable for violations of the UN Charter or International Law. Disruptive behaviour by the United States early in COVID led to

defunding and attacks on WHO. Also, the refusal by some countries to suspend sanctions during the pandemic—despite a plea from the UN Secretary-General—shows the low priority given to humanitarian concerns when strategic interests are at stake.

The WHA (World Health Assembly)—which governs the WHO and is composed of the health ministers of WHO member states—proved to be inadequate to the task of responding to an outbreak on the scale of the COVID-19 pandemic, which demanded a whole-of-government approach, that is, beyond the health sector, to control the outbreak effectively (Sachs *et al.* 2022). Thus, health ministers need more political authority within their governments to make decisions (*ibid.*). This is complicated by the governance of WHA, which is too large to take executive decisions on behalf of the 193 WHO member states, which meet only once a year. At the same time, an outbreak response requires daily, interactive, hands-on decisions and actions (*ibid.*). Therefore, in theory, WHO is supposed to coordinate and govern, but in practice, the WHO mainly provides technical recommendations, norms and standards and supports decision-making processes, leaving countries to make independent decisions on their own course of action (Hannon *et al.* 2022). Further, the primary focus of the IHR is capacities at the national level, and these may not necessarily be adequate for improving *global* oversight and coordination (*ibid.*).

Therefore, it is time to revisit the IHR 2005. Two parallel processes are currently ongoing at the WHO: (a) negotiations on the pandemic treaty or accord via the INB and (b) the revision of the existing IHR coordinated through the IHR Working Group (WGIHR). Both the INB and WGIHR are bodies appointed by the WHA, and their aim is to have the treaty text and the amendments to the IHR ready for adoption when the WHA convenes in May 2024 (Behrendt and Müller 2023). The goal of the pandemic accord is broader than the IHR: to set the rules to be followed by all countries in the event of a pandemic and to ensure that equity is at the heart of all actions undertaken.

Thus, it is clear that the key governance challenge during the pandemic was the failure of international cooperation and coordination among countries. Instead of solidarity during the crisis, countries failed to coordinate containment strategies and failed to examine, share and adopt best practices for controlling the pandemic (World Health Organization 2021a). Global funding for LMICs fell short. Countries competed to seize limited supplies of major goods and commodities such as personal protective equipment and medical countermeasures like diagnostics, therapeutics and vaccines (*ibid.*). This led to severe inequities in access to all these essential products between countries, resulting in many preventable deaths.

As if this were not enough, the situation was worsened by the lack of sharing of timely, accurate and systematic data on infections, deaths and variants and a failure to fight the *infodemic*. WHO defined an infodemic as ‘too much information, including false or misleading information in digital and physical environments during a disease outbreak’ (World Health Organization 2023b). The infodemic during the COVID-19 pandemic has undermined public health responses, leading to public mistrust of health authorities. Social media played a critical role during the pandemic, influencing public attitudes and reactions, including people’s emotions, convenience and feasibility of following certain PHSM. These had to be adapted in accordance with the evolving scientific understanding of the virus, such as reproduction rate, mode of transmission, susceptibility factors, and variants of concern (Sachs *et al.* 2022). Clickbait headlines from social media influenced public perception and attitudes towards the virus without regard for scientific evidence, often undermining the required PHSM adjustments. The social media posts that originate such unscientific opinions often leave no room for in-depth discussion and instead offer mere ‘beliefs’ without scientific evidence (Sachs *et al.* 2022).

There were also instances when the infodemic was exaggerated by some irresponsible political leaders whose actions were influenced by political interests and not by science. As the pandemic was a learning curve for most political leaders, and SARS-CoV-2 was a novel disease with many unknowns, some political leaders made irresponsible statements in the first few months of the pandemic, neglecting scientific evidence and risking lives for political gain (Sachs *et al.* 2022). Governing the infodemic during the pandemic was challenging, as the world was in need of more effective mechanisms to ensure accountability (World Health Organization 2021a). The pandemic has exposed ‘a polarised world characterised by heightened nationalism, distrust, and inequality’ (Sachs *et al.* 2022).

Nonetheless, there were many positive aspects during the COVID-19 pandemic. Governments from many upper-middle and HICs established support systems for small businesses, expanded social support nets and used telemedicine and telehealth to mitigate the pandemic’s consequences (Sachs *et al.* 2022).

Moreover, multilateral financial institutions such as World Bank and the IMF provided emergency funding for the pandemic response. World Bank (2022) allocated nearly US\$14 billion for pandemic relief and approved US\$12 billion in 2020 for countries to buy and deliver vaccines. However, the speed of distribution of these funds was not at the pace needed by countries, and the procedures were complex. The IMF also promised support of approximately US\$170 billion for some 90 countries (Sachs *et al.* 2022).¹ The Global Fund to Fight AIDS, Tuberculosis and Malaria repurposed their health programmes to COVID-19 responses by allocating up to 5 per cent of their grants (Global Fund 2022).

Many health systems around the world introduced innovative solutions to continue essential health services during the pandemic. The use of digital health was maximised as ministries of health looked for ways to deliver health care. Digital technology was integrated into policy, service delivery and health care at a scale never before seen. Health service delivery improved due to the increased use of telemedicine and telehealth. Digital technology was used in surveillance, contact tracing, screening for infection, testing, isolation and quarantine, clinical management, and tracking medical supplies, etc. (Whitelaw *et al.* 2020).

Digital data dashboards, migration maps, machine learning, and real-time data from wearable technology (such as smartphones) were used to track the virus in real-time as the technology allowed visual depiction of spread, announced border restrictions, guided resource allocation, and informed forecasts (Whitelaw *et al.* 2020) The use of Artificial intelligence (AI), digital thermometers, mobile phone applications, thermal cameras, and web-based toolkits in screening infections provided information on disease prevalence and pathology and identified individuals for testing, contact tracing and isolation (*ibid.*). AI for diagnostics and machine learning algorithms were increasingly used in clinical decision-making, diagnostics and risk prediction (*ibid.*). Telemedicine and virtual care rapidly expanded in countries where it was possible from technical, legal and regulatory standpoints. This technology also enables efficient service delivery, facilitates patient-centred remote care and helps with infection control (*ibid.*).

However, countries with better infrastructure were better able to implement digital technology than those with poorer infrastructure. Indeed, countries such as South Korea were able to flatten their incidence curve because they successfully integrated digital technology into government-coordinated containment and mitigation processes (Whitelaw *et al.* 2020).

One important human characteristic which informally enforces governance of the COVID-19 pandemic response is public trust in government and science. The pandemic

has shown that global trust at all levels of society is fundamental to the success of science and policy. We have witnessed that the public responded differently to government instructions in different countries. Even within the same country, public attitudes towards the pandemic were diverse, as formal rules, actions and statements of national leaders and informal norms and standards such as culture, path dependence, peer groups, and education level influenced public attitudes. The pandemic highlighted the importance of public trust in science as PHSMs such as mask-wearing, social distancing and isolation played a vital role in the control of spread. These control measures can be effective only when the public trusts the authorities and complies with these measures (Battiston, Kashyap and Rotondi 2021; Bromme *et al.* 2022; Travis *et al.* 2021).

Studies reported that countries with high levels of trust (some Nordic and East Asian nations) outperformed countries with low confidence in their authorities (Thornton 2022). High levels of government and interpersonal trust were reported to be associated with lower infection rates and higher COVID-19 vaccine coverage (Thornton 2022). An empirical study published in 2021 reported that governments that were perceived as organised and fair and which produced clear messaging on COVID-19 inspired public trust (COVID-19 National Preparedness Collaborators 2022). This trust in the government was associated with greater adoption of health and prosocial behaviours (COVID-19 National Preparedness Collaborators 2022; Han *et al.* 2021). Cultural practices also influenced community responses to the pandemic. Cultural psychologists reported that tight cultures had higher adherence to social norms than loose cultures that favour individualism, freedom of choice and human rights (Gelfand *et al.* 2021). Indeed, cultural and behavioural practices have influenced the implementation of PHSM that were used to control the spread of SARS-CoV2, such as mask-wearing, physical distancing and isolation (*ibid.*).

Looking to the future, it is clear that governance, including rules, regulations and practices, must be clear at the national and international levels. Further, regional bodies could also play an essential role in financing, procurement and cross-border cooperation. One excellent example is the Africa Centres for Disease Control for the whole of the African continent.

Systems and Structures

An effective response to COVID-19 and any future pandemic requires a checklist of policy actions and health systems that can deliver needed outcomes and support individuals to perform prosocial behaviours (Sachs *et al.* 2022). Many LMICs—particularly those that have faced other epidemics, such as HIV, Ebola and Zika—were able to integrate their responses to COVID-19 with well-established community screening and contact-tracing capacity and to deploy community health workers rapidly (Sachs *et al.* 2022). Indeed, the ability to prepare for, prevent, detect, and respond effectively to health emergencies at national, regional and global levels depends on the operational readiness and capacities of a central coordination body like WHO at the global level and collaborative surveillance and public health intelligence, skilled and trained health workforce, and access to medical countermeasures, including research at national and regional levels (World Health Organization 2022a).

Indeed, the role of the 75-year-old global health coordinating body that is WHO should be re-emphasised since it is central to the entire global health ecosystem. WHO is the only organisation with the mandate and legitimacy to advocate and lead global health emergency preparedness and response to meet the needs of all countries and deliver on

equity (World Health Organization 2022a). Even though WHO's response to the pandemic was not perfect, the agency at all times played a vital and instrumental role in the fight against the COVID-19 pandemic. WHO brought the best skills, technical expertise, science, and evidence to inform policy and practice by setting globally applicable norms and standards. Within a month of the announcement of the PHEIC, WHO published the Global COVID-19 Research Roadmap, outlining key research areas and priorities (World Health Organization 2023a). The Roadmap included research priorities on the natural history of the virus, epidemiology, diagnostics, clinical management, ethical considerations, and social sciences, as well as longer-term goals for therapeutics and vaccines (World Health Organization 2023a).

WHO and its partners launched the Solidarity trial, a unique, multi-arm, adaptive international clinical trial that aimed to generate robust data to find the most effective treatments for COVID-19. Enrolling large numbers of patients in a single trial made rapid testing of unproven treatments possible while generating strong evidence to inform treatment guidelines (World Health Organization 2023a).

To facilitate approval of different COVID-19 vaccine products, WHO facilitated the harmonisation of regulatory agencies across the world to standardise regulatory standards for manufacturers of COVID-19 vaccines; this facilitated rapid approval for pre-qualification and/or Emergency Use Listing. Regarding policy advice, WHO's Strategic Advisory Group of Experts on Immunization (SAGE) reviewed the emerging vaccine clinical trial data and provided updated policy recommendations on how best to use the various vaccines. Rapid development, deployment and access to diagnostics and therapeutics posed additional challenges due to many technical and financing issues. It is encouraging to note that a diagnostics resolution has been passed for the first time at the 76th WHA. This resolution is an essential step towards improving global access to diagnostic tools since nearly 50 per cent of the global population has little or no access to diagnostics, and this lack of diagnostics leads to premature mortality (Fleming *et al.* 2021).

Instead of systemic reform after every health crisis, a piecemeal response has resulted in a proliferation of independent health-related agencies outside the WHO framework. Competition for finances and overlap in mandates have resulted in complicating and sometimes weakening the WHO's role as the global health agency. While the Global Fund, Global Alliance for Vaccines and Immunizations (GAVI) and the Coalition for Epidemic Preparedness Innovations (CEPI) were set up with clear goals to meet a perceived need, it is essential, going forward, to learn lessons from the COVID-19 pandemic and previous epidemics in order to have a solid framework for cooperation during future emergencies. The new 'pandemic countermeasures platform' should be developed based on the outcomes of the INB deliberations and should provide the framework for a nimble, efficient and effective platform for providing equitable access to countermeasures to populations across the world. Preparedness for future pandemics inevitably requires strengthening the public health system within countries, as well as WHO, bringing greater coherence to the global health system.

The COVID-19 pandemic has exposed weaknesses in global *surveillance systems and structures*, regardless of the country's income status (IANPHI 2022). Even some HICs had challenges in getting information in a timely and useful way if the country has a federated system of government which collects surveillance data for different purposes using different approaches. Moreover, some countries' National Public Health Institutes did not have the authority to request data without data agreement from relevant jurisdictions (*ibid.*).

Similarly, in some LMICs, the pandemic has exposed long-term structural weaknesses in the surveillance system. These included challenges for human resources and reporting; a country may still be using paper-based reporting, and even when there may be electronic reporting, there may be a lack of interoperability and compatibility in systems among different ministries in the same country. The resulting problems can be compounded by fragmented surveillance systems operating in siloes, which can create difficulties for a country's National Public Health Institute when faced with the need to coordinate national surveillance and respond to the pandemic at all levels since it was next to impossible to collect data from all over the country (IANPHI 2022).

Though the pandemic revealed gaps in current surveillance systems worldwide, it helped raise the importance of integrated and collaborative surveillance. Countries began to recognise that the type of data that was collected through their existing surveillance systems during the pandemic needed to be at a sufficiently granular level to identify and understand patterns of risk and vulnerability in order to tailor response efforts to specific populations or geographic areas. Some datasets needed to be manually enhanced with additional information, such as location, in order to be useful for contact tracing. The pandemic also highlighted the potential role of harnessing non-traditional sources of surveillance data, such as social media activity, and the need to evaluate their relative utility and reliability moving forward. Alternate methods, such as wastewater surveillance (traditionally used for polio), were also activated. Over the course of the pandemic, there was heavy reliance on laboratory and diagnostic capacity in some countries, highlighting the need to strengthen these capacities in terms of physical infrastructure, transport, supplies and equipment, and human resources. In some countries, funding was diverted to COVID-19 response at the expense of other priority pathogens, such as TB, for which surveillance and response were interrupted.

Indeed, the pandemic brought high-level political attention to disease surveillance and heightened awareness of the need for good-quality surveillance systems. Many HICs began to invest in integrated and collaborative surveillance. For instance, Singapore recently set up a new Communicable Diseases Agency to oversee disease preparedness, prevention and control, surveillance, risk assessment, and outbreak response and to consolidate public health functions under the Ministry (Channel News Asia 2023). At the international level, the WHO set up a new Hub for Pandemic and Epidemic Intelligence in Berlin, Germany, in September 2021, with an initial investment of US\$100 million from the Federal Republic of Germany (World Health Organization 2021c). The aim of the Berlin hub is 'to harness broad and diverse partnerships across many professional disciplines, and the latest technology, to link the data, tools and communities of practice so that actionable data and intelligence are shared for the common good' (World Health Organization 2021c). Similarly, the United Kingdom announced a plan for a new 'Global Pandemic Radar', an advanced international pathogen surveillance network, to identify and track new COVID variants and emerging diseases, building on U.K. health security expertise to help stop the spread of COVID-19 and prevent future pandemics (Government of UK 2021). Indeed, the COVID-19 pandemic has raised public awareness and political attention to public health surveillance, including digital innovations using electronic surveillance systems.

Of core importance for such systems is a skilled, trained and protected health workforce, one that is able to reach even the most marginalised communities. The existing health workforce shortage was further worsened by the COVID-19 pandemic, especially in the African and Eastern Mediterranean regions and Small Island Developing States (World Health Organization 2023e). The health workforce challenge is not exclusive to

LMICs. Across the G7, OECD and HICs, there are growing demands for health and care workers, high vacancy rates, strikes, and protests. During the COVID-19 pandemic, many HICs had to rely on insufficiently trained temporary staff for contact tracing. Therefore, it is imperative that governments in LMICs double their health workforces over the next ten years, something that is financially and technically feasible with political will and implementation of the Working for Health Action Plan (2022–30). Furthermore, countries need to respect the Global Code of Practice from the International Recruitment of Health Personnel and stop recruiting from the 55 countries on the WHO Support and Safeguards list (World Health Organization 2023e).

There were significant inequalities in accessing medical countermeasures, including vaccines (Mathieu *et al.* 2023). While vulnerable populations such as older adults and people with existing co-morbidities need special attention in a pandemic, frontline workers such as health and social workers should be the first ones to receive vaccines, as they were critically underserved by vaccination programmes in many LMICs due to limited access to the COVID-19 vaccines. Such inequity in access to medical countermeasures occurred not only in the recent COVID-19 pandemic but was experienced in the previous outbreaks of HIV and Ebola.

Although there was a massive increase in investment in research funding during the COVID-19 pandemic, most of this investment occurred in HICs. Moreover, much of the research that did take place was not well coordinated and led to much duplication (Bucher *et al.* 2023). Therefore, better coordination is required among agencies that fund infectious disease research, and attention must be paid to funding research, including clinical trials, in low-income countries. This was the conclusion that Glopid-R—a group of about 30 national funding agencies that support infectious diseases research—came to as well. While research relating to diagnostics, therapeutics and vaccines (from basic research onwards) all received substantial investment across a wide range of different studies around the world, there were gaps in some areas, especially in the areas of operational and social science research, to better understand the effectiveness and potential downsides of PHSM (McCartney 2020).

It is vitally important that we take stock of achievements over the past three years and analyse what did not work well. Reorienting the research system towards the global public interest is not straightforward, as country priorities do not always align with global funding flows. Countries often have industrial, economic and political objectives for investment, as witnessed in the case of the production of COVID-19 vaccines. Yet international agreements can structure cooperation to meet each country's needs, as shown by the influenza (PIP) framework (Swaminathan *et al.* 2022).

Health Financing

The COVID-19 pandemic led to a deep global recession in February–April 2020. In March 2020, uncertainty was so high that it led to a dash for cash and general malfunctioning in financial markets (Sachs *et al.* 2022). Substantial employment losses accompanied the recessions caused by COVID-19 in many countries in 2020. These losses were significant in emerging markets and differed only in the age and education level of the workers affected. Workers who had received tertiary education were generally the least affected by employment losses (*ibid.*).

Current health financing is primarily provided by national (domestic) resources, which include both government and private health expenditures, in addition to out-of-pocket

spending, with modest levels of international support by donors for LMICs (Global Burden of Disease 2020 Health Financing Collaborator Network 2021; OECD 2019). As measured by the OECD Development Assistance Committee, total official development assistance for health came to a mere \$23 billion as of 2019, or less than 0.05 per cent of the GDP of donor governments (Global Burden of Disease 2020 Health Financing Collaborator Network 2021). This assistance amounted to roughly 1.5 per cent of the health financing of LMICs, a very modest sum (OECD 2019). The pandemic did not alter this picture in any decisive way. Even these modest amounts of official development assistance have proven decisive in scaling up disease control in many areas. The Global Fund and the GAVI have each saved tens of millions of lives with modest outlays of a few billion dollars per year (Friebel *et al.* 2019; Global Fund 2021; Zerhouni 2019). These programmes prove that international financing for health can result in practical solutions, despite being highly underfunded, considering the broad scope of their missions.

While Official Development Aid (ODA) for health represents only 1.5 per cent of total funding resources for health available in LMICs, all of these funds are reportedly not channelled directly into the LMICs (55). Instead, they are funded through public-private partnerships such as the Global Fund, CEPI, COVAX, the WHO Foundation, and World Bank's Financial Intermediary Fund (FIF) (Velásquez 2023). Nearly half of the ODA for health goes to medicines and vaccines produced in a handful of ODA donor countries (*ibid.*).

The creation of the Access to COVID-19 Tools (ACT) Accelerator and COVID-19 Vaccines Global Access (COVAX) in April 2020 aimed to set up an end-to-end mechanism for development and deployment of COVID-19 countermeasures, but both fell short of their ambitious (and highly ethical) goals (Sachs *et al.* 2022). Raising even a few billion dollars of international support for ACT Accelerator and COVAX proved extremely difficult despite the urgency of the pandemic. The modest funding was insufficient to obtain crucial PPE supplies, testing supplies and, especially, vaccines. Bilateral deals between countries and manufacturers for the purchase of these commodities were prioritised at the expense of COVAX. Many producing countries also implemented temporary export bans on essential products (e.g., PPE, pharmaceuticals, and hand sanitiser), with wider effects on access for countries in need. The multilateral development banks similarly provided too little health financing and too slowly to make up the pandemic financing gap (Okonjo-Iweala, Shanmugaratnam and Summers 2021).

The current proliferation of special health funds needs to be rationalised. The COVAX Facility is part of the ACT Accelerator, co-managed by WHO, GAVI, UNICEF, the Global Fund, CEPI, and other partners. Previously, for epidemic and pandemic response, World Bank Group hosted the Pandemic Emergency Financing (PEF), while WHO had a Contingency Fund for Emergencies (CFE). The PEF and the CFE were established after the 2014–15 Ebola outbreak in West Africa. The PEF was closed in 2021 after failing to catalyse funding for outbreak response due to delays in complex procedures required to legally release funds during epidemics (Brim and Wenham 2019). Furthermore, the PEF failed to link explicitly to the IHR and provide funding at the early stage of epidemics or at the declaration of a PHEIC (Wenham *et al.* 2021). The same year that PEF closed, World Bank announced a new grant-based health emergency preparedness and response (HEPR) Umbrella Programme, followed by the establishment of the FIF (later renamed the Pandemic Fund) in 2022.

The Pandemic Fund represents a new financing mechanism designed to provide greater financial resources for preparedness and response efforts in LMICs. The Pandemic Fund

is focused heavily on prevention and preparedness efforts, which are widely regarded as more cost-effective than financing response efforts (Boyce, Sorrell and Standley 2023).

Ideally, one needs a well-resourced, nimble and efficient fund that will support preparedness in low-income countries as well as be ready to disburse large amounts quickly, for response, when needed. The fund could be effective even with guarantees from HICs that they will refund the countermeasures platform for emergency purchases and investments in drugs, diagnostics and therapeutics development and procurement.

The Way Forward

The COVID-19 pandemic has demonstrated the importance of global health governance for health system preparedness, resilience and response and how weak it currently is. The pandemic has diverted scarce resources from achieving Sustainable Development Goals (SDGs). On May 5, 2023, WHO announced that COVID-19 is no longer a PHEIC, following a recommendation from the COVID-19 emergency committee (World Health Organization 202c). However, COVID-19 is still a global health threat.

It is now time for countries to transition from emergency mode to managing COVID-19 alongside other infectious diseases (World Health Organization 2023c). Recovering from the pandemic will take much time for many countries due to the effects it has had on the wider social and economic conditions. While it is critically important to invest in health system preparedness and response capability, as well as universal health coverage, countries urgently need to invest to build back their economies, which are critical for restoring good health systems, access to education, nutrition, social connections, and healthy environments. These investments should not be siloed but rather should be comprehensive and coordinated across sectors to make them sustainable. Politically powerful countries should set aside political rivalries and work together to counter the effects of this pandemic and prevent the next global crisis.

Keeping the peace is the first step, as disease outbreaks exploit the presence of wars, conflicts and social instability. Official development assistance or aid should be driven by the recipient country's needs and not a donor-driven agenda. If equity and solidarity are the heart of humanitarian or outbreak response, the global community has to find a way to give voice to the voiceless, not simply as a slogan.

Countries should invest in primary health care to achieve universal health coverage while simultaneously enhancing their readiness for any future pandemic and developing the capabilities prescribed in the WHO Joint External Evaluation. Most LMICs do not have strong health infrastructure and are struggling with weakened existing health systems and endemic diseases, let alone having to prepare to respond to future public health emergencies. The COVID-19 pandemic has shown us that countries must take more responsibility for their own and others' health security. Moon and Kickbusch (2021) express beautifully the compelling responsibility of the nations of the world to accept their role in caring for the whole human family by avoiding 'the self-interested behaviour of sovereign states' and accepting 'the challenge of ensuring that they comply with international rules when their perceived interests lie elsewhere'.

Thus, countries need to increase total expenditure on health systems worldwide, with increased investments in research and development, not only in biomedical research but also in social and behavioural research. For public health systems to function better, we need to maximise the contribution of the behavioural and social sciences to improving and protecting the public's health and well-being and reducing health inequalities. For

instance, many risk factors causing NCDs are behaviourally driven, such as smoking and a sedentary lifestyle (Ghebreyesus 2021). The misuse of antibiotics in human health care is a principal, but avoidable, driver of antimicrobial resistance (Torreele *et al.* 2023). Hand hygiene is one of the most effective measures to stop the spread of infection, but people often fail to maintain adequate hand hygiene, even where water and soap are available (*ibid.*).

Countries should support the review of the IHR 2005 and effectively engage in developing the pandemic treaty with real participation from LMICs. A binding pandemic treaty is an important step but will only be successful if commercial interests are kept aside, and it will require real political commitment to make that happen. Furthermore, it is important that equity stays at the heart of the pandemic treaty and that equitable access to health products be assured, regardless of the ability to pay. The review of IHR needs to incorporate appropriate enforcement mechanisms, with incentives for countries to cooperate, sanctions for non-compliance or both (Duff *et al.* 2021). A careful balance is required for setting incentives and sanctions to enforce IHR: consideration of a particular country's characteristics and unique circumstances and its access and ability to mobilise resources (*ibid.*). Additionally, countries should ensure that WHO is well funded and independent so that its decisions and recommendations are science-based and data-driven, with minimal political and ideological interference (*ibid.*).

Investments in health should take a One Health approach, which integrates different disciplines and sectors, including veterinary medicine, biology, epidemiology, immunology, human medicine, public health, behavioural and communication science, anthropology, sociology, psychology, education, and others. Focusing on and investing in proactive and preventive strategies and policies, along with strengthening surveillance, rapid risk assessment, and risk communication, are of paramount importance to prevent or detect emerging and re-emerging diseases at an early stage when localised control is still possible.

Multiple disease surveillance efforts should be integrated, such as for malaria, rabies, HIV, and TB, avoiding vertical funding. Indeed, the integrated surveillance system should use a broad-based, multi-source horizontal platform able to detect different pathogens. The system should capture useful contextual information, such as clinical and epidemiological information, supply chain data and information about available resources, as they are indispensable for providing the right policy and response decision. The contextual information must include real-time social data, which is essential for identifying the most relevant response to the crisis on the ground. We also need to explore the potential role of harnessing non-traditional sources of data, such as social media activity, and evaluate its relative utility and reliability.

It is vital to build health systems that can switch efficiently and quickly into emergency mode. Many innovations, systems and resources built during the pandemic should also be sustained in the interpandemic period so as to be ready for the next pandemic before it arrives. Post-COVID-19 financing needs to be strategic and should focus on the core elements of the national investment plan for health system strengthening, including pandemic preparedness. Therefore, national governments should steer all investments (domestic and international) to ensure the scalability, agility, flexibility, and sustainability of their health system. A piecemeal project-based approach to funding should be avoided, as this can lead to a cacophony of different initiatives.

Research funding should balance biomedical research (on vaccines, therapeutics and diagnostics) and behavioural and social science research. Different scenarios to optimise biomedical research are setting up pre-negotiated public-private partnerships like ACT-A

(a dedicated public research and development infrastructure) or long-term technology transfer initiatives (Torreel *et al.* 2023). The WHO Council on the Economics of Health for All has just produced a new model of Research and Development (R&D) for public good, which is not a typical model in the biotech sector (WHO Council on the Economics of Health for All 2023). One excellent example is the WHO mRNA technology transfer programme, which uses a network model with its technology transfer hub based in South Africa and links with 15 partners in Africa, Asia, Europe and Latin America. The programme also aims to establish an R&D network within these network partner countries, not only with industries but also with local academic institutions, to support the development and manufacture of mRNA vaccines (beyond COVID-19) against priority diseases relevant to each region.

Going forward, we should learn lessons from the COVID-19 pandemic, as there have been many scientific advancements in the past few years. For instance, we have produced COVID-19 vaccines in a record-breaking 11 months using mRNA technology. Similarly, there are newer epidemiological surveillance tools, such as the re-emergence of wastewater surveillance; evolution of rapid, multiplex and easy-to-use diagnostics; prompt development and evaluation of therapeutics with fewer regulatory and financial hurdles; increased use of digital tools and AI; and leverage of the mRNA platform for other diseases, including vaccines. We watched how international solidarity failed and equity became a slogan, revealing eloquently the urgent need for a binding pandemic treaty. It is time to enhance preparedness for future pandemics and strengthen the public health sector, including WHO itself. Funding should not be segmented into different mechanisms and entities. Most importantly, it is crucial to rebuild trust and invest in the health workforce so that they can be confident about their working conditions, enabling them to deliver quality care to the public to whom they are accountable (Kluge *et al.* 2023).

Note

- 1 The IMF was quick to respond to the COVID crisis and created two facilities: the Rapid Credit Facility (RCF) and Rapid Financing Instrument (RFI), the latter a facility providing fast-disbursing support to countries experiencing commodity price shocks, natural disasters and other fragility-related emergencies.

Bibliography

- Battiston, Pietro, Ridhi Kashyap and Valentina Rotondi. 2021. 'Reliance on Scientists and Experts During an Epidemic: Evidence from the COVID-19 Outbreak in Italy', *SSM—Population Health*, 13: 100721, <https://doi.org/10.1016/j.ssmph.2020.100721>
- Behrendt, Silvia and Amrei Müller. 2023. 'The Proposed Amendments to the International Health Regulations: An Analysis', <http://opiniojuris.org/2023/02/27/the-proposed-amendments-to-the-international-health-regulations-an-analysis/> (accessed on 10 June 2023).
- Boniol, Mathieu, Teena Kunjumen, Tapas S. Nair, Amani Siyam, James Campbell, and Khassoum Diallo. 2022. 'The Global Health Workforce Stock and Distribution in 2020 and 2030: A Threat to Equity and "Universal" Health Coverage?', *BMJ Global Health*, 7(6), <https://doi.org/10.1136/bmjgh-2022-009316>
- Boyce, Matthew R., Erin M. Sorrell and Claire J. Standley. 2023. 'An Early Analysis of the World Bank's Pandemic Fund: A New Fund for Pandemic Prevention, Preparedness and Response', <https://gh.bmj.com/content/bmjgh/8/1/e011172.full.pdf> (accessed on 26 June 2023).
- Brim, Bangin and Clare Wenham. 2019. 'Pandemic Emergency Financing Facility: Struggling to Deliver on Its Innovative Promise', *BMJ*, 367: 15719, <https://doi.org/10.1136/bmj.15719>

- Bromme, Rainer, Niels G. Mede, Eva Thomm, Bastian Kremer, and Ricarda Ziegler. 2022. 'An Anchor in Troubled Times: Trust in Science Before and within the COVID-19 Pandemic', *PLOS ONE*, 17(2): e0262823, <https://doi.org/10.1371/journal.pone.0262823>
- Bucher, Adrian, Emilia Antonio, Henrike Grund, Nusrat Jabin, Chantel Jones, Meron Kifle, Susan Kader, Genevieve Boily-Larouche, Morgan Ley, and Alice Norton. 2023. 'A Living Mapping Review for COVID-19 Funded Research Projects: Two Year Update', *Wellcome Open Research*, 5: 209, <https://doi.org/10.12688/wellcomeopenres.16259.9>
- Carducci, B., E. C. Keats, M. Ruel, L. Haddad, S. J. M. Osendarp, and Z. A. Bhutta. 2021. 'Food Systems, Diets and Nutrition in the Wake of COVID-19', *Nature Food*, 2(2): 68–70, <https://doi.org/10.1038/s43016-021-00233-9>
- Channel News Asia. (2023). 'New Communicable Diseases Agency to Be Set Up to Oversee Disease Prevention and Control, Outbreak Response', press release, <https://www.channelnewsasia.com/singapore/singapore-communicable-diseases-agency-outbreak-response-covid-19-white-paper-debate-3362421> (accessed on 10 June 2023).
- COVID-19 National Preparedness Collaborators. 2022. 'Pandemic Preparedness and COVID-19: An Exploratory Analysis of Infection and Fatality Rates, and Contextual Factors Associated with Preparedness in 177 Countries, from Jan 1, 2020, to Sept 30, 2021', *The Lancet*, 399(10334): 1489–1512, [https://doi.org/10.1016/s0140-6736\(22\)00172-6](https://doi.org/10.1016/s0140-6736(22)00172-6)
- Duff, J. H., A. Liu, J. Saavedra, J. N. Batycki, K. Morancy, B. Stocking, ... J. Szapocznik. 2021. 'A Global Public Health Convention for the 21st Century', *The Lancet Public Health*, 6(6): e428–e433, [https://doi.org/10.1016/s2468-2667\(21\)00070-0](https://doi.org/10.1016/s2468-2667(21)00070-0)
- European Commission. 2022. 'Expert Panel on Effective Ways of Investing in Health', https://health.ec.europa.eu/expert-panel-effective-ways-investing-health/publications_en (accessed on 25 June 2023).
- FAO. 2020. 'Forecasting Threats to the Food Chain Affecting Food Security in Countries and Regions', <https://go.nature.com/3cRZ7Xy> (accessed on 25 June 2023).
- Fleming, K. A., S. Horton, M. L. Wilson, R. Atun, K. DeStigter, J. Flanigan, ... K. Walia. 2021. 'Lancet Commission on Diagnostics: Transforming Access to Diagnostics', *The Lancet*, 398(10315): 1997–2050, [https://doi.org/10.1016/s0140-6736\(21\)00673-5](https://doi.org/10.1016/s0140-6736(21)00673-5)
- Friebel, R., R. Silverman, A. Glassman, and K. Chalkidou. 2019. 'On Results Reporting and Evidentiary Standards: Spotlight on the Global Fund', *The Lancet*, 393(10184): 2006–2008, [https://doi.org/10.1016/s0140-6736\(18\)33055-1](https://doi.org/10.1016/s0140-6736(18)33055-1)
- Gelfand, M. J., J. C. Jackson, X. Pan, D. Nau, D. Pieper, E. Denison, ... M. Wang. 2021. 'The Relationship Between Cultural Tightness-Looseness and COVID-19 Cases and Deaths: A Global Analysis', *The Lancet Planet Health*, 5(3): e135–e144, [https://doi.org/10.1016/s2542-5196\(20\)30301-6](https://doi.org/10.1016/s2542-5196(20)30301-6)
- Ghebreyesus, T. A. 2021. 'Using Behavioural Science for Better Health', *Bull World Health Organ*, 99(11): 755, <https://doi.org/10.2471/blt.21.287387>
- Global Burden of Disease 2020 Health Financing Collaborator Network. 2021. 'Tracking Development Assistance for Health and for COVID-19: A Review of Development Assistance, Government, Out-of-Pocket, and Other Private Spending on Health for 204 Countries and Territories, 1990–2050', *The Lancet*, 398(10308): 1317–1343, [https://doi.org/10.1016/s0140-6736\(21\)01258-7](https://doi.org/10.1016/s0140-6736(21)01258-7)
- Global Fund. 2021. 'Results Report 2021', <https://www.theglobalfund.org/en/results/> (accessed on 10 June 2023).
- Global Fund. 2022. 'The Global Fund: Our Response to COVID-19', <https://www.theglobalfund.org/en/covid-19/> (accessed on 10 June 2023).
- Government of UK. 2021. 'PM Announces Plan for “Global Pandemic Radar”', press release, <https://www.gov.uk/government/news/pm-announces-plan-for-global-pandemic-radar> (accessed on 10 June 2023).
- Gustafsson, Bo. (1998). 'Some Theoretical Problems of Institutional Economic History', *Scandinavian Economic History Review*, 46(2): 5–31, <https://doi.org/10.1080/03585522.1998.10414738>
- Han, Q., B. Zheng, M. Cristea, M. Agostini, J. J. Bélanger, B. Gützkow, ... N. P. Leander. 2021. 'Trust in Government Regarding COVID-19 and Its Associations with Preventive Health

- Behaviour and Prosocial Behaviour During the Pandemic: A Cross-Sectional and Longitudinal Study', *Psychological Medicine*, 1–11, <https://doi.org/10.1017/s0033291721001306>
- Hannon, E., L. Hanbali, S. Lehtimäki, and N. Schwalbe. 2022. 'Why We Still Need a Pandemic Treaty', *The Lancet Global Health*, 10(9): e1232–e1233, [https://doi.org/10.1016/s2214-109x\(22\)00278-9](https://doi.org/10.1016/s2214-109x(22)00278-9)
- IANPHI. 2022. 'The Challenges of Integrated Surveillance for National Public Health Institutes during the COVID-19 Pandemic', <https://ianphi.org/news/2022/integrated-surveillance-webinar.html> (accessed on 10 June 2023).
- International Monetary Fund. 2022. 'World Economic Outlook: War Sets Back the Global Recovery', <https://www.imf.org/en/Publications/WEO/Issues/2022/04/19/world-economic-outlook-april-2022> (accessed on 10 June 2023).
- International Monetary Fund. 2023. 'World Economic Outlook: Update Inflation Peaking and Low Growth', <https://www.imf.org/en/Publications/WEO/Issues/2023/01/31/world-economic-outlook-update-january-2023> (accessed on 10 June 2023).
- Kluge, H., N. Azzopardi-Muscat, J. Figueras, and M. McKee. 2023. 'Trust and Transformation: An Agenda for Creating Resilient and Sustainable Health Systems', *BMJ*, 380: 651, <https://doi.org/10.1136/bmj.p651>
- Mahamat-Saleh, Y., T. Fiolet, M. E. Rebeaud, M. Mulot, A. Guihur, D. El Fatouhi, ... G. Severi. 2021. 'Diabetes, Hypertension, Body Mass Index, Smoking and COVID-19-Related Mortality: A Systematic Review and Meta-Analysis of Observational Studies', *BMJ Open*, 11(10): e052777, <https://doi.org/10.1136/bmjopen-2021-052777>
- Mathieu, Edouard, Hannah Ritchie, Lucas Rodés-Guirao, Cameron Appel, Charlie Giattino, Joe Hasell, ... Max Roser. 2023. 'Coronavirus Pandemic (COVID-19)', <https://ourworldindata.org/coronavirus> (accessed on 10 June 2023).
- Matthew, R. B., M. S. Erin and J. S. Claire. 2023. 'An Early Analysis of the World Bank's Pandemic Fund: A New Fund for Pandemic Prevention, Preparedness and Response', *BMJ Global Health*, 8(1): e011172, <https://doi.org/10.1136/bmjgh-2022-011172>
- Mbow, C., C. Rosenzweig, L. G. Barioni, T. G. Benton, M. Herrero, M. Krishnapillai, E. Liwenga, P. Pradhan, M. G. Rivera-Ferre, T. Sapkota, F. N. Tubiello, Y. Xu. 2019. 'Food Security', in J. S. P.R. Shukla, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D.C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, and J. Malley (eds), 'Climate Change and Land', an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystem, <https://www.ipcc.ch/srccl/> (accessed on 10 June 2023).
- McCartney, M. 2020. 'We Need Better Evidence on Non-Drug Interventions for COVID-19', *BMJ*, 370: m3473, <https://doi.org/10.1136/bmj.m3473>
- Moon, S., and I. Kickbusch. 2021. 'A Pandemic Treaty for a Fragmented Global Polity', *The Lancet Public Health*, 6(6): e355–e356, [https://doi.org/10.1016/s2468-2667\(21\)00103-1](https://doi.org/10.1016/s2468-2667(21)00103-1)
- OECD. 2019. 'Aid by DAC Members Increases in 2019 with More Aid to the Poorest Countries', <https://www.oecd.org/dac/financingsustainabledevelopment/development-finance-data/ODA-2019-detailed-summary.pdf> (accessed on 10 June 2023).
- Okonjo-Iweala, N., T. Shanmugaratnam and L. H. Summers. 2021. 'Rethinking Multilateralism for a Pandemic Era', <https://www.imf.org/en/Publications/fandd/issues/2021/12/Multilateralism-Pandemic-Era-Okonjo-Iweala-Shanmugaratnam-Summers> (accessed on 10 June 2023).
- Picchioni, F., L. F. Goulao, and D. Roberfroid. 2022. 'The Impact of COVID-19 on Diet Quality, Food Security and Nutrition in Low and Middle Income Countries: A Systematic Review of the Evidence', *Clinical Nutrition*, 41(12): 2955–2964, <https://doi.org/10.1016/j.clnu.2021.08.015>
- Pyone, T., and T. Mirzoev. 2021. 'Feasibility of Good Governance at Health Facilities: A Proposed Framework and its Application Using Empirical Insights From Kenya', *International Journal of Health Policy Management*, <https://doi.org/10.34172/ijhpm.2021.01>
- Ratha, D. K., S. De, E. J. Kim, S. Plaza, G. K. Seshan, and N. D. Yameogo. 2020. 'COVID-19 Crisis Through a Migration Lens (English)', Migration and Development Brief No. 32, <http://>

- documents.worldbank.org/curated/en/989721587512418006/COVID-19-Crisis-Through-a-Migration-Lens (accessed on 10 June 2023).
- Sachs, J. D., S. S. A. Karim, L. Aknin, J. Allen, K. Brosbøl, F. Colombo, ... S. Michie. 2022. 'The Lancet Commission on Lessons for the Future from the COVID-19 Pandemic', *The Lancet*, 400(10359): 1224–1280, [https://doi.org/10.1016/s0140-6736\(22\)01585-9](https://doi.org/10.1016/s0140-6736(22)01585-9)
- Swaminathan, Soumya, Bernard Pécoul, Hisham Abdullah, Christos Christou, Glenda Gray, Carel IJsselmuiden, Marie Paule Kieny, Mariana Mazzucato, Veronika von Messling, Bernhards Ogutu, John Reeder, John-Arne Røttingen, Renu Swarup, Marcel Tanner, Nísia Trindade Lima, Michelle Childs, Alex Harris, Els Torreele, and Suerie Moon. 2022. 'Reboot Biomedical R&D in the Global Public Interest', *Nature*, 602(7896): 207–210, <https://doi.org/10.1038/d41586-022-00324-y>
- Thornton, J. 2022. 'COVID-19: Trust in Government and Other People Linked with Lower Infection Rate and Higher Vaccination Uptake', *BMJ*, 376: o292, <https://doi.org/10.1136/bmj.o292>
- Torreele, Els, Michel Kazatchkine, Joanne Liu, Mark Dybul, Mauricio Cárdenas, Sudhvir Singh Helena Legido Quigley, Christine McNab, Ellen Johnson Sirleaf, Mariana Mazzucato, and Helen Clark. 2023. 'Stopping Epidemics When and Where They Occur', *The Lancet*, 401(10374): 324–328, [https://doi.org/10.1016/s0140-6736\(23\)00015-6](https://doi.org/10.1016/s0140-6736(23)00015-6)
- Travis, Justin, Scott Harris, Tina Fadel, and Ginny Webb. 2021. 'Identifying the Determinants of COVID-19 Preventative Behaviors and Vaccine Intentions Among South Carolina Residents', *PLOS ONE*, 16(8): e0256178, <https://doi.org/10.1371/journal.pone.0256178>
- UNICEF. 2020. 'The State of Food Security and Nutrition in the World 2020: Transforming Food Systems for Affordable Healthy Diets', <https://www.unicef.org/reports/state-of-food-security-and-nutrition-2020> (accessed on 10 June 2023).
- United Nations. 2021. 'Up to 180,000 Health Workers May Have Died from COVID-19', <https://news.un.org/en/story/2021/10/1103642> (accessed on 10 June 2023).
- Velásquez, Germán. 2023. 'Where Does Global Health Funding Come From and Where Does It Go?', <https://www.southcentre.int/research-paper-176-29-march-2023/> (accessed on 10 June 2023).
- Wang, Yuxi, John Bye, Karam Bales, Deepti Gurdasani, Adityavarman Mehta, Mohammed Abba-Aji, David Stuckler, and Martin McKee. 2022. 'Understanding and Neutralising COVID-19 Misinformation and Disinformation', *BMJ*, 379: e070331, <https://doi.org/10.1136/bmj-2022-070331>
- Wenham, C., M. Kavanagh, I. Torres, and G. Yamey. 2021. 'Preparing for the Next Pandemic', *BMJ*, 373: n1295, <https://doi.org/10.1136/bmj.n1295>
- Whitelaw, S., M. A. Mamas, E. Topol, and H. G. C. van Spall. 2020. 'Applications of Digital Technology in COVID-19 Pandemic Planning and Response', *The Lancet Digital Health*, 2(8): e435–e440, [https://doi.org/10.1016/s2589-7500\(20\)30142-4](https://doi.org/10.1016/s2589-7500(20)30142-4)
- WHO Council on the Economics of Health for All. 2023. 'Health for All: Transforming Economies to Deliver What Matters—Final Report', <https://www.who.int/publications/m/item/health-for-all--transforming-economies-to-deliver-what-matters> (accessed on 26 June 2023).
- World Bank. 2022. 'World Bank Group's Operational Response to COVID-19 (Coronavirus)—Projects List', <https://www.worldbank.org/en/about/what-we-do/brief/world-bank-group-operational-response-covid-19-coronavirus-projects-list> (accessed on 10 June 2023).
- World Health Organization. 2016. 'International Health Regulations (2005)—Third Edition', <https://www.who.int/publications/i/item/9789241580496> (accessed on 10 June 2023).
- World Health Organization. 2021a. 'From Worlds Apart to a World Prepared: Global Preparedness Monitoring Board Report', https://www.gpmb.org/docs/librariesprovider17/default-document-library/gpmb-annual-report-2021.pdf?sfvrsn=44d10dfa_9 (accessed on 26 June 2023).
- World Health Organization. 2021b. 'State of Inequality: HIV, Tuberculosis and Malaria', <https://www.who.int/publications/i/item/9789240039445> (accessed on 10 June 2023).
- World Health Organization. 2021c. 'WHO, Germany Open Hub for Pandemic and Epidemic Intelligence in Berlin', <https://www.who.int/news/item/01-09-2021-who-germany-open-hub-for-pandemic-and-epidemic-intelligence-in-berlin> (accessed on 10 June 2023).

- World Health Organization. 2022a. '10 Proposals to Build a Safer World Together—Strengthening the Global Architecture for Health Emergency Preparedness, Response and Resilience', <https://www.who.int/publications/m/item/10-proposals-to-build-a-safer-world-together---strengthening-the-global-architecture-for-health-emergency-preparedness--response-andresilience--white-paper-for-consultation--june-2022> (accessed on 10 June 2023).
- World Health Organization. 2022b. 'Global Tuberculosis Report 2022', <https://www.who.int/teams/global-tuberculosis-programme/tb-reports/global-tuberculosis-report-2022> (accessed on 10 June 2023).
- World Health Organization. 2022c. 'Health and Care Workforce in Europe: Time to Act', <https://www.who.int/europe/publications/i/item/9789289058339> (accessed on 10 June 2023).
- World Health Organization. 2022d. 'World Health Statistics 2022: Monitoring Health for the SDGs, Sustainable Development Goals', <https://www.who.int/publications/i/item/9789240051157> (accessed on 10 June 2023).
- World Health Organization. 2023a. 'Timeline: WHO's COVID-19 Response', <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/interactive-timeline> (accessed on 10 June 2023).
- World Health Organization. 2023b. 'Infodemic', https://www.who.int/health-topics/infodemic#tab=tab_1 (accessed on 10 June 2023).
- World Health Organization. 2023c. 'Statement on the Fifteenth Meeting of the IHR (2005) Emergency Committee on the COVID-19 Pandemic', press release, [https://www.who.int/news/item/05-05-2023-statement-on-the-fifteenth-meeting-of-the-international-health-regulations-\(2005\)-emergency-committee-regarding-the-coronavirus-disease-\(covid-19\)-pandemic](https://www.who.int/news/item/05-05-2023-statement-on-the-fifteenth-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-coronavirus-disease-(covid-19)-pandemic) (accessed on 10 June 2023).
- World Health Organization. 2023d. 'World Health Organization COVID-19 Dashboard', <https://covid19.who.int/> (accessed on 10 June 2023).
- World Health Organization. 2023e. 'WHO Health Workforce Support and Safeguards List 2023', <https://www.who.int/publications/i/item/9789240069787> (accessed on 10 June 2023).
- Zerhouni, Elias. 2019. 'GAVI, the Vaccine Alliance', *Cell*, 179(1): 13–17, <https://doi.org/10.1016/j.cell.2019.08.026>