

Public Disclosure Authorized

Public Disclosure Authorized

Public Disclosure Authorized

Public Disclosure Authorized

# Change

# Cannot Wait

BUILDING RESILIENT HEALTH SYSTEMS  
IN THE SHADOW OF COVID-19



# **Change Cannot Wait**

**BUILDING RESILIENT HEALTH SYSTEMS  
IN THE SHADOW OF COVID-19**

**Investing in Health System Resilience for the Anthropocene**

© 2022 International Bank for Reconstruction and Development / The World Bank

1818 H Street NW, Washington, DC 20433

Telephone: 202-473-1000; Internet: [www.worldbank.org](http://www.worldbank.org)

This work is a product of the staff of The World Bank with external contributions. The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of The World Bank, its Board of Executive Directors, or the governments they represent. The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries. Nothing herein shall constitute or be considered to be a limitation upon or waiver of the privileges and immunities of The World Bank, all of which are specifically reserved.

### **Rights and Permissions**

This work is available under the Creative Commons Attribution 3.0 IGO license (CC BY 3.0 IGO) <http://creativecommons.org/licenses/by/3.0/igo>. Under the Creative Commons Attribution license, you are free to copy, distribute, transmit, and adapt this work, including for commercial purposes, under the following conditions:

**Attribution**—Please cite the work as follows: World Bank. 2022. “Change Cannot Wait: Building Resilient Health Systems in the Shadow of COVID-19.” Washington, DC: World Bank

**Translations**—*If you create a translation of this work, please add the following disclaimer along with the attribution: This translation was not created by The World Bank and should not be considered an official World Bank translation. The World Bank shall not be liable for any content or error in this translation.*

**Adaptations**—*If you create an adaptation of this work, please add the following disclaimer along with the attribution: This is an adaptation of an original work by The World Bank. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by The World Bank.*

**Third-party content**—The World Bank does not necessarily own each component of the content contained within the work. The World Bank therefore does not warrant that the use of any third-party-owned individual component or part contained in the work will not infringe on the rights of those third parties. The risk of claims resulting from such infringement rests solely with you. If you wish to reuse a component of the work, it is your responsibility to determine whether permission is needed for that reuse and to obtain permission from the copyright owner. Examples of components can include, but are not limited to, tables, figures, or images.

All queries on rights and licenses should be addressed to World Bank Publications, The World Bank Group, 1818 H Street NW, Washington, DC 20433, USA; e-mail: [pubrights@worldbank.org](mailto:pubrights@worldbank.org).

# Preface

The number and intensity of global health shocks are rising exponentially. As the world still struggles to contain the coronavirus disease 2019 (COVID-19) pandemic, we have seen new health threats such as Monkeypox emerge. The pandemic highlights how extremely vulnerable our society is when we are unprepared for public-health crises—and how we must build robust, resilient health systems that not only can withstand shocks but also improve health outcomes between crises by preventing and managing threats.

This report makes a valuable contribution to efforts to improve health system resilience. The authors have mined country experiences during COVID-19 and earlier disease outbreaks and explored previous authoritative work to describe the key features of resilient health systems and the health sector investments that enable them. The report presents a unique but simple health system resilience framework and a detailed roadmap for countries to operationalize resilience in the form of integrated investments that promote progress toward the International Health Regulations (IHR) and Universal Health Coverage (UHC). These investments will help countries prepare for, withstand, and manage acute health shocks and prevent disruptions in essential health service delivery during crises.

The actions recommended in this report further will help unlock the resilience dividend by promoting preservation of human capital during crises and inter-crisis periods. The report also offers a three-tier investment framework to help countries prioritize investments —especially important given today's difficult economic environment.

The report is also a call to action. Our world grows more interconnected by the day, and the pandemic has shown everyone how quickly and easily acute infectious diseases cross borders. Becoming resilient will require every country to meet its responsibilities, not only to its own population but also to the global community, to change policies and strengthen health system resilience through integrated actions that promote equity and strengthen health security – bringing pandemic prevention, preparedness, and response within the folds of service delivery. This includes a focus on early warning systems, strong public health institutions (including legislation, planning, and decision-making for crises), cross-sectoral and public-private partnerships that strengthen coordination and joint implementation of activities, frontline-ready and agile health workforce, community engagement, and primary health care. For strong defenses can only be built on strong foundations.

The time to build our defenses is now, before the next public-health emergency overwhelms health systems again. The next epidemic or pandemic could be around the corner. As our report title underscores, change cannot wait.

**Mamta Murthi**

Vice President for Human Development  
World Bank



na Ok M.D.

KNY  
JER

# Executive Summary

The COVID-19 pandemic and its devastating health, economic, and societal impacts demonstrate how unprepared the world is for such immense public-health emergencies. The pandemic's staggering consequences include projected cumulative global output losses of US\$22 trillion by 2025 and a death toll estimated at two-to-four times higher than the official count of 6.5 million lives lost so far. And yet this devastation may be surpassed by impacts from even graver health threats on the horizon.

As people extend their footprint on the planet, encroaching on natural habitats and altering them to extract resources while accelerating human population movements, commerce, and climate change, the potential for infectious diseases to emerge and spread is rising exponentially. The pace of outbreaks has accelerated from less than 100 per year before 1980 to more than 400 annually since 2000. The increasing frequency of acute infectious disease outbreaks and trends such as population aging, rising chronic-disease burdens, and climate change raise the risk of syndemics—events in which two or more diseases adversely interact with each other and with political and economic conditions of inequality and poverty. COVID-19 is a bitter lesson in how these dynamics interact to cause profound suffering.

The only way to prevent, prepare for, and manage these threats is by building resilient health systems to withstand shocks and improve health outcomes between crises. But, over the years, countries and international donors have largely focused health investments on outbreak response, leaving the world grossly unprepared to thwart or manage health emergencies. This report shows how strengthening health system resilience is within every country's reach, even those with low incomes.

Based on country experiences, previous authoritative work, and new World Bank research, this report describes the key features of resilience and the investments that enable it. It defines resilient health

systems as *integrated systems that are aware of threats; agile in response to evolving needs; absorptive of shocks; adaptive to minimize disruptions; and able to transform after a crisis, based on lessons learned.* Governments have two main types of levers to achieve these qualities and advance resilience in the health sector—enablers and core capacities. Enablers are crosscutting factors that influence all aspects of health systems: governance, partnerships, financing, human resources, and innovation. Core capacities essential for resilience include health intelligence; health service delivery, especially primary health care (PHC); community engagement and risk communication; and the health supply chain.

The report details recommendations for countries to operationalize health system resilience and sets out a three-tier framework to help them prioritize investments based on their resilience impact:

**Tier 1: Risk Reduction—prevention and community preparedness.** This is the most important tier, the foundation of pre-crisis pandemic defense, and the cornerstone of health security. Investments for prevention and preparedness yield the biggest “bang for the buck” in resilience outcomes. Its focus is on upstream, preventive action and includes strong PHC and community-based surveillance.

**Tier 2: Detection, containment, and mitigation capabilities.** Countries also need health systems that can detect, contain, and mitigate outbreaks before they spread widely. Tier 2 operates primarily early in an outbreak—identifying and protecting at-risk populations; scaling up testing; isolating suspected cases; conducting epidemic intelligence, surveillance, and contact tracing.

**Tier 3: Advanced case management and surge response.** The third layer of defense includes surge response interventions and secondary and tertiary hospital interventions for complicated cases. Investments focus on surge financing to quickly meet the extraordinary costs of a full-force epidemic or

pandemic, making this the most expensive and least cost-effective tier.

While the report focuses on policy actions and investments within the health sector to strengthen resilience, multisectoral collaboration, partnerships, and investments are also crucial. Ultimately, it will take the whole-of-government and the whole-of-society to achieve resilience in health systems.

During this time of major economic contraction and uncertainty, governments may ask how they can afford these investments. Notably, as research for this report reveals, even low- and lower-middle-income countries, from the Democratic Republic of the Congo to Vietnam, have learned lessons from past health

crises to invest in making their health systems more resilient to future outbreaks. While these investments must be sustained over time, quick wins for resilience are also possible, and the report shows countries how to achieve them.

By starting now, countries can break the cycle of panic and neglect and prepare for the next epidemic or pandemic that could be around the corner. As COVID-19 has underscored, countries cannot afford to take a business-as-usual approach to infectious disease outbreaks. The fundamental message of the report is urgency. To improve health and save lives and economies, countries and international donors must act now—before it is too late.



# Key Recommendations

## Governance:



- i. Review and strengthen decision-making processes based on evidence.
- ii. Invest in national public-health institutions and update legal and regulatory frameworks.
- iii. Update preparedness plans and strategies to incorporate risk drivers and leverage learning from prior experiences.
- iv. Ensure leadership and command structure by enabling clarity of roles, capacity building, and establishing emergency operation centers (EOCs).

## Partnerships:



- i. Leverage regional institutions and partnerships for coordination, capacity building, and harmonization of policies.
- ii. Institutionalize whole-of-government approaches by setting up multisectoral and One Health platforms for planning and coordination of cross-sectoral activities.
- iii. Develop a fit-for-purpose private-sector engagement strategy and establish agreements to facilitate the private sector's role during crises.

## Financing resilient health systems:



- i. Prioritize, ring-fence, and track investments in pandemic prevention, preparedness, and response (PPR).
- ii. Leverage catalytic, complementary investments in resilience (e.g., joint planning tools).
- iii. Reduce financial barriers to access crisis interventions and essential health services.
- iv. Develop diverse and agile crisis-ready financing—create contingency funds and use innovative financing for disaster-risk layering.

## Human resources:



- i. Map health workforce needs and develop an evidence-based human resources for health strategy.
- ii. Diversify and repurpose the health workforce.
- iii. Develop and sustain cadres of community health workers (CHWs) and train them for frontline PPR roles.
- iv. Build multi-disciplinary competencies for PPR through pre-service and in-service trainings.
- v. Protect frontline staff by providing access to infection, prevention, and control (IPC) training, personal protective equipment (PPE), and information, education, and communication (IEC).

### **Innovation:**



- i. Update preparedness plans and national health strategies to include mechanisms for research and regulatory review processes during emergencies.
- ii. Spur people-centered innovation by engaging communities and supporting intermediary innovation platforms.
- iii. Invest in an agile regulatory system to accommodate and fast-track new medical technologies.
- iv. Build research, regulatory, and monitoring and evaluation capacity.

### **Health intelligence:**



- i. Strengthen early-warning surveillance and epidemic intelligence functions.
- ii. Strengthen inter-connected laboratory capacity and regional networks.
- iii. Strengthen and integrate information systems, including for monitoring of service provision and disruptions at facilities.
- iv. Leverage digital tools and new technology.

### **Health service delivery:**



- i. Assess readiness of health facilities for shocks and invest in crisis-ready facilities.
- ii. Develop plans for continuity of essential services during crises and leverage alternate health service delivery sites and adapted models of care during crises, including through maintenance and broadening of successful telemedicine platforms.
- iii. Strengthen patient referral systems and develop coordinated networks of health facilities.
- iv. Build partnerships between public-health agencies, health facilities, the private sector, and humanitarian agencies to scale service delivery in crises.
- v. Invest in community-centered primary health care (PHC) with integrated public-health functions.

### **Risk communication and community engagement:**



- i. Strengthen risk communication procedures, build capacity to communicate risks, and enable two-way communication.
- ii. Empower communities by involving them in decision-making.
- iii. Strengthen rumor monitoring, address misinformation, and build community trust in public-health interventions.

### **Crisis-ready supply chains:**



- i. Develop forecasting capacities, emergency logistics and supply chain management plans, rational-use guidance, pre-positioned contingency procurement plans, and acquisition flexibilities for health emergencies.
- ii. Leverage regional cooperation and domestic production for key medical goods.
- iii. Tackle human-resource and infrastructure gaps to upgrade supply chains.

# Contents

<b>Preface</b>	<b>iii</b>
<b>Executive Summary</b>	<b>v</b>
<b>Key Recommendations</b>	<b>vii</b>
<b>Acknowledgements</b>	<b>xiii</b>
<b>Abbreviations</b>	<b>xiv</b>
<b>SECTION I: Laying the groundwork for health system resilience</b>	<b>1</b>
Fundamental change in health systems cannot wait	1
Health system challenges in the Anthropocene: COVID-19 and beyond	1
A new framework for health system resilience	1
Resilient health systems enable health security and promote equity	2
Contribution of this report	3
Data sources and limitations	4
<b>SECTION II: Leveraging enablers for health system resilience</b>	<b>5</b>
Governance	6
Investing in health system resilience is a political choice	6
Focus on decision-making processes	7
Translate evidence into action through scientific advisory bodies and information sharing	7
Invest in strong national public-health institutions	7
Review and update legal and regulatory frameworks for risk reduction and management	8
Empower local authorities for planning, decision-making, and capacity building	8
Strengthen leadership and command structure for public-health crisis response	8
Adopt risk-informed plans and leverage learning from prior crises and simulations	8
Partnerships	10
Leverage regional collaboration and institutions to strengthen health system resilience	10
Adopt a whole-of-government approach	10
Leverage the One Health approach for pandemic risk reduction	11
Adopt a whole-of-society approach built with strong community partnership	12
Harness the power of the private sector	12
Financing resilient health systems	14
Financing preparedness is critical for resilience	14
Leverage catalytic and complementary investments in health system resilience	15

Reduce financial barriers to access essential health services	15
Improve financial accountability and monitoring and evaluation	15
Develop diverse, agile, and crisis-ready financing for emergencies	16
Human Resources	18
Develop a multi-disciplinary health workforce, guided by data and evidence	18
Diversify and repurpose the workforce	19
Develop, expand, and sustain cadres of community health workers	19
Upskill the workforce to build frontline capacities for PPR	19
Protect frontline health workforce	20
Targeted information, education, communication strategies for HCWs	21
Innovation	22
Innovation in countries during COVID-19	22
Innovation enablers and barriers	23
Leverage research and innovation to improve health outcomes	23
Adopt a people-centered and demand-driven approach to innovation	24
Deploy innovative digital tools for resilience	24
Foster innovation capacity in the private sector and engage in partnerships	25
Invest in an agile regulatory system	25
<b>SECTION III: Core Capacities</b>	<b>27</b>
Health Intelligence	28
Strengthen early-warning surveillance and epidemic intelligence functions	28
Strengthen detection through inter-connected laboratory networks	30
Data collection and information systems are the foundation of health intelligence	30
Monitor service provision at facility level and disruptions in essential services	31
Leverage digital tools and new technology to enhance timely detection and notification	31
Health Service Delivery	32
Health emergencies negatively impact essential service delivery	32
Assess the readiness of health facilities for crises before they strike	32
Develop plans for continuity of essential services and surge response for threats	33
Leverage alternate health service delivery sites and adapt models of care	33
Redistribute health service delivery capacity based on needs	34
Maintain and broaden successful telemedicine platforms	34
Primary health care for delivery of public-health functions	35
Develop a coordinated network of health facilities	35
Build partnerships between public-health agencies and health facilities	35
Establish partnerships with the private sector and neighboring countries	36
Strengthen health information systems to enable granular and real-time data	36

Risk communication and community engagement	37
Community engagement is critical for building trust	37
Empower communities by engaging them in decision-making and governance structures	38
Strengthen procedures and capacity to communicate risks, and enable two-way communication	38
Invest in human-resource capacity building for RCCE	39
Address the dangers of infodemics and misinformation in crises	39
Crisis-ready supply chains	42
Create crisis-ready supply chains that are aware and agile	42
Leverage regional cooperation and foster domestic production	43
Deepen and diversify engagement with the private sector	43
Use technology and innovation more systematically	43
Tackle critical human-resource gaps and professionalize supply chains	44
Invest in supply chain infrastructure	44
<b>Section IV: Where should countries invest first?</b>	<b>47</b>
<b>Conclusion</b>	<b>49</b>
<b>References</b>	<b>51</b>
<b>BOXES</b>	
Box 1. Characteristics of a resilient health system	2
Box 2. Country examples of governance reforms	9
Box 3. Country examples of investing in partnerships	13
Box 4. Country examples of financing resilience	17
Box 5. Country examples of human resources strategies	21
Box 6. Country examples of innovation	26
Box 7. Country examples of health intelligence	31
Box 8. Country examples of service delivery	36
Box 9. Country examples of RCCE	40
Box 10. RCCE successes in crises	41
Box 11. Country examples of supply chains	45
<b>FIGURES</b>	
Figure 1. Framework for health system resilience	3
Figure 2. Value-add of regional approach	11
Figure 3. A three-tiered investment framework to build resilient health systems	47



# Acknowledgements

We would like to extend our appreciation to all the individuals, organizations, and institutions who provided their knowledge and expertise to the development of this report. This flagship report was prepared by World Bank staff with contributions from partners and collaborators.

This report's coordination, the drafting, and intellectual conceptualization was led by Sulzhan Bali, Zara Shubber, and Alexander Irwin under the supervision and guidance of Feng Zhao and Juan Pablo Uribe.

The following core team supported the drafting and coordination for the report: Kseniya Bieliaieva, Alethea Cook, Clement Jaidzeka, Akiko Kitamura, Meghna Raman, Gayatri Rao Sanku, Jigyasa Sharma, Shweta Sinha, Aditya Upadhyaula, and Peeriya Watakulsin. The editing of the report was done by Karen Schneider, and Cathy Lips. Graphics support was provided by Diana De León and Alejandro Espinosa. Karen Baza, Corinne Bernaldez, Aissatou Chipkaou, Marize de Fatima Santos, and Erika Yanick provided operational and administrative support.

Other World Bank staff and consultants who contributed content to the report included Alejandra Barandiaran, Lucia Bedregal, Peter Berman, Franck Berthe, Marco Boggero, Andre Carletto, Patricio Marquez, Dai Morita, Rocio Schmunis, Sarah Shanks, Huihui Wang, Katelyn Yoo, and Bomy Yun. Technical content for the report was also supported by contributions from: Prince Adu, Till Barnighausen, Maxwell Cameron, Vijay Kumar Chattu, Exemplars in Global Health research partner coalition, Victoria Haldane, Eva Jarawan, Jennifer Nuzzo, Candice Ruck, Muntaqa Umar-Sadiq, Wu Zeng, and teams from BRAC, Curatio International Foundation, and the Indian Institute of Technology Bombay (IIT Bombay).

The report was reviewed in its draft form by: Franck Berthe, Claire Chase, Amit Dar, Timothy Johnston, Christoph Lemiere, Jennifer Nuzzo (Brown University), Jun Rentschler, and Mersedeh Tariverdi. Mickey Chopra, Andre Carletto, Adanna Chukwuma, Teegwende Valerie Porgo, and Sherin Varkey also provided helpful comments during the review.

The report was greatly enriched by the insights and expertise of the members of the report's Technical Advisory Group (TAG). The TAG included several partners and external experts: Salma M. Abdalla (Boston University), Till Bärnighausen (University of Heidelberg), Becky Bartlein (Exemplars in Global Health), Vijay Kumar Chattu (University of Toronto), Francesca Colombo (OECD), Patricia Geli (Reform for Resilience, Harvard), Victoria Haldane (University of Toronto), Keith Hamilton (OIE), Sara Hersey (Resolve To Save Lives), Eva Jarawan (Georgetown University), Nirmal Kandel (WHO), Joe Kutzin (WHO), Chevy Lazenby (Exemplars in Global Health), Anne Liu (Exemplars in Global Health), Shunsuke Mabuchi (Bill and Melinda Gates Foundation), Robert Marten (WHO), Jennifer Nuzzo (Brown University), Patrick Osewe (Asian Development Bank), Ahmed Ouma (Africa CDC), Scott Douglas Pendergast (WHO), Alexandra Phelan (Georgetown University), K. Srinath Reddy (Public Health Foundation of India), Sohel Saikat (WHO), Scott Stewart (USAID), Laksono Trisnanto (Gadjah Mada Medical School Indonesia), Muntaqa Umar-Sadiq (Nigeria Health Innovation Marketplace, Private Sector Health Alliance of Nigeria), Jeanette Vega Morales (Institute for Healthcare Improvement), and Wu Zeng (Georgetown University). World Bank members of the TAG included: Ayodeji Ajiboye, Priya Basu, Franck Berthe, Andre Carletto, Mickey Chopra, Adanna Chukwuma, John Paul Clark, Ian Forde, Marelize Gorgens, Arian Hatefi, Cristian Herrera, Johnston, Christophe Lemiere, Magnus Lindelow, Suresh Mohammed, Dinesh Nair, Toomas Palu, Joao Pires, Teegwende Valerie Porgo, Subhashini Rajasekaran, Sanam Roder-DeWan, Yoshini Naomi Rupasinghe, Rocio Schmunis, Mersedeh Tariverdi, Jeremy Veillard, Shiyong Wang, and David Wilson.

We are grateful to Japan Policy and Human Resources Development Fund (PHRD) Trust Fund for support to this report.



# Abbreviations

<b>A4EPR</b>	Alliance for Emergency Preparedness and Response
<b>AAR</b>	After Action Review
<b>ABPM-JAY</b>	Ayushman Bharat Pradhan Mantri Jan Arogya Yojana
<b>ABR</b>	Antibacterial Resistance
<b>ACDCP</b>	Africa CDC Regional Investment Financing Project
<b>ACRES</b>	Center For Rapid Evidence Synthesis
<b>ADB</b>	Asian Development Bank
<b>AGPMPN</b>	Association of General and Private Medical Practitioners of Nigeria
<b>AMR</b>	Anti-Microbial Resistance
<b>AMSP</b>	Africa Medical Supplies Platform
<b>APA</b>	Advance Purchase Agreements
<b>ASCP</b>	Agent De Santé Communautaire Polyvalent
<b>ASHA</b>	Accredited Social Health Activists
<b>ASLM</b>	African Society for Laboratory Medicine
<b>AU</b>	African Union
<b>AVATT</b>	African Vaccine Acquisition Task Team
<b>AVET</b>	Applied Veterinary Epidemiology Training
<b>AWW</b>	Anganwadi Workers
<b>BAHO</b>	Bayanihan To Heal as One Act
<b>BCM</b>	Business Continuity Management
<b>BIDI</b>	Bamrasnaradura Infectious Diseases Institute
<b>BMGF</b>	Bill and Melinda Gates Foundation
<b>BOI</b>	Board of Investment
<b>BPS</b>	Brazil's Health Price Bank
<b>CACOVID</b>	Coalition Against COVID-19
<b>CAGR</b>	Compound Annual Growth Rate
<b>CAT-DDO</b>	Catastrophe-Deferred Drawdown Option
<b>CBD</b>	Cannabidiol
<b>CBS</b>	Community-Based Surveillance
<b>CCMDD</b>	Central Chronic Medicines Dispensing and Distribution
<b>CCSA</b>	Center for COVID-19 Situation Administration
<b>CDAC</b>	The Inter-Agency Working Group on Communicating with Disaster Communities
<b>CDC</b>	Centers For Disease Control
<b>CDCO</b>	Communicable Disease Control Officers
<b>CDCU</b>	Communicable Disease Control Units
<b>CEPI</b>	Coalition for Epidemic Preparedness Innovations
<b>CERC</b>	Contingent Emergency Response Components
<b>CERI</b>	Center For Epidemic Response and Innovation
<b>CETC</b>	Chinese Electronic Technology Corporation
<b>CFE</b>	Contingency Financing for Emergencies
<b>CFR</b>	Council on Foreign Relations
<b>CHSLM</b>	Certificate Program in Health Systems Leadership and Management

<b>CHW</b>	Community Health Workers
<b>CIDARS</b>	The China Infectious Diseases Automated Alert and Response System
<b>CMST</b>	Central Medical Stores Trust
<b>COG-UK</b>	The COVID-19 Genomics UK Consortium
<b>COMISCA</b>	SICA's Council of Ministers of Health
<b>COPD</b>	Chronic Obstructive Pulmonary Disease
<b>COVAX</b>	Covid-19 Vaccines Global Access
<b>COVAX-AMC</b>	Covid-19 Vaccines Advance Market Commitment
<b>COVGEN</b>	Pan American Health Organization (PAHO)'S COVID-19 Genomic Surveillance Regional Network
<b>COVID-19</b>	Coronavirus Disease 2019
<b>CPIA</b>	World Bank's Country Policy Institutional Assessment
<b>CRVS</b>	Civil Registration and Vital Statistics
<b>CSCS</b>	COVID-19 Supply Chain System Assessment
<b>CSO</b>	Civil Society Organizations
<b>CSIS</b>	Capita Per Year for Strengthening Pandemic Preparedness
<b>CSMBS</b>	Civil Servant Medical Benefit Scheme
<b>CTAP</b>	Coronavirus Treatment Acceleration Program
<b>DALY</b>	Disability-Adjusted Life Years
<b>DRC</b>	Democratic Republic of the Congo
<b>DRM</b>	Disaster Risk Management
<b>DRR</b>	Disaster Risk Reduction
<b>DTP</b>	Diphtheria-Tetanus-Pertussis Combined Vaccine
<b>EAIDSNet</b>	East African Integrated Disease Surveillance Network
<b>EBS</b>	Event-Based Surveillance
<b>ECMO</b>	Extracorporeal Membrane Oxygenation
<b>EHS</b>	Environmental Health and Safety
<b>EID</b>	Emerging Infectious Diseases
<b>EOC</b>	Emergency Operations Center
<b>EMA</b>	European Medicines Agency
<b>ERP</b>	Emergency Response Plan
<b>EVD</b>	Ebola Virus Disease
<b>FCS</b>	Fragile and Conflict-Affected Situations
<b>FCV</b>	Fragility, Conflict, and Violence
<b>FELTP</b>	Field Epidemiology and Laboratory Training Programs
<b>FELTP-V</b>	Field Epidemiology and Laboratory Training Programs-Veterinarian
<b>G7</b>	Group of Seven
<b>GBD</b>	Global Burden of Disease
<b>GBV</b>	Gender-Based Violence
<b>GDP</b>	Gross Domestic Product
<b>GFF</b>	Global Financing Facility
<b>GHS</b>	Global Health Security
<b>GHSA</b>	Global Health Security Agenda
<b>GPG</b>	Global Public Goods
<b>GPMB</b>	Global Preparedness Monitoring Board
<b>GRAM</b>	Global Research on Antimicrobial Resistance

<b>GRID</b>	Green, Resilient, and Inclusive Development
<b>HDI</b>	Human Development Index
<b>HIC</b>	High-income Country
<b>HIV</b>	Human Immunodeficient Virus
<b>HMIS</b>	Health Management and Information System
<b>HNP</b>	Health, Nutrition, and Population
<b>HSA</b>	Singapore Health Services Authority
<b>ICCM</b>	Integrated Community Case Management
<b>ICT</b>	Information and Communication Technology
<b>IDA</b>	International Development Association
<b>IEC</b>	Information, Education, and Communication
<b>IHME</b>	Institute For Health Metrics and Evaluation
<b>IHR</b>	International Health Regulations
<b>IMF</b>	International Monetary Fund
<b>IMS</b>	Incident Management System
<b>IOAC</b>	Independent Oversight and Advisory Committee for the WHO Health Emergencies Programme
<b>IoT</b>	Internet of Things
<b>IPC</b>	Infection, Prevention, and Control
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>JEE</b>	Joint External Evaluation
<b>LGBTQI</b>	Lesbian, Gay, Bisexual, Transsexual, Queer, and Intersex
<b>LIC</b>	Low-income Country
<b>LMIC</b>	Lower-Middle-Income Country
<b>MBDS</b>	Mekong Basin Disease Surveillance network
<b>MERS</b>	Middle East Respiratory Syndrome
<b>MoH</b>	Ministry of Health
<b>MoHFW</b>	India's Ministry of Health and Family Welfare
<b>MOU</b>	Memorandum of Understanding
<b>NBER</b>	National Bureau of Economic Research
<b>NDMA</b>	National Disaster Management Agency
<b>NCD</b>	Non-Communicable Disease
<b>NGO</b>	Non-Government Organization
<b>NIDIRIS</b>	Notifiable Infectious Diseases Reporting Information System
<b>NPI</b>	Non-Pharmaceutical Interventions
<b>NPHEC</b>	National Public-Health Emergency Center
<b>NPHI</b>	National Public-Health Institutes
<b>NPHIL</b>	National Public-Health Institute of Liberia
<b>OECD</b>	Organisation For Economic Co-Operation and Development
<b>OECS</b>	The World Bank's Organization of Eastern Caribbean States
<b>OH</b>	One Health
<b>OHP</b>	One Health Partnership for Zoonoses
<b>OWS</b>	Operation Warp Speed
<b>PCR</b>	Polymerase Chain Reaction
<b>PEF</b>	Pandemic Emergency Financing Facility

<b>PHC</b>	Primary Health Care
<b>PHPC</b>	Singapore’s Public Health Preparedness Clinic Scheme
<b>PPE</b>	Personal Protective Equipment
<b>PPM</b>	Pooled Procurement Mechanisms
<b>PPP</b>	Public-Private Partnerships
<b>PPR</b>	Pandemic Preparedness and Response
<b>R&amp;D</b>	Research and Development
<b>RCCE</b>	Risk Communication and Community Engagement
<b>REDISSE</b>	Regional Disease Surveillance Systems Enhancement
<b>RISLNET</b>	Regional Integrated Surveillance and Laboratory Network
<b>ROI</b>	Return on Investment
<b>RMP</b>	Registered Medical Practitioners
<b>RRT</b>	Rapid Response Teams
<b>RTMD</b>	Remote Temperature-Monitoring Devices
<b>SAGE</b>	Strategic Advisory Group of Experts on Immunization
<b>SARS</b>	Severe Acute Respiratory Syndrome
<b>SBP-RFCC</b>	State Bank of Pakistan Refinance Facility for Combating COVID-19
<b>SCM</b>	Supply Chain Management
<b>SDG</b>	Sustainable Development Goals
<b>SHA</b>	System of Health Accounts
<b>SICA</b>	Central American Integration System
<b>SLIPTA</b>	Stepwise Laboratory Improvement Process Towards Accreditation
<b>SLMTA</b>	Strengthening Laboratory Management Toward Accreditation
<b>SMSI</b>	Social Media Search Indexes
<b>SOFPON</b>	Society of Family Physicians of Nigeria
<b>SOP</b>	Standard Operating Procedures
<b>SORMAS</b>	Surveillance, Outbreak Response Management, and Analysis System
<b>SPAR</b>	State Party Self-Assessment Annual Reporting
<b>SRRT</b>	Surveillance Rapid Response Teams
<b>STAR</b>	Strategic Tool for Assessing Risks
<b>TAG</b>	Technical Advisory Group
<b>TB</b>	Tuberculosis
<b>UHC</b>	Universal Health Coverage
<b>UMIC</b>	Upper-Middle-Income Country
<b>UN</b>	United Nations
<b>UNAIDS</b>	The Joint United Nations Programme On HIV/AIDS
<b>UNDP</b>	United Nations Development Programme
<b>UNESCO</b>	United Nations Education, Scientific, and Cultural Organization
<b>UNHCR</b>	United Nations High Commission for Refugees
<b>UNICEF</b>	United Nations Children’s Fund
<b>US</b>	United States
<b>USAID</b>	United States Agency for International Development
<b>VHV</b>	Village Health Volunteers
<b>WBG</b>	World Bank Group
<b>WHO</b>	World Health Organization



# SECTION I:

## Laying the groundwork for health system resilience

### Fundamental change in health systems cannot wait

The global crisis of COVID-19 has revealed structural weaknesses in health systems worldwide and had a devastating impact on individuals, societies, and economies. In the pandemic's wake, political leaders and everyday people alike recognize the importance of resilient health systems that can prevent, prepare for, respond to, and learn from infectious disease outbreaks and other shocks while continuing to deliver quality essential health services.<sup>1</sup> However, urgent questions remain: which characteristics of the health system are most important for achieving resilience? Which health sector investments—especially in low- and middle-income countries (LMICs)—can reinforce resilience to future health emergencies, including pandemics and disasters, while strengthening the foundations of health systems?

This report answers these questions by building on previous authoritative work, leveraging new research, and learning from country experiences during the pandemic. In a world increasingly shaped by complex anthropogenic, or 'human-made' processes, the report presents a new framework for health system resilience, recommendations to achieve it, and where countries can target investments to fill financing gaps to improve resilience and health outcomes.

### Health-system challenges in the Anthropocene: COVID-19 and beyond

Even as the frequency of natural disasters, epidemics, and zoonotic spillovers has increased in recent years, several potent factors have converged to influence outcomes during a health crisis. These include aging populations, chronic co-morbidities, socio-economic and gender inequalities, and the historic neglect of

essential public-health functions and their lack of integration with service delivery.

The growing frequency and complexity of acute infectious disease outbreaks and long-range trends such as population aging, rising chronic-disease burdens, and climatic and environmental change increasingly converge to raise the specter of *syndemics*—events in which two or more diseases adversely interact with each other and with political and economic conditions of inequality.<sup>2,3</sup> COVID-19 provides a stark illustration of how such dynamics can be expected to play out. Analysis of the pandemic's epidemiological and political context reveals a "perfect storm" of rising chronic diseases, social inequalities, and cascading public-health failures fueling the pandemic.<sup>4,5</sup> As countries continue to grapple with COVID-19 and its fallout across multiple domains, other global health threats loom, including some with the potential to dwarf the current pandemic's destructive impacts. Taken together, these trends constitute a powerful wakeup call to policymakers and political leaders to invest in building resilience and strengthening health equity now.

### A new framework for health system resilience

The report describes what a resilient health system looks like and how it performs (See *Box 1* for key resilience characteristics). As Figure 1 illustrates, this report defines resilient health systems as *integrated systems that are aware of threats; agile in response to evolving needs; absorptive of shocks; adaptive to minimize disruptions; and able to transform after a crisis based on lessons learned*. This definition, which builds on previous foundational work, highlights the importance of integration—the system's ability to leverage relationships in the health sector by

## Box 1. Characteristics of a resilient health system

**Aware**—recognizes population health needs and risk drivers, detects threats, and maps strengths and weaknesses. E.g.: through investments in multi-sectoral disease surveillance.

**Agile**—responds to evidence and changing needs and uncertainty, e.g., pre-positioned resources, procurement, and essential supplies; incorporation of risks in planning (including preparedness plans).

**Absorptive**—manages crises and maintains core functions despite a need for redistribution of resources, e.g., emergency operation centers, capacity for contact tracing, and upskilling health workers.

**Adaptive**—minimizes disruptions and maintains essential individual and population-based health services despite change in resources, e.g., reallocation of resources, use of telemedicine, altered standards of care, and rational use of personal protective equipment (PPE).

**Transformative**—innovates and reorganizes structures and operations based on lessons learned during a crisis to reduce risk and improve function, e.g., the enactment of reforms based on lessons learned, simulations, and evaluations.

**Integrate**—integrates essential public-health functions with individual and clinical service delivery through investments; integrates health security, and disease-specific planning with health systems-strengthening initiatives.

**Multi-sectoral**—coordinates and draws value from partnerships to implement resilience-sensitive and specific interventions with allied health (e.g., environmental and animal health) and beyond the health sector (e.g., education; finance; transport; media, communications, and the private sector).

connecting preparedness with health service delivery. While this report focuses on policy actions and investments in the health sector to strengthen resilience, multisectoral collaboration, partnerships, and investments are also crucial. Ultimately, it will take the whole-of-government and the whole-of-society to achieve resilience.

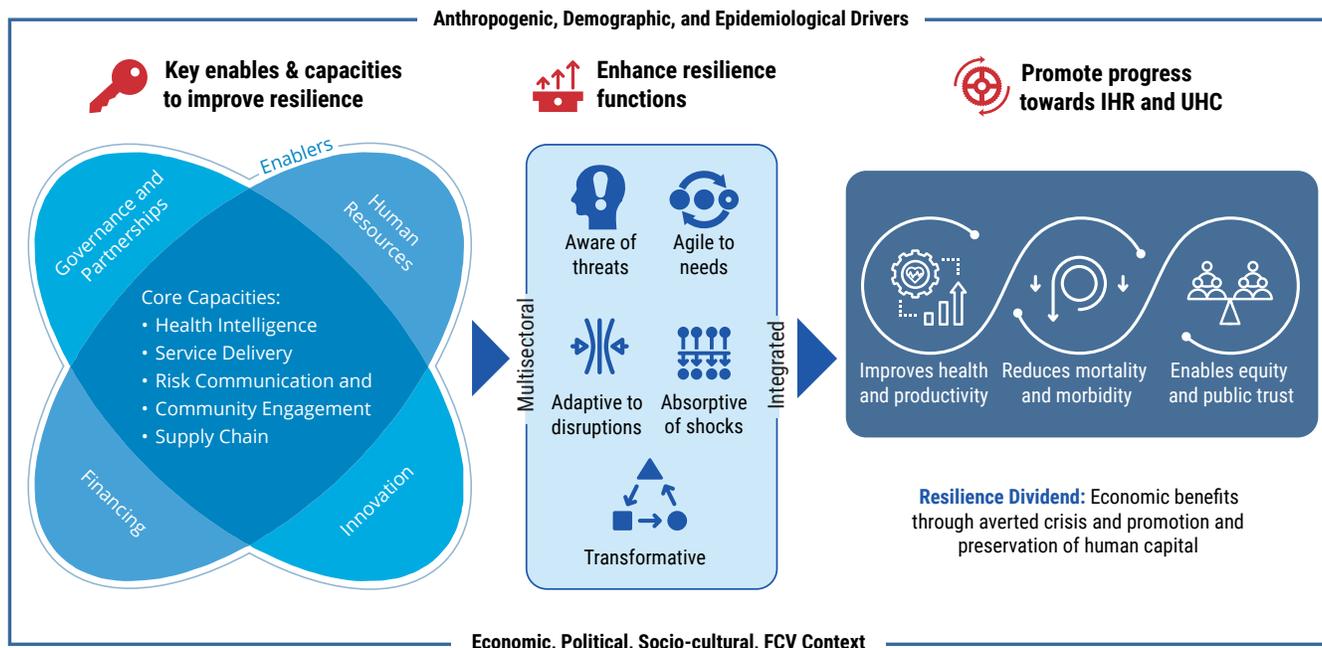
Governments have two main types of levers to advance resilience: enablers and core health system capacities. *Enablers* are crosscutting actions that influence all aspects of health system performance, including other enablers and core capacities. They include *governance, partnerships, health financing, human resources, and innovation*. Core capacities essential for resilience include *health intelligence, health service delivery, community engagement and risk communication, and the health supply chain*. Figure 1 shows how these levers relate to each other and support health-system goals.

## Resilient health systems enable health security and promote equity

Investments proposed in the report strengthen the resilience of health systems and progress toward International Health Regulations (IHR) and Sustainable Development Goals (SDGs), including Universal Health Coverage (UHC).

COVID-19 had a disproportionate impact on already-vulnerable groups and reinforced the importance of equity in enabling resilience during crises and inter-crisis periods. Countries with the most inequality in income and access to quality care had higher excess mortality during COVID-19.<sup>6,7</sup> At the same time, inequitable access to interventions for high-risk and vulnerable populations—the elderly, refugees, women, minorities, and others—highlighted the importance of addressing socio-economic determinants of health.

**Figure 1. Framework for health-system resilience**



The actions proposed in the report will not only allow countries to minimize shock events and increase the capacity of health systems to maintain and provide services during crises, but also boost performance by promoting the overall efficiency of health systems and improving the quality of care, use of health services, and equity in access.

This report shows that critical investments in health system resilience are within reach of all countries and that an array of options exist to strengthen resilience through policy action in the health sector, which also have proven power to save lives and money. Some countries have already scored important resilience gains by leveraging resilience enablers and improving capacities. The findings and analyses presented in the report underscore the importance of moving resolutely to a model of health system resilience, which includes both crisis preparedness and strong service delivery systems.

Most importantly, foundational and integrated investments in stronger health systems that also promote IHR capacities can create a resilience dividend—economic benefits through averted crises

and the promotion of human capital. This occurs through positive impacts on health and productivity, reduced mortality and morbidity from averting crises, and greater trust and confidence in health systems.

### Contribution of this report

At the global level and in countries and local jurisdictions, important efforts have already been made to understand the successes and failures of the COVID-19 response and to reinforce preparedness for future epidemics, pandemics, and other emergencies.

This report is not the first on health system resilience, and it certainly won't be the last. However, it is unique in that it builds upon substantive knowledge to clarify how the concept of health system resilience is evolving in the wake of COVID-19 and focuses on country-level operationalization by identifying actions that boost the ability of health systems to prepare for and withstand health emergencies while preventing disruption in essential health services. The report includes an investment framework designed to aid countries in prioritizing financing in areas that will maximize resilience in the event of a health shock.

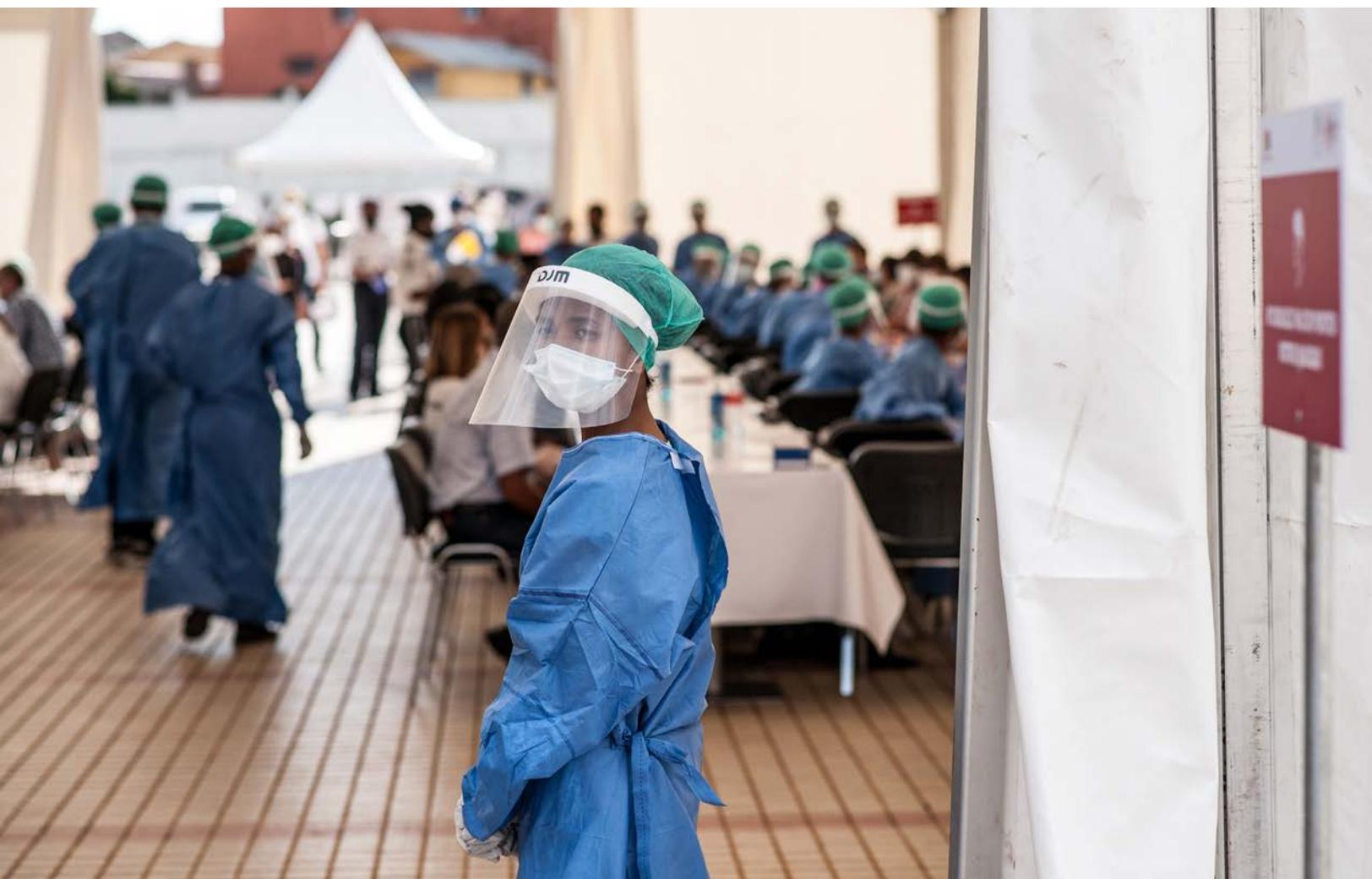
## Data sources and limitations

The report leveraged a wide variety of data sources, including peer-reviewed and grey literature, new case studies and background papers prepared for this report, media sources, and data from global organizations, including the World Bank, International Monetary Fund (IMF), World Health Organization (WHO), Gates Ventures Exemplars case studies, and the Organisation for Economic Development and Co-operation (OECD). Stakeholder consultations and strategic and technical input from the Technical Advisory Group (TAG) informed the report.

While the report draws on a wide range of sources to inform its recommendations, we recognize that more in-depth follow-up analyses are needed at the

country level to contextualize these recommendations and develop a context-specific investment case.

The country examples showcased in the report are not necessarily exemplars in the totality of their health system or COVID-19 response but were chosen because they highlight good practices or specific areas critical to building a resilient health system. The select country examples were sourced from available literature and are used as illustrative examples; it is by no means a comprehensive list. Finally, many countries are still reviewing lessons from the COVID-19 pandemic, which will be critical for learning how to ensure better preparedness and resilience for future health emergencies. In the pandemic's third year, health systems have an opportunity to continue learning and developing resilience.



# SECTION II: Leveraging enablers for health system resilience





## Governance

*Governance has a profound impact on the trajectory of a crisis but is often neglected in preparedness. Key recommendations include:*

- i. Review and strengthen decision-making processes based on evidence.*
- ii. Invest in national public-health institutions and update legal and regulatory frameworks.*
- iii. Update preparedness plans and strategies to incorporate risk drivers and leverage learning from prior experiences.*
- iv. Ensure leadership and command structure by enabling clarity of roles, capacity building, and establishing emergency operation centers (EOCs).*

### **Governance performance has substantially determined the effectiveness of countries' response to COVID-19.**

The Sendai Framework for Disaster Risk Reduction emphasizes the importance of governance in the effective, efficient management of disaster risk—calling for clear guidance, strong coordination within and across sectors, and the participation of relevant stakeholders.<sup>8</sup> Yet governance has been relatively neglected in the health-system resilience literature, giving decision-makers limited guidance on how to strengthen resilience through governance reforms. Moreover, decision-makers tend to focus on the immediate crisis response, neglecting long-term investments and reforms that can prevent crises from occurring in the first place—fueling a cycle of panic and neglect. The pandemic is a reminder that uneven distribution of power, lack of evidence-based decision-making, and marginalization of vulnerable groups—all political aspects of governance that can influence resilience during crises—can hinder an effective response. While it is critical to build strong institutions and policies, equal attention should be paid to political economy, decision-making, accountability, and community participation. Countries can strengthen health-sector resilience by investing in governance

reforms to improve organizations, processes, policies, and legislation.



### **Investing in health system resilience is a political choice**

Despite several lessons learned from prior health emergencies—including Avian Flu, Ebola, and Zika—foundational investments in preparedness have been not only insufficient but also unbalanced and siloed—disconnected from investments in health systems and UHC. The COVID-19 pandemic serves as a reminder that decisions by policymakers determine policies, regulations, and investments—including in public health.

Investments in health system resilience require integrated investments that bring together and promote pandemic preparedness and response (PPR) with investments toward achieving UHC. However, public-health investments, particularly toward health system resilience, can often be long-term in nature, requiring the allocation of resources to generate benefits. Consequently, like other long-term investments, investments in health system resilience are not only vulnerable to fiscal austerity but are also seldom reflected in legislative or parliamentary votes. This can lead to a tendency for decision-makers to prefer decision alternatives that focus on the immediate response and the obvious problems in the

short term but neglect the long-term needs that can prevent the crises from occurring in the first place—leading to an ongoing cycle of panic and neglect.

While this represents a paradox, the challenges of the political economy can somewhat be addressed by examining decision-making processes, creating strong public-health institutions, conducting stronger advocacy, and leveraging the whole-of-government and whole-of-society approach. For example, engaging communities most vulnerable to the impacts of health shocks can play an important role in shifting perceptions and galvanizing political will.

### **Focus on decision-making processes**

Which entity has authority over the processes of decision-making—including for allocation and deployment of resources, management of staff and situations, information sharing, and development of policies and regulations—has an immense impact on health system resilience.<sup>9</sup> National governance responsibilities include overall health-system stewardship both during and between emergencies. However, other stakeholders, including local and non-state actors, also play a critical role in enabling resilience.

### **Buy-in of decision-makers and clarity about decision-making authority, roles, and responsibilities are critical for strengthening resilience.**

To gain buy-in, understanding where the public-health system and core capacity interventions fit within the governance structure is imperative. Similarly, management models within health and other sectors—and how they relate to each other—are crucial.<sup>10</sup> Cross-sectoral collaboration and intragovernmental processes and relationships at all levels of government (including decentralization of decision-making) will also determine health system performance.



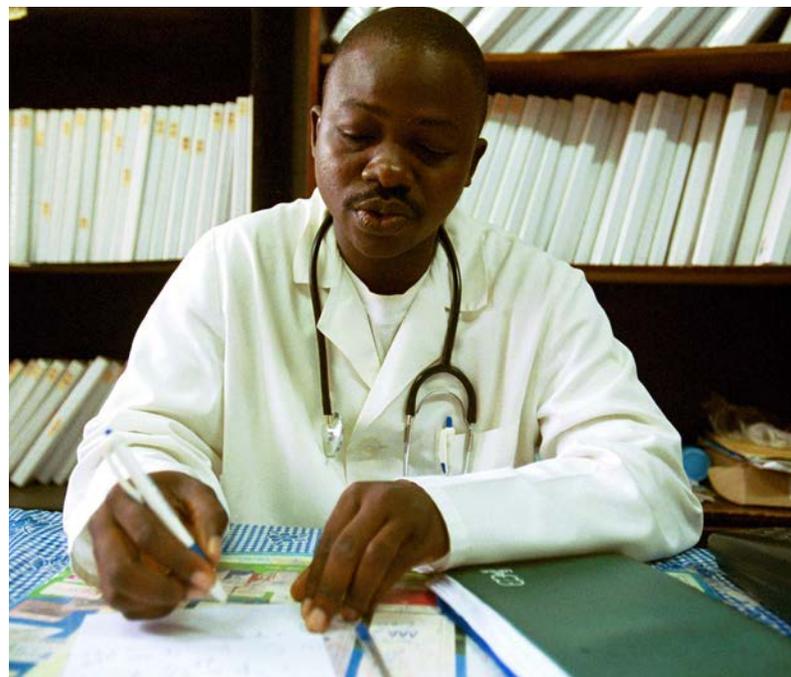
### **Translate evidence into action through scientific advisory bodies and information sharing**

Generating and translating evidence to inform action during crises is a race against time. With COVID-19, epidemic analyses in several countries were *ad hoc*, and politics often influenced the implementation of interventions. The pandemic taught lessons about the importance of well-functioning, formal science advisory institutions, information sharing, leveraging data and evidence, engaging with the scientific community, and incorporating timely analysis into policymaking.<sup>11</sup>



### **Invest in strong national public-health institutions**

Investments in national public-health institutes (NPHIs) can promote resilience by helping manage crises and ensuring that health policies are based on evidence. However, it is crucial that NPHIs have the autonomy and authority to make decisions and that political or economic considerations do not prevail over evidence-based decision-making.<sup>12</sup> NPHIs require legal and structural frameworks to enable them to coordinate pandemic responses on a scientific basis. Investments in building and maintaining sufficient



capacity in personnel, training, technology, and logistics also influence the effectiveness of public-health institutes. Other enablers include country ownership, robust management that can navigate changing political landscapes, financial independence, and a focus on bolstering the public-health workforce at national and subnational levels.



### **Review and update legal and regulatory frameworks for risk reduction and management**

Strong, updated legislative and regulatory frameworks can help countries build support for public-health capacity development, including establishing sustainable norms to support IHR core capacities.<sup>13</sup> Laws, policies, and plans should establish risk-management frameworks that enable preparedness for, and response to, public-health risks by adopting an “all public-health risk” approach in line with IHR. Legal frameworks should include clarifications on triggering events (e.g., novel epidemics), the entity that can declare a public-health emergency, and budgetary resources. Governments should review and update, as needed, laws and policies for risk management to ensure they remain fit for purpose and address all public-health emergency risks. Policies and laws should include the One Health approach and facilitate risk-reduction measures by coordinating activities across sectors.



### **Empower local authorities for planning, decision-making, and capacity building**

Crises are often characterized by centralization of power and top-down decision-making, which can lead to economy of scale in purchasing. However, top-down decision-making alone—without buy-in, flow of resources, and engagement at the local level—can compromise a resilient response. Engaging with local and provincial authorities and, where appropriate, empowering them by redistributing resources and responsibilities can create resilience through a “shock absorber” effect, in which failure at one level of government can be compensated by backup resources at other levels.



### **Strengthen leadership and command structure for public-health crisis response**

Emergency response operations require effective coordination and management. Emergency operations centers (EOCs), along with plans and procedures, are critical to promote a command structure and coordinate resources and response during crises. EOCs should be swiftly activated based on a public-health alert and manage national (or regional) public-health emergencies while coordinating with other sectors. Before establishing an EOC, the Ministry of Health (MoH) should draft and seek approval for an Emergency Response Plan (ERP). The ERP (often based on an incident management system describing the leadership hierarchy) typically describes the EOC’s organizational system and structure of response operations, roles of stakeholders, and how and when to engage across sectors and agencies during an emergency. The ERP should be aligned with existing all-hazards emergency plans, with input from national disaster management agencies and other cross-sectoral agencies. EOCs also need standard operating procedures (SOPs), templates (for data management, reporting, and briefing), mapped public resources, personnel trained in emergency operations, and regular simulations.



### **Adopt risk-informed plans and leverage learning from prior crises and simulations**

National preparedness plans and health strategies must incorporate country-specific risk drivers and context at national levels and strengthen local planning. It is also crucial that governments regularly test the plans and address gaps. In the context of syndemics, a risk-informed approach to preparedness planning can lead to impactful multi-level risk mitigation and management strategies. It is also valuable for countries to learn from previous emergencies. Countries should also undertake scenario planning, simulation, and table-top exercises to regularly test emergency response systems, decision-making, coordination processes, legislative

frameworks, and legal readiness for future crises. Conducting intra- and after-action reviews—with input from various stakeholders—will be critical to

learn lessons from the COVID-19 response and other emergencies.

## Box 2. Country examples of governance reforms

**Generating and sharing evidence:** Several countries successfully bridged the chasm between experts generating and analyzing evidence about COVID-19 and policymakers who could use it. **Uruguay** created the Scientific Advisory Group, empowered its coordinators, and recruited 55 top national scientists to support data analysis and advise on health measures.<sup>14</sup> The **United Kingdom** (UK) activated its Scientific Advisory Group for Emergencies to provide independent evidence reviews and advice to senior government administrators<sup>15</sup>.

**Strengthening public-health institutes:** Learning lessons from previous crises, **South Korea** and **Nigeria** instituted legal reforms to increase the autonomy and capacity of their NPHIs (the Korea Disease Control and Prevention Agency and Nigeria Centres for Disease Control [NCDC], respectively).<sup>16-20</sup> These reforms enhanced their authority to prevent, detect, and respond to public-health threats and upgraded public-health capabilities for IHR implementation.

**Updating legal and regulatory frameworks:** **Cote d'Ivoire, Liberia, Nigeria, Singapore, South Korea,** and **Togo** have updated their legal frameworks to strengthen crisis management.<sup>21-24</sup> After the Ebola crisis, **Liberia** reviewed its public-health laws, identified gaps in the legal structure, and revised laws to strengthen emergency operations; set up a One Health platform to address zoonotic diseases; and established the National Public Health Institute of Liberia (NPHIL). These revisions enabled the MoH to swiftly declare a national emergency on March 21, 2020, for the COVID-19 pandemic—a contrast from the delayed reporting and declaration during the 2014-15 Ebola outbreak.

**Empowering local authorities:** In **Pakistan**, provincial governments established task forces, designated hospitals for testing and treatment, expanded testing capacity, and set up quarantine centers, which served as a stop-gap measure when the federal government was initially struggling to formulate an effective response.<sup>25</sup>

**Improving leadership and command structure:** **Nigeria's** establishment of EOCs at national and subnational levels has helped improve the coordination of preparedness and response activities and resource management. The EOC created in 2012 for Polio eradication was a critical intervention for Nigeria's rapid multisectoral response to Ebola.<sup>18,26</sup> It also established a National Public Health EOC in 2017 to improve the coordination of public-health emergencies, activating it during such crises as the Lassa fever epidemic, the Meningitis outbreak, and COVID-19.<sup>20</sup>

**Learning from previous crises:** **Indonesia** applied learnings from the 2004 Indian Ocean tsunami, which damaged more than 100 health facilities and displaced or killed more than half the health workforce, establishing nine regional crisis-mitigation centers in disaster-prone areas five years later.<sup>27</sup> These centers were equipped with staff, vehicles, and emergency supplies and performed community outreach with local health facilities between natural disasters, teaching basic first aid and natural disaster response. Similarly, **Canada's** experience with the 2003 SARS epidemic led to the creation of the Public Health Agency of Canada and legislative changes for managing public-health crises.<sup>28</sup>



## Partnerships

*Collaborative planning, strong regional networks, cross-sectoral partnerships, and community engagement are vital for resilience. Key recommendations to strengthen partnerships include:*

- i. Leverage regional institutions and partnerships for coordination, capacity building, and harmonization of policies.*
- ii. Institutionalize whole-of-government approaches by setting up multisectoral and One Health platforms for planning and coordination of cross-sectoral activities.*
- iii. Develop a fit-for-purpose private-sector engagement strategy and establish agreements to facilitate the private sector's role during crises.*

**Health leaders cannot build resilient health systems alone. Partnerships spanning multiple stakeholders and sectors within and beyond government are a key instrument to strengthen resilience.**

Taking a multisectoral, whole-of-society approach can lead to effective management of all types of hazards. Four types of partnerships are key to building resilient health systems: (i) regional collaboration, (ii) multisectoral partnerships with non-health sectors (e.g., the disaster, agriculture, and environment sectors) through a One Health approach, (iii) whole-of-society partnerships with communities, and (iv) partnerships with the private sector. These pivotal partnerships are especially important in fragile and conflict-affected situations (FCS), which have high levels of mistrust and weak health systems and governance.



**Leverage regional collaboration and institutions to strengthen health system resilience**

Strong regional institutions, cooperation, and networks with clearly defined roles enhance resilience during crises. Cooperation between

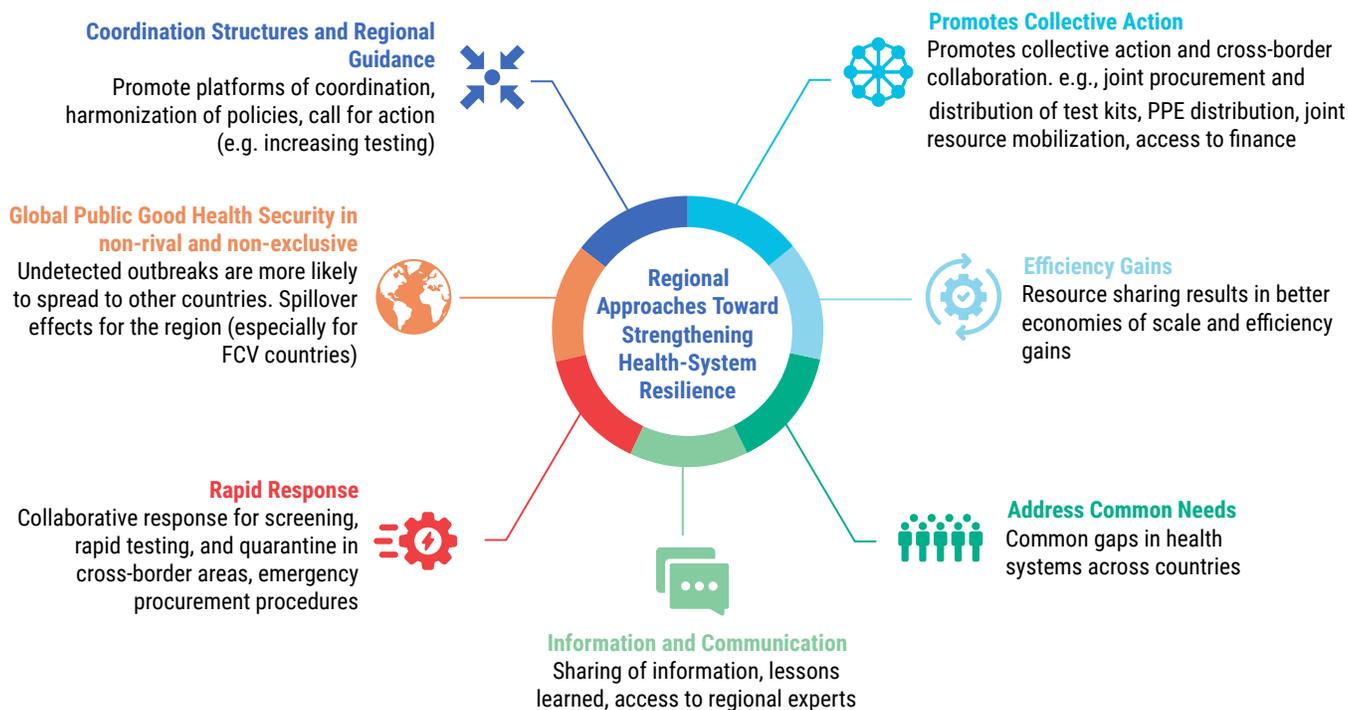
countries can include joint projects, coordination of policies and regulatory frameworks, and development of regional policies and institutions.<sup>29,30</sup> Regional institutions can promote public awareness of risks and interventions and bolster regional surveillance networks, coordination mechanisms, contingency financing, and distribution of resources (Figure 2). Regional coordination platforms enable countries with weaker public-health capacities to benefit from regional expertise. Regional pooled procurement boosts negotiating power of lower-income countries that otherwise could not compete in the marketplace. Pooling supplies and resources can shift benefits from countries with overcapacity to those with lower capacity and provide access to regional resources (including human resources, laboratories, and hospitals).



**Adopt a whole-of-government approach**

The resilience of health systems during emergencies depends on the resilience of sectors such as water, electricity, transport, communications, infrastructure, and digital systems to ensure the availability of interventions, equitable access to health care including essential services, and functioning supply chains.<sup>31</sup> To be effective during crises, multisectoral collaboration between health and non-health sectors

**Figure 2. Value-add of regional approach**



must be robust before the crisis strikes. While the MoH usually manages outbreaks, coordination with other sectors is critical to ensure that both health and non-health essential services can continue. The national disaster management agency (NDMA) and/or equivalent bodies at subnational and local levels often become focal points for coordinating preparedness and response. Joint multisectoral platforms can coordinate the response, or in their absence, the NDMA, which often has a mandate to coordinate across sectors during crises, can perform this function. Planning must be informed by lessons learned, including about changing risk drivers for health crises. Clarifying roles and responsibilities of different stakeholders is critical along with identifying resilience-sensitive and risk-mitigating interventions that can be implemented across sectors.

 **Leverage the One Health approach for pandemic risk reduction**

For whole-of-government partnerships and coordination to be truly effective in enabling resilience, it is essential that they operate with a One Health (OH) vision to reduce risks of spillovers

and enable adaptation to climate change<sup>32</sup>. OH recognizes that health crises are increasingly complex, transboundary, multifactorial, and cross-species. Several drivers—including climate change, land use (e.g., agricultural encroachment, deforestation, and mining), food systems (e.g., food safety and production standards), urbanization, and population movement—can intensify the magnitude and frequency of epidemic risks without preventive measures in place. Understanding the nature of drivers facilitates prevention and reduces the likelihood or consequences of spillover from animals to humans.

OH is critical to reduce the likelihood of spillovers, while resilient health systems are critical to reduce their impact. Recent crises including Avian Influenza and COVID-19 show that reactive strategies won't achieve good health outcomes and are far more expensive—requiring emergency instruments and often massive resources—than a preemptive, cost-effective OH approach that tackles drivers of outbreaks. Increasing the uptake of OH is vital because most epidemic-prone emerging infectious diseases (EIDs)—including COVID-19, Ebola, and Zika—have a zoonotic, wildlife-



based origin. OH strategies (e.g., joint surveillance in the animal and health sectors) can speed detection of, and intervention for, outbreaks to minimize their health and social costs. OH also lowers disease spillover risks and enables cost-sharing across sectors. Countries can incorporate One Health to unlock health system resilience gains through the following cross-sectoral actions: (i) *adopting a OH 'risk' approach in planning* by understanding and incorporating risk drivers in plans and developing or updating national OH strategies with multisectoral implementation tools; (ii) *promoting joint implementation of OH* by establishing and formalizing national multisectoral or OH coordination mechanisms and implementing resilience-sensitive activities (e.g., regulating wildlife breeding facilities), and (iii) *catalyzing OH financing and collaboration* by tracking resilience-sensitive expenditures across sectors.



### **Adopt a whole-of-society approach built with strong community partnership**

Communities are critical for resilience yet are often an after-thought. Community engagement is the cornerstone of building trust in governments and institutions, ensuring compliance with public-

health measures, and enabling demand and use of interventions and essential health services.<sup>33</sup> Community-based interventions are also important for health promotion, prevention, and preparedness activities. The rise of misinformation and distrust in governments threaten an effective response, especially for a novel disease such as COVID-19. To strengthen decision-making and risk communication, civil society organizations (CSOs), village councils, and religious and traditional leaders can be engaged to disseminate accurate information and build trust.<sup>34</sup>



### **Harness the power of the private sector**

The government health sector bears primary responsibility for fostering health system resilience. However, the private sector—both health and commercial sectors—has an extensive range of capabilities and resources that can contribute to resilience, and private actors are often willing and ready to engage.<sup>35,36</sup> Although in many countries the private sector has yet to be effectively enlisted in resilience efforts, the COVID-19 response provides evidence of promising public-private collaboration. Early in the pandemic, several countries rapidly engaged the private sector for an agile and adaptive response by mobilizing human resources, expanding hospital bed and intensive care capacity, streamlining health financing flows, and reducing barriers to access. Several countries creatively used policy and regulatory instruments to spur partnerships. Successful measures included: (i) using emergency laws to capitalize on private-sector capacity and relaxing procurement laws to facilitate purchasing of medical services; (ii) easing accreditation requirements under social health insurance schemes to quickly approve new health facilities; (iii) allowing local governments to directly contract with private facilities and laboratories under “state of emergency” laws to increase essential capacity; and (iv) enacting laws and adopting policies to prevent hoarding, exploitative pricing, and export of medical supplies. Some countries used health financing tools to help defray private providers’ costs during the response.

<sup>i</sup> This report defines the private sector as encompassing the part of the economy run by individuals, providers, and commercial companies that are not state controlled, operating both within and external to the health sector.

Several broad lessons can be gleaned from country experiences with the private sector during COVID-19. Countries are likely to achieve the best outcomes if they design and implement joint public-private preparedness efforts before shocks occur; develop a fit-for-purpose private-sector engagement strategy;

engage private partners in multisectoral coordination platforms; and foster innovation and technology.<sup>37</sup> Contingency contracts with the private sector could also be further leveraged to strengthen agility and adaptiveness of surge response.

### Box 3. Country examples of investing in partnerships

**Leveraging regional institutions:** The **Africa Centres for Disease Control and Prevention** (Africa CDC) played a strong role in the COVID-19 response. By April 2020, Africa CDC had developed a regional COVID-19 strategy; trained tens of thousands of clinicians and CHWs; established a pooled procurement system to reduce costs of medical equipment and purchase vaccines; and expanded testing capacity from two to 43 countries, in part by repurposing equipment used for HIV and TB testing.<sup>29</sup>

**Adopting a whole-of-government approach:** **Mozambique** leveraged a whole-of-government approach to integrate its health and disaster response to COVID-19 and established an Emergency Commission to ensure effective coordination and planning through nine Technical Working Groups co-led by MoH staff and development partners.<sup>37</sup> **Ghana's** political leadership for a whole-of-government approach was reflected in the country's mobilization of a multisectoral coordination mechanism including government agencies, academic institutions, donors, and the private sector.<sup>38</sup> **China** also responded to COVID-19 by creating a whole-of-government strategy and establishing a Joint Prevention and Control Mechanism linking 32 ministries for communication, collaboration, and resource mobilization.<sup>39</sup>

**Leveraging One Health:** **Vietnam** has been a leader in adopting the OH approach, prompted by the impact of multiple zoonotic outbreaks, including SARS (2003), H5N1 (2003), and H1N1 (2009).<sup>40</sup> Vietnam operationalizes OH through the One Health Partnership for Zoonoses (OHP). In 2021, Vietnam launched the OHP's second phase (2021–2025). The Vietnam One Health University Network has supported OH capacity building and integration of competency-based OH training into the curriculum for health and veterinary professionals.<sup>41,42</sup> **Rwanda** also leveraged One Health structures to coordinate its response to COVID-19. The government created a OH Steering Committee and a OH strategic plan to streamline cross-sectoral and institutional interventions and a One Health platform to oversee the plan's implementation.<sup>43</sup>

**Harnessing the power of the private sector:** **Australia's** partnership with the private health sector rapidly secured 30,000 hospital beds and 105,000 nurses for its pandemic response.<sup>44</sup> **India's** national insurance program, Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (ABPM-JAY), increased private laboratory testing by covering costs.<sup>45</sup> **Nigeria** partnered with the Private Sector Health Alliance of Nigeria to develop the Alliance for Emergency Preparedness and Response (A4EPR) initiative to strengthen outbreak preparedness and response capacity. During the pandemic, **Nigeria** quickly scaled up engagement with the private sector by forming the Coalition against COVID-19 (CACOVID), which provided additional support to the Nigeria Centre for Disease Control and other parts of the government.<sup>46</sup> Partnership with the private sector also enabled adaptiveness, affordability, and scale-up of interventions for surge response. In **South Africa**, the cost of polymerase chain reaction (PCR) tests for COVID-19 dropped from R1,400 to R850 (US\$80 to \$50), thanks to negotiations between the government and private labs.<sup>39</sup>



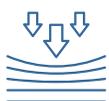
## Financing resilient health systems

*Building resilient health systems requires strong, sustainable health financing that encompasses preparedness and emergency response. Key recommendations to strengthen financing include:*

- i. Prioritize, ring-fence, and track investments in pandemic prevention, preparedness, and response (PPR).*
- ii. Leverage catalytic, complementary investments in resilience (e.g., joint planning tools).*
- iii. Reduce financial barriers to access crisis interventions and essential health services.*
- iv. Develop diverse and agile crisis-ready financing—create contingency funds and use innovative financing for disaster-risk layering.*

**The cost of the COVID-19 response and the resulting loss of economic output have been enormous, providing a wake-up call about the importance of investments in resilience.**

Strong, sustainable health financing is a cornerstone of resilient health systems, enabling resource mobilization, pooling, and allocation of financial resources. Financing preparedness and emergency response to a health crisis are separate challenges, though synergies can be achieved. Preparedness financing focuses on public-health functions between crises, including preventive interventions (e.g., immunization, water, and sanitation); infrastructure (e.g., laboratories and surveillance); human resources; and supplies, maintenance, and training. Crisis response financing focuses on the immediate need for health inputs, economic recovery, and support for poor and vulnerable people.



**Financing preparedness is critical for resilience**

The fiscal impacts of COVID-19 will impose additional strain on resources available for strengthening health systems. Several countries had to borrow to mitigate

COVID-19's economic impacts and, consequently, servicing increased debt will add to the tightening of fiscal space for financing health care. At the same time, historic low levels of health-sector financing in many countries that bore the brunt of COVID-19 impacts indicate a serious lack of prioritization of health. Developing countries devote, on average, 10 percent of government expenditures for health, compared to 15 percent in high-income countries (HICs), with some LMIC countries devoting as little as one percent.<sup>47</sup> Even within the health sector, investments in PPR and health systems have long been neglected. Other health-sector agencies often dwarf the budgets for public-health institutions such as Centers for Disease Control and Prevention (CDC) and MoH departments of infectious diseases. LMICs also dedicate a limited share of government funds to disease prevention and preparedness.

Countries should consider increasing fiscal space for health and PPR by: (i) prioritizing health in government budgets at all levels and pre-crisis investments in PPR, (ii) improving national tax revenue collection systems and introducing pro-health tax measures on goods and services with harmful health effects, and (iii) earmarking revenue sources and ring-fencing budgets for priority investments in preparedness.<sup>48</sup> It is also critical to increase budgetary resources for health

at sub-national levels. Strong political leadership is essential to ensure recognition of the connection between improved health and economic growth.



### Leverage catalytic and complementary investments in health system resilience

Resilient health systems require long-term investments, and donor and other external financing could complement and catalyze resilience efforts. It is critical to align donor priorities with those of recipient countries and harmonize health security objectives with other health targets (e.g., for UHC and HIV/AIDS). In the last decade, many donor-funded vertical programs such as HIV/AIDS have been integrated with countries' primary health care (PHC) systems and could help reinforce resilience. Similarly, it is critical to integrate a robust PPR agenda into UHC systems. Countries can leverage complementary and resilience-sensitive investments for strengthening health system resilience by assigning donor funds based on clear country priorities; aligning the flow of funds by using joint planning tools; using multisectoral coordination platforms to mobilize resilience-sensitive investments in other sectors (e.g., WASH, livestock, and agriculture for joint surveillance and training); leveraging existing

infectious disease programs (e.g., HIV/AIDS, TB, and malaria) to strengthen health systems; integrating pandemic preparedness with financing and delivery agendas, including PHC for UHC; and incorporating in country action plans and budgets cross-border and regional activities, which can enhance efficiency by sharing regional resources.



### Reduce financial barriers to access essential health services

**Governments should make foundational investments to promote equity in access to essential care including during crises. COVID-19 has underscored that ensuring availability of diagnostics and essential health care requires multi-layered investments including in PHC, which is a cornerstone of UHC.**

Effective service delivery for pandemic preparedness reduces outbreak risks and enables swift response, while a focus on UHC lowers financial barriers to care for the most vulnerable people and encourages care-seeking behaviors during crises.





### Improve financial accountability and monitoring and evaluation

Because what is not measured cannot be managed, resources aimed at financing pandemic preparedness should be tracked. But there has been no systematic effort to do so, making accurate estimates of preparedness spending largely impossible and complicating advocacy to raise resources. Recently, researchers have launched fresh efforts, including at Georgetown University, which developed a tracking dashboard to map the flow of funding for global health security.<sup>49</sup> The World Bank developed the health security financing assessment tool (HSFAT) to estimate resources for preventing, detecting, and responding to infectious diseases and other public-health emergencies.<sup>41,50</sup> Given that many countries have used the System of Health Accounts (SHA) framework to estimate their total health expenditures, developing a standardized approach to estimate investments, including for preparedness, in resilient health systems by using this framework is feasible. At the same time, it is critical to strengthen financial accountability, transparency, and monitoring and evaluation, as a lack of absorptive capacity can be a

major bottleneck to using donor funds and limits the dispersal of funds to local levels. Governments should improve absorptive capacity by providing training in national and sub-national financial management and accounting.



### Develop diverse, agile, and crisis-ready financing for emergencies

**Resilient health systems must be able to mobilize sufficient monetary resources with enough flexibility to promptly reallocate existing funds and inject extra money where needed during crises.<sup>17</sup>**

Countries should consider investing in disaster risk-layering by leveraging innovative financing instruments and contingencies to address needs during emergencies. Injection of agile funds to contain the crisis early-on can be extremely impactful. Global contingency mechanisms such as Contingency Financing for Emergencies (CFE) and the Pandemic Emergency Financing Facility (PEF) provided support to

countries for early and surge response, respectively. Diversity helps ensure that resources remain adequate and stable under changing conditions, and countries should also invest in agile financing tools at national and sub-national levels to unlock funds swiftly. During crises, special financing arrangements can accommodate fast-changing needs. For COVID-19, countries set up special or extra-budgetary funds, repurposed existing funds, pooled revenue, sought supplementary funds, and used contingency/reserve funds.<sup>51,56</sup> Partnerships with the private sector and innovative use of bonds and insurance for pandemics can also provide surge financing. Additional actions include investing in disaster risk-layering by leveraging innovative financing instruments and contingencies to manage health emergencies (including those stemming from natural disasters) and ensure diversity

of surge funding and the decentralization of financing for emergency response.

Countries, particularly LMICs, can strengthen their position by employing multiple financing mechanisms to generate stable and sizable resources for resilience. Weak and outdated financial management systems can compromise financial accountability, with implications for the efficient use of funds. During emergencies, special financing arrangements (e.g., requests for additional development assistance funds and reallocation of government budget) can accommodate fast-changing needs in an unpredictable, dynamic outbreak. Along with public and external funding, LMICs can engage new partners (e.g., in the private sector) and explore innovative mechanisms, such as social bonds, to finance health security.

#### Box 4. Country examples of financing resilience

**Financing preparedness:** **South Korea, Vietnam, China**, and the **Democratic Republic of the Congo (DRC)** have learned from previous epidemics that caused substantial economic loss. After the 2003 SARS outbreak, **China** has consistently invested in public health by expanding its influenza centers to include 408 laboratories and 554 sentinel hospitals, training public-health staff, upgrading its surveillance system, and building an integrated, web-based disease control and prevention information system to produce real-time reporting.<sup>52,53</sup> **Vietnam's** prioritization of spending on health security and other preventive measures stems from a resolution that specifies that at least 30 percent of the total health budget be allocated to preventive care and pandemic preparedness, including reserve budget funds (set at 2 percent to 4 percent of the annual budget) for emergencies.<sup>42</sup>

**Reducing financial barriers to care:** **Singapore** covered the costs of hospitalization for COVID-19 patients in public facilities, including citizens, permanent residents, and long-term pass holders (e.g., spouses of citizens).<sup>39</sup> **Thailand** covered the cost of COVID-19 treatment across all levels of care.<sup>39,54</sup> **South Korea** used National Health Insurance (NHI) financing to provide testing and quarantine treatment for all suspected and confirmed COVID-19 patients.<sup>55</sup>

**Leveraging diverse, crisis-ready financing:** The **Dominican Republic** combined budget reallocations, loans from development banks, and government-issued bonds to finance its COVID-19 response.<sup>56</sup> **DRC** used multiple agile financing tools such as World Bank's Contingent Emergency Response Component (CERCs), existing projects on surveillance, and global financing instruments such as CFE and PEF to enable prompt repositioning and repurposing of funds during the Ebola epidemic. **Uganda, Spain**, and **UK** created contingency funds through their constitutional or legal structures. **South Korea's** allocation (one percent of general tax revenue) to the Disaster Management Fund helped provincial governments procure medical supplies for COVID-19. **Uganda** ring-fences—or designates—a portion of its budget for contingency financing that can be released during outbreaks, with distinct funding for surveillance and response.<sup>57,58</sup>



## Human Resources

*The pandemic has underscored how human resources, including health care workers (HCWs), are at the heart of health systems but also revealed significant challenges, including staff shortages and maldistribution of trained professionals. Key recommendations to strengthen human resources include:*

- i. Map health workforce needs and develop an evidence-based human resources for health strategy.*
- ii. Diversify and repurpose the health workforce.*
- iii. Develop and sustain cadres of community health workers (CHWs) and train them for frontline PPR roles.*
- iv. Build multi-disciplinary competencies for PPR through pre-service and in-service trainings.*
- v. Protect frontline staff by providing access to infection, prevention, and control (IPC) training, personal protective equipment (PPE), and information, education, and communication (IEC).*

### **The lack of human resource capacity in hospitals and health centers challenged many jurisdictions during COVID-19.**

Health systems rapidly mobilized HCWs to support the COVID-19 response, with many communities lauding them as heroes for putting their health and lives on the line. But they paid a high price as the pandemic progressed in the form of extreme stress, burnout, mental health problems, disease, and death. According to WHO, between 115,000 and 180,000 of the global health workforce of 135 million died from COVID-19 between January 2020 and May 2021.<sup>59</sup> This alarming picture is especially pronounced in LMICs, which already suffer from huge shortages and inequitable distribution of HCWs.<sup>60</sup>

The lack of human resource capacity in hospitals and health centers challenged many jurisdictions during COVID-19. To address staffing shortages, countries re-deployed health professionals; assigned tasks to workers beyond their traditional responsibilities; and deployed students, medical residents, and personnel in training for patient care.<sup>37</sup> Several countries also

rapidly mobilized CHWs to shoulder key frontline tasks.<sup>61</sup> While much broader investments in human resources are needed to strengthen health systems, several strategies used during the pandemic can strengthen resilience.



### **Develop a multi-disciplinary health workforce, guided by data and evidence**

Global health workforce challenges especially affect the ability of LMICs and FCS to deliver essential health services and achieve UHC. Investments and human resource reforms—including in education, salaries, incentives, and working conditions—can build and retain a robust multi-disciplinary workforce with flexible mechanisms for task-sharing and rapid redeployment. Countries should develop an evidence-based, multisectoral human resources for health strategy and plan, with links to national health-security strategic and action plans. This will require mapping the existing workforce and multisectoral needs to deliver core capacities for resilience. Health officials should work with facilities to meet international benchmarks for human resource development.



## Diversify and repurpose the workforce

Stronger cross-sectoral coordination across interdisciplinary health system actors can expand workforce profiles, broaden the skill mix, and recruit under-represented populations, including women and youth. Health systems should leverage pools of non-traditional talent for functions that boost population health, including community- and home-based screening, treatment, care, and support. During COVID-19, several countries tapped students, health professionals-in-training, retired health professionals and non-health professionals. Strategies such as task-shifting, task-sharing, and reallocation of medical workers were also used to optimize the health workforce.<sup>62</sup>

Health systems should develop rapid deployment plans for these talent pools for public-health emergencies. Studies show that most health workers are willing to perform different roles to support a crisis response, but this willingness depended on proper training, working conditions perceived as fair, financial reimbursement or incentives, and belief in the preparedness of colleagues and health facilities.<sup>63-65</sup>



## Develop, expand, and sustain cadres of community health workers

**CHWs have been a cornerstone of COVID-19 control efforts in many countries. Well-trained, supervised CHWs provide an operational link between PHC and outbreak detection and response while strengthening community-based care (including for NCDs).**

CHWs have conducted COVID-19 community education, surveillance, and contact tracing while maintaining essential health services.<sup>61</sup> CHW engagement should move from a volunteer model to a more sustainable one based on professionalization, supportive supervision, continual skill-building, and



appropriate compensation. CHWs who are equipped, trained, and paid as part of a well-functioning health system can help prevent epidemics from becoming pandemics and maintain health care delivery amid significant disruption.



## Upskill the workforce to build frontline capacities for PPR

With the rapid influx of COVID-19 patients, simulation training and virtual training became vital tools to share knowledge and build skills among frontline health workers. Countries used simulation training to introduce new protocols and practices such as infection control strategies and to train redeployed HCWs. Studies demonstrate that simulation training increased the confidence of HCWs, and that virtual training was an effective tool to refine clinical knowledge and skills while respecting social distancing measures.<sup>66-71</sup> Many countries retrained health and non-health workers to take on new duties during the pandemic. Online training should be accredited and regulated to ensure high quality and boost competencies among students and professionals. Online training between crises will enhance resilience during crises and support the rapid production of new content to address future training needs.

**Access to flexible, competency-based learning platforms is a prerequisite for more efficient, equitable service delivery models that include task-sharing, flexible staffing models, and person-centered care.**

Training curricula should be reviewed and revised to ensure that they include provision for new competencies (e.g., digital health and contact tracing) and responsibilities that HCWs may take on as part of task-shifting during a crisis.

The existence of field epidemiology and laboratory training programs (FELTP) paid dividends when COVID-19 struck.<sup>72</sup> Investment in joint training and building FELTP and FELTP-Veterinarian (FELTP-V) capacities can strengthen resilience. FELTP not only enhances the ability to be aware of and absorb health shocks but also supports preparation and response activities for public-health threats and environmental disasters. FELTP graduates supported COVID-19 coordination, surveillance, rapid response teams, case investigations, activities at points of entry, and risk communication and community engagement (RCCE). Health systems should establish and scale up joint FELTP training, including for frontline health workers and CHWs, to leverage the One Health approach in strengthening the workforce to achieve IHR compliance and integrate preparedness activities more effectively.



**Protect the frontline health workforce**

Lack of adequate PPE at the PHC and community levels contributed to high rates of infections in HCWs early

in the pandemic.<sup>73</sup> This reduced workforce capacity, either because HCWs were exposed, quarantined, infected, or had quit because of the health risks.<sup>73</sup> The pandemic also revealed hierarchies within the workforce, including inequitable PPE access among frontline staff including nurses and CHWs. Effective IPC programs can mitigate the disproportionate burden of epidemic-prone and hospital-acquired diseases on HCWs. Adequate IPC training allows HCWs to continue their work safely and diminishes their sense of insecurity. It should include procedures for donning and doffing PPE, handling waste, and caring for high-risk or contagious patients. During the Ebola epidemic, supportive supervision and monitoring likely contributed to improved IPC practices at health facilities and a reduction in the proportion of HCW infections from 12 percent in July 2014 to 1 percent in February 2015.<sup>74</sup> Training and education on IPC also decreased the risk of SARS-CoV and MERS-CoV infection among HCWs.<sup>75,76</sup> A combination of IPC and FELTP training for frontline and PHC workers can protect health workers while building flexible capacity for health emergencies.

While HCWs often work long hours and face difficult working conditions, COVID-19 presented significant additional pressure, with impacts on mental health including stress, anxiety, and burnout. During the pandemic, health systems tested a wide range of interventions to boost workers' emotional well-being including stress-resilience training, peer-support programs, psycho-education training, support hotlines, and even cannabidiol (CBD) therapy.<sup>77,78</sup> Health systems should develop and test novel interventions to boost HCW mental health and coping skills and deploy evidence-based interventions. Many



countries also increased financial rewards for HCWs and other frontline personnel during the pandemic including monetary incentives, bonuses, insurance, tax benefits, overtime pay, meal allowances, and classification of COVID-19 infections as an occupational disease or injury, entitling them to compensation.



### Targeted information, education, communication strategies for HCWs

As COVID-19 vaccines became available, almost all countries prioritized HCWs for vaccination, in line with WHO's Strategic Advisory Group of Experts on Immunization (SAGE) roadmap. A global review of

COVID-19 vaccine hesitancy among HCWs found that hesitancy ranged from 4.3 percent to 72 percent.<sup>79</sup> Evidence suggests multiple causes including a lack of knowledge, safety concerns, media misrepresentation, and a lack of trust in health institutions.<sup>80-82</sup> Targeted educational programs that take socio-demographics and related factors into consideration show promise to overcome these barriers. IEC strategies should be tailored to specific health worker cadres, such as CHWs, nurses, and physicians.<sup>83</sup> Public-health information should be translated into local dialects, and regular drills to practice the implementation of IEC strategies across health worker cadres should be conducted.

## Box 5. Country examples of human resources strategies

**Diversifying and repurposing the workforce:** **New Zealand, Spain, UK, Vietnam,** and several other countries recruited non-practicing health workers and medical and nursing students to perform COVID-19 response functions.<sup>37</sup> **Uganda** reassigned staff including epidemiologists, doctors from other specialties, anesthetists, nurses, and laboratory technologists to COVID-19 control and treatment.<sup>39,84</sup> **South Korea** reassigned employees from non-health sectors and redeployed some low-level and middle-level employees to perform contact-tracing tasks.<sup>37</sup> **Thailand's** Ministry of Public Health contracted with 150,000 temporary medical workers, 40,000 of whom were later offered positions as permanent civil servants.<sup>39</sup> **Costa Rica's** Social Security Fund authorized the hiring of temporary staff reassigned from their original functions, leading to an 11 percent increase in number of temporary staff between 2020 and 2022.<sup>85</sup>

**Expanding use of CHWs:** **Thailand** deployed over one million CHWs to disseminate and amplify messages in communities, and **Singapore** used volunteers to educate seniors and distribute daily necessities.<sup>61</sup> **Ethiopia** mobilized its health extension workers<sup>ii</sup> to conduct contact tracing, transport supplies, and provide risk communication.<sup>86</sup> During the 2017 pneumonic plague outbreak, **Madagascar** relied on its CHWs for conducting community-based active surveillance.<sup>87</sup>

**Upskilling the workforce:** **South Korea** expanded its workforce of Epidemic Intelligence Service officers by quickly training redeployed staff at approximately 250 local public-health centers.<sup>39</sup> Field epidemiology training can help build capacity for sample collection, surveillance, and contact tracing (e.g., the **Dominican Republic** and **Ghana**); logistics coordination (e.g., **Paraguay**); and RCCE (e.g., **Indonesia** and **Namibia**).<sup>72,88</sup> In **Namibia**, FELTP graduates conducted "cascaded training" on COVID-19 preparedness in all 14 regions and 35 districts.<sup>72</sup>

**Protecting frontline workers:** **Japan, Mozambique, Singapore,** and **South Korea** supported HCWs by reorganizing shifts to avoid long hours without rest, permitting leave for mental health and physical recovery, and providing childcare and housing near workplaces to protect HCWs' families.<sup>39</sup> **Thailand** offered incentive pay to workers and financial support in case of adverse COVID-19 events including death, permanent disability, or loss of organ function.<sup>39</sup>

<sup>ii</sup> Health extension workers are the salaried community health providers that deliver a package of preventative and basic curative services to neighborhoods (kebeles) in Ethiopia. They are recruited among high school graduates in local communities and undergo a one-year training program.



## Innovation

*Addressing health shocks requires innovation to enable awareness, agility, absorptiveness, and adaptiveness. Innovation can catalyze health-system transformation while enabling resilience functions during a crisis. Key recommendations to strengthen innovation include:*

- i. Update preparedness plans and national health strategies to include mechanisms for research and regulatory review processes during emergencies.*
- ii. Spur people-centered innovation by engaging communities and supporting intermediary innovation platforms.*
- iii. Invest in an agile regulatory system to accommodate and fast-track new medical technologies.*
- iv. Build research, regulatory, and monitoring and evaluation capacity.*

### **COVID-19 has shown that health systems' capacity to innovate is a crucial determinant of resilience.**

Importantly, countries that responded to the pandemic with successful innovations were not only wealthy ones known for frequent technological breakthroughs but also countries at all income levels that seized the crisis as an opportunity to test fresh solutions for emergency response and build long-term resilience. Even before the pandemic, many countries were undergoing multiple transitions, including demographic, social, epidemiological, economic, and technological changes that were reshaping people's health and well-being. Amid this rapid change, countries struggled to meet rising expectations for quality, affordable health care. The pandemic accelerated some of these transitions and raised the pressure on countries for innovation to adapt to evolving global and local landscapes, tackle health security challenges, and promote and sustain health system resilience.

There are four types of innovations—product, process, organizational, and frugal innovations.<sup>89-91</sup> *Product innovation* includes technological advancements, such as the development of new goods and

services or improvements to existing ones—such as phone apps, video consultation platforms, and other digital tools, which have grown in importance. *Process innovation* involves new service delivery arrangements or novel organizational, management, and quality improvement strategies that increase the efficiency of service delivery or product production, thus decreasing operating costs or improving service delivery or product outcomes for the same cost. *Organizational innovation* includes new methods of business practice, workplace organization, or external relations; novel partnerships between organizations; and new organizational structures to improve service delivery.<sup>90</sup> *Frugal innovation* involves simplifying or modifying product components and manufacturing processes to make them more efficient and cost-effective.<sup>89</sup> Consequently, frugal innovations significantly appeal to resource-constrained countries.



### **Innovation in countries during COVID-19**

The pandemic has spurred many health care innovations, especially digital solutions, including for surveillance, supply chain management, clinical trials, and service delivery. Solutions included pooled testing, digital innovations for disease detection, innovations that enabled service delivery, including

hospital upgrading, isolation mechanisms, supply chain management, and research collaboration. Several multilateral organizations including WHO and the World Economic Forum, private start-ups, and academic institutions have established overview platforms to facilitate developing and vetting solutions. Examples include the Global Coronavirus Innovation Map, launched by StartupBlink and the Joint United Nations Programme on HIV/AIDS Health Innovation Exchange; WHO's Digital Health Atlas; and Duke University's Innovations in Healthcare.

 **Innovation enablers and barriers**

The processes involved in innovation include adoption, implementation, sustainability, dissemination, and scale-up. For example, digital health technologies may raise major technical or regulatory issues, and regulatory agencies might view them as compromising professional practice. Innovation should be considered in the context of implementation processes, the intended users and other stakeholders, and the broader setting in which it is being introduced. Even a seemingly simple innovation may be difficult to implement without the right processes. Several factors enable

these processes, including (i) user-centric design that fosters understanding of the innovation's complexity, value-add, and costs; (ii) evidence of effectiveness and regulations to enable trust in the innovation; (iii) early and widespread stakeholder and community feedback; (iv) adaptation of the innovation to the local context and integration with existing programs and policies; (v) monitoring and evaluation, including demonstration of cost-effectiveness and impact; (vi) strong partnerships across sectors to drive scale; (vii) sustainable business models to support the innovation over time; and (viii) regulatory agility during crises.<sup>92</sup> At the same time, several factors can hinder the adoption, implementation, and scale of innovation needed to ensure equitable access to new products and processes. These include regulatory challenges, legal and privacy concerns, inequality, the digital divide (including the gender digital divide), and workforce and organizational barriers.

 **Leverage research and innovation to improve health outcomes**

**COVID-19 highlighted the importance of research and development (R&D) as key enablers of response to the health crisis and its other health, economic, and social disruptions.**

R&D and innovation were critical to developing and deploying COVID-19 diagnostics, therapeutics, and vaccines. When researchers identified the SARS-CoV-2 virus in early 2020, they shared its entire genetic blueprint—its genome—online within 42 days. This rapid research and dissemination were key to producing safe, effective vaccines within just a year. Countries can strengthen innovation and R&D by ensuring that preparedness plans and national health strategies incorporate science, technology, and innovation. They can create platforms and partnerships to support R&D, develop mechanisms for directing R&D, and update national emergency plans including procedures for R&D and regulatory review of interventions during crises. Governments can also identify institutions with research capacity;



support those that conduct research in priority areas for health system resilience; and document, disseminate, and incorporate findings into policies.



### **Adopt a people-centered and demand-driven approach to innovation**

Successful implementation strategies will require expedited and coordinated policies, with collaboration among multiple government agencies, regulators, companies, non-governmental organizations (NGOs), and communities.<sup>93</sup> Countries should adopt a people-centered, demand-driven approach to innovation by engaging communities. Ensuring a user-centric design that enables understanding the value-add of the innovation and evidence of its effectiveness, along with early and widespread stakeholder and community feedback, can strengthen acceptance and adoption of the innovation. Countries should also improve capacity for monitoring and evaluation, including demonstrating the cost-effectiveness and impact of the innovation to boost acceptability.



### **Deploy innovative digital tools for resilience**

The pandemic accelerated the use of digital tools, which support resilience in several ways. Electronic health records allow sharing information about a person's health for referrals and timely clinical decision-making. Telemedicine, remote care, and mobile health facilitate agile and adaptive service delivery for the elderly and vulnerable groups. Big data and artificial intelligence enable prediction and identification of risk drivers and adverse events. Medical and assistive devices and services, such as 3-D printing, have revolutionized manufacturing of affordable devices and equipment. Countries can strengthen planning mechanisms to spur digital innovation by adopting national digital health strategies and guidance, such as telehealth/eHealth implementation guidelines. Countries can also adopt legislation on the use of national electronic health records and privacy. Strong regulations, laws, dynamic consent processes, and privacy-preserving technologies can strengthen adoption and trust in innovative tools.





## Foster innovation capacity in the private sector and engage in partnerships

Although the private sector's potential to enhance resilience remains untapped in many settings, engaging the sector has been key to health innovation strategies in others. Private actors have an extensive range of capabilities and resources that can contribute to resilience and are often willing to engage. Countries can improve the capacity of private sector actors, providers, entrepreneurs, and innovators by strengthening platforms for public-private dialogue, building the capacity of intermediary organizations and networks, and curating health-innovation marketplaces to secure resilient health markets. Adopting a whole-of-government approach by establishing platforms for multi-stakeholder collaboration and PPPs are important vehicles for anchoring and driving reform toward value-based and person-centered models focusing on patient outcomes.



## Invest in an agile regulatory system

### Effective innovation requires agile and supportive policies and regulatory mechanisms.

This includes measures to set standards for private and public entities, providers, and facilities; create regulatory entities backed by fiscal and human resources; and monitor, supervise, and enforce adherence to standards, guidelines, partnership frameworks, and policies. Core responsibilities include scientific assessments, clinical trial and marketing authorization, assurance of quality manufacturing, and post-marketing vigilance. Countries should build regulatory capacity and leverage international partnerships to supplement internal regulatory capacity.

Investing in agile regulatory systems that can accommodate new medical technologies, vaccines, and other products to enable crisis response within accelerated timelines is also crucial. A recent review



of 1,705 documents on regulatory responses to COVID-19 highlights agilities that promoted an effective response including (i) expedited reviews, streamlined clinical trials, one-year conditional approvals, and emergency use of approved/conditionally approved medical products in the absence of alternatives; (ii) strengthened international/regional cooperation; and (iii) digital tools to reduce bureaucracy and expedite labelling.<sup>94</sup>

### International and regional partnerships can benefit lesser-resourced regulatory authorities.

Regulators can rely on trusted authorities in the WHO-Listed Authority Interim List of National Regulatory Authorities and on global pathways and the WHO Emergency Use Listing, which provides guidance to multilateral procurement agencies and country regulatory agencies on the quality, tolerability, and performance of COVID-19 interventions.

Innovative designs for clinical trials, including decentralized trials and novel forms of data collection, and a more dynamic regulatory assessment process can speed innovation. Cross-border partnerships between regulatory agencies, fast-tracking review of crucial innovations, and establishing protocols for accelerated marketing authorizations during crises can also strengthen regulatory agility for innovation.

Countries can consider regional partnerships to harmonize their regulatory frameworks, standards, and licensing requirements for importing medical devices and medicines and conducting research trials.

Countries should reduce or eliminate unnecessary administrative steps during crises through approaches including leveraging e-Certificates and e-Signatures.

## Box 6. Country examples of innovation

**Innovating during COVID-19:** **South Korea** applied an innovative “test, trace, and treat” strategy and mobilized private sector know-how through public-private partnerships for COVID-19 control,<sup>95,96,97</sup> and **India** enlisted the country’s creative “maker” community and its vibrant startup sector to drive frugal technology solutions for shortfalls in crucial health supplies.<sup>98</sup>

**Enabling innovation:** **Ghana** facilitated innovation during COVID-19 through legal and policy frameworks, a whole-of-government approach, strong stewardship, and partnerships.<sup>99</sup> Ghana detected its first COVID-19 case in March 2020, but testing capacity was limited to a single facility in Accra. Despite resource limitations, by July 2020, Ghana had developed one of the strongest testing capacities in Sub-Saharan Africa. Key innovations including a “pooled testing strategy” drove this rapid transformation,<sup>100</sup> which was aided by Ghana’s expansion of its laboratory network from one to 10 facilities and its embrace of other innovations.<sup>100,101,102</sup> In collaboration with the logistics company Zipline, the MoH deployed drones to speed the delivery of test samples from over 1,000 health facilities to labs, shortening delivery time from days to under one hour.<sup>103</sup> Ghana also scaled up contact tracing through mobile apps, including the COVID-19 Tracker app, which traces and connects contacts to health services, and the Surveillance, Outbreak Response Management, and Analysis System (SORMAS), which links contact tracing data with a national database.<sup>104,105</sup>

**Leveraging R&D:** The **United States** (US) leveraged special programs, including Operation Warp Speed (OWS), a partnership across several government agencies and private firms that accelerated the development of COVID-19 vaccines, and the Coronavirus Treatment Acceleration Program (CTAP), designed to facilitate the discovery and development of new COVID-19 treatments.<sup>106</sup> **India’s** support for the R&D efforts of local manufacturers enabled the country to make purchase of hundreds of millions of doses of domestically manufactured vaccines.

**Deploying digital tools:** **Uganda** used SMS alerts for U-report Ebola on how to recognize and report Ebola cases and for a vaccine registry system to remind caregivers about the need for childhood vaccines. **India’s** support of the telehealth industry shows what can be achieved when judicious government stewardship enables and guides a creative private sector. Telehealth became ubiquitous during the pandemic. In recent years, telehealth in India has increased at a compound annual growth rate (CAGR) of 39.6 percent, becoming the fastest-growing segment in India’s health sector.<sup>107</sup> The sector received an influx of investor capital into telehealth startups and a game-changing boost from India’s Ministry of Health and Family Welfare (MoHFW), which released telemedicine practice guidelines on March 25, 2020, enabling registered medical practitioners (RMPs) to provide care using telemedicine via audio, video, or text communication.<sup>108</sup> Legalizing and regulating telemedicine provided the necessary policy support for rapid scale-up, creating both large-scale telehealth startups and small pockets of physician-led telemedicine consultations in small villages. **Singapore** addressed digital privacy concerns through a “privacy by design” approach for its Trace Together application, which allowed notification about a potentially exposed person while preserving privacy.<sup>93</sup>

**Investing in agile regulatory systems:** Several countries have mechanisms to authorize diagnostics and medical interventions in emergencies. The **European Medicines Agency** (EMA) can provide conditional marketing authorization and the **US Food and Drug Administration** has an emergency use authorization process.<sup>109,93</sup> The **African Union’s** Consortium for COVID-19 Vaccine Clinical Trial is an example of regional partnerships for clinical trials.



## SECTION III: Core Capacities



## Health Intelligence

*Effective infectious disease surveillance and other core intelligence capacities are cornerstones of resilience. Health intelligence can help countries leverage early-warning, detection, and data systems to identify and contain health threats. Key recommendations to boost health intelligence include:*

- i. Strengthen early-warning surveillance and epidemic intelligence functions.*
- ii. Strengthen inter-connected laboratory capacity and regional networks.*
- iii. Strengthen and integrate information systems, including for monitoring of service provision and disruptions at facilities.*
- iv. Leverage digital tools and new technology.*

**Strong health intelligence is one of the most critical capacities to ensure that a country is aware of public-health threats and can swiftly contain outbreaks.**

Intelligence functions for resilience during crises are enabled by robust, integrated disease surveillance, disease-reporting structures and information systems, and laboratory networks. COVID-19 presents major lessons for countries to strengthen their surveillance systems, including by underscoring the importance of active surveillance and contact tracing, novel approaches such as genomic surveillance, and data and information systems including civil vital registration systems (CVRS) for accurate counts of excess deaths during an epidemic. Countries should strengthen their surveillance and detection capacities in an integrated manner by investing in strong sample transport and referral systems, community-based surveillance, and detection embedded in PHC systems. Many actions to detect and control outbreaks depend on capacities within broader health systems including patients' access to care, HCWs' ability to recognize and report suspicious infections, systems for collecting and transporting specimens to laboratories for analysis, and human resources.

Multisectoral collaboration is also vital to ensure that data collection and analysis go beyond surveillance to a more cooperative intelligence model that informs decision-makers about risk drivers and trends. Joint surveillance of zoonotic diseases in livestock and wildlife can provide early warning of spillovers that may lead to epidemics and forecast contagion hotspots, while geospatial data collected by Disaster Risk Management (DRM) and environmental agencies help decision-makers forecast natural disasters such as typhoons and extreme rains that often create a surge in vector-borne and water-borne outbreaks. Cross-border collaboration through regional disease surveillance, laboratory networks, and resource-sharing can expedite detection and strengthen efficiency.



**Strengthen early-warning surveillance and epidemic intelligence functions**

COVID-19 has revealed weaknesses in disease surveillance systems including delayed detection, identification, and response. Especially early in the pandemic, several countries struggled with reporting and testing from lack of laboratory capacity, weak surveillance systems, and shortage of testing kits, which led to under-reporting of cases. Because decision-

makers and health facilities can't manage a disease they can't detect, identify, and track, surveillance and reporting are key priorities to strengthen public-health functions and broader health system capacities. How fast a system detects and responds to a threat is a strong performance measure. The 7-1-7 metric timeline for detection (within 7 days), notification (within 24 hours), and response (within 7 days) is increasingly becoming the standard for surveillance and detection systems.<sup>110</sup> To meet this standard, countries need robust surveillance to support rapid early warning; systems for data monitoring, collection, and analysis; reporting; swift laboratory confirmation; and epidemiological investigation. Detecting events early enables authorities to intervene rapidly to contain outbreaks and avert crises.

To enable resilience, countries need to monitor threats in the environment and animal populations to ensure that public-health systems and health facilities are aware of risks and ready to respond. Strengthening early-warning surveillance systems includes establishing community-based surveillance (CBS) systems, particularly in high-risk areas, such as refugee and rural populations; using cross-sectoral and One Health approaches through joint surveillance networks for detection of spillovers; and conducting surveillance at points of entry and epidemic intelligence.

**Community-based surveillance**—Engaging individuals or groups to collect local health information may yield crucial data not captured by facility- or laboratory-based surveillance. CBS identifies and reports events based on agreed indicators (case definitions) or reporting unusual events (alerts) to detect early stages of health threats.

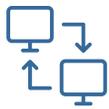
**Cross-border surveillance and points of entry**—The rapid global spread of outbreaks has focused attention on the importance of cross-border surveillance at airports, ports, and ground crossings to identify and contain threats.

**Cross-sectoral surveillance and One Health**—The vast majority of recent EIDs resulted from spillover of pathogens from wildlife, leading to a focus on surveillance of animal and environmental

threats to complement human health surveillance. Taking a OH approach by collaborating with non-health sectors on livestock and wildlife surveillance can prevent spillover and enable early response to contain outbreaks. Countries also need to strengthen networks of animal and human laboratories to promote efficiency, incorporate risk mapping, and use data and assessments from non-health sectors.

**Epidemic intelligence**—Countries should strengthen epidemic intelligence and capacity for disease verification, case investigation, and active surveillance by forming multisectoral Rapid Response Teams (RRTs) and scaling up training in field epidemiology and contact tracing. They should improve event-based surveillance (EBS)—the collection and analysis of data from health settings and other sources to rapidly detect a public-health event. EBS uses official and unofficial sources, including media reports, medical alert systems, rumor collection, and informal networks. EBS also strengthens early-warning functions and can fill gaps in national surveillance systems. Building on existing surveillance networks and staff trained in data analysis can be particularly cost-effective.





## Strengthen detection through inter-connected laboratory networks

Interconnected, integrated laboratory networks and scalable testing are the backbone of health intelligence, but many countries lack capacity to support routine diagnosis of high-priority infections. In 2021, 47 percent of the world had little access to COVID-19 diagnostics, and others faced long delays in obtaining test results. The largest gap is in PHC, highlighting the need to improve diagnostics at PHC facilities. Other gaps in laboratory systems include sample referral and transport, shortages of trained personnel, low capacity of regulatory bodies, weak laboratory networks and infrastructure for sharing information, poorly funded quality management systems, and poor planning and resources to maintain infrastructure and equipment and manage essential supplies.

Strategic, multi-level, and strong laboratory networks that can detect and identify emerging pathogens enable robust surveillance systems. Several regions have launched multi-country networks to coordinate and strengthen national surveillance efforts. Peer-to-peer collaboration among countries makes surveillance more efficient, provides opportunities to share methods, tools, and resources, and helps countries better understand scientific evidence about the nature of outbreaks and the best control measures. Examples of regional surveillance initiatives include Mekong Basin Disease Surveillance network (MBDS), East African Integrated Disease Surveillance Network (EAIDSNet), and Regional Integrated Surveillance and Laboratory Network (RISLNET).<sup>111,112</sup>



## Data collection and information systems are the foundation of health intelligence

The absence of reliable data or timely data sharing hindered a resilient response to COVID-19 in many countries. An effective national surveillance system depends on infrastructure that enables information to be tracked and communicated. Surveillance infrastructure should support systematic data collection integrated within health systems for



effective and timely analysis. Reporting of diseases from facilities or laboratories to higher levels (including international reporting) and rapid and detailed analysis and verification are core to strong detection.

Strong integrated, inter-operable information systems support decision-making and surveillance through data generation, compilation, analysis, and synthesis. COVID-19 experiences underscore the need for robust electronic disease and reporting surveillance systems integrated with health management information systems. Real-time health information is invaluable not only for early warning but also for forecasting and preparing health systems for a surge. However, lack of interoperability between Health Management and Information System (HMIS) and disease surveillance and reporting platforms (especially in non-health sectors) can often be a challenge.<sup>113</sup>

### Civil registration and vital statistics (CRVS)—

Lack of data sharing and inadequate, outdated, and unintegrated CRVS systems were major challenges in LMICs that impacted accurate estimates of excess deaths from COVID-19 and its mortality burden. Without the capacity to collect, consolidate, and quickly use accurate population-level data, health leaders are likely to underestimate the impact of a crisis and the scope of measures needed to counteract it. Countries should strengthen CRVS by developing SOPs; creating

systems for timely reporting of births and deaths from health facilities, communities, police, and traditional healers; and establishing a designated unit for CRVS in the MoH.<sup>114,115</sup>



### Monitor service provision at facility level and disruptions in essential services

Countries should assess the capability of their health facilities including integration; capacity for detection; the availability of such essential resources as hospital beds, ICU beds, ventilators, PPE, and health care personnel; and disruptions in essential health services. Service delivery indicator tools (e.g., WHO's Interim Service Delivery Indicator Assessment Tool, USAID's Service Provision Assessment, and the World Bank's Service Delivery Indicators survey) provide guidelines on measuring facility preparedness. Regular monitoring of service provision is crucial for ensuring effective routine care and meeting additional demands during crises.<sup>116</sup> High-capacity facilities can serve as models for others and potential referral centers as part of national preparedness strategies.<sup>117</sup>



### Leverage digital tools and new technology to enhance timely detection and notification

Digital tools enable deployment of electronic surveillance systems, real-time transmission of data between health systems, and contact tracing. Countries that rapidly used digital technologies including apps, location data, and electronic tags to facilitate planning, surveillance, testing, contact tracing, quarantine, and clinical management have been leaders in managing COVID-19. While digital tools such as mhealth, which uses mobile and wireless technology, have revolutionized contact tracing, their success relies on population adherence and vulnerable populations may not have access. As surveillance systems become digitized, it is important to implement privacy safeguards to prevent misuse and minimize stigma. Countries should also leverage new technology and data intelligence to build early-warning systems, inform decision-makers during and between crises, and strengthen public trust. New technologies to bolster detection include genomic surveillance and wastewater surveillance.<sup>118</sup>

## Box 7. Country examples of health intelligence

**Deploying community-based surveillance: Thailand** leveraged CBS by investing in Village Health Volunteers (VHVs) to collect data, maintain health records, and educate people about disease prevention.<sup>119</sup> A community-based network of healers and village health teams enabled **Uganda** to avert epidemics including of pneumonic plague and viral hemorrhagic diseases<sup>120</sup>.

**Using cross-border/points of entry surveillance: Uganda** used this surveillance to contain outbreaks of Marburg and Ebola.<sup>121</sup> When DRC declared an Ebola outbreak in 2019, Uganda activated screening and opened rapid-testing field laboratories near points of entries to DRC, enabling swift detection of its index case and subsequent contact tracing.<sup>121</sup>

**Adopting cross-sectoral/One Health surveillance:** Sentinel surveillance using a OH approach through the USAID PREDICT program enabled rapid detection of yellow fever virus in dead howler monkeys in **Bolivia**.<sup>122</sup> **Cambodia** used data from live bird markets to understand animal movements to identify critical locations for H5N1 surveillance and targeted early interventions to markets with high potential for spread.<sup>123</sup>

**Strengthening data collection: Nigeria** adapted SORMAS, an open-source epidemic surveillance software platform developed during the Ebola outbreak to enhance information management systems for surveillance for Monkeypox, Lassa, Meningitis, and COVID-19.<sup>18,124,125</sup>

**Leveraging digital tools for detection: Vietnam** developed online COVID-19 reporting systems to analyze epidemiological data across countries and an NCOVI mobile app to create a neighborhood map of positive cases and clusters.<sup>126,127</sup>



## Health Service Delivery

Health emergencies have far-reaching impacts on patients and exacerbate gaps and vulnerabilities in service delivery in many settings. Key recommendations to strengthen health service delivery include:

- i. Assess readiness of health facilities for shocks and invest in crisis-ready facilities.
- ii. Develop plans for continuity of essential services during crises and leverage alternate health service delivery sites and adapted models of care during crises, including through maintenance and broadening of successful telemedicine platforms.
- iii. Strengthen patient referral systems and develop coordinated networks of health facilities.
- iv. Build partnerships between public-health agencies, health facilities, the private sector, and humanitarian agencies to scale service delivery in crises.
- v. Invest in community-centered PHC with integrated public-health functions.

**Health service delivery is the most visible function of health systems, connecting patients to HCWs to receive a constellation of interventions, medicines, and supplies to meet their needs.**

Health service delivery sites range from PHC in communities to specialized tertiary treatment centers. Responding to shocks and stressors while providing essential care requires investments in service delivery, including using alternate service delivery sites and models and redistributing capacity and tasks. Core attributes of health service delivery include comprehensiveness, appropriateness, coordination, continuity, quality, equity, responsiveness, and acceptability. Service delivery is so central to health systems that resilience cannot be achieved without strengthening it.



**Health emergencies negatively impact essential service delivery**

Unusual disease events that spread and become emergencies put immense strain on health systems to respond to pathogen-driven care needs while also ensuring continuity of care for other essential

health needs. During outbreaks, health service delivery capacities shift to managing the often-acute care needs of infected patients, while also engaging in public-health activities such as screening, triage, referral, and diagnostic testing.<sup>128</sup> Outbreaks have far-reaching impacts on patients seeking health care and exacerbate existing gaps and vulnerabilities in health service delivery, which can be particularly devastating in fragile or fragmented health systems.<sup>129</sup> The Ebola outbreak in Sierra Leone negatively affected maternal and child health care services; non-communicable disease (NCD) screening, treatment, and management; routine immunizations; surgical care; and care for other infectious diseases such as tuberculosis (TB), HIV/AIDS, and malaria.<sup>130-134</sup> The pandemic has had similar impacts, with emerging evidence of widespread and persistent disruption in health service delivery. The destruction of infrastructure such as health facilities, transport systems, and electrical systems from shocks such as extreme weather events and conflict presents additional challenges.



**Assess the readiness of health facilities for crises before they strike**

Health facility capacities to respond to shocks should be assessed by mapping resources to identify facility

locations; understanding the level of care each facility can provide; planning to deploy mobile health care assets (e.g., vans and buses) and telehealth in emergencies; conducting equity assessments of patient access to essential health services and improving access; involving facilities in exercises or simulations for emergency scenarios; and strengthening the resilience of facility infrastructure to climatic and other shocks.



### **Develop plans for continuity of essential services and surge response for threats**

Before a crisis strikes, governments should develop plans for responding to a surge in demand created by the emergency and for continuing essential health services. These plans should be flexible and adaptable depending on the type of event and an assessment of different threat scenarios that could disrupt essential services and emergency care and specify which services are essential based on population needs and local health conditions that must be prioritized during an emergency. They should include prioritization of facilities for restoration of critical infrastructure (e.g., power and water); plans for patient evacuations and transfers; protection of HCWs; surge capacity including designation of facilities to care for patients with high-consequence infectious diseases; provision of care to vulnerable and marginalized groups (e.g.,

disabled, elderly, and displaced people); and scale-up of other enablers and capacities including financing and supply chains that are critical for service delivery.



### **Leverage alternate health service delivery sites and adapt models of care**

Health systems face fiscal pressures and often cannot sustain having significant idle capacity between crises. Service delivery must therefore adapt to health needs for surge response including by using alternate delivery sites and models and redistributing capacity and tasks among organizations. Countries used several strategies to rapidly increase service delivery capacity to meet the COVID-19 surge.<sup>39</sup> This included cancelling or postponing elective surgeries and reverse triaging, in which lower-risk inpatients were discharged or transferred to community facilities and building new facilities or repurposing existing ones. They also redistributed capacity (and patients) including by leveraging spare capacity in the private sector and neighboring countries.

Alternate care sites such as makeshift hospitals served patients with mild-to-moderate disease to relieve pressure on overwhelmed tertiary care facilities. Furthermore, as public-health guidelines on physical distancing and IPC rendered health facilities potential places of transmission, many health care providers



sought adapted models of care to safely provide care including provisions to separate COVID-19 patients from others to avoid viral spread. Alternate care sites should be developed and operated with a focus on the epidemiological situation and patient needs; staffed by a trained, protected, and well-equipped interdisciplinary health workforce; and able to link patients to ongoing care—either through referral to higher levels of care or supported discharge back to the community.<sup>135,136</sup>



### **Redistribute health service delivery capacity based on needs**

Early in the COVID-19 crisis, several countries and localities mobilized surplus capacity by transferring HCWs, equipment, and supplies to more burdened areas (and patients to less burdened facilities). Several factors contributed to the ability to redistribute service delivery capacity including the availability of monitoring systems to provide real-time granular data (e.g., on the availability of ICU beds), central coordinating mechanisms to manage the transfer of resources or patients, and the relaxing of regulations to enable HCWs to work in other jurisdictions.



### **Maintain and broaden successful telemedicine platforms**

Many countries have deployed innovative technology to meet communities' evolving health needs. COVID-19 experiences suggest that telehealth interfaces that link health providers and communities can deliver routine health services. Health systems should evaluate digital health solutions for their cost-effectiveness, quality, acceptability, and desirability and sustain, enhance, and scale cost-effective models. Adopting innovative technologies requires making online access more equitable, having supportive policies including regulatory frameworks, adjusting payment mechanisms to authorize reimbursement of telemedicine services, and creating standards for data quality and interoperability. In many settings, however, the transition to telehealth came with challenges in access for patients, efficiency in delivery of care, reimbursements, technological limitations, and unclear integration with public-health responses. However, promising efforts that blended telemedicine with other care strategies including in-person visits provide promising pathways forward.





## Primary health care for delivery of public-health functions

**Once an outbreak is confirmed, primary care sites often deliver health services and public-health response functions to impacted communities.**

It is crucial to equip PHC sites to safely carry out response functions including screening for suspected illness, triaging patients, and supporting home or follow-up care. But while some countries leveraged public, private, and community-based PHC for crisis response, national COVID-19 responses largely neglected meaningful primary care involvement during the crucial early months.<sup>137</sup> Health service delivery was often challenged by poorly defined roles for primary care, limited integration between PHC and other parts of the response, and a lack of supplies to safely deliver pandemic-related services in PHC facilities. Systems where the private sector provides primary care require guidance for, and coordination with, providers to ensure their inclusion in the broader response.

Detecting unusual illness or death trends at the point of care is key to PPR. Countries need to build capacity of frontline workers in PPR (e.g., contact tracing and data collection) and provide PPE and diagnostics to PHC sites, promote models of primary care, enable patient referral systems, and make service delivery innovations that equitably reach all populations. Investing in primary care facilities will ensure resilient health service delivery from outbreak detection to response including by integrating PHC with public-health response efforts, ensuring alternate care sites are community-centered and linked with PHC and higher levels of care, investing in primary care capacity to detect, monitor, and report unusual disease activity or deaths, and scaling up equitable, privacy-oriented use of innovative technologies to link providers to communities.



## Develop a coordinated network of health facilities

Integrating health systems into emergency response systems requires a coordinated network of facilities

to communicate and cooperate to manage a surge in demand.<sup>138,139</sup> The network can identify solutions for when demand outpaces capacity, including marshalling resources (e.g., mobile clinics, pharmacies, and community health centers) to deliver care and share resources to address shortages. Government funding may facilitate the creation of these networks, which can integrate into emergency response efforts, such as by having a dedicated presence in EOCs.



## Build partnerships between public-health agencies and health facilities

Efforts to strengthen resilience require greater partnership between health facilities and public-health agencies. The contributions of health facilities, especially private ones, are typically unidirectional as providers of data that get aggregated at national or subnational level as part of routine surveillance. Including health facilities in response networks may improve detection of, and response to, emerging health threats and ensure that broader health system capacities that are foundational to public-health activities are adequate and functioning.





### Establish partnerships with the private sector and neighboring countries

Health officials should establish relationships with other organizations including NGOs, the non-health private sector, and neighboring countries, which may be able to help during emergencies. The use of contingent contracts and MoUs can formalize these partnerships and facilitate a rapid crisis response. Health officials could consider offering incentives to other health service delivery organizations, including in the private sector, to participate in emergency preparedness efforts.



### Strengthen health information systems to enable granular and real-time data

Adapting health service delivery to population needs in a timely manner requires high-quality localized, real-time data including on hospitalization, patient outcomes, and supply-side data such as the number of available beds, health workers, and supplies. Sharing this data through a central coordinating mechanism can facilitate redistribution of service delivery capacity during emergencies.

## Box 8. Country examples of service delivery

**Build shock-proof facilities:** The World Bank's Organization of Eastern Caribbean States (OECS) project is supporting the upgrade of health facilities in the Caribbean to strengthen their resilience to climate change and extreme weather.

**Leveraging alternate care sites and adapting models of care:** **China** built two large specialty field hospitals in less than 12 days.<sup>39,140</sup> **Costa Rica** repurposed an 88-bed rehab center as a hospital for COVID-19 patients in less than two weeks.<sup>85</sup> Through a private sector-led initiative, **Ghana** built a 100-bed hospital in May 2020 to isolate and treat COVID-19 patients and converted some churches into isolation and treatment centers.<sup>36</sup> **The Philippines, South Africa, Spain, US,** and several other countries repurposed convention centers, community halls, football stadiums, and concert venues for COVID-19 care.<sup>39, 141-144</sup> **Rwanda and Uganda** established COVID-19 treatment centers that were structurally separate but operationally linked to existing health facilities to minimize the risk of infection.<sup>145</sup> To separate COVID-19 patients from others, hospitals in **Sri Lanka** introduced outdoor triage of patients and COVID-19 wards to minimize disruption to people seeking other care.<sup>146</sup> **Malta's** main acute hospital duplicated its emergency room to allow separate entry points and delivery of emergency services.<sup>147</sup> Hospitals in **Thailand** implemented fast-track systems for vulnerable patients and decentralized non-urgent ambulatory services to PHC facilities.<sup>148</sup>

**Redistributing service delivery capacity:** **Thailand** transferred intensive care nurses, critical care experts, and epidemiologists to overwhelmed provinces.<sup>148</sup> **Costa Rica** and the **Dominican Republic** used hospital occupancy data to coordinate ambulance services and transfer patients across hospitals to manage demand.<sup>56,85</sup> **Germany's** federal and regional governments, in collaboration with intensive care physicians, established a central coordination mechanism to load balance ICU units.<sup>149</sup>

**Broadening telemedicine platforms:** Before the pandemic, **China** innovated in delivering care virtually through its Internet Plus Health Care program. Its PHC system offers telehealth as a more efficient alternative to patients who need follow-up treatments for common illnesses or chronic diseases, alleviating HCW workloads and minimizing infections.<sup>95</sup>

**Leveraging PHC for service delivery:** **Singapore's** Public Health Preparedness Clinic (PHPC) scheme helps over 900 private PHC facilities through grants, provision of PPE and medical supplies, and training to strengthen outbreak response.<sup>150</sup>



## Risk communication and community engagement

RCCE is crucial for building individuals' trust in government interventions to prevent and manage threats. Key actions to strengthen risk communications and involve communities to improve trust include:

- i. Strengthen risk communication procedures, build capacity to communicate risks, and enable two-way communication.
- ii. Empower communities by involving them in decision-making.
- iii. Strengthen rumor monitoring, address misinformation, and build community trust in public-health interventions.

**COVID-19 has shown how important RCCE is in enabling trust for a resilient response to shocks, but RCCE has been one of the weakest links in the response.<sup>151</sup>**

Political interference in public-health decisions, confused and uncertain risk communication, and lack of community buy-in of interventions jeopardized uptake of preventive measures to slow viral spread in populations with low trust, fear, and rampant misinformation. Countries that ensured compliance with public-health measures leveraged a whole-of-government and whole-of-society approach with strong RCCE plans to build trust (Box 9). Lessons from recent health crises highlight two key strategies to strengthen community resilience: (i) swift communication to provide locally appropriate messaging including risk perception and awareness to promote behavior change and counter misinformation and (ii) community engagement for decision-making, planning, and facilitating community-led activities to enable a whole-of-society approach.<sup>152</sup> Concurrent efforts to understand public sentiment about interventions and work with community leaders to tailor messages can dramatically improve trust.



**Community engagement is critical for building trust**

**Community engagement through relationship-building is a key enabler to increase trust and ensure uptake and compliance with risk reduction measures.<sup>153</sup>**

It is critical to promote people-centered services and support buy-in and sustainability of health interventions, health advocacy, and improved quality of services and to contribute to health system responsiveness to a crisis.<sup>154</sup> Community engagement is also crucial to promote people-centered services through PHC. Although RCCE can greatly reduce stigma and mobilize the demand for testing, inadequate RCCE during COVID-19 impacted the demand for testing and eventually vaccines and undermined efforts to track and trace people who were exposed or infected. Community engagement can also be a powerful tool to combat 'fearonomic effects'<sup>iii</sup> on demand for essential services and minimize disruptions in the delivery of essential services during crises.<sup>36</sup>

<sup>iii</sup> The direct and indirect economic effects of both misinformation and fear-induced aversion behaviour, exhibited by individuals, organisations or countries during an outbreak or epidemic.

Several countries also grappled with vaccine hesitancy, and those implementing mass vaccine campaigns without public-health approval and strong RCCE faced even greater hesitancy. Vaccine hesitancy can also stem from misinformation, misperceptions of efficacy and need, previous experience with other vaccination processes, mistrust in the system that delivers the vaccine, knowledge gaps of “who, where, and when” one should be vaccinated, and fear of needles and potential side effects.

**Empower communities by engaging them in decision-making and governance structures**

Vulnerable populations, including women and marginalized communities, bear a disproportionate impact of health crises and should be engaged in decision-making, planning, and implementation to ensure a “whole-of-society” approach, enhance trust, and reduce inequality.<sup>34,155</sup> Because of their caregiving role and gender norms, women face a triple burden during epidemics—a high risk of exposure to nosocomial infections in their role as HCWs, lost livelihood opportunities from school closures and increased unpaid family care, and heightened risk of illness from the cascading effects of epidemics.<sup>34</sup> Misperceptions and fearonomic effects during crises can also spur stigmatization and violence (including gender-based violence) and marginalization of minorities, which can hamper response efforts.<sup>156</sup> Minorities and foreigners can become convenient

scapegoats during health emergencies, including during the pandemic.

Local leaders should be engaged in decision-making during and between crises to foster trust, which is necessary for efficiently dealing with long-term community needs and issues.<sup>157</sup> Key groups to be included in decision-making include women’s organizations, religious and traditional leaders, chiefs, and elders. Experience with Ebola, Polio, and COVID-19 shows that risk communication is most effective when led by these local leaders and CHWs, who can promote uptake of behavior change.<sup>158,159</sup> Countries can foster community empowerment by conducting research on the effects of crises on vulnerable groups; including them in key governance, coordination, and planning structures; incorporating equity-focused initiatives into disaster preparedness plans; and involving communities in crisis communication preparedness plans.

**Strengthen procedures and capacity to communicate risks and enable two-way communication**

Risk communication includes not only public dissemination of information about health risks but also mitigation of misinformation to facilitate behavior change. It involves transforming complex scientific knowledge into simple, understandable, and accessible information and quickly sharing it in local languages and channels that people trust. Countries



should develop multi-sectoral, multi-hazard RCCE plans; identify populations vulnerable to health risks; develop risk communication key messages in local languages; mainstream and contextualize key messages for high-risk communities; and implement cascade training for decision-makers and HCWs in risk communication practices and key messages.

Risk communication should be a two-way process that integrates top-down information dissemination with bottom-up feedback. Countries can enable two-way communication through social listening, using online tools to capture insights from social media platforms, community meetings, hotlines, and surveys; conducting regular surveys on knowledge and attitudes about health threats and prevention measures; and incorporating analysis of community feedback into the design of interventions.



### Invest in human-resource capacity building for RCCE

How well health workforces are prepared to engage with other professionals, patients, families, and local communities also influences public trust. Poor knowledge and engagement competencies of health service providers can have long-term, systemic effects on health system performance (e.g., staff morale, stress, and burnout) and service uptake and use. Strengthening and training HCWs in communication and awareness of evidence-based policies can strengthen trust in interventions.<sup>160</sup>



### Address the dangers of infodemics and misinformation in crises

Lack of RCCE during COVID-19 led to an explosion of misinformation that not only reduced compliance with risk-reducing behavior (e.g., masking, social distancing, and handwashing), but also promoted risky behavior that gave a false sense of security, lowered trust in government interventions, and caused deaths. Examples include the belief that drinking alcohol, applying heat, eating high-alkaline foods, and using herbal remedies could cure COVID-19.<sup>161</sup> In several countries, misinformation led to dangerous interventions, such as ingestion of chlorine dioxide, a bleach used to disinfect swimming pools.<sup>162</sup>

Misinformation also led people in several African countries to believe initially that the virus only affected Caucasians, that testing kits were contaminated, and that vaccines were being tested on them. Concerns about vaccine safety arose from lack of contextualized reporting about blood clots in some patients who received the Astra Zeneca vaccine, leading to low vaccine uptake by HCWs and vulnerable people in several countries.

In others, unscientific claims touted by political leaders reduced trust and contributed to vaccine hesitancy and risky behavior such as use of hydroxychloroquine as a cure (scientific evidence later found that the drug was ineffective for COVID-19).<sup>163</sup> The advent of digital media has made it easier for misinformation to spread. Consequently, evidence-based decision-making and strong stewardship complement effective RCCE during a crisis.

The same channels—social media, local media, and word of mouth—that are spreading falsehoods can also be used to discredit them. Governments should designate local champions and official spokespersons to convey information clearly and simply. They should release new information promptly based on risk assessments, public perception of risk, and community adherence to response measures. Infodemics and misinformation don't only stem from people sharing 'fake news' on social media but also from how experts



and governments communicate uncertainty. To be heard and acted upon, a message must come from a trusted source, whether a government spokesperson or a community member, HCW, or religious leader.<sup>164</sup> The key to combatting infodemics and supporting proper communication is identifying, monitoring, and dispelling rumors by deploying trusted community leaders and two-way communication between government officials and community actors to identify misinformation and support accurate messaging.

Countries can control infodemics and misinformation by dynamic rumor monitoring, including through

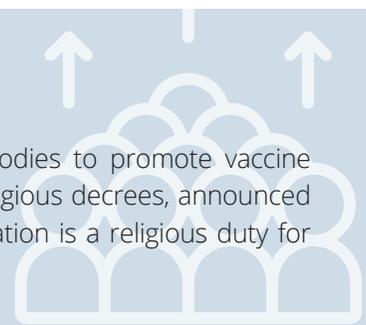
digital tools and social media; encouraging fact-checking and peer-review; developing SOPs for countering misinformation; holding forums to exchange knowledge about community engagement interventions and outcomes; setting up toll-free National Public Health Emergency Center (NPHEC)/RCCE call centers; developing partnerships with the private sector and digital tools/platforms to counter misinformation; and developing an independent national alliance of influencers, public officials, and stakeholders who can listen, educate, and address rumors and misinformation.

### Box 9. Country examples of RCCE

**Engaging communities:** **Indonesia, Egypt, and UAE** engaged with religious bodies to promote vaccine acceptance. In **Egypt**, Dar al-Iftaa, the religious authority responsible for issuing religious decrees, announced that the COVID-19 vaccine is halal (permissible under Islamic law), and that vaccination is a religious duty for everyone.<sup>165</sup>

**Using two-way communication:** During the Ebola epidemic, suspicions about its existence and the motives of governments and international NGOs hindered the response. **Nigeria** learned from this experience to leverage dynamic listening about COVID-19 and rumors management through media and social media surveillance and communication and engage communities through SMS, toll-free hotlines, media interviews, and translation of information into local languages. The government worked with community leaders and traditional healers to develop and adjust key messages for behavior change. **Sri Lanka** and the **Dominican Republic** used helplines to provide a forum for complaints, questions, and information on prevention, specialized care, and how to request tests.<sup>56,146</sup> **Japan** used online surveys to understand compliance with social distancing measures and the pandemic's financial impacts.<sup>37</sup> **Thailand** conducted online surveys to monitor knowledge, misinformation, and COVID-19 attitudes, and a daily broadcast by its Center for COVID-19 Situation Administration (CCSA) educated people about the epidemiological situation and the preventive measures they were required to adopt. The country also launched multilingual messaging in Thai, Burmese, Laotian, Khmer, and Chinese.<sup>148</sup>

**Countering misinformation:** Several countries partnered with the private sector to address misinformation, including **Nigeria's** #TakeResponsibility campaign, which called on individuals to take greater individual and collective responsibility for controlling the spread of COVID-19.<sup>39</sup> **Singapore's** MoH provided daily information to the public on mainstream media and to doctors via messenger apps Telegram and WhatsApp.



## Box 10. RCCE successes in crises



**Nipah in Kerala, India**—Kerala leveraged a robust RCCE strategy to communicate risk information and counter misinformation during the Nipah outbreak in 2018. To combat misinformation circulating across social media and causing panic, the government organized a health camp to raise awareness and engaged with local elected village leaders (Panchayat leaders), CHWs known as Accredited Social Health Activists (ASHAs), and Anganwadi workers (AWWs) to convey accurate disease information.<sup>166</sup> The state administration also updated the public through regular media briefings.



**COVID-19 in Vietnam**—Vietnam recognized the critical role of the media for sharing information during the pandemic, using it to disseminate its mid-term 2020-2025 strategy on health risks. The MoH, with support of leading telecommunications and information technology companies, developed and launched a website to further disseminate public-health information and publicized information about COVID-19 and prevention measures through mass text messaging (>27 billion) using major mobile service providers (e.g., Viettel, MobiFone, and Vinaphone) and several applications (e.g., Zalo, Viber, Lotus, and TikTok).<sup>42,125</sup>



**COVID-19 in Bhutan**—In July 2021, Bhutan became the first country to fully vaccinate over 90 percent of adults against COVID-19.<sup>167</sup> Bhutan's high vaccine rate is attributed to strong leadership, a well-coordinated national preparedness plan, regular communication strategies, and successful community mobilization. Bhutan, where 60 percent of the population is under age 25, focused on youth to accelerate community-based interventions, which led to high vaccine acceptance and delivery.<sup>168</sup> The Bhutan Scouts Association of the Ministry of Education, with 800 Scout youth volunteers, spearheaded the RCCE response among young people, backed by UNICEF and the MoH. The country also leveraged its citizen volunteers, known as Desuups, to facilitate vaccinations and other COVID-19 measures. Desuups supported online registration and verification of vaccine recipients and ensured compliance with safety protocols.

Bhutan's RCCE strategy was also guided by evidence from a U-Report and Rapid Pulse Survey, designed to analyze the reach and clarity of COVID-19 preventive messaging in distant areas and assess knowledge about prevention. Bhutan launched awareness campaigns using pamphlets, national television (BBSTV) and radio advertisements, press briefs, and the Facebook pages of the MoH and the Prime Minister's Office (PMO). The prime minister, foreign minister, health minister, vaccine experts, and epidemiologists regularly provided updates to alleviate fears about vaccination. This communication, along with legislative efforts to quash misinformation under the Information, Communications, and Media Act of Bhutan 2018, limited the spread of COVID-19 misinformation.<sup>169</sup> The country also leveraged religious leaders to promote vaccine acceptance. The Central Monk Body of Bhutan (Zhung Dratshang) and other monastic organizations led by spiritual masters (Rinpoches) played a pivotal role in building trust in COVID-19 control through vaccination and other measures.<sup>168</sup>



## Crisis-ready Supply Chains

Supply chains are vital but often undervalued components of resilient health systems. The pandemic highlighted both the critical importance and fragility of health supply chains. Key recommendations to strengthen them include:

- i. Develop forecasting capacities, emergency logistics and supply chain management plans, rational-use guidance, pre-positioned contingency procurement plans, and acquisition flexibilities for health emergencies.
- ii. Leverage regional cooperation and domestic production for key medical goods.
- iii. Tackle human-resource and infrastructure gaps to upgrade supply chains.

### A vast array of medical products delivered through global supply chains is necessary to provide health services.

Supply chains are vital but often undervalued segments of health care systems—during pandemics, global supply chain shortages compromise health outcomes.<sup>170</sup> Without PPE, HCWs cannot safely deliver services; without test kits, they cannot confirm infections; and without essential medicines to treat infections, clinicians cannot provide quality care. Early in the pandemic, critical shortages of PPE from supply chain weaknesses left frontline HCWs vulnerable to infection and death.<sup>171</sup> While COVID-19 revealed and exacerbated supply chain flaws, it did not create them. For decades, especially in LMICs, weak supply chains and resulting medical product shortages have threatened the ability to deliver the right care to the right person at the right time. The pandemic has made systemic supply chain risks impossible to ignore and solutions to address them more feasible and urgent.<sup>172</sup>



### Create crisis-ready supply chains that are aware and agile

To enable resilience, supply chains need to ensure real-time flexibility and a dynamic response.

Targeted investments in flexible strategies can make supply chains less vulnerable to disruptions during emergencies to boost health system awareness, agility, and adaptive capabilities. Countries should develop logistics and supply chain management plans that identify procedures and decision-making on supply chain activities including product registration, forecasting, procurement, importation, warehousing, retailing, and distributing medical products. Other actions include developing guidelines, pre-positioning contracts for crises, and introducing/strengthening acquisition flexibilities, such as waivers for registration requirements and allowance of single-source solicitation in exceptional circumstances. Countries can also use regional trade mechanisms, such as the African Continental Free Trade Area agreement, to ease export and import controls on essential medicines and supplies. Agile regulatory and tariff tools can also facilitate import of medical products, and the presence of rational-use guidance and SOPs for essential health supplies can enable adaptive capacities during crises. Countries and partners can engage in strategic “market shaping” to improve supply imbalances for health products in emergencies. A key step is to diversify sourcing so that a shock in one region will not disrupt the entire supply chain. Countries also need to build forecasting capacity to estimate demand for essential medicines and supplies during crises.



### Leverage regional cooperation and foster domestic production

Building domestic and regional production and distribution capacities for medicines and other medical goods can reduce supply chain vulnerabilities, accelerate regional technological and economic development, and strengthen health resilience. Sub-Saharan Africa holds special promise for regional initiatives. HICs should work with LMICs to build regional manufacturing hubs that can produce adequate supplies of vaccines, antiviral drugs, diagnostic tests, and medical devices.

During COVID-19, countries accelerated domestic manufacturing of key medical products including new types of PPE, eye shields, and respirators and strengthened laboratory networks and manufacturing to support large-scale COVID-19 diagnostic testing.<sup>173</sup> Countries can build domestic capacity to produce essential equipment and medicines not subject to intellectual property-related restrictions and give subsidies to incentivize manufacturers to build excess capacity into medical product supply chains. Other countries leveraged regional institutions and cooperation mechanisms to address the challenge of disrupted supply chains. Countries can use regional platforms to share best practices in technical areas such as warehousing and distribution and promote

joint logistics solutions; convene industry experts from governments, multilateral agencies, and private firms; and leverage pooled procurement mechanisms (PPM).<sup>174</sup>



### Deepen and diversify engagement with the private sector

A shift in mindset from competition to collaborative supply chain operations via public-private partnerships addressed shortages of critical medical supplies early in the pandemic. In several countries, the private sector contributed resources for surge capacity.<sup>170</sup> Having pre-positioned contracts and agreements with the private sector can address supply challenges in crises. Recent global experiences also suggest that dedicated partnerships may increase supply chain efficiency in LMICs, in some cases by leveraging the resources and experience of prominent logistics companies such as Bolloré Logistics, DHL, FEDEX, MAERSK, and UPS.



### Use technology and innovation more systematically

Countries can reinvent health supply chains using advanced technologies, such as drones for delivery, real-time delivery verification/confirmation, 3-D printing, remote temperature-monitoring devices



(RTMDs), big data analytics linked to the Internet of Things (IoT), and autonomous robotics.<sup>175</sup>



### Tackle critical human-resource gaps and professionalize supply chains

Human-resource management is critical for effective supply chains. Human resource and supply chain practitioners emphasize the importance of human capital for successful supply chain management (SCM), and professionalization would significantly bolster supply chain resilience, especially in LMICs. With many health supply chains heavily linked to pharmaceuticals, supply chain functions are often managed by pharmacists, who may learn SCM through trial and error and lack technical training and certification. Policies should encompass pre-service training (including review of academic training curricula) and in-service training for young professionals including pharmacists.



### Invest in supply chain infrastructure

Both primary and secondary infrastructure are required to sustain supply chains and make them resilient. Many settings, however, face infrastructure shortfalls including in water, sanitation, electricity, telephone and Internet connectivity, refuse collection, and essential transport such as roads. These shortfalls make it harder or impossible to achieve effective supply-chain performance in areas including warehousing, transportation, distribution, quality control, and advanced medical waste management. Experience with COVID-19 vaccines has also underscored the need to rapidly reinforce countries' cold chain capacities, but this requires expanding access to electricity in underserved regions. Bolstering information and communication technology (ICT) access can fortify the supply chain.<sup>170</sup>



## Box 11. Country examples of supply chains

**Creating crisis-ready supply chains:** To accelerate access to COVID-19 vaccines, **Spain, Thailand, India,** and several other countries signed advance purchase agreements with pharmaceutical companies.<sup>39</sup> **Sri Lanka** eliminated import duties and taxes on masks and disinfectants; **Fiji** temporarily eliminated import duties and VAT on medical supplies; and **Nigeria** approved a temporary waiver of import duties and VAT on imported medical equipment and supplies beginning in May 2020.<sup>39</sup> **Malawi, Mozambique, South Korea,** and **Uganda** introduced extended use or re-use (“rational use”) guidelines to conserve limited stocks of PPE.<sup>176</sup> In **South Korea**, hospitals adapted standard PPE protocols to conserve supplies while protecting frontline workers and patients by replacing Level D coveralls with disposable plastic gowns and N95 respirators with KF94 masks. Predicting a rise in demand for medical oxygen early in the pandemic, the Indian state of **Kerala** approved new manufacturing plants and diverted industrial oxygen cylinders for medical use. This allowed Kerala to manage surplus oxygen supply during the second wave of the pandemic, while other states struggled with acute oxygen shortages that led to preventable deaths.<sup>170, 177</sup>

**Leveraging regional cooperation and domestic manufacturing:** **Uruguayan** scientists developed a COVID-19 PCR test kit in early 2020, and health authorities organized a national network of 24 testing labs, which boosted diagnostic capacity from 200 to nearly 1,000 tests per day within three months of the first reported case.<sup>178</sup> **Nigeria** developed and mass-produced a low-cost, rapid COVID-19 diagnostic test, reducing costs and reliance on international supplies. **Vietnam** promoted inter-industry technology transfers to accelerate domestic production of more portable ventilators.<sup>39</sup> **Africa CDC** provided regional supply chain coordination and improved countries’ SCM capacity. African Union (AU) member states mandated the CDC to facilitate procurement negotiations with manufacturers of vaccines and other commodities crucial for crisis response. Africa CDC created the Africa Medical Supplies Platform (AMSP) for countries to source health commodities. It also designed technical training programs for countries to strengthen their SCM.<sup>174</sup>

**Deepening private-sector engagement:** **Japan, Nigeria,** and **Uganda** developed partnerships with the private sector to enhance domestic manufacturing of critical supplies.<sup>170</sup> **South Africa** bolstered local manufacturing capabilities by leveraging the South Africa Biovac Institute and Aspen Pharmacare to produce Johnson & Johnson’s COVID-19 vaccine.<sup>179</sup> **Singapore**, drawing from its experience responding to SARS, had a six-month national stockpile of medical products by working with the private sector.<sup>180,181</sup> Project Last Mile, a well-known public-private partnership between the Coca-Cola Company and Foundation, the Bill and Melinda Gates Foundation, the Global Fund, and the US Agency for International Development (USAID) strengthened the health supply chain in **Ghana, Liberia, Mozambique, Nigeria, Sierra Leone, South Africa, Swaziland,** and **Tanzania** by sharing Coca-Cola’s best practices in logistics, management, and product delivery with ministries of health.<sup>182</sup>



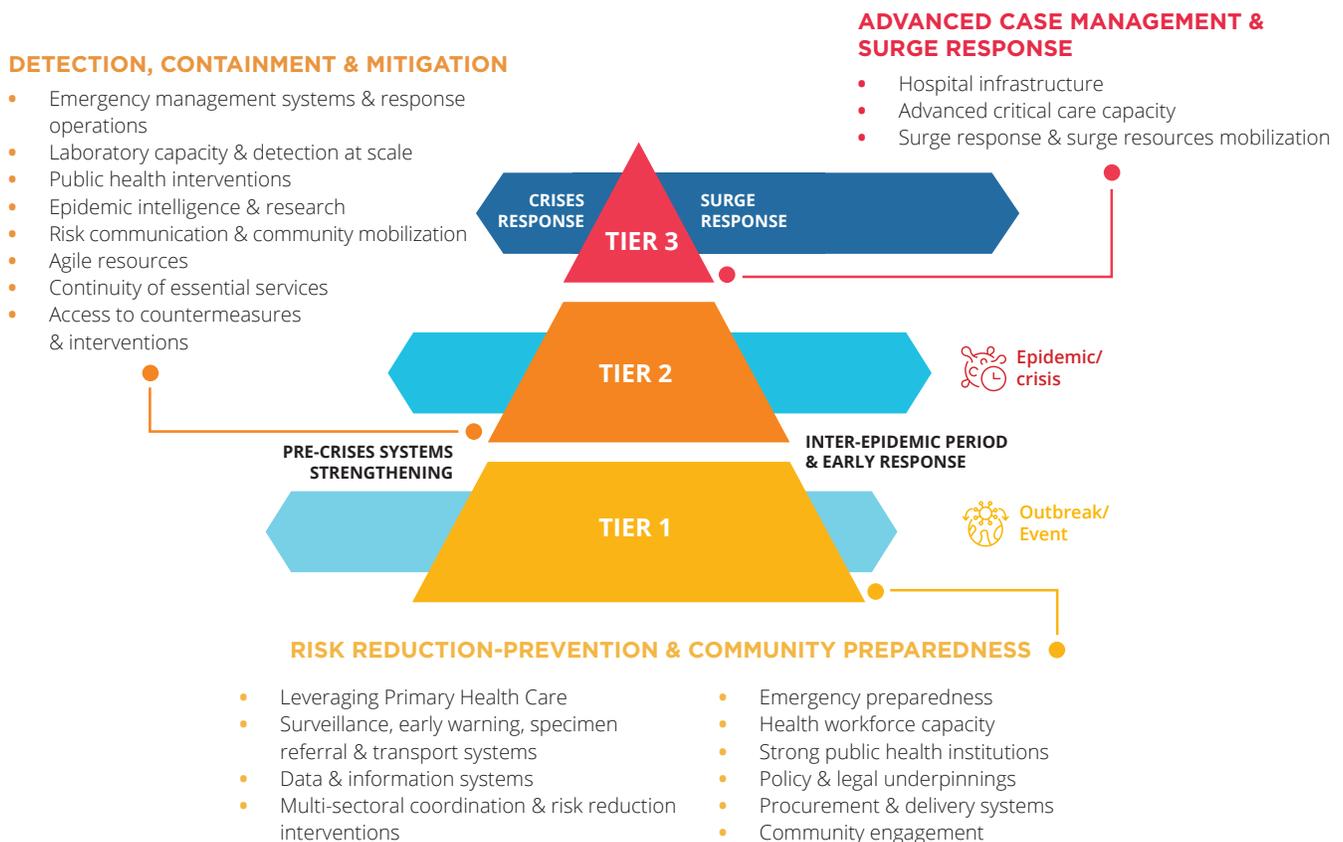
# SECTION IV:

## Where should countries invest first?

A broad range of investments is needed to build resilience, but many countries face shrinking health budgets following heavy outlays for COVID-19 crisis response, making it imperative to set priorities for high-yield resilience spending. By starting now, before the next pandemic strikes, countries can make the task easier and less costly and optimize results. To support country investment choices, this report proposes a three-tiered framework<sup>iv</sup> (Figure 3, which adapts the traditional “Prevent, Detect, and Respond” model and prioritizes spending options based on their impact on resilience).<sup>183</sup>

**Tier 1: Risk Reduction—prevention and community preparedness.** This tier is the foundation of pre-crisis pandemic defense and the cornerstone of health security. As the most important tier, investments for prevention and preparedness yield the biggest “bang for the buck” in resilience outcomes. Its focus is on upstream, preventive action to thwart potential health crises, and its elements include well-functioning PHC and strong community-based surveillance. Tier 1 also includes policies and regulations, emergency planning, and strong public-health institutions. Sustained

**Figure 3. A three-tiered investment framework to build resilient health systems**



<sup>iv</sup> The framework is based on the analysis set out in Zhao et al. (2021) and informed by the country experiences and recommendations in Collins et al. (2020).

engagement of communities in health prevention and preparedness is critical to this tier, which also includes robust health information systems and vital registration mechanisms. Thus, this tier highlights the crucial relays between national policymaking and the frontlines of daily health action in communities. Examples of Tier 1 investments include reinforcing national public-health institutes, bolstering legal and regulatory frameworks, mainstreaming an integrated OH approach, ramping up community-based disease surveillance, and training PHC providers in health intelligence.

**Vietnam's** well-developed and highly accessible health system was at the heart of its successful COVID-19 response. PHC providers delivered health education and preventive measures to communities, helping slow the spread of SARS-CoV-2. **Cambodia's** scale-up of community-based surveillance and training of frontline HCWs in detection and contact tracing fueled its early success in managing the pandemic.<sup>184,185</sup> **South Korea's** investments in Tier 1 included investments in a strong primary care network, surveillance system (National Infectious Disease Surveillance System) including for zoonotic diseases, and a disaster management fund.<sup>42,186</sup> Following the MERS outbreak, South Korea implemented 48 reforms from 2015 to 2020 to strengthen public-health institutions, emergency preparedness, and research capacity and updated legislation (such as the Infectious Disease Control and Prevention Act)—allowing for a strong first layer of defense.

**Tier 2: Detection, containment, and mitigation capabilities.** With Tier 1 in place, countries also need a system whose primary objective is detection at scale, containment, and mitigation of outbreaks before they spread widely. Tier 2 operates primarily during the early phase of an outbreak through identification and protection of at-risk populations; scale-up of testing; isolation of suspected cases; epidemic intelligence, surveillance, and contact tracing; and implementation of non-pharmaceutical interventions (NPIs) in

communities. This tier also encompasses integrated surveillance systems that link local, national, and international actors. Examples of Tier 2 investments include strengthening disease surveillance systems, creating or upgrading national EOCs, reinforcing testing capacities, and training CHWs to conduct contact tracing.

**Senegal's** emphasis on testing enabled it to detect early COVID-19 cases and, by February 2020, the Institut Pasteur Dakar was one of two laboratories in Africa that could test for SARS-CoV-2.<sup>187</sup> The country combined a comprehensive public communication campaign with effective use of NPIs to slow disease spread. Clear messaging from the government created high levels of public support for COVID-19 public-health measures.<sup>183</sup> **Vietnam**, complementing the prevention-focused COVID-19 action of its frontline PHC providers, relied on its national disease surveillance system and public-health operations center launched in 2016. Strong contact tracing and isolation coupled with swift implementation of NPIs and use of digital media and mobile apps also helped Vietnam mitigate the early impact of COVID-19. Although the country had a slow start to the COVID-19 mass vaccination program, with support from the COVAX facility, the country had vaccinated over 90 percent of its population against COVID-19 by May 2022.<sup>188</sup> Prior investments in laboratory capacity and the ability to leverage digital innovations were critical to **South Korea's** ability to scale testing during COVID-19.<sup>42,183</sup> South Korea leveraged public-private partnerships to fast-track development of testing, conducted predictive research on the spread of COVID-19, used drive-through testing, and utilized digital tools to strengthen testing and contact tracing.<sup>189</sup> The country also leveraged triage, telemedicine, alternate delivery sites and adapted models of care to avoid transmission of COVID-19 and reduce demand for hospital beds. A survey of 10 countries showed that South Korea was relatively less affected by essential health service disruptions during the pandemic.<sup>190</sup>

### **Tier 3: Advanced case management and surge response.**

The third layer of defense includes surge response interventions and secondary and tertiary hospital interventions for complicated cases. This tier relies on surge financing to quickly meet the extraordinary costs of a full-force epidemic or pandemic. While investment across all three tiers is important for resilience, the first two are foundational. The most impactful and cost-effective public investments are those that strengthen upstream interventions in a country's health system—enhancing disease prevention, preparedness, early detection, and containment and mitigation capabilities. Investments in the pre-crisis tiers will not only ensure efficiency and resilience of health systems but will

also prepare a post-COVID-19 world to address the full range of health challenges that lie ahead.

Most countries' COVID-19 response relied mainly on the costly third tier. While a focus on this layer is reasonable during a crisis, ultimately, there is no resilience without pre-crisis preparedness, which requires upstream investments in Tiers 1 and 2. That will not only ensure health system efficiency and resilience but will also make it more likely that a post-COVID-19 world can address health challenges more effectively. Only by doing so will countries finally break the tragic cycle of “panic and neglect” and meet the next crisis with far more resilience—improving health outcomes and saving lives.

## **Conclusion**

COVID-19 has shown the world that fundamental change in health systems cannot wait. As new threats loom, there is only a brief window of political opportunity for ambitious, resilience-oriented reform in health systems. This report traces clear lines from evidence to policy, distilling practical recommendations that decision-makers, implementers, and stakeholders can use to deliver needed changes—before it's too late. While the report highlights the need to invest in resilience, there is also a need to identify metrics to track progress and performance.

COVID-19 has confirmed that countries that invest consistently in resilience during non-crisis times reap large dividends when emergencies occur. Resilience dividends mean gains for countries' economies, but above all for the health and well-being of their people. The exact timing of the next devastating global pandemic cannot be predicted. But the critical moment that will determine countries' resilience to that future crisis is known. That moment is now.





# References

- <sup>1</sup> Tediosi, F., K. Lönnroth, A. Pablos-Méndez and M. Raviglione (2020). "Build back stronger universal health coverage systems after the COVID-19 pandemic: the need for better governance and linkage with universal social protection." *BMJ Global Health* 2020;5:e004020. doi:10.1136/bmjgh-2020-004020.
- <sup>2</sup> Singer, M., S. Clair (2003). "Syndemics and public health: reconceptualizing disease in bio-social context." *Med Anthropol Q.* 17(4):423-41.
- <sup>3</sup> Mendenhall, E., B.A. Kohrt, S.A. Norris, D. Ndeti and D. Prabhakaran (2017). "Non-communicable disease syndemics: poverty, depression, and diabetes among low-income populations." *Lancet.* 389(10072):951-63.
- <sup>4</sup> Bollyky, T. J (2021). "A Year Out: Addressing International Impacts of the COVID-19 Pandemic." Council on Foreign Relations.
- <sup>5</sup> Council on Foreign Relations (2021). "Noncommunicable Diseases Kill Slowly in Normal Times and Quickly in COVID-19 Times". <https://www.cfr.org/article/noncommunicable-diseases-kill-slowly-normal-times-and-quickly-covid-19-times>.
- <sup>6</sup> Sepulveda, E. R. and A.S. Brooker (2021). Income inequality and COVID-19 mortality: Age-stratified analysis of 22 OECD countries. *SSM - population health*, 16, 100904. <https://doi.org/10.1016/j.ssmph.2021.100904>.
- <sup>7</sup> Varkey, S., E. Kandpal and S. Neelsen (2022). Why addressing inequality must be central to pandemic preparedness. *BMJ Global Health*, 7(9), e010453.
- <sup>8</sup> Aitsi-Selmi, A. and V. Murray (2015). "The Sendai framework: disaster risk reduction through a health lens, *SciELO Public Health*". 93: 362-362.
- <sup>9</sup> Maor, M. and M. Howlett (2020). "Explaining variations in state COVID-19 responses: psychological, institutional, and strategic factors in governance and public policy-making." *Policy Design and Practice* 3(3): 228-241.
- <sup>10</sup> Khan, Y., T. O'Sullivan, A. Brown, S. Tracey, J. Gibson, M. Génereux, B. Henry and B. Schwartz (2018). "Public health emergency preparedness: a framework to promote resilience." *BMC public health* 18(1): 1-16.
- <sup>11</sup> Nature Editorial. (2022). "Wanted: better systems for turning evidence into action." *Nature* from <https://www.nature.com/articles/d41586-022-00559-9/>
- <sup>12</sup> Woldetsadik, M. A., S. Bratton, K. Fitzpatrick, F. Ravat, L. Del Castillo, K. J. McIntosh, D. Jarvis, C. R. Carnevale, C. H. Cassell and C. Chhea (2022). "Qualitative evaluation of enabling factors and barriers to the success and sustainability of national public health institutes in Cambodia, Colombia, Liberia, Mozambique, Nigeria, Rwanda and Zambia." *BMJ open* 12(4): e056767.
- <sup>13</sup> Resolve To Save Lives. (2021). "Characteristics of an Effective Public Health Emergency Law." Retrieved 04/18/2022, from [https://preventepidemics.org/wp-content/uploads/2020/08/CCC\\_276\\_LEG\\_-Characteristics-of-an-Effective-Public-Health-Emergency-Law-.pdf](https://preventepidemics.org/wp-content/uploads/2020/08/CCC_276_LEG_-Characteristics-of-an-Effective-Public-Health-Emergency-Law-.pdf).
- <sup>14</sup> Lewis, J., S. Schneegans and T. Straza (2021). "UNESCO Science Report: The race against time for smarter development", UNESCO Publishing.
- <sup>15</sup> McKee, M., D. Altmann, A. Costello et al (2022). Open science communication: The first year of the UK's Independent Scientific Advisory Group for Emergencies. *Health Policy*, 126(3), 234-244.
- <sup>16</sup> Kang, H., S. Kwon and E. Kim (2020). "COVID-19 health system response monitor: Republic of Korea."
- <sup>17</sup> Lee, S., J. Yeo and C. Na (2020). "Learning from the past: Distributed cognition and crisis management capabilities for tackling COVID-19." *The American Review of Public Administration* 50(6-7): 729-735.
- <sup>18</sup> The World Bank (2019). "Lessons Learned in Financing Rapid Response to Recent Epidemics in West and Central Africa". World Bank Group.
- <sup>19</sup> Onyemelukwe, C (2019). "IHR Implementation in Nigerian Law - Mapping of Legal Authorities and Analysis of Legislation at Federal Level". [https://ncdc.gov.ng/themes/common/docs/protocols/116\\_1580654680.pdf](https://ncdc.gov.ng/themes/common/docs/protocols/116_1580654680.pdf)
- <sup>20</sup> Chioma, D.N., C. L. Ochu, E. Kelly, J. Oladejo, I. Elsie, U. Chukwuma, L. Steinhardt, I. Ehimario, J. Wagai and O. Tochi (2020). "Nigeria's public health response to the COVID-19 pandemic: January to May 2020". *Journal of Global Health*.
- <sup>21</sup> Chua, A.Q., M.M.J. Tan, M. Verma, E.K.L. Han, L.Y. Hsu, A.R. Cook, Y.Y. Teo, V.J. Lee, and H. Legido-Quigley (2020). "Health system resilience in managing the COVID-19 pandemic: lessons from Singapore". *BMJ Global Health*.
- <sup>22</sup> Menon, A. N., E. Rosenfeld and C. A. Brush (2018). "Law and the JEE: Lessons for IHR Implementation". *Health security*.
- <sup>23</sup> Tony, A (2021). "Reps pass Infectious Diseases Bill despite opposition". *The Nation*. Internet.
- <sup>24</sup> Yang, T. U., J. Y. Noh, J.Y. Song, H. J. Cheong and W. J. Kim (2020). "How lessons learned from the 2015 MERS outbreak affected the effective response to the COVID-19 epidemic in the Republic of Korea". *The Korean Journal of Internal Medicine*.
- <sup>25</sup> Chattopadhyay, R., F. Knüpling, D. Chebenova, L. Whittington and P. Gonzalez (2022). "Federalism and the Response to COVID-19: A Comparative Analysis". Taylor & Francis.

- <sup>26</sup> Bali, S (2016). "Fearonomics and the Role of Nigeria's Private Sector in the Nigerian Ebola Response". Duke University.
- <sup>27</sup> Kruk, M. E., E. J. Ling, A. Bitton, M. Cammett, K. Cavanaugh, M. Chopra, F. El-Jardali, R. J. Macauley, M. K. Muraguri and S. Konuma (2017). "Building resilient health systems: a proposal for a resilience index". *BMJ*.
- <sup>28</sup> Webster, P (2020). "Canada and COVID-19: learning from SARS". *Lancet*. 395(10228): 936.
- <sup>29</sup> Massinga Loembé, M., A. Tshangela, S.J. Salyer, J. K. Varma, A. E. O. Ouma and J. N. Nkengasong (2020). "COVID-19 in Africa: the spread and response". *Nature Medicine* 26(7): 999-1003.
- <sup>30</sup> Blanton, R. E., N. B. Mock, H. N. Hiruy, J. S. Schieffelin, S. Doumbia, C. Happi, R. J. Samuels and R. A. Oberhelman (2020). "African resources and the promise of resilience against COVID-19". *The American Journal of Tropical Medicine and Hygiene* 103(2): 539.
- <sup>31</sup> Rentschler, J., C. Klaiber, M. Tariverdi, C. Desjonqueres and J. Mercadante (2021). "Frontline: Preparing healthcare systems for shocks from disasters to pandemics", World Bank.
- <sup>32</sup> Berthe, F., S. Bali and G. Batmanian (2022) *Putting Pandemics Behind Us : Investing in One Health to Reduce Risks of Emerging Infectious Diseases* (English). World Bank Group.
- <sup>33</sup> World Health Organization (2021). "Building health systems resilience for universal health coverage and health security during the COVID-19 pandemic and beyond: WHO position paper".
- <sup>34</sup> Bali, S., R. Dhatt, A. Lal, A. Jama, K. Van Daalen, and D. Sridhar (2020). "Off the back burner: diverse and gender-inclusive decision-making for COVID-19 response and recovery". *BMJ Global Health*. 5: e002595.
- <sup>35</sup> Fidler, H (2014). "The Role of the Private Sector in Health Financing and Service Delivery". *European Journal of Public Health*: 451.
- <sup>36</sup> Bali, S., K. A. Stewart and M. A. Pate (2016). "Long shadow of fear in an epidemic: fearonomic effects of Ebola on the private sector in Nigeria". *BMJ global health* 1(3): e000111.
- <sup>37</sup> USAID (United States Agency for International Development) (2020). "Engaging the Private Sector in Health System Resilience Efforts - A Strategic Approach". USA.
- <sup>38</sup> Exemplars in Global Health (2022). "Ghana: COVID-19 Response & Maintenance of Essential Health Services." Available online at: <https://www.exemplars.health/emerging-topics/ecr> (forthcoming).
- <sup>39</sup> Haldane, V., C. De Foo, S. M. Abdalla, A.S. Jung, M. Tan, S. Wu, A. Chua, M. Verma, P. Shrestha and S. Singh (2021). "Health systems resilience in managing the COVID-19 pandemic: lessons from 28 countries." *Nature Medicine* 27(6): 964-980.
- <sup>40</sup> Jonas, O. B. N., A. Thuy, T. Palu, V. Kwakwa, and A. Von Trotsenberg (2014). *Implementation Completion and Results Report on the Vietnam Avian and Human Influenza and Human Pandemic Preparedness Project Financing*, The World Bank.
- <sup>41</sup> The World Bank (2019). *Vietnam: Health Security Financing Assessment*, World Bank Group.
- <sup>42</sup> Osewe, P. L (2021). "Pandemic Preparedness and Response Strategies: COVID-19 Lessons from the Republic of Korea, Thailand, and Vietnam."
- <sup>43</sup> Henley, P., G. Igihozo and L. Wotton (2021). "One Health approaches require community engagement, education, and international collaborations—a lesson from Rwanda." *Nature Medicine* 27(6): 947-948
- <sup>44</sup> WHO (World Health Organization), *Impact for Health* (2020) *Engaging the private health sector in the COVID-19 response* <https://www.impactforhealth.com/post/engaging-the-private-health-sector-in-the-covid-19-response>
- <sup>45</sup> Clarke, D., M. Hellowell, B. O'Hanlon and C. Eldridge (2020). "All hands on deck: mobilising the private sector for the COVID-19 response." from <https://www.uhc2030.org/blog-news-events/uhc2030-blog/all-hands-on-deck-mobilising-the-private-sector-for-the-covid-19-response-555347/>.
- <sup>46</sup> NCDC (Nigeria Centre for Disease Control) (2021). "One Year After: Nigeria's COVID-19 Public Health Response." 2022, from <https://covid19.ncdc.gov.ng/media/files/COVIDResponseMarch1.pdf>.
- <sup>47</sup> Gupta, I (2020). "Relying on serendipity is not enough: Building a resilient health sector in India." *Indian economic review* 55(Suppl 1): 1-23.
- <sup>48</sup> Kurowski C, D. Evans, A. Tandon et al (2021). *From double shock to double recovery —Implications and options for health financing in the time of COVID-19*. World Bank Group
- <sup>49</sup> "Georgetown Global Health Security Tracking." Retrieved April 4, 2022, from <https://tracking.ghscosting.org/>.
- <sup>50</sup> The World Bank (2017). *From panic and neglect to investing in health security: financing pandemic preparedness at a national level*, World Bank Group.
- <sup>51</sup> Rahim, F., R. Allen, H. Barroy, L. Gores and J. Kutzin (2020). "COVID-19 Funds in Response to the Pandemic." Washington (DC): International Monetary Fund.
- <sup>52</sup> Shu, Y., Y. Song, D. Wang, C. M. Greene, A. Moen, C. K. Lee, Y. Chen, X. Xu, J. McFarland, L. Xin, J. Bresee, S. Zhou, T. Chen, R. Zhang and N. Cox (2019). "A ten-year China-US laboratory collaboration: improving response to influenza threats in China and the world, 2004-2014." *BMC Public Health* 19(Suppl 3): 520.

- <sup>53</sup> Yamey, G., M. Schaferhoff, O. K. Aars, B. Bloom, D. Carroll, M. Chawla, V. Dzau, R. Echalar, I. S. Gill, T. Godal, S. Gupta, D. Jamison, P. Kelley, F. Kristensen, C. Mundaca-Shah, B. Oppenheim, J. Pavlin, R. Salvado, P. Sands, R. Schmunis, A. Soucat, L. H. Summers, A. El Turabi, R. Waldman and E. Whiting (2017). "Financing of international collective action for epidemic and pandemic preparedness." *Lancet Glob Health* 5(8): e742-e744.
- <sup>54</sup> WHO (World Health Organization) (2021). "Crisis or opportunity? Health financing in times of uncertainty: Country profiles from the SEA Region."
- <sup>55</sup> Park, H., B. Sim, B. Zhao and E. W. Nam (2022). Public Health Financing and Responses to COVID-19: Lessons from South Korea. *Healthcare*, MDPI.
- <sup>56</sup> Exemplars in Global Health (2022). "Dominican Republic: COVID-19 Response & Maintenance of Essential Health Services." Available online at: <https://www.exemplars.health/emerging-topics/ecr> (forthcoming)
- <sup>57</sup> Nabyonga-Orem, J., K. Brendan, C. Abewe, H. Barroy and P. Tumusiime (2020). "Building sustainable health financing options for emergency response: Lessons from the COVID-19 response in Africa." Retrieved Nov 11, 2021, from <https://blogs.bmj.com/bmjgh/2020/05/26/building-sustainable-health-financing-options-for-emergency-response-lessons-from-the-covid-19-response-in-africa/>.
- <sup>58</sup> IMF (International Monetary Fund) (2021). Policy responses to COVID-19. <https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#P>.
- <sup>59</sup> WHO (World Health Organization) (2021). The impact of COVID-19 on health and care workers: a closer look at deaths.
- <sup>60</sup> WHO (World Health Organization) (2016). Global Strategy on Human Resources for Health: Workforce 2030.
- <sup>61</sup> Ballard, M. et al. Prioritising the role of community health workers in the COVID-19 response. *BMJ Global Health* 5, 2020, e002550.
- <sup>62</sup> Auerbach M.A., K. Abulebda, A.M. Bona, L. Falvo, P.G. Hughes, M. Wagner et al (2021). A National US Survey of Pediatric Emergency Department Coronavirus Pandemic Preparedness. *Pediatric Emergency Care*.;37(1):48.
- <sup>63</sup> ElGeed H., Y. Owusu, S. Abdulrhim, A. Awaisu, V.S. Kattezhathu, P.V. Abdulrouf et al (2021). Evidence of community pharmacists' response preparedness during COVID-19 public health crisis: A cross-sectional study. *Journal of Infection in Developing Countries*.;15(01):40–50.
- <sup>64</sup> Rafi M.A., M.T. Hasan, D.T. Azad, S.F. Alam, V. Podder, S. Hossain S et al (2021). Willingness to work during initial lockdown due to COVID-19 pandemic: Study based on an online survey among physicians of Bangladesh. *PLoS One*. 2021;16(2):e0245885.
- <sup>65</sup> Luo Y., X. Feng, M. Zheng, D. Zhang, H. Xiao and N. Li (2021). Willingness to participate in front-line work during the COVID-19 pandemic: A cross-sectional study of nurses from a province in South-West China. *Journal of Nursing Management*. 2021 Sep;29(6):1356–65
- <sup>66</sup> Abbas K., S.M.A. Nawaz, N. Amin, F.M. Soomro, K. Abid, M. Ahmed et al (2020). A web-based health education module and its impact on the preventive practices of health-care workers during the COVID-19 pandemic. *Health Education Research*. Oct;35(5):353–61.
- <sup>67</sup> Marcasciano M., J. Kaciulyte, F.L.R. Mori, F. Lo Torto, L. Barellini, A. Loreti et al (2020). Breast surgeons updating on the thresholds of COVID-19 era: results of a multicenter collaborative study evaluating the role of online videos and multimedia sources on breast surgeons' education and training. *European Review for Medical and Pharmacological Sciences*. 2020 Jul;24(14):7845–54.
- <sup>68</sup> Odayappan A., R. Venkatesh, R. Tammineni, S. Nachiappan and M. Iswarya (2021). Perspectives of physicians regarding the role of webinars on medical education during the COVID-19 pandemic. *Indian Journal of Ophthalmology*. 2021 May;69(5):1251–6.
- <sup>69</sup> Cho M.J. and J.P. Hong (2021). The emergence of virtual education during the COVID-19 pandemic: The past, present, and future of the plastic surgery education. *Journal of Plastic, Reconstructive & Aesthetic Surgery*.;74(6):1413–21.
- <sup>70</sup> Zhang D., H. Liao, Y. Jia, W. Yang, P. He, D. Wang et al (2021). Effect of virtual reality simulation training on the response capability of public health emergency reserve nurses in China: a quasiexperimental study. *BMJ Open*. e048611.
- <sup>71</sup> Mark M.E., P. LoSavio, I. Husain, P. Papagiannopoulos, P.S. Batra and B.A. Tajudeen (2020). Effect of Implementing Simulation Education on Health Care Worker Comfort with Nasopharyngeal Swabbing for COVID-19. *Otolaryngology–Head and Neck Surgery*. 2020 Aug;163(2):271–4.
- <sup>72</sup> Hu, A. E., R. Fontaine, R. Turcios-Ruiz, A. A. Abedi, S. Williams, A. Hilmers, E. Njoh, E. Bell, C. Reddy and K. Ijaz (2022). "Field epidemiology training programs contribute to COVID-19 preparedness and response globally." *BMC public health* 22(1): 1-9.
- <sup>73</sup> Bourgeault, I. L., C. B. Maier, M. Dieleman, J. Ball, A. MacKenzie, S. Nancarrow, G. Nigenda and M. Sidat (2020). "The COVID-19 pandemic presents an opportunity to develop more sustainable health workforces." *Human resources for health* 18(1): 1-8.
- <sup>74</sup> Cooper, C., D. Fisher, N. Gupta, R. MaCauley and C.L. Pessoa-Silva (2016). Infection prevention and control of the Ebola outbreak in Liberia, 2014–2015: key challenges and successes. *BMC medicine*, 14(1), 1-6.
- <sup>75</sup> Patel, A., M. D'Alessandro, K. Ireland, W. Burel, E. Wencil and S. Rasmussen (2017). Personal protective equipment

supply chain: lessons learned from recent public health emergency responses. *Health Security*. (2017) 15:244–52. 10.1089/hs.2016.0129

<sup>76</sup> Patel, L. N., S. Kozikott, R. Ilboudo, M. Kamateeka, M. Lamorde, M. Subah, M and C.T. Lee (2021). Safer primary healthcare facilities are needed to protect healthcare workers and maintain essential services: lessons learned from a multicountry COVID-19 emergency response initiative. *BMJ global health*, 6(6), e005833.

<sup>77</sup> Crippa J.A.S., A.W. Zuardi, F.S. Guimarães, A.C. Campos, F. de Lima Osório, S.R. Loureiro et al (2021). Efficacy and Safety of Cannabidiol Plus Standard Care vs Standard Care Alone for the Treatment of Emotional Exhaustion and Burnout Among Frontline Health Care Workers During the COVID-19 Pandemic: A Randomized Clinical Trial. *JAMA Network Open*. 2021;4(8):e2120603–e2120603.

<sup>78</sup> Schug C., E. Morawa, F. Geiser, N. Hiebel, P. Beschoner, L. Jerg-Bretzke et al (2021). Social Support and Optimism as Protective Factors for Mental Health among 7765 Healthcare Workers in Germany during the COVID-19 Pandemic: Results of the VOICE Study. *International Journal of Environmental Research and Public Health*. 2021;18(7):3827.

<sup>79</sup> Biswas N., T. Mustapha, J. Khubchandani and J.H. Price (2021). The Nature and Extent of COVID-19 Vaccination Hesitancy in Healthcare Workers. *Journal of Community Health*.;46(6):1244-1251. doi: 10.1007/s10900-021-00984-3. Epub 2021 Apr 20. PMID: 33877534; PMCID: PMC8056370.

<sup>80</sup> Castañeda-Vasquez D.E., J.P. Ruiz-Padilla and E. Botello-Hernandez (2021). Vaccine Hesitancy Against SARS-CoV-2 in Health Personnel of Northeastern Mexico and Its Determinants. *Journal of Occupational and Environmental Medicine*.;63(8):633–7.

<sup>81</sup> Maraqa B., Z. Nazzal, R. Rabi, N. Sarhan, K. Al-Shakhra and M. Al-Kaila (2021). COVID-19 vaccine hesitancy among health care workers in Palestine: A call for action. *Preventive Medicine, Baltimore*. 2021 Aug;149:106618.

<sup>82</sup> Angelo A.T., D.S. Alemayehu and A.M. Dachew (2021). Health care workers intention to accept COVID-19 vaccine and associated factors in southwestern Ethiopia, 2021. *PLoS One*.;16(9):e0257109

<sup>83</sup> Berry S.D., K.S. Johnson, L. Myles, L. Herndon, A. Montoya, S. Fashaw et al (2021). Lessons learned from frontline skilled nursing facility staff regarding COVID-19 vaccine hesitancy. *Journal of the American Geriatrics Society*.

<sup>84</sup> Exemplars in Global Health (2022). “Uganda: COVID-19 Response & Maintenance of Essential Health Services.” Available online at: <https://www.exemplars.health/emerging-topics/ecr> (forthcoming)

<sup>85</sup> Exemplars in Global Health (2022). “Costa Rica: COVID-19 Response & Maintenance of Essential Health Services.” Available online at: <https://www.exemplars.health/emerging-topics/ecr> (forthcoming)

<sup>86</sup> Apolitical. (2020) How Ethiopia’s community health workers are hunting down Covid-19 <https://apolitical.co/solution-articles/en/how-ethiopia-community-health-workers-are-hunting-down-covid-19>

<sup>87</sup> Ballard, M., A. Johnson et al (2022). Community Health Workers in Pandemics: Evidence and Investment Implications. *Global Health: Science and Practice*, 10(2).

<sup>88</sup> TEPHINET (2020). “FETP Activities in Response to Coronavirus Disease 19 (COVID-19)” <https://www.tephinet.org/fetp-activities-in-response-to-coronavirus-disease-19-covid-19>

<sup>89</sup> McGee, J. and T. Sammut-Bonnici (2014). *Frugal Innovation*: 2.

<sup>90</sup> Nolte, E. and P. Groenewegen (2021). How can we transfer service and policy innovations between health systems?, WHO.

<sup>91</sup> Zaidi, A (2018). “Three Types of Innovation – Product, Process and Business Model.” from <https://mdi.com.pk/management/2018/05/three-types-innovation/>

<sup>92</sup> Nolte, E (2018). How do we ensure that innovation in health service delivery and organization is implemented, sustained and spread?, WHO Regional Office for Europe.

<sup>93</sup> Budd, J., B. S. Miller, E. M. Manning, V. Lampos, M. Zhuang, M. Edelstein, G. Rees, V. C. Emery, M. M. Stevens and N. Keegan (2020). Digital technologies in the public-health response to COVID-19. *Nature medicine* 26(8): 1183-1192.

<sup>94</sup> Bolisli, W., M. De Lucia, F. Dolz et al (2021). Regulatory agilities in the time of covid-19: overview, trends, and opportunities. *Clinical therapeutics*, 43(1), 124-139.

<sup>95</sup> Asia Pacific Foundation of Canada (2022). “Digital Innovations for Pandemic Response in Asia: Lessons for Canada.” from [https://www.asiapacific.ca/sites/default/files/inline-files/PHAC-Paper2\\_MARCH.pdf](https://www.asiapacific.ca/sites/default/files/inline-files/PHAC-Paper2_MARCH.pdf).

<sup>96</sup> Asia Pacific Foundation of Canada (2022). “How the Asia Pacific Region Managed the Public Health Response to COVID-19 and What Canada Can Learn from Them.”

<sup>97</sup> Yilmaz, M. and N. Aydin. (2020). “3T key to South Korea’s success in COVID-19 fight.” from <https://www.aa.com.tr/en/asia-pacific/3t-key-to-south-koreas-success-in-covid-19-fight/1850084>.

<sup>98</sup> Corsini, L., V. Dammico and J. Moultrie (2021). “Frugal innovation in a crisis: the digital fabrication maker response to COVID-19.” *R&D Management* 51(2): 195-210.

<sup>99</sup> Sibiri, H., D. Prah and S.M. Zankawah (2021). Containing the impact of COVID-19: Review of Ghana’s response approach. *Health Policy Technol*. 10, 13–15.

<sup>100</sup> Dzansi, J (2020). “Ramping up early detection of COVID-19 with limited resources: The role of pool testing.” from <https://www.theigc.org/blog/ramping-up-early-detection-of-covid-19-with-limited-resources-the-role-of-pool-testing/>.

- <sup>101</sup> Zhang, J., J. Nonvignon and M. Wenhui (2020). How well is Ghana—with one of the best testing capacities in Africa—responding to COVID-19?, from <https://www.brookings.edu/blog/future-development/2020/07/28/how-well-is-ghana-with-one-of-the-best-testing-capacities-in-africa-responding-to-covid-19/>
- <sup>102</sup> WHO (World Health Organization) (2020). Pooling samples boosts Ghana's COVID-19 testing. WHO | Regional Office for Africa <https://www.afro.who.int/news/pooling-samples-boosts-ghanas-covid-19-testing>.
- <sup>103</sup> Romero, M. and L. Emmanouilidou (2020). "In fight against coronavirus, Ghana uses drones to speed up testing." from <https://theworld.org/stories/2020-04-23/fight-against-coronavirus-ghana-uses-drones-speed-testing>.
- <sup>104</sup> PHCPI (The Primary Health Care Performance Initiative) (2020). Utilizing Primary Health Care for COVID-19 Testing and Contact Tracing in Ghana.
- <sup>105</sup> News (2020). "Ghana launches COVID-19 Tracker App." from <https://news.itu.int/ghana-launches-covid-19-tracker-app/>.
- <sup>106</sup> Bolisli, W. R., M.L. de Lucia, F. Dolz, R. Mo, M. Nagaoka, H. Rodriguez, M.L. Woon, W. Yu and T.C. Kühler (2021). Regulatory Agilities in the Time of COVID-19: Overview, Trends, and Opportunities. *Clinical therapeutics*, 43(1), 124–139. <https://doi.org/10.1016/j.clinthera.2020.11.015>.
- <sup>107</sup> Lilani, K. and L. Sally (2001). Regulation in the context of global health markets, *Health Policy in a Globalising World*.
- <sup>108</sup> Dayalani V (2021) *Telemedicine: A Post-Covid Reality In India*. Datalabs. Available at: <https://inc42.com/datalab/telemedicine-a-post-covid-reality-in-india/> (accessed 26th August 2021).
- <sup>109</sup> Singhi, A., P. Malani, A. Gopalka, P. Aggarwal, A. Goel, P. Boobna, A. Bijapurkar, R. Guha, A. Bhattacharya, S. Sinha, B. Janssens, S. Bansal, N. Bhaskar and V. Agarwalla (2020). Leapfrogging to a Digital Healthcare System Re-imagining Healthcare for Every Indian, Federation of Indian Chambers of Commerce & Industry.
- <sup>110</sup> Frieden, T. R., C. T. Lee, A. F. Bochner, M. Buissonnière and A. McClelland (2021). 7-1-7: an organising principle, target, and accountability metric to make the world safer from pandemics. *The Lancet* 398(10300): 638-640.
- <sup>111</sup> Amukele, T (2017). "Africa CDC: Establishing Integrated Surveillance and Laboratory Networks for Rapid Disease Detection and Response, Control, Prevention, and Clinical Care in Africa." *African journal of laboratory medicine* 6(1): 638-638.
- <sup>112</sup> Nuzzo, J. B (2014). "Global Surveillance for Emerging Infectious Diseases." *Concepts and Methods in Infectious Disease Surveillance*: 177-188.
- <sup>113</sup> Sundararaman, T., V. Muraleedharan and A. Ranjan (2021). "Pandemic resilience and health systems preparedness: lessons from COVID-19 for the twenty-first century." *Journal of Social and Economic Development* 23(2): 290-300.
- <sup>114</sup> AbouZahr, C., M. W. Bratschi, E. Cerccone, A. Mangharam, D. d. Savigny, I. Dincu, A. B. Forsingdal, O. Joos, M. Kamal and D. M. Fat (2021). "The COVID-19 pandemic: effects on civil registration of births and deaths and on availability and utility of vital events data." *American Journal of Public Health* 111(6): 1123-1131.
- <sup>115</sup> Kelly, M., G. Mathenge and C. Rao (2021). "Lessons learnt and pathways forward for national civil registration and vital statistics systems after the COVID-19 pandemic." *Journal of Epidemiology and Global Health* 11(3): 262.
- <sup>116</sup> Sharma, J., K. Andrews and R. Bhatia (2022). "Responding better in emergencies: Innovations in measuring health facility resilience for pandemics and other disasters." from <https://blogs.worldbank.org/health/responding-better-emergencies-innovations-measuring-health-facility-resilience-pandemics-and>
- <sup>117</sup> Ibrahim, N. K (2020). "Epidemiologic surveillance for controlling Covid-19 pandemic: types, challenges and implications." *Journal of Infection and Public Health* 13(11): 1630-1638.
- <sup>118</sup> Matheri, A. N., M. Belaid, C. Njenga and J. C. Ngila (2022). "Water and wastewater digital surveillance for monitoring and early detection of the COVID-19 hotspot: industry 4.0." *International Journal of Environmental Science and Technology*: 1-18
- <sup>119</sup> WHO (2020). Thailand: How a strong health system fights a pandemic.
- <sup>120</sup> Global Health Risk Framework Commission (2016). "The neglected dimension of global security: a framework to counter infectious disease crises."
- <sup>121</sup> Resolve To Save Lives (2021). "Epidemics that Didn't Happen." from <https://preventepidemics.org/epidemics-that-didnt-happen/>.
- <sup>122</sup> Kelly, T. R., C. Machalaba, W.B. Karesh, P.Z. Crook, K. Gilardi, J. Nziza and J.A. Mazet (2020). Implementing One Health approaches to confront emerging and re-emerging zoonotic disease threats: lessons from PREDICT. *One Health Outlook*, 2(1), 1-7.
- <sup>123</sup> Southgate, R., C. Roth, J. Schneider, P. Shi, T. Onishi, D. Wenger, W. Amman, L. Ogallo, J. Beddington and V. Murray (2013). Using Science for Disaster Risk Reduction.
- <sup>124</sup> Exemplars in Global Health (2021). "SORMAS in Nigeria: Adapting a Fully Integrated Surveillance System to Track COVID-19." Available online at: <https://www.exemplars.health/emerging-topics/epidemic-preparedness-and-response/digital-health-tools/sormas-nigeria>

- <sup>125</sup> Exemplars in Global Health (2021). "Testing & Surveillance: Nigeria." Available online at: <https://www.exemplars.health/emerging-topics/epidemic-preparedness-and-response/testing-and-surveillance/nigeria>
- <sup>126</sup> Morgan, O. W., X. Aguilera, A. Ammon, J. Amuasi, I. S. Fall, T. Frieden, D. Heymann, C. Ihekweazu, E.-k. Jeong, G. M. Leung, B. Mahon, J. Nkengasong, F. N. Qamar, A. Schuchat, L. H. Wieler and S. F. Dowell (2021). "Disease surveillance for the COVID-19 era: time for bold changes." *The Lancet* 397(10292): 2317-2319.
- <sup>127</sup> Exemplars in Global Health (2021). "NCOVI and Bluezone in Vietnam: Government Launches Digital Apps to Contain COVID-19." Available online at: <https://www.exemplars.health/emerging-topics/epidemic-preparedness-and-response/digital-health-tools/ncovi-and-bluezone-in-vietnam>.
- <sup>128</sup> Nuzzo, J.B., D. Meyer, M. Snyder et al (2019) "What makes health systems resilient against infectious disease outbreaks and natural hazards? Results from a scoping review." *BMC Public Health* 19, 1310 (2019).
- <sup>129</sup> Lu, T.H., Y.J. Chou and C.S. Liou (2007). "Impact of SARS on healthcare utilization by disease categories: implications for delivery of healthcare services." *Health Policy*. 83(2-3):375-81.
- <sup>130</sup> Delamou, A., A.M.E. Ayadi, S. Sidibe, T. Delvaux, B.S. Camara, S.D. Sandouno et al (2017). "Effect of Ebola virus disease on maternal and child health services in Guinea: a retrospective observational cohort study." *Lancet Glob Health*. 5(4):e448-e57.
- <sup>131</sup> Samba, T., P. Bhat, P. Owiti, L. Samuels, P.J. Kanneh, R. Paul et al (2017). "Non-communicable diseases in the Western Area District, Sierra Leone, before and during the Ebola outbreak." *Public Health Action*. 7(Suppl 1):S16-S21.
- <sup>132</sup> Sun, X., T.T. Samba, J. Yao, W. Yin, L. Xiao, F. Liu et al (2017). "Impact of the Ebola outbreak on routine immunization in western area, Sierra Leone - a field survey from an Ebola epidemic area." *BMC Public Health*. 17(1):363.
- <sup>133</sup> Bolkan, H.A., A. van Duinen, M. Samai, D.A. Bash-Taqi, I. Gassama, B. Waalewijn et al (2018). "Admissions and surgery as indicators of hospital functions in Sierra Leone during the west-African Ebola outbreak." *BMC Health Serv Res*. 18(1):846.
- <sup>134</sup> Parpia, A.S., M.L. Ndeffo-Mbah, N.S. Wenzel and A.P. Galvani (2016). "Effects of Response to 2014-2015 Ebola Outbreak on Deaths from Malaria, HIV/AIDS, and Tuberculosis, West Africa. ." *Emerg Infect Dis*. 22(3):433-41.
- <sup>135</sup> Haldane V., A. Jung, C. De Foo, M. Bonk, M. Jamieson, S. Wu et al (2021). "Strengthening the basics: public health responses to prevent the next pandemic ." *BMJ* 375 :e067510.
- <sup>136</sup> Zungu, M., K. Voyi, N. Mlangeni, S.V. Moodley, J. Ramodike, N. Claassen et al (2021). "Organizational factors associated with health worker protection during the COVID-19 pandemic in four provinces of South Africa." *BMC Health Serv Res*. 21(1):1080.
- <sup>137</sup> Haldane, V., Z. Zhang, R.F. Abbas, W. Dodd, L.L. Lau, M.R. Kidd et al (2020). "National primary care responses to COVID-19: a rapid review of the literature." *BMJ Open* 10(12):e041622.
- <sup>138</sup> The World Bank (2021). FRONTLINE: Preparing healthcare systems for shocks. Accessed November 12, 2021. <https://www.worldbank.org/en/news/feature/2021/04/13/frontline-preparing-healthcare-systems-for-shocks>.
- <sup>139</sup> The World Bank (2021). Walking the Talk: Reimagining primary health care after COVID-19. <https://openknowledge.worldbank.org/handle/10986/35842>.
- <sup>140</sup> Luo, H., J. Liu, C. Li, K. Chen and M. Zhang (2020). "Ultra-rapid delivery of specialty field hospitals to combat COVID-19: Lessons learned from the Leishenshan Hospital project in Wuhan." *Autom Constr*. Nov;119:103345.
- <sup>141</sup> Reid, S., T. Ras and K. Von Pressentin (2020). "The Cape Town International Convention Centre from the inside: The family physicians' view of the Hospital of Hope." *Afr J Prim Health Care Fam Med*. 12(1):e1-e4.
- <sup>142</sup> Candel, F.J., J. Canora, A. Zapatero, R. Barba, J. Gonzalez Del Castillo, G. Garcia-Casasola et al (2021). "Temporary hospitals in times of the COVID pandemic. An example and a practical view." *Rev Esp Quimioter*. 34(4):280-8.
- <sup>143</sup> Naganathan, S., K. Meehan-Coussee, S. Pasichow, H. Rybasack-Smith, W. Binder, F. Beaudoin et al (2020). "From Concerts to COVID: Transforming the RI Convention Center into an Alternate Hospital Site in under a Month." *R I Med J* 103(6):8-13.
- <sup>144</sup> Republic of the Philippines (2021). Amendment to Joint Administrative Order No. 2020-0001 entitled "Guidelines on Local Isolation and General Treatment Areas for COVID-19 cases (LIGTAS COVID-19) and the Community-based Management of Mild COVID-19 cases" [press release].
- <sup>145</sup> Tumusiime, P., H. Karamagi, R. Titi-Ofei et al (2020). "Building health system resilience in the context of primary health care revitalization for attainment of UHC: proceedings from the Fifth Health Sector Directors' Policy and Planning Meeting for the African Region." *BMC Proc* 14, 16. <https://doi.org/10.1186/s12919-020-00203-2>.
- <sup>146</sup> Exemplars in Global Health (2022). "Sri Lanka: COVID-19 Response & Maintenance of Essential Health Services." Available online at: <https://www.exemplars.health/emerging-topics/ecr> (forthcoming)
- <sup>147</sup> Webb, E., C. Hernández-Quevedo, G. Williams, G. Scarpetti, S. Reed and D. Panteli (2021). "Providing health

services effectively during the first wave of COVID-19: A cross-country comparison on planning services, managing cases, and maintaining essential services." *Health Policy*.

<sup>148</sup> Exemplars in Global Health (2022). "Thailand: COVID-19 Response & Maintenance of Essential Health Services." Available online at: <https://www.exemplars.health/emerging-topics/ecr> (forthcoming).

<sup>149</sup> Sagan, A., W. Erin, R. Dheepa, K. Marina and L. G. Scott (2021). "Health system resilience during the pandemic: it's mostly about governance." *Eurohealth* 27(1): 10-15.

<sup>150</sup> Lau, J., D.H. Tan, G.J. Wong, Y.J. Lew, Y.X. Chua, L.L. Low et al (2021). "Prepared and highly committed despite the risk of COVID-19 infection: a cross-sectional survey of primary care physicians' concerns and coping strategies in Singapore. ." *BMC Fam Pract.* 22(1):22.

<sup>151</sup> Tambo, E., I. C. Djuikoue, G. K. Tazemda, M. F. Fotsing and X.N. Zhou (2021). "Early stage risk communication and community engagement (RCCE) strategies and measures against the coronavirus disease 2019 (COVID-19) pandemic crisis." *Global Health Journal* 5(1): 44-50.

<sup>152</sup> Adame, B. J (2018). "The persuasive efficacy of real versus salient hazard scenarios in motivating citizen-level hazard preparedness." *International Journal of Disaster Risk Reduction* 31: 292-301.

<sup>153</sup> Barker, K. M., E. J. Ling, M. Fallah, B. VanDeBogert, Y. Kodl, R. J. Macauley, K. Viswanath and M. E. Kruk. (2020). "Community engagement for health system resilience: evidence from Liberia's Ebola epidemic." *Health policy and planning* 35(4): 416-423.

<sup>154</sup> Gilmore, B., R. Ndejjo, A. Tchetchia, V. De Claro, E. Mago, C. Lopes and S. Bhattacharyya (2020). "Community engagement for COVID-19 prevention and control: a rapid evidence synthesis." *BMJ global health* 5(10): e003188.

<sup>155</sup> Romac, S (2014). "The Importance of Community Resilience: Developing the American Red Cross International Services Department in the New Hampshire Region." Capstone Collection 2735.

<sup>156</sup> Bali, S (2017). "We Need to 'Fear-guard' Economies During Health Emergencies." *Global Policy*.

<sup>157</sup> Kellar, E (2019). "Community Engagement's Vital Role in Building Resilience." Retrieved June 11, 2022, from <https://www.governing.com/archive/col-community-engagement-vital-role-disaster-resilience.html>.

<sup>158</sup> Toppenberg-Pejcic, D., J. Noyes, T. Allen, N. Alexander, M. Vanderford and G. Gamhewage (2019). "Emergency risk communication: lessons learned from a rapid review of recent gray literature on Ebola, Zika, and yellow fever." *Health communication* 34(4): 437-455.

<sup>159</sup> Kurpiers, L. A., B. Schulte-Herbrüggen, I. Ejotre and D. M. Reeder (2016). Bushmeat and emerging infectious diseases:

lessons from Africa. *Problematic wildlife*, Springer: 507-551.

<sup>160</sup> Paterson, P. and R. M. Clarke (2021). "Climate change risk communication: a vaccine hesitancy perspective." *The Lancet Planetary Health* 5(4): e179-e180.

<sup>161</sup> Oliveira, T. M. d., R. Q. R. Martins and J. P. Toth (2020). "Antivacina, fosfoetanolamina e Mineral Miracle Solution (MMS): mapeamento de fake sciences ligadas à saúde no Facebook."

<sup>162</sup> Trigo, M., A. Kurmanaev and J. Cabrera. (2021). "With Officials' Backing, Dubious Virus Remedies Surge in Latin America." from <https://www.nytimes.com/2020/07/23/world/americas/chlorine-coronavirus-bolivia-latin-america.html>.

<sup>163</sup> Avezum, Á., H. Oliveira et al (2022). "Hydroxychloroquine versus placebo in the treatment of non-hospitalised patients with COVID-19 (COPE – Coalition V): A double-blind, multicentre, randomised, controlled trial." *The Lancet Regional Health - Americas* 11: 100243.

<sup>164</sup> Ruijs, W. L. M., J. L. A. Hautvast, S. Kerrar, K. van der Velden and M. E. J. L. Hulscher (2013). "The role of religious leaders in promoting acceptance of vaccination within a minority group: a qualitative study." *BMC Public Health* 13(1): 511.

<sup>165</sup> Library of Congress (2021). "Egypt and United Arab Emirates: COVID-19 Vaccine Ruled Permissible under Islamic Law." from <https://www.loc.gov/item/global-legal-monitor/2021-01-22/egypt-and-united-arab-emirates-covid-19-vaccine-ruled-permissible-under-islamic-law/>.

<sup>166</sup> Singhai, M., R. Jain et al (2021). "Nipah virus disease: recent perspective and One Health approach." *Annals of Global Health* 87(1).

<sup>167</sup> Schiffling S and C. Phelan (2022). What the world can learn from Bhutan's rapid COVID vaccine rollout, from <https://theconversation.com/what-the-world-can-learn-from-bhutans-rapid-covid-vaccine-rollout-168341>.

<sup>168</sup> Tsheten, T., P. Tenzin, A. C. Clements, D. J. Gray, L. Ugyel and K. Wangdi (2022). "The COVID-19 vaccination campaign in Bhutan: strategy and enablers." *Infectious Diseases of Poverty* 11(1): 1-4.

<sup>169</sup> Zam, N (2022). "Overcoming COVID-19 the Bhutanese Way." from <https://thediplomat.com/2022/03/overcoming-covid-19-the-bhutanese-way/>.

<sup>170</sup> Fernandes, G., I. Hassan and D. Sridhar (2022). Building resilient health-care supply chains to manage pandemics in low- and middle-income countries. *Bulletin of the World Health Organization*, 100(2), 174–176.

<sup>171</sup> Ranney M.L., V. Griffeth and A.K. Jha (2020). Critical Supply Shortages - The Need for Ventilators and Personal Protective Equipment during the Covid-19 Pandemic. *New England Journal of Medicine*. 2020;382(18):e41.

- <sup>172</sup> Francis, J.R (2020). COVID-19: Implications for Supply Chain Management. *Frontiers of Health Service Management*. 2020 Fall;37(1):33-38.
- <sup>173</sup> Mehrotra P., P. Malani and P.Yadav (2020). Personal Protective Equipment Shortages During COVID-19—Supply Chain–Related Causes and Mitigation Strategies. *JAMA Health Forum*. 2020;1(5).
- <sup>174</sup> Kovacevic, R., M. Mwencha, A. Ouma, M.C. Adeyeye, O. Folorunso, K. Legins and S. Kone (2021). “Challenges and opportunities of supply chain in time of COVID-19.” World Bank Health Nutrition and Population Global Practice Knowledge Brief. World Bank, Washington, DC.
- <sup>175</sup> The World Bank and World Trade Organization (2019). *Global Value Chain Development Report 2019: Technological Innovation, Supply Chain Trade, and Workers in a Globalized World* (English). World Bank Group.
- <sup>176</sup> Limani F., D. Garley, D. Cocker, P. Patel, P. Patel, S. Gordon et al (2021). Lessons learnt from the rapid implementation of reusable personal protective equipment for COVID-19 in Malawi. *BMJ Global Health*. 2021;6(9).
- <sup>177</sup> Venugopal Bhagat, S (2021). As India stumbles, one state charts its own course. *The New York Times*. 2021 May 23. Available from: <https://www.nytimes.com/2021/05/23/world/asia/coronavirus-kerala.html> [cited 2021 Oct 9].
- <sup>178</sup> Taylor, L (2020). Uruguay is winning against covid-19. This is how. *BMJ*. 2020;370:m3575.
- <sup>179</sup> Hakobyan, S. and R. Cherif (2021). Trade in Medical Goods: Challenges and a Way Forward for Sub-Saharan Africa.
- <sup>180</sup> Goh, K. T., J. Cutter, B.H. Heng et al (2006). Epidemiology and control of SARS in Singapore. *Annals-Academy of Medicine Singapore*, 35(5), 301.
- <sup>181</sup> Kim, S., Y. Goh and J.H.B. Kang (2022). Moving toward a common goal via cross-sector collaboration: lessons learned from SARS to COVID-19 in Singapore. *Globalization and health*, 18(1), 1-18.
- <sup>182</sup> Washington Business Dynamics (2021). Private Sector Solutions for Global Health Supply Chain Challenges in Low-to-Middle-Income Countries. <https://www.wbdynamics.com/wp-content/uploads/2021/04/GHSC.10-20-21-edited.pdf>
- <sup>183</sup> Zhao, F., S. Bali, R. Kovacevic and J. Weintraub (2021). A three-layer system to win the war against COVID-19 and invest in health systems of the future. *BMJ Global Health* 2021;6:e007365.
- <sup>184</sup> Crawley, A (2021) Surveillance technology in Thailand, Cambodia, and Tanzania: case study from ending pandemics. Available: <https://www.exemplars.health/emerging-topics/epidemic-preparedness-and-response/surveillance-technology-ending-pandemics-case-study>
- <sup>185</sup> Nit, B., A.L. Samy, S.L. Tan et al (2021). Understanding the slow COVID-19 trajectory of Cambodia. *Public Health in Practice*, 2, 100073.
- <sup>186</sup> Wang, H., P. Marquez, I. Hwang and J. Sharma (forthcoming). From MERS to COVID-19: Building a Resilient Health System in Korea. World Bank.
- <sup>187</sup> Exemplars in Global Health (2021). “Testing & Surveillance: Senegal.” Available online at: <https://www.exemplars.health/emerging-topics/epidemic-preparedness-and-response/testing-and-surveillance/senegal>.
- <sup>188</sup> Le, L (2022). “Vietnam vaccinates 90% of its population against COVID-19.” Retrieved May 12, 2022, from <https://www.gavi.org/vaccineswork/vietnam-vaccinates-90-its-population-against-covid-19>.
- <sup>189</sup> Kim, J.H., J. Ah-Reum An, S.J. Oh, J. Oh and J.K. Lee (2021). “Emerging COVID-19 success story: Korea learned the lessons of MERS”. *Our World in Data Post*, March 05, 2021. Available at: <https://ourworldindata.org/covid-exemplar-south-korea>.
- <sup>190</sup> Arsenault, C., A. Gage, M.K. Kim et al (2022). “COVID-19 and resilience of healthcare systems in ten countries.” *Nat Med* 28, 1314–1324. <https://doi.org/10.1038/s41591-022-01750>.



ESHABILLAGE  
2

SOLU  
0.05