GLOBAL REPORT ON THE FRAMEWORK FOR HEALTH, SOCIAL AND ECONOMIC VULNERABILITIES AND RISKS (FEVR) RELATED TO PANDEMICS

World Health Organization/World Bank with inputs from the Organisation for Economic Co-operation and Development

1 October 2025

Contents

Solidarity   Equality   Sustainability

Acronyms

AMR	Antimicrobial Resistance
DRM	Domestic Resource Mobilization
FCV	Fragile, Conflict-Affected, and Vulnerable
FEVR	Framework for Health, Social and Economic Vulnerabilities and Risks
FTM	Financial Tracking Mechanism
GDP	Gross Domestic Product
GISRS	Global Influenza Surveillance and Response System
IHR	International Health Regulations
IVPP	influenza viruses with Pandemic Potential
JEE	Joint External Evaluation
JFHTF	Joint Finance and Health Taskforce
MOH	Ministry of Health
NAP	National Action Plan
NAPHS	National Action Plan for health security
NPHA	National Public Health Agencies
NPHI	National Public Health Institutes
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
PFM	Public Financial Management
PHSM	Public Health and Social Measures
PPR	Pandemic Preparedness and Response
PRET	Preparedness and Resilience for Emerging Threats
SDH	Social Determinants of Health
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization

Solidarity   Equality   Sustainability

1. Executive Summary

While the unprecedented global economic impact of COVID-19 is fading, continuing work to better understand and integrate the economic risks and vulnerabilities to pandemics in policy development and decision-making is ongoing to enable countries to better prepare for and respond to pandemics in a comprehensive and systematic way. The Framework for Health, Social and Economic Vulnerabilities and Risks (FEVR) was launched in 2023 to help policymakers assess and address the interlinked risks and vulnerabilities that shape national and global decisions to pandemic outcomes. This 2025 Global Report on FEVR provides an update to the last global report, including an analysis of global risks and vulnerabilities observed from 2022 to 2025. The report seeks to address four main questions: What do we understand to be the most significant pathogen threats and their impacts? How can countries use FEVR to better address vulnerabilities and risks and mitigate pandemic impacts? How prepared are countries to respond to future pathogen threats and pandemics? How can we better address the inequities exposed by pandemics?

Pandemic risk reflects the likelihood and potential impact of widespread infectious disease outbreaks on health, economies, and societies, driven by the interaction of hazards (pathogen threats), vulnerabilities (health, social, economic conditions), and preparedness and response capacities (infrastructure and institutions). While the large-scale global response to COVID-19 has waned, persistent and emerging threats, especially respiratory viruses, alongside ongoing vulnerabilities such as poverty, conflict, climate change, antimicrobial resistance (AMR) and weak health systems, continue to heighten pandemic risks globally. Recent data show that infectious diseases remain the predominant cause of acute public health events, with significant regional variation in risk and detection capacity.

FEVR illuminates the dynamic interplay between current risks and vulnerabilities, and the potential policy actions and investment needs to strengthen preparedness and resilience of health systems. Country case examples illustrate how FEVR diagnoses diverse vulnerabilities from fragile health infrastructure and economic shocks in a conflict-affected low-income setting to economic dependencies and social protection gaps in a middle-income context, informing tailored strategies to mitigate pandemic impacts. Effective application of FEVR in countries requires an enabling environment grounded in strengthening national data systems, building institutional capacity, embedding FEVR into existing governance structures, and fostering equity-focused, cross-sectoral planning. The recent mpox outbreak response underscores the value of FEVR, while highlighting the need to complement FEVR insights with other assessments to provide a comprehensive overview of preparedness and response capacities. Integrating FEVR into national planning transforms preparedness from reactive crisis management to proactive, risk-informed decision-making.

Past outbreaks revealed significant gaps in global and national health emergency preparedness, prompting the G20 under South Africa's presidency to prioritize strengthening National Public Health Agencies and Institutes (NPHAs/NPHIs) as pivotal institutions for pandemic preparedness and response (PPR). Effective PPR depends on coordinated governance across diverse health and non-health sectors, with NPHAs/NPHIs playing a central role despite varying legal mandates and institutional arrangements. Domestic resource mobilization is critical for fiscal sustainability in low- and middle-income countries, as tax revenues remain low. Declining Official Development Assistance (ODA), especially in low- and middle-income countries heavily reliant on external funding, further underscore the urgent need to diversify financing sources and

enhance national and regional-level capacities. Multisectoral coordination mechanisms, anchored in frameworks including the International Health Regulations (IHR) 2005, the WHO Pandemic Agreement 2025, and initiatives such as the Preparedness and Resilience for Emerging Threats (PRET), are a way forward for integrating social, economic, and health vulnerabilities into preparedness efforts. Institutional readiness should incorporate a One Health approach - an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems - while also addressing AMR through inclusive, equity-focused strategies. Ensuring sustained pandemic readiness requires countries to codify NPHA roles, align plans with global frameworks, embed social determinants into PPR strategies, and prioritize innovative financing while strengthening data-driven, multisectoral coordination and governance.

Social determinants of health (SDHs), the conditions in which people are born, grow, live, work, and age, play a critical role in health outcomes and equity. Pandemics and other public health emergencies expose and exacerbate inequalities, disproportionately affecting marginalized groups, those with insecure income, overcrowded housing, limited access to water, sanitation, hygiene (WASH), and those facing discrimination. Evidence from past pandemics and outbreaks highlights that policies addressing SDHs not only mitigate the immediate impact of crises but also strengthen systems for upstream protection, reducing vulnerability and accelerating recovery. Key policy levers include robust social protection systems that secure income and basic services, especially for the informal sector and marginalized populations; sustained investment in WASH infrastructure to prevent disease transmission and support healthcare delivery; affordable and adequate housing to reduce crowding and improve health outcomes; accessible, inclusive education to promote resilience and equity; and targeted efforts to combat structural discrimination to build trust and ensure equitable access to health and social services.

Under the G20 South African presidency, the 2025 Global Report on FEVR advances the analytical foundation established in the 2023/2024 report, focusing on overcoming challenges in applying the updated framework and its 23 indicators at the country level. The report proposes policy options for countries to consider, recognizing that the recommendations are not mandatory and that FEVR remains a supportive, non-binding tool. Acknowledging the dynamic and interdependent nature of FEVR indicators, the report calls for concrete next steps in operationalizing FEVR by 1) partnering with one country willing to leverage existing data to assess vulnerabilities and outcomes, using a whole-of-government approach; 2) integrating FEVR into policy and planning processes; and 3) securing dedicated resources to support country-specific analyses and multisectoral engagement, a critical next step in the operationalization of FEVR. The successful operationalization of FEVR is important for identifying and addressing the underlying vulnerabilities that drive pandemic risk, and guiding strategic action/investments across health, social, and economic sectors.

2. Introduction

The COVID-19 pandemic and other recent public health emergencies, including Ebola, Zika, and mpox, have had profound impacts on health, society, and the economy, significantly altering economic growth patterns, increasing financial hardships, and affecting social and economic indicators across all countries.*(1)* Health security is increasingly at risk as health systems, whether under-resourced or well-resourced, face persistent challenges in maintaining essential health services while responding to acute and protracted public health emergencies. These growing threats are further exacerbated by systemic vulnerabilities that are interconnected and mutually reinforcing.

Social protection, critical for safeguarding communities, provides benefit to individuals on the basis of vulnerabilities faced across the life cycle (e.g., unemployment, disability, maternity, etc.) and to those suffering general poverty and social exclusion. *(2)* Currently, only 46% of the global population is covered by at least one social protection benefit, leaving 4.1 billion people, approximately 53% of the world's population, without coverage.*(3)* The 2014 Ebola epidemic resulted in an estimated economic loss of between US$ 2.8 billion and US$ 32.6 billion in the affected West African countries.*(4,5)* Outside West Africa, limited studies examined the broader impact of the outbreak. One analysis from the United States of America estimated more than US$2 billion in economic losses and the loss of over 10,000 export-related jobs.*(6)* During COVID-19, global labor income in 2020 is estimated to have declined by 8.3%, amounting to US$3.7 trillion or 4.4% of global gross domestic product (GDP), underscoring the critical link between health and economic stability. *(7)*

Against this backdrop, the 2025 Global Report on FEVR introduces a strengthened analytical framing. This framing defines pandemic risk as the probability and magnitude of negative health, social, and economic impacts of a pandemic. This risk is a dynamic function of three key components:

- Hazards - the presence, severity, and likelihood of pathogen threats, including respiratory viruses, zoonoses, and antimicrobial-resistant organisms.

- Vulnerabilities - the underlying health, social, and economic conditions that amplify the impact of hazards, such as poverty, food insecurity, and weak health systems.

- Capacities - the institutional, infrastructural, and human capabilities that enable societies to anticipate, respond to, and recover from pandemic events.

As part of the 2023 G20 Indian Presidency, FEVR was established as a key component of the G20 Joint Finance Health Task Force (JFHTF) mandate.*(8)* An essential principle of the FEVR framework is that risks can be mitigated through enhanced capacities. FEVR was developed to support policymakers to understand and mitigate the health, social and macroeconomic vulnerabilities and risks related to pandemics. The Framework is intended to guide health and finance policymakers in addressing two key questions:

- What are the current risks, vulnerabilities and impacts associated with future pandemic scenarios, and what are the potential policy actions to strengthen institutional capacity, coordination, and legislation, and the investments required to maximize preparedness and resilience and to minimize the health, social and economic impacts?

- In the context of a response to future pandemic scenarios, what are the types of policy responses and associated costs required, as well as the differential health, social and economic outcomes of different mitigation measures?

An initial set of 16 indicators was identified to guide the assessment of economic vulnerabilities and risks due to pandemics (Annex 1).*(8)* These indicators, which were identified through a scoping review and suitability assessment, showed strong correlation with economic outcomes, specifically GDP per capita and changes in GDP per capita during the COVID-19 pandemic.

The work in 2023 provided the foundation which underpinned the 2024 Global Report on FEVR presented in Brazil.*(9)* The evolution from an initial set of 16 indicators to the current 23 reflects a progressive understanding of pandemic vulnerabilities and their dynamic nature. The indicators span three critical domains: health, economic and fiscal conditions, and social determinants of health. The selection of these 23 indicators involved a rigorous methodology including correlation analysis of historical data, analytical modelling, and extensive feedback from technical experts and academics. This process aimed to ensure the indicators represent the complex linkages between underlying vulnerabilities and the health and economic outcomes observed during pandemics.

The refined set of 23 indicators incorporates a broader analytical approach to further refine the list and better understand the relationships and possible causal pathways between vulnerabilities and outcomes.*(9)* This expansion notably includes an enhanced focus on SDHs, with specific indicators such as access to water and sanitation, educational attainment, proportion of urban population living in slums, social protection coverage, internet access, food insecurity levels, and the prevalence of informal employment. This shift acknowledges that factors like inadequate housing in urban slums directly influence baseline population health and susceptibility to socioeconomic vulnerabilities, as well as disease transmission rates (in the case of past pandemic), need for stringent public health and social measures (PHSMs) and the capacity of populations to adhere to PHSMs. Consequently, these social determinants affect both health outcomes and economic stability, making the FEVR a more holistic and representative framework for assessing pandemic risk. The list of 23 indicators is provided in Annex 2.

FEVR is not only a diagnostic tool but a strategic planning instrument. It enables countries to simulate pandemic scenarios, stress-test systems, and prioritize investments. The voluntary integration of FEVR into national planning and budgetary frameworks transforms preparedness from reactive crisis management to proactive, risk-informed decision-making.

The purpose of the 2025 Global Report on FEVR is to provide an update to the last global report, including an analysis of global risks and vulnerabilities observed from 2022 to 2025 and the operationalization of FEVR. Policy recommendations are presented to increase awareness of vulnerabilities, identify policies that can strengthen pandemic preparedness and response (PPR), and demonstrate progress over time.

The 2025 report aims to address four main questions –

1. What do we understand to be the most significant pathogen threats and their impacts?

2. How can countries use FEVR to better address vulnerabilities and risks and mitigate pandemic impacts?

3. How prepared are countries to respond to future pathogen threats and pandemics?

4. How can we better address the inequities exposed by pandemics?

The four questions outlined shape the scope and structure of this 2025 FEVR report. The chapters begin with an overview of pandemic-related risks and vulnerabilities, drawing from recent global trends and emerging pathogen threats. Building on this, the report further explores how FEVR can be applied to support country-level decision-making for PPR, using two distinct country settings. A case example using mpox illustrates how FEVR can be applied to inform policy and investment actions in addressing pandemic related-risks. This is followed by an expanded discussion on institutional capacities and equity, which are critical to ensuring the effective and appropriate use of FEVR across diverse contexts.

---

3. The current state of pathogen threats and their impacts

Pandemic risk is the likelihood of a widespread infectious disease to emerge and escalate as well as the potential impact of such an outbreak on health, economies, and society. It is a function of hazards (or threats)[*], vulnerabilities, and capacities, and their interactions. **Hazards** refer to the presence, severity, and likelihood of new or existing pathogens that can cause a pandemic, while **vulnerabilities** are the underlying health, social, and economic conditions that interact with these hazards, either amplifying or mitigating the impacts of a pandemic. PPR **capacities** are the infrastructure, institutions, human knowledge, and skills within a society to manage and reduce the pandemic risks and strengthen resilience. Pandemic risks to economies and health are greatest in situations or areas with substantial threats and vulnerabilities alongside gaps in necessary PPR capacities. *(9,10)*

As the world has largely moved on from the acute response to the COVID-19 pandemic, the cycle of panic and neglect reenters the neglect phase. Even as threats persist or continue to grow and vulnerabilities multiply, countries, donors, and other stakeholders are deprioritizing spending on public health, including pandemic risk reduction. As a result, the risk of a pandemic continues to increase. The most relevant pandemic threats include a variety of pathogens. Respiratory viruses such as coronaviruses and influenza viruses are the most studied and considered the most likely to cause the next major pandemic. Other possibilities include antibiotic-resistant bacteria, vector-borne diseases such as dengue and yellow fever, and contact-transmissible viruses such as Ebola or poxviruses. In 2022, there were 457 verified acute public health events monitored globally by WHO.*(11)*Amongst these, infectious diseases were the main cause, accounting for 83%. In 2023, there were 365 monitored events, of which 79% were infectious. In 2024, there were 432 events monitored globally, of which 75% were infectious (Figure 1).

Not every infectious disease event[†] has the potential to become the next pandemic, but many, such as avian influenza infections in humans, even though sporadic, are considered to have such potential. In the past five years, 10 distinct infectious diseases or conditions have been the most frequent causes of acute public health events each year. Notably, next to influenza and COVID-19 globally, dengue appeared consistently in all six WHO regions since at least 2018.*(12)* Aggregated across the five-year period (2020-2024), new infectious disease events were dominated by COVID-19 (n=270), followed by mpox (n=108), dengue (n=107), avian/animal influenza (n=86), cholera (n=78), and measles (n=75).

[*] Hazards and threats will be used interchangeably throughout the document to indicate the presence, severity, and likelihood of pandemic-prone infectious diseases

[†] WHO has adopted an all-hazards approach, in which events of any nature, including infectious diseases but also disasters, chemical, biological or nuclear threats, and human-made conflicts, are assessed. Hazards have been grouped into seven categories with an infectious disease event defined as an event where "there is potential harm to public health from an infectious disease."

Figure 1: Acute public health events, 2022-2024

ACUTE PUBLIC HEALTH EVENTS (2022-2024)
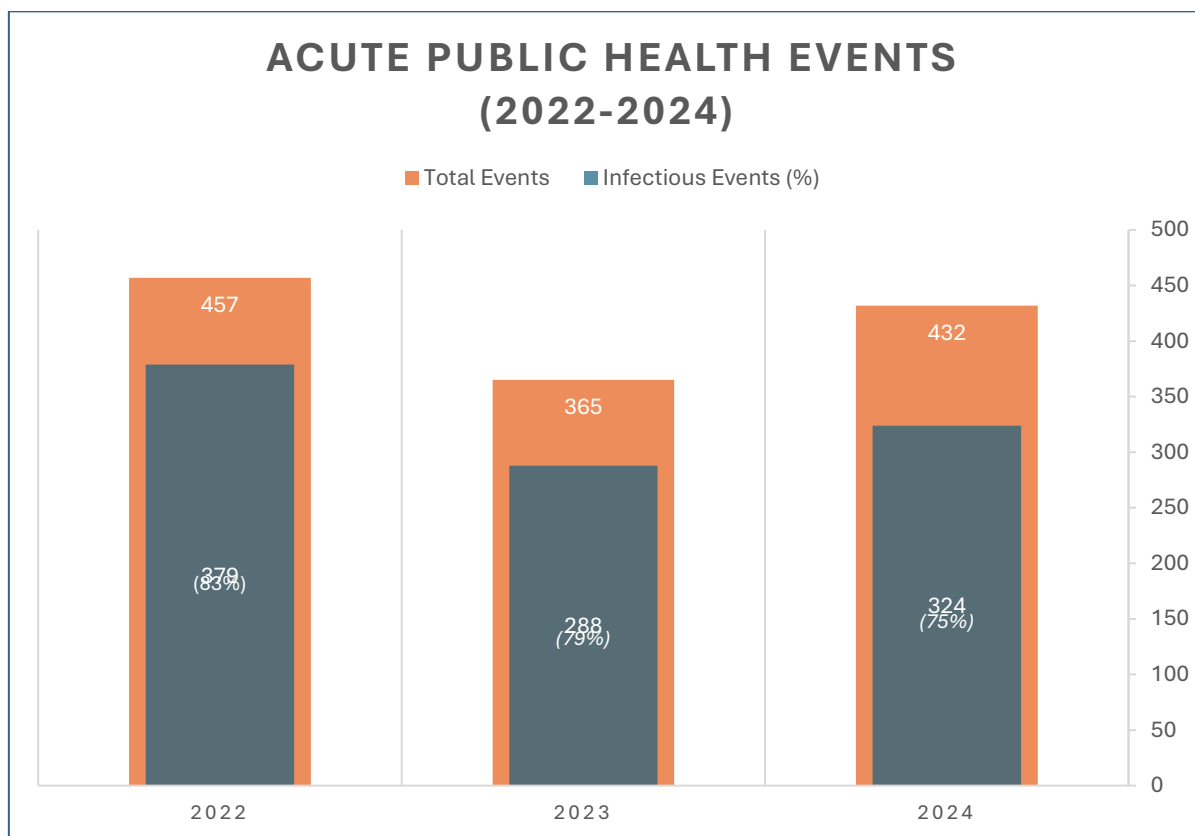
The number of reported acute public health events varied by WHO Region (Figure 2): in 2024, the African Region and the Region of the Americas, reported the highest proportions of acute public health events (141; 32.6% and 92; 21.3%, respectively); Over the past five years, the events reported from each of these two WHO Regions have represented roughly 20-30% of the total events reported, whereas the events occurring in each of the other WHO Regions have typically varied between 5% and 20%. Due attention is warranted to the fact that some countries and areas with the highest risk for emergence of pathogens with pandemic potential (e.g., areas with equatorial rainforests and/or high levels of animal-human interaction) are also amongst those with the least ability to detect them rapidly and control them at the source.

Figure 2: New acute public health events reported to WHO in 2024
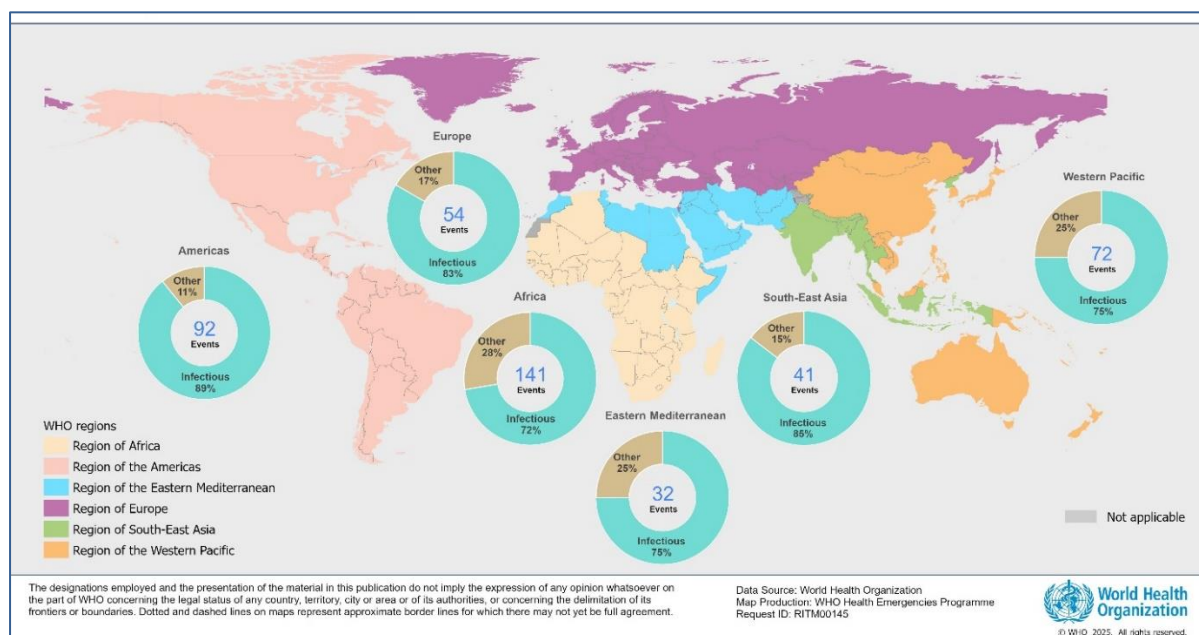
While there is significant regional variation, there is global vulnerability. The chief vulnerabilities were outlined in detail in the 2024 FEVR Report*(9)* and include, above all, poverty and its correlates – conflict, displacement, food insecurity, and poor health security – as well as climate change. In 2025, 305 million people around the world will require urgent humanitarian assistance and protection, as multiple crises escalate with devastating consequences for the people affected by them. (*13*) *(*Table 1)

Table 1: People in need by geographical region 2025

REGION	TOTAL NUMBER OF PEOPLE
Southern and Eastern Africa	85 million
Middle East and North Africa	59 million
West and Central Africa	57 million
Asia and the Pacific	55 million
Latin America and the Caribbean	34 million
Europe	15 million

Source: 2025 Global Humanitarian Overview (14)

The past year was also the hottest year on record*(15)*, not only increasing vulnerabilities, such as water scarcity, food insecurity, malnutrition, and the risk of natural disasters such as floods and major storms,*(16)* but also contributing to the rise in pandemic threats. Many pathogens have a demonstrated link to climate change and climate phenomena such as the El Niño-Southern Oscillation*(17)*, particularly dengue, malaria, and cholera; zoonoses such as Rift Valley fever; and other emerging vector-borne diseases such as chikungunya and Oropouche. Other drivers for

emergence or re-emergence of pathogens with pandemic potential include deforestation and human encroachment into previously untouched habitats, environmental pollution, intensive farming and agriculture systems as well as global mobility and marketing practices. This interdependency between human health, animal health, and environmental health underscores the need for a One Health approach to pandemic preparedness.

Assessing Pandemic Risk

Planners confronting a wide range of natural hazards – floods, earthquakes, wildfires, hurricanes – typically consider the expected frequency and severity of losses in setting policy and determining budgets. Pandemics, by contrast, are generally treated as inevitable yet unpredictable hazards, leaving decisionmakers to make choices regarding prevention, preparedness and resilience strategies and financing under high levels of uncertainty. Operating under such uncertainty makes it challenging to assess whether funding has been appropriately scaled against needs, whether country preparedness targets and levels are sufficient to mitigate the level of risk posed by future pandemics, and whether (and which) investments in prevention, preparedness and resilience are cost-effective(*18*).

Assessing pandemic risk is challenging. Historical data, while valuable, is not a sufficient guide. Pandemics occur sporadically, and vary widely in terms of their health, economic, and societal impacts. Historical pandemics represent only a small subset of events that could *potentially* occur, and basing expectations of future risk based solely on historical data underestimates potential "tail risk", driven by rare, severe events. *(18, 19)* It is possible to experience epidemics that far exceed historical norms. This pattern has been observed recently across multiple pathogens, including the Ebola virus and mpox. The COVID-19 pandemic, likewise, vastly exceeded the scale of prior coronavirus epidemics.

Evidence suggests that pandemic risk is increasing. Key drivers of risk, including climate change, land-use change (deforestation, agricultural practices), and the wildlife trade are shifting the frequency of cross-species contact and disease transmission, as well as the rate of infectious disease spillover into human populations, increasing the risk of future epidemics and pandemics.*(20, 21, 22)* Understanding pandemic risk requires that we understand how it may be changing over time.

The field of pandemic risk assessment is still developing: risk estimates come with substantial uncertainty, driven both by limitations in scientific knowledge about key drivers and how they interact, rates of change over time, and the impact of mitigating factors such as improvements in vaccine and therapeutic technologies, and the speed and equity with which they can be deployed.*(23)* Understanding global pandemic risks, preparedness, and policy options will require continued improvement in scientific understanding, the aggregation and synthesis of scientific information by global networks of researchers, and the effective translation of evidence to policy.*(24)*


Source: Ben Oppenheim, Ginkgo Bioworks Inc.

3.1.   Influenza viruses – a persistent global threat

Influenza remains a major global pandemic threat due to its ability to spread easily between people and animals, genetically recombine and mutate rapidly, and circulate widely. Wild aquatic birds are the natural hosts of influenza A viruses, which can infect both birds and mammals, sometimes jumping into new species and adapting.(*25,26*) Certain strains, like A(H3N2) and A(H1N1)pdm09, have evolved to spread easily between humans and are now part of regular seasonal flu outbreaks. The constant genetic changes of the influenza virus through mutation and mixing of genetic material allow new strains to emerge, including highly pathogenic avian influenza (HPAI) viruses. These strains can cause serious outbreaks in animals and may also pose a risk to humans, with the potential to spark future pandemics.(*27*) Forthcoming analyses suggest that a new global outbreak of avian influenza, if left unmitigated, could reduce economic output by nearly 4% across G20, EU, and Organisation for Economic Co-operation and Development (OECD) countries. Sectors such as transport and storage and manufacturing would be among the hardest hit, respectively experiencing declines in the range of -11% to -15% and -5% to -8% for most countries.(*28*)

Coordinated, timely, and cost-effective surveillance and response efforts are essential to monitor the emergence and global spread of influenza viruses. Through the *Global Influenza Surveillance and Response System (GISRS),(29)* WHO and key partners track influenza activity, virological changes, and disease burden, underscoring the importance of a One Health approach, as outbreaks of several subtypes of influenza viruses with pandemic potential (IVPP) continue to be reported in humans across multiple WHO regions, including low- and middle-income countries and fragile, conflict-affected, and vulnerable (FCV) settings (Figure 3). Between October 2024 and May 2025, countries reported an increase in zoonotic avian influenza outbreaks compared to the same period the previous year, emphasizing the accelerating risk landscape and the need for heightened surveillance in both humans and animals as well as strengthened, equitable global coordination.(*30*)

Figure 3: Confirmed Zoonotic Influenza Cases with IVPP by WHO Region and Year[‡]
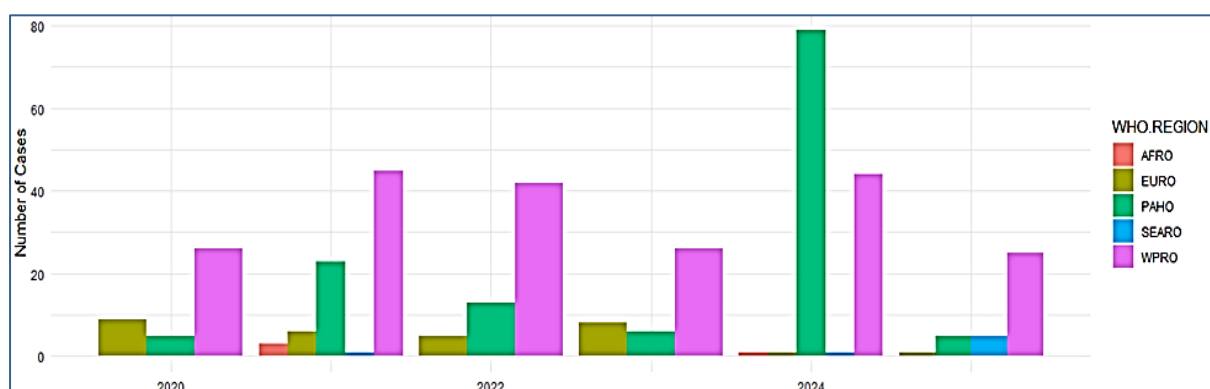
[‡] Data generated from WHO GISRS. All IVPP subtypes are represented in this graph.

In recent years, H5 influenza viruses, a subtype of influenza A, have infected a growing number of species, including wild birds, and both land and marine mammals. Since 2020, the H5N1 virus, especially clade 2.3.4.4b, has spread rapidly through migratory birds to every continent except Australia, reaching as far as Antarctica. Alongside this wider spread, the virus has also infected more animal species, such as cattle with large outbreaks reported in the United States of America and Canada in 2024-2025. Of particular concern is the increasing number of human infections linked to contact with both birds and mammals, signaling the ongoing evolution of the virus and its potential to become a serious global health threat.

Economic impact of influenza pandemics

The 1918 "Spanish Flu" is estimated to have killed 50 million people and caused a global economic contraction of around 6% of GDP The 1918 pandemic also led to a 15% drop in global consumption. If a similar shock were to occur in 2025, with projected global GDP at US$ 113.8 trillion and consumption accounting for 60%, a 15% contraction would result in over US$ 10 trillion in lost spending, roughly equal to the combined annual GDP of Japan and Germany. In contrast, the 2009 H1N1 pandemic had a minimal economic impact, with estimated GDP losses of 0.01% to 0.03%. Applied to today's economy, that would still mean losses of US$ 11.4 to US$ 34.1 billion. These figures highlight the wide-ranging economic stakes of pandemic preparedness.

Source: Barro, Ursúa, and Weng (31) and the International Monetary Fund (IMF) (32). Note: Recent OECD analyses are exploring five pandemic scenarios based on the epidemiological characteristics of agents such as avian influenza, influenza A, Ebola, coronavirus, and measles. In most scenarios, assuming unmitigated spread, GDP could decline by 1% to 5%, and up to 16% in the case of a disease similar to measles, which is highly contagious. The transportation and storage sector would be particularly affected (-12% to -15% in most scenarios, excluding the measles-like case), along with manufacturing (-5% to -7.5%). Overall, the agent's transmissibility and fatality rate were key determinants of both health and economic impacts.

Although a robust network for global influenza monitoring exists, significant surveillance vulnerabilities remain.*(33)* In particular, the WHO African Region, the South-East Asia Region, and parts of the Eastern Mediterranean Region contend with critical shortfalls in virological testing capacity, genomic sequencing capabilities, and the timely sharing of surveillance data. These limitations hinder early detection of emerging strains and constrain the monitoring of viral evolution. Effectively reducing the risk of zoonotic emergence and improving outbreak response requires targeted investment to strengthen surveillance infrastructure, enhance national preparedness plans, expand vaccine access, and improve the operationalization of One Health strategies.

3.2. Towards a global pandemic risk-need metric

There is a growing recognition that in an era marked by overlapping pandemics and frequent outbreaks, a unified global pandemic risk metric is essential to support coordinated preparedness and response. The Pandemic Fund - a multilateral financing mechanism supporting PPR in low- and middle-income countries - is working to help direct funds to countries with the greatest gaps in preparedness, highest pandemic risks, and most challenging socioeconomic conditions informed by a tailored pandemic risk metric and country classification.*(34)* WHO developed the *risk-need metric* for the Pandemic Fund, which is

comprised of more than 70 open-source indicators to assess pandemic risk. This considers interactions between hazards, vulnerability and PPR capacity, and the enabling environment[§] as an additional factor, building on the Dynamic Preparedness Metric.*(35)* This effort builds on and aligns with the 2024 FEVR indicators. Of the 23 core FEVR indicators, 13 health and social indicators are integrated into the *risk-need metric*.

Table 2: FEVR and the Pandemic Fund Risk-Need Metric

ASPECT	FEVR	RISK-NEED METRIC
Primary Purpose	Country allocation decision support for actionable vulnerabilities	Global funding allocation based on overall risk-need profile
Target Users	National policymakers, ministries	Pandemic Fund, international donors
Analytical Focus	23 indicators across health, economic, social domains	70+ indicators including 13 of 23 FEVR indicators
Primary Output	Investment priorities and policy action plans	Country eligibility and funding decisions
Application	Country-specific diagnostic framework with local adaptation	Global comparative for funding prioritization

While FEVR is a voluntary and non-binding framework for country policymakers to assess and address interlinked risks and vulnerabilities that shape national and global decisions to pandemic outcomes, the *risk-need metric* is a Pandemic Fund initiative developed to determine through quantitative indicators which countries have the highest risk-need gaps and are therefore eligible for a dedicated funding application process (Table 2). The aim is to provide greater predictability in funding size and timing, and flexibility in proposal development to allow countries to coordinate with in-country processes and funding cycles of other PPR actors. In terms of the analytical framing, FEVR complements the *risk-need metric* as a decision-support tool to identify areas of heightened vulnerability within countries, where targeted policy action and strategic investments could mitigate negative impacts across the three domains of healthcare systems, economic and fiscal resilience, and social determinants of health.

3.3.   Recommendations and policy options

Key recommendations

- **Integrate hazard assessment, including influenza viruses and other pandemic threats, into FEVR**. This should be done by international partners and technical bodies to inform the entire risk profile of countries alongside health, financial, and social vulnerabilities, to guide country-level prioritization and investment planning.

[§] The enabling environment dimension plays a critical role in understanding how to implement capacity building within the broader structural, political, and institutional context in which health emergency capacities operate.

- **Expand genomic surveillance infrastructure and data-sharing protocols**. Governments, supported by joint financing mechanisms and integrated national preparedness plans, should **focus on regions with critical gaps** such as Africa, South-East Asia, and the Eastern Mediterranean.

Additional policy options

- Ensure FEVR and the *risk-need metric* operate in coordination. This requires the Pandemic Fund Secretariat and WHO/World Bank to align indicator definitions, data sources, and reporting cycles, ensuring that each tool informs the other, enabling coherent country assessments and reducing fragmentation in investment planning.

- Strengthen zoonotic surveillance and response systems. National governments and multisectoral platforms must enhance coordination between human health, animal health, and environmental monitoring to address interconnected drivers of pandemic emergency, particularly given the demonstrated links between climate change, animal-human interactions, and pathogen spillover events.

- Use the WHO Benchmarks for Strengthening Health Emergency Capacities. Countries should use these benchmarks to guide and prioritize capacity-building investments, aligning resources with country-specific risk profiles and the most critical preparedness gaps.*(36)*

4. Application of FEVR at the national level

4.1. Interpreting the FEVR Indicators

FEVR provides a framework to identify risk, guide investment planning, support evidence-based decision-making, and inform policy trade-offs at the country level. It helps address the crucial questions of understanding current vulnerabilities, and the potential policy actions and investment needs to strengthen preparedness and resilience of health systems. FEVR is a tool that integrates three domains - health, economic and fiscal resilience, and SDHs - across the continuum of pandemic risk. This framing allows policymakers to interpret indicators not only in isolation but as part of a broader system of interdependent risks. A country's level of risk is a function of hazards (or threats), vulnerabilities, and capacities, and their interactions. Hazards (e.g., zoonotic viruses, climate-related events) are external drivers of risk, while vulnerabilities and capacities are internal characteristics that shape a country's exposure and response.

The 23 FEVR indicators, which are central to this report, are interpreted through three dynamic analytical lenses: Pre-pandemic Vulnerability (V), Pre-pandemic Capacity (C), and Intra-pandemic Outcome (O) (Figure 4). The "V-C-O" labelling is explicitly mapped to each indicator (Annex 2) to inform decision making for targeted investment planning. Understanding the distinction and interplay between these V-C-O analytical framework roles of FEVR indicators is needed for pandemic preparedness and targeted investment to sectors with highest vulnerability where investments could mitigate negative outcomes. These indicators capture the critical attributes of a society that either increase the susceptibility to adverse pandemic outcomes (vulnerabilities) or represent investable strengths for prevention and response (capacities), directly relating to the concept of essential "needs" for targeted pandemic preparedness and investment (Table 3). Beyond the pre-pandemic baseline assessment, examining FEVR indicators as outcomes based on changes measured from baseline over time further allow us to understand how health, economic, and social aspects are impacted by pandemics, offering country-specific insights from past experiences on where resources are best allocated to minimize the negative outcomes at the next event.

Table 3: V-C-O analytical framework roles – Interpretation of Vulnerability, PPR Capacity and Outcome.

| V-C-O ANALYTICAL FRAMEWORK	INTERPRETATION
Vulnerability (V)	Measures pre-existing conditions (physical, social, economic, and environmental factors), that increase a country's susceptibility to adverse pandemic outcomes. These underlying factors are often external to direct health system financing and cannot be directly 'bought' or 'built' with a budget line item, but they can amplify pandemic hazards and significantly influence the scale of potential losses and the effectiveness of investments.
Capacity (C)	Measures investable strengths and resources that can be directly built or reinforced through government investments in effective PPR. These include infrastructure, institutions, human capital, governance, and

V-C-O ANALYTICAL FRAMEWORK	INTERPRETATION
	financial instruments that mitigate economic disruption and safeguard public welfare.
Outcome (O)	Measures the consequences and effectiveness of the response during a pandemic, considering the interaction of pre-existing vulnerabilities, invested capacities, and the hazard of the pandemic itself. Outcomes are best interpreted as a change from pre-pandemic baseline, reflecting the overall health, financial, and social impact.

Based on terminology from United National Office for Disaster Risk Reduction 2017, (37) modified for pandemic interpretation

It is important to note that the V-C-O framing reflects the primary analytical purpose of each indicator, not fixed categories. The same indicator may serve different analytical roles depending on the timeframe or context being examined. For example, healthcare expenditure serves as a capacity indicator when assessing pre-pandemic preparedness, but changes in healthcare expenditure during a pandemic can serve as an outcome indicator reflecting system stress and adaptation ability.

This dynamic interplay between the FEVR indicators is inherent to understanding how pandemics unfold and affect societies. Outcome indicators are best interpreted as changes from pre-pandemic baseline values, rather than absolute measures. A pre-existing vulnerability, if left unaddressed, can directly contribute to the amplification of risks during a crisis and subsequently manifest as a measurable change from baseline conditions. Recognizing this interconnectedness allows policymakers to trace pathways from baseline conditions to pandemic-induced changes, informing more targeted investment strategies that address the most consequential vulnerabilities and capacities.

Figure 4: Illustration of FEVR[**]
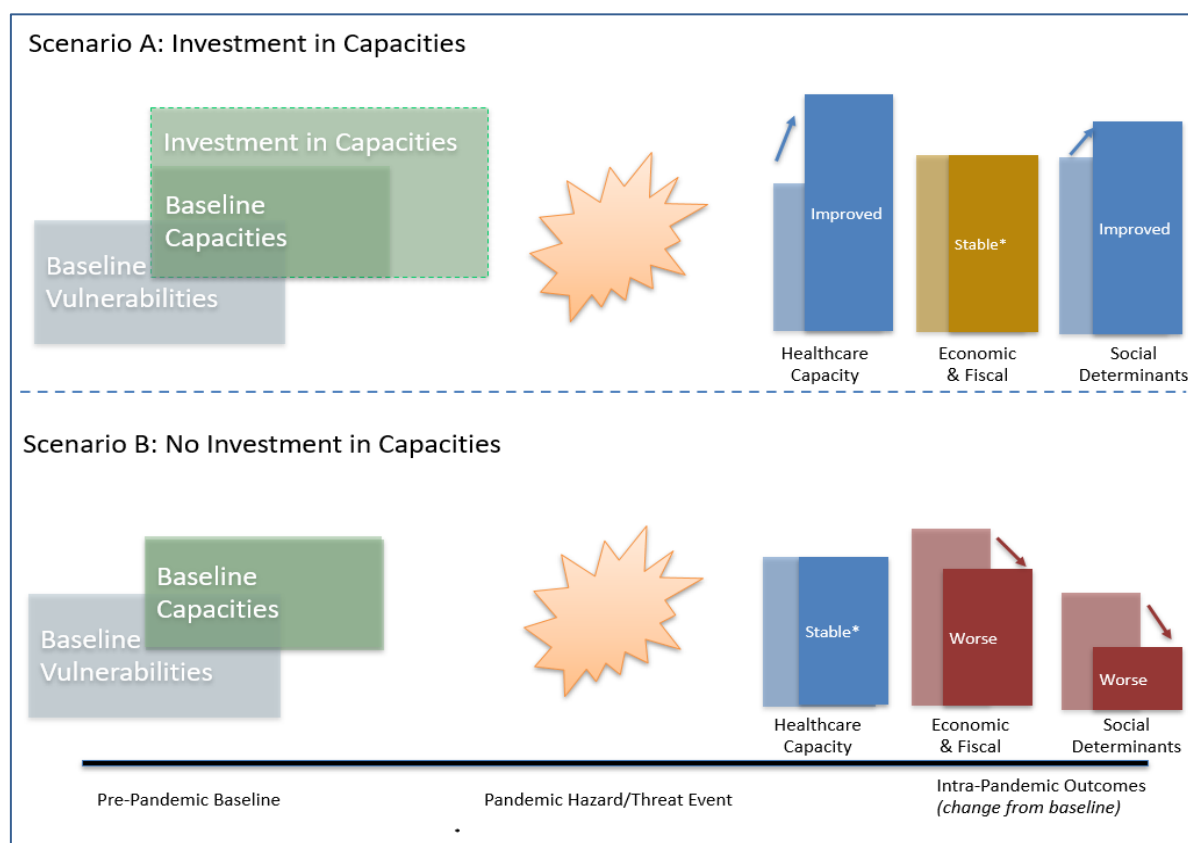
The FEVR framework - vulnerability, capacity and outcomes

- **Pre-Pandemic Baseline:** High "International tourism receipts (% of GDP)" is a **Vulnerability (V)**. Low "Laboratory testing capacity modalities" is a **PPR Capacity (C)** gap.

- **During Pandemic:** The high tourism dependency **amplifies risk** of economic shock. Low laboratory capacity **amplifies risk** of uncontrolled spread, increases pandemic hazards.

- **Intra-Pandemic Outcomes/Impacts (O):** Significant GDP loss (economic O), overwhelmed health system (health O).

- **Post-Pandemic Recovery:** Data on GDP loss and health system strain informs **Feedback Loop**.

- **Future Investment:** Investment in economic diversification (addressing V), and increased lab capacity (strengthening C) for future resilience.

[**] Figure 4 illustrates two pandemic scenarios using FEVR: Scenario A shows that targeted investment in capacities before a pandemic can mitigate adverse outcomes, supporting improved healthcare, stable economic/fiscal conditions, and better social outcomes. Scenario B demonstrates that without such investment, a pandemic often results in worsened economic/fiscal and social outcomes, with healthcare capacity struggling to maintain baseline services during high healthcare need caused by the pandemic whereby some indicators may worsen (e.g., vaccination coverage or hospital bed capacity) and some may improve (e.g., multisectoral coordination). This highlights how proactive investment in capacities enhances resilience and reduces negative impacts.

Many indicators can serve multiple roles across the pandemic continuum, reflecting how initial conditions and capacities influence final outcomes. During a pandemic, pre-existing capacity is critical for ensuring widespread access to essential health services. However, the direct health impact of the pandemic – specifically, the scale of cases and mortality can severely strain and redirect health resources. This primary impact can lead to a disruption of routine health services and, consequently, a decline in effective essential health service coverage (O), as health systems become overwhelmed. This dynamic was seen during the Ebola Virus Disease outbreak in West Africa, where routine health services, including vaccine coverage (O), were significantly impacted.*(38,39)* The interplay between pre-existing capacities, the hazard of pandemic-driven cases and mortality, and observed changes in other intra-pandemic factors directly influence the FEVR outcome (O) indicators.

Ultimately, these shifts in this dimension of health system performance and public health burden cascade onto the need for stringent PHSM, thereby affecting economic, fiscal and non-pandemic health outcomes (O), underscoring the interconnectedness of health system and economic dimensions. Further, UHC service coverage index is a clear measure of pre-pandemic health system capacity (C). A higher UHC index indicates a population with stronger baseline access to essential health services, which can improve resilience and mitigate downstream disruptions during a pandemic.

Annex 2 provides a comprehensive overview of the 23 FEVR indicators, their respective domains (health, economic and fiscal conditions, and social determinants of health), and the V-C-O analytical framework - Pre-pandemic Vulnerability (V), Pre-pandemic Capacity (C), or Intra-pandemic Outcome (O) and their data sources.

4.2.   Enabling country-level FEVR implementation: key parameters

While the goal of applying FEVR using country-specific data is to serve as a diagnostic tool to identify risks, guide investment planning, support evidence-based decision-making, and inform policy trade-offs to achieve value-for-money, **more work is needed to lay the necessary groundwork for its effective application at country level.** To strengthen its utility, FEVR should be positioned not only as a diagnostic tool but as a strategic planning instrument that links risk assessment to investment prioritization and policy implementation across sectors. Operationalizing FEVR at the country level requires an understanding of **its relevance and utility in different national contexts**. This includes **capacity building to interpret and use the framework and results** effectively. **Strengthening data systems** and improving access to timely, disaggregated, **and relevant indicators also facilitates the robustness and usability of FEVR outputs.**

Institutional integration is equally important. Embedding FEVR within existing governance and planning structures will help ensure it is used consistently and meaningfully over time, serving as an integral part of the national decision-making process and facilitating the sustainable use of FEVR indicators. Maximizing the impact of FEVR at the country level requires that its outputs inform funding decisions and resource allocation. **Sustained country engagement**, along with opportunities for **peer learning and knowledge exchange**, can further accelerate uptake and support contextual adaptation. Underpinning all of this is a commitment to **equity** - ensuring that the use of FEVR promotes inclusive processes and supports integrated approaches to pandemic preparedness and broader health system strengthening.

4.3.   Illustrating the application of FEVR - country case examples

The following country case examples demonstrate how to apply this V-C-O analytical framework in practice at the country level. These examples look retrospectively at two countries' experiences during COVID-19, examining their pre-pandemic risk profiles and the intra-pandemic impacts they experienced. This retrospective analysis illustrates how targeted pre-pandemic investments in sectors identified as more vulnerable could have potentially mitigated some of the negative outcomes observed during the pandemic.

Previous FEVR analyses demonstrated correlations between indicators and pandemic outcomes including cases, deaths, and GDP impacts. The country application examples presented in this report extend that work by examining how pre-pandemic vulnerabilities and capacities translated into actual changes during COVID-19, identifying which baseline conditions proved most consequential on a country level.

These examples use real, de-identified data to show how countries can:

- Systematically assess their pre-pandemic risk profile using Vulnerability and Capacity indicators.

- Track pandemic impacts through Outcome indicators to understand which vulnerabilities were most consequential.

- Identify where pre-pandemic investments in vulnerable sectors might have reduced pandemic impacts.

- Make evidence-based decisions about where limited resources can have the greatest impact of future pandemic preparedness.

Each example illustrates how indicators serve different analytical purposes depending on timing and context, and how countries with different risk profiles require tailored investment strategies informed by their unique V-C-O analytical framework role. By analyzing actual pandemic experiences, these example cases provide evidence of how pre-existing vulnerabilities translated into pandemic impacts, offering valuable insights for prioritizing future investments. These examples are intended to guide country-level engagement and highlight areas where additional work is needed to adapt and operationalize FEVR effectively.

COUNTRY A: LOW-INCOME, CONFLICT-AFFECTED COUNTRY		
Pre-Pandemic Baseline (≤2019):	**Intra-Pandemic Impacts / Changes from Baseline (2020-2022)**	**2022 Onwards**
• **Healthcare Capacity:** Extremely limited, with only **0.9 hospital beds per 1,000 people** (2019), **low healthcare expenditures** (2.4% of GDP and US$12.7 per capita	**Healthcare Resilience:** The slight improvements in UHC coverage (27 in 2021) as well as health expenditure (15.4 in 2022) reflects the system's ability to adapt and maintain function.	**Improvements** in **health emergency response management** (Level 3), effective **diagnostic network** (Level 2), and **multisectoral**

COUNTRY A: LOW-INCOME, CONFLICT-AFFECTED COUNTRY		
Pre-Pandemic Baseline (≤2019):	**Intra-Pandemic Impacts / Changes from Baseline (2020-2022)**	**2022 Onwards**
in 2018), and **low UHC service coverage** (25 in 2017). Further, health emergency indicators like **lab testing capacity** and effective national **diagnostic network** were at **Level 1**, reflecting very poor foundational health infrastructure.		**coordination mechanism** (Level 3) scores **in 2024** but **lab testing capacity** and **community engagement scores remained low** at Level 1. More recent data were not available on outcome indicators past 2022.
• Economic Vulnerability: • **High reliance on trade** (74% of GDP in 2018) could imply economic vulnerability from global trade restrictions during a pandemic. **Low informal employment** (6.2%) suggests reliance in formal sectors, while **lower exports of goods and services** (14.2% of GDP in 2018) reduced external shock exposures.	**Economic Shock: Severe debt stress** was evident as the debt servicing ratio surged from 0% in 2018 to 66.9% in 2020. **Exports were stable** and t**rade dependency increased** slightly in 2020. 	**Exports increased to** 19.7% of GDP in 2023**.** Similarly**, trade represented 93% of GDP in 2023,** which was higher than pre-pandemic baseline. **Debt to service ratio decreased** significantly to 16.9% of exports in 2023 but did not return to pre-pandemic level of 0**.**

COUNTRY A: LOW-INCOME, CONFLICT-AFFECTED COUNTRY		
Pre-Pandemic Baseline (≤2019):	**Intra-Pandemic Impacts / Changes from Baseline (2020-2022)**	**2022 Onwards**
• Social Vulnerability Indicators: • **Critical gaps in education** (23% primary school completion in 2007, recent data not available), **widespread slum** population (53.4% in 2018), and **low access to social protections** (8.2% in 2017) and **safely managed sanitation** (29.7% in 2018) magnify social strain during a crisis.	**Social Strain:** While slum populations saw a modest decline (53.4% in 2018 → 48.7% in 2022) and **access to social protection increased** (8.2% in 2017 → 16.3% in 2020**)** and **safe sanitation increase** (29.7% in 2018 → 32.6% in 2022**), food insecurity worsened** (12,800 thousand people in 2020 t→ 14,032 in 2022) and **primary school completion was very low (8% in 2021)**, highlighting continued social fragility. 	Only 2 social vulnerability indicators were available post-pandemic, showing **increase in primary school completion** (21% in 2023) and **consistent levels of informal employment** (6.2% across all years). More recent data were not available for other outcome indicators past 2022.

Data Gaps: Missing Pre-Pandemic Data: Government debt, food security, and recent education metrics (only 2007, 2021, and 2023 data for enrollment). Tourism receipts data is missing although likely low due to ongoing conflict; **Intra-Pandemic Data Availability:** Majority of indicator data was available; **2022 Onwards:** Missing for most health and social indicators in recent years.

COUNTRY B: MIDDLE-INCOME, TRADE AND TOURISM RELIANT ISLAND COUNTRY		
Pre-Pandemic Baseline (≤2019)	**Intra-Pandemic Impacts / Changes from Baseline (2020-2022)**	**2022 Onwards**
• **Healthcare Capacity: Strong healthcare systems** were in place (3.9 hospital beds/1,000 in 2018, 65 UHC score in 2017, and 99% vaccination	**Healthcare Resilience: UHC coverage** was maintained (67 in 2021) despite economic crisis and decrease in health expenditures per capita (154.7 per capita in 2018 → 145.6 in 2022), reflecting system resilience.	**Improvements in lab testing capacity** (Level 5), **management of health emergency response** (Level

COUNTRY B: MIDDLE-INCOME, TRADE AND TOURISM RELIANT ISLAND COUNTRY		
Pre-Pandemic Baseline (≤2019)	**Intra-Pandemic Impacts / Changes from Baseline (2020-2022)**	**2022 Onwards**
coverage in 2019). **Moderate health emergency capacity levels for lab testing, diagnostics, health emergency management, and community engagement**, despite somewhat **low levels of health expenditures** (3.6% of GDP and US$154.7 per capita in 2018).		5), effective **diagnostic network** (Level 5), and **multisectoral coordination mechanism** (Level 5) scores in **2024** while **community engagement scores remained the same** (Level 4). More recent data were not available on outcome indicators past 2022.
• **Economic Vulnerability: High trade reliance** (50% of GDP in 2018) and **high debt** (73.5% of GDP in 2015) indicate potential fiscal vulnerabilities. **Moderate tourism dependency** (5.9% of GDP in 2018).	**Economic Crisis:** Debt servicing increased slightly (36.1% in 2018 → 38% in 2020), however **tourism collapse** (5.9% in 2018 → 1.1% of GDP in 2020) and **decreased exports and trade** (exports 21.4% in 2018 → 15.5% of GDP in 2020, trade 50% of GDP in 2018 → 37% in 2020 compared to) drastically impacted the economy.	While **exports rose back to pre-pandemic levels** (20.5% of GDP in 2023) and **debt service ratio decreased** to 15.9% in 2023, **trade had not yet rebounded** (43% of GDP in 2023). Indicators on tourism and debt were missing for recent years.
• Social Vulnerability Indicators: Robust education access (97% primary school completion in 2018)	**Social Impacts: Food insecurity doubled** (1,639 in 2018 to 2,496 thousand people in 2022), though **social protection coverage grew moderately** (36.4% in 2019 → 41.3% in 2021) and proportion living in **slums decreased slightly** (50.7% in	**Informal employment remained steady** throughout the

Solidarity   Equality   Sustainability

COUNTRY B: MIDDLE-INCOME, TRADE AND TOURISM RELIANT ISLAND COUNTRY		
Pre-Pandemic Baseline (≤2019)	**Intra-Pandemic Impacts / Changes from Baseline (2020-2022)**	**2022 Onwards**
provides social resilience, but a large proportion of population living in slums (50.7% in 2018) remains a social vulnerability. Moderate social protection coverage (36.4%) offers some initial buffering capacity.	2018→ 44.7% in 2022) offered some mitigating social resilience. Primary school enrollment (SDG 4): 97 (2018), 96 (2022) Urban slum population (SDG 11.1.1): 50.7, 44.7 Access to social protection (SDG 1.3.1): 30.4, 36.4, 41.3 Food insecurity (SDG 2.1.2): 1639.5, 2164, 2495.8 Informal employment (%): 2.8, 2.5, 2.9	pandemic. All other outcome indicator data was not available after 2022.

Data Gaps: Missing Pre- and Intra-Pandemic Data: Government debt after 2021, sanitation metrics for all years; **2022 Onwards:** Missing most indicator data for health and social outcomes in recent years.

4.4.   Comparative insights based on country case examples

Both countries experienced significant challenges, but their pre-existing conditions and responses led to different outcomes and future needs. **Country B's stronger pre-pandemic systems** provided more resilience against economic and social shocks, while **Country A's pre-existing fragilities** amplified these impacts. The data also reveals a common challenge: a **lack of consistent post-2022 data** for key health and social indicators for both countries.

- **Divergent Capacity:** Country B, with its strong healthcare and social protections, maintained some stability, evidenced by consistent UHC scores and improving health emergency capacity scores post-2022. In contrast, Country A's already limited capacity was strained, leading to significant debt and food insecurity. While Country A has shown some recent improvements in emergency managements, foundational health and social indicators like lab testing capacity and school enrollment remain low.

- **Economic Vulnerability**: Both countries show the last effects of the pandemic on their economies. Country B's trade sector has not fully recovered to pre-pandemic levels despite a rebound in exports, highlighting the need for economic diversification. Country A's trade dependency has increased and while its debt service ratio has decreased, it has not returned to the pre-pandemic baseline, showing continued financial stress.

- **Data Limitations:** Both countries exhibit relatively good data availability for key indicators before 2022 despite Country A's conflict-affected status, which is a positive sign for monitoring capabilities and indicator choice. However, a major limitation in analyzing post-pandemic recovery is the inconsistent availability of recent data for both countries, making it

difficult to get a full picture of long-term recovery and to measure the impact of recent policy changes.

- **Policy Implications:**

  o Country A needs targeted investments to build foundational health and social infrastructure. The recent improvements in health emergency management scores are a positive sign but must be paired with efforts to improve basic services like lab testing capacity, education, and social protection.

  o Country B should focus on economic diversification and strengthening social safety nets. The pandemic revealed the risk of reliance on tourism and trade. Addressing the debt service ratio and persistent food insecurity will be crucial for long-term stability and resilient response to future pandemics.

4.5. Recommendations and policy options for integrating FEVR into national planning, policy cycles, and investment decisions

FEVR is a tool for policymakers to proactively assess and address interconnected risks related to pandemics. Integrating FEVR into planning and investment frameworks, tailored to each country's context, can shift preparedness from a reactive to a risk-informed approach. This section outlines next steps and policy uses for how FEVR can be used in national planning, policy cycles, and investment decisions.

1. **Framing and Adaptation**

   Key recommendations

   - **Work with a country to pilot the operationalization of the FEVR framework to identify priority investment areas**. This would involve using the V-C-O analytical framework to conduct **scenario-based stress testing**, such as simulation or tabletop exercises, of their health and economic systems, **identifying which vulnerabilities are most likely to amplify hazards and which capacities offer the greatest return on investment**.*(40)*

   Additional policy options

   - Develop technical guidance to help countries interpret indicators across the vulnerability (V) – Capacity (C) – Outcome (O) analytical framework and address areas of concern. Pandemic-based scenarios, including the timeframe, nature of the pathogen, and potential response measures, can guide the simulation of potential impacts.

   - Promote systems thinking to account for cascading risks, such as how poor sanitation can lead to increased disease spread and economic shocks.

   - Build institutional capacity for cross-sectoral risk interpretation and scenario-based planning.

Example: In Country A, a low-income, conflict-affected state, limited laboratory capacity and high urban slum populations exacerbated health and economic losses during the COVID-19 pandemic. Interpreting these as vulnerabilities (V) informs priorities for future capacity (C) investments in PPR.

2. **Data Systems and Indicator Use**

   Key recommendations

   - **Invest in national data systems to ensure regular, disaggregated reporting on FEVR indicators**. This includes establishing baseline data collection capabilities, standardized reporting protocols, and creating **sustainable data management infrastructure** with support from partners.

   Additional policy options

   - Allow local adaptation of indicators to national priorities while maintaining global comparability through normalization protocols. Establish a FEVR data initiative with key partners (e.g., WHO, World Bank, UNICEF, etc.) to identify and fill key FEVR indicator gaps in priority countries, develop standardized methodologies for estimating missing data, and create a technical working group to support countries in building national data systems aligned with FEVR reporting

   - Fund regional data hubs to support fragile states in maintaining FEVR-compatible data systems.

Example: Despite institutional fragility, Country A maintained strong data coverage for most indicators—underscoring the feasibility of applying FEVR in fragile contexts with targeted data system support.

3. **Institutional Integration**

   Key recommendations

   - **Integrate FEVR into national health sector processes and related plans,** including health security plans, pandemic preparedness plan, development plans, and medium-term expenditure frameworks.

   Additional policy options

   - Establish and empower interministerial bodies to translate FEVR insights into cross-sectoral policy actions. This includes codifying their roles through legal mandates and securing dedicated budgets to ensure sustained operations and authority during peacetime and emergencies.

   - Designate a national FEVR focal point to coordinate cross-sectoral integration and reporting.

   - Work with international financial institutions, global health initiatives, and other international organizations to enable a shared understanding of roles and ways to coordinate processes and avoid duplication of effort in an emergency situation using FEVR framework as a basis for vulnerability and outcome assessments. *(33)*

Example: In Country B, a middle-income island state, FEVR highlighted how economic overreliance on tourism and inadequate food security systems amplified pandemic shocks. This data supports diversification strategies and social protection reform.

4. **Alignment with Expenditure and Investment Frameworks**

   Key recommendations

   - **Estimate the costs and resource requirements of the policy measures informed by FEVR**. **Refine the costing methodology and ensure standardized methods** to cost preparedness investments and inform donor coordination. This requires developing a

common costing tool and training modules for national governments to accurately budget for FEVR-informed interventions.

- **Continue to incorporate the relevant FEVR indicators in the Pandemic Fund's *risk-need metric*** to inform targeted allocation of funds to countries with the largest gaps in pandemic PPR capacity and highest pandemic risks.

Additional policy options

- Embed FEVR in whole-of-government planning and resource allocation frameworks, both to inform policy measures, but also to include in key processes such as in fiscal risk assessments, and disaster risk planning and financing tools

- Improve evidence base on which policy measures provide value for money in the context of emerging work on pandemic preparedness financing to support integration into national budget submissions.

- Develop approaches to costing responses and planning for budgetary provisions that would support rapid domestic resource mobilization, including fiscal measures to build up reserves for emergencies as well as fiscal escape clauses and use of prearranged mechanisms.*(33)* These mechanisms should be tracked using FEVR outcome indicators.

- Standardize mapping of FEVR indicators to national investment plans, using the V-C-O analytical framework to prioritize interventions that reduce vulnerability, build capacity, and improve outcome resilience. This mapping should be embedded in budgetary and fiscal planning cycles.

Example: Country B shows how FEVR indicators, such as health spending (as a percentage of GDP) and UHC service coverage index, can be used to assess the return on investment in strengthening primary care systems.

5. **Country Support and Peer Learning**

   Key recommendations

   - **Institutionalize feedback loops using FEVR outcome data to adjust policy and spending**, noting sectors and areas most impacted from past outbreaks and pandemics are areas for specific investment and policy action.

   Additional policy options

   - Facilitate peer learning between countries with shared profiles (e.g., tourism-dependent, conflict-affected), potentially through the establishment a FEVR peer learning network to share best practices and lessons learned.

6. **Equity and Inclusion**

   Key recommendations

   - **Disaggregate indicators by income, gender, and geography** to identify at-risk populations.

   Additional policy options

   - Use FEVR to guide pro-poor investment in health access and social protection.

   - Engage civil society in interpreting and applying the findings of FEVR.

   - Include equity impact assessments as part of their FEVR-based investment planning.

Solidarity   Equality   Sustainability

FEVR enables countries to assess and address pandemic risk proactively. Its integration into planning and investment frameworks, tailored to each country's context, can shift preparedness from a reactive to a risk-informed approach. Country examples show that even fragile or resource-constrained settings can operationalize FEVR when supported with the right tools and partnerships.

4.6. Spotlight - applying FEVR to mpox and financial tracking

Having emerged gradually in central and West Africa since 1970, mpox was first detected outside Africa in 2018, followed by a large global outbreak of clade IIb with sustained human-to-human transmission across multiple countries and continents which began in May 2022. Between 1 January 2022 and 30 June 2025, a total of 153,874 laboratory-confirmed cases and 359 confirmed deaths were reported across 137 countries. *(41)* In July 2024, another virus strain (clade Ib) which had emerged in the Democratic Republic of the Congo (DRC) was confirmed to have caused mpox in four additional countries in the African Region: Burundi, Kenya, Rwanda, and Uganda, subsequently spreading to other countries in and well beyond Africa. *(42)*

As part of the international response coordination, the Mpox Financial Tracking Mechanism (FTM)[††] was initiated under the G20 JFTHF to track total international contributions to national mpox responses. Overall, nearly US$ 581.5 million (Figure 5)[‡‡] in contributions were allocated across the five countries. These contributions were allocated across all five sub-systems of the WHO Health Emergency Preparedness and Response (HEPR) framework: collaborative surveillance, community protection, safe and scalable care, access to countermeasures, and emergency coordination.*(43)* Notably, earmarked allocations, where specified by contributors[§§], were heavily concentrated in strengthening surveillance and laboratory capacity, as well as improving access to medical countermeasures.

[††] Tracker does not include in-kind donations, including vaccines, therapeutics and other interventions.

[‡‡] Note 1: Multi-country funding is funding allocated to two or more of the five countries. Note 2: The recognized contribution to the African Region, includes the total allocation for the five countries. Note 3: The graph does not include contributions with missing geographic target. Note 4: Total recognized contribution to the African Region from the mpox FTM: USD 594,027,945

[§§] The Mpox FTM does not require contributions to be earmarked for specific response pillars. As such, data on funding allocation to response pillars is limited.

Solidarity   Equality   Sustainability

Figure 5: Total contribution committed and distributed for mpox: Burundi, DRC, Kenya, Rwanda, Uganda. Source: mpox FTM data as provided by contributors, October 2024 – July 2025*

**Note - Of the total committed funds, $143 million is pending final confirmation from donors.*

FEVR was applied using 2023 data to assess baseline risk an d vulnerabilities reflecting the context before mpox was declared a Public Health Emergency of International Concern (PHEIC) for the second time in August 2024 due to the upsurge of cases. Although mpox was not declared a pandemic by WHO, it is a hazard with pandemic potential.

A closer look at confirmed mpox cases and funding, (Figures 5 and 6) through the lens of FEVR and its indicators across the five countries, highlights a complex interplay of pre-existing risk and vulnerabilities, outbreak response, and financing. DRC and Burundi exhibit the most risk and vulnerabilities across all three domains. DRC shows particularly weak multisectoral coordination mechanisms, and widespread gaps in social determinants (e.g. access to sanitation). This potentially contributed to DRC consistently dominating weekly case counts, in both endemic and newly affected areas.*(44)* Despite these challenges, DRC has received the highest financial support (US$185.3 million), a reflection of both the scale of need in the largest affected country and strategic prioritization to address the outbreak at source. Burundi shares similarly high risk and vulnerability levels, especially in health and SDHs indicators. Although total mpox case counts are lower than in the DRC, limited health infrastructure (e.g., emergency management, lab capacity) poses risks for future outbreaks. Burundi received US$79.5 million in support, yet the magnitude of its risk and vulnerabilities suggests greater investment will be required to strengthen the foundations of its health systems. Kenya and Uganda demonstrate relatively stronger health system capacities, with Uganda scoring highest in areas including community engagement, vaccination coverage, and hospital management. However, both countries face persistent risks, especially in safe sanitation and informal employment. Rwanda has balanced vulnerability and capacity across health, economic, and social determinants as reflected in its higher FEVR scores and relatively stable mpox trends.

The data highlights the urgent need for tailored investments that align financing with context-specific risk profiles. The mpox outbreak illustrates how vulnerabilities amplify outbreak impact, reinforcing the value of FEVR as a strategic tool for providing insights to tailor resourcing to mitigate future pandemic risks.

The findings further underscore the importance of flexible funding mechanisms that can address pre-existing conditions that increase susceptibility to adverse pandemic outcomes. For instance, while laboratory testing capacity was assessed as moderate to strong in the five countries prior to the outbreak, published studies during the recent mpox outbreak in Africa pointed to weak surveillance and diagnostic systems.*(45)* The April 2025 update to the continental mpox response plan highlights the ongoing need to expand diagnostic testing, especially in remote and underserved areas.*(46)* This example illustrates FEVR offers valuable insights for strategic resource allocation and highlights where targeted investments are needed to address foundational PPR capacity and vulnerability. However, FEVR assessments are a complement to other tools, such as the IHR Monitoring and Evaluation Framework (SPAR/JEE) and broader health sector assessments to support a comprehensive understanding of national risk and guide evidence-based investment decisions.

Figure 6: Trends in confirmed mpox cases
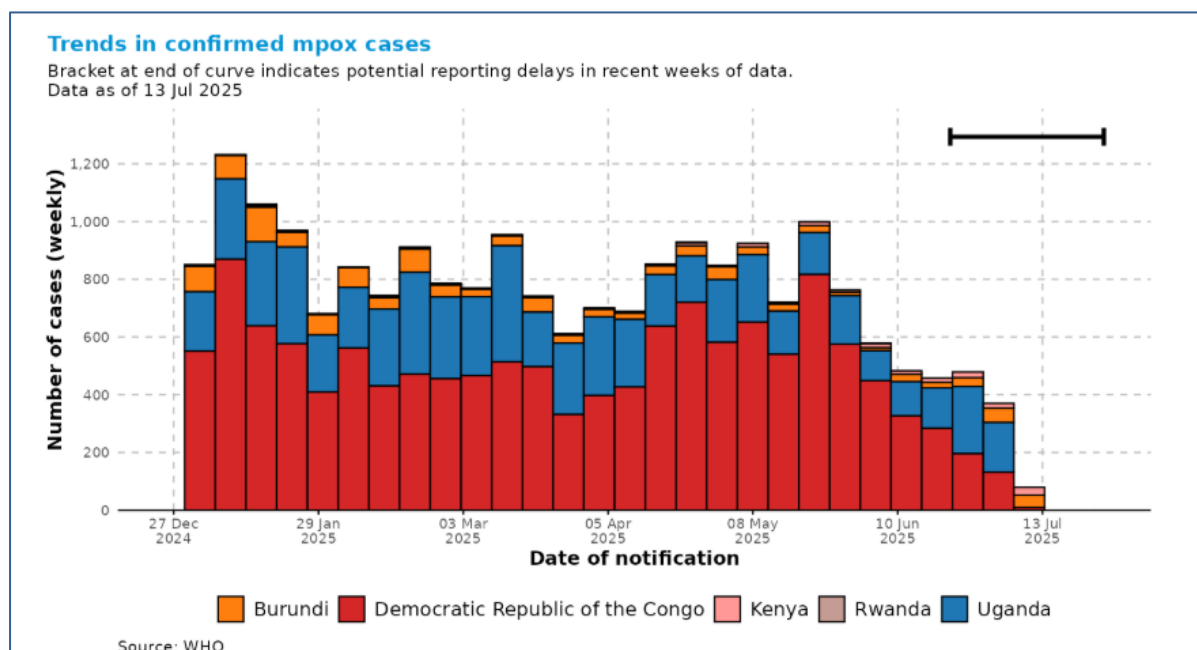
5. Institutional capabilities - towards population-centered pandemic preparedness and response

The COVID-19 pandemic exposed critical gaps in global and national health emergency preparedness. In response, under South Africa's presidency, the G20 JFHTF prioritized strengthening National Public Health Agencies (NPHAs) and Institutes (NPHIs) as central institutions for pandemic preparedness and response. Notably, this agenda includes analyzing **governance structures**, assessing **financing institutional capabilities,** reviewing **multisectoral coordination mechanisms,** and evaluating **institutional readiness capacities.**

5.1. Governance models and legal mandates

Implementation of PPR relies on the close and effective coordination of multiple national and international health institutions, including ministries of health, NPHAs/NPHIs, national disaster management authorities, security apparatuses, subnational and municipal authorities, private and voluntary sectors, academic institutions, and others. Increasingly NPHAs/NPHIs[***] are recognized as a cornerstone of national health systems, with key responsibilities for PPR functions, including surveillance, outbreak response, emergency preparedness, and technical guidance. Where NPHAs/NPHIs exist in countries, they operate under diverse governance models (Figure 7) and institutional arrangements, some embedded within ministries of health, others as autonomous entities. Legal mandates vary, affecting their authority in emergency response, coordination, and international deployment.

NPHAs/NPHIs and other national health authorities have highlighted the need for further clarity on the desirable capabilities NPHAs/NPHIs should possess in order to contribute and lead emergency preparedness and response functions within diverse governance contexts. In addition, autonomous NPHAs /NPHIs with legal mandates have been found to be better positioned to secure and manage funds to carry out their duties.*(47)*


[***] The core functions and attributes recommended for NPHAs/NPHIs are summarized in the IANPHI Framework for NPHI Development and the more recent Application of the essential public health functions: an integrated and comprehensive approach to public health.

Case study from the Africa CDC guidance on Providing a Legal Framework to an NPHI.(48)

Case Study - Providing a Legal Framework for a National Public Health Institute in Mozambique

The National Institute of Health of Mozambique (INS) was established in 1976 as a division within the Preventive Medicine Directorate of the Ministry of Health (MoH). In 1983, the INS became a distinct institution within the MoH, with limited autonomy. This changed in 2017, with the passage of Decree 57/2017. The 2017 Decree provides the INS with autonomy and assigns it additional public health responsibilities, while also increasing its operational efficiency. For example, the INS budget is now negotiated directly with the Ministry of Finance. In addition, the INS is now authorized to establish sub-national divisions. With more operational autonomy, the INS will be better able to rapidly respond to outbreaks, have improved efficiency in conducting nation-wide surveys, and have increased capacity for grant management and oversight. Under the Decree, the Director-General and Deputy Director-General are appointed by the Prime Minister for renewable terms of five years, which helps ensure institutional stability. The INS must establish strong collaboration and coordination with the MoH, as the INS is technically supervised by the Minister of Health. INS funding derives from several sources, but still depends heavily on external funding through bilateral or multilateral funding mechanisms, as well as through competitive grants.

Figure 7: Examples of emergency preparedness and response governance models
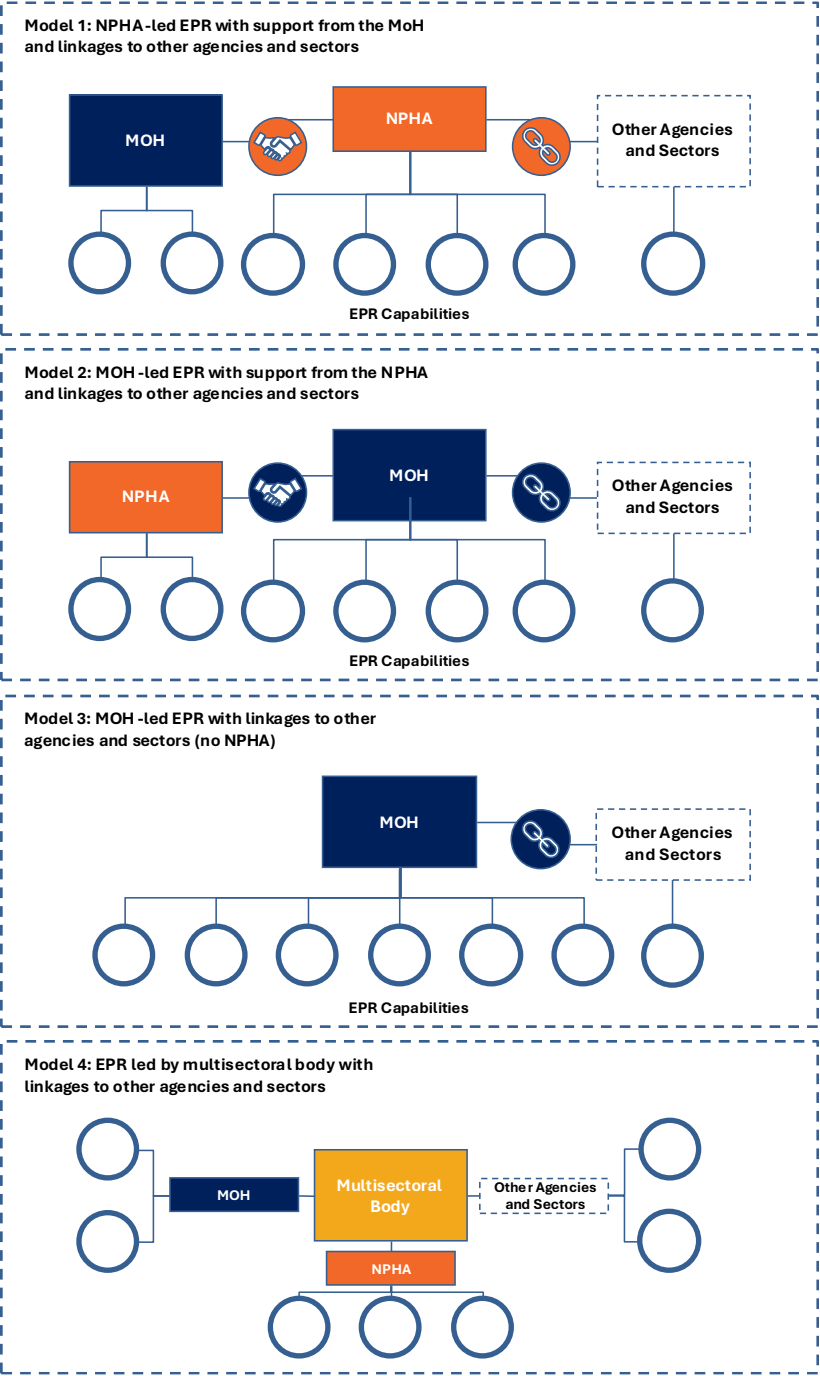
5.2. Financing institutional capabilities for PPR

An expanded narrative on financing for PPR is presented in the supplementary G20 paper on preparedness financing. Excerpts from the paper are provided:

WHO and World Bank estimate an annual PPR financing gap of approximately US$ 10 billion. Domestic revenue mobilization (DRM) is a priority concern in lower income countries to ensure that these and other key spending challenges can be met. Yet the tax revenue to GDP ratio is 16% on average in African countries, compared to 34% on average across OECD countries. This challenge is exacerbated by successive and compounding crises that have increased debt and inflation globally, threatening fiscal sustainability, particularly in the poorest and most vulnerable countries.*(21)* International efforts, notably through the establishment of the Pandemic Fund, are helping to address critical gaps. Nevertheless, recent declines in Official Development Assistance (ODA) highlight new risks, particularly in low-income countries where ODA funding accounts for almost 80% of PPR financing. From its height of US$ 26 billion in 2022, the decline in COVID-19 related funding drove a 40% decrease in ODA for health to US$16 billion. Meanwhile, the OECD estimates show a further 19-33% drop between 2023 and 2025, potentially reducing health ODA to levels last seen in the mid-2000s.*(21)*

While high-income countries are seeing health budget recoveries, many low- and middle-income countries remain heavily reliant on external funding - over 50% of health budgets in sub-Saharan Africa, Haiti, Yemen, Lao, Tonga, and other Small Island Developing States depend on ODA. In countries like Kenya, Uganda, and Mozambique, health represents over 25% of total ODA; in Sri Lanka and Nepal, it makes up 21% and 17%, respectively.*(49)* Given the reliance of many developing countries on ODA, this decline poses a significant risk to national health systems and global health security, at least in the shorter term. (Figure 8)

Figure 8: Total spending on PPR, per capita, constant prices
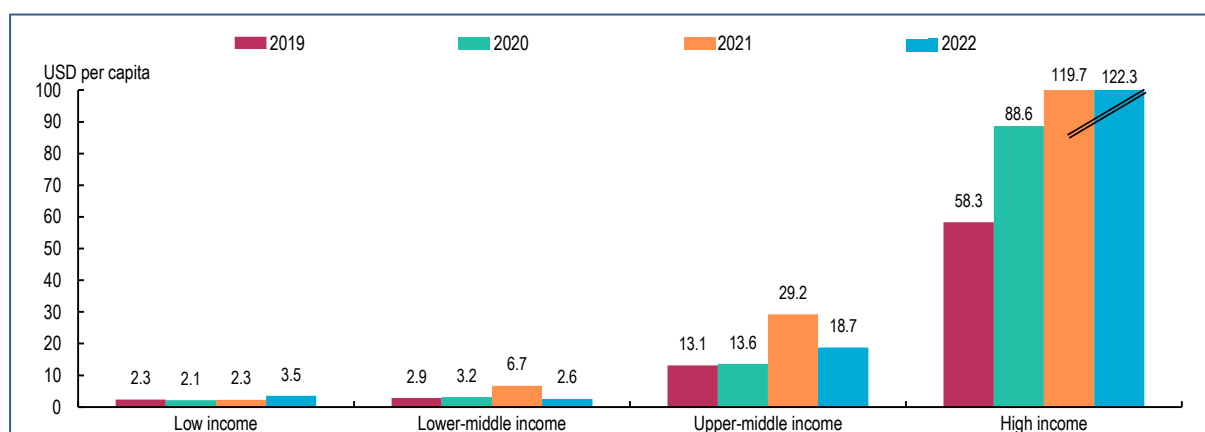
Note: Graph extracted from report on Financing For Pandemic Preparedness: Ensuring Sustainable And Efficient Funding. Source: OECD Health Expenditure and Financing Database and WHO Global Health Expenditure Database

New and additional financing sources beyond ODA are urgently needed, alongside sustained efforts to strengthen DRM in line with the Lusaka Agenda and Abuja targets. As an example, in some OECD countries, maximizing DRM has included comprehensive tax policy approach that broadens tax bases, reduces ineffective tax expenditures, supports economic growth while addressing informality, and strengthens tax administration and digital transformation.

Equally important is ensuring that public financial management (PFM) systems are equipped to execute health budgets efficiently, especially in emergency contexts. Governments must also reconsider how public funds are allocated across sectors, ensuring that health, including

universal health coverage and PPR, receives sufficient investment. This is particularly urgent given the reduction in ODA. Without such a recalibration, countries risk reversing hard-won gains in service continuity and pandemic readiness.

International financing structures must also evolve. Greater alignment is needed between global and country-level funding streams to avoid fragmentation and inefficiencies. The roles of various global actors in PPR financing and coordination should be clearly defined, especially in the context of vertical fund replenishments and ongoing reviews of development aid, including International Development Association (IDA) flows.

Structural reforms are needed to increase the leverage and impact of international finance. This includes blending grants and loans at a scale and consolidating global health financing to enable catalytic investment. As more countries move toward financial transition, they will require targeted, time-limited grants with clear expectations for increased domestic contributions and measurable milestones.

Finally, efficient and sustainable PPR investment depends on high-quality evidence and data. Global collaboration should support countries to generate and share data on value for money, technical efficiency, and best practices. Investments in PPR needs to be underpinned by transparent, evidence-informed, and country-led priority setting processes for expenditures and investments. Governments also need improved tools for tracking health expenditures (including both domestic and external) by leveraging digital systems such as Integrated Financial Management Information Systems to improve accountability and alignment.

5.3. Existing institutional mechanisms and platforms for multisectoral coordination

Effective pandemic response demands coordination across health, finance, agriculture, education, housing, labor, and other sectors. Existing platforms at the global and country-level including: the International Health Regulations (IHR 2005) and associated monitoring and evaluation frameworks, the WHO-led Preparedness and Resilience for Emerging Threats (PRET) initiative, the antimicrobial resistance (AMR) multisectoral coordination mechanisms, and national One Health platforms, offer starting points. The amended IHR and the historic Pandemic Agreement offer unique opportunities to formalize these structures and build a governance architecture that is coherent, inclusive, and accountable.

5.3.1. Global mechanisms for multisectoral coordination

The WHO Pandemic Agreement 2025

The WHO Pandemic Agreement, formally adopted by the majority of Member States at the 78th World Health Assembly on 20 May 2025, is the world's first legally binding treaty designed to bolster global viral outbreak response through equitable cooperation and the One Health approach. As parties implement the relevant elements of the Pandemic Agreement in the future, they may take into consideration FEVR with regard to social protection measures, multisectoral coordination, and the maintenance of essential health and social services.

International Health Regulations (IHR) (2005) Amendments:

The 2024 IHR amendments significantly broaden the scope from traditional health security to include social justice, equity, and economic resilience. The amendments empower states and

communities to implement holistic strategies that safeguard both health and livelihood, offering a stronger legal and operational foundation for future pandemic planning.

2024 AMENDMENTS TO THE IHR (2005)	HOW IT MITIGATES SOCIAL & ECONOMIC VULNERABILITIES
Pandemic Emergency Declaration	Triggers early multisectoral interventions, reducing social/economic harm
Equity in Medical Access	Supports marginalized and low-income populations
Financial Mechanism	Funds social infrastructure and resilience capacities
Role of National IHR Authorities	Enables whole-of-government, cross-sector preparedness
Human Rights Integration	Anchors social protections and non-discrimination in health measures
Surveillance & Product Coordination	Ensures equitable deployment of health tools across contexts

WHO Health Emergency Prevention, Preparedness and Response (HEPR) Framework

The WHO HEPR Framework defines WHO's vision for a unified, whole-of-society architecture for PPR. *(50)* The Framework reinforces that pandemic readiness must include actions that directly address the conditions in which people live, work, and access services - thereby aligning closely with the FEVR's social and economic vulnerability indicators.

The Community Protection subsystem is central to ensuring that PPR efforts are inclusive, equitable, and context-sensitive and includes core components of risk communication and community engagement and PHSM.

Preparedness and Resilience for Emerging Threats Initiative (PRET)

The Preparedness and Resilience for Emerging Threats Initiative (PRET) approach promotes multisectoral, hazard-specific pandemic planning using a "mode of transmission" lens (e.g., respiratory, vector-borne).*(51)* It integrates surveillance, health systems, and community measures while emphasizing equity by adapting responses to social vulnerabilities like informal work and overcrowding. PRET encourages disaggregated data, inclusive planning, and regular simulation exercises. It also provides a monitoring and evaluation framework using 13 indicators across the five HEPR sub-systems.*(52)* WHO regularly tracks global progress on preparedness for respiratory pandemics, with the report covering the period 2023.*(53)*

Country mechanisms for multisectoral coordination

IHR Monitoring and Evaluation Tools *(54)*

The IHR State Party Self-Assessment Annual Reporting Tool completed by 195 State Parties in 2024 includes indicators for community engagement and multisectoral coordination mechanisms which can serve as entry points to integrate socio-economic risk messaging.

The IHR Joint External Evaluation (JEE) conducted by 124 countries includes several indicators related to FEVR: P2 (Antimicrobial Resistance) and R5 (Risk Communication) touch on health equity and community-level vulnerabilities. P5 (Zoonotic Disease) links with One Health approaches to food and environment. R2 (Emergency Response Operations) and R3 (Linking Public Health and Security Authorities) can be adapted to include risk assessments based on

socio-economic indicators (e.g., informal settlements, food insecurity). The JEE's "National Legislation, Policy, and Financing" indicator can indirectly support integration of social protection and economic resilience.

The National Action Plan for Health Security (NAPHS) developed by 91 countries encourages countries to integrate FEVR indicators into NAPHS by including socio-economic risk analysis as part of the hazard mapping, linking actions in the risk communication and community engagement pillars to address education, housing, and vulnerable groups, and use multi-year costing frameworks to budget for WASH, social support systems, and multisectoral coordination platforms.

After Action Reviews allow assessment of pandemic responses in light of social and economic disruptions (e.g., school closures, business losses, social service disruptions) and can be used to assess mitigation of FEVR vulnerabilities in past events.

Antimicrobial Resistance (AMR) coordination platforms

Antimicrobial Resistance (AMR) occurs when bacteria, viruses, fungi and parasites do not respond to antimicrobial medicines. Exposure to antimicrobials and their inappropriate use are the leading drivers of this global health challenge that affects humans, animals, plants and the environment. As a result of drug resistance, antibiotics and other antimicrobial medicines become ineffective and infections become difficult or impossible to treat, increasing the risk of disease spread, severe illness, disability and death. Particularly concerning is bacterial resistance to antibiotics, where resistance emerges soon after a new antibiotic introduction, outpacing drug development efforts. Since 2017, 13 new antibiotics have been approved, however more than three-quarters of these belong to existing antibiotic classes for which resistance mechanisms are well known. *(55)*

In 2019, WHO identified AMR as one of the top ten global public health threats.*(56)* In addition, in 2024, the Global Burden of Disease Global Research on Antimicrobial Resistance (GRAM) project estimated that in 2021, 4.71 million deaths were linked to drug-resistant infections and USD1.14 million directly caused by AMR-related diseases. This model also projected that AMR would be the attributable cause for 39 million deaths between 2025 and 2050.(*57*) In addition, studies estimate that, globally, treating drug- resistant bacterial infections could cost up to USD 412 billion annually, with an additional USD 443 billion per year in lost productivity and reduced workforce participation over the next decade.*(58)* However, with global cooperation, strategic investment, and immediate action underpinned by multisectoral coordination, the AMR health crisis can be addressed.

AMR response requires an approach integrating the components associated with human and animal medicine and the use and/or persistence of antimicrobials in the environment, and therefore effective multisectoral coordination. However, a review of data based on the annual multisectoral Tracking AMR Country Self-assessment Survey (TrACSS) suggest that progress has plateaued in the last three years and in 2024, 100 Member States (52% of 194) still have not established formalized and functional multisectoral AMR coordination mechanisms in their countries. However, on a positive note, the proportion of countries that have all One Health sectors involved in their AMR national action plan (NAP) implementation increased from 22% (42 of 194) in 2022 to 40% (78 of 194) in 2024. In addition, 145 Member States report that their AMR NAP is linked to other sectoral plans, with 74 Member States specifically reporting links to their national action plan on health security (NAPHS). The AMR NAP, is WHO's people-centred approach to addressing AMR with inclusion of gender and equity data to address barriers and health system failures.

Solidarity   Equality   Sustainability

One Health Planning Tools

The IHR–PVS National Bridging Workshops facilitate coordination between public health and veterinary sectors. While mainly technical, the One Health coordination mechanisms established can be expanded to include environment, agriculture, and socio-economic sectors and address livelihood vulnerabilities, particularly in regions dependent on livestock, agriculture, and informal trade.

Strategies for incentivizing multisectoral collaboration may include:

- Establishing dedicated funding for joint PPR activities.

- Incentivizing governments to embed social protection interventions in their preparedness financing proposals (e.g., to the Pandemic Fund), using FEVR to define needs.

- Providing incentives for cross-sectoral training and simulation exercises.

- Integrating of NPHAs/NPHIs into national development and security agendas.

- Building on the UN framework for the immediate socio-economic response to COVID-19 for future pandemics.

5.4. Institutional readiness to integrate health, social, and economic vulnerabilities during PPR

Institutional Integration of One Health, Climate, AMR and Equity

Pandemics emerge from the convergence of environmental, animal, and human health risks. Institutional capabilities must therefore incorporate the One Health approach, particularly as climate change intensifies zoonotic spillover risks and disrupts food systems, water security, and health infrastructure. Countries have engaged with the IHR–Performance of Veterinary Services (PVS) National Bridging Workshops and adopted elements of the Quadripartite Joint Plan of Action, and are positioned to translate these frameworks into national preparedness plans with enforceable commitments and adequate financing.

Specific platforms to encourage coordination at the intersection of One Health, climate change, and pandemic preparedness exist and are in use (e.g. IHR, AMR, PRET), but require further political and institutional support.

One Health integration: climate, zoonotic threats

75% of emerging diseases are zoonotic. One Health approaches are essential but under-implemented due to siloed governance and financing, often resulting in limited cross-sectoral collaboration. If the need is clearly identified and the willingness to adopt such an approach is truly established, implementation nonetheless remains challenging for multiple reasons, including difficulties in reconciling mandates, practices, and prerogatives. Under the Tripartite Zoonoses Guide, operational tools have been developed, notably by the organizations, and can be effectively used to support this intersectoral coordination. *(59, 60)* Responding to international requests to prevent future pandemics and to promote health sustainably through the One Health approach, the Quadripartite has developed the One Health Joint Plan of Action (2022–2026).*(61)*

Antimicrobial Resistance

Equity, gender and disability inclusion dimensions have not been considered in the vast majority of the over 170 AMR national action plans that are available. In addition, only 27 Member States (14% of 194) report that they collect relevant AMR data disaggregated by sex, location, income and other social stratifies. To promote equitable access to prevention, diagnosis and treatment of (drug-resistant) infections, WHO promotes a comprehensive people-centred approach to tackling AMR, including through mainstreaming of core AMR interventions (surveillance, prevention, laboratory capacity, diagnostics, appropriate treatment) into broader primary health care-oriented health systems strengthening efforts, as well as emergency preparedness and response plans. Existing evidence identifies that exposure and susceptibility to infection, health-seeking behaviors, prevalence of drug-resistant infections, as well as antimicrobial prescribing and use patterns are all influenced by equity stratifies, including gender. For example, women are 27% more likely to receive an antibiotic throughout their lifetime, and make up 70% of the global health workforce.

Need for costing, mapping, and operational integration

Few countries have costed, multisectoral preparedness plans. Mapping institutional roles and integrating operational protocols remain key gaps. Options do exist, building on the strengthening of national capacities (through the JEE, SPAR, and other tools from the IHR Monitoring and Evaluation Framework), the development of NAPHS, and resource mapping using the REMAP tool.

In closing, strengthening the institutional capabilities needed for PPR should consider codifying NPHAs roles and mandates in national legislation, aligning preparedness plans with the amended IHR and Pandemic Accord, and integrating FEVR into institutional frameworks. Embedding equity and social determinants in PPR strategies is critical, with NPHAs supported to address non-health drivers of risk. In the shifting global financing landscape, countries should mobilize new resources beyond ODA, sustain domestic financing, and protect core NPHA functions. Finally, integrated AMR surveillance and inclusive One Health governance must be prioritized to address cross-sectoral risks and reduce health inequities

5.5. Recommendations and policy options

Key recommendations

- Commit to stabilizing and replenishing health-related ODA, particularly for pandemic preparedness, through multi-year pledges and alignment with national investment plans informed by FEVR.

- Institutionalize health and PPR spending targets within medium-term expenditure frameworks, supported by FEVR-based costing and prioritization tools.

- Coordinate the relevant work of global health financing mechanisms, including the Pandemic Fund, Gavi, and the Global Fund.

Additional policy options

- Adopt integrated DRM strategies that include broadening tax bases, reducing ineffective tax expenditures, formalizing informal sectors, and digitizing tax administration. These reforms should be linked to health financing goals, including PPR.

- Strengthen PFM systems to enable rapid and accountable execution of health budgets during crises, including through contingency funds and flexible budget lines for PPR.

- Adopt digital tools such as Integrated Financial Management Information Systems (IFMIS) to track health expenditures including domestic and external sources and link spending to FEVR indicators for improved accountability and alignment.

6. Addressing inequities exposed by pandemics

SDHs, the conditions in which people are born, grow, live, work and age, and people's access to power, money and resources, are influenced by broader factors and shape who thrives and who is left behind.*(62,63,64,65,66,67,68)* Pandemics and other public health emergencies, including conflicts and natural disasters, reveal and amplify inequalities embedded in the social and economic conditions that generate health and health equity. Groups facing insecure income, overcrowded housing, limited WASH and discrimination, experience the highest mortality *(69,70,71)* and slowest recovery, as evidenced during the COVID-19 pandemic.*(72,73)* SDHs-oriented policies not only mitigate the effects of public health emergencies once they occur; they also build systems for upstream protection that reduce community vulnerability, strengthen societal preparedness, and speed recovery.*(74)* Figure 9 outlines the key policy levers needed to address inequities exposed by pandemics.

Figure 9: Five policy levers for addressing inequities exposed by pandemics
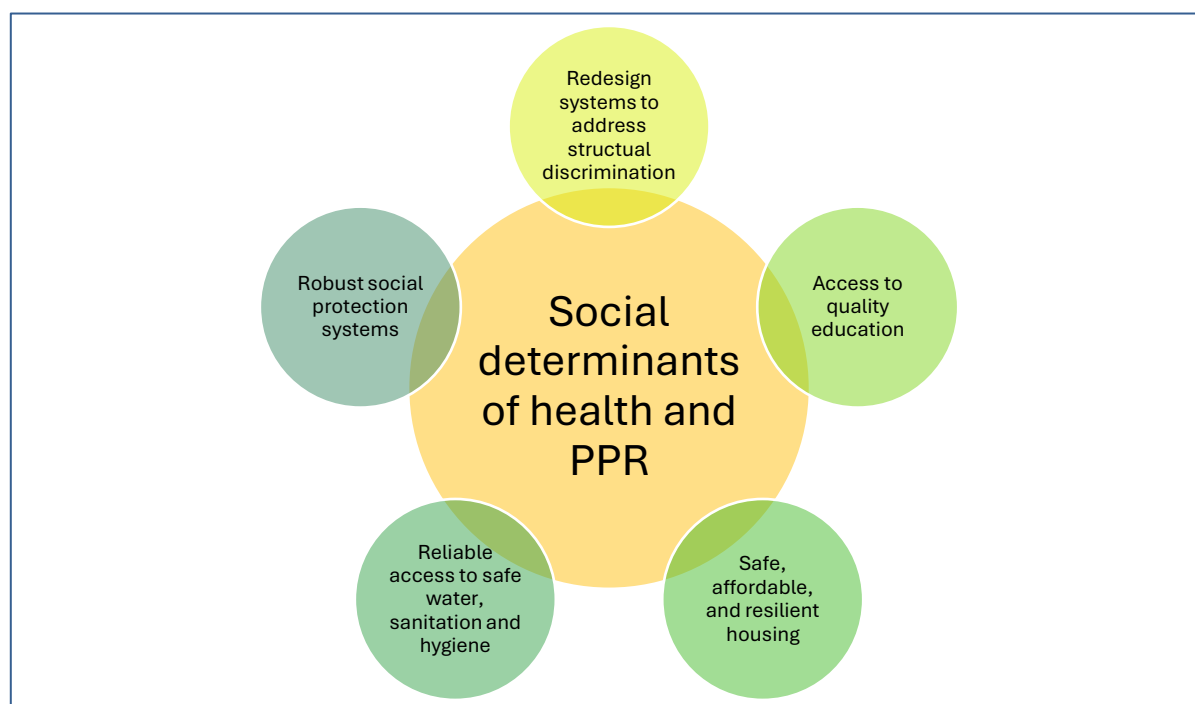
6.1. Recommendations and policy options to tackle inequities exposed by pandemics

Robust social protection systems are essential for PPR. These systems reduce vulnerability and improve health outcomes by securing income and access to basic services, especially for marginalized and informal populations. During crises, as evidenced by the COVID-19 pandemic, countries with scalable cash transfers and sick-leave benefits showed stronger resilience, with social protection acting as a first-line defense against the SDHs.*(75)* Additionally, evidence shows that social protection yields high economic returns and direct health benefits, such as reducing child poverty, improving nutrition, and even decreasing HIV infection rates.*(76,77)* For

example, during HIV epidemics, cash transfer programmes cut new infections among adolescent girls by up to 30% and improved antiretroviral therapy adherence and viral suppression. *(43, 44)*

Strengthening the role of social protection in pandemic preparedness and response requires countries to expand and adapt benefits (e.g., sick leave, unemployment, maternity), enforce worker protection through legislation, and integrate social and health systems to reduce financial barriers and improve resilience. Institutional flexibility must also be enhanced through coordinated platforms linking national to community-level actors to ensure continuity of essential services during crises.

Access to safe water, sanitation, and hygiene (WASH) is a cornerstone of effective PPR, as it reduces infectious disease transmission and creates safer environments for healthcare delivery. Investments in WASH yield strong economic returns - ranging from USD 3 to USD 45 per dollar spent - by lowering medical costs, boosting productivity, and preventing disease.*(78,79,80,81)* During public health emergencies, WASH is essential for infection prevention, as shown during the Ebola outbreak and the COVID-19 pandemic. Evidence from the 2014–2015 Ebola outbreak in Liberia underscores this link, both regarding investments in facilities and social norms: none of the 104 communities that had achieved "open-defecation-free" status through Community-Led Total Sanitation reported a single Ebola case, implying more than a 90% reduction in transmission risk for a modest community-mobilization cost.*(82)* Every dollar invested in WASH reliably returns several dollars in economic and health benefits while fortifying preparedness for future pandemics and other health emergencies. Strengthening WASH is essential for PPR. Key policy recommendations focus on strengthening government-led, multisectoral sanitation policies to improve surveillance and crisis response; establishing standards for disease prevention and environmental health; prioritizing vulnerable areas with targeted WASH investments; integrating emergency preparedness into WASH policies; and ensuring infrastructure resilience for continuous service during both normal operations and emergency situations.

Safe, affordable, and resilient housing plays a critical role in PPR by reducing exposure to infectious diseases, supporting mental and physical health, and strengthening community resilience. Evaluations have demonstrated that a selection of housing interventions can offer return on investment of 4:1 when health and climate savings are included. Improved housing conditions are a major mitigator of infectious disease spread.*(83,84)* Household crowding - a condition where the number of occupants exceeds the capacity of the dwelling space available - has a direct association with adverse health outcomes, such as infectious disease and mental health problems.*(85)* Alleviating household crowding can cut pandemic mortality: U.S. counties with severe overcrowding saw up to a three-fold higher COVID-19 mortality rate, underscoring that safe housing is protective during health emergencies.*(86)* An integrated social policy approach in which reductions in crowding are supported by appropriate rehousing that takes unintended effects into consideration is crucial to equity.*(87)* Policy recommendations include increasing investments in affordable housing, reducing overcrowding, improving housing quality, and establishing emergency housing measures such as eviction moratoria and rapid shelter for vulnerable populations.

Access to quality education is a powerful enabler of health, economic resilience, and equity, making it a critical component of PPR. Higher educational attainment accelerates uptake of public-health measures: across 133 countries, secondary schooling predicts substantially higher COVID-19 vaccination coverage. The COVID-19 pandemic laid bare the scale of losses when education systems are disrupted. At the height of the pandemic, school closures sidelined 1.6 billion learners and the average student lost 199 instructional days, which risked erasing USD 10 trillion in future earnings - roughly 16 % of current public education spending. *(88)* In low and middle-income countries, learning poverty jumped to 70 percent of 10 year olds unable to read a

simple text. More than 39 billion school meals were missed since the start of the pandemic.*(89)* An estimated 24 million learners were projected to drop out of school permanently, with associated spikes in violence, mental health distress and child marriage. *(63)* Recommended policy actions should safeguard and increase education financing, even during fiscal stress, while ensuring equitable resource distribution. Embedding crisis-responsive governance at all levels enables real-time data use and coordinated action. Inclusive learning continuity must be guaranteed through expanded digital access, flexible learning options, and teacher training. Safe school reopening should follow local health data and apply evidence-based safety measures. Finally, schools should serve as hubs for health and social support by integrating services like immunization and school meals, and by actively re-engaging at-risk learners through targeted outreach and incentives.

Evidence shows that **structural discrimination** erodes trust and lowers adherence to public health guidance, amplifying health emergency harm.(*90)* The COVID-19 pandemic made these stakes explicit: tackling discrimination across gender, indigeneity, disability, sexual orientation and race not only advances justice but also delivers multi-fold economic returns and essential resilience in health emergencies.*(91)* Key policy recommendations to address structural discrimination include enforcing anti-discrimination laws, ensuring equitable resource distribution during emergencies, and investing in community empowerment and inclusive workforce initiatives. Crisis protocols should incorporate real-time monitoring to address discriminatory practices, while community-based service delivery models can improve access and protect health equity for marginalized groups.

7. Conclusion and next steps

Under South Africa's presidency, the 2025 Global Report on FEVR builds on the analytical foundation laid in the 2023 and 2024 reports, with a sharpened focus on addressing the challenges in translating the updated framework and its 23 indicators at the country level. The 2025 report highlights four interrelated areas for effective application and continued refinement of FEVR, as prioritized by South Africa.

The report takes stock of the evolving landscape of pandemic threats, underscoring the increasing vulnerabilities faced across all regions in the 21st century. Institutions central to PPR, including NPHAs/NPHIs continue to face challenges related to mandate clarity, multisectoral coordination, and sustainable financing. Equity, a foundational principle for PPR, is further emphasized through deeper analysis of the SDH and the identification of policy levers to address the inequities amplified by pandemics.

Building on the 2024 report, the 2025 update emphasizes the dynamic and interdependent nature of the indicators where certain measures serve both as markers of baseline vulnerability or capacity and as metrics for assessing outcomes or impact, particularly in relation to pre-pandemic conditions.

Maximizing the value of FEVR's utility as an analytical and strategic tool to inform policy and investment planning and decision-making requires continued effort to support policymakers in identifying and addressing health, social, and macroeconomic vulnerabilities and risks associated with future pandemics. As a next step, operationalizing FEVR would benefit from:

1. Build on the narrative and analytical foundation of this report to work with one country on operationalizing FEVR. This includes using existing data to define pre-pandemic baselines, assess intra- and post-pandemic outcomes/impacts, and identify priority investment areas to strengthen PPR capacity.

   o The success of this recommendation will depend on countries self-nominating (grounded by an enabling environment with strong multi-sectorial whole-of-government collaboration) to work with WHO/World Bank and partners to operationalize FEVR.

2. Draw on the country case above to develop a structured whole-of-government approach for the identification of a set of policy measures informed by FEVR, situated within national and subnational planning and policy-making processes. This should include processes for the evidence informed deliberative appraisal of policy trade-offs, and the translation of recommendations into practical guidance that can be implemented under real-world fiscal and political constraints, with the aim of maximizing impact on FEVR outcomes.

3. Mobilize and coordinate financing to support country-level implementation. Rather than focusing solely on new funding, the emphasis should be on aligning existing domestic and international resources, including those from G20 countries with national investment plans and FEVR priorities. This calls for a joint financing strategy, that brings together development finance institutions, global health initiatives, and national budgets.

4. The ultimate success of operationalizing FEVR effectively requires redirecting existing funding to support in-depth, country-specific analysis and engagement at both national and subnational levels. Generally, dedicated funding from countries is needed to operationalize FEVR.

The path forward for building resilient, equitable, and multisectoral health systems capable of preventing, preparing for, and responding to pandemics in a systematic and sustainable manner depends on robust evidence, integrated governance, and targeted investments. When used alongside other health, social and economic tools/assessments, FEVR is a valuable analytical tool for identifying, and linking institutions and policies to addressing the underlying risk and vulnerabilities that drive pandemics, while guiding strategic actions and investments across the health, social, and economic sectors. The Global Report is a living document. The G20 Joint Finance and Health Taskforce will continue to update it regularly to ensure its continued relevance and responsiveness.

8. Annex

Annex 1: 2023 FEVR Indicators

2023: First iteration of the framework with 16 vulnerability indicators

DOMAIN	INDICATOR
Healthcare Capacity	1. Health expenditure per capita
	2. Logistics performance index
	3. Physicians per 1,000 population
	4. UHC Service Coverage
	5. International Health Regulations
Macroeconomic stability	6. Population with bank savings
	7. Exports
	8. Credits to private sector
	9. Global value chain
	10. Agriculture and tourism
	11. Central government debt
Social & economic determinants	12. Informal economic relative to GDP
	13. Food security index
	14. Social protection benefit coverage
	15. SDG index
	16. Internet Access

Annex 2: 2024 FEVR Indicators

2024: Second iteration of FEVR 23 core indicators used to help countries assess pandemic risk and inform policy and investment decisions. These indicators are classified based on their primary analytical role in the Vulnerability (V), Capacity (C), and Outcome (O) analytical framework. While each indicator is assigned a main role, many can serve multiple purposes depending on the context or timeframe. Note that outcome indicators are best understood as changes from a pre-pandemic baseline, showing the overall impact of a pandemic on health, social, and economic factors. The dynamic nature of these indicators allows policymakers to trace how initial conditions contribute to pandemic-induced changes, guiding more effective investment strategies.

DOMAIN	INDICATOR	DATA SOURCE DEFINITION WITH COVERAGE AND FREQUENCY OF UPDATE	V-C-O ANALYTICAL FRAMEWORK ROLES: VULNERABILITY (V), CAPACITY (C), OUTCOME (O)
Healthcare Capacity	1. Timeliness of event detection, notification, and response	WHO GPW13 indicator, Triple Billion progress. Global data source that is updated biannually.	C
	2. Laboratory testing capacity modalities	States Parties Self-Assessment Annual Reporting: SPAR capacity C4.4. Covers all WHO member states and is updated annually in April.	C
	3. Community engagement	States Parties Self-Assessment Annual Reporting: SPAR capacity C10.3. Covers all WHO Member States and is updated annually in April.	C
	4. Hospital bed capacity per 100k	World Bank Data. Global database, updated annually.	C
	5. Management of health emergency response	States Parties Self-Assessment Annual Reporting: SPAR capacity 7.2. Covers all WHO member states and is updated annually in April.	C
	6. Effective national	States Parties Self-Assessment Annual Reporting: SPAR capacity	C

DOMAIN	INDICATOR	DATA SOURCE DEFINITION WITH COVERAGE AND FREQUENCY OF UPDATE	V-C-O ANALYTICAL FRAMEWORK ROLES: VULNERABILITY (V), CAPACITY (C), OUTCOME (O)
	diagnostic network	C4.5. Covers all WHO member states and is updated annually in April.	
	7. Vaccination coverage rate for high-priority pathogens[*]	WHO GPW13, Triple Billion progress. Global data source that is updated biannually.	C, O
	8. Multisectoral coordination mechanisms	States Parties Self-Assessment Annual Reporting: SPAR capacity C2.2. Covers all WHO member states and is updated annually in April.	C
	9. UHC service coverage index (SDG 3.8.1)	SDG Indicators Global Database. Global database covers more than 200 country or area profiles. Regularly updated.	C, O
	10. Health expenditure (% of GDP)	Global Health Expenditure Database (who.int). Global database covers 190 WHO Member States and is updated annually.	C, O
	11. Health expenditure per capita (current USD)	Global Health Expenditure Database (who.int). Global database covers 190 WHO Member States and is updated annually.	C, O
Economic & fiscal	12. Exports of goods and services (% of GDP)	World Bank Data. Global database, updated annually	V, O
	13. International tourism receipts (% of GDP)	World Bank Data. Global database, updated annually	V, O

DOMAIN	INDICATOR	DATA SOURCE DEFINITION WITH COVERAGE AND FREQUENCY OF UPDATE	V-C-O ANALYTICAL FRAMEWORK ROLES: VULNERABILITY (V), CAPACITY (C), OUTCOME (O)
	14. Trade as a percentage of GDP	Several data sources including: OECD-WTO Trade in Value-Added (TiVA) database or GVC Trade Table WITS Visualization (worldbank.org) but updates are not frequent to all countries. World Bank Data. Global database, updated annually	V, O
	15. General government gross debt (% of GDP)	International Monetary Fund World Economic Outlook database. Data available for 190 countries and updated twice a year.	V, O
	16. Debt servicing ratio (% of exports of goods, services and primary income)	World Bank Data. Global database updated annually.	V, O
Social determinants	17. Access to water and sanitation (SDG 6) - Population using safely managed sanitation services (%) (SDG 6.2.1a)	SDG Indicators Global Database. Global database covers more than 200 country or area profiles. Regularly updated.	C, O
	18. Access to education (SDG 4) – School completion rate (primary) (%) **	SDG Indicators Global Database, specifically primary school completion. Global database covers more than 200 country or area profiles. Regularly updated.	V, O
	19. Urban slum population - Proportion of urban	SDG Indicators Global Database. Global database covers more than 200 country or area profiles. Regularly updated.	V, O

DOMAIN	INDICATOR	DATA SOURCE DEFINITION WITH COVERAGE AND FREQUENCY OF UPDATE	V-C-O ANALYTICAL FRAMEWORK ROLES: VULNERABILITY (V), CAPACITY (C), OUTCOME (O)
	population living in slums, informal settlements or inadequate housing (%) (SDG 11.1.1)		
	20. Access to social protection benefits - Proportion of population covered by at least one social protection benefit (%) (SDG 1.3.1)	SDG Indicators Global Database. Global database covers more than 200 country or area profiles. Regularly updated.	V, C, O
	21. Internet Access (SDG 9 C: Proportion of population covered by a mobile network, by technology)	SDG Indicators Global Database, specifically 4G mobile coverage. Global database covers more than 200 country or area profiles. Regularly updated.	V
	22. Food insecurity (SDG 2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale – FIES, in thousands of people)	SDG Indicators Global Database. Global database covers more than 200 country or area profiles. Regularly updated.	V, O

DOMAIN	INDICATOR	DATA SOURCE DEFINITION WITH COVERAGE AND FREQUENCY OF UPDATE	V-C-O ANALYTICAL FRAMEWORK ROLES: VULNERABILITY (V), CAPACITY (C), OUTCOME (O)
	23. Informal employment (%)	World Bank Data. Global database, updated annually	V, O

For vaccination coverage, while more recent disease-specific vaccination rate data is available, this report uses the 2019 GPW13 data source as the most recent observed data rather than projections calculated post-2019. This data source will be updated in future G20 reports once standardized vaccination coverage rates are available.

**For access to education, primary school completion rate was used due to the global availability and consistency of data. This aligns with previous FEVR reports citing SDG4 as the source of the education metric, noting now the specific SDG4 primary school completion measure is being used to add specificity and ensure reproducibility for future analyses. This metric reflects a fundamental level of schooling that serves as a social determinant of health, providing basic literacy, and numeracy.*

References

[1] WHO COVID-19 Dashboard: Deaths. Geneva: World Health Organization; 2024 (https://data.who.int/dashboards/covid19/deaths, accessed 20 Mar. 2025)

[2] Social Protection. Geneva: International Labour Organization; 2025 (https://www.ilo.org/topics-and-sectors/social-protection#:~:text=Social%20protection%2C%20or%20social%20security%2C%20provides%20benefits%20to,to%20those%20suffering%20general%20poverty%20and%20social%20exclusion, accessed 3 July 2025)

[3] World Health Organization, World Bank, International Monetary Fund (IMF), and European Investment Bank (EIB). Report on Economic Vulnerabilities and Risks to Pandemics and Potential Policy Measures. India: G20 India Joint Finance and Health Taskforce; 2023 (https://g20.in/content/dam/gtwenty/gtwenty_new/document/aug_docs/2_new_G20_Report_FEVR_Paper2Report.pdf, accessed 20 Mar. 2025)

[4] Huber, Caroline, et al. The Economic and Social Burden of the 2014 Ebola Outbreak in West Africa. The Journal of Infectious Diseases, vol. 218, suppl. 5, 22 Nov. 2018, pp. S698-S704, https://doi.org/10.1093/infdis/jiy213

[5] Chong, Phoon H., et al. The Impact of COVID-19 on Mental Health and Well-Being in Asia: A Review of the Literature." *Asian Journal of Psychiatry*, vol. 76, 2022, p. 103232, https://doi.org/10.1016/j.ajp.2022.103232.

[6] Centers for Disease Control and Prevention. CDC's Response to the 2014–2016 Ebola Epidemic - West Africa and United States. CDC, Atlanta; 2019. (https://www.cdc.gov/global-health/impact/historic-ebola-response.html, accessed 28 July 2025)

[7] International Labour Organization. ILO Monitor: COVID-19 and the World of Work. Seventh Edition. Geneva, ILO; 2021 (https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/briefingnote/wcms_767028.pdf., accessed 28 July 2025)

[8] World Health Organization and World Bank. G20/World Health Organization/World Bank Global report on the Framework for Health, Social, and Economic vulnerabilities and Risks (FEVR) related to Pandemics. Third Joint Finance and Health Task Force (JFHTF) Meeting. India; 2023.

[9] World Health Organization and World Bank. G20/World Health Organization/World Bank Global report on the Framework for Health, Social, and Economic vulnerabilities and Risks (FEVR) related to Pandemics. Joint Finance and Health Task Force (JFHTF) Meeting. Brazil; 2024.

[10] Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. New York: United Nations Office for Disaster Risk Reduction (UNDRR) United Nations General Assembly, 2017 (https://www.undrr.org/publication/report-open-ended-intergovernmental-expert-working-group-indicators-and-terminology, accessed 14 July 2025)

[11] Global public health intelligence report 2024. World Health Organization, in press.

[12] Global dengue surveillance [online database]. Geneva: World Health Organization; 2025 (https://worldhealthorg.shinyapps.io/dengue_global/, accessed 14 July 2025)

[13] Foreword by the Emergency Relief Coordinator. In: Global Humanitarian Overview 2025[website]. Geneva: United Nations Office for the Coordination of Humanitarian Affair; 2024 (https://www.unocha.org/publications/report/world/global-humanitarian-overview-2025-enarfres, accessed 7 July 2025)

[14] Global Humanitarian Overview. Geneva, Geneva: United Nations Office for the Coordination of Humanitarian Affair; 2025 (https://humanitarianaction.info/document/global-humanitarian-overview-2025, accessed 7 July 2025)

Solidarity   Equality   Sustainability

[15] 2024 was the world's warmest year on record [website]. National Oceanic and Atmospheric Administration; 2025 (https://www.noaa.gov/news/2024-was-worlds-warmest-year-on-record#:~:text=It's%20official%3A%202024%20was%20the,extent%20(coverage)%20on%20record, accessed 7 July 2025)

[16] Health is the argument for climate action, COP29 special report on climate change and health. Geneva: World Health Organization, 2024 (https://cdn.who.int/media/docs/default-source/environment-climate-change-and-health/58595-who-cop29-special-report_layout_9web.pdf, accessed 7 July 2025)

[17] Public Health Situation Analysis. Geneva: World Health Organization, 2023 (https://cdn.who.int/media/docs/default-source/documents/emergencies/phsa-el-nino-2023_update-oct-2023.pdf?sfvrsn=84a74b22_1&download=true, accessed 7 July 2025)

[18]

 Madhav, N. K., Oppenheim, B., Stephenson, N., Badker, R., Jamison, D. T., Lam, C., & Meadows, A. (2023). Estimated future mortality from pathogens of epidemic and pandemic potential (No. 665). Center for Global Development.

[19] Cirillo, P., & Taleb, N. N. (2020). Tail risk of contagious diseases. Nature Physics, 16(6), 606-613.

[20] Carlson, C. J., Albery, G. F., Merow, C., Trisos, C. H., Zipfel, C. M., Eskew, E. A., ... & Bansal, S. (2022). Climate change increases cross-species viral transmission risk. Nature, 607(7919), 555-562.

[21] Carlson, C. J., Brookson, C. B., Becker, D. J., Cummings, C. A., Gibb, R., Halliday, F. W., ... & Poisot, T. (2025). Pathogens and planetary change. Nature Reviews Biodiversity, 1(1), 32-49.

[22] Meadows, A. J., Stephenson, N., Madhav, N. K., & Oppenheim, B. (2023). Historical trends demonstrate a pattern of increasingly frequent and severe spillover events of high-consequence zoonotic viruses. BMJ Global Health, 8(11), e012026.

[23] Balatbat, C., C. Mundaca Shah, and B. Oppenheim. 2025. Pandemic Risk Assessment and its Intersection with Climate Change: Needs, Opportunities, and Design Considerations. NAM Perspectives. Discussion Proceedings, National Academy of Medicine, Washington, DC. https://doi.org/10/31478/202506b.

[24] Carlson, Colin J et al. 2025. Pathways to an Intergovernmental Panel on Pandemics: lessons from the IPCC and IPBES. The Lancet Microbe, (in press)

[25] Webster, R G et al. Evolution and ecology of influenza A viruses. Microbiological reviews vol. 56,1 (1992): 152-79. doi:10.1128/mr.56.1.152-179.1992

[26] Petrova, Velislava N, and Colin A Russell. The evolution of seasonal influenza viruses. Nature reviews. Microbiology vol. 16,1 (2018): 47-60. doi:10.1038/nrmicro.2017.118

[27] Peacock, T.P., Moncla, L., Dudas, G. et al. The global H5N1 influenza panzootic in mammals. Nature 637, 304–313 (2025). https://doi.org/10.1038/s41586-024-08054-

[28] Organization for Economic Cooperation and Development. Economics of Pandemic Preparedness: Preliminary Results. OECD; 2025. [Forthcoming]

[29] Global Influenza Programme [website]. Geneva: World Health Organizations, 2025. (https://www.who.int/teams/global-influenza-programme, accessed 7 July 2025)

[30] The Global Influenza Surveillance and Response. Geneva: World Health Organization; 2025 (https://www.who.int/health-topics/influenza-avian-and-other-zoonotic#tab=tab_1, accessed 7 July 2025)

[31] Barro, R. J., Ursúa, J. F., & Weng, J. (2020). The Coronavirus and the Great Influenza Pandemic: Lessons from the "Spanish Flu" for the Coronavirus's Potential Effects on Mortality and Economic Activity. NBER Working Paper No. 26866. National Bureau of Economic Research. https://doi.org/10.3386/w26866

32 International Monetary Fund (IMF). World Economic Outlook Database. Washington, D.C.: International Monetary Fund, 2024. (https://www.imf.org/en/Publications/WEO/weo-database/2024/April, accessed June 2025).

33 Global Influenza Strategy 2019-2020. Geneva: World Health Organization, 2019. (https://www.who.int/publications/i/item/9789241515320, accessed 7 July 2025)

34 Pandemic Fund. Pandemic Fund Strategic Plan.Washington, DC; 2024. (https://www.thepandemicfund.org/sites/default/files/2024-06/Pandemic%20Fund%20Strategic%20Plan.pdf, accessed 28 July 2025)

35 Dynamic preparedness metric: a paradigm shift to measure and act on preparedness

Kandel, Nirmal et al. The Lancet Global Health, Volume 10, Issue 5, e615 - e616

36 WHO benchmarks for strengthening health emergency capacities. Geneva: World Health

Organization; 2023. Licence: CC BY-NC-SA 3.0 IGO.

37 The Sendai Framework Terminology on Disaster Risk Reduction. Geneva: United Nations Office for Disaster Risk Reduction (UNDRR), 2017.(https://www.undrr.org/terminology/vulnerability, accessed 11 June 2025)

38 Alexandre Delamou, Thérèse Delvaux, Alison Marie El Ayadi, Abdoul Habib Beavogui, Junko Okumura, Wim Van Damme, Vincent De Brouwere - Public health impact of the 2014–2015 Ebola outbreak in West Africa: seizing opportunities for the future: BMJ Global Health 2017;2:e000202.

39 Pulse survey on continuity of essential health services during the COVID-19 pandemic: interim report. Geneva: World Health Organization, 2020(WHO-2019-nCoV-EHS_continuity-survey-2020.1-eng.pdf, accessed 7 July 2025)

40 Operational Playbook for Pandemic Response Financing. World Health Organization and the World Bank; 2024. (https://www.gov.br/g20/en/tracks/finance-track/finance-and-health, accessed Aug 7, 2025)

41 Global mpox trend. Geneva: World Health Organization; 2025 (https://worldhealthorg.shinyapps.io/mpx_global/, accessed 15 July 2025)

42 Mpox Global Strategic Preparedness and Response Plan. World Health Organization: Geneva September 2024 (https://www.who.int/publications/m/item/mpox-global-strategic-preparedness-and-response-plan, accessed 8 September 2025)

43 Strengthening the global architecture for health emergency prevention, preparedness response and resilience. World Health Organization: Geneva; 2023. (https://www.who.int/publications/m/item/strengthening-the-global-architecture-for-health-emergency-prevention--preparedness--response-and-resilience, accessed 15 July 2025)

44 Mpox Cases. World Health Organization: Geneva, 2025 (https://worldhealthorg.shinyapps.io/mpx_global/#sec-afr, accessed 16 July 2025)

45 Moyo E, Musuka G, Murewanhema G, Moyo P, Dzinamarira T. Monkeypox outbreak: a perspective on Africa's diagnostic and containment capacity. International Journal of Infectious Diseases. 2022 Oct;123:127–130. doi:10.1016/j.ijid.2022.08.016. Epub 2022 Aug 22. PMCID: PMC9534167

46 Africa CDC and World Health Organization. Mpox Continental Response Plan 2.0. Africa CDC and WHO; 2025 (https://africacdc.org/download/mpox-continental-response-plan-2-0/, accessed 15 July 2025)

47 International Association of National Public Health Institutes. Framework for the Creation and Development of National Public Health Institutes. 2007.

48International Association of National Public Health Institutes (IANPHI). Case Study: Providing a Legal Framework for a National Public Health Institute – Mozambique Experience [PDF]. Appendix C. Case Studies of Creating Legal Frameworks for NPHIs. Published circa 2018–2019 (

https://www.ianphi.org/_includes/documents/sections/tools-resources/case-studies/mozambique-case-study-legal-framework-english-v7_final.pdf, accessed 16 July 2025)

49 Myhre SL, French SD, Bergh A. National public health institutes: a scoping review. Glob Public Health. 2022;17(6):1055–72

50 Strengthening the global architecture for health emergency prevention, preparedness, response and resilience. World Health Organization: Geneva; 2023 (Strengthening the global architecture for health emergency prevention, preparedness, response and resilience, accessed 28 July 2025)

51 Preparedness and Resilience for Emerging Threats (PRET). World Health Organization; Geneva: 2023 (https://www.who.int/initiatives/preparedness-and-resilience-for-emerging-threats, accessed 28 July 2025)

52 A Framework for Tracking Global Progress on Preparedness for Respiratory Pandemics. Preparedness and Resilience for Emerging Threats (PRET) initiative. World Health Organization; Geneva: 2025. (https://www.who.int/publications/i/item/9789240094246, accessed 28 July 2025)

53 Tracking Global Progress on Preparedness for Respiratory Pandemics. World Health Organization; Geneva: 2023. (https://www.who.int/publications/i/item/9789240110434, accessed 28 July 2025)

54 Strategic Partnership for Health Security and Emergency Preparedness (SPH) Portal. World Health Organization, Geneva: 2025 (https://extranet.who.int/sph/, accessed 28 July 2025)

55 WHO releases report on state of development of antibacterials. World Health Organization: Geneva;

2024 (https://www.who.int/news/item/14-06-2024-who-releases-report-on-state-of-development-ofantibacterials, accessed 1 October 2025)

56 Ten threats to global health in 2019 (online). World Health Organization: Geneva; 2019. (https://www.who.int/newsroom/spotlight/ten-threats-to-global-health-in-2019 , accessed 2 October 2025)

57 GBD 2021 Antimicrobial Resistance Collaborators. Global burden of bacterial antimicrobial resistance

1990-2021: a systematic analysis with forecasts to 2050. Lancet. 2024 Sep 28;404(10459):1199-1226. https://doi.org/10.1016/S0140-6736(24)01867-1

58 GLG report: Towards specific commitments and action in the response to antimicrobial resistance. Global Leaders Group on Antimicrobial Resistance: Geneva; 2024 (https://www.amrleaders.org/resources/m/item/glgreport, accessed 2 October 2025)

59 Tripartite Zoonoses Guide:Operational tools and approaches for zoonotic diseases [website]. World Health Organization, Geneva :2025. (https://www.who.int/initiatives/tripartite-zoonosis-guide, accessed 28 Kuly 2025)

60 Zinsstag, J., Kaiser-Grolimund, A., Heitz-Tokpa, K., Sreedharan, R., Lubroth, J., Caya, F., Stone, M., Brown, H., Bonfoh, B., Dobell, E., Morgan, D., Homaira, N., Kock, R., Hattendorf, J., Crump, L., Mauti, S., del Rio Vilas, V., Saikat, S., Dar, O., de la Rocque, S. 2023. One Health for global health security: What does the evidence say?. The Lancet. – doi: 10.1016/S0140-6736(22)01595-1

61 FAO, UNEP, WHO, and WOAH. 2022. One Health Joint Plan of Action (2022-2026). Working together for the health of humans, animals, plants and the environment. Rome. https://doi.org/10.4060/cc2289e

62 McGinnis JM et al. The case for more than healthcare. Health Aff. 2002;21:200-17.

63 Commission on Social Determinants of Health. Closing the gap in a generation: health equity through action on the social determinants of health. Geneva: WHO; 2008.

64 LaVeist TA. Examining racial/ethnic disparities in health. 2011.

65 Braveman P et al. Health disparities and health equity: the issue is justice. Am J Public Health. 2011;101:S149–55.

[66] Hood C et al. County health rankings: drivers of population health. 2016.

[67] Donkin A et al. Global action on the social determinants of health. BMJ Glob Health. 2018;3:e000603.

[68] World Health Organization, Regional Office for Europe. Healthy, prosperous lives for all in Europe: the European Health Equity Status Report. Copenhagen: WHO/Europe; 2019.

[69] World Health Organization. Infection-prevention barriers during health-care emergencies: rapid evidence review. Geneva: WHO; 2021.

[70] World Health Organization; United Nations Children's Fund. Progress on WASH in health-care facilities: global report 2021. Geneva: WHO & UNICEF; 2021.

[71] World Health Organization. Discrimination in health-emergency response: technical brief. Geneva: WHO; 2021.

[72] World Health Organization. Global diarrhoeal disease burden estimates 2023 update. Geneva: WHO; 2023.

[73] World Health Organization. Building a global architecture for health-emergency preparedness, response and resilience (HEPR): report to the Seventy-sixth World Health Assembly. Geneva: WHO; 2023

[74] World Health Organization. Health-sector climate-resilience checklist. Geneva: WHO; 2022

[75] World Health Organization, Regional Office for Europe. Social protection and health: evidence digest 2023. Copenhagen: WHO/Europe; 2023

[76] Baird S et al. Cash transfers and HIV prevention among adolescent girls in Malawi. Lancet. 2012;379:1320-9.

[77] Cluver L et al. Cash-plus care: social protection and adolescent HIV outcomes. 2021.

[78] Hutton G, Varughese M. The costs of meeting the 2030 SDG targets on drinking-water, sanitation and hygiene. Washington DC: World Bank; 2016.

[79] Donkin A et al. Global action on the social determinants of health. BMJ Glob Health. 2018;3:e000603.

[80] Jamison DT et al. Global health 2035: a world converging within a generation. Lancet. 2013;382:1898-955.

[81] World Health Organization; United Nations Children's Fund. Progress on WASH in health-care facilities: global report 2021. Geneva: WHO & UNICEF; 2021.

[82] Meyer Capps J, Njiru H, de Vries J. Community-Led Total Sanitation and Ebola transmission in Liberia. 2017.

[83] World Health Organization. Global costs and benefits of drinking-water supply and sanitation interventions. Geneva: WHO; 2020.

[84] World Health Organization. Infection-prevention barriers during health-care emergencies: rapid evidence review. Geneva: WHO; 2021.

[85] World Health Organization. Housing and health guidelines. Geneva: WHO; 2018.

[86] Varshney J et al. Overcrowding and COVID-19 mortality in US counties. 2022.

[87] World Health Organization. Housing and health guidelines. Geneva: WHO; 2018

[88] Azevedo JP, Hasan A, Goldstein M et al. Learning losses during COVID-19: early estimates and constraints to recovery. Washington DC: World Bank; 2021.

[89] United Nations Children's Fund. World Children's Well-Being Report. New York: UNICEF; 2021.

[90] World Health Organization. Discrimination in health-emergency response: technical brief. Geneva: WHO; 2021b.

Solidarity   Equality   Sustainability

[91] Pichler S, Wen K, Ziebarth N. Paid-sick-leave mandates and COVID-19 spread in the USA. Health Aff. 2020;39:207-15.