The reemergence of polio, as monkeypox soared and COVID-19 continues its devastation, has laid bare the magnitude of communicable disease threats and humankind’s vulnerability. COVID-19 has caused 15 million deaths worldwide through last year and still kills more than 1000 daily. More than 60,000 monkeypox cases have been reported across 103 countries, most of which had never experienced cases unrelated to travel.

By contrast, vaccination campaigns brought poliomyelitis to near eradication, with wild polio circulating only in Afghanistan and Pakistan. Yet vaccine-derived polio (from an oral vaccine containing live, attenuated virus) was recently discovered in New York, London, and Jerusalem, with wastewater samples suggesting wider circulation. The World Health Organization (WHO) has now officially added the US to the WHO’s list of 30 poliovirus outbreak countries.

The WHO has declared COVID-19, monkeypox, and polio Public Health Emergencies of International Concern. They are remarkably diverse—a novel coronavirus (COVID-19), an ancient scourge (polio), and a disease endemic in certain African countries (monkeypox). Yet the same global forces have propelled all 3 diseases with immense cumulative effects on health and society.

Pandemic risks are escalating, with new outbreaks projected to increase up to 3-fold. Pandemics reverse human and economic development. Why are they occurring more frequently, and what lessons can we learn?

**Pandemic Drivers**

Zoonotic pathogens—such as those causing HIV, SARS, Ebola, monkeypox, and COVID-19—account for 60% of all communicable diseases and 70% of novel ones. Zoonotic spillovers are more frequent and resulting outbreaks are spreading more rapidly due to human behavior. As humans encroach on wildlife environments at an alarming rate for agriculture, natural resource extraction, and urban expansion, ecosystems are destroyed and wild species are displaced and placed under stress. Increased co-mingling of wildlife, humans, and livestock increases zoonotic spillovers. High-density livestock operations and international trafficking of wild animals pose high risks. The accumulated evidence suggests SARS-CoV-2 most likely originated at the Huanan Seafood Wholesale Market.

Anthropogenic climate change dramatically increases cross-species viral transmission because global warming makes some habitats less habitable. Species, harboring pathogens, migrate to cooler latitudes, potentially across continents. Bats, in which scores of coronaviruses have been identified, can travel long distances. Climate change also expands pathogen vectors to new geographic areas, propelling mosquito-borne diseases.

Urbanization increases human population density, driving person-to-person spread of pathogens, and rapid transportation and mass migrations propel global outbreaks throughout the globe. The World Bank estimates that 56% of the world’s population—4.4 billion people—live in cities, and 70% will do so by 2050. Mass migrations driven by food insecurity, climate change, and armed conflict are at all-time highs, with the International Migration Office estimating 281 million international migrants in 2020, encompassing 3.6% of the global population.
Lessons Learned

The WHO lists 10 high-priority pathogens, including novel coronaviruses, Ebolavirus, and Zika virus, as well as disease X—a placeholder for an unknown pathogen. Attempts to deal with outbreaks have uncovered shortcomings in 5 areas, which urgently need solutions.

Health Systems

The International Health Regulations (IHR) require countries to build core health system capacities (surveillance, laboratories, human resources, and risk communication, among others). In March 2020, the WHO estimated that health care workers would need 89 million medical masks and 76 million gloves per month; extreme shortages left frontline workers "dangerously ill-equipped," and low-income countries struggling to compete in global markets. An estimated $124 billion is needed globally to build effective country-level health security capacities—far less than the approximately $4 trillion the US spent on COVID-19 response and recovery.

Global Cooperation

COVID-19 fractured global cooperation and solidarity, with flawed early reporting and incomplete investigation of COVID-19's origins. Then-President Trump announced the US would withdraw from the WHO, while the agency was unable to gain access to crucial data and viral samples from China.

Equity

High-income countries hoarded diagnostics, personal protective equipment, vaccines, and therapeutics. During the Omicron coronavirus wave in November 2021, nearly 70% of people in most high-income countries were fully vaccinated, with only about 8% of people in low-income countries receiving even 1 dose. Only 25% of health care workers in Africa were fully vaccinated. Echoing COVID-19, high-income countries again hoarded limited vaccine, testing, and treatment supplies for monkeypox. In the US, White residents lost 2.4 years of life expectancy in 2020 and 2021 compared with a decrease of 4.2 years and 4.0 years for Black and Hispanic populations, respectively, and 6.6 years for American Indian/Alaska Native populations. Similarly, by August 2022, Black and Hispanic populations experienced monkeypox cases at twice their population share.

Health Communication

Trust in public health agencies plummeted during COVID-19, facilitated by weak health communication. Trusted communicators and accurate information are important for polio too, given high vaccine hesitancy in some communities. Most monkeypox cases have been among men who have sex with men; avoiding stigmatization is important. Successful partnerships from the HIV/AIDS pandemic, such as the PEPFAR (the US President’s Emergency Plan for AIDS Relief) and the Global Fund to Fight AIDS, Tuberculosis and Malaria, offer lessons on effective community and stakeholder engagement.

Childhood Vaccinations

Polio's reemergence highlights that vaccination efforts are successful only if they are ongoing. During COVID-19, 25 million children missed routine vaccinations—the largest decline in 30 years.

5 Steps Toward a More Secure Future

Pandemics require a far-reaching plan with 5 areas of immediate action.

Prevention

Preventing epidemics begins with recognizing their chief source—zoonotic pathogens—and reducing spillovers. The collaborative One Health agenda would institutionalize governance around
inseparable links between human, animal, and environmental health. Key steps include land conservation and stewardship, reducing human activities on intact habitats, and restoring degraded ecosystems. Countries should ban live wildlife trade; presently, only some trade is illegal. Zoonotic spillovers can be reduced by keeping animals healthy through humane, sustainable farming.

**Preparedness**
Expanding the Global Virome Project could identify high-risk viral pathogens that may spill over to people, thereby informing countermeasure development. Wastewater and genetic monitoring should become standard practices. Investing in research and development against known high-risk pathogens enables rapid deployment when outbreaks emerge. Globally shared stockpiles, regional manufacturing hubs, and fair distribution for countermeasures would advance preparedness and equity.

**Response**
Effective prevention and robust health systems would improve response capabilities. Governments should use interpandemic periods to build capacities and create biomedical platforms to respond to high-priority pathogens, including unknown ones. Governance is also vital, with stronger monitoring and accountability to avoid a repeat of IHR violations seen during COVID-19.

**Recovery and Resilience**
After an epidemic, schools will need to recoup learning losses, health systems to restore disrupted care, and governments to expand social safety nets. Strengthening health systems and social services can prevent people from falling into poverty, losing years of life expectancy, and losing educational skills. High-income countries should provide funding to ensure recovery of even the poorest countries.

The world is at a turning point in global governance for health. The World Health Assembly placed 3 audacious reforms in motion: a new pandemic instrument, IHR reforms, and WHO sustainable financing. All may come to fruition by the May 2024 World Health Assembly. In September 2022, the United Nations General Assembly adopted a Resolution on Pandemic Prevention, Preparedness, and Response to add political heft and financing for global health security. When disease X strikes, the question is whether the world will be prepared. That answer hangs in the balance.

**ARTICLE INFORMATION**
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