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ACCELERATING GLOBAL HEALTH

Pathways to Health Equity for the G20

Nitya Mohan Khemka and Srinath Reddy

Editors

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Foreword

Ensuring the health and well-being of all is essential to nation-building. A healthy person can help build a healthy society, and healthy societies can build a healthier nation. The COVID-19 pandemic showed the importance of investment in building a strong healthcare system, improving access to quality healthcare for all, and finding innovative ways of tackling emerging threats.

1st December 2022 marked a milestone for India as it took charge of the G20 Presidency with the theme of 'One Earth, One Family, One Future'. Prime Minister Shri Narendra Modi's vision for G20 India's Presidency is that "it should be inclusive, ambitious, action-oriented, and decisive." This G20 Presidency has been a unique opportunity to voice the concerns of the Global South, especially given that India's predecessor in the G20 Troika (Indonesia), and its successor, too (Brazil), are both developing countries themselves.

India's G20 Presidency focuses on three priorities: health emergencies prevention, preparedness and response, with a focus on anti-microbial resistance and the 'One Health' framework; strengthening cooperation in the pharmaceutical sector, with a focus on access and availability to safe, effective, quality and affordable medical countermeasures (Vaccines, Therapeutics and Diagnostics); and Digital Health innovations and solutions to aid universal health coverage and improve healthcare service delivery. India's vision for healthcare is universal.

This compendium, *Accelerating Global Health: Pathways to Health Equity for the G20*, discusses the state of public health in G20 countries and explores current initiatives being undertaken to bring the world closer to achieving health equity. Researchers, policymakers, development practitioners, and other readers will immensely benefit from the insightful chapters contained in this compendium, which have been contributed by a range of eminent authors in the field of healthcare. The curated essays explore the various issues related to healthcare and suggests innovative pathways to create a healthier future for all, and thus seek to improve readers' understanding of public health issues. This volume highlights the role of India's G20 Presidency in shaping global health agendas, and further global collaboration to build resilient, well-prepared and equitable health systems that can withstand any future health challenges.

Let us all work together towards creating a healthier world through advocacy and action. I hope this resource will go a long way in accelerating the journey towards global health equity.

Dr Mansukh Mandaviya
Minister for Health and Family Welfare and
Minister for Chemicals & Fertilizers, Government of India

Preface

In a world that is increasingly interconnected, the pursuit of global health equity stands as a collective responsibility for humanity. The G20, a forum of the world's leading and biggest economies, represents a unique platform with the potential to drive transformative change in public health on a global scale. This compendium, *Accelerating Global Health: Pathways to Health Equity for the G20*, is an important resource that brings together experts, policymakers, and thought leaders to explore the multifaceted dimensions of health disparities, the barriers hindering equitable access to healthcare, and the innovative pathways that can lead us towards a future of better health for all.

The COVID-19 pandemic was a defining crisis of our time that underscored the urgent need for global solidarity and cooperation in tackling health disparities. The disproportionate impact of the pandemic on vulnerable populations serves as a stark reminder that no nation can truly prosper while leaving others behind. As we look back on the lessons learned from this devastating global health crisis, we are compelled to rethink and reframe our approach to public health, and ensure that we build resilience,

preparedness, and equitable health systems that can withstand any future challenges.

The essays in this volume attempt to shed light on the pivotal role of India's Presidency in leading the G20 in shaping health agendas and fostering collaboration among nations for the common goal of health for all. While the obstacles may seem daunting, the authors highlight the immense potential for transformation and progress. The chapters offer a wealth of case studies, successful interventions, and best practices from different G20 countries, illustrating the positive impact that well-conceived public health policies and programs can have on people's lives. By learning from one another, sharing our successes, and collaborating across borders, we can step up the pace of change and create a virtuous cycle of health and well-being that uplifts entire nations.

I extend my deepest gratitude to the authors for their invaluable contributions to this volume, and to the readers for embarking on this transformative journey. May this monograph inspire the potential for progress and motivate our imperative to act together and accelerate the journey towards global health equity.

Nikolaj Gilbert

CEO & President, PATH

Editors' Note

The COVID-19 pandemic has demonstrated the importance of investing in strong health systems for countries to be able to respond to the myriad health issues that continue to confront the world—from climate change, antimicrobial resistance, and the threat of future pandemics, to chronic diseases that account for seven of every 10 deaths worldwide. G20 member states are in a unique position to tackle these urgent issues at the G20 Summit in New Delhi in September 2023. These countries account for 85 percent of global GDP, over 75 percent of global trade, and approximately two-thirds of the world's total population. Given that sustainable development and good health and well-being for all (SDG 3) are deeply intertwined, addressing global health inequity should be at the centrestage of the G20's primary objectives of promoting financial stability and economic growth.

The state of public health in G20 nations is complex and multifaceted, with a range of interrelated challenges in need of sustainable solutions. A few of the G20 nations have well-developed healthcare systems, and yet, there continue to be significant disparities in health outcomes and access to healthcare. For instance, the United States (US) spends far more on health than other high-income countries, yet life expectancy in the country is

not only significantly lower than those of its counterparts, but it has also declined since 2014.[1] Avoidable mortality in the US in the past 10 years has dropped by only 5 percent per capita—lower than the reductions of 25 percent in Switzerland or 19 percent in the United Kingdom.[2] Addressing these disparities and improving access to quality healthcare for all, as well as tackling emerging threats are a few of the key public health challenges facing the G20 nations.

India assumed the year-long presidency of G20 in December 2022. Under its leadership, the G20 has accorded particular emphasis on various health priorities. These tasks are aimed at addressing the critical challenges faced by the global community and advancing the well-being of populations.

One area of emphasis is pandemic prevention, preparedness and response, with a focus on international cooperation. India's Presidency recognises the importance of strengthening global health security to prevent outbreaks and pandemics; and if they do occur, to respond effectively to them. This requires enhancing early warning systems, improving 'One Health' surveillance and data sharing, and promoting collaboration among countries to tackle health emergencies. Scaling up laboratory capacity for genomic testing and expediting data-sharing are also important priorities. This multi-pronged approach aims to reduce the risk of future zoonotic outbreaks that have the potential to become pandemics.

The mounting threat of antimicrobial resistance is another subject on the G20 agenda. Without urgent action, AMR could claim more lives every year (10 million) than the COVID-19 pandemic did in the past three years (nearly 7 million at the time of writing). Indeed, AMR is one of the most significant challenges in global health, food security and global development. In the long-haul, AMR not only threatens our capacity to treat infections like pneumonia and tuberculosis, but it also risks rendering basic medical procedures ineffective—from organ transplants to chemotherapy and hip replacements. Addressing this issue is crucial, and involves encouraging the prudent use of antimicrobials, strengthening surveillance systems, promoting research and development for new antibiotics, and enhancing infection prevention and control measures.

Ensuring easy access to affordable essential vaccines, therapeutics, and diagnostics (VTDs) is another crucial G20 priority under the Indian Presidency. In high-income countries, three of every four people have received at least one vaccine dose as of mid-July this year, compared to a far less one in every three in low-income countries.[3] These products need to meet high standards of effectiveness, safety, and quality assurance. Supporting the development of scientific and technological capabilities worldwide requires knowledge-sharing and financial co-investment, particularly from high-income countries, to allow the intellectual and entrepreneurial potential in low- and middle-income countries (LMICs) to flourish. The Presidency is committed to promoting equitable access to vaccines, particularly for LMICs. It supports efforts to enhance vaccine production and distribution, facilitate technology transfer, and address barriers to vaccine access and affordability.

Another priority for the Indian Presidency is enhancing the capacities of health systems in all countries to effectively address both pandemic threats and essential healthcare needs. This necessitates co-investments in building a diverse and skilled health workforce that can serve the global population, and strengthening health systems so that they are capable of effectively responding to health crises and meeting the healthcare needs of populations. Without urgent global action, the World Health Organization (WHO) estimates, there could be a shortfall of 10 million healthcare workers by 2030, largely in the developing world.[4]

Leveraging innovative digital technologies to advance primary-care-led universal health coverage (UHC) is an additional priority being pursued. Today, more people have access to mobile phones (6 billion) than toilets (4.5 billion). While this is not a cause for celebration, it only means that digital health could reach a huge proportion of the global population.[5] The G20 recognises the potential of digital health technologies in improving healthcare delivery and accessibility. It seeks to harness digital innovations to enhance health systems, facilitate remote healthcare services, strengthen health information systems, and promote interoperability of health data. This is key to providing equitable and affordable healthcare, especially for vulnerable populations.

While the G7 has given impetus to global health from a sense of shared vulnerability, the G20 under India's Presidency aims to contribute to global health governance, foster international cooperation, and drive tangible actions that can improve public health outcomes in the G20 and beyond.

In this spirit of global solidarity and health equity, this compendium offers itself as a platform for debate around key issues in public health. It is a "thinking and doing" monograph for readers seeking to understand how we can transform society by addressing today's complex and interconnected public health challenges. The featured essays not only highlight the ongoing battles but also offer ideas and positive examples of how public health can be transformed in creative and practical ways.

The curated essays in the volume discuss the state of public health in G20 countries and explore current initiatives that are being taken to promote health equity. It consists of country-specific studies and also regional and global perspectives that can enlighten readers about the issues pertaining to public health challenges, including emerging infectious diseases, access to vaccines and drugs, and environmental pollution. To this end, we have brought together scholars, policymakers, members of civil society organisations, and domain experts across the field of public health to provide insightful analyses of the many facets of the current public health agenda.

The compendium has three parts.

Part One concerns itself with the conceptual terrain and framework around strengthening health emergency preparedness, prevention and response through global cooperation in public health.

The first essay, authored by *Richard Hatchett* and *Kate Kelland*, makes a compelling case for the creation of a global 'vaccine library' to counter future inevitable viral pandemic threats. The authors argue that such a repository of knowledge will allow the scientific and medical community to deliver new vaccines against a novel pathogen in as little as 100 days, and harness the prospect of a future free from the deadly threat of pandemics.

The second chapter, by *Aurélia Nguyen*, offers a comprehensive assessment of the global response to COVID-19, focusing on life-saving vaccines. It outlines crucial measures taken to curb global vaccine disparities and save more lives: flexible funding, robust health systems, and stronger vaccine manufacturing in the Global South. The essay showcases mechanisms like Gavi's COVID-19 Vaccine Delivery Support Program in countries like Somalia, and closes with a hopeful call to fortify global defenses against infectious outbreaks that loom over the horizon.

In their essay, *Ranga Reddy Burri*, *Robert Skov*, *B.E. Pradeep* and *Ralf Sudbrak* provide a nuanced overview of the emerging crisis of Antimicrobial Resistance (AMR) that poses challenges to healthcare systems and patient outcomes across the world. The essay explores the multifaceted nature of AMR and emphasises the importance of collaboration, low-cost interventions, alternative diagnostics, and therapeutics in containing AMR. The analysis highlights the need for a comprehensive, multi-pronged approach and a whole-of-society approach to combat AMR.

The fourth chapter, contributed by *Barbara Stocking*, critically examines how stronger international frameworks can help the world better prepare for the next pandemic, with a focus on the Pandemic Accord as well as a revision of the International Health Regulations. The chapter underscores the need to bolster financing to ensure that the Instrument is effective, particularly for low-income countries.

The succeeding essay by *Soumya Swaminathan* and *Priyadarshini Rajamani* discusses the transdisciplinary concept of 'One Health' as an integrative approach that considers all the determinants of health, designed for disease prevention and control. This approach allows multisectoral collaboration across a range of connecting factors including antimicrobial resistance, and prevention and control of zoonoses, vector-, food- and water-borne diseases. The chapter makes the case that One Health implementation would help in pandemic prevention, preparedness and response and enable the strengthening of the Indian health system.

Janice Tan and *Jeremy Lim* round up this section with an essay that highlights the persistent challenges on the journey to universal health care

and health equity. The chapter notes how high out-of-pocket expenses continue to burden vulnerable populations even in highly developed countries, highlighting the need for targeted interventions and policies to achieve health equity. The inclusion of case studies on Indonesia and Singapore, representing a developing and developed nation respectively, elucidates the applicability of solutions in government funding, health and social insurance, public-private partnerships and procurement in distinct national contexts and over different time frames.

Part Two of the monograph delves into the critical role of digital health as an enabler for health equity and Universal Health Coverage.

Sumit Sharma opens this section with a discussion of the challenges posed by a growing disease burden particularly in LMICs, and the parallel opportunities for public and private players to execute innovative solutions through public-private partnerships (PPPs). The authors examine how PPPs can drive collaborative research, enable infrastructure and capacity build-up, and promote new execution capabilities and skills to improve services.

The eighth essay, by *Lav Agarwal*, explores the country-level experience of adopting digital technologies to implement health goals. Using the case of India, the article argues that digital health is propelling the world towards more integrated health systems that are focused on delivering patient-centred care, improving health outcomes, and making the best use of healthcare resources.

Sameer Kanwar and *Varun Kumar*, in their case study on India, underline the country's success in establishing a robust digital public infrastructure (DPI) by leveraging technology for inclusive growth, economic development, and improved governance. They observe that India's efforts in building its digital public infrastructure (DPI) incorporates the principles of scalability and inclusion, balancing regulation and innovation, and the need for continuous adaptation in regulatory frameworks. The chapter offers India's DPI transformation as a lesson for other countries to emulate to leverage technology for inclusive growth.

In the tenth essay, *Shoko Noda* outlines how India's digital infrastructure, driven by transformative platforms like Co-WIN, U-WIN, and e-VIN, has ushered in a new era of digital health for all citizens. They describe the continuing evolution of India's digital landscape and technology's role in revolutionising healthcare delivery as it can transcend barriers of geography and socio-economic status and help foster a healthier nation.

Part Three of the compendium opens up a discussion on emerging themes in Public Health transformation, underscoring the direction for policy and praxis in the context of public health.

Chapter Eleven, authored by *Robin Fears*, *Volker ter Meulen* and *Andy Haines*, discusses how human activity-driven climate change is contributing to a growing global health crisis. The authors call on the G20 to mobilise its resources and reach to: capitalise on regional policy initiatives, bridging between national and global levels of governance; address current biases in generation and use of research worldwide; and support the Planetary Health approach to understand and manage changes to natural systems affecting human health, equity and well-being at multiple scales.

In the twelfth essay, *Mansi Chopra*, *Tina Rawal* and *Monika Arora* discuss the significant burden of non-communicable diseases (NCDs) on health, development, and economies particularly in LMICs where over 75 percent of NCD-related deaths occur. Health promotion approaches, supported by evidence-based policies, play a crucial role in NCD prevention and management. The chapter draws attention to the urgent need for comprehensive and collaborative approaches to prevent and manage NCDs and improve population health outcomes.

In their piece, *Pratima Murthy*, *K.P. Muliyala* and *C. Naveen Kumar* describe the systemic response in mental health care service delivery. Using India as a case study, the chapter outlines the legislations, policies and programmes in place and the challenges for their implementation to ensure equity in mental health care.

In Chapter Fourteen, *Wenzhen Zuo, Huan Xu, Lizzie Tecson, Bettina Borisch, Sadaf Lynnes, Laura Magaña, Priscilla Robinson, Duncan Selbie* and *Jim Campbell*

discuss the ways that COVID-19 pandemic tested our core public health capacities and exposed the weaknesses in health systems around the world. As countries build their public health capacities and fill the health systems gaps exposed during the pandemic, a key way forward is to strengthen national health systems by investing more on the public health workforce.

Naveen Rao, in his chapter, notes how the rapid development and equitable distribution of COVID-19 vaccines highlighted the transformative power of public health partnerships. Drawing lessons from these partnerships, the author emphasises the need to replicate their success in tackling the existential threat that is climate change.

The last chapter, authored by *Patrick Webb*, *Sandy Thomas* and *Derek Flynn* discusses the failures of contemporary food systems in providing diets that are healthy, affordable, and sustainable for three billion people; and why their transformation is key to resolving such challenges. The authors recommend specific actions to reverse this profound failure of policy through priorities to enable change and address systemic inhibitors to progress.

Accelerating Global Health: Pathways to Health Equity for the G20 is not just a compendium of essays but a collective call to action. The chapters in the monograph address a raft of intersecting issues around public health, from global, regional and local perspectives. The aim is to initiate dialogue that furthers research methodologies, conceptual frameworks and the larger policy agenda in G20 member states. Finding solutions to some of the questions identified in this volume will help countries effectively respond to global health security challenges and pave the way for a healthier, more equitable, and sustainable future.

Nitya Mohan Khemka and Srinath Reddy

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Endnotes

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I.

Strengthening Health Emergency Preparedness, Prevention and Response through Global Cooperation in Public Health

A Global Vaccine Library:

Giving Humanity a Head Start Against Pandemic Threats

Richard Hatchett and Kate Kelland

Among the most important lessons the world should learn from the COVID-19 pandemic is that being prepared—being ready to act urgently with the right technology, know-how and resources—can give the world a crucial head start in tackling a newly-emerging infectious disease outbreak.

With COVID-19, many countries and regions of the world were seriously deficient on many important epidemic and pandemic preparedness measures, putting them way behind the line. However, in one key aspect of the race against the novel viral threat—vaccine development—the world had put itself a few critical steps ahead by the time the SARS-CoV-2 coronavirus emerged in 2020.

This was in large part a result of many years of studying other similar viruses, whereby scientists had the chance to develop and hone techniques to facilitate new vaccine designs. Research initially on respiratory syncytial virus (RSV)—a virus first identified in 1956 that can cause respiratory tract infections—and subsequently on the SARS coronavirus that emerged in China in 2003, then on the MERS coronavirus that was first reported a

decade later in Saudi Arabia, meant scientists had well-developed insights into these types of viruses and knew how to go about designing effective vaccines against them.

Those decades of work allowed scientists to understand, for example, the importance of the spike protein of the coronavirus for the production of neutralising antibodies. They had also developed and refined techniques for manipulating the spike protein to make it more visible to the immune system and therefore more able to illicit a potent immune response.

In early 2020 when the novel coronavirus SARS-CoV-2 emerged, drug developers were able to create new candidate vaccines at record speed. They pulled off the shelf previous research, data and knowledge on RSV, SARS and MERS virology, vaccinology and immunology, and tweaked it to figure out how to best tackle the novel threat. Therefore, despite never before having seen the COVID-19-causing virus, they were not reinventing the wheel in developing COVID-19 vaccines. Humanity had a head start.

Consider also the case of Mpox. Formerly known as monkeypox, Mpox is a contagious disease caused by a virus from a family called the orthopoxviruses—a viral family that also counts smallpox, cowpox and many other pox viruses among its members. When Mpox began to spread in 2022 in a far larger outbreak that reached more geographies, humanity had again put itself a few critical steps ahead. It was in the late 1800s when vaccines against the highly deadly smallpox were developed, before being refined and ultimately deployed to greatest effect in the 1970s and 1980s when smallpox became the first—and so far only—human disease to be eradicated. After this success, however, many governments remained highly concerned about the potential for the smallpox virus to be used one day as a weapon of bioterrorism. This led national and international health security bodies to decide to maintain stockpiles of smallpox vaccines.

Fortunately, those smallpox vaccines also offer broad protection against other viruses in the orthopoxvirus family, including Mpox. When Mpox case numbers ballooned into an epidemic of international emergency proportions in 2022, the bank of knowledge, data and vaccines that could help public health authorities curb the outbreak was significant. Again, humanity had a head start.

What if humanity could get itself a similar head start against any viral threat—known or unknown, novel or re-emerging? What if we could get ahead of any infectious pathogen with the potential to cause a serious and deadly epidemic? Doing that would give us a far better chance of winning the containment race against an emerging virus and of controlling a nascent pandemic before it is able to spread across the world.

A Proposed 'One World Vaccine Library'

At the Coalition for Epidemic Preparedness Innovations (CEPI), of which the authors of this essay are part, we have a concept for how the world could do just this—by creating and stocking a library of knowledge, data and prototype vaccines against every one of the viral families we already know have the potential to cause human disease outbreaks. CEPI calls this the 'One World Vaccine Library'—a vaccine library for the whole world that will help the global community achieve greater health security by being better prepared to beat the next pandemic threat, wherever it emerges, and whatever form it takes.

Vaccines are among the most potent tools against pandemic threats and will be critical to any future response to dangerous and deadly outbreaks of infectious disease. The faster an effective vaccine can be developed and deployed, the faster it can be used to mitigate and potentially contain an incipient pandemic. This is why we need to work on getting those head starts against as many as possible of our potential opponents.

Getting ahead of any potential viral threat, known or unknown, can at first sound like an impossible task. There are between 250 and 300 viruses from around 25 viral families that are already known to have the ability to infect people, and the world's scientists cannot create new vaccines against every one of them, just on a chance that they might one day pose a deadly threat.

Yet the beauty of a One World Vaccine Library is that we do not need to. As those several hundred viruses all come from just 25 families, scientists can take a viral-family-based prototype vaccine approach to preparing the world's defences against them. They can gather knowledge, scientific

insights and research data on a selection of representative viruses from each family and create vaccines that target their most common threatening features. That way, the world will have a bank of detailed fundamental knowledge about the threats posed by these virus families.

As things currently stand, scientists have already made meaningful progress—proven safe and effective vaccines are available against scores of viruses that come from and represent at least 15 of the 25 virus families. For the One World Vaccine Library to be able to help the world respond at speed to a newly emerging threat, however, those vaccines will need to be transferred onto so-called rapid response platforms—technologies like mRNA platforms or viral vector platforms that can be rapidly scaled up to allow for hundreds of millions of doses to be produced within months if needed.

Beyond that, the library will need to be stocked with data and research and potential vaccine candidates against viruses that represent all the remaining families, and its sections on the most threatening virus families must be filled with as much preparatory work as possible. That way, new vaccine development will be faster and more efficient, saving precious time, and potentially lives, that would otherwise be at risk if new vaccines had to be started from scratch each time a pandemic threat looms.

Take the paramyxoviruses, for example. The paramyxovirus family includes a number of well-known human disease threats, including measles and mumps, as well as several less well-known ones, such as Hendra and Nipah.

If the aim is to make similarly fast—indeed, ideally, faster—progress against a future emerging novel paramyxovirus threat as was made in 2020 with the novel coronavirus, the One World Vaccine Library's paramyxovirus section should be stocked with as much research, data and technical knowledge about how to design and make effective vaccines against the known and closely related viruses in that family.

In other words, the library will collate scientific knowledge and prototype rapid-response vaccine candidates for measles, mumps, Nipah, Hendra and

other known paramyxoviruses. If and when a novel paramyxovirus emerges and begins to infect people in a fast-spreading outbreak, the library can be accessed for knowledge that can help rapidly create vaccines or other medical countermeasures to prevent that spread as much and as soon as possible.

An Ambitious Yet Achievable Global Endeavour

Building a One World Vaccine Library and stocking it to its fullest possible capacity is a substantial task and will require sustained investment of time, effort and money. Such a Library, however, will mean the fruits of human ingenuity—the benefits of scientific progress—can potentially be made available to all, whenever and wherever they are needed. It will mean that when the next viral pandemic threat emerges—whether it is a known virus or a novel one—humanity will have the knowledge and the technology to develop vaccines and other medical defences far more swiftly than it has ever done before.

Researchers assessing a new outbreak and the virus causing it, wherever and whenever it occurs, will be able within days and weeks to sequence its genome, match it against related viruses and select prototype vaccines from the library to develop and deploy new vaccines against the epidemic or pandemic threat.

CEPI's current work includes prioritising the development and stocking of sections of the One World Vaccine Library for the virus families that pose the greatest and most urgent threats to global health security. CEPI is engaging virus experts to systematically rank each family to assess its potential to spawn the next Disease X. For each family selected, the aim is to create vaccine candidates for at least one and potentially several different viruses, depending on the family's complexity and genetic diversity. Vaccines in the library will be taken through preclinical and early-stage clinical testing to build vital knowledge about the safety and immunogenicity of both the platform and the antigens they target. The larger goal is to establish clinical proof of concept for the lead candidates in multiple families over the next five years.

The '100 Days Mission' and the Need for Speed

Creating and stocking a One World Vaccine Library is a critical enabler of CEPI's 100 Days Mission, embraced by the G7 and the G20, to compress the development timeline for new vaccines against emerging disease threats to 100 days. Coupled with improved surveillance providing earlier detection and warning of potential viral disease threats, and with swift and effective use of non-pharmaceutical interventions such as testing, contact tracing and social distancing to suppress disease transmission, delivering an effective new vaccine within 100 days would give the world a real chance to extinguish the existential threat posed by a future Disease X pandemic virus.

The head starts in these viral races—and there are sure to be ever more frequent ones in this era of novel epidemic threats—will come from having a One World Vaccine Library that is comprehensive and extensive and, crucially, immediately accessible to all nations and regions whenever they need it. As the bank of knowledge builds up in the library, so too, does the potential for scientists to significantly accelerate vaccine development against a wide and growing range of virus families over time.

Like the 100 Days Mission, the ambition of creating a One World Vaccine Library is a bold one. It is also an essentially equitable one that seeks to help people across the world bolster their defences against the ever-increasing risk of viral infectious diseases.

Building and stocking the library will take the combined resources, will, and ingenuity of the world's best scientific minds, political leaders and health security experts. In return, the library's evolving knowledge and increasingly sophisticated contents will be a living gift from generation to generation: the prospect of a future free from the deadly threat of pandemics.

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Ensuring Equitable Supply and Access to Critical Vaccines During Pandemics:

The Lessons of COVAX

Aurélia Nguyen

There is an enormous sense of relief that the world has already suffered the most acute stage of the COVID-19 pandemic—with its heartbreaking death toll, devastating illness, and crushing social and economic fallout. The job of hardening the world's defences against future disease outbreaks, however, has only begun. Indeed, COVID-19 is still with us and will continue to smoulder for years to come, assuming it does not flare up again. Moreover, the prospect of future, and potentially more menacing, global infectious disease outbreaks remains in the horizon—made more likely by factors like climate change, unabated encroachment on the habitats of wild animals that carry dangerous pathogens, population growth, and urbanisation.

Now is the time to take stock of the many lessons of COVID-19 and, more importantly, to act on them. The emotional, physical, economic and social scars that millions suffered are still fresh enough to feed the political will as leaders need to make big, tough choices about investments in future

pandemic preparedness and response. If they fail to do so, the global community will once again pay dearly—in lives lost and damaged and in profound economic and social shocks.

The overarching and perhaps most obvious lesson of the pandemic was that most countries, and the world collectively, were unprepared to defend themselves against SARS-CoV-2, the virus that causes COVID-19.[1] Nearly all countries—even those whose health systems were presumed to be strong—struggled not just to arrest the spread and blunt the devastating impacts of the virus but also to continue delivering other vital health services.[2]

This was no surprise to the many global health experts who had long warned about the world's vulnerability to a crisis of such magnitude. Yet, even those experts could not have fully anticipated exactly the ways COVID-19 ultimately exploited the gaps in health security systems globally. If there is anything meaningful that emerged from the pandemic, it is the knowledge of where and how health systems struggled, where they performed well, and what must be done to prepare for future pandemics.

This author speaks from experience as managing director of the Office of the COVAX Facility from the fall of 2020 through mid-2022. The Access to COVID-19 Tools Accelerator (or ACT-A) was a global collaboration focused on accelerating the development, production, and access to vaccines. COVAX, the vaccines pillar of ACT-A, had the remit of facilitating access to potential COVID-19 vaccines to the most vulnerable everywhere, regardless of their income;[3] to date, it has delivered nearly 2 billion doses of COVID-19 vaccines to 146 countries across the world.[4] It is a collaborative work of the Coalition for Epidemic Preparedness Innovations (CEPI), the World Health Organization (WHO), the United Nations Children's Fund (UNICEF) and Gavi, the Vaccine Alliance which co-managed COVAX.

COVAX accomplished a great deal, and according to estimates from Imperial College London, the impact of COVID-19 vaccinations on COVAX AMC participants included the prevention of an estimated 2.7 million deaths worldwide.[5] It could have made even greater impact had certain conditions been met even before it was launched in 2020. To that end, one must heed three categories of lessons that emerged while dealing with the pandemic

puzzle—the procurement, distribution, and administration of COVID-19 vaccines across countries.

First, the world must be willing to take risks and make contingent financing available to ramp up rapidly as health crises emerge. Before the COVID-19 pandemic broke out, there was nothing in the world like COVAX. It began without any funding and with virtually no personnel. Unlike sovereign governments with sizeable spending power, global health organisations and other international development agencies could not take on the risk of paying billions of dollars in purchase orders for vaccines.[6]

It thus took COVAX several months to raise sufficient funds to secure early-purchase agreements with vaccine makers. Meanwhile, vaccine manufacturers gave priority to bilateral customers—typically, well-resourced sovereign governments—even months before it was clear which, if any of the vaccine candidates would earn regulatory approval.[7] That, in turn, left relatively few doses available early on for COVAX to procure. More importantly, some countries imposed export bans on vaccines or vaccine ingredients manufactured on their shores to ensure they would have enough supply for their citizens.[8]

It is understandable that countries will do everything they can to place the health needs of their citizens first in a crisis such as COVID-19. This dynamic will not change. The question, therefore, is how the world can navigate this geopolitical reality.

One way is to put in place now contingent funding that will be immediately deployable as soon as another crisis strikes. That will help global health agencies—like a future version of the COVAX Facility—mount an even more effective global response.

Such funding must be flexible and agile. It will require mechanisms to constantly update working assumptions regarding epidemiology, policy recommendations, supply, demand, R&D, manufacturing, country-level challenges, and other factors, and for making at-risk investments for multiple scenarios. This funding should also include a proportion that could be used with a high-risk appetite to secure vaccines that are at any R&D stage, even with the risk of vaccine failure.[9]

Another lesson is related to the value of an innovative financing mechanism that COVAX created, called the pandemic vaccine pool (PVP), which ensures that there will be cash on hand to make rapid procurement of vaccines available, especially to lower-income countries—even in a scenario such as the one in 2020 where it was uncertain which of the vaccine candidates would get approval. Likewise, COVAX pioneered other new innovations out of the crisis—such as indemnification and liability agreements and a 'no-fault compensation scheme' that would lower the risks for manufacturers—which were also critical to removing bottlenecks and speeding up the response-time during COVID-19. Mechanisms that allow fast response and sharing of risk during an emergency are important features of any future responses.

Moreover, multinational trade-facilitation measures must be strengthened to allow for the free flow of vaccines, manufacturing supplies, and other life-saving equipment during health emergencies. There should be in place, for example, exemptions and waivers that allow agencies involved in the global health response to ship life-saving medical countermeasures and materials to low- and middle-income countries as well as into humanitarian situations exempt from any trade barriers.[10]

Second, it is now known that turning *vaccines* into *vaccinations* depends upon strong, reliable health systems. That is, getting shots in people's arms requires complete end-to-end solutions at the country level, backed by investments—from early R&D; scaling-up manufacturing; securing deals; consistent policy guidance; and setting up operational, logistical, regulatory, and legal frameworks further along the value chain. This applies not just to the vaccines themselves but also ancillary supplies, such as cold chain and safe injection equipment, international freight and logistics as well as in-country delivery requirements, including personal protective equipment for healthcare workers.[11]

Many countries that lacked this infrastructure strained to get doses to the people who needed them. To be sure, the challenge was less pronounced—though still serious—in many countries where organisations like Gavi and WHO had already provided significant resources over many years to help strengthen health systems (particularly primary health care),

build cold chains that facilitated the widespread delivery of vaccines, and establish relations with all the many stakeholders who make immunisation programmes work.

At Gavi, which has supported the improvement of lower-income countries' routine immunisation programmes since 2000, the concern was that those efforts to vaccinate mostly children would flag significantly under the extra burden of delivering COVID-19 vaccines to other populations. It was unexpected, therefore, when many showed relatively little decline in routine immunisation. To be sure, their systems were pushed to the limit. Vaccinators, doctors and nurses were burned out. However, considering that while responding to the pandemic and having to deliver three times the number of vaccines compared with previous years, immunisation in Gavi-implementing countries suffered declines of only 4 percent in 2020 and 1 percent in 2021 and a near return to pre-COVID levels by the end of 2022—there was a lot more resilience than expected.[12]

Those many years of health system strengthening investments apparently paid off. But these countries will need more, especially when it comes to building out primary healthcare services, cold chain, vaccine track-and-trace, human resources and data monitoring systems[13] that reach all their citizens, especially those with the least access to healthcare.

One step in that direction, for example, is the COVID-19 vaccine Delivery Support (CDS) which was time-sensitive funding based on country's requirements across various areas, including service delivery, data and monitoring, and supply chain systems that Gavi helped put in place to deal with funding gaps for delivery and improve countries' capacity to rapidly scale up COVID-19 vaccinations. In addition to that goal, in many countries the programme has also contributed to health system strengthening, including upscaled cold chain infrastructure, digitisation of health data, improved outreach capabilities, combined COVID-19 and routine immunisation deliveries, and expanded vaccine supply chain capacity. Somalia, for example, where targeted CDS investment saw the digitisation of its health systems, strengthening of the country's cold chain capacity, and the training of health workers at the front of community engagement and support of risk communications for both COVID-19 vaccination and

routine immunisation helped increase primary COVID-19 vaccine coverage from 5 percent at the beginning of 2022 to 41 percent by the end of the year.[14] Gavi invested approximately US$1.3 billion in health systems in Gavi-implementing countries from 2021 to 2022.[15]

Moreover, it must be ensured that every country puts in place regulatory readiness, harmonisation, and policy development for pandemic preparedness. They must build access for the most vulnerable people—especially those who are chronically hard to reach—into the pandemic architecture. This should acknowledge that, despite best efforts, there will be disparities in countries' readiness levels, infrastructure, and capacity in the event of another pandemic.[16] The global community cannot shirk from the challenge of closing those gaps, as much as possible.

Third, it is important to lower barriers to the equitable supply of vaccines—such as vaccine nationalism, hoarding, and export bans. The very idea of the COVAX Facility emerged from a desire to prevent a replay of what took place in 2009 during the H1N1 pandemic when better-resourced countries dominated nearly all the global supply of vaccines.[17] Countries with little financial resources and without their own vaccine production capacity were left largely empty-handed.[18]

To solve that problem, COVAX sought to pool demand for COVID-19 vaccines from lower-income economies as well as from wealthier nations. With pooled demand and funding, COVAX would ideally be in a better position to make large-scale investments. It could build a diverse portfolio of what was eventually 11 vaccine-candidates across four technology platforms (10 of which received regulatory approval for use). This was the largest portfolio secured by any buyer, making more than 4 billion doses available to 191 countries that were part of COVAX.[19]

In other words, COVAX would be able to compete with better-resourced countries for what would surely be a finite supply of vaccine doses. Dose domination by relatively few countries would not follow the pattern of the H1N1 vaccine.

The experience during COVID-19 and previous pandemics cries out for increased and geographically diversified vaccine manufacturing, particularly across the African continent. Africa has an eighth of the world's population but only about 0.1 percent of the vaccine manufacturing capacity.[20] There is much work that must and *can* be done to help those regions establish this essential infrastructure, not just for emergencies but for the production of routine vaccines during non-crisis times. To help regional production take root and grow, there must be support for technology transfer as well as demand-side financing to promote a sustainable diversified manufacturing base.[21]

With this goal in mind, Gavi and the African Union Commission entered into a Memorandum of Understanding in May 2023 (with the cooperation of the Africa Center for Disease Control)[22] to work together to stimulate, among other health advances, sustainable regional vaccine manufacturing in the continent. The endeavour includes 10 commitments to increase political, financial, and technical investments in immunisation programmes.[23]

Another one of the biggest lessons was that critical to an effective global response is putting models in place that can ensure, long before the occurrence of a pandemic, that lower-income countries receive volumes of vaccine doses at the same time and in the same levels that high-income countries do to stop the spread of variants. This will require increased standards for manufacturers' transparency about their order books so that it is possible to determine—and *correct*—the supply inequities among countries. This will also require that contingent financing continues to be readily available to allow response to unexpected trends in the trajectory of the pandemic. Discussions on the use of available COVAX AMC funding is currently ongoing, with consideration on using part of the available PVP funding channelled to the procurement of new products, including variant-containing vaccine boosters, based on country requirements.

Discussions also focus on the implementation of the 2024–25 COVID-19 programme approved by the Gavi board in June 2023.[24] Equally important considerations include using these funds to prepare for other health emergencies, catching up from the effects of the pandemic, accelerating diversified manufacturing—all of which will be discussed further at the December board meeting of Gavi.

The global community is relieved to have moved past the worst of the biggest and most devastating global health crisis in more than a century. However, such sense of relief—and perhaps the understandable weariness after three years of searing crisis—must not turn into complacency or neglect. The future depends on learning from what the world lived through and to make the big, smart changes that are required.

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The Battle Against Antimicrobial Resistance

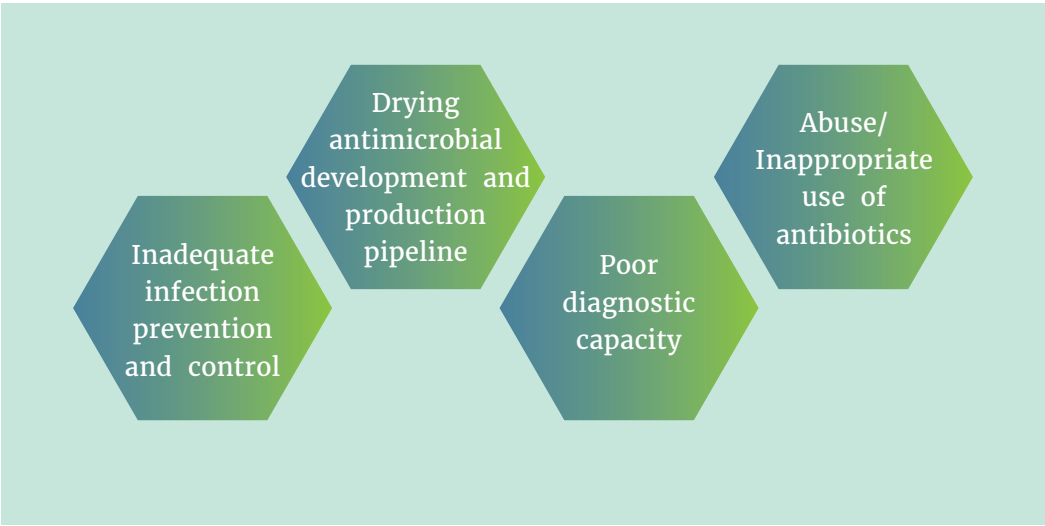
Ranga Reddy Burri, Robert Skov, Bulagonda Eswarappa Pradeep, and Ralf Sudbrak

Antibiotics have revolutionised modern medicine by reducing morbidity and mortality caused by bacterial infections. However, the overuse and misuse of antibiotics has accelerated the development of antibiotic resistance, making once-treatable infections increasingly difficult to manage.[1] Antimicrobial resistance (AMR) is a grave global health crisis, posing significant challenges to achieving health equity on a global scale. In 2019 alone, bacterial AMR was directly responsible for 1.27 million deaths worldwide.[2] If left unchecked, this is predicted to cause a staggering 10 million deaths by 2050,[3,4,5] underlining the urgent need for action. An increase in AMR will significantly impact the global economy and is expected to push an additional 24 million people into extreme poverty by 2030.[6] Although reliable estimates from developing nations remain limited, perhaps due to inadequate surveillance, the burden of AMR is suspected to be highest in low-income countries. Unless suitable interventions are implemented, certain susceptible bacterial pathogens will eventually become resistant to antimicrobials, thereby rendering treatments ineffective.[7] This essay explores the multifaceted nature of AMR and its impact on healthcare systems and patient outcomes. The focus is on accelerating efforts to combat AMR, with the recognition that addressing this issue is crucial for ensuring health equity for all.

Understanding Antimicrobial Resistance

The emergence of AMR impedes the prevention and/or treatment of persistent infectious diseases. Although a number of measures have been initiated at the global, national, and regional levels, AMR persists.[8] To effectively combat AMR, it is essential to comprehend its fundamental aspects. AMR refers to the ability of microorganisms, such as bacteria, viruses, fungi, and parasites, to withstand the effects of antimicrobial drugs. The development of resistance is part of the natural biological evolution as this is part of the defence system of microorganisms. Resistance can be inherent (i.e. no target for the antibiotic) or it can arise through various mechanisms, including genetic mutations, horizontal transfer of resistance genes between microorganisms, target modification, membrane permeability alteration, drug modification, and antibiotic efflux. Exposure to antimicrobials accelerates the generation of resistance by increasing rates of mutation and exchange of genetic resistance mechanisms as well as the killing of susceptible microorganisms (including many bacteria of the normal flora), thereby giving resistant microorganisms a competitive advantage (also known as 'selection'). Resistance affects all types of antimicrobial agents, including antibiotics, antivirals, antifungals, and antiparasitic drugs. There are five key factors that contribute to the rise of AMR (see Figure 1).

Figure 1: Factors Contributing to the Rise of AMR



Source: Authors' own

a) Inadequate infection prevention and control: The spread of AMR is closely linked to the ability of bacteria and other microorganisms to rapidly multiply and spread their population through various vectors/hosts. Poor hand hygiene, improper disinfection and sterilisation practices, and inadequate sanitation can lead to the rapid spread of these drug-resistant pathogens. Strict adherence to infection control measures can lower the occurrence of hospital-acquired infections.[9] Therefore, appropriate measures need to be taken to enhance the existing infection prevention framework and reduce the risk of the spread of AMR. A significant hurdle in implementing infection prevention and control (IPC) practices, especially in low- and middle-income countries (LMICs), is the presence of adequately-trained human resources. To address this, institutions such as the World Health Organization (WHO) and US Centers for Disease Control and Prevention have developed training modules, while the Infection Control Academy of India (IFCAI) has developed a diploma course to build the capacity of infection preventionists.

b) Abuse/inappropriate use of antibiotics: In addition to the selection pressure on microbes due to the use of antimicrobial drugs, social and administrative factors also contribute to, and exacerbate the emergence of AMR. One of the contributing factors is the availability, in many countries, of antimicrobials through over-the-counter (OTC) sales without requiring prescriptions. Furthermore, the inappropriate prescription of antibiotics by physicians contribute to the overuse of antibiotics. A study conducted by WHO highlighted that a significant proportion of antimicrobials prescribed in outpatient departments of various hospitals were unnecessary or inappropriate.[10] Rampant use of antibiotics in the livestock sector, pressure from patients to be prescribed an antibiotic for immediate relief from symptoms, self-medication, and the discontinuation of antibiotic course after relief from symptoms—all worsen drug resistance in pathogens.[11,12] New legislation and the enforcement of existing regulations to prevent the OTC sale of antimicrobials is crucial, as are stricter antibiotic prescription and consumption measures.

c) Drying antimicrobial development and production pipeline: The complete antimicrobial drug development process, from discovery to market entry, takes an average of eight to 12 years. Although advancements in computational

chemistry and artificial intelligence (AI) have aided in drastically cutting down the timelines for the discovery of new antimicrobials, the in vitro and in vivo trials take time. Even after such laborious efforts, bacteria swiftly develop resistance to these antibiotics. Quicker and more efficient antibiotic testing and approval pipelines need to be established to combat AMR.[13]

Recent advances in antimicrobial discovery—including the repurposing of existing drugs, exploration of natural products, employing alternate treatment strategies, the use of computational approaches for drug design, interdisciplinary collaborations, and the integration of new technologies may help in accelerating the discovery process[14] and in the mitigation of AMR.

Despite the recent advantages, investment in antibiotic research and development remains limited, resulting in a clinical antibacterial pipeline that is insufficient to address the emergence and spread of AMR infections. In 2021,[15] there were only 77 antibacterials in the clinical pipeline that target WHO priority pathogens (Enterobacteriaceae, *Acinetobacter* and *Pseudomonas*) including tuberculosis.[16] Of these, 45 are traditional antibacterial agents and 32 are non-traditional. Of the 45 traditional antibiotics, 27 are reported to be active against the WHO bacterial priority pathogens, 13 against Mycobacterium tuberculosis, and five exclusively against Clostridium difficile. Only six of the 27 antibacterials targeting the priority pathogens fulfil at least one of WHO's four innovation criteria (i.e., absence of known cross-resistance, new class of drug, new target site, and new mode of action).[17]

However, a robust pipeline of novel antibiotics is critical to tackling the increasing emergence and spread of AMR. The Global AMR R&D Hub and WHO[18] reported on the progress and challenges for incentivising the development of new antibacterial treatments to tackle the emerging threat of AMR. The return on investment for new antibiotics fails to cover the costs of their development, manufacturing, and distribution.[19] As a result, big pharmaceutical companies have exited the antibiotic market, and companies remaining in the space (often small or micro biotech firms) face challenges to sustain their operations given the cost and time for drugs to reach the market. Novel reimbursement models addressing the market failures are needed to make antibiotic development more economically sustainable.

Innovative financing mechanisms play a crucial role in addressing the lack of financial incentives for the private sector to develop, test, and roll out new antimicrobials. One potential solution is the implementation of advance market commitment–type investments, such as those undertaken by organisations like DNDi (Drugs for Neglected Diseases Initiative), CEPI (Coalition for Epidemic Preparedness Innovations), and Gavi (Global Alliance for Vaccines and Immunization).

Under this model, governments pool funding to support manufacturers and the private sector in creating antibiotics, thereby reducing innovation risks and ensuring equitable pricing and access. This approach incentivises private-sector investment, overcomes financial barriers, and contributes to the fight against AMR, securing effective treatments for all.

d) Poor diagnostic capacity: Accurate and timely diagnostics are critical for identifying and managing infectious diseases effectively. Poor diagnostic capacity can lead to delayed or inappropriate treatment, increased morbidity, mortality, and spread of infectious diseases, including outbreaks. Poor diagnostics encompass several aspects, including limited access to diagnostic technologies, inadequate laboratory supplies and equipment, poor quality of chemicals and equipment, absence of reliable quality assurance systems, limited access to reference laboratories, inadequate infrastructure, lack of trained personnel, and delays in obtaining test results.[20] Poor diagnostic capacity is one of the biggest challenges of the health sector in developing countries.[21] Lack of timely diagnostics is also a challenge in vulnerable populations in high-income countries (HIC). Therefore, improving diagnostic capacity is essential, especially in LMICs, as is ensuring equitable access to diagnostics for vulnerable populations to enhance the quality and efficiency of healthcare delivery and for achieving the global health goals of reducing the burden of communicable and non-communicable diseases.[22]

Innovations Related to AMR

a) Exploration of alternative therapies: Alternate ways of treatment like "bacteriophages,[23] antimicrobial peptides (AMPs) or bacteriocins,[24] antimicrobial adjuvants, faecal microbiota transplant (FMT) and competitive exclusion of pathogens through genetically modified probiotics and

postbiotics"[25] rather than antibacterial agents alone, could be an alternate way to reduce the use of antimicrobials.

b) Streamlined approval of new antimicrobials: Efficient and streamlined clinical trial processes are crucial for expediting the development timeline of new antimicrobials, including regulatory processes and innovative trial designs, such as adaptive dose-ranging studies and seamless phase transitions. This calls for better collaboration between regulatory agencies, researchers, and industry stakeholders to establish harmonised protocols, reduce administrative burden, and expedite patient recruitment, leading to faster completion of clinical trials.[26]

c) Repurposing of existing drugs: Drug repurposing, or identifying new therapeutic applications for existing drugs offers another strategy to expedite antibacterial production. By leveraging the extensive knowledge and safety profiles of approved drugs, researchers could bypass certain preclinical and early clinical development stages, significantly reducing the overall timeline. Repurposing can be achieved through in-silico analyses, high-throughput screening, and exploring drug libraries, aiming to identify existing drugs with potential antibacterial activity.[27]

d) Harnessing the power of AI: Machine learning (ML) and AI offer possibilities to accelerate drug repurposing in several ways, including the detection of the relationships among various biological components (such as genes, proteins, diseases, and drugs) and through the analysis of molecular fingerprints of compounds. Furthermore, neural network-based approaches can be trained to learn the patterns and properties of fingerprints, enabling prediction of drug activities and identifying potential drug candidates.[28]

AI can also be harnessed to streamline the diagnostic process. An academic–industry collaboration in India (between Sri Sathya Sai Institute of Higher Learning, IFCAI and SCIINV Biosciences Private Limited) has developed AMRx™, an AI/ML-based culture-free prediction system in the context of urinary tract infections. It is a clinical decision support system to improve empirical antibiotic prescriptions and to reduce unnecessary laboratory testing of samples.

e) Collaborative research and funding initiatives: Global efforts are urgently needed to address the complex elements of AMR. These include coordinated leadership at the global, regional, and national level, involving diverse government agencies, academia, practitioners, and industry.[29,30] Recognising the spread of AMR, WHO, the Food and Agriculture Organization, the United Nations Environment Programme, and the World Organisation for Animal Health have formed the Quadripartite to promote a 'One Health' approach[31] that aims to align actions across the human, animal, and environmental sectors. Several initiatives are ongoing, and 170 countries have developed national action plans (NAPs). However, only 10 percent of these plans are fully costed. Converting the NAPs to concrete AMR mitigation actions has proved to be difficult, including in the LMICs.

In response, Denmark initiated the establishment of the International Centre for Antimicrobial Resistance Solutions (ICARS) to support these countries with funding and expertise to develop evidence-based, context-specific and cost-effective solutions that can be scaled to establish sustainable AMR mitigation. The AMR Multi-Partner Trust Fund (MPTF) was launched in 2019 by the Quadripartite members to catalyse the implementation of One Health NAPs and to provide effective leadership and coordination of multisectoral One Health response to AMR. Additionally, the Global AMR R&D Hub in Berlin is promoting collaboration and coordination of research and development on AMR, and is cataloguing the present funding in AMR R&D to provide the landscape of present funding for future prioritisation. Organisations such as CARB-X, Global Antibiotic Research & Development Partnership (GARDP), and the AMR Action Fund work to stimulate drug discovery and equitable access. To solve the market failure for antimicrobials, new models for financing the development of novel antimicrobials, where countries pay for the accessibility of drugs, are currently being explored.[32]

f) Rapid Diagnostic Tests and Point-of-Care Technologies in AMR: Absolute, concrete, and timely diagnosis detection, and management of infection-causing pathogens will significantly decline morbidity, mortality, and the cost burden. Rapid diagnostic tests (RDTs)[33] and point-of-care technologies (POC) are tools that can be employed in achieving timely diagnostics. The integration of RDTs and POC technologies, such as polymerase chain reaction-based tests, genotypic assays, and phenotypic assays, in AMR

management can potentially transform clinical practice and public health interventions.[34]

Accelerating Efforts to Combat AMR

Combating AMR requires a multipronged approach the comprises all critical components—from policy to implementation.

- Development of new antibiotics and alternative treatments in the era of Antimicrobial Resistance
- Overcoming difficulties in finding new drugs
- Antibiotic repurposing
- Development of alternate therapies like Bacteriophages
- Improving infection prevention and control practices
- Optimising antimicrobial use
- Strengthening surveillance and data collection
- Integrated One Health approach to unify and integrate multiple sectors
- Incorporating AMR into national and global health plans
- Engaging stakeholders and raising awareness about AMR
- Mobilising political will and fostering multi-sectoral collaboration

Conclusion

AMR is an ongoing and evolving pandemic that impacts LMICs and vulnerable populations in HICs the hardest. This is aggravated by a drying pipeline of antimicrobials and the industry leaving the field of antimicrobial drug discovery due to lack of economic sustainability. The consequences of the AMR pandemic are already severe, but will become even more dire if not reversed. There is an urgent need for increased and focused action. Due to the complex nature of AMR, this effort needs to be multifaceted, both in reducing the circulation and spread of existing resistant microorganisms and in slowing the increase of novel resistance mechanisms. Key to this is lowering the overall use of antimicrobials (i.e. infection prevention), antimicrobial stewardship (including accessibility of affordable and timely diagnostics), and strengthening IPC and biosecurity procedures, all of which need to be carried out through the 'One Health' approach. This needs involvement at all levels and of all stakeholders, including civil society.

Exploring alternative therapies such as bacteriophage therapy, repurposing existing drugs, harnessing the power of AI, and fostering collaborative research initiatives are key strategies in tackling AMR. These innovative approaches provide hope for the future, where a robust antibacterial pipeline can meet the challenges posed by evolving bacterial infections and ensure effective treatment options for patients worldwide.

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The Urgent Need for a Pandemic Accord

Barbara Stocking

The COVID-19 pandemic took the world by surprise. In early 2020, no one would have thought that in months to come, millions of people would be in 'lockdown', trillions of dollars would be lost to the global economy, and over 7 million people would die from the disease caused by the novel coronavirus. For many years before 2020, scientists and medical experts had been warning that the world was simply not ready for disease 'X'; such a pandemic was almost inevitable, however, coming as it did from a zoonotic virus for which no vaccines or drugs had been developed.

Although it has been declared that the Public Health Emergency of International Concern relating to COVID-19 is over, many countries, especially low-income ones, still have a substantial number of COVID-19 cases and are without access to the vaccines and drugs they need. There is the risk of becoming complacent again. There are hundreds of thousands of bird and animal viruses that could get transmitted to humans, and potentially onwards from human to human. A new infectious disease can almost certainly strike. The question is when.

While not all disease outbreaks can be prevented, they can be arrested so that they do not escalate into an epidemic or pandemic. Social inequalities

can be reduced, and health systems strengthened, to better protect populations against such outbreaks. The imperative is to understand what went wrong, and what it would take to make things right.

Critical Failures

To prevent history from repeating itself, the global community would do well to learn the lessons of COVID-19.

a. Countries were insufficiently prepared. Even those with strong healthcare systems geared to tackle pandemics had not tested them through, for instance, simulation exercises. Poorer countries did not have the resources to run a fully functioning public health system. In almost all countries, there was little understanding of the implications of a lockdown—for livelihoods and the economy, trade, and social services such as education.

b. Aside from public health experts, others had no understanding of how fast an outbreak can develop into a pandemic. Initially, governments took a 'wait and see' approach rather than precautionary action. February 2020 was a critical month when the opportunity to take control of the virus was lost.

c. Countries did not comply with the International Health Regulations (IHR) which have been in place since 2005, and often did not accept evidence-based advice from the World Health Organization (WHO).

d. The wide inequities between countries and population groups were exacerbated, and the consequences were dire in determining who had access to vaccines and drugs and who did not.

A New Pandemic Treaty and Amendments to the IHR

Early on in the pandemic, calls were made for action including developing a 'pandemic treaty' that would set out what countries need to do, and hold them to account. At a special session of the World Health Assembly (WHA)

in 2021, WHO's 194 member states agreed to negotiate a new 'Convention Accord or other International Instrument' on pandemic preparedness and response (PPR) (referred to as the WHO CA+ or the Pandemic Accord).[1] The work began with an Intergovernmental Negotiating Body (INB) being established with a final proposal to be delivered to the WHA in May 2024. In May 2022, it was also agreed that a Working Group on amendments to the IHR should be established (WGIHR).[2] Its report is due at the end of 2023. All member states are engaged in both negotiations.

From the beginning, the scope of the changes to the IHR has been contentious. The resolution of the WHA was to keep it to a small number of amendments, but some countries argued for a much wider scope. They sought, for example, for 'One Health'[a] prevention measures, and equity in access to drugs and vaccines. It has led to 300 amendments to the IHR being submitted to the WGIHR. Countries which might have preferred a more limited approach also jumped in when it was clear that the scope was to be broader. As a result, many proposed changes are similar to those suggested in the Pandemic Accord.

Ultimately, there has to be coherence and compatibility between the Accord and the IHR. It is likely that the Accord will have more of the overarching principles and wider issues, with the IHR defining the technical requirements to deliver them. There is a long way to go but the member states guiding the negotiations are meeting regularly to try to ensure coherence and avoid conflicting recommendations.

Guiding Principles

The following are the key principles that should be at the heart of the Pandemic Accord and the IHR:

a 'One Health' is a collaborative, multi-sectoral approach to health, which recognises the interconnection between people, animals, plants and their shared environment.

- **Solidarity.**

Preventing outbreaks from turning into pandemics is a collective responsibility and is in every country's self-interest. Unhelpful campaigning on social media and elsewhere has suggested that a new treaty could challenge the sovereignty of a country. That is not the case; countries will continue to take their own decisions. The Charter of the United Nations affirms the sovereignty of States Parties in addressing their own public health matters.[3] However, it also sets out the obligation to ensure that "activities within their own jurisdiction or control do not cause damage to their peoples, other States Parties, and areas beyond the limits of national jurisdiction".

- **Equity.**

Morality and national self-interest demand equitable access to all tools, including vaccines, diagnostics and treatments, and financing for these resources. Equity includes a change of attitude in governance. There needs to be equity in governance systems, for example, in financing for preparedness and response to pandemics. It should not be just controlled by donors.

Equity also means fairness in the assessment of what countries are capable of. There are significant differences in each country's ability to deliver preparedness and response. Poorer countries simply do not have the same level of resources as the developed ones.

- **Transparency.**

Transparency of data and genomic sequencing are vital to responding quickly and effectively to the pandemic, and required for the development of new drugs and vaccines. Transparency is what builds trust within and between countries.

- **Accountability.**

The new Accord must set out greater accountability requirements than were in place in the past. This is one of the key reasons for the Accord. Many

civil society organisations have been sceptical about whether a new treaty would make a difference, pointing out that compliance with the IHR is still lacking. That challenge must be met.

Accountability should be to the people of each country through parliamentary systems and civil society. It is also needed for mutual assurance between countries. When governments require extraordinary actions from their populations—for example, lockdowns and mask mandates—they need to be confident that other countries are also taking appropriate action.

Building Consensus

Early in 2023 the 'zero draft' of the Accord was made available and the real negotiations began. Taking into account all the discussions and proposed texts from member states, a revised draft—the 'first draft'—is to be produced in the summer of 2023. The negotiations are undoubtedly complex, but it is worth noting that a surprising amount seems to be commonly agreed upon.

The purpose of the Accord and its principles seem widely accepted, including the protection of the human rights of all people wherever and whoever they may be. There is particular concern that the needs of the most vulnerable people are taken into account in pandemics. There is commitment to the development of public health and healthcare systems and to protect staff, who are most at risk in epidemics and pandemics. There is a need to communicate well with the public and deal with misinformation. There is commitment to a 'whole-of-society' approach for all plans and actions, and recognition of the need for global coordination.

There appears to be conceptual agreement that preparedness plans should involve all of government, and that there should be regular simulation exercises. A 'Universal Health and Preparedness Review' is suggested as a mechanism for review of each country's preparedness. Both peer review of the plans as well as independent assessment are being discussed. Surprisingly, remarkably little is being said about public health response, presumably because so much of it falls within the IHR.

An area of work making encouraging process is prevention. This brings together human and animal health, now often described as 'one health'. Because zoonoses[b] are the greatest risk, actions to reduce transmission—such as closure of wet markets or banning of exotic animal trade—are being considered alongside work on the habitats of humans and animals. However, it seems unlikely that a fully considered plan will be ready for the Accord; a new protocol might be more appropriate. The Joint Plan of Action is being developed by WHO, the Food and Agriculture Organization, the World Organisation for Animal Health, and the United Nations Environment Programme,[4] making up the so-called 'quadripartite'.

Areas of Contention

The contentious issues are around equity, especially related to countries' access to vaccines, drugs, and other medical equipment. Member states might sign up to the principle, but there are great differences among them on how this should be achieved. Developing countries are pressing for a wider spread of manufacturing, particularly for vaccines, but not only for them. Success in getting mRNA vaccine manufacturing underway in South Africa is a good start, although manufacturing for the whole continent and globally will require both financial investment and technology transfer. The extent to which the pharmaceutical industry would be prepared to engage with technology transfer and the associated question of intellectual property rights is unclear.

Various models have been proposed to achieve access. When wealthier governments fund the research and development (R&D) of companies, for example, they could persuade industry players to earmark a percentage of vaccines for the poorer countries, or to sell these to them at cost. However, that would still leave the poorest countries at their mercy. Meanwhile, the pharmaceutical industry argues that without commercial pricing of new drugs and vaccines, there is no incentive for innovation.

b These are infectious diseases which can be transferred from animals to humans, or vice versa.

Such debates are not new. The World Trade Organization struggled to reach an agreement on a Trade Related Aspects of Intellectual Property Rights (TRIPS) waiver throughout the pandemic, with limited success.[5] This was despite an early agreement on TRIPS waivers for drugs in a public health emergency, reached many years ago in 2001 during the Doha Trade Round.[6]

It is difficult to see how there can be a breakthrough, but developing countries have made it clear they will not support a new Accord which does not deal with equity of access.

Crucial Gaps

The Pandemic Accord and the IHR will fail if two areas are not attended to: financing and accountability.

Financing: The G20 Independent High-Level Panel estimated that the annual financing need for future preparedness and response to pandemics was US$ 31 billion.[7] Even considering domestic and international financing, US$ 10 billion a year is required for PPR, which includes upgrading public health systems, R&D, and overall preparedness. If the amount seems high, it must be remembered that it is a tiny amount compared to the cost of a pandemic.

The G20 report and another from the World Bank and WHO[8] led to the establishing of the Pandemic Fund at the World Bank. However, the promised funding in the first year has been only US$ 1.6 billion, and there are concerns about how funds can be raised in the longer term. This is the moment for the G20 to deliberate on how the necessary financing can be found.

Accountability: For the Accord and the IHR to succeed, countries must deliver on the obligations they have committed to. External accountability mechanisms are also needed as safeguards to ensure that all parties are answerable for these obligations. The Panel, which this author chairs, firmly believes that there should be independent assessment of countries—their preparedness plans, response, and other matters which might be agreed upon in the Accord. WHO is a friend and supporter of countries,

which makes it difficult for it to challenge them in the public space. The Panel believes that the way forward is a small independent body for the Accord and perhaps the IHR, too. The Accord will be hosted by WHO but will have its own secretariat. An arms-length independent assessment body could be housed within the Accord's treaty structure. The International Atomic Energy Agency (IAEA) is one model being proposed, but because WHO already has much of the monitoring information, the independent assessment body need not be as large as the IAEA.

Assessments do not have to be about blaming and shaming. They need to be public but supportive, especially of countries that do not have the resources and are in need of financial and technical help. Pandemics create huge risks to individuals and nations. The public has a right to know what their governments and other governments are doing to protect them, and that includes ensuring countries across the world have the resources to deliver.

Dame Barbara Stocking, *Chair, Panel for a Global Public Health Convention, is responsible for opinions expressed in this article though they are informed by the Panel's discussions.*

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Bridging the Divide:
Advancing 'One Health' for a Better World

Soumya Swaminathan and Priyadarshini Rajamani

Human health is interconnected with the ecosystem that consists of animals, plants, and the environment. As such, any health intervention should be integrative of these connecting factors. 'One Health' (OH) is a holistic approach that considers all the determinants of health, designed for disease prevention and control. It is a transdisciplinary approach that allows multisectoral collaboration and deals with antimicrobial resistance and the prevention and control of zoonoses and vector-, food- and water-borne diseases.

Since 2022, the Quadripartite collaboration between the World Health Organization, Food and Agriculture Organization, United Nations Environment Programme, and World Organisation for Animal Health has been responsible for OH operations, guiding countries in planning and adapting strategies for addressing global health challenges. Implementing OH will enhance pandemic prevention, preparedness, and response, and will also enable the strengthening of domestic health systems, including in India.

Deconstructing 'One Health'

The World Health Organization (WHO) defines 'One Health' (OH) as "an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems."[1] In addition to an individual's characteristics and behavioural patterns, social, economic and physical environments are important determinants of health, and include a variety of factors such as water, air, animals, plants, housing, and jobs. Animal trade, agriculture, livestock farming, urbanisation, extractive industries, climate change, habitat fragmentation, and encroachment into wild areas are some of the factors that can impact human health. It is essential to consider the possible interactions of these factors with an individual's health to achieve optimal health outcomes. Therefore, no health intervention can be designed and implemented with the consideration of the health sector alone. There should be multisectoral inclusivity in addressing any health-related issues. For example, antimicrobial resistance (AMR) cannot be addressed only through medical intervention and also requires the checking of antibacterial content in food and water.

The OH concept encourages a collaborative, multisectoral, and transdisciplinary approach at the local, regional, national, and global levels. It recognises the interconnection between people, animals, plants, and their shared environment to achieve optimal health outcomes, and it encourages experts from multiple sectors to work together. Under the OH concept, policy, advocacy, financing, organisational development, data, evidence, and knowledge are focused on providing sustainable and long-lasting results at all levels.

The OH concept identifies a range of priority health issues that need the world's urgent attention:

Antimicrobial Resistance (AMR)

AMR is one of the greatest threats to human health, food security, and development. WHO has declared AMR as one of the top 10 global public health threats that need coordinated and concerted global action.[2] By 2050, there could be nearly 10 million deaths due to AMR each year, and it could cost the global economy between US$11–444 million.[3]

Medicines become ineffective when pathogens undergo structural changes as a result of increased drug exposure. Misuse or overuse of antimicrobials, multiplication of pathogens due to unhygienic water and poor sanitation processes, and inadequate infection prevention and control measures in hospitals and healthcare settings are some of the other factors that cause AMR. It also arises due to the use of antibiotics in the farming, livestock, and fisheries sectors, which enables pathogens infecting these animals to develop resistance. Close contact with these animals and the contamination of soil and water with these microbes exposes humans to these bugs.

AMR makes treating infections difficult, leaving patients with limited treatment options, if at all. In such cases, managing serious infections in children and adults alongside any surgical intervention becomes a challenge. Indeed, the global health system is already exposed to drug-resistant Tuberculosis, HIV infections, and specific AMRs such as artemisinin-based combination therapy-resistance in malaria treatment, and antileprotic drug resistance.

Zoonotic diseases

Over the past three decades, around 30 pathogens have been detected, with 75 percent of them originating from animals, causing zoonotic diseases and contributing to about 60 percent of emerging infectious diseases globally.[4] These diseases can be spread directly through the saliva, blood, urine, mucous, faeces, or body fluids of infected animals, or indirectly through contact with areas where animals live and roam as well as through contaminated objects or surfaces.

Urbanisation and the destruction of the natural habitats of animals, illegal trade in wildlife, and wet markets increase the chances of interaction between animals, animal products and humans, thereby increasing the risk of zoonotic disease and contributing to zoonotic spillover. Recent disease outbreaks such as SARS, MERS, Ebola, Nipah, and avian influenza are examples of zoonotic infections being established in humans. It is important to ensure the hygienic and appropriate care of animals in the agriculture sector, and the safe handling of meat, eggs, dairy, and vegetables to avoid contamination to prevent outbreaks of food-borne zoonotic diseases.

Addressing zoonotic infectious diseases through an OH approach includes multiple actions:

- Raising awareness at all levels of society on prevention and risk-reduction strategies.
- Investing in interdisciplinary approaches including OH perspectives.
- Initiating research to explore the complex social, economic, and ecological dimensions of diseases; to assess risks and effective interventions; and to conduct cost-benefit analyses.
- Regularly monitoring food systems, from farm to fork, and improving sanitary measures.
- Implementing biosecurity and zoonoses-control measures for both industrial and disadvantaged smallholder farmers and herders.
- Supporting agricultural and wildlife habitats by managing landscapes and seascapes collectively.
- Promoting agro-ecological methods of food production, mitigating waste and pollution, reducing further destruction of wildlife and habitat loss, and maintaining ecological connectivity.
- Being mindful of biodiversity during government and private-sector planning, decision-making, and capacity building.[5]

WHO, the Food and Agriculture Organization (FAO), and the World Organisation for Animal Health (WOAH) have already established the Global Early Warning and Response System for Major Animal Diseases to combat zoonoses to coordinate risk assessment and assist in early warning, prevention, and control of disease threats.[6]

Vector-borne diseases

The determining demographic, environmental, and social factors of the distribution of vector-borne diseases are often complex, such as global travel, trade, and unplanned urbanisation. WHO's Global Vector Control Response (GVCR) 2017–2030 provides strategic guidance to countries for strengthening vector-control programmes.[7]

Water-borne diseases

Drinking or coming in contact with contaminated water causes water-borne diseases. Faecal-contaminated water is consumed by two billion people globally, which causes diseases such as cholera, dysentery, typhoid and polio. These diseases are responsible for around 485,000 deaths every year.[8]

Food-borne diseases

Over 200 diseases, ranging from diarrhoea to cancers, are caused by eating or drinking food contaminated with animal or human faecal matter, chemical substances such as unpasteurised (raw) milk, undercooked meat or eggs, and raw fruits and vegetables. Globally, 600 million people are affected by food-borne diseases, in which 420,000 die each year, resulting in 33 million healthy life years lost. Access to adequate safe and nutritious food is key to sustaining life and promoting good health.[9]

Operationalising 'One Health'

In April 2022, WHO, FAO, United Nations Environment Programme (UNEP), and WOAH signed a memorandum of understanding for joint work on OH, forming the 'Quadripartite Collaboration for One Health'. The Quadripartite is a strategic coordination mechanism that aims to work towards "*a world capable of preventing, detecting, containing, eliminating, and responding to animal and public health risks attributable to zoonoses and animal diseases with an impact on food security through multi-sectoral cooperation and strong partnerships*".[10] The One Health High-Level Expert Panel comprising 26 key international experts serves as the advisory group to the Quadripartite. In late 2022, the group launched the first One Health Joint Plan of Action (2022-2026) to combat health risks at the human–animal–environment interface.[11]

The Quadripartite has urged all countries to translate the OH approach into policy actions by promoting and increasing investment in intersectoral health governance. Countries are encouraged to adopt national OH policies, and create and exchange research on OH. Research institutions can be encouraged to work on improved genomic surveillance and data-sharing practices. Academic courses on OH can help train and equip a workforce.

Since the OH approach is similar to pandemic prevention and preparedness, resources allocated for the latter can also be utilised for operationalising OH. For instance, the World Bank's US$10-billion fund for pandemic prevention can be used to implement the OH approach. Additionally, the UN's high-level meeting on pandemic prevention, preparedness, and response (scheduled for September 2023) is an opportunity to integrate the OH agenda into the pandemic action plan.

According to the World Bank, between US$10.3-11.5 billion is needed annually to implement OH at a global scale.[12] But the lack of centralised OH funding is a challenge, leaving relevant ministries in each country to assume the responsibility for implementing necessary actions and activities. This hinders the development of effective global OH strategies.

WHO has identified several other existing gaps in the implementation of the OH approach.[13] These gaps are evident in the following areas:

- Databases and knowledge-sharing resources for effective information exchange.
- Showcasing best practice examples to encourage successful OH initiatives.
- Mapping and generating an OH workforce to strengthen capacity.
- Developing a model for an integrated OH surveillance system.
- Establishing routine and emergency coordination mechanisms with stakeholders.
- Creating a standardised framework for addressing zoonotic spillover risks related to animal trade, agriculture, and livestock farming.
- Addressing issues related to urbanisation and habitat fragmentation.
- Identifying spillover risks and disease spread in ways that minimise trade-offs and maximise co-benefits.

'One Health' in the G20 countries[14]

The G20 countries can play a key role in improving global health, for various reasons—the member countries are among the world's largest economies, they are home to roughly two-thirds of the global population

(including the majority of the ageing population), they house 78 percent of the world's pharmaceutical companies, see a high prevalence of non-communicable diseases (and account for nearly 70 percent of proportional mortality from such diseases), and contribute 72 percent of all CO_2 emissions.[15] The G20 countries agreed to adopt OH at the 2022 Summit.[16] India has already made headway on this front.

One Health approach in India[17]

The Indian government initiated the OH approach under the office of the Principal Scientific Adviser (PSA) with the aim to increase pandemic preparedness and integrated disease control against priority diseases in both human and animal sectors. A supplementary goal includes establishing an early warning system built on an integrated surveillance system and response-readiness for endemic and emerging epidemic or pandemic threats. The country has also sought to implement integrated disease surveillance, build environmental surveillance systems, and develop robust outbreak investigation mechanisms. The OH mission will also focus on:

- **Targeted R&D** to develop critical tools such as vaccines, diagnostics, therapeutics, and other prevention tools, and to invest in developing novel disease surveillance and control methodologies.

- **Data and database integration** for better information sharing across different departments, and investing in analytics for better tracking of national-level progress and implementation at the local level.

- **Streamlining regulatory and approval processes** for enabling OH research and for rapid decision-making.

- **Building a governance model** for integrating OH into existing programmes for system strengthening, sustainability and resource allocation for maximising outcomes.

India has also established a One Health Centre at the National Institute of Animal Biotechnology, Hyderabad, for intersectoral collaboration among veterinary, medical, agriculture, environmental, forestry, meteorological and

other areas to detect, prevent and control zoonoses and transboundary animal diseases.[18]

In 2008, an attempt to operationalise the OH approach for zoonotic disease control and prevention identified the barriers preventing effective cross-sectoral collaboration on disease control.[19] These included a lack of supportive policies, conflicting departmental priorities and limited institutional capacities. A review of zoonotic policy documents revealed there is a lack of specific mechanisms or strategies to safeguard livestock health, and a lack of guidelines for promoting cross-sectoral action. It also revealed a lack of clarity and inadequate information regarding engagement in the animal and forest sectors. This study found that implementing the OH approach in India requires contextual adaptation based on the underlying sociopolitical, institutional, and cultural contexts.[20]

Given India's diverse context, the way forward involves developing strategies that focus on fostering existing informal interpersonal relationships and collaborations between different sectors to successfully adopt the OH approach. It also requires intersectoral coordination at all levels, including the veterinary workforce, academic institutions, and the local or grassroots population. For instance, to conduct the SARS-CoV2 vaccine trial, the Tamil Nadu Veterinary and Animal Sciences University signed a pact with the Tamil Nadu Dr MGR Medical University for conducting joint academic and research activities. Similarly, during an outbreak investigation in Punjab, community health workers, non-government organisations, auxiliary nursing midwives, accredited social health activists (or ASHAs) and village leaders actively participated in efforts to address vaccine hesitancy.[21]

Conclusion

Implementing the OH approach will enhance pandemic prevention, preparedness, and response. It will also strengthen systems and cross-sectoral capacities, allowing for the co-design and implementation of inclusive and equitable multi-level workplans and strategies in line with OH principles. It is essential to develop, disseminate, and utilise improved and harmonised OH tools, technologies, and practices that integrate data and knowledge to prevention of future pandemics, reduce the spread

of infectious diseases through better surveillance systems, and boost collaboration between different organisations.

India's G20 theme of 'One Earth, One Family, One Future' highlights that global collaboration and solidarity is needed to live harmoniously with nature and to ensure health and well-being for all people, everywhere.

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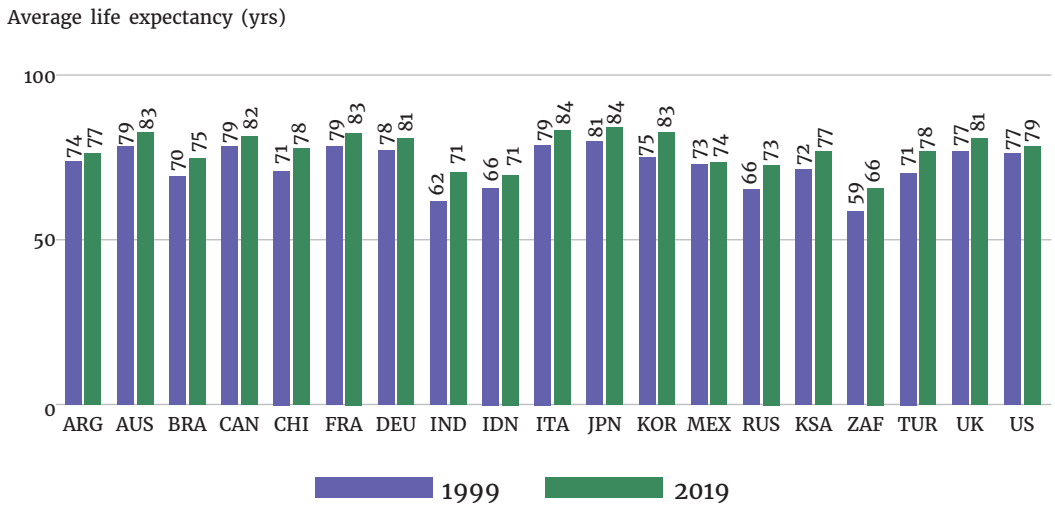
Ensuring Access to Affordable Healthcare for All:

The Role of Health Finance in G20 Countries

Janice Tan and Jeremy Lim

The G20 countries, individually and collectively, have made strides in improving human health since the group's inception in 1999. Average life expectancy across the member states has shown remarkable progress, increasing from 73 years to 78 years over the past two decades, well above the global average of 67 years.[1]

Figure 1: Average Life Expectancy in G20 Countries

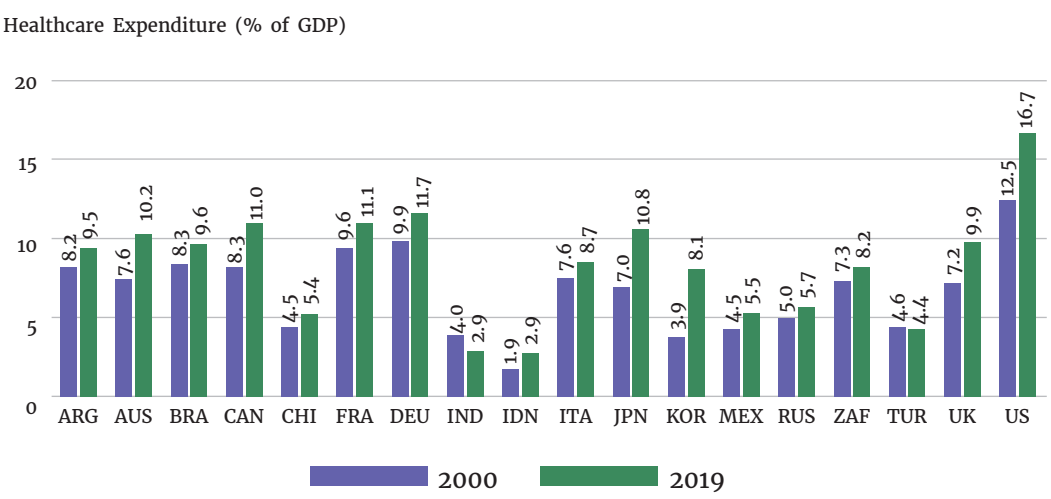


Source: WHO data

This achievement demonstrates the potential of the G20's collective commitment towards enhancing public health outcomes and underscores the importance of continued efforts to prioritise health equity between countries. There is still much to be done: within the group, there is an 18.2-year difference in life expectancy between the highest and lowest achieving members. Imagine the life and health gains if all G20 countries levelled up.

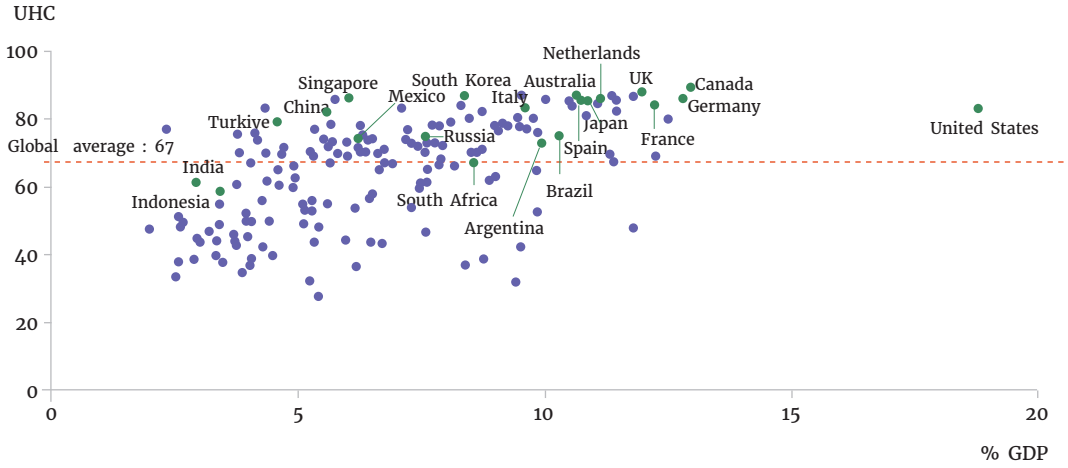
The improvements in human health have been accompanied by an increase in healthcare spending in absolute terms. With the exception of India and Turkey, G20 nations saw a rise in the average healthcare expenditure as percent of GDP, from 6.8 percent to 8.5 percent between 2000 and 2019, or just above US$3,000 per capita.

Figure 2: Healthcare Expenditure as % of GDP for G20 countries



Source: WHO data[2]

Figure 3: Higher % GDP Spending in Healthcare and Increase in UHC Coverage



Source: WHO Data[3]

There is recognition that investments in healthcare, overall, runs parallel to expansion in coverage of Universal Health Care (see Fig. 3). However, this coupling between healthcare spending and health outcomes is a topic of intense interest when discussing health finance in G20 countries. While increased healthcare expenditure often leads to improved health outcomes, this is not always the case and it is crucial to ensure that investments are directed effectively and efficiently. By adopting innovative financing mechanisms, G20 countries can optimise the impact of healthcare spending and achieve desired health outcomes for their populations.

Persisting Out-of-Pocket Expenses

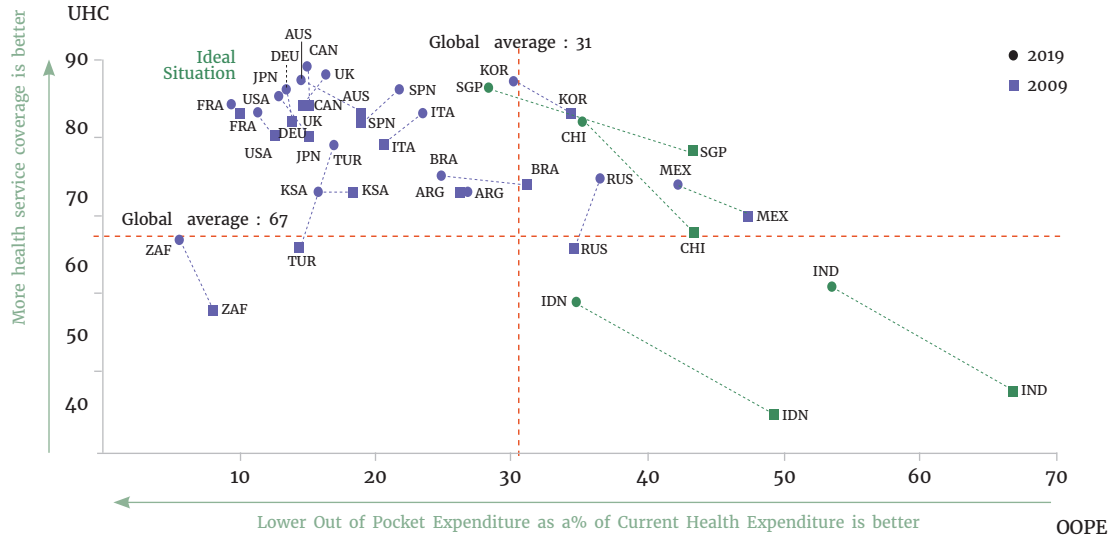
Despite progress, the issue of high out-of-pocket (OOP) expenses remains a significant concern in many G20 countries. OOP expenses often place a disproportionate burden on vulnerable populations, leading to financial hardships and limited access to healthcare.[4] Embedded in the advocacy for health equity is the recognition that health disparities exist among different populations due to various factors such as socioeconomic status, race, ethnicity, gender, geographic location and access to healthcare services.[5] Thus, achieving health equity requires interventions and policies targeted towards those who are most disadvantaged and have the greatest needs. This may involve redistributing resources, implementing targeted healthcare programs, improving access to quality healthcare services, addressing social and economic inequalities, and promoting health education and prevention

initiatives. As the COVID-19 pandemic has illustrated, no one is safe until everyone is, and even if primarily motivated by self-interest, there is an economic case (if not for reasons of equity) for uplifting the most vulnerable populations.

The efficiency of healthcare systems also varies greatly among G20 countries. While some economies have successfully implemented efficient and effective healthcare models, others continue to face challenges in delivering equitable care. The authors of this article examine the relationship between universal healthcare service coverage (UHC) and Out-Of-Pocket Expenses (OOPE) as a proportion of Current Health Expenditure for G20 countries (Fig. 4), reflecting targets 3.8.1 and 3.8.2 of the UN Sustainable Development Goals for Universal Health Care.

UHC measures coverage of essential health services that include reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access among the general and the most disadvantaged populations. Meanwhile, 3.8.2 highlights catastrophic OOP healthcare spending, usually defined as populations with household expenditure on health >10 percent or 25 percent of total household expenditure. The authors used data from previous decade to sift out which countries of the G20 had shown the most recent improvements, and also included Spain and Singapore to the analysis as both these countries are permanent or recurring guest nations to the G20 dialogues and could offer lessons to emulate.

Figure 4: Changes in UHC Service Coverage with OOPE in the Past Decade for G20 Countries



Source: WHO data[6]

From the chart, directional movement to the upper left quadrant or North-West direction would be ideal as it highlights increased UHC with lower OOPE, i.e. better coverage at greater affordability. The most significant improvements are highlighted in green (China, India, Indonesia, Singapore). This article discusses efforts in Indonesia and Singapore that have contributed to these remarkable achievements. By examining diverse strategies, readers can gain insights into potential pathways towards achieving health equity within different national contexts, be they in developing or developed nations.

Best Practices

Indonesia

Indonesia's journey to UHC is a textbook case of adherence to expanding health insurance coverage and implementing social protection mechanisms. The landmark JKN National Health Insurance was implemented in 2014 to provide access to healthcare for its population and today covers approximately 250M people.[7] The JKN program covers all Indonesian citizens, including formal and informal sector workers, and those categorised as poor and near-poor, ensuring that everyone has access to essential healthcare services. It consolidates more than 300 risk pools and operates under a single-payer system, managed by the Social Security Agency for Health (*Badan Penyelenggara Jaminan Sosial Kesehatan* or BPJS). BPJS collects contributions, manages the insurance fund, and coordinates with healthcare providers. Participation for all eligible individuals is mandatory, and contributions are based on income and employment status, with the government subsidising the premium for the poor and near-poor. The insurance scheme entitles every Indonesian to the same medical benefit package, decreasing OOPE from 47 percent to 34 percent in just four years.[8]

Within this OOP spending, in LMICs (low- and medium-income countries) such as Indonesia, medicines typically account for 20-60 percent of total healthcare expenditure with nearly 90 percent of the population purchasing medicines through OOP payments.[9] Managing drug pricing and procurement is thus a key lever for further managing costs and affordability. Indonesia

has implemented a generic medicine pricing policy where the retail price of generics cannot exceed the maximum retail price set by the MOH.

A 2010 study across nine public hospitals, 64 private pharmacies, and nine NGO hospitals in four provinces in Indonesia, showed that the prices of Lowest Price Generic (LPG) and Innovator Brand (IB) medicines was lower in 2010 than in 2004, with declines ranging from 40 percent to 2200 percent.[10] This showed that generic medicine pricing policies have succeeded in lowering the price of medicines. Despite this success, however, there is wide variation in implementation as exemplified by the excess paid by patients compared to MOH set prices varying widely from 2 percent to 600 percent. Even within countries, there is substantial opportunity to narrow the differences. More recently, the government has also embarked on working through state-owned enterprises (SOEs) to centralise drug procurement and leverage purchasing power, negotiating lower prices to further ensure availability of medications across facilities.

On the demand side, Indonesia has promoted the use of generics with public awareness campaigns to educate the public about their benefits. These campaigns aim to dispel misconceptions and increase confidence in the quality and efficacy of generic medications. Additionally, the government has provided incentives for healthcare professionals to prescribe and dispense generic medications. These incentives may include financial incentives or recognition for healthcare providers who prioritise generic prescribing. Again, implementation has been varied. In an observational study at Kalisat District Hospital, doctor's compliance in prescribing generic drugs reached 68 percent while the national standard in April 2013 reached 90 percent.[11]

Overall, in Indonesia, BPJS and various national policies have forged significant steps in achieving UHC. However, as highlighted above, uniform and consistent implementation remains a challenge. Beyond these, there are also additional efforts that Indonesia can undertake to improve UHC further. Whilst JKN has an extensive network of healthcare providers, including public and private hospitals, clinics and facilities, challenges exist due to disparities in healthcare infrastructure across the vast island archipelago, and despite co-payments by beneficiaries, the JKN also faces a

significant deficit. To raise funds, Indonesia has room to raise Public Health Expenditure and contribution compliance. At the same time, Indonesia can also improve primary care and manage spending and governance.[12]

Singapore

Whilst Indonesia is rightly lauded as having the fastest growing insurance program in the world (with BPJS covering close to 91 percent of its population in less than 10 years),[13] Singapore has had its 3M approach (Medisave - a compulsory health savings account, Medishield – catastrophic illness insurance and MediFund – a social security net for the indigent) initiated 30 years prior, in 1984. What has Singapore done in the past decade to continue to move the needle in improving UHC and affordability?

Expanding capacity has been a priority. In 2009, there were approximately 8,000 acute hospital and 9,000 nursing home beds in Singapore. Today, those numbers have grown to 12,000 and 17,000 beds, respectively, or a combined 70-percent increase in institutional places. With healthy economic and GDP growth, the Singapore government has been assiduously increasing healthcare infrastructure, particularly in the eldercare sector as it prepares to become the 2nd fastest aging economy in Asia outside of Japan. By 2030, one in every four Singaporeans will be above 65, and along with changing societal and family patterns, will require massive capacity to cater to the elderly who mostly live independently and require support with their daily activities. Singapore has tried to keep costs manageable for the eldercare sector by footing high land and building costs of residential nursing homes and then offering concessions through competitive bids for operators. Eligible seniors are means tested and substantial subsidies of up to 80 percent of monthly fees are extended.

Widening coverage to become truly universal has been a highlight of the last decade. In 2015, MediShield was replaced by MediShield Life, a more comprehensive and universal health insurance scheme that extended coverage to all Singaporeans, including those with pre-existing conditions and older individuals who were previously excluded or had difficulty obtaining coverage. All citizens and permanent residents were automatically enrolled in the scheme with lifetime coverage. Whilst MediShield Life helps

to pay for large hospital bills and selected costly outpatient treatments such as dialysis and chemotherapy, Singaporeans also have access to CareShield Life, which is a long-term insurance targeted at severe disability, providing cash payouts for long-term care costs for life (and applicable towards nursing home fees). Both MediShield and CareShield premiums can be paid using Medisave, with needier beneficiaries able to benefit from top-ups by family members or occasionally, one-off government disbursements.

Prudent and rational use of limited funds is a priority in Singapore, especially with increased investment. The visible, frontline expansion of services aside, the Ministry of Health has also been actively shoring up decision-making and support services for better health economics. The Agency for Care Effectiveness (ACE) was set up in 2015—subsuming the prior Pharmacoeconomic and Drug Utilization Unit (PEDU)—as an expanded health technology assessment (HTA) unit to support the MOH's Drug Advisory Committee in making evidence-based recommendations for the public funding of drugs. Standardised HTA methods and processes have been developed in line with international best practices and since ACE's establishment, subsidised medications are provided earlier within a drug's life cycle and value-based pricing has led to more cost-effective prices being negotiated with pharma.[14] However, bandwidth limitations and lack of skilled HTA practitioners impact ACE's capacity to achieve greater impact.

The cost positioning for Singapore was further improved when the public healthcare clusters banded together in 2018 to centralise procurement through the setting up of ALPS Healthcare. Touted as a supply chain partner, ALPS consolidates, negotiates and manages logistics for supplies for all public healthcare players—from primary to quarternary care and including the eldercare sector. ALPS's coverage goes beyond pharmaceuticals to include consumables and even support services such as housekeeping and laundry. This is especially important given the small size of the domestic Singapore market and consolidation improves efficiency and more cost-effective procurement.

Despite these cost-saving measures, Singapore has not escaped the worldwide dilemma of rising healthcare costs. 'Healthier SG', set to go live in July 2023, advocates the signing up of every citizen with

a dedicated GP/family physician. The GP then serves as continuing and continuous partner in managing each individual's healthcare needs more holistically—from simple needs to acute referrals to chronic diseases. The focus will progressively shift from a hospital-centric healthcare system to a preventive model and right-siting care to the most appropriate (and cost-effective) modalities, which translates to more care within community settings and providing care that is most appropriate for the individual and not necessarily just what is most advanced medically.

As this article highlights the examples of Indonesia and Singapore, broad themes emerge in the approaches used in achieving universal health care. Expanding financial coverage is critical and with this, widening service accessibility, especially in primary care and judicious purchasing and effective procurement. Implementation is paramount and there is opportunity here for countries to learn and work better together.

Particularly in Southeast Asia, where government procurement is significant and yet not entirely efficient, the region lacks cross-country learning opportunities. In the vein of RESYST (Resilient and Responsive Health Systems) and SPARC (Strategic Purchasing for Africa Resource Centre), international consortia focused on strategic purchasing, the South East Asia Regional Collaborative for Health (SEARCH)[15] hosted by the National University of Singapore aims to review existing health purchasing mechanisms of all ASEAN countries and provide national and regional-level policy recommendations. This will be a meaningful step to educate policymakers and help countries overcome roadblocks to strategic purchasing.

Beyond risk pooling, pricing and procurement, more efforts can be poured into strengthening primary care provision; there are additional opportunities from technology and digital modalities. Telehealth and insurtech, if devised and regulated appropriately, could allow the next step-change in improving access to healthcare, both within a dense urban city state like Singapore or a dispersed island nation such as Indonesia. The COVID-19 pandemic has shown the need and case for such services, and particularly for a developing nation like Indonesia, the vast proliferation of mobile services could pave the way for micro-insurance and insurtech to further improve affordability of healthcare services.

The journey to UHC and improving health equity is an ongoing endeavour. While G20 countries have made remarkable progress in improving human health and increasing healthcare spending, more can be done to ensure access to affordable healthcare for all. By prioritising health equity and implementing innovative approaches to health finance, G20 countries can accelerate progress in transforming public health systems. It is hoped that some of the learnings shared in this chapter may inform and support continued commitment to addressing the complex and interconnected public health challenges faced by societies worldwide.

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Janice Tan *is an experienced healthcare management executive who holds a wealth of experience spanning diverse landscapes, including both public and private sector hospitals as well as nursing homes, across both Singapore and Malaysia.*

Endnotes

1 WHO data

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II.

Digital Health as Enabler for Health Equity and Universal Health Coverage

Public-Private Partnerships:

Bringing High-Quality Healthcare to the World

Sumit Sharma

The growing disease burden is putting increased strain on global healthcare infrastructures, only aggravated by the COVID-19 pandemic. This increased burden has particularly affected low- and medium-income countries (LMICs), which account for the lion's share of non-communicable disease-led mortality rates. These challenges, however, present an opportunity for public and private players to join hands and execute bold and innovative solutions. Working together, the reach of the public sector and the dynamism of the private sector can provide ground-breaking solutions to transform healthcare through public-private partnerships (PPPs). This essay explores how PPPs can drive collaborative research, enable infrastructure and capacity build-up, and promote new execution capabilities and skills to improve services. It highlights the common qualities that characterise successful global PPPs, encouraging the wider adoption of these models to provide high-quality, accessible, and affordable healthcare across the world.

A moment of reckoning

Healthcare systems around the world are at a tipping point, and the moment is ripe for bold and creative solutions. The fundamental challenge

is the world's growing disease burden, driven by ageing populations and lifestyle diseases. Non-communicable diseases (NCDs) such as diabetes, cardiovascular diseases, and cancer now account for an estimated 40 million deaths, or about 75 percent of global mortality, and 77 percent of NCD deaths are in low- and medium-income countries (LMICs).[1]

This rising disease burden comes amidst an acute shortage of skilled workers, with an estimated global shortfall of 10 million health workers by 2030, primarily in the LMICs. India and Indonesia, for example, have just 0.7 and 0.6 doctors per 1,000 people, respectively, against a global average of 1.5.[2] This calls for urgent and drastic measures to recruit, develop, and retain healthcare workers around the world.

These long-term trends were aggravated by the shock of the COVID-19 pandemic, which pushed health workers to the brink and exposed the limits of healthcare systems. Hospitals struggled to accommodate patients and even routine services were disrupted. The effects were immediately palpable. South Africa, for instance, saw a record number of missed immunisations, with 266 fewer vaccinations per 1,000 births during the pandemic.[3] In other countries, new diagnoses of conditions like cancer, tuberculosis, and HIV fell between 26 percent and 96 percent.[4] The consequences of these omissions will be felt for decades to come.

A Challenge and an Opportunity

These seminal healthcare challenges also present an opportunity for public and private sector entities to work together towards innovative and sustainable solutions. Public-private partnerships (PPP) offer a proven model to address these challenges,[5] combining the vision and reach of the public sector with the expertise and dynamism of the private sector. These partnerships have the power to transform healthcare through interventions in three main areas—research (collaboration to develop new technologies and solutions), resources (financing for infrastructure and healthcare capacity build-up), and remittance (development of execution capabilities, skills, and knowledge for care delivery).

Figure 1: The 3R framework

Source: BCG research and analysis

Research: Driving the quest for new technologies and solutions

Research and development in healthcare is a painstaking and prohibitively expensive process. Companies spend billions of dollars in the development and trials of new drugs, and the typical timeline from commencement of trials to drug approval and launch could be over 10 years. In this scenario, collaboration between government bodies and private entities could ease financing concerns and make drug trials more efficient. For such arrangements to work, governments should ideally seek partnerships that will help them solve the wider public health challenges in their country.

India's success in COVID-19 vaccine development underlines the potential of such a partnership model. The government and the private sector joined forces to bring safe, effective, and affordable vaccines to the market in a short time. Among the notable PPP successes was Mission COVID Suraksha, launched by the government with an investment of INR 900 crore (approximately US$110 million).[6] This scheme supported clinical trial sites for several vaccine candidates, including ZyCoV-D, Covovax, Gemcovac-19, Corbevax, the Covaxin booster, Serum Institute's rBCG vaccine, and Johnson & Johnson's COVID vaccine. It also created a 150,000-strong volunteer

database in the process and provided immunogenicity assay services for iNCOVACC Phase III clinical trials, under the aegis of the National Institute of Immunology.

In Europe, the Innovative Medicines Initiative (IMI) is another notable exemplar of PPP. It is billed as the world's largest healthcare PPP, formed as a partnership between the European Commission and the European Federation of Pharmaceutical Industries and Associations (EFPIA).[7] Its €5 billion (approximately US$5.4 billion) budget is contributed equally by the EU and the pharmaceutical industry. It supports consortia working towards specific public health goals, with representatives drawn from the EFPIA, academia, research centers, patient organisations, small- and medium-sized enterprises, and regulators. For instance, the CARE consortium (Corona Accelerated R&D in Europe) operates a COVID-19 drug discovery programme, bringing together 37 teams from academic and research institutions and pharmaceutical companies. The IMI model has helped overcome major hurdles in clinical R&D, including knowledge fragmentation, limited disease understanding, lack of biomarkers for drug safety, late involvement of regulators in R&D, and inappropriate clinical trial design. Over the years, IMI consortia have succeeded in establishing robust validated models for drug development (including the first human beta cell line for diabetes), eliminating inadequate pre-clinical models, identifying novel biomarkers and candidates in pain management, and developing an in-silico model to predict cardiac toxicity. They have also pioneered methods to predict, detect, and monitor drug-induced injuries in the liver, kidneys, and cardiovascular system.

These research partnerships can offer a powerful platform for collaboration and bring innovation to the market faster. The examples of India and the EU show how governments can work as mediators and facilitators to unite disparate elements of the private sector in pursuit of a shared goal.

Resources: Building up new infrastructure and capacity

PPPs have proved highly effective in bridging infrastructure gaps in healthcare. The private sector can bring in additional funding, capabilities,

and knowledge to design, build, and operate healthcare projects. Private companies can also gain access to new markets in the public space, with a potentially large base of end-customers. There are around 600 healthcare infrastructure PPP projects in operation globally, with about 25 percent of them in Asia-Pacific, Latin America, West Asia and North Africa, and Sub-Saharan Africa regions.[8]

Brazil offers an insight into the role of PPPs in strengthening healthcare infrastructure, even in the most deprived areas. The country's first healthcare PPP initiative, launched in 2010, has dramatically improved emergency hospital services in the state of Bahia.[9] The partnership was facilitated by the International Finance Corporation, the private sector arm of the World Bank Group, which was engaged by the state government. The winning bid was made by a private consortium comprised of Promedica, a leading Brazilian healthcare company, and Dalkia, a French facilities management firm. In its first year, the consortium invested US$23 million in medical equipment for the new Hospital do Subúrbio in the state capital of Salvador. Located in one of the city's most underserved districts, this 298-bed facility was the first new hospital in the city in two decades, providing emergency care and specialised treatment for trauma, orthopedic, and cardiac emergencies, and other complex injuries. Since 2010, the hospital has performed 1.8 million medical procedures, including 680,000 emergency procedures.

Building on this success, the Bahia state government embarked on another PPP in 2015 to address the shortage of high-quality complex imaging equipment and tests in the region. This time, the winning bid was made by the multinational AFP consortium, which included Philips do Brasil, a medical equipment provider, and Alliar, a diagnostic medicine network. It has since invested over US$40 million and placed 45 new machines, including CT and MRI scanners, in imaging units across 12 Bahia hospitals.[10] This project has helped bring high-quality imaging and tests to some of the state's most underserved areas. It has also improved the quality of care by delivering diagnostic reports for emergency patients in less than an hour. Amidst all this, the government's role is capped at a maximum payment of US$30 million every year, significantly mitigating risk.

The Brazilian example shows that clearly defining the end-goals and creating a conducive environment is critical to the success of PPP. In this context, governments have a vital role to play in defining these objectives, facilitating collaboration, and putting 'skin in the game' to set the program up for success.

Remittance: Developing knowledge and skills for superior service delivery

Besides supporting research and new infrastructure, PPPs also play an important role in delivering care to patients, particularly in areas where the public sector lacks the knowledge or skill base.

In the Gowa regency of Indonesia's South Sulawesi province, the government launched its first PPP to support a maternity waiting home in 2022.[11] The regency was grappling with high maternal and neonatal mortality, having reported 32 maternal and 107 neonatal deaths in 2020-21. Women in remote locations were often stranded without access to health facilities during high-risk deliveries. The maternity waiting home initially served two mountainous villages around 100 km from Gowa's capital. The regency government, USAID, and four other partners facilitated the programme. A local NGO, Jas Publik Gowato, was engaged to manage operations and provide midwives. A private company, PT Indofood Sukses Makmur Tbk, provided equipment support and nutritional products for pregnant women. Another NGO, Domphet Dhuafa Republika Foundation, ran education and outreach programmes in the villages. Lastly, the South Sulawesi CSR Social Welfare Forum supported facility maintenance, painting, and minor renovation. This farsighted initiative could serve as a template for future solutions to LMIC healthcare challenges, particularly in remote areas.

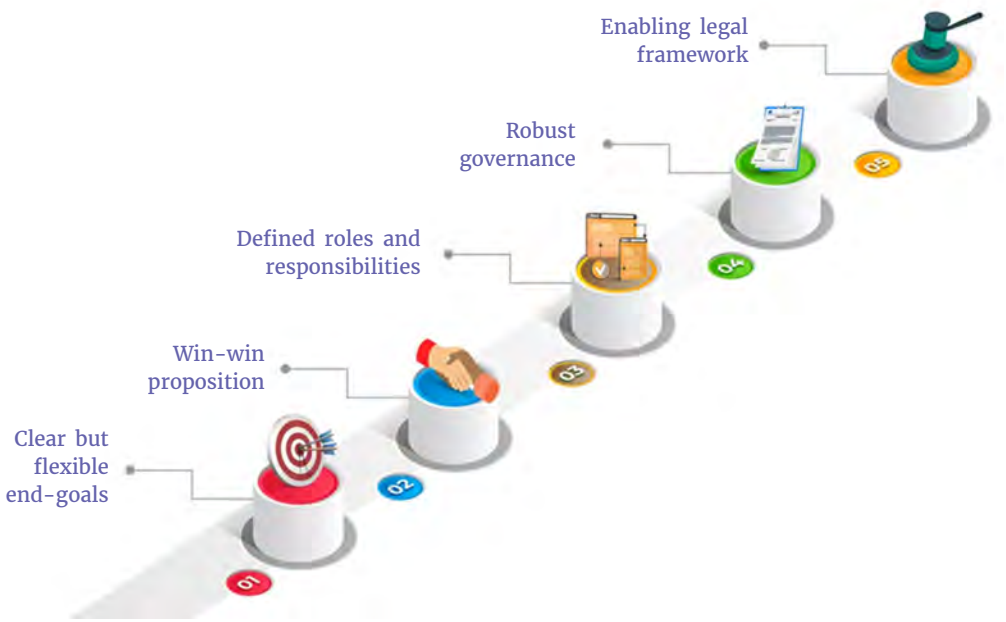
Another promising example is that of the Biovac Institute in South Africa, a PPP between the South African government and the Biovac Consortium.[12] This was set up in 2003 to manufacture and distribute affordable, high-quality vaccines for Africa. It now supplies over 15 million doses of vaccines each year to South Africa's provinces, focusing on tuberculosis, measles, pneumonia, and hepatitis B. Its partners include research organisations like the University of Cape Town and the Council for Scientific and Industrial

Research; international organisations like the World Health Organization; pharmaceutical majors like Sanofi & Pfizer; and funding bodies like the Industrial Development Corporation. Biovac has successfully reduced costs and made vaccines accessible to the underserved African market. Its state-of-the-art local facilities and knowledge transfer have also contributed to the development of the local pharmaceutical industry. This success paves the way for more innovative PPPs to address Africa's healthcare challenges.

The Five Ingredients of a Successful PPP

Healthcare PPPs vary widely based on demographics, economics, policies, and objectives. Yet, there are also some common qualities that characterise successful PPPs across the world. There are five elements that can maximise the chances of a successful partnership.

Figure 2: Five ingredients of a successful PPP



Source: BCG research and analysis

- **Clear but flexible end-goals:** PPPs are usually initiated by government entities to address major public health challenges that require support from the private sector. Successful PPPs clearly define the problem at the outset, along with potential end-outcomes and metrics to assess

programme success. They also tend to build in some flexibility, with scope to change course to meet changing needs (especially in long-term projects).

- **Win-win proposition**: Sustainable long-term partnerships cannot be a zero-sum game—they must offer a compelling value proposition for all parties. The best PPPs offer a win-win proposition, whereby the government gains access to funding and knowledge, and the private sector gains access to a large market that might otherwise have been inaccessible.

- **Defined roles and responsibilities**: Successful PPPs depend on a clear allocation of roles and responsibilities. Government agencies should provide genuine political will and conducive policies to encourage private sector participation. In return, private sector parties can offer complementary benefits like technical, financial, and cultural expertise. Robust contractual terms could help ensure consistency and predictability and minimise shocks due to changes in the political landscape.

- **Robust governance and transparency:** Given the disparate entities involved, PPPs need well-defined governance practices and a culture of open dialogue and transparency. Setting a clear reporting hierarchy, instituting periodic status updates, and monitoring key data points are some ways to keep the project on track, evaluate progress, and maximise the chances of success.

- **Enabling legal framework:** Stable, conducive regulations and policies can help create an enabling environment for PPPs to succeed. For instance, policy changes that remove existing barriers and inefficiencies in the system could help partners reduce operational complexities, and thus enable them to achieve their end-goals for the programme.

A Partnership for the Future

Public-private partnerships have the potential to solve the most intractable healthcare problems facing governments across the globe. For these partnerships to succeed, the public sector must tap into the scale

and best practices of the private sector, including product innovations, people's capabilities, superior technology, efficient processes, and enhanced financing. Achieving the most ambitious end-goals will require a multi-pronged approach from all parties, including regulators, policymakers, and the private sector. For regulators and policymakers, the challenge is to create a conducive environment to optimise these partnerships. For the private sector, the challenge is to go beyond corporate social responsibility and develop sustainable offerings that add value to the partnership. The onus is on both sides to find common ground and harness the potential of PPPs, ushering in a new paradigm of accessible high-quality healthcare.

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Building a Resilient Digital Health Ecosystem in India

Lav Agarwal

Technology now permeates every facet of human existence. From communication and transportation to healthcare and entertainment, technology has redefined how we live, work, and interact. Its omnipresence is reshaping societal norms, revolutionising various sectors, and propelling us into the future.

Through improvements in diagnostics, treatment, and patient care, technological advancements have had a profound impact on healthcare. Medical devices, telemedicine, electronic health records, and artificial intelligence (AI)-driven diagnostics have transformed healthcare delivery by making it more precise, efficient, and accessible. Wearable devices and health apps have empowered individuals to monitor and manage their well-being proactively. Technology has also played a crucial role in advancing medical research, discovering new treatments, and improving overall healthcare outcomes. In response to the COVID-19 pandemic, the world witnessed the exponential growth of digital health.

Digital Health Landscape in India

Given India's massive population, providing equitable access to healthcare services to all is an important agenda. By harnessing the power of technology, digital health can effectively address these challenges and ensure that healthcare services are accessible even in the remote regions. Patients can use digital platforms for convenient access to care. Digital platforms therefore bridge gaps and improve healthcare delivery across the nation.

In line with the 'Digital India' initiative and the vision to create interoperable and standardised electronic health records across the country, the Indian government notified the Electronic Health Record[1] standards in 2016. The National Health Policy[2] (2017) envisages the creation of a digital health technology ecosystem that serves the needs of all stakeholders and improves efficiency, transparency, and citizens' experiences across public and private healthcare.

Over the recent years, India has made progress in digital healthcare delivery, as demonstrated in national health programmes such as the Hospital Management Information System, Online Registration System, the national tuberculosis elimination (Ni-kshay) programme, Mother and Child Tracking System, *Mera Aspataal* (My Hospital, a patient feedback system), the Health Management Information System, the Integrated Health Information Platform, and Non-Communicable Diseases screening application—which have benefitted patients through the timely delivery of services and by making government healthcare more affordable and accessible.[3]

The need for a future-ready digital health system has become even more urgent with the announcement of the Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB-PMJAY)[4] in 2018, India's flagship programme that would herald an infrastructural transformation of the nation's health system. This mission envisions the following:

I. Operationalising 1.5 lakh health and wellness centres that offer preventive and primary care, including telemedicine consultation services; and

II. Providing financial protection of up to INR 500,000 per family annually for secondary and tertiary care hospitalisation to the over 120 million crore poor and vulnerable families that comprise the bottom 40 percent of the Indian population.

These initiatives aim to scale up a wellness-oriented approach instead of an illness-focused one—a key step towards achieving universal health coverage (UHC) through patient data portability across primary, secondary, and tertiary levels. This essentially translates into an environment where all people can obtain health services anywhere in the country without suffering financial hardship or excessive indirect costs.

Achieving such scale requires us to rethink the core technology backbone of our system and leverage cutting-edge digital solutions to tackle the challenge. However, it is also felt that all these efforts need to converge into a single framework to achieve interoperability of data, which would benefit both policymakers for decision-making and patients with effective services at the time of need. In response, the government developed the National Digital Health Blueprint as a framework for the efficient implementation of digital health treatments.

The Ayushman Bharat Digital Mission[5]

To implement the principles of the blueprint, the National Digital Health Mission, now known as the Ayushman Bharat Digital Mission (ABDM), was launched in six union territories in August 2020. It was proposed to be carried out via six key components—i.e, the digital health ID card, Digi-Doctor, Health Facility Registry, Personal Health Records, e-pharmacy, and telemedicine. India launched the nationwide implementation the ABDM in September 2021. The ABDM intends to create the framework needed to enable an integrated digital health infrastructure in India. Additionally, it will bridge the existing gap amongst different stakeholders of the healthcare ecosystem through digital highways.

Under the ABDM, every citizen will be provided a 14-digit Ayushman Bharat Account (ABHA) number, which is a unique health identifier. With the patient's informed consent, the ABHAs will be used to identify and

authenticate people's health records across various systems and stakeholders. As of July 2023, over 435 million ABHA[a] numbers have been created, and 214,396 health facilities and 207,274 doctors have been registered under the ABDM ecosystem.

ABDM has accelerated the participation of various stakeholders of the healthcare ecosystem and ensured deployment of patient-centric policies—resulting in cashless care with improved access to ensure protection for the poor. Given its federal and complex healthcare structure, India demands agility, flexibility and evidence-based smart policymaking for implementation of healthcare initiatives, driving all stakeholders towards health-seeking behaviours with renewed energy.

Digital Health in COVID-19 Management

The COVID-19 pandemic has challenged health systems across the globe. The India government not only focused on the management of the pandemic through various activities but also formulated innovative solutions to ensure the continuity of health services across the spectrum. It has followed a 'whole of government, whole of society' approach to battle the pandemic by engaging subnational and local governments, civil society organisations, the private sector, and local communities in mitigation efforts.

Amid the pandemic, India recognised the need to ease access to digital consultations, and issued the Telemedicine Practice Guidelines in March 2020. India also launched eSanjeevaniOPD,[6] a first of its kind and the world's largest national telemedicine service to facilitate online health facilities to patients in the confines of their home at no cost to ensure continuum of care. The eSanjeevani initiative has been instrumental in bridging the digital divide in India, particularly in rural areas where access to healthcare is often limited. This initiative has completed 142 million consultations[b] in record time and is currently serving around 400,000 patients every day as of 27 July 2023.

a https://dashboard.abdm.gov.in/abdm/

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India developed another state-of-the-art digital health system, CoWIN,[7] a digital platform that helped more than a billion beneficiaries book COVID-19 vaccinations in less than three months. In less than 18 months, CoWIN had helped administer two billion COVID-19 vaccination doses, immunising over 90 percent of all eligible adults.

The establishment of digitally-enabled COVID-19 'war rooms' at the central and state levels allowed key stakeholders to undertake data-driven decisions towards infrastructure gap analysis, case projection and management, and to identify problem areas that required specific state-centre coordination. Various other digital health initiatives that have enhanced India's efforts against the COVID-19 crisis are outlined in the following points:

i. the COVID-19 India Portal developed for disease tracking by geography, inventory tracking of essential items, and predicting demands at the national, state, and district levels based on case-loads;

ii. the Aarogya Setu, a mobile tracking app which uses the smartphone's GPS and Bluetooth features to track the coronavirus infection through contact tracing, syndromic mapping, and self-assessment in addition to essential risk communication for our citizens;

iii. the RT-PCR app, a hand-held tool for country-wide sample collection; and

iv. a COVID-19 facility app which allows health system stakeholders up to the district level to track the state and management of patients.

Institutionalising Pandemic Learnings: National Public Health Observatory (NPHO)

India has established the National Public Health Observatory (NPHO) and the Health Emergency Operations Centre (HEOC) for real-time monitoring and analysis of various data points for informed decision-making. The NPHO will ensure comprehensive monitoring of health systems, including overall healthcare service delivery, integration of healthcare programmes, and transformation of the healthcare situation in the country.

Leveraging AI for Improved Healthcare

Across the world, AI is being used in healthcare to support doctors and healthcare workers, improve customer service and patient management, and monitor diseases. The Indian government has established three centres of excellence for AI—at the All India Institutes of Medical Sciences in Delhi and Rishikesh, and at the Post Graduate Institute of Medical Education & Research in Chandigarh—to leverage and identify potential areas for the use of AI in the health sector. The centres are already working on several solutions for healthcare which leverage generative AI, including:

i. a clinical decision support system, a multilingual solution to provide diagnostic and triaging support to doctors;

ii. event-based disease surveillance to scan large volumes of digital media in English as well as 10 Indian languages to monitor events that signal an impending disease outbreak; and

iii. an AI assistant for frontline workers in 11 Indian languages to enable and empower healthcare workers to ask questions and receive responses to enhance their work.

Stimulating Advanced Knowledge for Sustainable Health Management (SAKSHAM) Portal

The inclusive capacity building of health professionals is an important component to ensure the efficient delivery of healthcare services across the country. Tele-education has benefitted all fields of education including medical education, especially for students in remote areas with limited access to schools and qualified teachers. Online platforms, video conferencing, and pre-recorded lectures have facilitated learning for students who were previously deprived of quality education due to their geographical location.

Keeping this vision in mind, the government has developed a unified and dedicated online learning and training platform, SAKSHAM,[8] to enable health professionals to receive advanced training without any disruption in their regular jobs. The portal hosts more than 200 courses on public health and 150 on clinical practices.

With such developments in digital health, India has leapfrogged in terms of the adoption of digital health in the public sector. This will arguably lead to the creation of a national digital health ecosystem through wide-scale adoption of digital tools across the continuum of care, both in the private and public sectors.

Promoting the Digital Health Agenda Globally

India has emerged as a frontrunner in championing digital health and in positioning it as a critical agenda at the global level. Recognising the transformative potential of technology in healthcare, India has taken proactive steps to harness digital innovations, promote healthcare accessibility, and drive advancements in the field globally.

India tabled the Digital Health Resolution in the 71st World Health Assembly in May 2018 at Geneva, which was unanimously adopted by all the member states of the World Health Organization (WHO). The resolution highlighted global attention to the potential challenges and opportunities related to digital health technology and need for close collaboration on the issue globally. As a follow-up action, WHO has prioritised digital health agenda by establishing the Department for Digital Health and Innovation in April 2019 and published the *Global Strategy on Digital Health 2020-2025* to promote healthy lives and well-being for all.

India served as Chair of the Global Digital Health Partnership (GDHP, between 2019 and 2021), which is the world's largest intergovernmental and multilateral forum on the issue of digital health. Under India's leadership, the GDHP's membership grew from 14 to 33, including three international organisations (WHO, Organisation for Economic Co-operation and Development, and the International Digital Health and AI Research Collaborative).

India's G20 Leadership Catalysing Global Health Initiatives

India's G20 presidency set ambitious goals to address the 21st century's greatest challenges such as climate change, food insecurity, the threat of

future pandemics, and other health emergencies by building international co-operation and strengthening global systems. The pandemic experience has taught us that preventing and preparing for a health emergency must always be a top priority at a global level, because when it comes to health, "no one is safe until everyone is safe."

Drawing from the lessons from the pandemic, the G20 Health Working Group set out to catalyse and enervate global health initiatives. Through four meetings, culminating in the health ministers' meeting, three main priorities were discussed:

i. prevention, preparedness, and response to health emergencies with focus on anti-microbial resistance and 'One Health';

ii. strengthening cooperation in the pharmaceutical sector with focus on availability and access to safe, effective, quality, and affordable medical countermeasures, namely vaccines, therapeutics, and diagnostics; and

iii. digital health innovations and solutions to aid universal health coverage and improve healthcare services delivery.

Digital health, the third priority under India's G20 presidency aims to leverage the country's acumen and achievements along with other global initiatives in the digital health space, and develop innovative digital health solutions that can be applied across the world. A number of programmes and projects seeking to develop digital health products are being initiated independently. These projects are cumulatively spending billions of dollars while working on similar aspects.

India's G20 presidency has aimed to bring them all under the umbrella of the Global Initiative on Digital Health (GIDH), a network managed by WHO. The GIDH is an opportunity to create a globally connected digital health ecosystem, converging worldwide efforts in scaling up commitments and investments of relevant stakeholders and promotion of digital health solutions as digital public goods. This will be achieved through coordinated engagements and implementation aligned with WHO norms, standards, and

guidelines, while increasing transparency of resources being allocated to digital transformation and identifying important gaps in support.

Conclusion

Adopting digital health is no longer a choice. The pandemic has undoubtedly paved the way for the quick adoption of digital health. Digital health is propelling the world towards more integrated health systems that are focused on delivering patient-centred care, improving health outcomes, and making the best use of healthcare resources. India's digital health initiatives such as the ABDM, CoWIN, and eSanjeevani have provided a stimulus to act in conformity with a globally progressive commitment to health equity. They have also enabled the country to work towards creating a movement to enable integration of technology-informed models for universal health coverage.

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Lessons from India's Digital Public Infrastructure Transformation

Sameer Kanwar and Varun Kumar

In today's rapidly evolving digital landscape, many countries are striving to establish and strengthen digital public infrastructure (DPI) to harness the transformative power of technology to benefit citizens. India has emerged as a noteworthy example by successfully using technological advancements to create robust DPI. It has implemented various initiatives that mobilise technology for inclusive growth, economic development, and improved governance. Countries around the world can learn from India's experience and achievements to initiate similar digital transformations.

Through the Digital India programme, India is seeking to digitally equip citizens with access to all government services by improving internet connectivity and developing online infrastructure. This encompasses three key areas: (a) establishing a secure digital infrastructure; (b) successfully delivering digital services; and (c) ensuring that every citizen has access to the internet. India has also seen an increase in the number of digital technology users, with an estimated 750 million smartphone users, and a projected one billion users by 2025.[1] This increase has generated demand for a centralised digital architecture that functions as a single enterprise.

In 2018, the Ministry of Electronics and Information Technology (MeitY) created the India Enterprise Architecture (IndEA) framework[1] for the adoption of a whole-of-government enterprise architecture by central ministries, state departments, and public sector enterprises. Built with a focus on performance, IndEA offers open standards to promote interoperability and supports decentralisation. At the same time, it supports both new (greenfield) and legacy (brownfield) e-governance initiatives. The emphasis of the IndEA initiative is to enable "One Government – a government that is least visible but is effective" by implementing the concept of "virtualisation of departments" to activate synergy.[2]

Growing digitalisation will lead to the increased generation of data, and consequently, data protection and ownership must be addressed at the outset. The Data Empowerment and Protection Architecture (DEPA) framework, introduced in 2020, seeks to ensure user control over data. DEPA suggests measures for consent-governed and secure data-sharing with third-party institutions. Controlled by consent managers, only relevant user data is plugged in to any private ecosystem and there is no need to set up bilateral databases.[3] This empowers citizens with ownership and control over their own data and how it is shared.

While DEPA has been flexibly applied in multiple sectors, it has been particularly well-used as a techno-legal solution in the finance sector. Since DEPA empowers individuals to securely share their financial data with banks, insurers, investors, and other stakeholders, its first immediate benefit has been to encourage competition among private players. Individuals and small businesses are now able to get loans, insurance, and other financial products at competitive rates, just by using their digital footprint. In practice, DEPA works closely with the many layers of India Stack[4]—Aadhaar-based e-KYC, Unified Payments Interface (UPI) for cashless payments, and Aadhaar-based eSign) and uses the Open Credit Enablement Network to facilitate lending. India Stack has enabled the country to build its digital infrastructure, especially in establishing a design to improve private sector service delivery, and has served as India's digital library, housing several digital global goods and offering learnings to the world.

Over the last decade, India has taken landmark steps to set in motion its vision of becoming an inclusive digital economy. This includes establishing

robust DPI and the facilitation of digital governance by streamlining roles, accountability, and change management. This encompasses various components, including digital identification systems, digital payments systems, and digital service delivery platforms.

Pillars of Digital Public Infrastructure in India

The foundation: Aadhaar[5]

India's Aadhaar programme, a biometric and face authentication-based digital identification system, has revolutionised identity verification and service delivery in the country. Aadhaar has provided a unique identification number to over 1.3 billion residents of India, enabling access to essential services such as government subsidies, bank accounts, and mobile connections. It has enabled the government to streamline service delivery and eliminate duplication by providing a single digital identity across multiple sectors. The world can learn from India's approach in implementing a centralised, secure, and inclusive identification system, that has facilitated interoperability across service delivery platforms, both public and private.

Driving financial inclusion: Unified Payments Interface[6]

India's push to digitise payments has transformed the way financial transactions are conducted in the country. The implementation of UPI has created a platform that enables instant money transfers between bank accounts. It offers a smartphone-based interface to support seamless, interoperable, and real-time payments, available on the go. UPI has not only transformed the way individuals transact but has also provided a significant boost to the growth of the digital economy. Countries can gather important lessons from India's experience in fostering a competitive and interoperable payment ecosystem, which has led to increased financial inclusion, reduced reliance on cash, and enhanced transparency in transactions.

The number of digital transactions increased by more than three times from 3 billion in November 2019 to 10 billion by January 2023.[7] A 2019

MeitY study noted that under a 'business as usual' scenario, India's digital economy will grow to US$500 billion by 2025, with the potential to increase to US$1 trillion.[8] In 2021, India had 48.6 billion real-time payments, as compared to 18.5 billion in China and 8.7 billion in Brazil.[9] This is indicative of the ease with which the Indian population has adopted digital platforms for making payments even if the average value of such payments may be rather low.

Efficient welfare delivery: Direct Benefit Transfer[10]

India's Direct Benefit Transfer (DBT) programme is aimed at eliminating potential leakages in the physical delivery of financial benefits and ensuring an efficient transfer of welfare to the right beneficiaries. By leveraging digital payment systems, benefits are directly credited to the beneficiaries' bank accounts, reducing corruption, eliminating middlemen, and improving transparency in the transfer of subsidies.[11] The enablers for DBT in India are the Pradhan Mantri Jan-Dhan Yojana, the Jan Dhan-Aadhaar-Mobile Yojana, and nearly 312 other schemes from 53 ministries across all states and union territories. More than INR 24,800 billion has been transferred through the DBT programme since 2013, with INR 6,300 billion transferred in FY 2021-22 alone. On average, more than 9 million DBT payments were processed daily in FY 2021-22.[12]

Citizen-centric services: E-governance[13]

India has leveraged technology to enhance governance and service delivery through initiatives like Digital India and other e-governance platforms. The use of digital platforms (or information and communication technologies) has facilitated efficient and transparent administration, improved the accessibility of government services, and reduced bureaucratic inefficiencies. The MyGov platform[14] has been a crucial contributor to transforming citizen-government interactions. India's approach to digital governance emphasises citizen-centricity, where technology acts as an enabler to bridge the gap between the government and its citizens. By adopting similar approaches, countries can enhance government services, promote transparency, and strengthen democratic participation.

Creating a digital ecosystem: Technology access and innovation

India has created a vibrant digital ecosystem that fosters innovation and entrepreneurship. Initiatives like Startup India[15] and Make in India[16] have encouraged the growth of technology start-ups and attracted global investments. India has nurtured a conducive environment for technology and innovation through policy reforms, access to funding, and incubation support. Managed by the Department for Promotion of Industry and Internal Trade under the commerce ministry, the Startup India initiative has helped introduce various programmes that support entrepreneurs and create a healthy start-up ecosystem. Similarly, the 'Make in India' initiative has incentivised the development, manufacture, and assembly of products in the country, and has thus boosted partnerships, investments, and innovations.

Growing digital literacy and inclusion in harnessing the benefits of technology has also been crucial achievements for the country. India's experience underscores the importance of widespread access to affordable internet connectivity, digital skills training, and tailored initiatives for marginalised communities. Initiatives like BharatNet,[17] which aims to connect over 250,000 local rural bodies with high-speed internet, and the Common Service Centers,[18] which provide access to government services in remote areas, have been instrumental in extending the benefits of India's digital infrastructure to rural communities. In addition to the digital training programmes offered through government-supported bodies like the National Skills Development Centre[19] and the National Institute for Entrepreneurship and Small Business Development,[20] other private training institutes and online platforms have significantly contributed to digital skill building among citizens, both in urban and rural settings. By prioritising digital literacy and inclusion, countries can bridge the digital divide and empower their citizens to participate fully in the digital age.

Key Drivers of India's Digital Transformation

India's achievements in implementing DPI demonstrate the transformative power of technology when combined with inclusivity, scalability, regulation, and collaboration. The key factors that equipped the country to achieve this digital revolution include:

Ecosystem collaboration

India's success in digital service delivery can be attributed to strong collaboration between government agencies, industry leaders, startups, academia, and civil society organisations. This collaborative approach has fostered innovation, shared expertise, and effective implementation. India's G20 presidency has further drawn attention to the importance of collaboration, with initiatives like the Global DPI Summit[21] allowing a close agreement between partners (and non-partners alike) on the common principles and design aspects of DPIs. By bringing together all the stakeholders, the Indian government has created a collaborative environment for developing and implementing digital public infrastructure projects.

Industry players have contributed their expertise, resources, and technological innovations to build and maintain the required infrastructure. Similarly, collaborations with academic institutions and research organisations have aided innovation and helped address technical and policy challenges. Public-private partnerships and international collaborations have further supported knowledge exchange, best practice sharing, and access to resources and funding.

The Indian government has been able to promote such an ecosystem collaboration by establishing platforms (such as, India Stack), forums (for example, India Stack Knowledge Exchange Forum, 2022[22]), and regulatory frameworks (IndEA and DEPA) that encourage active participation, information sharing, and coordination between different stakeholders. These collaborations prioritise interoperability, data privacy, security, and scalability to build a robust and sustainable DPI in the country.

Scalability and inclusion

India's experience in scaling up its DPI demonstrates the significance of inclusivity, with the most successful case being that of its digital identification system. MeitY, in response to an unstarred question in the upper house of Parliament (in July 2022), said that out of the approximate projected population of 1.37 billion, around 1.27 billion held a live Aadhaar number.[23] By ensuring accessibility and ease of enrollment for all citizens,

including marginalised communities, India has achieved a notable level of inclusivity. While there are gaps in digital inclusion across demographic locations (55 percent share of urban telephone subscribers, as of December 2022[24]) and gender (11 percent gender gap in mobile ownership, 2023[25]), the country is consistently invested in closing this difference.

India's digital infrastructure has been created keeping in mind future needs and potential growth. With a quantum increase in users connected to the internet, the emergence of multiple types of intermediaries (digital media, e-commerce, and others), and the possible use of connectivity to cause harm or commit crimes cannot be ignored. Comprehensive measures need to be taken to prepare for the future. To check a potential DPI's scalability even before introduction, significant emphasis has been placed on considerations like robust technology frameworks, interoperability, open Application Programming Interfaces, data management, and addressing infrastructure gaps.

India's journey is an example of how scalability and inclusion work together in building a resilient and equitable digital public infrastructure. Key strategies that have helped the country's efforts to establish its infrastructure at scale are ensuring accessibility, promoting digital literacy and skill development, focus on last-mile connectivity, multilingual support in technological solutions, participatory implementation, and regulations to ensure affordability.

Balancing regulation and innovation

India's digital payments ecosystem demonstrates the need to strike a balance between regulation and innovation. While fostering competition and innovation, the country has implemented robust regulatory measures to ensure the security and integrity of transactions.

Putting in place provisions like regulatory sandboxes, which provide a controlled environment for testing innovative technologies and business models, has allowed experimentation and innovation, while ensuring consumer protection and risk mitigation. At the same time, taking a

collaborative approach by establishing forums and platforms for stakeholders to engage in policy discussions and regulatory consultations has helped in understanding their needs and concerns, thus informing the adoption of balanced regulatory policies. Recognising the fast-paced nature of the digital landscape, Indian regulators have also shown agility in updating and adapting regulations. Recent policy measures like the introduction of the Digital Personal Data Protection Bill 2022,[26] which restricts the processing of personal data until after the individual's consent has been recorded, and the presentation of the Digital India Act 2023,[27] to set up global standard cyber laws, have demonstrated a willingness to understand and respond to consumer needs, emerging technologies, and market trends.

While India has made strides in regulation and innovation, challenges remain. Striking the right balance between the two requires continuous monitoring, assessment, and adaptation of regulatory frameworks to keep pace with evolving technologies and market dynamics. Employing these efforts at the desired scale in the country would require infrastructure, investment, and a strong commitment. Ongoing collaboration between regulators, industry players, and other stakeholders will be crucial to maintaining an innovation-friendly environment while upholding consumer protection and addressing emerging risks.

Conclusion

India's DPI provides valuable lessons on the advantages of harnessing technology for inclusive growth, economic development, and improved governance. Through initiatives like Aadhaar, UPI, digital health infrastructure, DBT, e-governance, regulatory frameworks, and creating an enabling digital ecosystem, India has been able to unlock the transformative potential of DPI. By focusing on the key lessons from India's experience, other countries can implement similar DPIs to address their unique challenges and leverage the potential of technology for the benefit of their citizens.

These countries must consider their contextual differences based on population size, level of technological development, political priorities, and policy outlooks to customise their learnings to suit their specific needs and challenges. As the world embraces the digital era, India's DPI experience can serve as inspiration and guide for building robust digital systems that could foster inclusive societies and drive sustainable development in the 21st century.

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WIN-ning for India:
A Decade of Healthcare Innovation

Shoko Noda

When the world was grappling with the shocks of an unprecedented pandemic, India was feverishly developing and deploying vaccines at record pace. After a few early stumbles in its pandemic response, the country launched the world's largest immunisation programme in January 2021. Powered by a homegrown app, Winning Over COVID or Co-WIN, India delivered over two billion vaccines in just 18 months, demonstrating the efficiency of its indigenous digital infrastructure.

India's digital public health infrastructure comprises e-platforms, apps, and solutions that support the delivery of healthcare at the last mile. Within a decade, India built robust digital health platforms that can track the vaccine supply chain, deliver billions of safe and effective vaccines, and is geared to immunise every expectant mother and child against deadly but preventable diseases.

Despite the multiple crises being faced by the world—such as the aftershocks of the COVID-19 pandemic, protracted and compounded conflicts, and the climate crisis—all of which have enormous impacts on health, digital technology is creating a quantum shift in healthcare in India. During the pandemic, Co-WIN enabled the country to administer vaccines at a

staggering pace, surpassing the combined vaccinations achieved by the US, Brazil, Indonesia, and Japan; at one point, 14,000 people across the country were being vaccinated every minute.

Table 1: COVID-19 Vaccination in India (January 2021–December 2022)

Month	Total Vaccinations	Month	Total Vaccinations
Jan-21	3,846,478	Jan-22	214,893,703
Feb-21	11,553,406	Feb-22	109,231,600
Mar-21	56,379,152	Mar-22	66,177,607
Apr-21	91,195,609	Apr-22	48,617,880
May-21	59,288,806	May-22	43,615,120
Jun-21	117,520,688	Jun-22	41,742,608
Jul-21	131,356,298	Jul-22	65,933,930
Aug-21	183,276,401	Aug-22	81,908,048
Sep-21	235,861,283	Sep-22	61,509,414
Oct-21	169,274,461	Oct-22	9,564,161
Nov-21	178,364,821	Nov-22	2,760,723
Dec-21	210,113,954	Dec-22	1,790,441

Source: Co-WIN

Co-WIN allowed individuals to register for vaccinations, locate nearby centres, and obtain a digital certificate that was valid globally—even as many other countries were still using paper-based confirmations. The development of Co-WIN took place within three months while simultaneously tackling the health crisis triggered by the pandemic. This included designing and developing modules for programme managers at all levels (administrator module), for healthcare workers to make real-time entries of vaccine

doses administered (vaccinator module), and for citizens to register, book appointments, and access their vaccination certificates (citizen module). These were also linked with Aadhaar and other approved national IDs.

Additionally, of approximately 20 million healthcare and frontline workers in India, one million were mandated to use Co-WIN and trained to operate the digital platform. A technical helpline was set up to resolve issues faced by healthcare workers while using Co-WIN. The digital platform ensured timely availability of vaccines, allocation of doses, and reach to the remotest corner of the country, highlighting how digital public infrastructure built using open-source technologies can work for the benefit of millions.

Till date, in India, more than 2.2 billion total vaccine doses have been administered, serviced by more than a million health workers, protecting more than 1.1 billion people over 73 percent of whom were spread across rural and hard-to-reach areas.

Table 2: COVID-19 Vaccination in India by Doses

Dose	Total Administered
Dose 1	1,027,415,109
Dose 2	951,982,099
Precautionary Dose	227,330,967

Source: Co-WIN

Traditionally marginalised groups such as migrant workers, the transgender community, and individuals without any form of identification could also get vaccinated, demonstrating the government's people-first approach to delivering care.

Table 3: COVID-19 Vaccine Doses to Vulnerable Groups in India

Target Population	Number of Vaccine Doses
Third gender	536,363
Pregnant women	3,517,260
Persons with disabilities	119,321
Prisoners	709,292

Source: Co-WIN

Co-WIN and India's ability to deploy a large-scale digital platform to manage vaccinations has been globally acknowledged, from policymakers to tech giants. A Stanford University report,[1] drawing on work published in the *Lancet*, estimated that undertaking the vaccination campaign at scale saved 3.4 million lives. The Co-WIN model has received widespread international acclaim, including recognition under the Exemplars in Global Health initiative, which identified Co-WIN as a modular, interoperable platform designed to handle scale.[2]

Accelerating Healthcare through Digitalisation

India has demonstrated that inclusive digital health infrastructure can overcome challenges such as inequitable access to life-saving vaccines, supply-demand mismatch, and low-quality vaccines. Historically, these challenges have hampered consistent access to health services for millions of vulnerable people.

Today, India is at the cusp of digitalising the world's largest universal immunisation programme for expectant mothers and newborns—which protects against 12 vaccine-preventable diseases, including diphtheria, tetanus, polio, measles, rubella, rotavirus diarrhoea, and hepatitis B—with the launch of the digital platform U-WIN (Universal Immunization Programme-WIN). U-WIN aims to improve the performance of the country's immunisation program and is expected to become the world's largest

electronic immunisation registry, reaching 100 percent of around 29 million pregnant women and 26 million newborns annually.

U-WIN was piloted for six months in 65 districts across India starting January 2023. Even before the pilot ended, U-WIN had seen over a million registrations of beneficiaries (mother and child) and tracked the administration of over three million vaccine doses.

However, in a country as diverse as India, challenges persist. Over the years, states have used different mechanisms, platforms, and data sources to report and monitor births. Additionally, data is often collected manually, without uniform data-capturing and reporting mechanisms, which sometimes leads to errors in reporting and analysis, disrupting vaccine supply chains and delaying health service to vulnerable populations.

Timely and accurate data is the cornerstone of effective systems for health. This is where digitalisation comes in handy. The U-WIN platform is designed to become a common database that can be referred to by all stakeholders, including states and union territories, to make informed decisions related to the immunisation programme. U-WIN will also allow expectant mothers and children to receive vaccinations anywhere in the country, ensuring that migrant populations are not left behind. In addition, the system will allow citizens to book and schedule appointments and keep track of the vaccines they need to take.

U-WIN will be integrated into India's digital stack and will be interoperable with other portals such as the Ayushman Bharat Digital Mission (ABDM)—a national digital health ecosystem that connects all digital health platforms, the Electronic Vaccine Intelligence Network (eVIN), the National Identification Number (NiN), and the Reproductive and Child Health Portal (RCH 2.0), based on evolving needs. With the integration of U-WIN and ABDM, which aims to develop the necessary backbone to support the integrated digital health infrastructure of the country, this would be a pioneering implementation to scale.

A Decade-Long Journey

India's quest to build a modern digital platform to manage routine vaccinations began almost a decade ago. With people and their well-being at the heart of this vision, India identified its vaccine supply chain as the first building block of its digital health infrastructure.

Introduced in 2014, eVIN is a smart vaccine supply chain management system that revolutionised how vaccines were received, stored, and distributed to the last mile. It is a mobile, cloud-based application that caters to the needs of stakeholders across the vaccine supply chain and improves service delivery by ensuring rational distribution and equitable access to vaccines. An independent assessment conducted in 2018 showed that, in just four years since its pilot, eVIN saved over 90 million vaccine doses which would otherwise have been wasted, with a return on investment of US$2.91 on every dollar invested.[3]

The eVIN initiative was led by the Ministry of Health and Family Welfare (MoHFW), Government of India, with support from Gavi, the Vaccine Alliance. The MoHFW onboarded UNDP as a technical partner to design, develop, implement, and scale up the eVIN solution, given its experience with improving the health supply chain in over 70 countries. Active across all 36 states and union territories, eVIN's journey from 2014 to 2023 is not just a transition from paper to smartphone but demonstrates India's capabilities in the digital and technology sector. eVIN allows health centres to safely store their vaccines at the right temperature and allows people to access vaccines without fear of stockouts.

Today, eVIN boasts the use of leading technologies such as Big Data architecture to manage and process huge amounts of data and API-based development to ensure interoperability that allows for seamless exchange of information. The platform is built on open-source software solutions, making it a sustainable, scalable, affordable, and convenient technological intervention.

From Local to Global

These indigenous systems are linked to India's globally recognised digital public infrastructure, India Stack, placing the country at the forefront of global best practices in digital public health. India Stack refers to a set of digital public goods that are interoperable and scalable, and offer developers the opportunity to build applications utilising its open-source software. Although the project bears India's name, the vision of India Stack is not limited to a single country; it can be applied to any nation, both developed and emerging.

During its G20 presidency, India has been showcasing digital health innovations and digital public infrastructure that work for millions of people, improving the efficiency and quality of healthcare. India has also indicated its intent to offer such technologies to interested countries.

The COVID-19 pandemic highlighted the need to build digital public health infrastructure that makes quality healthcare services accessible for all. The world can take a leaf out of India's story to turn this into reality.

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III.

Emerging Themes in the Transformation of Public Health

An Unhealthy Climate:
The Intersection of Climate Change and Human Health

Robin Fears, Volker ter Meulen and Andy Haines

Climate change, attributable to human activity, is increasingly contributing to a global health crisis. There is considerable concern that the health and health equity of future and current generations is being put at risk to realise economic gains in the short term.

Although previous G20 and T20 outputs[1,2] have discussed, in various contexts, issues of health (e.g., pandemics, food and nutrition insecurity, objectives for resilient health systems) and climate change (mitigation solutions, new financial initiatives), there has been little appreciation of the benefits of tackling climate change and health priorities together. Previous S20 outputs[3] have described the impacts of climate change on health and offered potential solutions but there remains a worrying disconnect between available scientific evidence and its use in informing policymaking. The Indian G20 Presidency's focus on global health governance provides an important platform to emphasise the connected issues of climate change and health, integrating the strengths and perspectives of developing and developed countries alike.[4]

There is much to be done to raise the visibility of climate change and health policy issues at the global, regional and national levels. For example, the EU, a G20 member, has launched its Global Health Strategy but was criticised for lack of ambition on climate change because of the insufficiency of clearly-defined deliverables to tackle the adverse impacts of climate change on human health.[5] Unfortunately, current policy initiatives are often characterised by weakness in defining and quantifying targets. In a related context, the European Court of Auditors in February 2023 expressed concern[6] about the lack of impact of the Global Climate Change Alliance, partly attributable to difficulties in accessing relevant, local evidence. Policymakers must work more closely with the scientific community to strengthen objectives and procedures for generating and using robust evidence to inform strategic initiatives. Despite the accumulating evidence, little has been done in the international political arena to combat the health threats posed by climate change.[7]

Using the Evidence Base

The IPCC report[8] is the latest and largest evidence-based wake-up call reflecting the rapidly growing body of primary research literature and systematic reviews on the climate crisis. The Lancet Countdown collaboration,[9] and other international initiatives such as the InterAcademy Partnership (IAP) project,[10] aim to further raise awareness on the issue. The IAP is the global network of more than 140 academies of science, engineering and medicine (including most G20 nations); the recent inclusive project on climate change and health brought together diverse evidence on the adverse effects of climate change on physical and mental health, currently and projected into the future, and the potential for science-based mitigation and adaptation solutions.

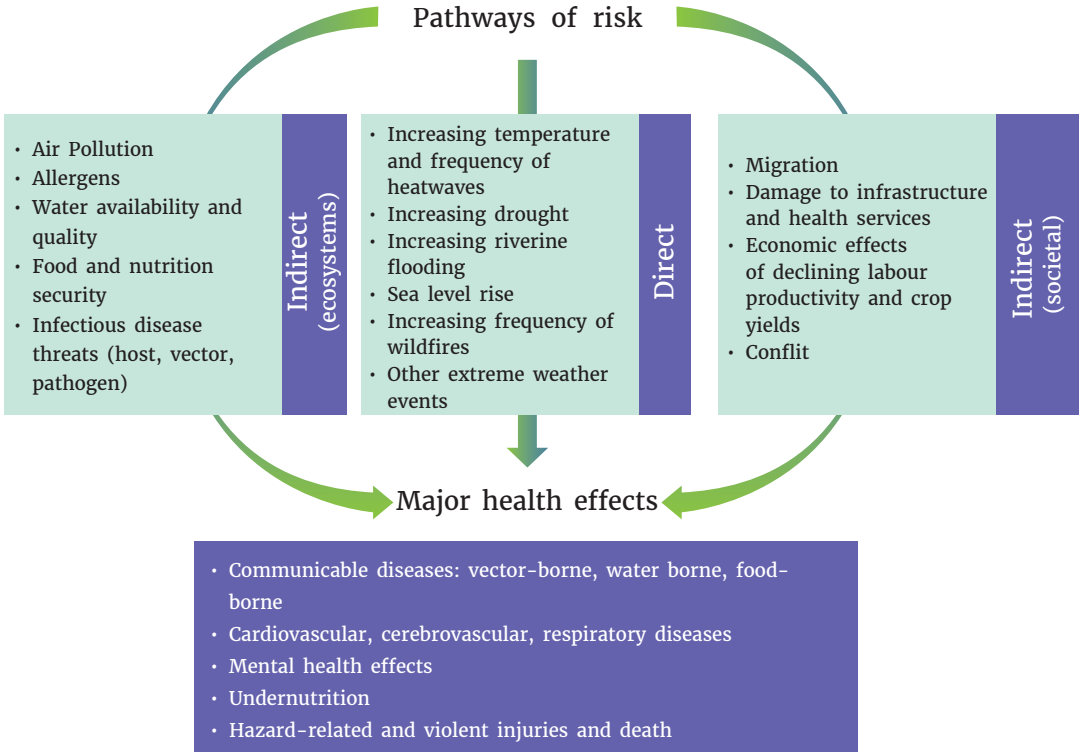
Project outputs also highlighted knowledge gaps and the skewed geographical distribution of available evidence that could be tackled by new research to inform public policy, innovation and practice. The global IAP report[11] draws many of its recommendations from four regional reports published by academic networks in Africa,[12] Asia,[13] the Americas,[14] and Europe.[15] A distinctive feature of the IAP project that can add value to other international studies is the encouragement of national science academies to

summarise evidence for their own countries and regions to drive the focus on both collective and customised solutions.

Multiple Pathways of Risk and Impact

Elucidating the intersection of climate change and human health involves using a complex framework partly summarised in Figure 1 and modified throughout by social determinants, for example influencing temperature-related mortality.[16]

Figure 1. Direct and Indirect Pathways for Climate Change Risks and Potential Effects on Health and Health Equity



Note: A detailed discussion can be found in the IAP reports.

Although there are uncertainties in attribution and extrapolation of effects, it is estimated, using data from 732 sites in 43 countries, that over 30 percent of heat-related deaths over recent decades can be attributed to climate change.[17] The implementation of adaptation and mitigation actions

could potentially prevent millions of premature deaths. For example, one modelling study compared the current pathways scenario with a sustainable pathways scenario resulting from climate mitigation actions designed to capitalise on the potential health co-benefits and consistent with the Paris Agreement. This resulted in an estimated annual reduction, across the nine countries studied, of 1.18 million air pollution-related deaths, 5.86 million diet-related deaths, and 1.15 million deaths due to physical inactivity by 2040.[18]

Key messages and recommendations from the IAP project on taking a systems-based approach to generating and using transdisciplinary science, are listed in Box 1.

Box 1. IAP's Messages to Policymakers

- Climate change is happening and is attributable to human activity. Climate change poses urgent challenges to development plans, growth and equity, and with risks to the integrity of societies, as well as to health and the environment.

- Climate change brings serious threats to human physical and mental health and health equity that are already apparent. Climate change is now impacting populations in diverse locations, but certain groups are increasingly vulnerable and experience a disproportionate burden of health effects. Equity is at the core of an effective response; solutions and their costs must be distributed fairly, and barriers to participation by those most affected must be dismantled.

- There is a need for better monitoring and surveillance of potential health impacts due to climate change across all countries, including assessment of the effects of other environmental changes (such as deforestation, pollution, freshwater depletion) that may interact with climate change to influence health.

- Rapid and decisive climate action could greatly reduce the long-term risks to health from climate change and bring near-term (co-)benefits for health, including through reduced air pollution. Every increment of heat matters: health risks are substantially lower if global temperature increases are limited to 1.5° compared to 2° C.

- In addition to the health, equity and environmental gains, 'net-zero carbon' development options can offer new economic opportunities, subject to capacities and governance.

- Many solutions are within reach using present knowledge; mitigation and adaptation experience is growing, but action is urgent and requires political will, sustained investment, and evaluation of effectiveness.

- The scientific community has important roles in generating new knowledge on effects of climate change on health and on appropriate climate mitigation and adaptation action, in countering misinformation and vested interests, and addressing equity in climate health responses. This requires international partnership and reform of the current geographical and other biases in designing, conducting and reporting research studies. Academies worldwide in the IAP network can do more to use their expertise and convening powers to bring together policymakers and the scientific community.

- While modelling studies can provide useful insights into the magnitude of benefits from adaptation and mitigation actions, there is a pressing need for better evaluation of implemented actions to quantify benefits, trade-offs and costs and to document facilitators and barriers to change.

- Climate change intersects with and exacerbates the impacts of other global challenges including COVID-19. The COVID-19 pandemic provides important lessons about responding to global challenges through cooperation and mobilisation of resources at large scale, for example international collaboration on research to develop and evaluate solutions.

In addition to the IAP global and regional reports, these points are discussed in further detail in other project outputs.[19,20]

Although there are unprecedented health threats, there are also opportunities to use scientific knowledge to inform policy and practice.

Mitigation and Adaptation

Both mitigation and adaptation solutions are essential but they have hitherto been applied in a fragmented way. If better integrated, they can do much to achieve resilient, net-zero emission societies. Mitigation solutions have historically not considered their direct effects on human health and well-being, but systematic literature review finds that demand-side solutions to climate change mitigation are consistent with high levels of well-being.[21]

The IAP reports discuss a range of mitigation examples (notably reduction of GHG emissions from fossil fuel combustion, agriculture and urbanisation) and their potential to deliver health co-benefits to those communities undertaking the mitigation. Recent multisectoral modelling studies[22],[23] indicate substantial benefits for public health, particularly in scenarios representing faster, greater change—for example where mitigation actions lead to changes in diet, household air pollution, and physical exercise. With its objective to "do no harm", the health sector must also hold itself accountable for its carbon footprint. Until recently, this has rarely been included in policy mitigation discussions, yet the sector's current carbon footprint is about 5 percent of national net emissions.[24],[25] National and global (e.g. WHO) initiatives to decarbonise the health sector that can also bring benefits for healthcare systems and health are discussed in further detail in the IAP reports.

The assessment of mitigation performance in G20 countries[26] using a composite Climate Performance Index demonstrates wide variation in climate action performance and identifies examples of good mitigation practice that could be shared more widely. However, in acting on these lessons learnt, it is important to ensure that health co-benefits are routinely taken into account when developing and applying indicators of mitigation performance.

Adaptation encompasses technological, behavioural, institutional, economic and societal approaches but the current evidence base for LMICs is limited,[27] as is understanding of the limits to adaptation.[28] Analogous to mitigation action, it is important to consider climate change adaptation across multiple sectors. Some examples are summarised in Table 1.

Table 1: Health Adaptation Solutions Worldwide

Hazard	Approaches to health adaptation
Heat	Improving effectiveness of heat-health early warning systems and targeting vulnerable groups (such as elderly and during pregnancy and childhood); innovation for building design, insulation and more sustainable cooling; supporting advances in regulation as well as policies and technologies for green space and infrastructure; addressing occupational health issues (such as advice on outdoor working).

Hazard	Approaches to health adaptation
Wildfires	Advice to identify, manage and treat health impacts, including targeting information to vulnerable groups (and their involvement in finding and implementing solutions) and recognising cross-border pollution threats; better understanding of different wildfire pollutants; avoiding use of fire to remove crop residues; reducing demand for commodities whose production drives wildfire-induced land clearance.
Flooding	Mapping areas at risk; improved urban planning and other land use, coastal defences, enlisting community participation; nature-based solutions (such as wetland and mangrove protection and restoration); behavioural adaptation; linkage with responses within Disaster Risk Reduction Framework and development of anticipatory policymaking.
Infectious diseases	Increased surveillance and early warning systems for vector-borne and emerging zoonotic diseases; reducing environmental exposure to vectors and pathogens, including modifying human behaviours; improving water, sanitation and food systems; innovation and increased access to diagnostics, therapeutics and vaccines; supporting fundamental research in advance of a crisis and promoting collaboration between public health and veterinary sectors.
Food and nutrition insecurity	Promoting healthy, environmentally-sustainable diets and ensuring that they are available and accessible to vulnerable groups; linking climate services and agricultural production with focus on climate-resilient nutritious crops; conservation of genetic resources, and breeding for improved resistance to environmental stresses and diseases.
Forced migration	Better linkage between policies for migration and health, including strengthening host country health systems to be climate-resilient and migrant-inclusive; addressing multiple problems in migrants' country of origin.

Note: Specific examples are provided in the four regional and global IAP reports and discussed in further detail elsewhere.[29]

Many of the adaptation actions may be customised at a local scale. However, there are often wider connotations including cross-border implications of health threats, such as those arising from air pollution, infectious diseases, and forced displacement. See, for example, the IAP project assessments for South and Southeast Asia.[30]

Focus on Climate Justice

Developed countries and their high-income populations, many found within the G20 membership, are responsible for a disproportionately large share of GHG emissions.[31] It is the lower-income countries, however, which suffer the greatest adverse effects of climate change on their economic growth[32] and on the health of their populations.[33,34,35] Difficulties in quantifying and attributing these climate injustices are compounded by imbalances in the geographical distribution of relevant research—biased away from characterisation of LMICs[36] —and in the use of research outputs to guide policy. The IAP project reports describe how academies worldwide can help in strengthening research systems and in framing research priorities, supporting targeted capacity building and partnerships in Africa,[37] Asia,[38] and the Americas.[39] The global reach of IAP is valuable in helping to represent the voices of those from LMICs and other vulnerable groups (for example, Indigenous Peoples in the Americas) who are not always heard during the processes whereby evidence informs international policy development and governance.

Climate justice solutions also depend on transforming present funding pathways in support of health protection and promotion. Global finance for climate adaptation across all sectors is only a small fraction of the finance for mitigation actions and finance flows to the health sector are still particularly low.[40] Furthermore, current spending on harmful subsidies for fossil fuels and unsustainable agriculture must be redirected to support, for example, universal health coverage, public transport and affordable, healthy food choices.[41,42]

Health metrics must be included in the Global Stocktake of the Paris Agreement.[43] Most damage functions used to monetise impacts of carbon

emissions have been developed by economists without participation by health researchers, who must now become more involved.[44] Climate "loss and damage" refers to the unavoided climate change impacts, both from extreme weather and slow-onset events, for which G20 countries bear a major responsibility. The 27th Conference of the Parties (COP27, international climate negotiations) agreed further commitment for loss and damage reparations, including new funding.[45] However, much is still uncertain about reparation mechanisms and the scientific community has an important role to support operationalisation of loss and damage arrangements by developing a robust evidence base and advising on its use, assigning core roles to health issues and the experience of LMICs.[46] We suggest that IAP and its academies worldwide can help by sharing research evidence, identifying priorities and acting locally to guide and monitor implementation of loss and damage funds for health and other solutions.[47]

Recommendations to the G20

The G20 and G7 have often been criticised for their failures to act on previous promises made on global health governance, including those relating to the climate crisis. There was criticism recently from those in a collective of young global health scholars and professionals who may be among the next global health leaders.[48] Transformative reform of intergovernmental responsibilities requires a practical recommitment to prioritise health equity in all countries. G20 collectively has the responsibility and the financial and other resources to act with solidarity, to increase the momentum on health and health equity goals with particular focus on vulnerable communities. G20 also embodies the capability to integrate multiple levels of governance, between political institutions and public authorities at national, regional and global levels, and their intersections with social infrastructures. The multiple potential benefits of taking a regionally-led approach to health policy, in addition to integrating climate change and health into the national and global levels of governance,[49] is discussed in further detail in a Policy Brief for the T20 Task Force 6.[50] The longstanding goal for African Union (AU) accession to the G20[51] can strengthen G20 credibility and empowerment in various ways, including the selection of research priorities and use of research outputs in policy and practice.

Transformative change to systems is essential and we highlight the following priorities where G20 members are well-placed to act:

- *Providing leadership for net-zero societies*, sharing and acting on the lessons of good practice already identified by G20 assessments,[52] implementing previous G20 commitments for reform of financial instruments, and ensuring a cross-sectoral approach to mitigation that capitalises on the health co-benefits of action and includes the healthcare sector.

- *Identifying and implementing evidence-based adaptation solutions and quantifying the effects*, with triple-win objectives for health, equity and the environment, empowering and working with vulnerable populations and local communities (including Indigenous Peoples)[53] to understand the limits to adaptation, the potential for maladaptation and the opportunities for scaling up interventions.

- *Bringing together the evidence necessary to understand and efficiently target climate change loss and damage reparations*, this requires new research efforts, with inclusion of the health sector. Stronger links between the policymaking and scientific communities can help identify national and local priorities, tackle them and monitor the impacts, feeding back into future policy development.

- *Recognising the value of regional policy initiatives*, to bridge between national/local and global levels of governance,[54] to build critical mass in evidence generation and synthesis, to address cross-border health threats.[55] The current regional policymaking institutions in the EU and AU provide valuable models for building regional policy coordination in all regions.

- *Addressing the current imbalances in the research enterprise worldwide*, by greater inclusivity in design, conduct and use of research across multiple scientific disciplines and all countries, developing international partnerships to strengthen systems for research, innovation, education and training.

- *Adopting the Planetary Health approach*, encompassing the health of human populations and the state of natural systems on which human health

depends.[56,57] By recognising the safe environmental limits within which species can flourish, the term 'Planetary Health' is of wider scope than the One Health term used previously, which customarily applied to human-other animal interdependencies and communicable diseases.

In conclusion, we emphasise that despite considerable diversities in geography, climate change hazards, socio-economic status, and health systems, as well as in scientific infrastructure, research capabilities and the extents to which research outputs are used to guide policy and practice—there are commonalities and opportunities to foster mutual learning and effective action across the G20. Climate change is a health crisis as well as an environmental and economic one. The imperative is to act on the transdisciplinary evidence to promote and integrate adaptation and mitigation solutions to tackle the adverse effects on health, and to stimulate and guide loss and damage funds.

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The Rise and Rise of Non-Communicable Diseases

Mansi Chopra, Tina Rawal, and Monika Arora

Non-communicable diseases (NCDs) are chronic health conditions that place a significant burden on global health, development, and the economy, killing nearly 41 million people each year or 74 percent of all deaths globally. NCDs encompass a range of diseases, including cardiovascular diseases (CVDs), diabetes, respiratory diseases, certain types of cancer, and mental disorders (UNSSCN 2018).

NCDs disproportionately affect populations in low- and middle-income countries (LMICs), where more than three-quarters of the global NCD deaths (31.4 million) occur. The primary NCDs responsible for these deaths include CVDs (17.9 million deaths, accounting for 44 percent of all NCD deaths and 31 percent of all global deaths); cancers (nine million deaths, 22 percent of all NCD deaths, and 16 percent of all global deaths); chronic respiratory diseases (3.8 million deaths, nine percent of all NCD deaths, and seven percent of all global deaths); and diabetes (1.6 million deaths, four percent of all NCD deaths and three percent of all global deaths) (WHO 2018).

Overweight and obesity contribute to more global deaths, compared with underweight. The World Obesity Atlas (WOA) reported that the prevalence of obesity (BMI ≥30kg/m^2) alone is expected to rise from 14 percent to 24 percent of the population from 2020 to 2035 (WOA 2022). Childhood obesity has risen from four percent in 1975 to over 18 percent in 2016, leading to increased risks in adulthood and immediate health challenges, such as early signs of cardiovascular diseases, insulin resistance, and psychological effects (WHO 2023). These conditions are strongly influenced by risk factors that include unhealthy diets, physical inactivity, alcohol and tobacco use, and exposure to air pollution (WHO 2022). Nearly 40 percent of NCD deaths are premature (i.e. occur before the age of 70 years); losing individuals in their productive years can have a devastating impact on families, society, and the economy.

The United Nations (UN) has set a target of a 25-percent reduction in mortality from NCDs by 2025. The World Health Organization (WHO) has also approved a new and stronger global roadmap to tackle NCDs, the Global Action Plan for the Prevention and Control of NCDs 2013-2030, which focuses on strengthening health systems, promoting healthier environments, ensuring access to essential medicines and technologies, and enhancing data and surveillance (WHO 2023). Additionally, the World Health Assembly has approved global guidelines for NCDs, which include 90 interventions that target key risk factors and associated diseases. These interventions, with 58 of them having cost-effectiveness estimates, aim to address use of tobacco and alcohol, unhealthy diets, physical inactivity and four critical NCDs (WHO 2022). Comprehensive interventions targeting prevention at all levels, management and enforcing both demand and supply reduction measures for unhealthy commodities, are essential to effectively combat NCDs as voluntary measures alone have shown limited impact on health behaviour change.

The impact of the commercial determinants of health ("systems, practices, and pathways through which commercial actors drive health and equity"[a]) is a critical area of concern; it is highlighted in the Lancet Series, which provides recommendations and frameworks to foster a better understanding

a Pledge F. Unravelling the commercial determinants of health. Lancet. 2023 Mar 23;401(1131):00590-1.

of the diversity of the commercial world, potential pathways to health harms or benefits, and the need for regulatory action and investment in enterprises that advance health, well-being, equity, and society (Gilmore et al. 2023). The NCD epidemic and four industry sectors (i.e. tobacco, ultra-processed food, fossil fuel, and alcohol) already account for at least one-third of global deaths, illustrating the scale and the huge economic cost of the challenge.

The Tobacco Control Research Group (TCRG) at the University of Bath in the UK, through their research, have exposed misconduct and marketing tactics employed by the tobacco industry, leading to significant impacts on global tobacco control initiatives. Their investigation has revealed targeted advertising, smuggling operations, and interference in public health policies while their evaluation of 'smoke-free' legislations has provided empirical evidence of the effectiveness (or lack of it) of such regulations. In addition, the commercial determinants of health affect everyone, but young people are especially at risk. Unhealthy commodities worsen pre-existing economic, social, and racial inequities (WHO 2023). In India, the Public Health Foundation of India (PHFI) in collaboration with UNICEF conducted a content analysis of food advertisements on popular television channels among children and youth in India. The results revealed that 88.6 percent of 1,735 food advertisements were for high in fat, salt and sugar (HFSS) foods and a higher proportion of food advertisements were seen on children's channels (38 percent) than on youth channels (23 percent) ($P<0.001$). The study highlighted that a large majority (90-95 percent) of advertisements broadcast on television channels targeting children and youth were of HFSS foods (Bassi, Bahl et al. 2021). Multisectoral convergence and collaborations are needed to address the commercial determinants of health.

Health, Development, and Economic Burden of NCDs in the G20 Countries

The burden of NCDs varies among countries, with G20 nations, including India, experiencing significant challenges. Within the G20, Germany has the highest incidence of NCDs, estimated at 39.6 percent; it is followed by Italy (39.2 percent), the UK (38.3 percent), France (38.2 percent), and Japan (37.8 percent). In comparison with these countries, India's NCD

incidence is at 32.8 percent (IHME 2020); this may be primarily attributed to low reporting rates and inadequate coverage, both geographically and demographically. Most national and subnational surveys fail to report comprehensive data regarding all NCD risk factors, thereby contributing to underreporting (Nethan et al. 2017).

NCDs have a profound impact on health, hindering human development and exacerbating existing health inequalities. These affect physical and mental well-being, limit educational opportunities, and create socioeconomic disparities, impeding overall economic growth and societal progress (UN 2019).

The economic burden of NCDs in the G20 countries is substantial. The global cost is estimated to be US$47 trillion between 2010 and 2030 (Bloom et al. 2012); this includes direct expenses related to healthcare services and treatments, as well as indirect costs arising from productivity loss and strain on healthcare systems. The COVID-19 pandemic has further highlighted the vulnerability of individuals with underlying NCDs as they face an increased risk of severe illness and complications (NCDA). Catastrophic health expenditure and out-of-pocket spending, related to NCDs, have drawn attention to prioritising preventive action. Notable disparities exist among countries with regard to factors such as political commitment, resource allocation, funding for prevention, health system infrastructure, and implementation of interventions across countries for NCD prevention and control.

Addressing the burden of NCDs requires comprehensive and multisectoral approaches. The G20 countries need to prioritise preventive measures, promote healthy lifestyles, implement effective health policies, and strengthen healthcare systems. Investment in research, surveillance, and early detection strategies is crucial for timely interventions and better management of NCDs. International cooperation and collaboration among the G20 countries can facilitate knowledge-sharing, best practices, and resource mobilisation. Achieving universal health coverage (UHC) is essential for addressing NCDs, ensuring equitable access to prevention, treatment, and care services for all individuals. By integrating NCD prevention and management into UHC frameworks, countries can effectively reduce the burden of NCDs and improve population health outcomes (WHO 2022).

The Rise of NCDs

NCDs have become the primary cause of deaths worldwide, making them a significant health concern. Around 80 percent of NCDs can be prevented by addressing common risk factors, such as tobacco use, physical inactivity, unhealthy diet, excessive alcohol consumption, and exposure to air pollution (UNSSCN 2018).

Prevalence of NCDs in India Over Time

Most G20 countries show an upward trend in the prevalence of NCDs and associated risk factors, except for a select few. Table 1 and Table 2 highlight the percentage change in the causes of deaths due to NCDs in the G20 countries and the DALYs due to risk factors of NCDs, and the percentage change from 2009 to 2019.

Table 1. Percentage change in the top causes of the total number of deaths from 2009 to 2019, according to the GBD country health profiles data

	Ischemic heart disease	Stroke	COPD	Diabetes	Lung cancer	Alzheimer's	Colorectal cancer	Chronic kidney disease	Cirrhosis
Argentina	9.4	12.7	17.8	17.6	13.5	20.5	24.1	18.9	24.9
Australia	8.1	13.1	35.5	75	17	39.4	26.2	44.3	-
Canada	16.9	20.6	30.8	6.8	14.1	45.6	28	41.6	-
Germany	9.5	10.7	28.5	15.8	-0.8	38.2	-12.1	42.7	-
France	7	10.9	23.4	-	8	48.8	14.3	-	
Japan	14.6	15.8	29	-	14	49.6	23.9	24.6	-
Italy	7.1	8.3	15.7	10.2	-	30.4	8	30.5	-
Saudi Arabia	23.3	16.9	20.4	37.4	-	-		28.8	28.8
South Korea	33.4	16.6	-	7.7	40.5	74.3	40.4	-	10.9
The UK	-0.1	1.6	17.5	-	9.8	16.8	17.1	-	-
The US	12.5	18.9	25.6	9.1	12.9	21	20.3	35.6	23.5
Brazil	18	14.2	28.2	33.6	-	49.3	-	41.4	14.1
China	39.3	12.4	-5.4		36.9	54.1	37.7	-	-
India	40.8	28.4	35.4	54.2	-	-	-	-	14.3
Indonesia	28.3	25.9	10.7	49.9	42.4	-	-	-	8.2
Mexico	48	25.8	36.7	53.4	-	51.4	-	39.5	32.1
Russia	-12.1	-12.9	1.7		-1.2	44.5	5.5		-12.5

	Ischemic heart disease	Stroke	COPD	Diabetes	Lung cancer	Alzheimer's	Colorectal cancer	Chronic kidney disease	Cirrhosis
South Africa	0.3	-6.2	-	11.8	-	-	-	-	
Turkey	21.5	11.8	18.1	3.9	38.3	35.6	44.9	37.7	

Source: https://www.healthdata.org/results/country-profiles

Table 2. G20 top risks contributing to the total number of DALYs and percentage change, 2009–2019, all ages

	Brazil	China	India	Indonesia	Mexico	Russia	South Africa	Turkey
Tobacco	-2.1	9.6	13.5	21.1	12.4	-15.4	-20.0	12.5
High blood pressure	13.8	21.8	23.6	23.8	39.9	-18.7	-3.2	11.1
High BMI	27.5	45.5	78.1	66.1	46.3	-9.9	0.084	29.5
Dietary risk	15.1	15.3	28.9	21	44.1	-21	-0.4	17.4
High fasting plasma glucose	32.4	15.4	61	50	46.3	-7.3	0.086	18.5
Alcohol use	3.6	8.7	19.3	-	29.5	-36.6	-19.5	-
Kidney dysfunction	26.6	15.7	-	22.5	37.7	-12.8	-	23.7
High LDL	11.3	26.9	29.7	26.5	40.9	-22.1	-	3
Malnutrition	-36.3	-38.2	-39.8	-41.4	-33.8	-	-33.5	-34.9
Drug use	-	-	-	-	-	-16.1	-	
Air pollution	-19.8	-3.4	-7.8	-9.7	-	-42.4%	-26.4	3.5
Water, sanitation, and hygiene (WASH)	-	-	-42.8	-38.7	-	-	-39.6	-

Source: https://www.healthdata.org/results/country-profiles

The WHO interventions, commonly referred to as Appendix 3 WHO Global NCD Action Plan 2013-2030 or the 'best buys', are critical to achieving SDG 3.4, which calls for reducing premature mortality due to NCDs by one-third by 2030, compared with the 2015 levels. The 'best buys' strategies, identified by WHO to effectively combat NCDs, include promoting tobacco

control, implementing salt intake reduction measures, restricting harmful alcohol consumption, encouraging physical activity, and improving access to essential medications for NCDs. These evidence-based interventions have been recognised as cost-effective and impactful for reducing the burden of NCDs and promoting healthier populations worldwide (WHO 2017). However, these are off-track, with WHO reporting annual rates of reduction hovering at one percent.

Health Promotion and Prevention of NCDs

Health promotion entails supporting people to change their lifestyle and move towards a state of optimal health. Lifestyle modifications can be facilitated through a blend of strategies to raise awareness, change behaviour, and create an environment that supports good health practices (Viner and Macfarlane 2005). According to WHO, "health promotion is the process of enabling people to increase control over, and to improve their health." Various theories and models guide health promotion and disease prevention programmes. Health promotion mostly focuses on multilayered and complex interactions that create or limit health and well-being, requiring knowledge and action that match this complexity (Norman 2009). Models or theories define interconnected concepts related to health behaviour or health conditions, utilising validated constructs, and are systematically built. Some of the commonly used models include the Social Ecological Model, the Health Belief Model, the Stages of Change Model, Social Cognitive Theory, and the Theory of Reasoned Action/Planned Behaviour (Taylor et al. 2006). Currently, nudge interventions and behaviour change models/techniques are also being used to prevent and control NCDs (Murayama et al. 2023).

Health Promotion Approaches to Prevention and Control of NCDs

Non-communicable diseases and their metabolic and behavioural risk factors can be prevented and managed. The strategies that need to be strengthened involve individual (lifestyle management), societal (awareness management), national (health policy decisions), and global (health strategy) elements, with targeted actions, such as multisectoral partnerships, knowledge and information management, and the whole-of-society approach (Budreviciute,

Damiati et al. 2020). Health in All Policies (HiAP) emphasise the need for comprehensive policy action in all sectors and at all levels of government, and private and civil society partnership at multiple levels to address health inequities, risk factors, and determinants of NCDs (Lin and Carter 2013). Developed in response to the globalisation of the tobacco epidemic, the landmark WHO Framework Convention on Tobacco Control is one of the most widely adopted UN treaties with 182 parties to the treaty and 168 signatories. It provides a comprehensive strategy for combatting the tobacco epidemic and sets out a broad range of evidence-based measures to reduce tobacco demand (Articles 6–14) and supply (Articles 15–17) (WHO 2003).

The setting-based approach recognises and addresses the context of a 'setting', advances health improvement at the social level within which people live, work, and play, and utilises interventions, considering the needs and capacities of people in different settings (Poland et al. 2009). WHO defines 'setting' as "the place or social context in which people engage in daily activities in which environmental, organizational, and personal factors interact to affect health and well-being". Thus, settings act as vehicles to reach individuals, access services, and synergistically combine interactions throughout the wider community.

Several research studies have used the settings-based approach to improve health behaviours. For example, the Boost study was conducted to ensure a persistent increase in fruit and vegetable consumption among 13-year-olds by implementing a school- and community-based, multicomponent intervention, guided by theory, evidence, and practice. Programme activities combined environmental and educational strategies, and focused on increasing access to fruits and vegetables in three settings: schools, families, and the local community (Krølner et al. 2012).

Box 1. Lessons in Tobacco Control: A School-Based Intervention – Mobilising Youth for Tobacco-Related Initiatives in India (MYTRI)

Project MYTRI, a school-based intervention that aimed at preventing tobacco use among adolescents in urban Delhi and Chennai, India, involved over 14,000 students in 32 schools. MYTRI was a tobacco prevention

intervention, engaging adolescents, teachers, and parents in innovative activities to enhance knowledge, attitude, and skills, related to tobacco control, and advocate for tobacco-free schools, homes, and communities. MYTRI's robust scientific design demonstrated the effectiveness of school-based interventions for curbing tobacco use among Indian adolescents by reducing the current tobacco use by 17 percent in the intervention group, controlling their future intention to use tobacco, and enhancing their health advocacy skills. Continuous action, based on the evidence from Project MYTRI, with the Government of India, the World Health Organization, and international scientific communities has resulted in the inclusion of school health programmes on tobacco control as a component of the National Tobacco Control Programme that was launched in 2007.

Source: Arora et al. 2011

Early Detection and Management

Prevention and investing in better management are the key components of NCD response. NCD management includes detection, screening, treatment of diseases, and providing people in need with access to palliative care. High-impact, essential NCD interventions can be delivered through a primary healthcare approach for strengthening early detection and timely treatment. Evidence shows such interventions make for excellent economic investment: if provided early to patients, these can reduce the need for more expensive treatment. Countries with inadequate health insurance coverage are unlikely to provide universal access to essential NCD interventions (WHO 2023). India has the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (launched in 2010), now known as the National Programme for Prevention and Control of Non-Communicable Diseases, which is part of the National Health Mission. The programme focuses on strengthening infrastructure, human resource development, health promotion and awareness generation for prevention, early diagnosis, management, and referral to an appropriate level of healthcare facility for treatment of NCDs (MoHFW 2023).

Access and Treatment

To improve access to treatment of NCDs, the WHO Global Diabetes Compact is available (WHO 2021) – it has a vision to reduce the risk of diabetes

and ensure that all people, who are diagnosed with diabetes, have access to equitable, comprehensive, affordable, and quality treatment and care. In May 2023, the Government of India (GoI) launched an initiative, seeking to ensure that at least 75 million people, living with hypertension and diabetes across the country, are on treatment by 2025. In addition, the GoI has realigned and renamed the National Programme for Prevention and Control of NCDs for 2023–2030, and has released an updated Operational Guidelines with expanded scope of services. For screening and treatment, with support from the Ministry of Health and Family Welfare, the Clinical Decision Support System has been fully integrated with the national NCD portal.

Capacity-building

The complex NCD challenges today require scientific competence nationally and internationally, with a cadre of researchers/programme managers, equipped with appropriate research training and technology-enabled health support mechanisms, who can conduct research in LMICs (Sturke et al. 2016). Comprehensive training programmes to enhance the capacity of front-line health workers and healthcare professionals for NCD prevention and management are implemented globally, including in India. However, globally, there is a shortage of trained healthcare professionals – it is estimated that there will be a shortage of nearly 10 million trained professionals by 2030.

Health Information System and Surveillance

A well-functioning health information system is crucial for monitoring NCDs, collecting data on risk factors, tracking disease trends, and evaluating the effectiveness of interventions. Robust data collection and analysis play a vital role in informing evidence-based policies and interventions for the prevention and control of NCDs (WHO 2023). WHO-supported surveys, such as STEPS[b], GSHS[c], GATS,[d] and GYTS,[e] provide valuable information on NCD risk factors and related behaviours, contributing significantly to informing

b STEPwise approach to NCD risk factor surveillance

c Global school-based student health survey

d Global Adult Tobacco Survey

e Global Youth Tobacco Survey

and improving public health policy. In the G20 countries, including India and Indonesia, all WHO-supported surveillance systems are implemented. In addition, several countries have their own national surveys and registries to collect information on NCDs and associated risk factors. India has the ICMR-National Non-Communicable Disease Monitoring Survey to assess national NCD targets and indicators.

Box 2 Initiatives to Address Risk Factors of NCDs in India

Tobacco Control and Other Addictions: India has made significant progress on regulating tobacco products, including implementing the Indian tobacco control law [Cigarettes and Other Tobacco Products Act 2003 (COTPA)], the National Tobacco Control Programme, and a nationwide ban on electronic cigarettes. India is the only country globally to regulate tobacco use exposure on screen by enforcing strict rules in movies and television programmes which has recently been extended to online streaming programmes (Arora, Nazar et al. 2021, MoHFW 2023).

Alcohol Control: Alcohol control policies in India vary across states, with some jurisdictions imposing a ban on alcohol. The introduction of a National Alcohol Control Policy is necessary, focusing on restrictions on advertisements, promotion, and sponsorship, banning public drinking, regulating locations of liquor shops, and setting a uniform minimum legal drinking age. Levying excise duty on alcohol and enforcing health warnings on alcohol bottles are also important measures.

Unhealthy Diet: The National Nutrition Strategy acknowledges the triple burden of malnutrition (undernutrition, overweight/obesity, and micronutrient deficiencies) and puts emphasis on nutrition education, dietary diversity (2023 declared as the International Year of Millets), and healthy lifestyle to address malnutrition and associated chronic conditions. However, policies to curb consumption of processed and high-fat, sugar, and salt (HFSS) foods need to be strengthened; these include evidence-based regulations and enforcement mechanisms.

Physical Inactivity: The Fit India Movement, launched by the Ministry of Youth Affairs and Sports, promotes fitness protocols and physical education in schools. However, more comprehensive actions are needed to promote physical activity across different settings, such as educational institutions, workplaces, and residential areas. A robust National Multisectoral Physical Activity Policy, supported by evidence-based interventions and dedicated infrastructure, is crucial to address physical inactivity effectively.

Air Pollution: To combat poor air quality levels in India, there are various governmental policies and programmes in place. These programmes and policies are being implemented under the aegis of key ministries and agencies, including the Ministry of Environment, Forest, and Climate Change (MoEFCC), the Ministry of Health and Family Welfare (MoHFW), the Central Pollution Control Board (CPCB), and the National Centre for Disease Control (NCDC). The National Air Quality Monitoring Programme (NAMP), the National Clean Air Programme (NCAP), and the National Programme for Climate Change and Human Health (NPCCHH) are among the key programmes aiming to mitigate this threat to human and planetary health in India. To reduce exposure to indoor air pollution, the Indian government has also launched initiatives like Unnat Chulha Abhiyan, Pradhan Mantri Ujjwala Yojana (PMUY), and PAHAL (Pratyaksh Hanstantrit Labh) Gas Scheme to make cleaner sources of fuel available for cooking purposes.

Overall, while India has taken several measures to address NCD risk factors, further action is needed to strengthen enforcement, enhance regulations, and implement evidence-based policies for tobacco and alcohol control, and promotion of healthy diets and physical activity.

Best Practices for Health Promotion in NCD Prevention and Management

Meaningful engagement of people living with NCDs is crucial for an effective response to addressing the challenges. People living with NCDs can contribute in multiple ways and act as role models and equal and valuable partners for planning and executing initiatives to advance efforts to prevent and manage NCDs. This is a key opportunity to harness the power of community knowledge to tailor the priorities, programmes, and practices so that they are contextually feasible, appropriate, and attractive to the target populations. The WHO Framework for Meaningful Engagement of People Living with NCDs and Mental Health and Neurological Conditions was released in May 2023. It provides practical guidance and actions to operationalise meaningful engagement (WHO 2023), and contributes to advancing understanding, knowledge, and action regarding meaningful engagement and related participatory approaches from an evolving evidence base. Furthermore, the Global Charter on Meaningful Involvement of People

Living with NCDs developed by NCD Alliance is based on the principle that people living with non-communicable diseases, including care partners (also known as carers or caregivers), should be meaningfully involved in every step of decision-making that affects their lives (NCDA 2017).

Box 3 India Advocacy Agenda of People Living with NCDs

The India Advocacy Agenda of People Living with NCDs (PLWNCDs) was developed as part of the Healthy India Alliance's partnership with the NCD Alliance, drawing on the Our Views, Our Voices initiative to promote meaningful involvement of people living with NCDs in the NCD response, at subnational, national, and global levels. The Advocacy Agenda is guided by the mandate of universal health coverage to 'Leave No One Behind' and has received inputs from PLWNCDs from all the four regions of the country. The Advocacy Agenda calls for the highest level of political support to put the needs of people living with NCDs at the centre of NCD policy and practice in India.

Source: Developed as a part of the Healthy India Alliance's (HIA) partnership with the NCD Alliance.

Multisectoral Action Plan for Prevention and Control of NCDs

To meet SDG 3.4, comprehensive action plans at the national level are required to address the existing as well as emerging risk factors of NCDs and provide evidence-based recommendations for 'best-buy' policies and

action plans to control the incidence of NCDs. The WHO Global Action Plan for the Prevention and Control of NCDs 2013–2020 (extended to 2030) provides countries, international partners, and the Organization with a roadmap and a menu of policy options which, when implemented collectively between 2013 and 2030, will contribute to the progress on meeting the nine global NCD targets, including the one seeking to reduce premature deaths from NCDs by one-third by 2030. The key strategic priorities include:

- political commitment, leadership/governance, lobbying, and partnership;
- health promotion and risk reduction, lifestyle modification;
- strengthening the health systems and delivery of basic healthcare services for NCDs; and

- progress tracking, monitoring and evaluation, and implementation research.

WHO proposed an implementation roadmap for 2023–2030 to assist its member states in implementing, as appropriate, for the national context, actions to achieve the nine voluntary global targets for NCD prevention and control through the six objectives of the WHO Global NCD Action Plan 2013–2030.

In recent times, there has been a steady rise in collaborations with influencers, promoting health on social media. The influencer market in India has seen substantial growth, particularly in the health and wellness sector. Thus, governments worldwide are introducing regulations to govern the influencer market, with India mandating disclosure of qualifications for health-related advice. Failure to comply may lead to legal consequences under consumer protection law. Similar regulations have been implemented in other countries. For instance, photoshopped content needs to be declared in Norway and scientific evidence behind health-related claims of wellness influencers (WHO 2023) is demanded by the US authorities.

Optimising Technology to Address NCDs

Effective health technologies, including medicines, vaccines, diagnostics, and delivery systems, are essential for managing and preventing NCDs, and achieving UHC and sustainable health systems. Culturally tailored, low-cost, technological innovations and government-led initiatives, such as India's mCessation and mDiabetes programmes, can address social, policy, and environmental challenges, promoting cardiovascular health and advancing health equity in the process. The Integrated Tracking, Referral, Electronic decision support, and Care coordination (I-TREC) program combines multiple evidence-based interventions: an electronic case record form (eCRF) to consolidate and track patient information and referrals across the publicly-funded healthcare system; an electronic clinical decision support system (CDSS) to assist clinicians to provide tailored guideline-based care to patients; a revised workflow to ensure coordinated care within and across facilities; and enhanced training for physicians and nurses regarding non-communicable disease (NCD) medical content and lifestyle management

(Patel, Sharma et al. 2020). It is vital to ensure collaboration among governments, the private sector, academia, and IT specialists, along with the development of a regulatory framework and monitoring mechanisms to ensure effective utilisation of technology (Prabhakaran et al. 2019).

Policies and Strategies for Addressing NCDs

Prevention and control of non-communicable diseases have become a priority for the G20 countries, including India, leading to the implementation of various evidence-based policies and strategies. These efforts have aimed to address the rising burden of NCDs and reduce their impact on public health. Several important policies and strategies have been implemented worldwide. Some of the policies are highlighted below.

Tobacco Control Policies: G20 countries, including India, have implemented several policies to control tobacco consumption. Notable milestones include the adoption of comprehensive tobacco control measures, such as smoke-free policies, ban on tobacco advertising, and graphic health warnings on tobacco packages (WHO 2021). Australia stands out as a success story with the introduction of plain packaging and prominent pictorial warnings, along with India enforcing 85% Pictorial Health Warnings on front and back of tobacco product package leading to a significant decline in smoking rates (Moodie et al. 2022). India has made significant progress on regulating use of tobacco products, as indicated in the case studies mentioned above (Ghose and Datta 2018).

New Zealand's Tobacco endgame strategies including Smokefree Environments and Regulated Products (Smoked Tobacco) Amendment Bill outlines three crucial measures: mandating very low-nicotine cigarettes, large reduction in the number of outlets selling tobacco, and the introduction of a Smoke Free Generation (SFG) policy, which aims to reduce smoking prevalence equitably to below five percent (and as close to zero percent as possible) among all population groups by 2025. The Smoke Free Generation (SFG) policy will frame smoking as socially unacceptable, prevent youth sales over time, and help ensure smoking prevalence can never rise again. The. (Hoek et al. 2022).

Salt Reduction Programmes: High salt intake is a major risk factor for hypertension, a leading cause of NCDs. Several G20 countries, including Argentina, Canada, and the United Kingdom, have implemented salt reduction programmes to combat this issue. These focus on promoting healthier diets, food reformulation, and raising awareness about the risks associated with excessive salt consumption (WHO 2020). The successful implementation of these initiatives has led to a decline in salt intake and contributed to a reduction in hypertension rates (He et al. 2013, Trieu et al. 2015).

Warning Food Labels for Ultra-Processed Food**:** Chile has been at the forefront of implementing comprehensive policies to combat nutrition-related non-communicable diseases, including front-of-package warning labels, marketing restrictions with regard to children, and banning in-school sales of unhealthy foods and beverages. After the implementation of these measures, a significant decline in the overall purchase of calories, sugar, saturated fat, and sodium was observed, highlighting the potential impact on health (Taillie et al. 2021). Chile witnessed a 26.7 percent reduction in sugar purchase, a 36.7 percent decline in sodium purchase, and a 23.8 percent drop in calorie purchase, two years after the labels were implemented.

Healthy Food Promotion: Unhealthy diets contribute to the development of NCDs, particularly obesity, diabetes, and cardiovascular diseases. To address this, G20 countries, including India, have implemented policies to promote healthy eating habits and reduce the consumption of unhealthy food. The Eat Right India campaign, launched by the Food Safety and Standards Authority of India (FSSAI), is a significant milestone in this regard (FSSAI 2021). The campaign focuses on improving food safety, encouraging balanced diets, and reducing intake of processed and junk food. It underscores the importance of nutrition education and raising awareness about healthier food choices. Several countries, such as Canada, Mexico, and the UK, have implemented sugar tax, front-of-pack labelling, advertising restrictions for unhealthy foods, and fiscal measures to discourage consumption of sugary drinks. Such measures as front-of-package labelling schemes have been made mandatory in Chile, Mexico, Peru, Uruguay, Ecuador, Israel, Iran, Sri Lanka, and Thailand while labels will soon be compulsory in Argentina, Colombia,

Brazil, Venezuela, and Singapore, with others following suit. However, in most cases, labels are still voluntary, which means producers of unhealthy food products can choose to not include the labels.

Physical Activity Promotion: The G20 countries, have recognised the importance of promoting physical activity and have implemented policies to encourage active lifestyle. These policies include developing infrastructure for sports and recreational activities, promotion of physical education in schools, and organising campaigns to raise awareness about the benefits of exercising regularly. For example, the Fit India Movement, launched by the Government of India, aims to encourage citizens to adopt active lifestyle and prioritise physical fitness. Additionally, the Ministry of AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homoeopathy) is the nodal ministry for promoting yoga, which brings about harmony in all areas of life and is known for its significant role in preventing diseases, promoting health, and treating several disorders, related to lifestyle.

Universal Health Coverage: Achieving UHC is essential for effective NCD prevention and control. The G20 countries, have made significant progress on expanding access to quality healthcare services, including NCD prevention, diagnosis, management, treatment, and referral. The establishment of comprehensive health insurance schemes and the provision of affordable NCD medications have contributed to improving healthcare access and reducing the financial burden of NCDs on individuals and families.

Conclusion

Despite the initiatives undertaken by the G20 countries, challenges remain; these arise from various factors that affect prevention, control, and management of NCDs. First, the high prevalence of NCD risk factors observed in the G20 countries, including India, contributes to the incidence of the most harmful NCDs in people residing in these countries, thereby leading to health, development, and economic burden. Preventing NCDs needs to be prioritised at all levels as this would be most cost-effective strategy. Second, health system capacity and infrastructure present challenges to addressing NCDs.

Third, disparities in income, education, and living conditions contribute to unequal distribution of NCD burden within and across the G20 countries. Furthermore, the globalisation of unhealthy products and marketing practices is a veritable threat as well. The multisectoral nature of NCDs necessitates coordination and collaboration among various sectors within Government and stakeholders in the community (NCDA 2021). To address these challenges, evidence-based policies and interventions, tailored to the specific context of each country, are needed. Strengthening healthcare systems, meaningful engagement of people living with NCDs in decision-making, promoting health literacy, implementing effective public health campaigns, and adopting a multisectoral approach are essential strategies. Additionally, tackling the social and commercial determinants of health is a crucial step in reducing the burden of NCDs.

The G20 countries, including India, have made important strides in the prevention and control of NCDs through the implementation of various policies and strategies. Continued efforts, collaboration, increased investment, sharing of best practices and operationalisation of the meaningful involvement of people with lived experience as role models, equal and valuable partners in planning and execution of initiatives to advance efforts along with strengthening of strategies for community engagement are crucial for making further progress on addressing the NCD burden and improving population health outcomes.

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Mental Health as a Pathway to Health Equity

Pratima Murthy, Krishna Prasad Muliyala, and Channaveerachari Naveen Kumar

Equity, diversity, and inclusiveness are the basic tenets of distributive justice and are essential goals for development. The World Health Organization (WHO) envisages that health equity can be achieved when everyone attains their full potential for health and well-being. This includes mental health. According to WHO's definition, 'mental health' is a state of mental well-being that enables people to cope with the stresses of life, realise their abilities, learn well and work well, and contribute to their community.[1]

Mental health is closely linked with many of the United Nations (UN) Sustainable Development Goals (SDGs).[2] It comprises people's individual and collective abilities to make decisions, build relationships, and shape the world, and is more than the mere absence of mental illness. In its broadest sense, mental health encompasses promotive and preventive aspects, while mental disorders or illnesses (used interchangeably in this article) are more focused on treatment and rehabilitative aspects. However, mental health and well-being is equally important for persons with mental disorders, as much as it is for those without such disorders.

Integrating Mental Health into General Healthcare

The complex interaction of biological, psychological, and social determinants shapes an individual's mental health. There is evidence that poverty and other adverse social circumstances are risk factors for poor mental health, and for mental disorders. Biological vulnerability as well as psychosocial distress predispose an individual to common mental disorders like depression, substance use disorders, and behavioural addictions.[3] They can also be reasons for relapse for episodes of severe mental illness (SMI) such as schizophrenia or bipolar mood disorder.

The relationship between social adversity, mental distress, mental and physical illness is both interactive and complex. The presence of mental illness, particularly SMI, can drive people to poverty and worsen mental distress for both the individual and their family. Similarly, psychosocial adversity is a recognised risk factor in conditions like diabetes and tuberculosis and influences health outcomes.[4,5] Socioeconomic, political, cultural and place-based conditions all determine health outcomes, including on mental health.

Multimorbidity—defined as the co-occurrence of more than one chronic condition in an individual—can occur a decade earlier in those who are experiencing socioeconomic vulnerabilities.[6] When two or more conditions cluster together (both contributing and resulting in socioeconomic inequalities), medical specialists use the term 'syndemic' to describe such a situation. Therefore, the contextual determinants of health and disease are paramount in the conceptual framework of syndemics. Moreover, the two or more chronic conditions can interact and lead to adverse mutual outcomes for the conditions. The imperative, therefore, is to shed a dichotomous approach to mental and physical health and integrate them both in healthcare service delivery.

The challenge is how to efficiently distribute healthcare resources to those who most need them. In many regions of the world, while disadvantaged populations need greater healthcare, they receive less.[7] Some sections of society (for example, those with mental illness) may warrant greater allocations of resources, as much as equal treatment is required for similar needs. Health economists and the World Health Organization (WHO) have

argued that investing in mental health is important from the point of view of improving population health and reducing social inequality, promoting human rights, and improving economic efficiency.[8] The economic implications of mental and substance disorders can be enormous: for example, the global economic loss due to common mental disorders is an estimated US$ 1 trillion per year.[9] Given the increasing prevalence of mental illness, the costs are likely to only further mount. Investment in treatment of mental illness can result in large economic productivity gains.[10]

The Burden of Mental Health, Substance Use Disorders and Multimorbidity

Mental and substance-abuse disorders are leading contributors to premature morbidity and mortality globally. In India, for example, the National Mental Health Survey (NMHS), 2015-16, has reported a 13.6-percent lifetime prevalence of any mental/substance-abuse disorder morbidity.[11] The overall number of Disability-Adjusted-Life-Years (DALYs) for mental disorders has increased by more than 50 percent between 1990 and 2019.[12] This growth pattern is expected to continue, necessitating a proportionate response from the health systems. Most of the mental and substance abuse disorders are chronic and disabling conditions. The treatment gap for mental and substance abuse disorders (defined as proportions of those needing care but not receiving) remains high (about 75 percent), contributing to the high burden at various levels (individual, family and community). A vast majority of the population cannot afford out-of-pocket (OOP) spending for the treatment of mental and substance abuse disorders and psychiatric rehabilitation.

Such out-of-pocket expenditure, in India, is dominated by medicines.[13] In more than half of the population, non-medical costs such as expenses on travel and accommodation contribute to more than one-third of OOP spending. The share of doctors' fees and diagnostic charges in OOP expenditure is high in private healthcare settings.[14] Discrimination in the coverage by health insurance toward mental illness significantly raises the chances of catastrophic spending in such circumstances. Despite the Insurance Regulatory and Development Authority of India (IRDAI) having directed Indian insurance companies to cover mental illnesses as per the

Mental Health Care Act, 2017, there have been many reported violations of the provision of the Act.[15] The violations have included rejections of claims for mental illness by insurance companies and discriminatory ceilings on the sum of reimbursement for mental illness.

Worldwide, people with SMI have shortened life expectancy by 10-20 years, which is explained by the high rates of multimorbidity.[16] Yet the interventions to address the multimorbidity, primarily non-communicable diseases (NCDs) and the associated risk factors such as tobacco and alcohol use, physical inactivity, and poor diets—are insufficient for this group. The existing national programs to address these chronic conditions seem oriented vertically with poor horizontal integration across the programmes. Homeless persons, women, persons with developmental disorders, and elderly with mental illness experience even further inequities among the unequal.

The living conditions of persons in India with SMI chronically and who reside in psychiatric hospitals have been highlighted through public interest litigations and addressed by the active intervention of the judiciary. The National Human Rights Commission (NHRC), with the technical support of the National Institute of Mental Health & Neuro Sciences (NIMHANS), Bengaluru, has reviewed the rights violations of persons with SMI in these hospitals and monitored the required systemic changes.[17,18]

Over the last two decades, there have been consistent efforts toward developing a better systemic response in the care of persons with mental illness.

Key Efforts in Improving Mental Healthcare in India

The NMHS, 2015-16, India, reported the current prevalence of any mental morbidity to be 10.56 percent.[19] Those with low education and lower income, and are middle-aged were at the highest risk for mental illness.[20] Only two out of every 10 individuals with mental illness received mental healthcare.[21] Lack of mental health resources (e.g., shortage of mental health professionals), poor mental health literacy, stigma and discrimination,

social inequality, gender issues and lack of community participation may be among the various factors that impede mental health equity in India.

To be sure, India has made strides toward improving mental healthcare (summarised in Box 1). India was one of the first Asian countries to have a National Program for Mental Health (NMHP; as early as 1982). The District Mental Health Program (DMHP) today covers 700 districts across the country. The DMHP is the implementation arm of the NMHP tasked to ensure the availability and accessibility of minimum mental healthcare, integration of mental health in general healthcare, and to promote community participation in mental health development.

Box 1. Initiatives in India to Ensure Equitable Mental Healthcare

Programmes:

- Expansion of the National Mental Health Programme – District Mental Health Programme (>700 districts) and Taluk Mental Health programme (e.g., Karnataka)
- Ayushman Bharat-Pradhan Mantri Jan Arogya Yojna (PM-JAY) – Universal Health Coverage, Health and Wellness Centres
- National Tele Mental Health Programme (Tele Mental Health Assistance and Networking Across States: Tele-MANAS)
- Generic medicines – Jan Aushadhi Kendras

Policies:

- National Mental Health Policy (2014)
- National Health Policy (2017)

Legislations:

- Rights of Persons with Disability Act, 2016
- Mental Health Care Act, 2017

Moreover, the availability of psychotropic medications in primary healthcare has also improved. Screening and basic management of mental illness have been incorporated into the services offered at Health and Wellness Centres (HWC). India has a progressive Mental Health Policy (2014) based on equity, justice, integrated and evidence-based care in a rights-based approach.[22]

The use of digital technology is being leveraged for training and expanding human resources for mental health care in the country through digital academies at NIMHANS as well as other institutions. The National Tobacco Control Program has employed a mobile-based strategy called m-Cessation and tobacco quit-lines to support those who wish to quit tobacco.[23,24] The Government of India launched the National Tele Mental Health Program (Tele Mental Health Assistance and Networking Across States: Tele-MANAS) initiative on World Mental Health Day, 2022, to provide 24/7 comprehensive tele-mental health services that cater to remote and underserved areas.[25] The Tele-MANAS initiative—a phone-based, counsellor-led service—aims to address mental distress, identify mental illnesses and behaviours that need specialist mental health referrals, and improve service networking in each State/Union Territory. The examples of digital technology-based initiatives in India for mental health are summarised in Box 2.

Box 2. Technological Initiatives in India for Mental Health

- **Telephone/mobile based:** Quitline, m-cessation (tobacco), *Nikshay Sampark* (TB helpline), Tele-MANAS (National Tele-mental health programme), *Kiran* (mental health rehabilitation), COVID-19 psychosocial helpline, suicide helplines, crisis helplines for elderly, women, children, farmers
- **E-healthcare:** eSanjeevani (National Telemedicine Service of India), e-Manas Karnataka (Mental Healthcare Management System)
- **Training:** NIMHANS digital academy, Telemedicine Centre, NIMHANS, CIP Digital Academy, LGBRIMH Digital Academy
- **Telepsychiatry:** NIMHANS ECHO model, PGIMER "Tele-enabling model"
- **Potential uses:** chatbots, telerehabilitation, self-help

The Government of India's flagship insurance scheme, Ayushman Bharat-Pradhan Mantri Jan Arogya Yojna (PM-JAY), aims to achieve Universal Health Care (UHC) in India.[26] The scheme will cover most secondary and tertiary hospitalisations for nearly 40 percent of the population. The annual coverage of INR 500,000 per family is irrespective of family size. The scheme does not, however, cover outpatient expenses. Generic medicines have been made available in Jan Aushadhi Kendras.[27] The availability of generic medicines at cheaper rates than branded drugs will likely reduce the economic burden for all sections of society, especially the poor and marginalised. The second pillar of the PM-JAY is the provision of universal, comprehensive healthcare in primary care through the 150,000 Health and Wellness Centres (HWC). The HWC will act as the first point of contact for comprehensive services, including screening and essential mental health conditions management.

Two progressive legislations were enacted by the Government of India in the backdrop of the United Nations Convention on the Rights of Persons with Disability to address critical concerns of inequality and inequity in mental healthcare. The Rights of Persons with Disability Act (RPWD), 2016 has provided a reservation of 1 percent for mental illness-related disabilities in recruitment to government jobs or aided organisations.[28] The Act guarantees reasonable accommodation in education and work in government institutions for persons with disability. The Mental Health Care Act (MHCA) 2017 provides the right to access mental healthcare and treatment from mental health services run or funded by the appropriate Government.[29] The provision under the Act encompasses a range of services for persons with mental illness, including psychiatric rehabilitation and community reintegration. The Act also underscores the need for integrating mental health services with general health services at all levels. The MHCA 2017 also directs parity for mental illness in health insurance as is available for physical conditions. Appointing persons with mental illness, their family members and NGOs in the Central and State Mental Health Authorities and the Mental Health Review Boards is an affirmative step towards ensuring checks and balances in the delivery of mental healthcare in an equitable manner.

Thus, there have been improvements in curative and preventive care domains for mental and substance use disorders in the last decade. However, these need to be translated on the ground. There is also still a lack of adequate focus on rehabilitative care, which remains restricted to select tertiary care mental health institutions.

The Way Forward

If the vision of the National Mental Health Policy 2014 must be truly realised, its strategic directions and recommendations for action will need to be implemented. The distinct mental health needs of vulnerable populations such as children, the elderly, the homeless, require to be addressed. Macro-environmental issues such as poverty, unemployment, displacement, and emerging concerns such as the mental health impact of climate change require particular focus. Leadership and governance at various levels must be strengthened. Mental health systems should be strengthened at various levels to provide decentralised care in smaller administrative units such as the *taluks*/blocks.

Preventive and promotive aspects of mental health provide an opportunity to integrate existing mainstream/biomedical as well as alternative/traditional systems of care, including Yoga. Mental health should be effectively addressed at the workplace. The mental health of children and adolescents should take primacy and can be addressed in educational settings.

However, given that there may be a substantial group of out-of-school children and adolescents, as well as a large proportion of the population that works in the unorganised sector, there is a need to expand the reach of access to mental healthcare. A life-span approach to mental healthcare, extending from perinatal care to elderly care is recommended. Research in public mental health aspects is another priority. Mental health indicators need to be standardised and incorporated in governance regularly. The comprehensive set of interrelated services has been deemed necessary in the *World Mental Health Report, 2022* –these cover the life cycle, from maternal and child mental health, to the elderly.[30]

Inequity in mental healthcare needs to be systematically measured and monitored in LMICs to identify gaps and to inform policies and programmes. WHO has developed the Health Equity Assessment Toolkit (HEAT and HEAT Plus) software to explore and compare within-country health inequalities and across settings using disaggregated datasets.[31] Simultaneously, there is a need to learn from successful models developed in High-Income Countries (HICs). For example, in the United Kingdom (UK), the National Health Service (NHS) through the Five-Year Forward View for Mental Health has prioritised addressing inequity.[32] There have been debates in the public health domain for "disparity interventions" that are specifically designed for populations that face inequality.[33] Most of the existing inequality interventions in the mental health field from the HICs have focused on racial disparities, age-related factors, and socioeconomic issues. While developing, testing, and implementing the interventions, at each stage, all stakeholders including the service users will have to get involved.

To ensure universal health coverage for mental health, specific efforts have been conducted by WHO in six early adopter countries. Inadequate human resource and inequitable distribution of specialists were reported to be the crucial issues in the situational analysis.[34] In India, for the PM-JAY to meet the goal of universal health coverage, service delivery needs to be strengthened at all levels and systems to maintain continuity of care must be created, an area that is particularly relevant for mental health.[35] The coverage for non-PM-JAY patients, specifically non-below poverty line but belonging to lower/middle socioeconomic classes will have to be addressed to reduce catastrophic spending.[36] Mechanisms of surveillance and health information must be further strengthened to encompass private healthcare providers.

The national programmes for non-communicable diseases and chronic communicable diseases such as Tuberculosis need to consider that most patients with these conditions have multimorbidity and align the programmes with the NMHP at various levels. Integration of care at the primary care level and the HWC will have to be implemented as envisioned in the PM-JAY, with an emphasis to improve patient reported outcomes, besides clinical outcomes. There is sufficient evidence for self-management and peer-based interventions for chronic conditions that have emerged and have been successfully implemented in HICs.[37,38] They must be adapted

to the cultural settings of LMICs. The effectiveness of brief psychological interventions delivered by lay counsellors for moderate to severe depressive disorders and harmful drinking in primary care has been demonstrated in India.[39,40]

These low-cost interventions may have important lessons for HIC as the health systems in HICs are overwhelmed with long waiting periods for psychological intervention. Low-intensity interventions such as WHO's Problem Management plus (PM+) can be used in low-human resource settings for adults in distress due to exposure to adversity.[41] Families are an important resource for care provision in LMICs, specifically in the context of mental health and the role and concerns of family caregivers must be formally addressed. Indigenous interventions such as Yoga as well as alternative forms of medicine have potential benefits for multimorbidity. An evidence-based integration into the public health system may enhance outcomes as they are culturally acceptable and may have a broad spectrum of action.

Technology has been harnessed in healthcare in India as exemplified by the Tele-MANAS programme. However, the metrics to monitor the implementation of the programme should encompass inequities in the delivery of virtual care. Methods to enhance digital literacy and adaptation of the care so that even those with low digital literacy can comfortably use the portals of care, need to be considered during implementation. As primary healthcare is the locus of UHC, addressing the referral pathways with monitoring of the referrals, robust information systems and integration of mental and physical care are central to improving outcomes. The successful translation of policies and programmes on the ground requires governmental engagement as well as that of all stakeholders to ensure equitable and quality healthcare.

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Investing in the Public Health Workforce:
Reflections for the G20

Wenzhen Zuo, Huan Xu, Lizzie Tecson, Bettina Borisch, Sadaf Lynnes, Laura Magaña, Priscilla Robinson, Duncan Selbie, and Jim Campbell

Public health workers are the backbone of the public health system and a determining factor in the capacity for emergency preparedness and response. The COVID-19 pandemic tested and exposed the weaknesses in core public health capacities around the world,[1,2] which are often the result of decades of underfunding and lack of political commitment to public health.[3,4] Alongside the number of confirmed deaths from COVID-19, there was increased mortality and morbidity due to the severe disruptions in essential health services, including preventive care such as routine immunisation.[5,6] The inadequate preparedness of many health systems to respond to disease outbreaks partly explains these outcomes.[7] However, the limited availability of the health workforce was the critical bottleneck.[8,9] This was largely due to longstanding workforce shortages that were exacerbated by COVID-19 infections and deaths among health workers; the burden placed upon them, which resulted in mental health issues, including burnout; and poor working conditions.[10,11]

The world is also burdened with other public health emergencies, including protracted conflicts and a global increase in climate-related and humanitarian disasters. These have collectively contributed to a public health crisis, with reversals in life expectancy and Sustainable Development Goals

targets.[12,13] These reversals and the increasing likelihood of multi-hazards and future emergencies stress the imperative for strengthening national health systems through investment in the 12 Essential Public Health Function[a] (EPHF) through an all-hazards emergency risk management approach.[14] Strengthening the quantity and quality of the national public health workforce capacity to deliver these EPHFs is essential[15] and requires political leadership as well as global investment

There was the emergence of a global consensus to strengthen public health during the pandemic, as evident in the political and technical consensus within the G7 and G20 intergovernmental processes from 2021 to 2023.[16] This contributed to an iterative process coordinated by the World Health Organization (WHO) along with a global partnership of associations, institutions, and schools of public health (as represented by their national, regional, and global bodies)[b] to jointly develop and endorse a WHO Roadmap to strengthen national public health and emergency workforces.[17]

The G20's and G7's Role in Strengthening Public Health and Emergency Workforces

Both the G20 and the G7 processes have historically incorporated public health within their intergovernmental deliberations, aiming to address pressing global health challenges and foster international cooperation amongst member and partner countries. This was reinforced during the COVID-19 pandemic, where both the G20 and the G7 platforms tabled agenda items on public health for consideration in the Health Ministers and Heads of State meetings.

a The EPHFs are a set of interconnected activities both within and beyond the health sector that are required to ensure effective public health action to prevent disease and promote and protect health and well-being.

b Including the World Federation of Public Health Associations (WFPHA), International Association of National Public Health Institutions (IANPHI) and Global Network Academic Schools of Public Health (GNASPH).

G20 and G7 Deliberations on Public Health (2021–2023)

G20 Italy, 2021

In May 2021, the G20 and invited leaders, heads of international and regional organisations, and representatives of global health bodies gathered in Rome for the Global Health Summit that culminated in the Rome Declaration.[18] This political declaration recognised the impacts of the pandemic, the reversal of public health gains, and the sacrifices from the health and care workforce. The Rome Declaration set out a global consensus which subsequently informed the G20 Italia Declaration of Health Ministers in September 2021,[19] where investment in health systems and public health workforce strengthening was identified as a prerequisite for countries to improve future pandemic preparedness and response. The declaration affirmed the role of political consensus in strengthening the health workforce. It highlighted the need to protect workers and invest in their education, employment, and retention, including to strengthen multidisciplinary teams to better respond to future emergencies and deliver the essential functions in "health care system and preventive care".[20]

G7 United Kingdom, 2021

In June 2021, the Carbis Bay Health Declaration[21] was signed at the G7 Summit in Cornwall, United Kingdom. The primary objective of the G7 Summit 2021 was to bring the world's leading democracies together to fight COVID-19 and build a greener, more prosperous future. The G7 summit recognised the contributions and commitment of health and care workers and highlighted the importance of maintaining a health workforce that can adapt to changing circumstances. Training, supporting, and protecting health and care workers were important aspects of the discussion.

G7 Germany, 2022

Germany's presidency of the G7 built upon Italy's legacy on essential public health functions by diving deeper into pandemic preparedness and response. On 19 May 2022, the G7 ministers met in Berlin and launched the G7 Pact for Pandemic Readiness,[22,23] which focuses on strengthening collaborative surveillance in low- and lower-middle income countries (LMICs) and

predictable rapid "regional and global surge readiness groups".[24] This focus on pandemic preparedness and response demonstrated alignment with similar deliberations among WHO member states in Strengthening the Global Architecture for Health Emergency Preparedness and Response (HEPR).[25] The HEPR structures a new global health architecture around health emergency governance,[c] systems, and financing, applying the principles of EPHFs at a global level. Supporting the global health architecture, the G7's Roadmap for Practical Cooperation to Advance the G7 Pact[26] committed to help 100 countries strengthen their International Health Regulation (IHR 2005) core capacities.[d]

G20 Indonesia, 2022

G20 in Indonesia continued to advance the global health architecture for emergency preparedness and response by launching the Pandemic Fund.[27] The fund aims to strengthen countries' pandemic prevention, preparedness, and response (PPR) capacities by addressing capacity and capability gaps. The Pandemic Fund further aims to catalyse investment in critical health workforce capacities and in health systems to strengthen synergies between the health system and pandemic PPR capacity at country and local levels in core domains of the IHR 2005 and the World Organisation for Animal Health's (WOAH) international standards. It is estimated that there is a need for US$10 billion per year of international funding to cover the catalytic funding for systemic preparedness required in LMICs.[e]

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c Under the governance part of HEPR, it contains the ongoing Intergovernmental Negotiating Body on new WHO convention, agreement, or other international instrument on PPR (WHO CA+) and International Health Regulation amendments.

d IHR core capacities: described in IHR 2005's Annex 1, the core capacities for surveillance and responses require public health capacities ranging from the local community and primary public health level all up until the national public health leadership level. In the voluntary Joint External Evaluation tool to assess the IHR 2005 capacities, the highest scores for IHR capacities as human resources are given to countries who have a national multisectoral skilled and competent health personnel for sustainable and functional public health surveillance and response at all levels of the health system.

e Worth noting that the Pandemic Fund, as of May 2023, had received a pledge of just 10% of the annual amount needed from donors and foreign aid from the main G20 countries.

G7 Japan, 2023

The G7 in Japan further reaffirmed the prevailing health consensus to strengthen the national Public Health and Emergency Workforce in the G7 Global Plan for UHC Action Agenda.[28] Action area 8 of the UHC Action Agenda specifically addresses UHC and health security by strengthening all EPHFs and to "support well-trained workforce to deliver the EPHF in line with WHO Roadmap".[29] The Action Agenda also advocates for investing, protecting, educating, and employing the entire health and care workforce while also recognising the importance of strengthening the public health workforce.

The G7 leaders supported the development of global network of experts, including their trainings, and committed to work together to implement IHR core capacities in 100 LMICs until 2027, echoing the 2022 commitment at G7 Germany. To achieve UHC and health security, G7 Japan also announced the launch of the Impact Investment Initiative for Global Health,[30] in time for the United Nations' three High-Level Meetings (HLM) on UHC, tuberculosis, and pandemic preparedness and response. This initiative prioritises investment in impactful initiatives and capacity building in the Global South for non-communicable and communicable diseases, PPR, and to "restore of essential health services to better than pre-pandemic level".[31]

Emerging Consensus for WHO and Partners' Roadmap for Public Health Workforce

The public health momentum from the G20 and the G7 processes enabled renewed dialogue on public health, the 12 essential public health functions that are typically prevalent across all countries, and the public health workforce required to deliver these functions. Building on the political call for action during Italy's G20 presidency and resolutions adopted in the World Health Assembly,[32,33,34,35] WHO convened and worked with its partners to jointly develop and launch a roadmap and an action plan[36] on national public health workforce capacity to deliver all EPHFs, including emergency preparedness and response. The public health workforce encompasses core public health personnel and professionals, health and care workers who perform at least one of the essential public health functions, and all

occupations outside of the health sector that contribute to public health (e.g., water, sanitation, social determinants).[37,38]

Global partners on the roadmap and action plan have jointly developed reference documents and tools for countries of all income classifications to assess their public health workforce against the standard EPHF and their individual public health priorities.[39] The assessment is underpinned by a whole-of-government and whole-of-society approach that involves national stakeholders and existing national and global networks of partners of the roadmap, including associations, institutions, and schools of public health. This country-based assessment will ultimately guide policy improvement and address gaps in national public health workforce planning, delivery, and competency-based education curricula in order to bolster national workforce capacity and readiness for all current and future public health needs.

The above tools are timely additions to support national assessments and benchmarking. The G20 support to invest in preparedness and national capacity contributed to the launch of the World Bank's Pandemic Fund in November 2022. In its first call for submissions, strengthening human resources to help countries prevent, prepare for, and respond to health emergencies was highlighted as a priority.[40] This indicates an opportunity to prioritise sustainable public health workforce capacity in LMICs.

The roadmap also assists in alignment with the ongoing governance processes of IHR 2005 amendments and negotiations on a global pandemic accord, the Intergovernmental Negotiating Body (INB) on a new WHO convention, agreement, or other international instruments on PPR (WHO CA+).[f]

f Under the governance part of HEPR, it contains the ongoing Intergovernmental Negotiating Body on new WHO convention, agreement, or other international instrument on PPR (WHO CA+) and International Health Regulation amendments.

The Role of India's G20 Presidency

The intergovernmental consensus and commitment for public health strengthening has evolved over the last three years, and in mid-2023, there was a window of opportunity to convert consensus into national actions that address public health workforce needs. The G20 in India has signalled the development cooperation for SDGs and the global health architecture for PPR as important priorities for the Indian presidency.[41,42] It also presents an opportunity for India to amplify public health workforce strengthening from the perspective of developing countries, ensuring that multilateral investment is leveraged to strengthen public health workforce across LMICs. This might present an attractive legacy agenda in 2024 when Brazil assumes the G20 and would likely resonate with Italy's G7.

Elements for reflection might therefore include the role of G20 stakeholders and partners to:

- Expand domestic financing to strengthen national health system capacity and the respective public health workforce to deliver all essential health services and public health functions, including health emergency preparedness and response.

- Expand international financing to support the LMICs in national public health and health system strengthening, as committed by the G7 Germany in the Roadmap to PPR in 2022 and G7 Japan.

- Capitalise and leverage the proposed Impact Investment Initiative for Global Health and the Pandemic Fund to meet demand.

- Strengthen and position the G20 consensus language on protecting and investing in the public health workforce, consistent with the Italy G20 language and recommendations from the 5th Global Forum on Human Resources for Health.

- Strengthen and position the G20 consensus language in the preparations and outcomes for the UN HLM for PPR in New York and the member state deliberations on the IHR amendments and WHO CA+ in Geneva.

- Strengthen and position gender inequality as a systemic issue to contribute to an enabling environment for women's economic and social rights by gender-equitable policy for the health sector and beyond.[43]

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Public Health Partnerships:

Success in COVID-19 Fight; a Model for Tackling Future Challenges

Naveen Rao

Born in 1919 during the flu pandemic,[a,1] Maurice Hilleman was a prolific vaccine developer who would contribute to the creation of over 40 vaccines over his lifetime. For decades, he held the record for the fastest development of vaccines—at one vaccine every four years.[2] Many decades later, the development of the COVID-19 vaccines would break that record, as the journey from laboratory to pharmacy shelves took only a little over one year.[3] In addition to harnessing technologies that were right for the time, the key factor that changed between Hilleman's time and 2020 was the emergence of novel partnerships that were forged in response to the global pandemic.

The COVID-19 vaccine development showcased the power of collaboration between industry, governments, and academia, as exemplified by 'Operation Warp Speed' in the United States, the development of the AstraZeneca vaccine by Oxford University, and that of Covaxin by Bharat Biotech and Indian Council of Medical Research. Today, there are 50 vaccines against COVID-19, approved by at least one country.[4]

a The 1918 influenza pandemic would last until 1920. It was the most severe pandemic in history at that time, and was caused by an H1N1 virus with genes of avian origin.

When vaccine equity became a concern in the aftermath of the Delta surge of 2021, the inter-agency COVID-19 Vaccine Delivery Partnership (CoVDP) formed in December 2021 accelerated coverage in 34 countries with vaccination rates of 10 percent or less in January 2022.[5] Countries like Tanzania and Zambia, where the increase in vaccination reach was remarkably sharp, have since achieved over 46 percent coverage.[6]

Covax, led by the Coalition for Epidemic Preparedness Innovations, GAVI, and the World Health Organization (WHO) played a vital part in the development of multiple vaccines and ensured their equitable distribution across geographies.[7] When Imperial College researchers analysed COVID-19 deaths between December 2020 and December 2021, they found a marked difference in the mortality rates in countries where the vaccines were delivered and those where they were not. They concluded that these vaccines have saved 20 million lives[8] –three-quarters of whom live in low-income countries.[9]

In all, over 72 percent of the world's population have received at least one dose of the COVID-19 vaccine.[10] This remarkable achievement took less than four years, owing mainly to public health partnerships.

Current Public Health Threats

Public health encompasses a wide range of fields, including epidemiology, behavioural health, environmental health, pharmaceuticals, and health promotion. It focuses on the development of programmes and policies that promote health and wellness driven by principles of equity. Strategic investments in public health yield economic dividends and save lives and livelihoods. However, the success of public health initiatives relies on long-term commitments and trust between partners; persistence, adaptability, and active involvement of beneficiaries are key to achieving the desired goals.

Partnerships are effective across sectors. These include the transition to digital payments facilitated by the Better Than Cash Alliance in many countries across the world including Nepal, Jordan, and Pakistan,[11] to collaborations protecting women and children from domestic violence such

as the partnership between UNICEF, UNFPA, the Mexican government, and a private corporation.[12] In fields like climate change, progress cannot be achieved without multi-lateral, multi-level partnerships spanning local, regional, and global agencies.

Lessons from fields such as finance and those learnt during the COVID19 pandemic can be used to tackle emerging challenges. Recognised as an existential threat, climate change represents the new frontier in partnership-driven initiatives. No government or institution can tackle the monumental challenges on their own.

The impact of climate change on vulnerable populations is already evident. For instance, between 2012 and 2022, 6,500 migrant workers from India, Pakistan, Nepal, Bangladesh and Sri Lanka died in Qatar, many of them working in the construction sector.[13] The country's intense summer heat (2010 summer in Qatar was the hottest on record)[14] was thought to be one of the causes for such high number of casualties during that period.

Island states are facing peculiar challenges related to climate change, too. Kiribati and Tuvalu in the Pacific, for example, are facing the threat of sea-level rise that could submerge certain land masses in their territories. Their governments have put in place specific plans for the relocation of vulnerable populations, and have bought land in Fiji to prepare for such a scenario.[15]

Rohingya camps in the hilly tracts of Cox's Bazar district of Bangladesh are vulnerable to climate disasters triggered by rampant deforestation and vanishing groundwater. The district, at current emission levels, could be the worst hit district of South Asia by 2050, putting the already displaced community through further hardships.[16]

Overall, climate change-induced deaths are projected to rise to 250,000 annually by 2030, with over 9 million climate-related deaths expected each year by the end of the century.[17] To put this in context, globally, the COVID-19 death toll stands at 6,943,390 at the time of writing this article.[18]

The worst is over in the first pandemic in a century; it is crucial to leverage the lessons learned from this global experience to tackle climate change collaboratively. Partnerships between conservation organisations, governments, and local communities will prove vital to the protection of vulnerable ecosystems and populations.

The Essentials of a Partnership

To replicate the success of public health partnerships during COVID-19 in arenas such as climate change, it is important to identify certain working principles.

1. **Shared Vision**: Partnerships must unite around a common goal and vision, ensuring alignment among stakeholders. The COVID-19 response demonstrated the necessity of a unified vision for global vaccine distribution and equity.

2. **Clear Roles and Responsibilities**: Partnerships thrive when roles and responsibilities are clearly defined, ensuring transparency and accountability. This helps maintain trust and prevents conflicts of interest.

3. **Effective Communication**: Open, transparent, and regular communication is essential. The timely sharing of information, updates, and challenges helps build trust.

4. **Flexibility and Adaptability**: Partnerships must be able to adapt to evolving circumstances and emerging data. It is important to learn from setbacks. A flexible approach allows partners to pivot and respond effectively to challenges.

5. **Resource Mobilisation**: Partnerships require adequate resources to achieve their goals. By pooling financial, technical, and human resources, partners can leverage their collective and complementary strengths to achieve greater impact.

6. **Long-Term Commitment**: Achieving meaningful outcomes in public health requires sustained effort and commitment as results can take time to show and estimating impacts is not always straightforward. Partnerships must be long-term, with a clear focus on data-driven accountability and sustainability.

Climate change has far-reaching implications for public health, exacerbating the incidence of both communicable and non-communicable diseases. Tackling these multifaceted challenges will require multi-sectoral partnerships.

The Health Impacts of Climate Change

Much of the pressure of climate change will have to be shouldered by the public health system; the worst hit will be the poor and vulnerable populations. Heat-induced deaths will rise the world over. The dual challenges of increased incidence of known ailments and emergence of unknown pathogens (such as SARS-CoV2) can overwhelm immature and stagnant health systems. In 2021, *The Lancet Planetary Health* estimated that 4.7 billion more people could be susceptible to malaria and dengue by 2070.[19] These diseases are now inching towards countries of the global North, which was not their traditional catchment area. At the same time, dwindling crop yields could add to food insecurity and therefore, vulnerability.[20]

Even without factoring in unknown zoonoses, it is clear that as the ravages of climate change are more widely felt, diseases such as malaria and cholera will become more common.

1. **Vector-borne Diseases:** Climate change influences the distribution and behaviour of disease-carrying vectors such as mosquitoes, ticks,[21] and sandflies.[22] The expansion of their habitats due to rising temperatures and altered precipitation patterns increases the risk of diseases like malaria, dengue, Lyme disease, and leishmaniasis. Addressing these vector-borne diseases requires partnerships between health authorities, environmental agencies, climate scientists, urban planners, and community organisations for surveillance, vector control measures, community education, and strengthening health systems.

2. **Waterborne Diseases:** Extreme weather events are extreme health events. Climate change impacts water quality, leading to increased incidence of waterborne diseases. Extreme weather events, such as flooding and heavy rainfall, can contaminate water sources, causing outbreaks of diseases like cholera, typhoid, and diarrhoea.[23] Drought will lead to human (and animal) migration, shifting disease patterns and increasing exposures (CDC).[24],[25] Partnerships between public health and refugee health agencies, water and sanitation authorities, climate experts, and local communities are vital for implementing preventive measures, ensuring access to safe drinking water, and improving sanitation infrastructure.

3. **Respiratory Diseases:** Climate change contributes to air pollution, which is linked to respiratory diseases such as asthma, chronic obstructive pulmonary disease (COPD), and respiratory infections. Air pollution leads to 7 million premature deaths annually (WHO).[26] Collaborations involving health departments, environmental agencies, urban planners, and policymakers are crucial for implementing air quality regulations, promoting clean energy sources, and raising public awareness.

4. **Mental Health:** Climate change-related events like natural disasters, heatwaves, and prolonged periods of extreme weather can affect mental health. Displacement, loss of livelihoods, and increased stress and anxiety are some of the challenges to people's mental well-being. Partnerships between mental health professionals, disaster response teams, community support organisations, and policymakers therefore need to focus on developing resilience programmes, providing psychological support services, and integrating mental health considerations into climate change adaptation and mitigation strategies.

5. **Non-Communicable Diseases (NCDs):** Climate change indirectly influences the prevalence and distribution of non-communicable diseases such as cardiovascular diseases, diabetes, and certain types of cancers. Changing food availability, altered agricultural patterns, and increased exposure to environmental pollutants contribute to the rise of NCDs. Partnerships involving health sectors, agriculture departments, food industry representatives, and urban planners can work together to promote healthy and sustainable food systems, encourage physical

activity, reduce environmental exposures, and implement policies that support NCD prevention and control.

These examples illustrate the interconnectedness of climate change and public health, emphasising the need for multi-sectoral partnerships. By joining forces and combining expertise, resources, and strategies, stakeholders from diverse sectors can effectively address the health challenges arising from global warming.

Sustainability is Key

Governments are the most crucial stakeholders in sustainable partnerships. They possess the necessary political and financial influence to facilitate scaling up of small local partnerships into national, regional, and global initiatives. Bridging the gap between rhetoric and action, governments can serve as agents of transformative change.

Numerous instances highlight the successful expansion of local best practices in the public health domain, underscoring the importance of government involvement. One such example is the partnership between the international non-profit organisation Partners in Health and the government of Rwanda. Partners in Health introduced an HIV treatment program in Rwanda in 2005. Recognising its potential, the Rwandan government invited the organisation to build a hospital in Burera. Over time, the collaboration led to the renovation of three district hospitals, the building of multiple community health centres, and created jobs for thousands of healthcare workers.[27]

In India, the Comprehensive Rural Health Project (CRHP) that originated in 1970 in Jamkhed, Maharashtra, aimed to provide healthcare to marginalised populations. The Jamkhed Model[28] garnered acclaim in the public health sphere. It encompasses community-based primary healthcare, along with social and economic development. Recognising the multifaceted nature of healthcare access, the program addressed social realities such as caste discrimination, and governance problems such as lack of clean water. By 1985, it was covering a population exceeding 250,000. Building upon the CRHP experience, the Indian government launched the National Rural

Health Mission in 2005, which presently boasts an all-women force of a million accredited social health activists (ASHAs) providing community-level health services. NRHM continues to operate, drawing significant influence from the Jamkhed model. [29]

Examples from Rwanda and India demonstrate how government collaboration can amplify the success of sustainable healthcare practices. Multilateral development banks and international philanthropies have also been solid partners in this scaling up effort, providing financial and technical support (particularly in low and middle-income countries) to address systemic deficiencies leading to poverty and vulnerability that fuel health inequalities.[30]

Public health partnerships will continue to play a crucial role in addressing global health challenges. As the world grapples with emerging infectious diseases, antimicrobial resistance, mental health crises, and climate change, partnerships will be essential for leveraging diverse expertise, resources, and perspectives.

Evaluating the effectiveness and impact of partnerships is crucial to identify necessary areas for growth. Transparent assessments can help identify best practices, share lessons learned, and inform future strategies.

Public health partnerships have proven to be powerful tools in tackling complex global challenges. The success of the COVID-19 vaccine development and distribution is testament to their transformative potential. As we navigate future uncertainties, investing in—and strengthening public health partnerships—will be crucial for ensuring a healthier, more resilient world. By leveraging the collective resources of diverse stakeholders, we can overcome the most daunting challenges and achieve shared victories.

As the African proverb says: “If you want to go fast, go alone, if you want to go far, go together.”

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The Critical Role of Nutrition in Global Development

Patrick Webb, Sandy M. Thomas, and Derek J. Flynn

There is insufficient recognition of the key role of healthy diets and nutrition in delivering on all the Sustainable Development Goals (SDGs), beyond SDG2 (hunger and malnutrition). Poor nutrition, in all its forms, is fundamentally intertwined with entrenched poverty and inequality. It impairs the physical and mental development of children and carries lifelong effects on their earning potential.[1] It is linked to ill health and poor well-being in adolescents and adults, bearing far-reaching ramifications in terms of economic growth and prosperity. Food systems, from which all diets come from, including the production of carbon-intensive foods, are also one of the largest sources of greenhouse gases and thus represent a crucial contributor to climate change. They are also implicated in the current near-catastrophic decline of the many ecosystems on which human and planetary health depends.[2,3]

Given the role of nutrition in many areas of policy, it is surprising that today's food systems fail to provide diets that are healthy, affordable, and sustainable for three billion people. This is a profound and systemic failure of policy. This essay examines what is likely to occur without decisive intervention and sets out essential priorities, based on the best available science and evidence to stimulate action and to overcome barriers that impede progress.

Inadequate Nutrition: A Great Challenge of Our Age

Food prices continue to escalate as part of the current cost-of-living crisis, contributing to a worsening global outlook for hunger and malnutrition. By 2020, healthy diets were unaffordable to almost 3.1 billion people, up by 112 million from just a year before.[4] Of these, approximately 1.5 billion live in G20 countries.[5,6] The rise partly reflects the effects of inflation in consumer food prices stemming from the early impacts of the COVID-19 pandemic and measures put in place to contain it. Since then, events in Ukraine have contributed to cost increases in agricultural inputs (e.g., energy and fertiliser) leading to double-digit rises in food prices in many parts of the world.[7,8]

World hunger is on the rise. As many as 828 million people were affected by hunger in 2021, 46 million more than a year earlier and 150 million more than in 2019.[9] Climate change also contributed to this worsening situation through sustained droughts in particular. In 2020, 45 percent of all deaths of children under five were linked to undernutrition.[10] Looking to 2030, projections suggest that nearly 670 million people (8 percent of the world population) will still be facing hunger, even if a global economic recovery is taken into consideration. However, the effects of malnutrition and poor diets extend into much wider areas of policy.

Poor nutrition disrupts economic growth. Estimates indicate that the impact on the global economy could be as high as US$3.5 trillion per year, equivalent to an average of US$500 per capita.[11] These huge costs result from economic growth foregone and lost investments in human capital associated with preventable child deaths, as well as premature adult mortality linked to diet-related non-communicable diseases.

Box 1. The Escalating Cost of Diabetes in China

As just one of the growing threats to public health in China posed by diet-related non-communicable diseases, diabetes prevalence among adults (aged 20-79) is projected to increase from 8.2 percent to 9.7 percent between 2020 and 2030. During the same period, the total costs would increase from $250.2 billion to $460.4 billion—equivalent to an annual growth rate of 6.3 percent.[12] An earlier study has projected diabetes to cost China $631.7 billion by 2030—2.9 percent of GDP.[13]

Poor nutrition is increasingly consuming health budgets. More than half of the world's malnutrition disease burden is borne by the G20 countries.[14] This includes malnutrition related to undernutrition and micronutrient deficiencies, as well as overweight and obesity. Globally, there is an epidemic of overweight and obesity in adults—the incidence was estimated at 1.9 billion in 2020. This is driving substantial increases in the prevalence of non-communicable diseases such as diabetes and cardiovascular disease. In India, for example, the population with diabetes is predicted to reach more than 80 million by 2030.[15] Substantial increases are also projected for China (see Box 1). The increase in global health expenditure relating to diabetes alone has grown from US$232 billion in 2007 to US$966 billion in 2021 for adults aged 20-79 years. Estimates suggest that the total diabetes-related health expenditure will reach US$1.03 trillion by 2030, placing even greater strain on health budgets that are already overstretched.[16,17]

What people choose to eat directly affects the chances of minimising global temperature rise. Every small increment above 1.5°C affects whether climate change tipping points are exceeded. While food systems account for approximately one-third of all greenhouse gas emissions, some foods have much larger carbon footprints than others: e.g., processed red meat, farmed shellfish, and dairy rank amongst the highest. Influencing what people choose to eat offers a crucial opportunity to reduce emissions.

Currently, actions on food systems are failing to reduce GHGs at anything like the scale required. It has been estimated that global food systems need to reduce their GHG emissions by 40-70 percent by 2050 to play their part in limiting global warming to 1.5°C.[18] In contrast, their emissions are projected to *increase* by up to 60–90 percent between 2010 and 2050,

without dedicated measures and if current trends continue with respect to population growth and dietary changes towards more animal-source foods.[19] Most of the commitments to transform national food systems made by countries as part of the outcomes of the 2021 UN Food Systems Summit (UNFSS) have failed to address the need to reduce food systems-related emissions. This is a crucial omission.

What we choose to eat—and how that food is produced—is driving other forms of environmental degradation. The world is at risk of large-scale and potentially irreversible environmental changes relating to catastrophic biodiversity loss and the unsustainable use and health of the planet's environmental resources. Without concerted action, environmental impacts of the food system could increase by 50-90 percent by 2050 because of population growth and the rise of diets high in fats, sugars, and meat. Such an outcome would lead to all planetary boundaries related to food production being exceeded, some by more than twofold.[20]

Entrenched inequalities affecting the poor, particularly women, cannot be properly addressed without universal access to affordable, healthy diets. Malnutrition combines with poverty to form a vicious cycle. People who are poor are more likely to be affected by different forms of malnutrition, which in turn increases healthcare costs, reduces productivity, and slows economic growth. The result can be a cycle of poverty, ill health, and inequality.

Women are disproportionally affected by poor nutrition, **with the situation worsening in recent times.** In 2021, 31.9 percent of women in the world were moderately or severely food insecure, compared to 27.6 percent of men—a gap of more than 4 percentage points, compared with 3 percentage points in 2020. Women are also disproportionally affected by anaemia. In 2019, global anaemia prevalence was 29.9 percent (95% uncertainty interval (UI) 27.0% - 32.8%) in women of reproductive age, equivalent to over half a billion women aged 15-49 years.[21] Globally, most of the prevalent cases were attributable to dietary iron deficiency, as well as hemoglobinopathies and haemolytic anaemias.[22]

Poor food choices and diets are harming the health of people and the planet. For affected individuals, this can lead to lifetimes of inequality and

disadvantage. For the planet, the situation is fast deteriorating. Without decisive and radical action, these factors are contributing substantially to the risk of irreversible collapse of global environmental systems.

Systemic Reasons for Failure and How to Address Them

Redressing the very concerning trends set out above will require both vision and leadership at the highest levels. Of critical importance is the reality that the situation is still reversible, but only if large-scale, ambitious, and concerted action is taken immediately. The G20 meeting offers a real opportunity to act, and in that context, the Global Panel on Agriculture and Food Systems for Nutrition has identified five priorities to enable change, and five to address inhibitors that are holding back progress. These are founded on the best available science and evidence from around the world.[23] Importantly, most of these priorities are low- or zero-cost to governments.

Enabling change:

Galvanising political will to achieve universal access to sustainable healthy diets and nutrition. Policymakers across governments must appreciate how influencing food choices and improving nutrition can swiftly yield multiple benefits for diverse areas of policy—from mitigating and adapting to climate change, promoting health and well-being, improving productivity and growth, reducing healthcare costs, and addressing deeply entrenched inequalities. The aim is to use a systems approach to build diets and nutrition into policy agendas across government so that they work in concert and trade-offs can be managed. This will entail relevant ministries (e.g., agriculture, health, transport infrastructure, environment) collaborating to implement policies that realign all parts of food systems to support healthy diets in sustainable ways, to ensure coherence, and refocus policy goals.

Demonstrating leadership from the top. Getting different parts of government to work together toward a common agenda—i.e., to improve diets and nutrition—can present considerable challenges. Leadership from the top is essential to break down siloed government departments and

agencies and to incentivise decision-makers to work collaboratively and identify multiple policy opportunities by exploiting synergies and common interests.

Realigning current government resources. Worldwide, governments spend more than US$817 billion annually to support the agriculture sector.[24] Analysis commissioned by the Global Panel demonstrates how repurposing subsidies and other forms of support could yield benefits in terms of health, the environment and economic growth.[25] There is also a case to rebalance research so that more emphasis is given to the following priorities: developing and facilitating the production and supply of nutrient-rich crops and foods; the affordability of healthy diets; how to build resilience into the long-term transformation of food systems; and identifying better what works in terms of informing and influencing consumer demand for sustainable, nutrient-rich foods. There also is scope for governments to promote and procure healthy foods in public settings, including schools, hospitals, the military, and prisons.

Influencing demand. The sustained supply of healthy diets requires sustained demand. People should be informed and encouraged to include foods that are nutrient-rich, sustainably sourced, and with lower carbon footprints among their choices. This has the potential to improve public health in a significant way. It also has the potential to leverage the considerable resources of businesses of all sizes in the global food system as they respond to changing consumer demand. Possible actions include: promoting better use of up-to-date food-based dietary guidelines; and public health campaigns to explain what constitutes a healthy diet, and the benefits for child development and individual health. However, more research is needed on how to influence demand specifically in LMIC settings.

Supporting disadvantaged regions and vulnerable populations in the transition by building in social protection measures. Not everyone can choose what they eat and too many go hungry by necessity. The need to protect and support the poor while diets and nutrition gradually improve will be vital and needs to be built into the foundation of any strategy moving forward. The donor community has a crucial role to play.

Addressing systemic inhibitors to progress:

Concerted coherent multilateral action is needed to strengthen the international trade system to better support universal access to healthy diets. Current geopolitical fragmentation is having adverse effects on free trade, which is widely seen as a tool to achieve transformation in food systems.[26] Global and regional agreements are needed on ways to promote trade patterns that will help promote access to diverse, nutrient-rich, safe foods for all.

Targeting the affordability of healthy diets. The world is simply not producing enough of the right foods. For example, only around one-third of the fruits and vegetables are grown across the world to provide healthy diets for everyone.[27] However, focus also needs to be given to making such foods affordable to consumers; rising incomes alone will not bridge the 'affordability gap'. Concerted actions from both high- and low-income countries, as well as donors, will be essential.

Harnessing the power and resources of the private sector. Influencing the behaviour of business in the food chain offers the opportunity to leverage substantial resources—the global food system is projected to grow from US$2.5 trillion in 2022, to nearly US$5.2 trillion by 2029.[28] However, there are deep-rooted tensions between the business models operating today within the food system, and the imperative to improve diets, nutrition, and environmental sustainability. A reset in policies for the public sector and institutional support is overdue. Too often, businesses in the food system promote ultra-processed foods that have negative impacts on human health, the environment or both. As mentioned earlier, influencing consumer demand can be a powerful way to drive change. More generally, incentives and regulation also need to be carefully weighed—past evidence shows that the latter is often needed to drive real change in the food sector. Possible approaches include: taxes on the sugar content of foods;[29] the use of mandatory warning labels;[30] and restricting the marketing of ultra-processed foods to children.[31]

Making finance available for those actors who can reach the impoverished, deprived and discriminated against. Much more and better-targeted finance, is needed to enable food systems to be transformed to deliver

secure, sustainable, healthy diets to the poor and vulnerable.[32] LMICs are in particular need of support: many of the problems besetting food systems today are global in nature, yet LMICs are invariably the most affected, and have the least resource to cope. The ensuing impacts will affect all countries, not least through the contagion of unrest, financial instability, and forced migration.

Box 2. Food Loss and Waste in the US and the UK

Halving food loss and waste along the food supply chain could reduce the environmental impact of the US food system by 8-10 percent.[33] The UK is currently a global leader in reducing food loss and waste, with a 27-percent reduction per capita over the course of a decade of measurement and action.[34]

Tackling food loss and waste (FLW). One-third of the food produced in the world is lost or wasted. This means having to grow food twice with all the implications for economic inefficiency and wastage of inputs, as well as environmental and human resources. Food loss and waste occurs throughout the food supply chain but is concentrated on the farm in LMICs, and in the home in HICs.[35] The United Nations has called for halving of FLW by 2030, although many countries are woefully behind in setting targets for reductions.

Conclusion

The G20 meetings in New Delhi in 2023 offer an important opportunity for world leaders to demonstrate their vision and leadership by giving far greater priority to healthy diets and nutrition. This crucial step would reinvigorate progress on many of the SDGs, for example, on those relating to hunger, child development, health and well-being, equity, poverty and economic growth, and planetary health. The opportunity at the G20 to set the priorities and policy context comes at a critical time, not least as it will take place just a few months before the UNFCCC COP28 meeting in Dubai.

It may be a cliché to argue that urgent and decisive action will be needed, yet time is running out on many of the agendas mentioned in this article. Whatever is decided will impact the three billion people already enduring inadequate diets. But it will affect us all through the profound implications for climate change and the health of the world's environmental systems.

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