



A HALF-CENTURY OF PROGRESS IN HEALTH: THE NATIONAL ACADEMY OF MEDICINE AT 50

Emerging Infectious Diseases — Learning from the Past and Looking to the Future

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Since the start of the 20th century, there have been substantial reductions in deaths from infectious diseases in high-income countries. In the United States, infectious disease mortality fell

from about 800 per 100,000 people in 1900 (accounting for nearly 50% of all deaths) to 50 per 100,000 people in 1950 (accounting for about 6% of deaths).¹

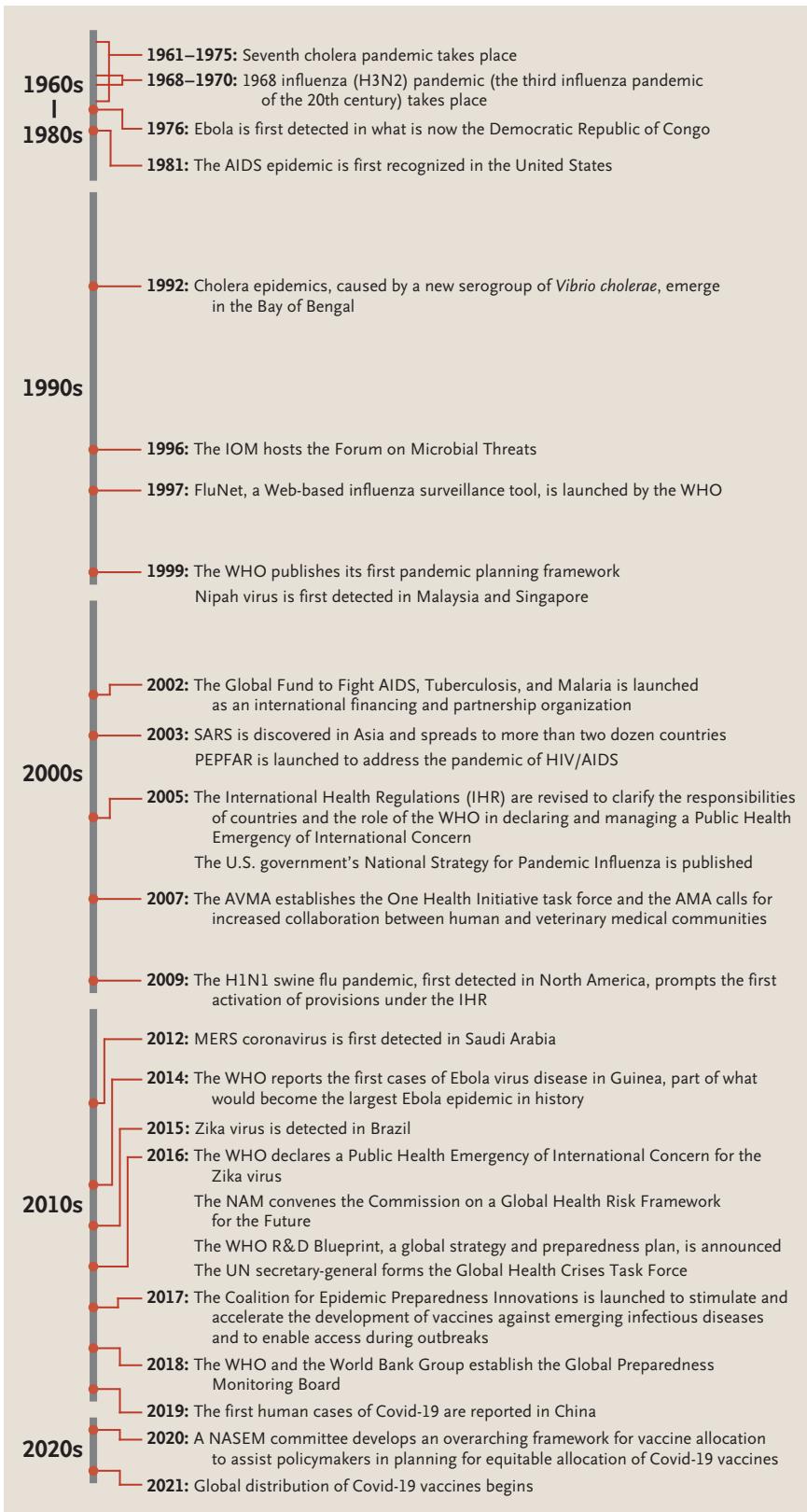
Over the past three decades, a similar transformation has occurred in low- and middle-income countries (LMICs) in Asia and sub-Saharan Africa. As immunization coverage of children increased to 80% worldwide, deaths among children younger than 5 years of age in these countries decreased by more than 50%. Global maternal mortality has also dropped by nearly 50% during this period, deaths from malaria have decreased by 60%, and the HIV infection rate has fallen by more

than 40%. Poliovirus now stands on the brink of eradication.

Many factors account for this remarkable progress, including increased investment in health systems and public health infrastructure; improvements in the prevention, diagnosis, and treatment of infection; and the development and distribution of safe and effective vaccines (see timeline). Much of the credit for scaling up global access to lifesaving interventions belongs to multilateral organizations and partnerships such as the World Health Organization (WHO); UNICEF; Gavi, the Vaccine Alliance; the Global Polio Eradication Initiative; and the Global Fund to Fight

AIDS, Tuberculosis, and Malaria, as well as to the U.S. president's AIDS and malaria initiatives. These efforts are as vital as ever, since health inequities are ubiquitous and all countries face new threats, including antimicrobial resistance. As Covid-19 has made clear, emerging infectious diseases also present important challenges for global health security, and the same conditions that have fueled broad-based gains in health and wealth — including increased trade, travel, and labor migration — have made humans increasingly vulnerable to pandemics.

In recent decades, previously isolated zoonotic pathogens have regularly infected and been transmitted between humans, and some have spread rapidly among people and across borders. Between 1980 and 2017, outbreaks of more than two dozen such



diseases were reported worldwide.² Years before the emergence of Covid-19, many observers cited a growing risk of a once-in-a-century pandemic caused by a fast-moving virus. The National Academy of Medicine (NAM, formerly known as the Institute of Medicine) has long worked to raise awareness of emerging infectious diseases, including by means of its Forum on Microbial Threats, launched in 1996, and the Commission on a Global Health Risk Framework for the Future, convened in response to the 2014–2016 Ebola virus outbreak in West Africa.³ Given other acute needs, however, it proved difficult to sustain public attention, political will, and funding in the area of pandemic preparedness, even after the Ebola outbreak demonstrated the extent to which the world was unprepared to respond to a transnational health emergency.⁴

One important response to the Ebola crisis was the creation of the Coalition for Epidemic Preparedness Innovations (CEPI) in 2016. CEPI was designed as a public–private partnership to accelerate the discovery and development of “just-in-case” vaccines against known pathogens such as Ebola, Nipah virus, Middle East

Selected Events Related to Emerging Infectious Diseases and Pandemic Preparedness during the Past 60 Years.

AMA denotes the American Medical Association, AVMA the American Veterinary Medical Association, IOM the Institute of Medicine, MERS Middle East respiratory syndrome, NAM the National Academy of Medicine, NASEM the National Academies of Sciences, Engineering, and Medicine, PEPFAR the President's Emergency Plan for AIDS Relief, SARS severe acute respiratory syndrome, UN the United Nations, and WHO the World Health Organization.

respiratory syndrome, and SARS. Innovative vaccine-development platforms supported by CEPI — including messenger RNA (mRNA) and DNA constructs — were used to quickly develop vaccines against Covid-19 and could be mobilized in the future to produce just-in-time vaccines against newly discovered pathogens. CEPI's greatest challenge has involved needing to rely on a pass-the-hat type of funding strategy, rather than having appropriate funding secured before an emergency. Although many high-income countries have provided financial support for vaccine research and development, major donors such as the United States remained outside the coalition until recently.

A second important step was the launch of the Global Preparedness Monitoring Board (GPMB) by the WHO and the World Bank Group in 2018 in response to recommendations from the United Nations secretary-general's Global Health Crises Task Force. Composed of political leaders, multilateral agency heads, and scientific experts, the GPMB was established to appraise the steps required to prepare the world to respond quickly and decisively to global health emergencies. The board issued its first set of recommendations in a 2019 report, *A World at Risk*, then updated these recommendations in its 2020 report, *A World in Disorder*.⁵ Despite positive steps by CEPI and the GPMB, the Covid-19 pandemic arrived before global leaders could fully act on these recommendations.

In the 2020 report, the co-chairs of the GPMB wrote, “The Covid-19 pandemic has revealed a collective failure to take pandemic prevention, preparedness

and response seriously.”⁵ In reflecting on lessons from Covid-19, the board noted that conventional standards for national pandemic preparedness — such as having strong disease-detection capacity, well-funded public health systems, and the ability to safely treat and isolate infected people — failed to predict how countries would fare during a major outbreak. When national leaders ignored public health guidance and residents proved unwilling to adapt their behavior to reduce transmission risk, Covid-19 incidence spiked.

Another important lesson outlined in the 2020 report is that planning for future pandemics should include stakeholders outside the health sector. The severe effects of Covid-19 on national economies and household incomes demonstrate the degree to which countries must be willing to mobilize emergency funding to mitigate financial shocks and deliver social protection to people who are most at risk of serious health outcomes or impoverishment because of social and economic disruption. As the GPMB described, pandemic preparedness should move from being a responsibility financed and led by health ministries to one that is prioritized by finance ministers and involves all affected sectors as part of a government-wide approach. Under such a strategy, budgets for preparedness would increase at least 10-fold and non-health sectors would have an explicit stake in national readiness.

The speed with which the pharmaceutical industry responded to the Covid-19 pandemic emphasizes its capacity to develop and scale up manufacturing of the vaccines, diagnostics, and thera-

peutics required to end the acute phase of pandemics. In this case, the most important market failure has been the lack of access to vaccines in LMICs. The disconnect between the existence of global public goods and industry incentives to deliver such goods must be bridged; doing so will require innovative public-private partnerships.

As world leaders develop strategies for ending the Covid-19 pandemic, we believe they should abandon the cyclical phases of “panic and neglect” that have characterized reactions to health emergencies. Instead, leaders should commit to a new framework of prevention, detection, and response. Such an approach would involve focusing more resources on detecting emerging zoonotic threats and finding and containing these threats while they are localized and manageable.

Implementing this type of initiative would require strengthening national, regional, and global institutions and scaling up development of the public health workforce, including increasing the number of community health care workers. Such efforts would bolster surveillance systems, enable countries to report threats early, and help countries respond quickly — which they were unable to do for Covid-19.

As part of these efforts, we need robust research-and-development capacity that can be rapidly activated on a global scale. Private-sector producers must have adequate financial guarantees from governments to reduce the risks associated with investing in pandemic preparedness and response, and preclinical and clinical research capacity should be developed at both the national

and regional levels in LMICs. We also need broadly distributed sites for manufacturing products to meet global needs and regulatory systems that are prepared to provide emergency approval of new products and ensure their rational allocation by prioritizing distribution to regions where products can be most effective in stopping progression of a pandemic.⁵

Finally, in an era of nearly limitless digital potential, we can harness the tools of the information age to share essential data for detecting new pathogens,

 An audio interview with Dr. Elias is available at NEJM.org

accelerating product development, and enhancing pandemic response efforts. Countries should work together to break down barriers to data sharing while taking steps to protect privacy and prevent misuse.

The annual cost of making these investments would be billions of dollars. The GPMB has reported that adequate investment in preparedness would require

an average of \$5 per person worldwide each year. In comparison, economists estimate that the world has already spent more than \$11 trillion fighting Covid-19 and that the pandemic will exact another \$10 trillion in lost future earnings. The NAM will continue to play an important role in these debates. Recently, for example, the National Academies of Sciences, Engineering, and Medicine published a consensus study report, *Framework for Equitable Allocation of Covid-19 Vaccine*.

We believe it's time for world leaders to heed warning signs, abandon half-measures, and commit to the global system we need to respond to the ever-present danger of emerging infectious diseases. We simply cannot afford the alternative.

The series editors are Victor J. Dzau, M.D., Harvey V. Fineberg, M.D., Ph.D., Kenneth I. Shine, M.D., Samuel O. Thier, M.D., Debra Malina, Ph.D., and Stephen Morrissey, Ph.D.

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1. Hansen V, Oren E, Dennis LK, Brown HE. Infectious disease mortality trends in the United States, 1980-2014. *JAMA* 2016; 316:2149-51.

2. Ndow G, Ambe JR, Tomori O. Emerging infectious diseases: a historical and scientific review. *Socio-cultural Dimensions of Emerging Infectious Diseases in Africa* 2019;31-40.

3. National Academies of Sciences, Engineering, and Medicine. *Global health risk framework: resilient and sustainable health systems to respond to global infectious disease outbreaks: workshop summary*. Washington, DC: The National Academies Press, 2016 (<https://doi.org/10.17226/21856>).

4. Institute of Medicine. *Emerging viral diseases: the one health connection: workshop summary*. Washington, DC: The National Academies Press, 2015 (<https://doi.org/10.17226/18975>).

5. Global Preparedness Monitoring Board. *A world in disorder: Global Preparedness Monitoring Board annual report 2020*. Geneva: World Health Organization, 2020 (https://apps.who.int/gpmb/assets/annual_report/GPMB_AR_2020_EN.pdf).

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Ensuring That LGBTQI+ People Count — Collecting Data on Sexual Orientation, Gender Identity, and Intersex Status

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Most national surveys in the United States, including the decennial census, do not collect demographic data on sexual orientation, gender identity, or intersex status. As a result, despite improvements in the social and legal standing of lesbian, gay, bisexual, transgender, queer, intersex, and other sexual and gender-diverse (LGBTQI+) populations, many simple facts about these communities remain elusive. As

outlined in a comprehensive new report on LGBTQI+ populations from the National Academies of Sciences, Engineering, and Medicine, the data that do exist point to epidemics of depression, substance use, HIV infection, violence, homelessness, and other adverse outcomes driven by the discrimination and social and economic marginalization that many LGBTQI+ people continue to experience.¹ For every gap in health

and well-being whose contours we have mapped, the widespread lack of comprehensive data collection means that many more disparities — and the policy and programmatic interventions that might address them — remain unknown.

Data are fundamentally political: decisions about which data are collected and which are overlooked both reflect and shape policy and program priorities. At