THE NEW FACE OF PANDEMIC PREPAREDNESS

2025 GPMB report

GPMB
GLOBAL PREPAREDNESS MONITORING BOARD

The new face of pandemic preparedness: 2025 GPMB report

Suggested citation. The new face of pandemic preparedness: 2025 GPMB report. Global Preparedness Monitoring Board, Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO.

Cataloguing-in-Publication (CIP) data. CIP data are available at *http://apps.who.int/iris*.

CARE – MEASURE – COOPERATE

THE NEW FACE OF PANDEMIC PREPAREDNESS

2025 GPMB report

GPMB

GLOBAL PREPAREDNESS MONITORING BOARD

Contents

Foreword

The world remains immersed in the COVID decade: we are making progress toward better health security, but much work remains before we can consider ourselves truly safer. It is no surprise that the greatest social and economic disruption in a century continues to reverberate, compounded by geopolitical turmoil and cascading crises.

Stepping up for a better world requires cool heads, solid data, and groundbreaking science. But above all, it requires rebuilding trust – fulfilling the promise that we have far more to gain by engaging with our neighbours and working together than by retreating behind barriers.

We take heart from the adoption of the WHO Pandemic Agreement by this year's World Health Assembly. It is a clear demonstration of the collective determination of nations to protect their populations by agreeing on a common set of rules, obligations, and concrete steps to build capacity. The core values of equity and reciprocity embedded in the agreement represent the only sustainable path to achieving health security for all.

Some have expressed concerns about the agreement's potential impact on national sovereignty. Yet no country is obliged to ratify it, and we hope all will, because true sovereignty is strengthened when every country meets shared responsibilities, exchanges information transparently, cooperates to build response capacities everywhere, and ensures that no country or region is left behind without access to medicines or vaccines in times of global crisis.

Pandemics force humanity to stare chaos in the face. But we can choose our fate. With goodwill, good science and good planning we can step back from the brink. The guidance from this report – care, measure, cooperate – shows us how.

Ms Kolinda Grabar-Kitarović
GPMB Co-Chair
and former President
of Croatia

Ms Joy Phumaphi
GPMB Co-Chair and
former Minister of Health
of Botswana

Executive summary

The 2025 Global Preparedness Monitoring Board (GPMB) report, *The New Face of Pandemic Preparedness*, underscores the urgent need to transform global health security in a world still recovering from the COVID-19 pandemic. Pandemics have profound and lasting impacts, which extend beyond health to disrupt economies, societies, and governance systems. Despite advances in science and technology, the world remains vulnerable to future pandemics due to persistent inequities, mistrust, and underinvestment in preparedness. A paradigm shift in preparedness is needed, based on three imperatives: CARE, MEASURE, and COOPERATE.

Key lessons from COVID-19

The COVID-19 pandemic exposed critical gaps in global preparedness and response. Its cascading effects — economic losses in tens of US$ trillions, over 20 million estimated deaths, and disruptions to education, mental health, and social cohesion — revealed systemic weaknesses. Key lessons include:

- **Multidimensional impact:** Pandemics are not just health crises, but social and economic quakes that deepen inequalities and erode trust.
- **Unintended consequences:** Public health and social measures (PHSM), while necessary, often lacked strategies to mitigate their economic and social fall-out.
- **Fragmented governance:** Geopolitical tensions and weakened multilateralism hindered coordinated responses, exacerbating global inequities in access to vaccines and treatments.

PNDMC: Five keys to better preparedness

There are five key ways to address future pandemics and better guard against the risks of a volatile, uncertain, complex, and ambiguous (VUCA) world:

1. **Primary defences:** Strengthen frontline health systems and One Health approaches to detect and contain outbreaks early.
2. **Novel governance:** Foster agile, inclusive decision-making and rebuild trust through transparent, equitable policies.
3. **Data analytics:** Leverage artificial intelligence (AI) and real-time monitoring to guide adaptive responses and mitigate unintended impacts.
4. **Multisectoral collaboration:** Integrate planning and responses of health, agriculture, finance, and security sectors for whole-of-society resilience.
5. **Critical health response:** Invest in pathogen-agnostic tools, health workforce protection, and community-led initiatives.

The path forward: care, measure, cooperate

- **CARE: A more resilient system begins with strong primary health care that can absorb the first wave of cases while maintaining essential services.** Integrating One Health principles into frontline surveillance is essential, because most emerging pathogens originate in animals. Accelerated research into broad-spectrum antivirals and rapid diagnostics can make rapid response more available while vaccines are produced, and support equity in access to countermeasures.

  Protecting the health workforce is critical to maintaining service capacity during crises. Enhanced community engagement will lessen the disruption caused by public health and social measures and boost pandemic prevention and containment.

- **MEASURE: Dynamic metrics must be developed to assess health system resilience, social impacts, and economic costs in real time.** A global Pandemic Risk Observatory that brings together multiple stakeholders to collaborate, integrates epidemiological, economic, social, and environmental data into a single decision-support platform and deploys new technologies to improve the efficiency and timeliness of data analysis can transform preparedness.

  It would allow leaders to view pandemic risk in comprehensive, near-real-time terms, improve forecasting, and facilitate more effective resource allocation.

- **COOPERATE: Ratification, implementation and financing of the WHO Pandemic Agreement — adopted at the 78th World Health Assembly — alongside the continued implementation of the amendments to the International Health Regulations, would ensure fair sharing of samples, data and products.** Regional institutions are well placed to organize cross-border surge operations and pooled procurement.

  Financial mechanisms should align disbursements with measurable preparedness targets and maximize investment from both public and private sector channels, nationally, regionally and globally. Civil society networks that proved indispensable during COVID-19 need predictable funding and formal roles in preparedness plans to sustain risk communication, logistics and service delivery.

Future pandemics will exploit the vulnerabilities caused by inequity and mistrust unless systemic reforms are adopted. By investing in care systems, robust data tools, and international cooperation, the world can mitigate the catastrophic impacts of future health crises.

Adoption of the WHO Pandemic Agreement is a beacon of hope in a world weighed down by crisis. Born out of the depth of COVID-19's impact, it signals that nations are prepared to work through their different perspectives and come to agreement on their common interests.

Building strong care systems, measuring the full spectrum of pandemic impacts and strengthening cooperation across sectors and borders will determine whether the next outbreak becomes a manageable event or a repeat of recent global upheaval.

Introduction

The *multidimensional* impact of pandemics

- Five years since the COVID-19 pandemic began, the world has not fully recovered, and we are living with the dramatic changes it has caused. Despite heightened fragility, significant new opportunities to build resilience are emerging.
- We have learnt from the COVID-19 crisis that collective defences must be strengthened.
- Each crisis leaves scars in our societies and economies. The duration and complexity of recovery is always underestimated.
- Preparedness requires anticipating all plausible scenarios and planning for recovery accordingly.
- Negative impacts of the public health and social measures used during COVID-19 were largely unanticipated, but proper planning and foresight can mitigate these impacts next time a pandemic occurs.
- There will be other pandemics, but they will be different from pandemics of the past. Pandemic preparedness needs to be designed to meet these future challenges.

Photo credit: in-future on iStock

Pandemics are multidimensional shocks. It is a mistake to think of pandemics as purely health-related events, even if this is how they are triggered. Their impacts can be profound and far-reaching — affecting the structure of societies with long-lasting consequences across economic, political, and social spheres.

The COVID-19 pandemic was no exception. Even though the acute phase of the pandemic officially ended in 2023, countries are still grappling with its aftermath: direct and indirect health impacts including on mental health, economic burdens of inflation and debt, and a lost generation of schooling and training which will be felt in reduced human capital for decades.[1] The profound structural impacts of the COVID-19 pandemic deepened inequality and mistrust. Many of these impacts were the result of public health and social measures (PHSM) taken to contain the epidemic, but often without regard to necessary mitigating measures such as social safety nets[2,3,4] and with limited evidence on their efficacy or impact.

A huge range of PHSM was deployed during the acute phase of COVID-19 including testing, case finding and isolation; personal protection, such as hand hygiene and mask wearing; ventilation, sanitation and other environmental measures; measures to reduce gatherings, including school closures up to full lockdowns; and international travel and trade measures.[5] The application of these measures as well as their impact was very context dependent – for example, where informal economies predominate it was challenging to apply many PHSM, and the impacts on the most vulnerable workers were both severe and long-lasting.[6,7] Research into human behaviours, systemic impacts and PHSM effectiveness remains an urgent priority.[8]

Recovery and trust-building are needed. Recovery remains uneven and return to a pre-COVID-19 'normal' has proven elusive. The memories of the crisis remain vivid, yet many societies appear eager to move on, sometimes at the cost of ignoring hard-earned lessons. COVID-19 made clear that underlying inequity puts societies in danger when crisis strikes, that global rules are needed so that countermeasures are distributed according to need and not hoarded by the most powerful, and that mistrust and misinformation can upend even the most carefully planned response.

Pandemics have a deep and lasting impact on societies and economies. They are not just health crises — they are social quakes that shake the very foundations of how we live and function together.

Professor Ilona Kickbusch,
GPMB Board Member

We have not yet fully recovered. In many ways, our societies remain more vulnerable to infectious threats today than they were in 2019.

Dr Ibrahim Abubakar,
GPMB Board Member

The reverberations of the COVID-19 shock continue to be felt in geopolitical disruption and uncertainty. Social polarization has deepened, trust in institutions has eroded, and global health efforts have fragmented.[9] Political polarization has eroded trust in science in significant pockets of the population with damaging policy consequences.[10,11] Together with rapidly evolving trends — in technology, trade, climate, and finance — a globally interdependent world is increasingly unpredictable.

Geopolitical disruption and tension have put pressure on countries to increase military expenditure, at the cost of pandemic preparedness and health resilience. While a new pandemic fund was created in the wake of COVID-19, its funding has fallen short of needs and a number of high-income countries have retreated from development assistance funding. Multilateral institutions, chief among them the World Health Organization, have seen reduced funding.

The net impact of the global uncertainty fuelled by the COVID-19 pandemic is that global health security is currently in critical danger. If a new pandemic were to occur soon, the world could be even more vulnerable than it was in 2019 — still in the midst of recovery and without having fully internalized the lessons of COVID-19.

There are three critical elements to preparedness to enhance global health security: reinforcing the care capacities that will prevent outbreaks and accelerate early response, being able to measure strengths and weaknesses, and countries being willing to cooperate.

Ms Joy Phumaphi,
GPMB Co-Chair

Drawing lessons from COVID-19, we must revisit our preparedness frameworks — not to fight the last battle, but to be ready for the next ones.

Ms Kolinda Grabar-Kitarović,
GPMB Co-Chair

Some believe pandemics are once-in-a-century events. This is a misconception. Alongside the toll of smallpox, cholera, malaria and tuberculosis, the 20th century saw at least three major influenza pandemics[i,12] and an HIV pandemic which at the turn of the century was still on an upwards trajectory – cumulative AIDS deaths will exceed 43 million this year.[13] Before COVID-19, the 21st century had already seen an influenza pandemic (H1N1 2009)[ii,14,15] and major epidemics due to emerging or re-emerging diseases – such as SARS-CoV1, Ebola virus disease, yellow fever and mpox – spreading in 132 countries, and Zika disease spreading in 89 countries, together with major cholera outbreaks.[16,17,18]

These epidemics are the ones that evaded early containment. Thanks to increasingly robust global systems — such as those under the International Health Regulations (IHR) — many outbreaks are now detected and contained at their source. But because a pandemic averted receives little attention, a false sense of security is created. If we let our guard down and neglect these efforts to prevent, detect and contain outbreaks, the likelihood of future catastrophic events will only grow.

Pandemic preparedness needs to take account of impact. To better guard against catastrophic events, there is a need to go beyond immediate prevention and containment efforts and to anticipate the full range of impacts a pandemic is likely to bring. These include the morbidity and mortality resulting not only from the disease itself but also from the worsening of pre-existing conditions and the disruption of health systems.[19] Long-term consequences, such as those seen in long COVID, can also create new and persistent burdens on population health. Beyond the health sector, pandemic impacts are felt in various economic sectors; on poverty and food security; and on social structures, including the care economy, gender relations and gender-based violence; and education and training.[20]

This report, guided by the impact indicators of the GPMB Monitoring Framework[21], will address the shifts that are needed in preparedness efforts.

[i] It is estimated that the influenza pandemic of 1918 infected one-third of the Earth's population, and led to between 20 and 40 million deaths. One million people around the world died in a 1957 influenza outbreak and another 1 to 3 million lives were lost to the same disease in 1968.[12]

[ii] There is an estimated range of deaths between 151,700 and 575,400 people who perished worldwide from 2009 H1N1 virus infection during the first year the virus circulated.[14]

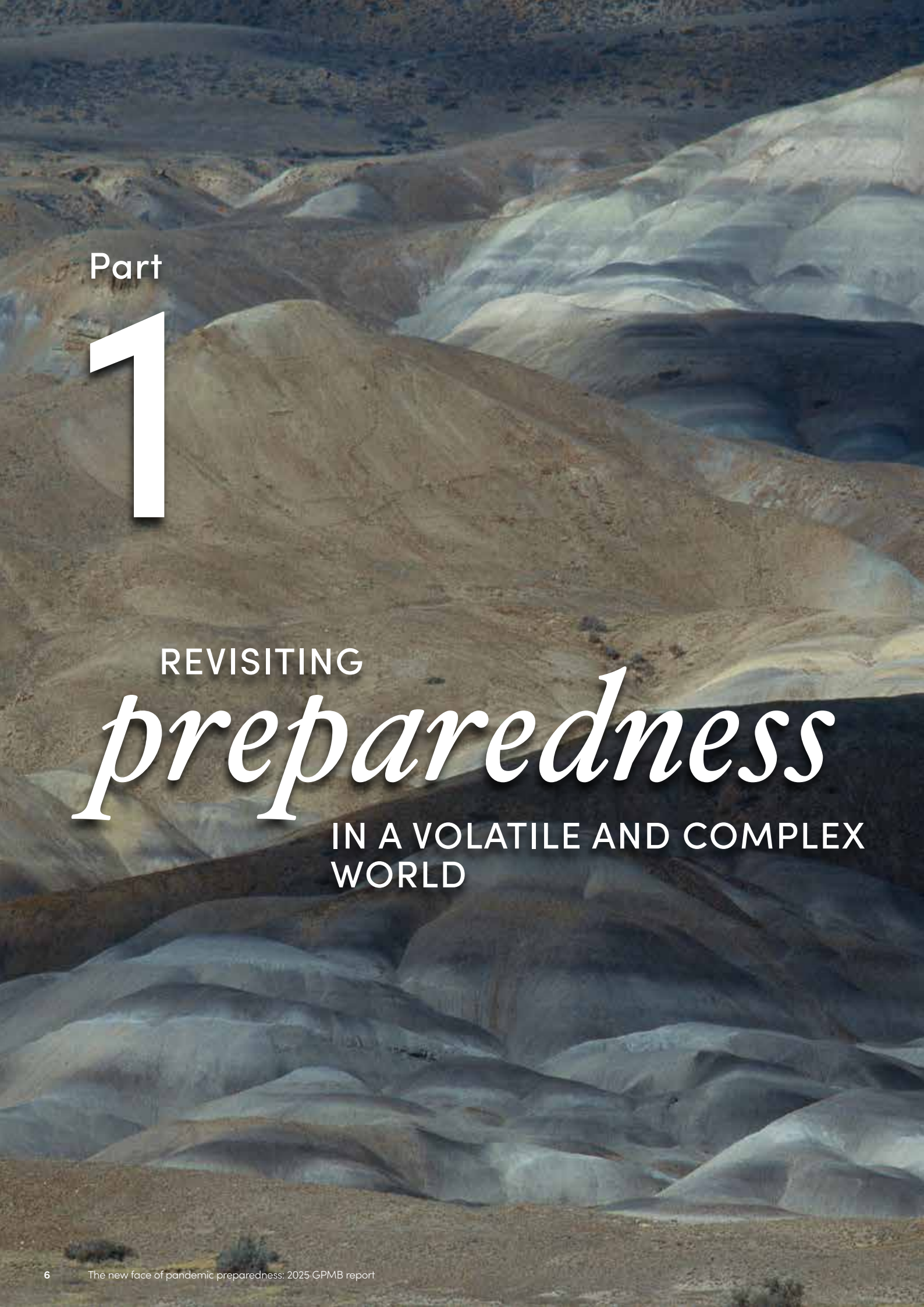
Table 1. The COVID-19 decade in numbers

MEASURE	IMMEDIATE IMPACT	2025 AND BEYOND
Mortality due to COVID-19 (reported deaths)	≈7 million (2023)[22]	>8 million[23,a]
Mental health burden (anxiety and depression prevalence, 2030 estimate based on implementation of the WHO global action plan)	+25% vs 2019 baseline (2022)[24,b]	>20% above baseline[25,b] (2030)
Long COVID cost (drag on OECD GDP)	≈US$ 1 trillion/year[26]	≥US$ 7 trillion cumulative[27] (2030)
Immunization (measured impact and excess deaths due to reduced immunization)	17 million children with zero dose (2020)[28]	≈49,000 additional deaths/ year (2020–2030)[29]
Children out of school	>1.6 billion learners affected (2020)[30]	130 million still facing school closures (2025)[31]
Gender-based violence surge (measured impact during the COVID-19 pandemic to date and population estimate of those affected by 2030)	45% of surveyed women[32] (2021)	Progress towards ending gender-based violence set back by 1/3[33] (2030)
Additional child marriages	≈2–3 million[34] (2021)	Up to 10 million (2030)[35]
GDP loss (shortfall vs pre-COVID-19 trend)	5.6% (US$ 4.7 trillion) (2020)[36]	>US$ 50 trillion lost output projected (2020–2030)[37,c]
Global public debt burden (during COVID-19 and compared to pre-pandemic projections)	+16% of global GDP (to 99%) (2020)[38]	≈100% instead of ≈85% of global GDP (2030)[39]
Extreme poverty (compared to pre-COVID-19 estimates)	≈70–100 million more people (2021)[40,41]	≈300–350 million more people (2030)[42]
Food insecurity (compared to pre-COVID-19 figures and projections)	122 million more people (2022)[43]	130 million more people (2030)[44]
Labour market changes	114 million jobs lost (2020)[45]	>100 million jobs shifted due to COVID-accelerated trends[46] (2030)

[a] Projected mortality by 2030 calculated by extrapolating from WHO's most recent monthly estimates of 4,500 monthly deaths. Note some estimates for excess mortality by 2030 range as high as 40 million.[47]

[b] Mental health burden: WHO scientific brief March 2022 reports +25% rise in global anxiety and depression in first year of COVID-19; WHO action plan notes the burden is likely persistent.

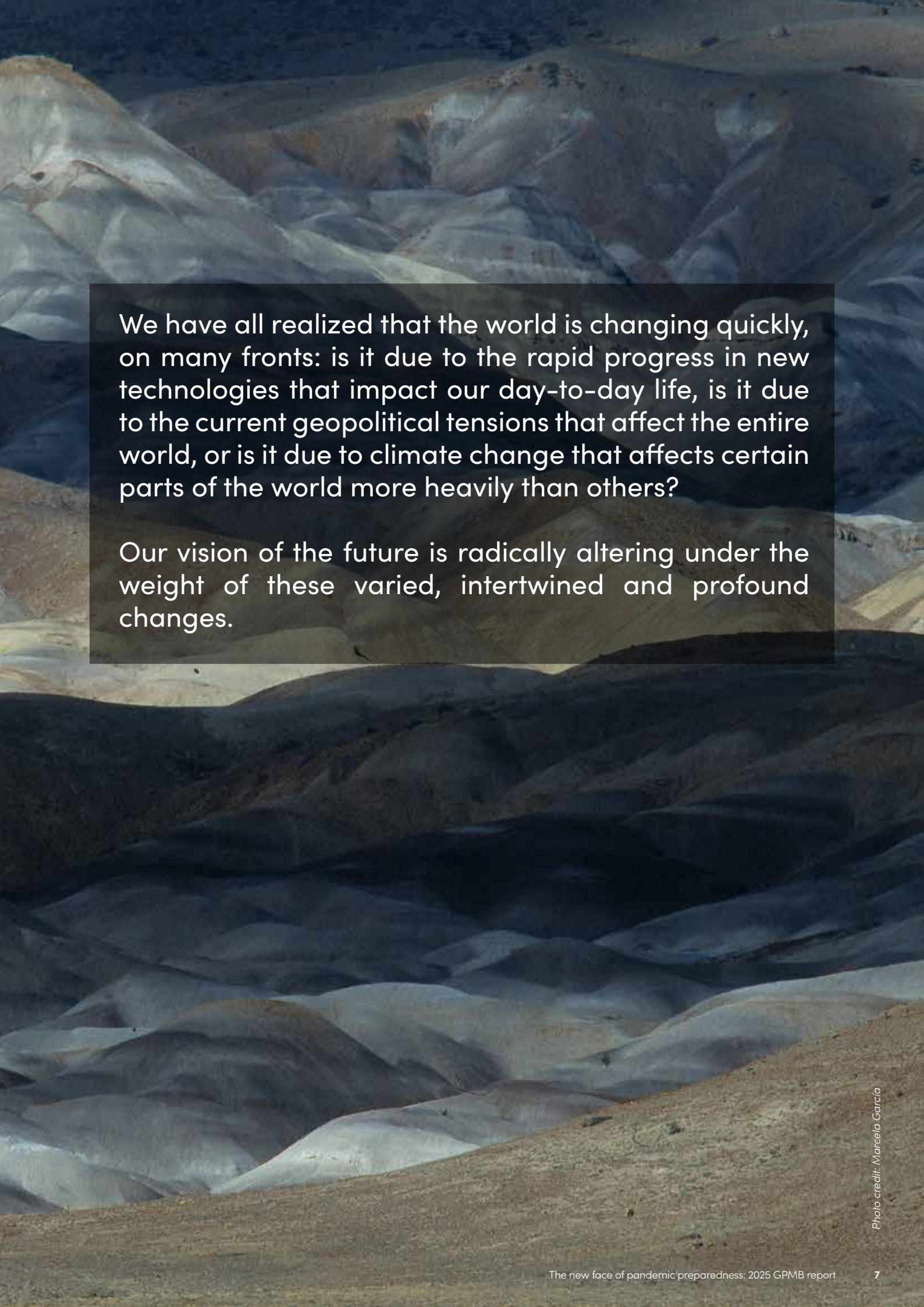
[c] As a result of COVID-19 and other polycrises.



Part

1

REVISITING *preparedness* IN A VOLATILE AND COMPLEX WORLD



We have all realized that the world is changing quickly, on many fronts: is it due to the rapid progress in new technologies that impact our day-to-day life, is it due to the current geopolitical tensions that affect the entire world, or is it due to climate change that affects certain parts of the world more heavily than others?

Our vision of the future is radically altering under the weight of these varied, intertwined and profound changes.

Photo credit: Marcela García

We can't stop human movement, but we can make it safer. This requires stronger international collaboration and frameworks.

Ms Bente Angell-Hansen,
GPMB Board Member

The interconnectedness of our world is a double-edged sword. It spreads diseases faster, but it also gives us the tools to respond swiftly if we invest in the right technologies.

Dr Palitha Abeykoon,
GPMB Board Member

As the COVID-19 pandemic underlined, today's world is more volatile and uncertain than ever, crises are cascading and complex, and responses have consequences that are often unanticipated, resulting in proliferating ambiguity.

Given this rapidly changing landscape, we need to adapt our preparedness efforts. Not only do we need to leverage technological advances to reduce uncertainty and monitor pandemic risks to avoid the nasty surprise we faced when COVID-19 started to spread, we also need to define the most cost-effective actions that will maximize the benefit of sustained preparedness. But investment in preparedness continues to lag far behind needs, with many countries reluctant to finance long-term risk reduction when faced with the resource demands of so many other acute crises.

Five interlocking sets of action are needed to radically reinforce pandemic preparedness to better cope with a volatile and uncertain risk environment:

- Primary defences strengthened at the frontline of pandemic emergence
- Novel and reinvigorated governance that can better mobilize adaptive responses
- Data analytics for better decision-making
- Multisectoral collaboration for integrated preparedness
- Critical health response capacities strengthened.

Box 1. Living in a VUCA world

The end of the cold war saw a rapid collapse in the world order that had prevailed for decades. Strategic leadership frameworks began to understand a world characterized by Volatility, Uncertainty, Complexity and Ambiguity (VUCA).[48]

Since its coinage in the early 1990s, VUCA analysis has become increasingly prominent, with many seeing the COVID-19 pandemic as a confirmation of these tendencies.

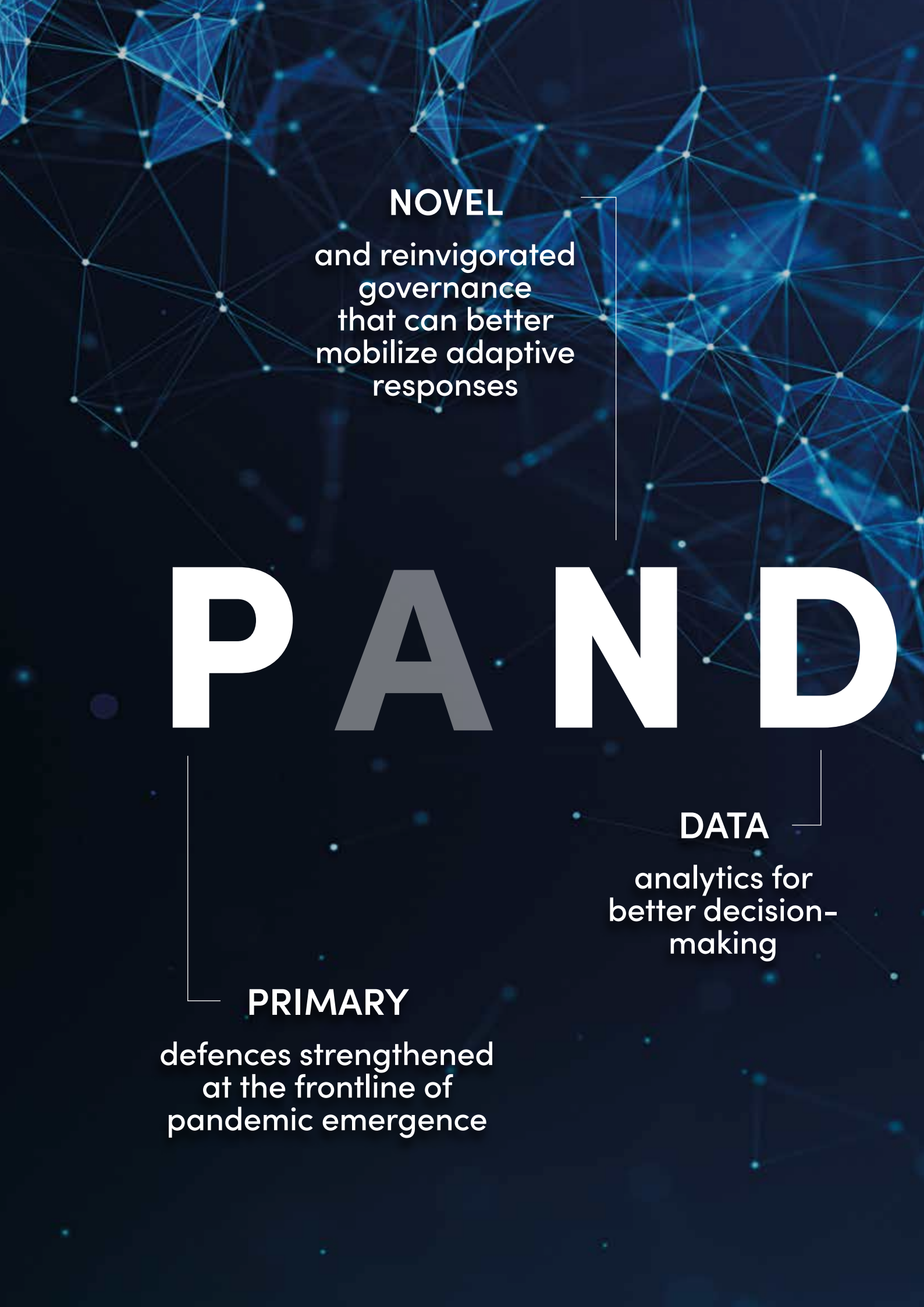
V **Volatility:** Pandemic risks are evolving rapidly and unpredictably, shaped by disruptive forces such as AI-driven technological change, new medical countermeasures, persistent inequities, and growing mistrust in innovation.

U **Uncertainty:** It is hard to predict when and how the next pandemic will strike — or how the world will respond. Years of underinvestment and global political shifts, including dozens of elections and weakening multilateralism, only add to the unpredictability.

C **Complexity:** Drivers of pandemic risk — social, technological, environmental, economic, and political — are deeply interconnected. Outbreaks often arise at the human–animal–environment interface, and response requires more than just tools such as vaccines; trust, coordination, and inclusive, multi-level action are critical.

A **Ambiguity:** Decision-making is challenged by conflicting information and many actors with competing interests. Clear communication, flexible governance, and cross-sector collaboration are essential to navigate this ambiguity and respond effectively.

The concept of 'VUCA Prime' has been introduced to guide the most strategic and productive responses to a VUCA world, namely Vision, Understanding, Clarity, and Agility.[49]


NOVEL
and reinvigorated governance that can better mobilize adaptive responses
PAND
DATA
analytics for better decision-making
PRIMARY
defences strengthened at the frontline of pandemic emergence


MULTISECTORAL
collaboration for integrated preparedness
EMIC
CRITICAL
health response capacities strengthened

Photo credit: WHO / Billy Miaron

Primary defences strengthened *at the frontline* of pandemic emergence

KEY MESSAGES

- **Stronger primary health care can help to withstand the first wave and reduce reliance on drastic social measures.**
- **Applying a One Health approach will better prevent outbreaks at source even if it is not always possible to contain them.**
- **More research is needed into treatments for emerging diseases.**
- **The impact of public health and social measures on economies and society should be better anticipated and managed.**

Accelerated movement of people and goods means epidemics can move faster and further nowadays. As a result, there is less time to prepare when there is an alert, and a higher, more rapidly disseminated level of global disruption. While no one can predict when the next pandemic will occur or which pathogen will emerge, we know the first six to nine months of the outbreak will be the most difficult to manage.

During this period, uncertainty is at its highest, as the course of events depends on several factors: the nature of the pathogen, availability of countermeasures, behaviour and existing immunity of the population, and efficiency of the early response to contain the outbreak at source. While the COVID-19 pandemic showed vaccines can be developed in months and prevent severe disease and death, the initial phase of a pandemic due to a new disease will often need to be managed without effective vaccines and tailored therapeutics. To prevent future pandemics and reduce their impact, it is essential to strengthen primary health care (PHC) systems, ensuring access to timely testing and treatment at the community level, and engagement of communities. This protects the first affected populations and first responders in the health workforce, and helps contain emerging diseases at their source.

A resilient primary health care system is crucial to:

- **manage the surge in health care demand** caused by a new disease, while protecting secondary and tertiary health care facilities to reduce the impact on the management of other illnesses and severe health conditions;
- **reduce the severity of the emerging disease**, including by rolling out rapid tests and using test-and-treat approaches to accelerate treatment use, especially in the most vulnerable and at-risk groups, and to deliver treatments, which — even if not 100% effective — can reduce the severity and duration of illness, making outbreaks more manageable;
- **reduce transmission** by providing trusted, community-based care capable of translating and adapting scientific recommendations to local contexts, and delivering supportive care at the household level, encouraging infected individuals to seek care and be motivated to adhere to isolation measures; and
- **enhance early detection** by providing early confirmation of unusual disease events and swift implementation of containment measures.[iii,50]

> The first wave of any pandemic is always the hardest to manage — marked by the most uncertainty, the most fear, and the steepest learning curve.
>
> **Dr Zijian Feng,**
> *GPMB Board Member*

[iii] The recent Marburg virus outbreak in Tanzania, for example, was swiftly confirmed and controlled following the identification of a cluster of deaths.[50]

Young people's online experiences are now an important determinant of their health and we have a collective responsibility to ensure these experiences are positive ones.

Professor Ilona Kickbusch,
GPMB Board Member

Digital solutions are potentially transformative of primary pandemic defences: they not only enable real-time processing of outbreak signals but also enable responses to be tailored to emerging needs, in addition to enhancing global connectedness, allowing instant sharing of the most effective response strategies. But if digital access is unequally distributed it runs the risk of entrenching inequality, and the same platforms that can spread good information can also be channels for misinformation and disinformation. Stewardship of digital health will assume even more importance in coming years.[51,52]

PHC approaches at the interface between the health sector and the community can also catalyse community responses to an emerging threat. The COVID-19 pandemic provided hundreds of examples of 'home-grown' community responses which galvanized community mobilization and enabled local resourcefulness to deliver responses such as community care, neighbourhood solidarity efforts, local production of personal protective equipment (PPE), and food and medicine delivery. In many lower-resource settings, the level of community mobilization was impressive despite the straitened circumstances, including significant contributions made by diaspora communities.[53]

Digital solutions are potentially transformative of primary pandemic defences: they not only enable real-time processing of outbreak signals but also enable responses to be tailored to emerging needs, in addition to enhancing global connectedness, allowing instant sharing of the most effective response strategies.

PHC approaches focused on human health have their corollary in environmental and animal health. Since the early 2000s the world has tried to reduce risk and contain outbreaks at source using One Health approaches to enhance prevention, assist early detection, support rapid initial measures at the human–animal–environment interface and seize the opportunity to control the spread of disease, under the stewardship of the tripartite alliance between WHO, the United Nations (UN) Food and Agriculture Organization (FAO) and the World Organisation for Animal Health (WOAH), and subsequently quadripartite with the addition of the UN Environment Programme (UNEP).[54]

Prevention, early detection and response at the local level are essential. Biosecurity systems and tools such as vaccination are used in livestock production to reduce risks of infection. Collaborative surveillance at the human–animal–environment interface is vital given that approximately 75% of emerging diseases in humans are of animal origin.[55] When combined with strong primary health care systems, this approach ensures the first patient is quickly identified and treated — offering a critical opportunity to stop transmission chains before they spread.

Photo credit: WHO / Loan Tran

While vaccine research has accelerated in recent decades, research into treatments, especially antivirals, has lagged. For example, more effort is needed to develop broad-spectrum drugs designed to reduce the severity of emerging diseases, which could potentially be a huge boost to the response toolbox.

In cases of a completely new disease and in the absence of medical countermeasures and supportive care, the initial response will of necessity heavily rely on public health and social measures (PHSM).[iv,56] However, application of these measures must take into account the potential for unintended consequences, including increased economic vulnerability and effects on critical economic and social infrastructure.[57] During COVID-19, PHSM were widely used but their social consequences were neither sufficiently assessed nor understood. The lack of clarity, transparency and equity in the application of PHSM sparked protests worldwide, driven by various grievances. Some demonstrations stemmed from economic hardship and food insecurity, while others opposed public health measures such as lockdowns, mask mandates, and medical countermeasures.[58,59,60,61] These protests contributed to societal polarization, further influencing political dynamics and governance.

Stronger PHC can therefore better equip countries to withstand the first wave as well as to anticipate the impact of PHSM and economic and social disruption, and thus identify the most important mitigating measures. For example, during COVID-19 adaptive social protection packages were deployed at scale by many countries which had the means to do so.[62]

> Epidemics are bad enough for the society where they hit – pandemics are exponentially worse as their multiplying impacts spread across the planet.
>
> **Dr Maha El Rabbat,**
> *GPMB Board Member*

[iv] The importance of PHSM in controlling infectious diseases and their role as the first and sometimes only interventions available in pandemics were acknowledged at the 78th World Health Assembly.[56]

Photo credit: WHO / Christopher Black

Novel and reinvigorated *governance* that can better mobilize adaptive responses

KEY MESSAGES

- **Decision-making structures need to be more agile, inclusive, and able to navigate geopolitical and institutional challenges.**
- **A growing pandemic of mistrust is a key barrier to preparedness.**
- **Multilateral defences have been strengthened (including the amended IHR) and the WHO Pandemic Agreement) but at the same time multilateralism itself is being challenged.**
- **Growing complexity and shifting power in the global and regional health landscape present new challenges.**
- **International development assistance is unable to bridge health security and development goals on a sustainable and coordinated footing.**

The scale and reach of the COVID-19 pandemic acted as a catalyst for significant political shifts, challenging existing structures and prompting a re-evaluation of governance and international cooperation, as well as shaking public trust in political systems.[63]

The pandemic raised questions about the adequacy of existing international frameworks for collaboration and cooperation during health crises. The International Health Regulations (2005) (IHR) underwent extensive revisions following challenges around implementation of and compliance with the IHR, as well as early alert and data sharing. An updated instrument was adopted in May 2024. These changes created a new alert tier of 'pandemic emergency', strengthened obligations on States to report on health measures taken in response to outbreaks and share genomic sequence data, added new provisions on improving timely and equitable access to health products, and established a Coordinating Financial Mechanism.

In parallel, an Intergovernmental Negotiating Body (INB) drafted and negotiated the WHO Pandemic Agreement, which was adopted by the 78th World Health Assembly in May 2025.[64] The negotiations enabled countries to reconcile often widely differing national and interest group positions – a process made even more complex by the 84 national elections held in 2024. The willingness of countries to come to consensus on the agreement, in a world where multilateralism is under challenge more than ever, is a token of the scale of disruption caused by COVID-19 and the determination to prevent this impact from ever occurring again.

The IHR amendments and the WHO Pandemic Agreement responded to key weaknesses in the COVID-19 response and provide a stronger international framework for global collaboration and solidarity during future pandemics. However, the implementation of the amended IHR and WHO Pandemic Agreement will need to receive sustained attention to ensure that the vision and commitments set by WHO Member States are upheld.

We cannot build an effective global pandemic response without mutual trust. Strong partnerships are built not only on resources and plans, but on confidence in one another.

Ms Kolinda Grabar-Kitarović,
GPMB Co-Chair

Photo credit: WHO / Christopher Black

Box 2. Key provisions of the WHO Pandemic Agreement adopted by the World Health Assembly, 20 May 2025

- **Technology transfer to build local manufacturing capacity**, on a voluntary basis;
- **Greater national investment in surveillance**, laboratory systems, routine immunization, and infection prevention;
- **A global supply chain and logistics network** coordinated by WHO and partners with systems to track and respond to shortages in real time;
- **Integration of One Health approaches** to prevent zoonotic spillovers;
- **Progress reporting** on preparedness measures;
- **Establishment of a Conference of the Parties** to monitor implementation and facilitate compliance;
- **A Pathogen Access and Benefit-Sharing (PABS) system** so that countries will share pathogen samples and genetic sequence data in a timely manner and access medical countermeasures equitably, with 20% of real-time production of vaccines, diagnostics, and treatments reserved for global distribution — 10% as donations, 10% at affordable prices (detailed arrangements to be negotiated);
- **Once the PABS annex is agreed the WHO Pandemic Agreement will be open to countries to ratify** and it will come into force once 60 ratifications have been reached.

Source: WHA78.1. WHO Pandemic Agreement. In: Seventy-eighth World Health Assembly, Geneva, 19-27 May. Geneva: WHO; 2025:1 (WHA78/2025/R1; https://apps.who.int/gb/ebwha/pdf_files/WHA78/A78_R1-en.pdf, accessed 2 June 2025).

The significant weaknesses in global health governance and multilateralism laid bare by COVID-19 prompted debates about the governance required to tackle global health threats and the effectiveness of institutions such as WHO. The decision by some Member States to withdraw from WHO will have consequences for global coordination, though the full impact is not yet clear. Additionally, the perception — widespread in some countries — that multilateral approaches undermine national sovereignty poses a serious challenge to international cooperation.

Governance at global level requires the capacity to take a global approach to tackle a global threat, while at the same time enabling and empowering myriad local solutions. Together these will make a difference in disease transmission and mitigate the impact of pandemics.

Retreating to national boundaries flies in the face of increasing evidence of the planetary scale of the poly-crises engulfing the world. These crisis events, whether driven by pathogens or climate change, conflict or economic instability, exceed both national and sectoral boundaries, as cascading risks meld into one another. The result is a crisis of governance which is clearly inadequate to the planetary scale of emergencies. One response to the planetary scale of crises is to assert the principle of subsidiarity, where the most local level that is competent to address the crisis is empowered to do so.[65]

Complementing reshaped global health governance, COVID-19 has focused more attention on the role of actors at regional level. The African Union's Africa CDC launched in 2017 was a critical actor in the regional response to mpox and it has led efforts to strengthen continental capacities since, with notable success.[66,67] Similar experience of regional cooperation in the Caribbean during COVID-19 has accelerated strengthening of the Caribbean Public Health Agency's pandemic response capabilities, and both the Association of Southeast Asian Nations (ASEAN) with the Coordinating Council Working Group on Public Health Emergencies[68] and the European Union (EU) through its new Health Emergency Preparedness and Response Authority[69] have significantly boosted their multisectoral health emergency and preparedness capabilities.

The growing interconnections and interdependencies in global health have augmented the global health landscape but made it more challenging to coordinate an effective, articulated response. This complexity is further amplified during crises, when new and existing stakeholders take on evolving mandates, often leading to overlapping responsibilities, ambiguity and competition for the reduced funding currently available.

We need pandemic governance that is both structured and adaptable. Striking the right balance between top-down authority and horizontal collaboration is key to responding effectively.

Ms Joy Phumaphi,
GPMB Co-Chair

But if these challenges can be overcome there is considerable potential in the reinforcement of regional capabilities and increased cooperation between regional institutions to create overlapping safety nets that minimize the gaps in multisectoral health protection and support national multisectoral health security bodies.

Governance at all levels needs to be able to address the different dynamics of each wave of transmission with an equally dynamic response. COVID-19 showed that a pandemic event evolves in many waves of variable severity. Responses therefore need to scale up and down swiftly, with measures selected depending on transmission patterns, perceptions of the population and capacities to respond.

Governance at global level requires the capacity to take a global approach to tackle a global threat while at the same time enabling and empowering myriad local solutions, which together will make a difference in disease transmission and mitigate the impact of pandemics.[v,70,71,72]

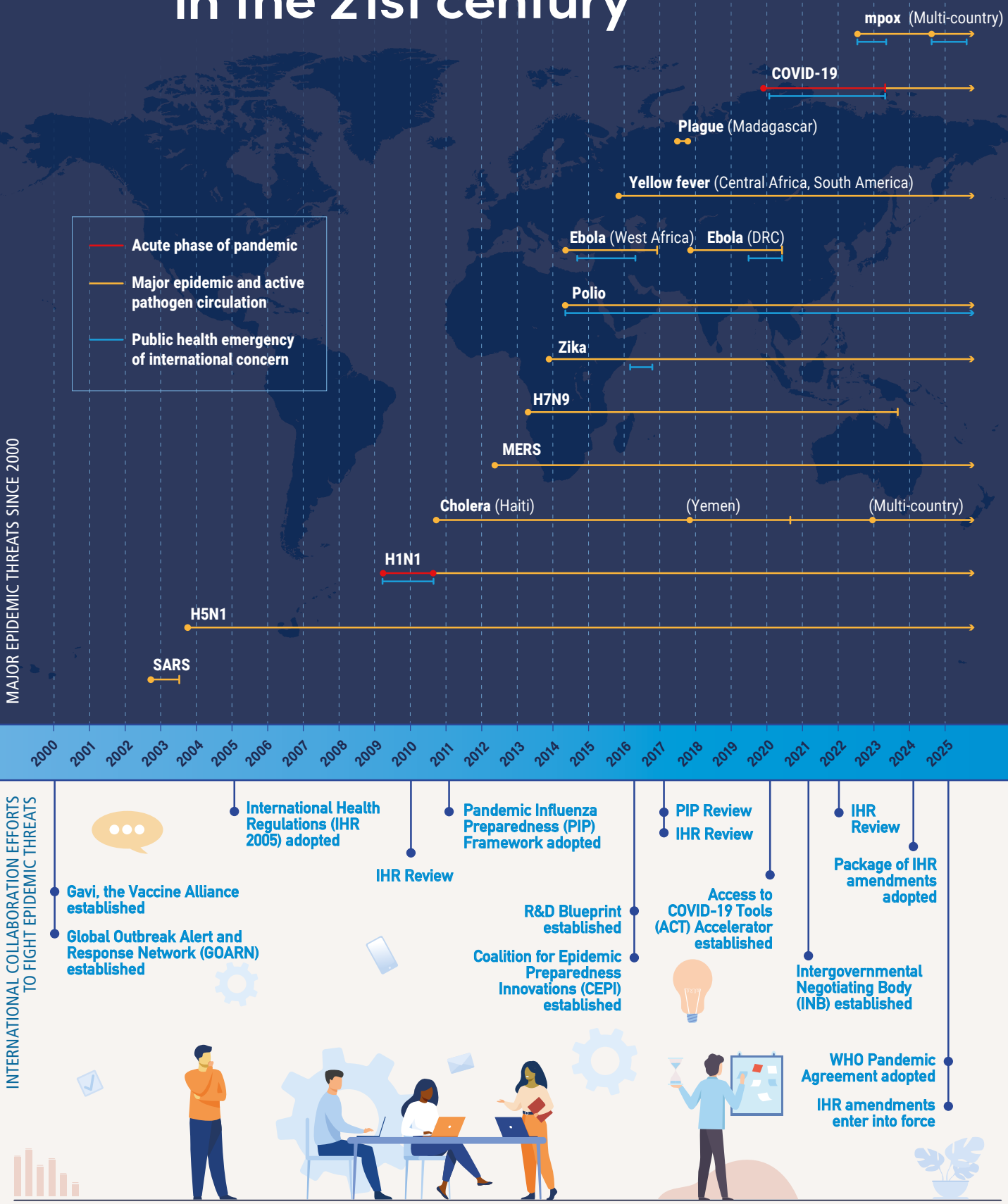
The real challenge lies in making this collaboration work in a landscape marked by geopolitical tensions, competing priorities, and mistrust. The combination of economic downturns and growing mistrust which has led to cuts in foreign aid — such as reductions by the US, the UK, and France — further undermines global solidarity and preparedness efforts in developing countries. Despite calls from some nations for stronger international collaboration, the rise of economic nationalism has had a domino effect on global public health financing. In an environment of shrinking international development assistance it is crucial that international financing mechanisms that support pandemic preparedness are streamlined to maximize their synergy and effectiveness, and to incentivize domestic investment in public health.

These mechanisms should function at the intersection of sustainable development and health system resilience, promoting long-term, coordinated investments rather than fragmented, short-term funding. The traditional divide between crisis and peacetime is no longer relevant, as the world now faces a period of overlapping crises (for example, see Figure 1). Investments in health must therefore simultaneously strengthen core health system capacities and enhance the specific capabilities needed for effective epidemic response.

[v] The Pandemic Agreement includes a Conference of the Parties (COP) comprising state and regional economic integration organization signatories, which "shall regularly take stock of the implementation of the WHO Pandemic Agreement and review its functioning every five years, and shall take the decisions necessary to promote its effective implementation."[70] The inclusion of a COP has been viewed as elevating the Treaty's governance.[71]

Figure 1.

Major *infectious threats* in the 21st century



Source: Updated and adapted from Timeline—Major infectious threats in the 21st century & associated collaboration mechanisms, Managing epidemics: key facts about major deadly diseases, second edition. Geneva: WHO; 2023, p4. Licence: CC BY-NC-SA 3.0 IGO, WHO/GPMB data. https://www.who.int/publications/i/item/9789240083196

Photo credit: monsitj on iStock

Data analytics for better *decision-making*

KEY MESSAGES

- **There are still gaps in impact measurement, in particular real-time health system impact assessment.**
- **Scenario planning and risk modelling can be used to prepare for a range of pandemic threats, supporting more flexible and adaptable response strategies.**
- **New technologies offer opportunities to improve decision-making and, in particular, to address unintended consequences of response measures (including environmental, mental health and social impacts).**
- **Interconnected global health intelligence platforms would facilitate the identification of anomalies for further investigation, tracking of threats and mapping of stakeholders, and enhance coordinated action.**

Better and more usable data holds substantial promise in guiding more effective pandemic response.

Considerable advances have been made over the past decade in data systems for epidemics and pandemics, including better assessment of impact. For example, during the 2009 H1N1 pandemic, there was no global system to collect real-time mortality data and it was challenging to standardize underlying risk factors, such as the definition of hypertension. As a result, measuring the impact on specific risk groups was difficult. In contrast, during COVID-19, significant strides were made in real-time mortality tracking and cross-country comparisons of epidemiological data.[73] However, measuring the number of cases and deaths does not fully capture the true burden of an epidemic.

Existing surveillance systems are primarily designed for outbreak detection and early response rather than crisis monitoring and impact assessment. To understand health impact additional factors must be considered, such as the duration of the crisis, its geographic spread, the age groups most affected, and the impact on health systems. And as health crises such as Zika and COVID-19 demonstrated, health consequences can persist long after the initial outbreak.[74,75,76]

Nevertheless, underreporting, limited surveillance and laboratory capacity, and variations in case definitions contribute to gaps in data. A particularly critical issue is the difficulty of assessing disease severity in the early stages of an outbreak, including hospitalization use.[vi,77]

New digital technologies and artificial intelligence (AI) are revolutionizing pandemic preparedness by improving modelling and simulation capabilities and creating the potential for more efficient decision-making.[78,79] AI-driven analytics can enhance early warning systems by detecting anomalies in disease surveillance data, predicting potential outbreaks, and simulating various intervention strategies.

[vi] Studies have shown that key indicators, such as the case fatality ratio (CFR), are often biased at the start of an epidemic and only become more accurate as more data becomes available.[77]

Photo credit: WHO / Egor Dubrovsky

> New technologies are essential for improving pandemic preparedness and response. But as we saw during COVID-19, their impact depends on two critical factors: public trust and equitable access. Without both, even the most advanced innovations can fall short.
>
> **Professor Victor Dzau,**
> *GPMB Board Member*

These tools can inform both preparedness planning and real-time response efforts, enabling decision-makers to adjust different aspects of a complex response in ways that maximize disease control while minimizing negative economic and social consequences. For example, AI tools can enhance risk communication and be deployed to manage infodemics.[80]

Given the uncertainty surrounding the timing and severity of the next pandemic, it is critical to enhance foresight capabilities and develop plausible future scenarios through scenario planning. This approach enables the creation of more flexible and adaptive preparedness plans that can be adjusted to a variety of possible circumstances, and the process of developing scenarios can foster greater collaboration between public and private sectors and between governments and communities. Advances in machine learning, big data analytics, and digital twins (virtual models that simulate real-world systems) can help refine scenario planning, optimize resource allocation, and improve situational awareness.

While innovations such as AI, simulation tools, and modelling offer hope for stronger preparedness and more effective investment strategies, they also require clear communication to both decision-makers and the public.[81] It is essential to explain how these tools are used to support decisions, what parameters and criteria are applied, and the sources of data involved.[vii,82]

[vii] The Responsible AI in Evidence Synthesis (RAISE) project published guidance and recommendations in June 2025. RAISE is led by individuals from the International Collaboration for Automation in Systematic Reviews (ICASR), Cochrane and Campbell, in collaboration with other relevant organizations.[82]

Politicians face the challenge of making decisions in an environment of uncertainty and fear. A major global pandemic revealed the tension between the need for decisive leadership grounded in the best available scientific guidance, and the inherent uncertainties embedded in the scientific process, which is built on doubt and evolving hypotheses before reaching consolidated knowledge. The failure to manage that tension resulted in a widening trust deficit between politicians and scientists during COVID-19.[83]

While evidence-based decision-making remains the best approach for an ethical and effective response, the interface between science and policy must adapt to the rapid spread of epidemics. Harnessing new technologies to quickly assess risks and generate reliable projections will help align scientific insights with the fast-paced demands of political decision-making. This requires sustained investment in the capacities of scientific institutions to support evidence-based, trusted, and relevant national decision-making, while also contributing to stronger global preparedness.[84] Data is a global public good that is the bedrock of pandemic preparedness.

If we adopt a culture of measurement, monitoring and evaluation in pandemic preparedness, we can improve the quality of data and strengthen our collective understanding of these global events — linking global patterns with local realities in a single, coherent view.

Dr Matthew Stone,
GPMB Board Member

Box 3. Progress in early warning systems

WHO has developed an effective system to detect and verify epidemic signals, collecting approximately 3,000 signals per month, assessing 300, and verifying around 30. This system allows for earlier containment of outbreaks, limiting the risk of epidemics. The graph below shows the number of acute public health events detected every year since 2011 either through WHO Member States reporting, or through the Epidemic Intelligence from Open Sources (EIOS) system, which detects signals from a variety of sources that are then verified by WHO. The system has improved over the years, especially after the Ebola outbreak in west Africa in 2015 (despite a major dip in 2020 during the COVID-19 pandemic), allowing the world to identify many events and contain them before they spread further and become epidemics.

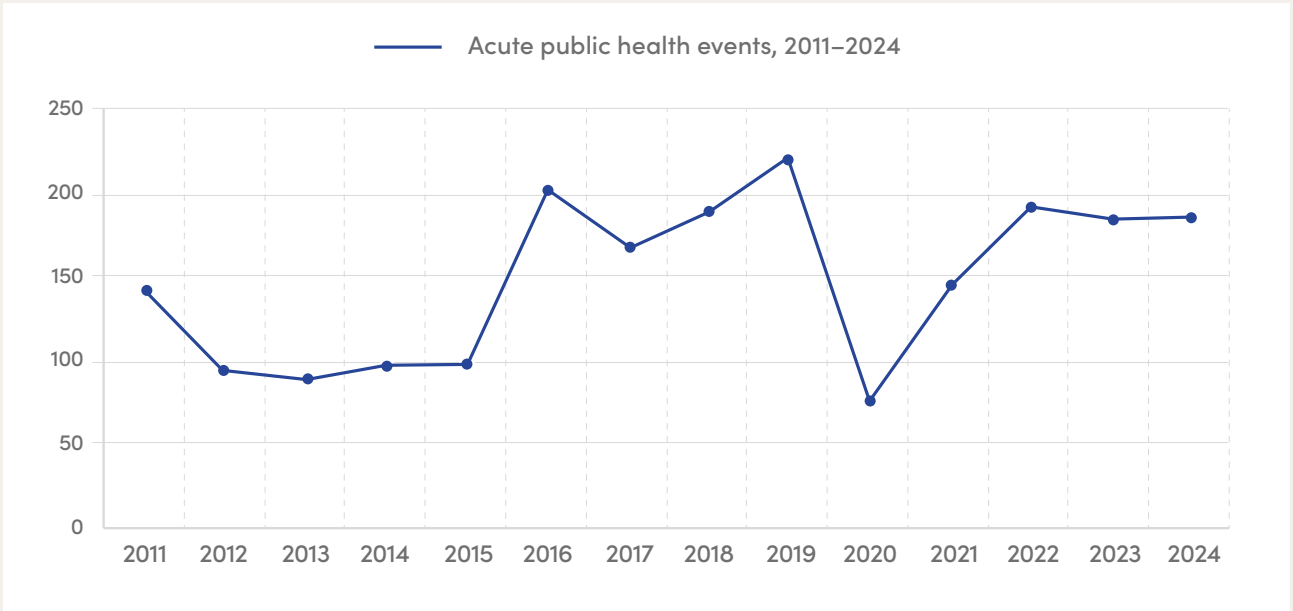


Photo credit: WHO / Rob Holden

Multisectoral *collaboration* for integrated preparedness

KEY MESSAGES

- **Health, agriculture, finance, and security systems must work together multisectorally to mitigate risks and deliver whole-of-society responses.**
- **One Health strategies are increasingly adopted at national level but challenges remain in their implementation.**
- **There is a lack of coordination and planning to mitigate impacts across economic, social, education, environmental and other domains relevant to pandemics.**

Given the domino effect of pandemics across all sectors of society, it is critical to enhance multisectoral preparedness and response.[85] While a pandemic initially impacts the health sector, its ripple effects quickly spread to the economy, education, transportation, and global supply chains, affecting entire societies and the world at large.[86,87,88,89] Siloed approaches not only do not work, they are actively counterproductive, undermining public trust and confidence in decision-making. Collaboration across sectors is needed along two axes: horizontally, between different economic and government sectors in every setting; and vertically, between different levels of government.

To address pandemic risk effectively, we must look beyond the health care sector and tackle risk drivers such as One Health challenges, inequities, misinformation ecosystems, and unsustainable farming practices, among others.[90] Strengthening preparedness requires a multisectoral approach that integrates public health, environmental sustainability, and social and economic resilience. Many countries are already developing specific agencies for health security that will enable this cross-sectoral collaboration and coordination.

Effective pandemic preparedness also requires strong collaboration across global, regional, national and local levels. In an interconnected world, cross-sectoral and multi-level coordination is not just a strategic advantage, it is a necessity.

> COVID-19 has deepened existing inequities. We know that inequities are the cracks through which viruses spread — weak points in the fabric of our societies.
>
> **Dr Jayati Ghosh,**
> *GPMB Board Member*

Photo credit: WHO / Jonathan Perugia

The adoption of a command-and-control approach in crisis response often overlooks the inclusion of local actors in preparedness efforts and fails to engage stakeholders beyond the public health sector in advance of an emergency. Yet, building collaborative, cross-sectoral, and cross-level partnerships before a crisis is essential for an effective whole-of-society response. These relationships must be established ahead of time to function smoothly during emergencies.

Strengthening preparedness requires a multisectoral approach that integrates public health, environmental sustainability, and social and economic resilience.

The defence sector is a paradigmatic command-and-control asset and for that reason many countries during COVID-19 deployed military forces in the response, with levels of involvement ranging from limited logistical support — such as for vaccination campaigns — to joint civil—military operations or even military-led responses. However, such involvement can be a double-edged sword: while it may enhance operational efficiency, it can also undermine public trust and compliance if not

Box 4. New multisectoral health security initiatives

- In 2024 India established a National Institute for One Health and National One Health Mission
- In 2025 the United States issued its five-year National One Health Framework
- Singapore created a new Communicable Disease Agency in 2025 to integrate various functions related to health security
- The UK Health Security Agency was formed in 2021
- Canada's Centre for Research on Pandemic Preparedness and Health Emergencies, created in 2022, saw its funding ramp up in 2023—2025
- Nigeria Centre for Disease Control and Prevention (CDC) expanded its remit to One Health in 2023
- Sierra Leone's new National Public Health Agency was inaugurated in 2023
- Bangladesh has a One Health Secretariat responsible for a 2025—2030 strategic framework

carefully managed.[91] To maximize the potential of defence and military security resources to contribute to pandemic response while averting the attendant pitfalls, clear ethical and operational frameworks are needed to guide military engagement during health crises and outbreak response.

Other sectors that bring key resources to pandemic response include the voluntary or non-profit sector (the 'third sector'), often able to mobilize and train large cadres of personnel in an emergency, as well as faith-based organizations, which have historically been important deliverers of health and social care more widely in countries of all income levels. Organizations representing minority ethnic groups were important sources of social support and trust-building during COVID-19. Indigenous groups often have their own sovereignty and governance mechanisms at local levels that are highly effective in providing targeted support for their own people, and while they may be recognized under national laws, they are often not well integrated into emergency management systems.

> Fear can prompt immediate action, but it is not a sustainable motivator for long-term health protection. It fades over time and can lead either to complacency or to harmful overreactions. Instead, we must invest in health literacy — empowering people to make informed choices about managing infectious risks.
>
> **Ms Henrietta Fore,**
> *GPMB Board Member*

Photo credit: WHO / Yoshi Shimizu

Critical *health response* capacities strengthened

KEY MESSAGES

- **Robust preparedness entails working simultaneously on strengthening core public health capacities and expanding threat-specific capabilities, such as better inventory management of essential assets.**
- **The health workforce has often found itself marginalized in pandemic preparedness and response decision-making.**
- **Greater knowledge exchange and international connections can serve to enhance preparedness and response capabilities.**

The complexity of today's world necessitates expanding the scope of preparedness beyond core public health capacities. While some countries were considered well prepared before COVID-19, they still struggled in their response.[92] This crisis highlighted a key lesson: generic preparedness capacities, while essential, are not sufficient. They must be complemented by pathogen-specific capabilities tailored to different types of threats.

For instance, preparing for a future respiratory pandemic requires stockpiling masks and other protective equipment, while a vector-borne outbreak may necessitate reserves of insecticides and vector control measures. However, these pathogen-specific capacities should be prioritized based on contextual risk assessments to ensure resources are allocated effectively. For example, temperate countries that are prone to seasonal influenza epidemics can focus on respiratory threats and have rotating stockpiles.

While the extension of research and development for emerging pathogens with pandemic potential is critical — for example, the Coalition for Epidemic Preparedness Innovations (CEPI) and R&D Blueprint — research into broad-spectrum and pathogen-agnostic countermeasures is also important. During the interpandemic period, greater investment in research and development of these countermeasures — such as immunomodulators and wide-spectrum antivirals, oxygen extractors, multiplex diagnostics platforms, air filters and improved masks — can help reduce the risk of severe disease and high mortality in future outbreaks.

> The health workforce is the backbone of the health system. We must protect, support, and care for health workers — they are our first line of defence and our safety net in times of crisis.
>
> **Dr Palitha Abeykoon**, *GPMB Board Member*

In a fragmented world, trust becomes the essential glue for collaboration. Without it, coordination fails.

Dr Maha El Rabbat,
GPMB Board Member

The COVID-19 pandemic highlighted the crucial role of the health workforce in care and in the implementation of public health measures, but the limited involvement that the health workforce has in preparedness efforts. The increased gap in the size of the health workforce and increased demands on that workforce experienced both during and since the acute phase of the COVID-19 pandemic is of concern. There is an urgent need to strengthen and update the capabilities of the health workforce, ensure their involvement in preparedness efforts, and make specific provision to protect the health workforce during crises.[93]

A growing body of evidence shows that civil society and community responses were pivotal — but uneven — during COVID-19. Many initiatives met with initial success but due to volunteer burnout, funding

Countries depend on others — not only to help control transmission but also to conduct rapid research and ensure access to countermeasures. This underscores the need to view preparedness as a shared responsibility across national, regional and global levels.

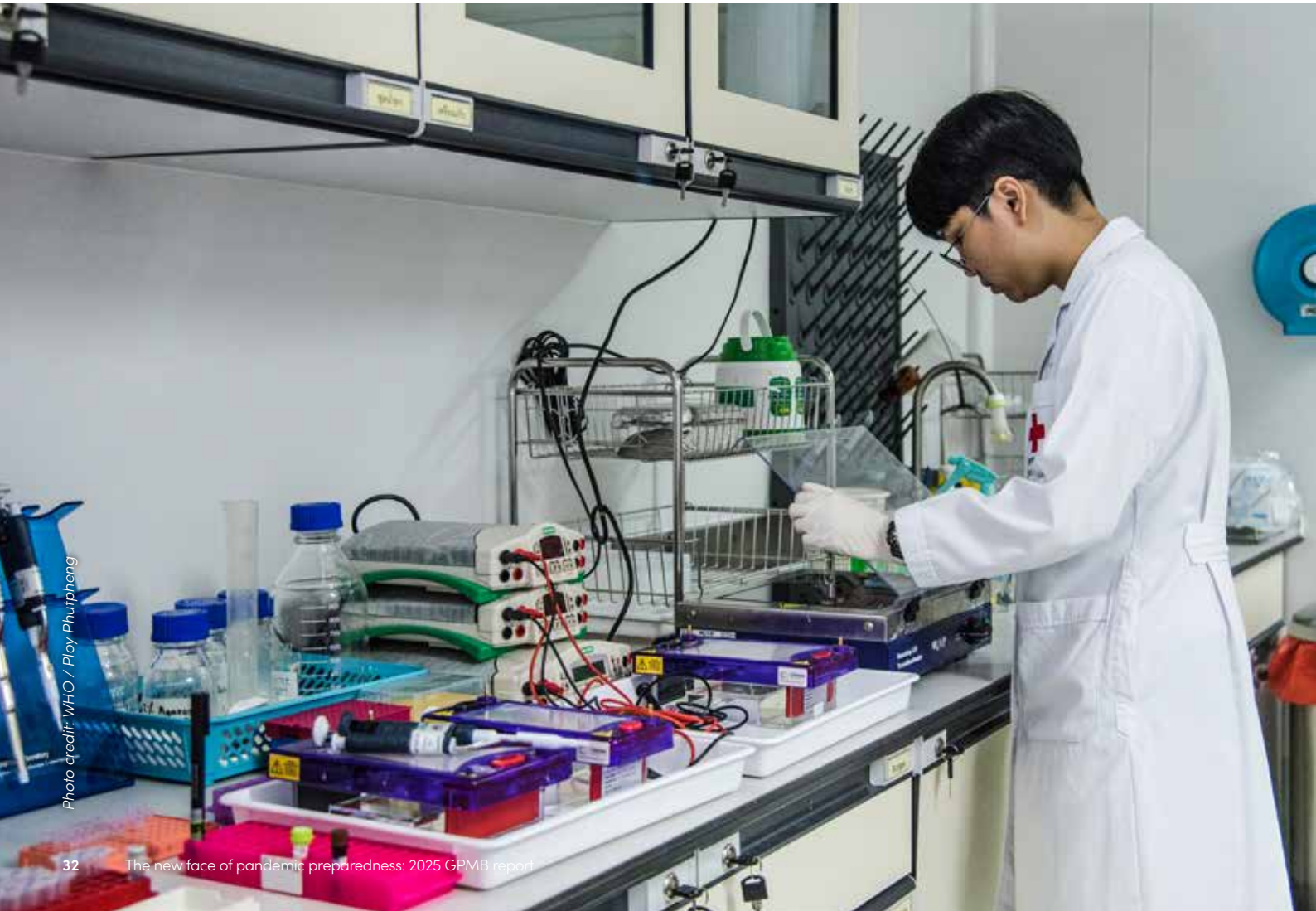


Photo credit: WHO / Ploy Phutpheng

Photo credit: WHO / Junior D. Kannah

shortfalls and weak links to government systems were unable to be sustained for more than a year.[94] Together, these analyses highlight a clear lesson: grassroots action is fastest and most trusted, but it needs to be integrated into formal preparedness architectures if it is to remain effective through protracted crises.

COVID-19 highlighted the limitations of addressing a pandemic solely from a national perspective. Countries depend on others — not only to help control transmission but also to conduct rapid research and ensure access to countermeasures. This underscores the need to view preparedness as a shared responsibility across national, regional and global levels. To take just one, albeit central, example, the health and research workforce: when pandemics strike, the maldistribution of human resources becomes a critical point of failure, highlighting the need for international health governance to tackle pervasive brain-drain issues. The established architecture of surge workforce provision is designed for relatively geographically sparse outbreaks, but rapidly failed in the case of COVID-19 when surge needs were experienced worldwide and simultaneously.

Responding to pandemics is more like playing football than tennis — it's a team sport. No country can do it alone. We need to train together, build trust, and move as one.

Sir Mark Lowcock,
GPMB Board Member

Part

2

LOOKING AHEAD:

strengthening

GLOBAL HEALTH SECURITY

The world's capability to respond effectively to inevitable new pandemics hangs in the balance. On the positive side of the ledger are massive technological advances in data analytics, the means to develop new vaccines and treatments rapidly, and a new global treaty that enshrines cooperative and coordinated threat responses. On the negative side are the explosion of misinformation, deepening mistrust, and geopolitical forces that threaten to divide the world and set some countries outside the framework of global collaboration.

To tip the balance towards health security, countries need to embrace an approach to pandemic threat grounded in three fundamental imperatives: CARE, MEASURE, and COOPERATE. These are the linchpins of global health security and hold the promise of a safer world for all.

Photo credit: Marcela García

care

Resilient systems that CARE for people and planet reinforce the first line of defence against health emergencies. They boost the capacity to prevent outbreaks from occurring in the first place, rapidly detect them if they do occur, and deploy multifaceted responses that can scale up in the face of uncertain epidemic dynamics. These systems should be tested in real-world conditions, with the support of mass community participation.

When humans stop
caring for one another,
humanity becomes
more fragile than ever.

Ms Bente Angell-Hansen,
GPMB Board Member

A fundamentally new orientation to preparedness is needed, organized around the concept of care. Taking its cues from the primary health care approach, a care response will help overcome the dichotomy between, on the one hand, pharmaceutical responses and on the other hand, public health and social responses, and instead see them as an interactive and adaptive duo that maximize health and well-being and mitigate risk and unintended consequences. A care approach combines care for people and planet, incorporating One Health perspectives. Care is deployed first and foremost at community level where it maximizes early detection, minimizes early harms, and enhances good communication and trust-building. Care requires sufficient resourcing and needs the bias of resource allocation towards tertiary-level institutions to be reversed.

Future pandemics are inevitable. With increased global mobility, dense urban populations, and extensive movement of animals, outbreaks will likely spread faster and farther than before.[95] Countries have different levels of resources with which to respond, but many of the issues are common to all. Global efforts to eliminate persistent epidemic diseases must continue until they are removed as public health threats. Demographic change with ageing populations and the rising burden of chronic illnesses create additional points of vulnerability that require proactive mitigation strategies.

Primary health care approaches at the local level will remain the first line of defence. Most pandemics begin with an unusual cluster of cases — or more often, deaths — and early recognition by a well-trained and well-protected health workforce is critical. Health systems must be ready for shocks — not only to detect and contain outbreaks using enhanced surveillance and PHSM, but to care for those affected.

Regular simulation exercises for the care system that engage health workers and communities will help to build trust, improve health system literacy, and reduce fear-based behaviours during emergencies. Meanwhile, seasonal and recurring outbreaks can be leveraged as opportunities to test and strengthen care capacities, especially at the primary care level, ensuring readiness before the next large-scale crisis hits.

Investing in resilient health systems with strong primary health care should be seen as an asset and not a cost. It serves as both a long-term preparedness strategy and a short-term benefit to population health. There is an estimated shortfall in pandemic preparedness funding incorporating care approaches of US$ 10.5 billion annually in international funding.[96] Cutting health system funding now would increase vulnerability and leave countries exposed to infectious disease crises that can quickly disrupt all sectors of society and have a long-lasting systemic impact on societies and economies. Investment in resilient health systems is an insurance policy for the global future.

Photo credit: WHO / Christopher Black

measure

A robust toolbox of pandemics metrics must include impact indicators that can be applied in real time to guide response decision-making, including measures of: health system resilience to shocks; anticipated and actual public health and social measures across sectors; and social impact, including trust. Early warning systems, nowcasting and foresight are also vital tools. Preparedness efforts need to include estimation of potential costs and model costs averted under different scenarios.

Many of the
transformations
we see today were either
triggered or accelerated by
COVID-19.
Its effects continue to
shape our world.

Professor Naoko Ishii,
GPMB Board Member

Pandemic response demands adaptive, real-time monitoring tools that empower whole-of-society responses. To be really useful to decision-making, data must be integrated across epidemiological, social, environmental and economic domains.

The growing complexity of pandemic response — driven by the interconnectedness of countries, sectors, and systems — demands a more robust, dynamic, and context-sensitive set of indicators.

Measuring the social impacts of pandemics remains a major blind spot. Public health and social measures are vital tools, but their effectiveness depends on timely, context-sensitive implementation and real-time evaluation. Better tools are needed to assess not only the implementation of these measures but also their outcomes — both positive and negative — across different sectors. This includes evaluating their cost-effectiveness and social acceptability.

There is a need to develop indicators that capture both the short- and long-term effects of public health and social measures on social cohesion, trust, and education, sensitive to their differentiated impact on specific population groups such as minorities, youth, and older adults. This entails integrating data across sectors to assess how public health and social measures affect other areas such as transportation, education, and tourism.

Pandemics are, by definition, global events. As the interconnectedness of countries and sectors increases, so too does the need for a comprehensive, multidimensional approach to monitoring pandemic risk and protecting global health security.

While numerous agencies and initiatives are already involved in tracking risks, vulnerabilities and capacities, the resulting landscape — though rich — is fragmented and complex. What is missing is a streamlined, coherent mechanism to synthesize information in a way that supports decision-making. Political leaders and policy-makers require a clear, integrated view of pandemic risk and the vulnerabilities that must be addressed in order to prioritize preparedness efforts effectively, especially in a context of limited resources.

Monitoring pandemic risk at global level is therefore essential — not only to detect emerging infectious threats, but also to assess systemic vulnerabilities that shape the spread and severity of outbreaks. These include weaknesses in health systems, infrastructure and governance, as well as broader social, technological, economic, environmental, and political (STEEP) risk drivers.[97]

Photo credit: AndreyPopov on iStock

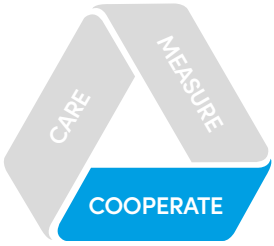
Photo credit: dem10 on iStock

The COVID-19 pandemic demonstrated the potential of digital tools and innovative technologies to enhance surveillance, modelling, and nowcasting. However, further progress is needed to develop reliable indicators that capture the full impact on health systems, particularly in terms of health workforce capacity, system strain, and long-term service disruptions. Even relatively simple response elements such as availability of personal protective equipment or the supply of oxygen can become critical points of failure at the height of pandemics and should be monitored.

Improved tools are needed to monitor the evolving dynamics of a pandemic and to support cost-effective, adaptive decision-making. Enhanced dashboards and scenario-based planning tools — drawing on integrated information systems — can support more flexible and strategic responses throughout multiple pandemic waves.

Estimates of potential costs, and modelling of costs averted under different scenarios, in the short-, medium- and long-term should be incorporated into preparedness efforts. Early warning systems, nowcasting and foresight should be included in the measurement toolbox.

Improved financial metrics are essential to assess the return on investment in preparedness and to build the economic case for sustained funding in global health security. Without clear, credible data on the costs and benefits of preparedness and response measures, it will remain difficult to attract and maintain the attention of policy-makers and investors.



cooperate

A pandemic is a global event that requires all countries to cooperate in the sharing of information, implementation of responses and development of countermeasures. Cooperation enhances national sovereignty by giving countries better capacity to confront risk but also necessitates adopting common frameworks that establish mutual and reciprocal obligations.

Cooperation
during a pandemic
may seem obvious, but it
doesn't happen automatically.
It must be cultivated during
times of peace through trust
and dialogue, and reinforced in
times of crisis through
formal agreements and clear
rules of engagement.

Dr Chris Elias,
GPMB Board Member

Photo credit: WHO / Antoine Tardy

Pathogens, both existing and emerging, circulate globally. A robust global health architecture that applies universally, enhances protection through mutual support, and creates incentives for sharing of data and knowledge is needed to underpin risk management.

In today's world, collaboration is increasingly challenged — both between countries and among development aid partners — due to the spillover of commercial tensions into the health sector, inward-looking national policies, and a reduction in international aid.

The COVID-19 pandemic accelerated a number of transformations in the global health architecture. The post-COVID era is characterized by rising economic pressures and a reduction in foreign aid, which has increased inequities — especially where domestic funding has not compensated for declining international support. This environment has also intensified competition for limited resources, sometimes prompting agencies to shift mandates to align with donor priorities. Meanwhile, we are seeing a trend toward multipolarity and greater regionalization, reflected in the emergence or strengthening of several regional health agencies. This is a positive step toward localized capacity, but requires management of the new challenges it presents in relation to coordination and definition of clear mandates across global, regional, national, and local levels.

At the global level the WHO Pandemic Agreement represents a significant advance. If countries adopt its annex on a Pathogen Access and Benefit-sharing system and ratify and implement the agreement, it will build on the existing International Health Regulations (2005), helping to address key gaps and establish more structured and equitable mechanisms for international cooperation. Its core features enshrining equity, technology sharing, strengthened supply chains and transparent oversight address precisely the gaps that undermined the COVID-19 response.

The WHO Pandemic Agreement has created a generational opportunity to strengthen pandemic governance for the entire planet. The moment the treaty receives the ratifications that will bring it into force will represent an irreversible inflection point in global health security, but even before that moment countries can already build the practical systems of reporting, measuring and cooperation which are at the heart of the agreement.

A GLOBAL MECHANISM TO ASSESS RISK:

Pandemic risk observatory

The Global Preparedness Monitoring Board calls for the development of a global Pandemic Risk Observatory.

This observatory would be a global mechanism to consolidate and align analyses conducted by various entities, offering an overarching view of pandemic risks. This observatory would enable policy-makers to access timely, accurate, and relevant insights to guide preparedness and response strategies.

Such a mechanism should align with international frameworks, including the International Health Regulations and the new WHO Pandemic Agreement, to ensure complementarity and reinforce their effectiveness. Its governance should reflect the current realities of the global health architecture and include meaningful participation from national, regional and international actors.

To be effective, the observatory must receive sustained political and financial support to ensure its independence, neutrality and impartiality. It should be mandated to monitor trends in pandemic risk drivers, assess global vulnerabilities, and provide actionable information to guide strategic planning and investment in preparedness across all levels, thus protecting global health security.

Photo credit: herraez on iStock

Conclusion

The advances in medicine and the incredible opportunities offered by new technologies give reason to hope that pandemics of the future will be less lethal and will have less impact on health systems. However, the impact of future pandemics on our societies is likely to increase, despite these medical and analytic advances.

The impact of pandemics will increase when advances in pandemic-fighting tools are not distributed equitably according to need, and when responses fail to make the connections between what happens in the clinic or laboratory and what happens on the street and in the community. Microbes exploit human vulnerabilities such as mistrust, conflict, inequities, and lack of international collaboration, allowing them to spread more rapidly and further undermine our social fabric.

A clear understanding of global vulnerabilities and strengths, combined with proactive investment in preparedness and collective action, can make a meaningful difference. Monitoring progress is essential to support continuous learning and strengthen our collective ability to respond to future pandemics.

GPMB Monitoring Framework for Preparedness

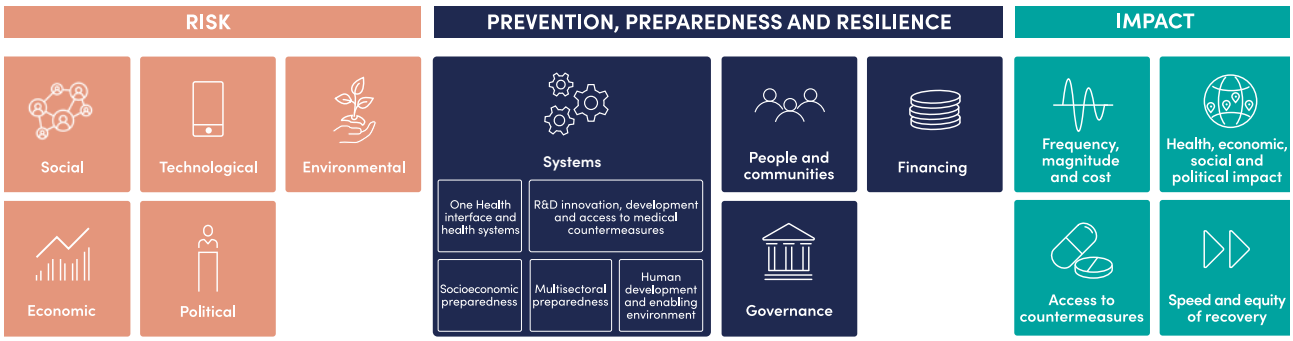
The GPMB published its Monitoring Framework for Preparedness in May 2023, following two years of development and broad consultation. The Framework provides a multisectoral, whole-of-society assessment of pandemic risks, capacities, and impacts at global, regional, and national levels. It features 90 indicators grouped into three dimensions: Risk; Prevention, Preparedness and Resilience; and Impact.

- **Risk** includes 15 indicators across five pillars — Social, Technological, Economic, Environmental, and Political determinants.
- **Prevention, Preparedness and Resilience** comprises 70 indicators assessing systems, governance, financing, and community capacities, using both quantitative and qualitative data to evaluate readiness.
- **Impact** includes five indicators measuring the consequences of health emergencies, including outbreak frequency, severity, and their health, social, economic, and political effects — with a focus on recovery speed and equity.

The GPMB uses the Framework to inform its reporting: the 2023 report assessed 30 indicators that the GPMB identified as most pertinent to equity, leadership and accountability, and coherence; the 2024 report examined the global state of pandemic risk; and the 2025 report focuses on impact, drawing on this dimension to highlight the shifts needed in preparedness efforts.

The Framework is designed to evolve, incorporating emerging risks and new evidence to ensure it remains relevant, predictive, and action-oriented.

High-level structure of the Monitoring Framework



GPMB purpose and membership

The GPMB is an independent monitoring and accountability body to ensure preparedness for global health crises, co-convened by the World Health Organization and the World Bank Group. The Board provides an independent and comprehensive appraisal for leaders, key policy-makers and the world on system-wide progress towards increased preparedness and response capacity for disease outbreaks and other emergencies with health consequences. The Board monitors and reports on the state of global preparedness across all sectors and stakeholders, including the UN system, government, non-governmental organizations, and the private sector.

CO-CHAIRS

Ms Kolinda Grabar-Kitarović
GPMB Co-Chair and former President of Croatia

Ms Joy Phumaphi
GPMB Co-Chair and former Minister of Health of Botswana

BOARD MEMBERS

Dr Palitha Abeykoon
Senior Advisor to the Ministry of Health of Sri Lanka and a former WHO Special Envoy for COVID-19 Preparedness and Response

Dr Ibrahim Abubakar
Vice Provost for Health at University College London (UCL) and Professor of Infectious Disease Epidemiology

Ms Bente Angell-Hansen
Former diplomat of Norway and former President of the EFTA Surveillance Authority

Professor Victor J. Dzau
President of the United States National Academy of Medicine and Vice-Chair of the US National Research Council

Dr Maha El Rabbat
Former Minister of Health and Population of Egypt and former WHO Special Envoy for COVID-19 Preparedness and Response

Dr Chris Elias
President of the Global Development Program at the Gates Foundation and former President and CEO of PATH

Dr Zijian Feng
Professor and PhD Supervisor, School of Public Health and Emergency Management, Southern University of Science and Technology; Vice President of the Chinese Preventive Medicine Association; Senior Research Fellow of the Chinese Center for Disease Control and Prevention

Ms Henrietta Fore
Former Executive Director of UNICEF, former USAID Administrator, and CEO & Chairman, Holsman International

Dr Jayati Ghosh
Professor of Economics at the University of Massachusetts Amherst

Professor Naoko Ishii
Former Deputy Vice Minister of Finance of Japan and Professor and Executive Vice President at the University of Tokyo

Professor Ilona Kickbusch
Founder and Chair of the Global Health Centre at the Graduate Institute of International and Development Studies in Geneva

Sir Mark Lowcock
Former Head of the UN Office for the Coordination of Humanitarian Affairs and former Permanent Secretary of the UK Department for International Development

Dr Matthew Stone
Veterinary epidemiologist and former Deputy Director-General – International Standards and Science at the World Organisation for Animal Health (WOAH)

Abbreviations

ACT-A	Access to COVID-19 Tools (ACT) Accelerator
Africa CDC	Africa Centres for Disease Control and Prevention
AI	Artificial intelligence
AIDS	Acquired Immune Deficiency Syndrome
ASEAN	Association of Southeast Asian Nations
CEPI	Coalition for Epidemic Preparedness Innovations
CFR	Case fatality rate
COP	Conference of the Parties (the supreme decision-making body of an international convention)
COVID-19	Coronavirus disease
EIOS	Epidemic Intelligence from Open Sources
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FSIN	Food Security Information Network
FTE	Full-time equivalent
G20	Group of Twenty
Gavi	Gavi, the Vaccine Alliance
GDP	Gross Domestic Product
HERA	Health Emergency Preparedness and Response Authority
HFTF	Health and Finance Taskforce
HIV	Human Immunodeficiency Virus
IFRC	International Federation of Red Cross and Red Crescent Societies
IHR	International Health Regulations
INB	Intergovernmental Negotiating Body
mpox	formerly known as monkeypox
ODA	Official Development Assistance
PABS	Pathogen Access and Benefit-Sharing
PHC	Primary health care
PHSM	Public health and social measures
R&D	Research and development
SARS-CoV-1	Severe acute respiratory syndrome coronavirus, first strain
STEEP	Social, technological, economic, environmental, and political
UN	United Nations
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VUCA	Volatility, Uncertainty, Complexity, Ambiguity
WHA	World Health Assembly
WHO	World Health Organization
WOAH	World Organisation for Animal Health

Acknowledgements

The GPMB is sincerely grateful to the Director-General of the World Health Organization and to the President of the World Bank Group for co-convening the Global Preparedness Monitoring Board.

The GPMB extends its warmest thanks to the following individuals for their time and expertise, which were invaluable in the development of this report:

Anne-Claire Amprou, Ambassador for Global Health, France; **Lisa Indar**, Executive Director, Caribbean Public Health Agency, Trinidad and Tobago; **Palitha Karunapema**, Director, Health Information Unit, Ministry of Health, Sri Lanka; **Esther Krofah**, Executive Vice President, Health, Milken Institute; **Vernon Lee**, CEO, Communicable Diseases Agency (CDA), Singapore; **Julian Madeley**, Director General, World Egg Organisation; **Lwazi Manzi**, Head of Secretariat, African Union COVID-19 Commission; **Sania Nishtar**, CEO, Gavi, the Vaccine Alliance; **David Reddy**, Director General, International Federation of Pharmaceutical Manufacturers and Associations (IFPMA); **John-Arne Røttingen**, CEO, Wellcome; **Tomoya Saito**, Director, Center for Emergency Preparedness and Response, National Institute of Infectious Diseases, Japan Institute for Health Security; **Mika Salminen**, Director General, National Institute for Health and Welfare, Finland; **Carsten Schicker**, CEO, World Health Summit; **Viroj Tangcharoensathien**, Advisor, International Health Policy Program, Thai Ministry of Public Health; **Eloise Todd**, Executive Director, Pandemic Action Network

The GPMB is deeply grateful to the following individuals who supported the creation of this report:

GPMB SECRETARIAT

Grace Acayo; **Hélène Binet**; **Dr Sylvie Briand**, Director; **Tim Corrigan**; **Nga Eichrodt**; **Maaya Kita**; **Amélie Rioux**; **Laetitia Sieffert**

Consultants:
Michael Bartos, Lead editing; **Lara Carim**, Editorial support; **Vivian Lee**, Design and layout

WORLD HEALTH ORGANIZATION

Oluwatosin Akande; **Adedoyin Abiola Awofisayo-Okuyelu**; **Supriya Bezbaruh**; **James Campbell**, Director, Health Workforce; **Stella Chungong**, Director, Health Security Preparedness; **Giorgio Cometto**; **Nedret Emiroglu**, Director, Country Readiness Strengthening; **Abdou Salam Gueye**, Regional Emergency Director, Regional Office for Africa (AFRO); **Esther Hamblion**; **Aspen Hammond**; **Nirmal Kandel**; **Olivier Le Polain**; **Abdi Rahman Mahamud**, Deputy Director, Alert and Response Coordination; **Peter Omondi Mala**; **Scott Pendergast**, Director, Strategic Planning and Partnerships; **Michael Ryan**, Deputy Director-General and Executive Director, WHO Emergencies Programme; **Gina Samaan**, Regional Emergency Director, Regional Office for the Western Pacific (WPRO); **Kai von Arbou**

WORLD BANK

Magnus Lindelow, Global Lead for Pandemic Preparedness, Health, Nutrition & Population; **Juan Pablo Uribe**, Global Director for Health, Nutrition & Population, Director of the Global Financing Facility

Finally, the GPMB is deeply grateful for the financial support provided to the GPMB Secretariat by the **Government of Norway**, the **Gates Foundation**, the **Institute of Philanthropy** and the **World Health Organization**.

References

1 The COVID decade: understanding the long-term societal impacts of COVID-19. London: British Academy; 2021. doi:10.5871/bac19stf/9780856726583.001.

2 Hosseinzadeh P, Zareipour M, Baljani E, Moradali MR. Social consequences of the COVID-19 pandemic. A systematic review. Invest Educ Enferm, 2023;40(1). doi:10.17533/udea.iee.v40n1e10.

3 Saka O. The political scar of epidemics: why COVID-19 is eroding young people's trust in their leaders. In: London School of Economics and Political Science (LSE) [website]. London: LSE; 7 September 2021 (https://www.lse.ac.uk/research/research-for-the-world/politics/the-political-scar-of-epidemics-why-covid-19-is-eroding-young-peoples-trust-in-their-leaders-and-political-institutions, accessed 9 May 2025).

4 New index shows governments worldwide stoked an inequality explosion during COVID-19 pandemic. In: Oxfam [website]. Nairobi: Oxfam International; 11 October 2022 (https://www.oxfam.org/en/press-releases/new-index-shows-governments-worldwide-stoked-inequality-explosion-during-covid-19, accessed 8 May 2025).

5 Conceptual framework for public health and social measures in the context of infectious disease transmission. Geneva: WHO, February 2024 (https://cdn.who.int/media/docs/default-source/documents/epp/phsm/phsm-concept-framework_brochure_final.pdf?sfvrsn=743ace98_1, accessed 16 June 2025).

6 Chen M, Rogan M, Sen K, editors. COVID-19 and the informal economy. Oxford: Oxford University Press; 2024. doi:10.1093/oso/9780198887041.001.0001.

7 Fadlallah R, El-Jardali F, Karroum LB, Kalach N, Hoteit R, Aoun A et al. The effects of public health and social measures (PHSM) implemented during the COVID-19 pandemic: an overview of systematic reviews. Cochrane Evid Synth Methods. 2024;2(5):e12055. doi:10.1002/cesm.12055.

8 WHA78.48. Third report of Committee A, Agenda item 17.1 Strengthening the evidence-base for public health and social measures. In: Seventy-eighth World Health Assembly, Geneva, 19-27 May. Geneva: WHO; 2025;48 (WHA78/2025/48; https://apps.who.int/gb/ebwha/pdf_files/WHA78/A78_48-en.pdf, accessed 2 June 2025).

9 Runciman D. Rage, waste and corruption: how Covid changed politics. The Guardian. 7 March 2024 (https://www.theguardian.com/world/2024/mar/07/how-covid-changed-politics, accessed 9 May 2025).

10 Cologna V, Mede NG, Berger S, Besley J, Brick C, Joubert M et al. Trust in scientists and their role in society across 68 countries. Nat Hum Behav. 2025; 9:713–730. doi:10.1038/s41562-024-02090-5.

11 Larson HJ, Eagan RL, Bowers AP, Smilingyte I, de Figueiredo A, Coulter A et al. Building public trust in preparation for future health shocks: a research agenda. BMJ. 2024;387:e078464. doi:10.1136/bmj-2023-078464.

12 Preventing the next human influenza pandemic: Celebrating 10 years of the Pandemic Influenza Preparedness Framework. In: WHO News [website]. Geneva: WHO; 21 May 2021 (https://www.who.int/news/item/21-05-2021-preventing-the-next-human-influenza-pandemic-celebrating-10-years-of-the-pandemic-influenza-preparedness-framework, accessed 12 May 2025).

13 HIV and AIDS fact sheet. In: WHO News [website]. Geneva: WHO, 22 July 2024 (https://www.who.int/news-room/fact-sheets/detail/hiv-aids, accessed 21 May 2025).

14 First global estimates of 2009 H1N1 pandemic mortality released by CDC-led collaboration. In: US Centers for Disease Control and Prevention (US CDC) [website]. Washington (DC): US CDC; 25 June 2012 (https://www.cdc.gov/flu/spotlights/pandemic-global-estimates.htm, accessed 21 May 2025).

15 Dawood FS, Iuliano D, Reed C, Meltzer MI, Shay DK, Cheng P-Y et al. Estimated global mortality associated with the first 12 months of 2009 pandemic influenza A H1N1 virus circulation: a modelling study. Lancet Infec Dis. 2012;12(9):687-695. doi:10.1016/S1473-3099(12)70121-4.

16 Managing epidemics: key facts about major deadly diseases, second edition. Geneva: WHO; 2023 (https://www.who.int/publications/i/item/9789240083196, accessed 21 May 2025).

17 Zika virus fact sheet. In: WHO News [website]. Geneva: WHO; 8 December 2022 (https://www.who.int/news-room/fact-sheets/detail/zika-virus, accessed 22 May 2025).

18 Multi-country outbreak of mpox, External situation report #52 - 14 May 2025. Geneva: WHO, 14 May 2025 (https://www.who.int/publications/m/item/multi-country-outbreak-of-mpox--external-situation-report--52---14-may-2025, accessed 22 May 2025).

19 Cuffari B. How has the COVID-19 pandemic impacted global health? In: News Medical Life Sciences [website]. Manchester: News-Medical.Net, AZoNetwork UK; 5 July 2022 (https://www.news-medical.net/health/How-has-the-COVID-19-Pandemic-Impacted-Global-Health.aspx, accessed 12 May 2025).

20 Hosseinzadeh P, Zareipour M, Baljani E, Moradali MR. Social consequences of the COVID-19 pandemic. A systematic review. Invest Educ Enferm, 2023;40(1). doi: 10.17533/udea.iee.v40n1e10.

21 GPMB monitoring framework for preparedness: technical framework and methodology. Global Preparedness Monitoring Board, Geneva: WHO, 2023 (https://www.gpmb.org/reports/m/item/gpmb-monitoring-framework-full, accessed 21 May 2025).

22 WHO Director-General's opening remarks at the media briefing – 5 May 2023. In: WHO News [website]. Geneva: WHO; 5 May 2023 (https://www.who.int/news-room/speeches/item/who-director-general-s-opening-remarks-at-the-media-briefing---5-may-2023, accessed 24 June 2025).

23 COVID-19 epidemiological update – 12 March 2025. In: WHO [website]. Geneva: WHO, 17 March 2025 (https://www.who.int/publications/m/item/covid-19-epidemiological-update-edition-177, accessed 2 June 2025).

24 COVID-19 pandemic triggers 25% increase in prevalence of anxiety and depression worldwide. In: WHO News [website]. Geneva: WHO; 2 March 2022 (https://www.who.int/news/item/02-03-2022-covid-19-pandemic-triggers-25-increase-in-prevalence-of-anxiety-and-depression-worldwide, accessed 18 May 2025).

25 Comprehensive mental health action plan 2013–2030. Geneva: WHO; 2021. (https://iris.who.int/bitstream/handle/10665/345301/9789240031029-eng.pdf?sequence=1; accessed 21 May 2025).

26 The impacts of long COVID across OECD countries (Health Working Paper No. 163). Paris: Organisation for Economic Co-operation and Development (OECD); 2024 (https://one.oecd.org/document/DELSA/HEA/WD/HWP(2024)3/en/pdf, accessed 18 May 2025).

27 ibid.

28 COVID-19 pandemic leads to major backsliding on childhood vaccinations, new WHO, UNICEF data shows. In: WHO News [website]. Geneva: WHO; 15 July 2021 (https://www.who.int/news/item/15-07-2021-covid-19-pandemic-leads-to-major-backsliding-on-childhood-vaccinations-new-who-unicef-data-shows, accessed 24 June 2025).

29 Hartner A-M, Li X, Echeverria-Londono S, Roth J, Abbas K, Auzenbergs M et al. Estimating the health effects of COVID-19-related immunisation disruptions in 112 countries during 2020–30: a modelling study. Lancet Glob Health. 2024;12(4):E563–E571. doi:10.1016/S2214-109X(23)00603-4.

30 One year into COVID-19 education disruption: Where do we stand? In: United Nations Educational, Scientific and Cultural Organization (UNESCO) [website]. Paris: UNESCO; 19 March 2021 (https://www.unesco.org/en/articles/one-year-covid-19-education-disruption-where-do-we-stand, accessed 24 June 2025).

31 At least 130 million children continue to face class closures five years after COVID-19 shut schools around the world. In: Save the Children [website]. London: Save the Children; 11 March 2025 (https://www.savethechildren.net/news/least-130-million-children-continue-face-class-closures-five-years-after-covid-19-shut-schools, accessed 25 June 2025).

32 Measuring the shadow pandemic: violence against women during COVID-19. New York: UN Women; 2021 (https://data.unwomen.org/sites/default/files/documents/Publications/Measuring-shadow-pandemic.pdf, accessed 18 May 2025).

33 Update on UNFPA response to the COVID-19 pandemic. In: United Nations Population Fund (UNFPA) [website]. New York: UNFPA; January 2021 (https://www.unfpa.org/update-unfpa-response-covid-19-pandemic, accessed 24 June 2025).

34 Ten million additional girls at risk of child marriage due to COVID-19. In: UNICEF [website]. New York: UNICEF; 7 March 2021 (https://www.unicef.org/press-releases/10-million-additional-girls-risk-child-marriage-due-covid-19, accessed 21 May 2025).

35 ibid.

36 Stacy B. Rebuilding economies after COVID-19: will countries recover? In: World Bank Blogs [website]. Washington (DC): World Bank; 6 September 2023 (https://blogs.worldbank.org/en/opendata/rebuilding-economies-after-covid-19-will-countries-recover, accessed 24 June 2025).

37 World Social Report 2024: Rebuilding trust in a fractured world. New York: United Nations Department of Economic and Social Affairs (UN DESA); 2024 (https://desapublications.un.org/publications/world-social-report-2024-0, accessed 18 May 2025).

38 Gaspar V, Medas P, Perrelli R. Global debt reaches a record $226 trillion. In: International Monetary Fund (IMF) Blog. Washington (DC): IMF; 15 December 2021 (https://meetings.imf.org/en/IMF/Home/Blogs/Articles/2021/12/15/blog-global-debt-reaches-a-record-226-trillion, accessed 24 June 2025).

39 ibid.

40 Poverty and Shared Prosperity 2022: Correcting Course. Washington (DC): World Bank Group, 2022. doi:10.1596/978-1-4648-1893-6.

41 The Sustainable Development Goals Report 2022, SDG 1: End poverty in all its forms. In: UN Statistics Division [website]. New York: UN DESA; 7 July 2022 (https://unstats.un.org/sdgs/report/2022/goal-01/, accessed 24 June 2025).

42 Alfani F, Aron DV, Atamanov A, Aguilar RAC, Diaz-Bonilla C, Devpura NP et al. Global poverty monitoring technical note 44: June 2025 update to the Poverty and Inequality Platform (PIP). Washington (DC): World Bank; June 2025 (https://documents1.worldbank.org/curated/en/099510306052516849/pdf/IDU-eb272b02-ecd1-4633-9e37-9297e20a711c.pdf, accessed 24 June 2025).

43 FAO, International Fund for Agricultural Development (IFAD), United Nations Children's Fund (UNICEF), World Food Programme (WFP) and WHO. 2023. The State of Food Security and Nutrition in the World 2023, Chapter 2: Food security and nutrition around the world. Rome, FAO. doi:10.4060/cc3017en.

44 ibid.

45 COVID-19: ILO Monitor – 7th edition: Uncertain and uneven recovery expected following unprecedented labour market crisis. Geneva: International Labour Organization (ILO); 25 January 2021 (https://www.ilo.org/resource/news/ilo-uncertain-and-uneven-recovery-expected-following-unprecedented-labour, accessed 24 June 2025).

46 Lund S, Madgavkar A, Manyika J, Smit S, Ellingrud K, Robinson O. The future of work after COVID-19. New York: McKinsey Global Institute; 18 February 2021 (https://www.mckinsey.com/featured-insights/future-of-work/the-future-of-work-after-covid-19, accessed 24 June 2025).

47 Meier D, Patkee P, Strange A. The future of excess mortality after COVID-19. Zurich: Swiss Re Institute; 2024 (https://www.swissre.com/institute/research/topics-and-risk-dialogues/health-and-longevity/covid-19-pandemic-synonymous-excess-mortality.html; accessed 21 May 2025).

48 Barber HF. Developing strategic leadership: the US army war college experience. Journal of Management Development. 1992;11(6):4-12. doi:10.1108/02621719210018208.

49 Johansen B. Leaders make the future: ten new leadership skills for an uncertain world. San Francisco: Berrett-Koehler, 2007.

50 Marburg virus disease – United Republic of Tanzania. In: WHO Disease Outbreak News [website]. Geneva: WHO; 2 June 2023 (https://www.who.int/emergencies/disease-outbreak-news/item/2023-DON471, accessed 9 May 2025).

51 Kickbusch I, Piselli D, Agrawal A, Balicer R, Banner O, Adelhardt M et al. The Lancet and Financial Times Commission on governing health futures 2030: growing up in a digital world. Lancet. 2021;398(10312):1727-1776. doi:10.1016/S0140-6736(21)01824-9.

52 WHA78.49. Third report of Committee B, Agenda item 24.2 Global strategy on digital health 2020–2025: extension. In Seventy-eighth World Health Assembly, Geneva, 19-27 May. Geneva: WHO; 2025;49 (WHA78/2025/49; https://apps.who.int/gb/ebwha/pdf_files/WHA78/A78_49-en.pdf, accessed 2 June 2025).

53 Kpodar K, Mlachila M, Quayyum S, Gammadigbe V. Defying the odds: remittances during the COVID-19 pandemic. The Journal of Development Studies. 2022;59(5):673–690. doi:10.1080/00220388.2022.2154150.

54 One Health timeline. In: Food and Agriculture Organization of the UN (UN FAO) [website]. Rome: UN FAO, 2025 (https://www.fao.org/one-health/highlights/one-health-timeline/en, accessed 22 May 2025).

55 One Health. In: World Organisation for Animal Health (WOAH) [website]. Paris: WOAH, 2025 (https://www.woah.org/en/what-we-do/global-initiatives/one-health/, accessed 22 May 2025).

56 WHA78.48. Third report of Committee A, Agenda item 17.1 Strengthening the evidence-base for public health and social measures. In: Seventy-eighth World Health Assembly, Geneva, 19–27 May. Geneva: WHO; 2025;48 (WHA78/2025/48; https://apps.who.int/gb/ebwha/pdf_files/WHA78/A78_48-en.pdf, accessed 2 June 2025).

57 WHA78.48. Third report of Committee A, Agenda item 17.1 Strengthening the evidence-base for public health and social measures. In: Seventy-eighth World Health Assembly, Geneva, 19–27 May. Geneva: WHO; 2025;48 (WHA78/2025/48; https://apps.who.int/gb/ebwha/pdf_files/WHA78/A78_48-en.pdf, accessed 2 June 2025).

58 van der Zwet K, Barros AI, van Engers TM, Sloot PMA. Emergence of protests during the COVID-19 pandemic: quantitative models to explore the contributions of societal conditions. Humanit Soc Sci Commun. 2022;9(68). doi:10.1057/s41599-022-01082-y.

59 Mercea D, Saker M, Santos FG. Protesting the lockdown: geo-indexing a movement publicly opposing Covid-19 policies on Facebook. Soc Mov Stud. 2024;23(6):695–718. doi:10.1080/14742837.2024.2336957.

60 Newey S, Gulland A, Smith N. Plague and protests: how Covid has sparked a wave of unrest around the world. The Telegraph. 25 July 2021 (https://www.telegraph.co.uk/global-health/terror-and-security/plague-protests-pandemic-has-sparked-wave-unrest-around-world/, accessed 22 May 2025).

61 Tharoor I. The pandemic leads to another summer of anger. The Washington Post. 30 July 2021. (https://www.washingtonpost.com/world/2021/07/30/pandemic-leads-another-summer-anger/, accessed 22 May 2025).

62 Gentilini U, Almenfi M, Blomquist J, Dale P, De la Flor Giuffra L, Desai V et al. Social protection and jobs responses to COVID-19: a real-time review of country measures. "Living paper", version 15. Washington (DC): World Bank, 14 May 2021. (https://documents.worldbank.org/curated/en/281531621024684216/pdf/Social-Protection-and-Jobs-Responses-to-COVID-19-A-Real-Time-Review-of-Country-Measures.pdf, accessed 30 May 2025).

63 Kickbusch I, Kirton J, editors. Health: a political choice – building resilience and trust. London: Global Governance Project, GT Media Group; 2024 (https://edition.pagesuite-professional.co.uk/html5/reader/production/default.aspx?pubname=&edid=4739a6bd-3618-4bc2-ad39-950773db138e, accessed 9 May 2025).

64 WHA78.1. WHO Pandemic Agreement. In: Seventy-eighth World Health Assembly, Geneva, 19–27 May. Geneva: WHO; 2025:1 (WHA78/2025/R1; https://apps.who.int/gb/ebwha/pdf_files/WHA78/A78_R1-en.pdf, accessed 2 June 2025).

65 Blake JS, Gilman N. Children of a modest star: planetary thinking for an age of crisis. Redwood City CA: Stanford University Press; 2004.

66 Africa CDC and WHO update mpox strategy as outbreaks persist. In: WHO News [website]. Geneva: WHO; 17 April 2025 (https://www.who.int/news/item/17-04-2025-africa-cdc-and-who-update-mpox-strategy-as-outbreaks-persist, accessed 2 June 2025).

67 Abdulrahim A, Gulumbe BH, Idris I, Abubakar TM, Sobur KA, Lawal AI et al. Strengthening global health preparedness amid mpox spread in Africa. Discov Public Health. 2025;22(9). doi:10.1186/s12982-025-00392-1.

68 Declaration of the Special ASEAN Summit on Coronavirus Disease 2019 (COVID-19). In: Association of Southeast Asian Nations (ASEAN) [website]. Jakarta: ASEAN, 14 April 2020 (https://asean.org/wp-content/uploads/2021/09/FINAL-Declaration-of-the-Special-ASEAN-Summit-on-COVID-19.pdf, accessed 30 May 2025).

69 Health Emergency Preparedness and Response Authority fact sheet. In: Public Health, European Commission (EC) [website]. Brussels: EC (https://health.ec.europa.eu/document/download/b5a6ba4e-ccc3-4a70-8a94-97f6332fa9df_en?filename=hera_general_factsheet_en.pdf, accessed 30 May 2025).

70 WHA78.10, Chapter 3, Article 19, item 2 in Annex: Intergovernmental Negotiating Body to draft and negotiate a WHO convention, agreement or other international instrument on pandemic prevention, preparedness and response. In: Seventy-eighth World Health Assembly, Geneva, 14 May 2025. Geneva: WHO (A78/10; https://apps.who.int/gb/ebwha/pdf_files/WHA78/A78_10-en.pdf, accessed 2 June 2025).

71 Schwalbe N, Hannon E, Gilby L, Lehtimaki S. Governance provisions in the WHO Pandemic Agreement draft. Lancet. 2024;403(10434):1333-1334. doi:10.1016/S0140-6736(24)00585-3.

72 Defining community protection. Geneva: WHO; 2024 (https://iris.who.int/bitstream/handle/10665/379055/9789240096134-eng.pdf, accessed 20 May 2025).

73 Mathieu E, Ritchie H, Rodés-Guirao L, Appel C, Gavrilov D, Giattino C et al. Coronavirus (COVID-19) Deaths. In: Our World in Data [website]. Oxford: Global Change Data Lab, 2024 (https://ourworldindata.org/covid-deaths, accessed 9 May 2025).

74 Foo S-S, Chen W, Azamor T, Jung KL, Cambou MC, Familiar-Macedo D et al. Sustained chronic inflammation and altered childhood vaccine responses in children exposed to Zika virus. eBioMedicine. 2024;106:105249. doi:10.1016/j.ebiom.2024.105249.

75 Leung TYM, Chan AYL, Chan EW, Chan VKY, Chui CSL, Cowling BJ et al. Short- and potential long-term adverse health outcomes of COVID-19: a rapid review. Emerg Microbes Infect. 2020;9(1):2190–2199. doi:10.1080/22221751.2020.1825914.

76 Giesbrecht G, Lebel C, Tomfohr-Madsen L. 'Pandemic babies' turn 5: Here's what research tells us about their development and remarkable resilience. The Conversation, 12 March 2025 (https://theconversation.com/pandemic-babies-turn-5-heres-what-research-tells-us-about-their-development-and-remarkable-resilience-251507, accessed 8 May 2025).

77 Farooq Z, Sjödin H, Rocklöv J, Brännström A. Improving case fatality ratio estimates in ongoing pandemics through case-to-death time distribution analysis. Sci Rep. 2025;15:5402. doi:10.1038/s41598-025-89441-y.

78 Ali O, AlAhmad A, Kahtan H. A review of advanced technologies available to improve the healthcare performance during COVID-19 pandemic. Procedia Comput Sci. 2023;217:205-216. doi:10.1016/j.procs.2022.12.216.

79 WHA78.49. Third report of Committee B, Agenda item 24.2 Global strategy on digital health 2020–2025: extension. In Seventy-eighth World Health Assembly, Geneva, 19–27 May. Geneva: WHO; 2025;49 (WHA78/2025/49; https://apps.who.int/gb/ebwha/pdf_files/WHA78/A78_49-en.pdf, accessed 2 June 2025).

80 Mahl D, Schäfer MS, Voinea SA, Adib K, Duncan B, Salvi C et al. Responsible artificial intelligence in public health: a Delphi study on risk communication, community engagement and infodemic management. BMJ Glob Health. 2025;10:e018545. doi:10.1136/bmjgh-2024-018545.

81 Kickbusch I, Piselli D, Agrawal A, Balicer R, Banner O, Adelhardt A et al. The Lancet and Financial Times Commission on governing health futures 2030: growing up in a digital world. The Lancet. 2021;398(10312):1727-1776. doi:10.1016/S0140-6736(21)01824-9.

82 Thomas J, Flemyng E, Noel-Storr A. et al. Responsible AI in Evidence Synthesis (RAISE): guidance and recommendations (version 2; updated 3 June 2025). In: Open Science Framework [website]. Washington (DC): Center for Open Science (https://osf.io/fwaud/, accessed 13 June 2025).

83 Advising governments about science is essential but difficult. So train people to do it. Nature. 2024;636(8041):8. doi:10.1038/d41586-024-03910-4.

84 WHA78.51. Fifth report of Committee A, Agenda item 13.3 Strengthening national capacities in evidence-based decision making for the uptake and impact of norms and standards. In: Seventy-eighth World Health Assembly, Geneva, 19-27 May. Geneva: WHO; 2025;51 (WHA78/2025/51; https://apps.who.int/gb/ebwha/pdf_files/WHA78/A78_51-en.pdf, accessed 2 June 2025).

85 Chief Public Health Officer of Canada's report on the state of public health in Canada 2023: creating the conditions for resilient communities. Ottawa: Public Health Agency of Canada; 2023 (https://www.canada.ca/content/dam/phac-aspc/documents/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/state-public-health-canada-2023/report/report.pdf; accessed 12 May 2025).

86 Inside Story: How has Covid-19 impacted global economy? [television programme]. Doha: Al Jazeera English; 13 December 2021 (https://www.youtube.com/watch?v=3hnEKDfbNTk, accessed 8 May 2025).

87 Gidal J, BloodBros. Understanding the economic shock of the Covid-19 crisis [video]. Brighton, MA: Harvard Business Review; 21 May 2020 (https://www.youtube.com/watch?v=RK2IfGPSqO0, accessed 8 May 2025).

88 McKibbin WJ, Fernando R. The global macroeconomic impacts of COVID-19: seven scenarios. CAMA Working Paper No. 19/2020. SSRN. 2 March 2020. doi:10.2139/ssrn.3547729.

89 Baars C, Büll A, Peters S, Bardenhagen K, Benson JK, Boelinger M et al. The pandemic spreads: how the coronavirus is changing the world [television programme]. Bonn: Deutsche Welle; 1 September 2020 (https://www.youtube.com/watch?v=UrcDLopNPV8, accessed 8 May 2025).

90 The Changing Face of Pandemic Risk: 2024 GPMB Pandemic Risk Report. Global Preparedness Monitoring Board, Geneva: World Health Organization; 2024 (https://www.gpmb.org/reports/report-2024, accessed 20 May 2025).

91 Gibson-Fall F. Military responses to COVID-19, emerging trends in global civil–military engagements. Rev Int Stud. 2021;47(2):155-170. doi:10.1017/S0260210521000048.

92 Prasiska DI, Osei KM, Chapagain DD, Rajaguru V, Kim TH, Kang SJ et al. The Global Health Security Index and its role in shaping national COVID-19 response capacities: a scoping review. Ann Glob Health. 2025;91(1):15. doi:10.5334/aogh.4625.

93 WHA78.53. Sixth report of Committee A, Agenda item 13.7 Accelerating action on the global health and care workforce by 2030. In: Seventy-eighth World Health Assembly, Geneva, 19-27 May. Geneva: WHO; 2025;53 (WHA78/2025/53; https://apps.who.int/gb/ebwha/pdf_files/WHA78/A78_53-en.pdf, accessed 2 June 2025).

94 Wu Y, Zhang Q, Li M, Mao Q, Li L. Global experiences of community responses to COVID-19: a systematic literature review. Front Pub Health, 19 July 2022 Sec. Infectious Diseases: Epidemiology and Prevention; 2022;10. doi:10.3389/fpubh.2022.907732.

95 The Changing Face of Pandemic Risk: 2024 GPMB Pandemic Risk Report. Global Preparedness Monitoring Board, Geneva: World Health Organization; 2024 (https://www.gpmb.org/reports/report-2024, accessed 20 May 2025).

96 Analysis of Pandemic Preparedness and Response (PPR) architecture, financing needs, gaps and mechanisms. Paper for the G20 Joint Finance & Health Task Force. Geneva/Washington (DC): World Health Organization, World Bank; 22 March 2022 (https://thedocs.worldbank.org/en/doc/5760109c4db174ff90a8dfa7d025644a-0290032022/original/G20-Gaps-in-PPR-Financing-Mechanisms-WHO-and-WB-pdf.pdf, accessed 30 May 2025).

97 The Changing Face of Pandemic Risk: 2024 GPMB Pandemic Risk Report. Global Preparedness Monitoring Board, Geneva: World Health Organization; 2024 (https://www.gpmb.org/reports/report-2024, accessed 20 May 2025).

GPMB
GLOBAL PREPAREDNESS MONITORING BOARD

Global Preparedness Monitoring Board Secretariat
c/o World Health Organization
20 Avenue Appia
1211 Geneva 27, Switzerland

gpmbsecretariat@who.int

@TheGPMB
@global-preparedness-monitoring-board

gpmb.org