

Preparedness for the Next Pandemic: Lessons from the Past and Strategies for the Future

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Abstract: This review article discusses the importance of preparedness for the next pandemic, drawing on lessons learned from past pandemics and exploring strategies for mitigating the impact of future health threats on public health and the economy. The article emphasizes the need for global cooperation and investment in research and development of countermeasures to control emerging pathogens. It also highlights the importance of prioritizing core capacities of laboratory, surveillance, workforce, and emergency response operations, as well as critical enabling areas such as emergency preparedness, risk communications, and national legislation, policy, and financing. The article concludes by calling for urgent, radical, and fundamental change in pandemic preparedness efforts.

Keywords: pandemic, preparedness, global cooperation, emerging pathogens, emergency response, risk communications, public health

1. Introduction

A pandemic is defined as “an epidemic occurring worldwide, or over a very wide area, crossing international boundaries and usually affecting a large number of people”. (1)

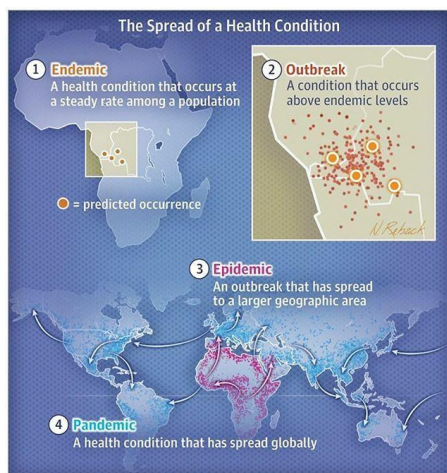


Figure 1: The terms endemic, outbreak, epidemic, and pandemic indicate how common a condition is at a point in time relative to how common it was at an earlier time.

The 1918 Spanish influenza, which infected more than one-third of the world’s population and killed approximately 50 million people, is the most famous example. There have been several influenza pandemics since 1918 - in 1957 and 1968, as well as H1N1 in 2009. Other examples include bubonic plague (the BlackDeath) in the 14th century, severe acute respiratory syndrome (SARS) virus in 2003, and HIV/AIDS. (2)

Whether by microbial mutation, movement across borders, or man - made biological release, a new health threat is inevitable, unpredictable and potentially devastating. (3) Infectious diseases pose the greatest threat to public health and result in more years of life lost from premature death

than any other disease process. (4) Influenza is one of the oldest infectious diseases affecting humans. Every influenza pandemic in history has ended with disastrous outcomes regarding public health and the social economy. (5)

However, over the past three decades, there has been a constant stream of newly identified pathogens that have received increasing attention. The approach to these new pandemic threats has generally been reactive, and specific medical interventions have not been available in time to make a substantial impact on the immediate outbreak. (4) The 2014–16 Ebola epidemic had mostly waned before successful medical countermeasures were deployed. Arguably, many lives could have been saved if these countermeasures had arrived sooner. (6)

When COVID - 19 was first identified in Wuhan, China, in December 2019, there were already many documents published by various global and national bodies as well as academic research papers and books that anticipated the possibility of a pandemic. (7) With increasing travel, immigration, crowding, and human interaction with livestock, there is an ever - increasing risk of another pandemic. (8) Over the past few decades, humans have experienced continued attacks by various deadly infectious diseases caused by newly found or evolved viruses, including SARS, MERS, ZIKA, EBOLA, influenza illness, etc. (9)

South Asia comprises eight countries – Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka – and is home to one - fifth of the world’s population. This region accounts for 21% of the reported total number of cases of coronavirus disease 2019 (COVID - 19) and 11% of COVID - 19 deaths worldwide. Initial projections placed South Asia at even higher risk than observed for deaths and catastrophe due to the high population density, high burden of comorbidities, vast socio - economic vulnerabilities and poor health system infrastructure. (10)

Table 1: Relative Impact of COVID - 19 on Three Most Populous Countries (11)

World Health Organization data on April 20, 2020				
Country	Population	GDP (US\$)	Coronavirus cases	Coronavirus deaths
China	1, 439, 323, 776	15.47 trillion	83, 369	4, 642
United States	331, 002, 651	22.20 trillion	461, 275	32, 427
India	1, 380, 004, 385	3.26 trillion	7, 747	507

Moreover, “lessons learned” from previous infectious disease outbreaks and “recommendations for the future” related to pandemic preparedness were encapsulated in a number of publications over the last two decades. (5) COVID-19 pandemic globally has emphasized the need for strengthening public health care systems. Earlier in 2016, Ebola outbreak raised concerns about the poor preparedness of health systems globally. System strengthening is essential as trial times that are visible during pandemics and epidemics leave no time for preparedness. (12)

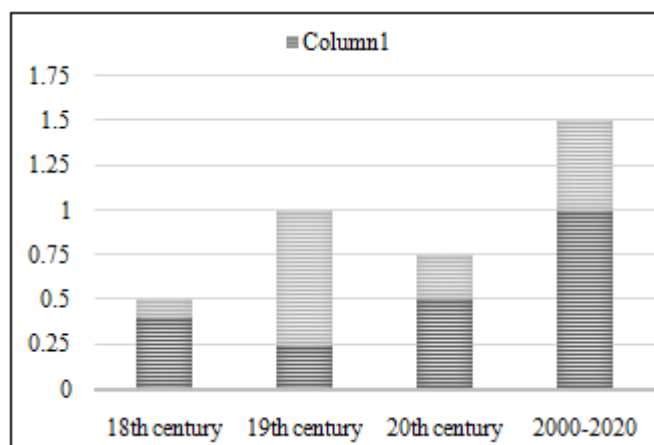


Figure 2: Number of pandemics per decade (13)

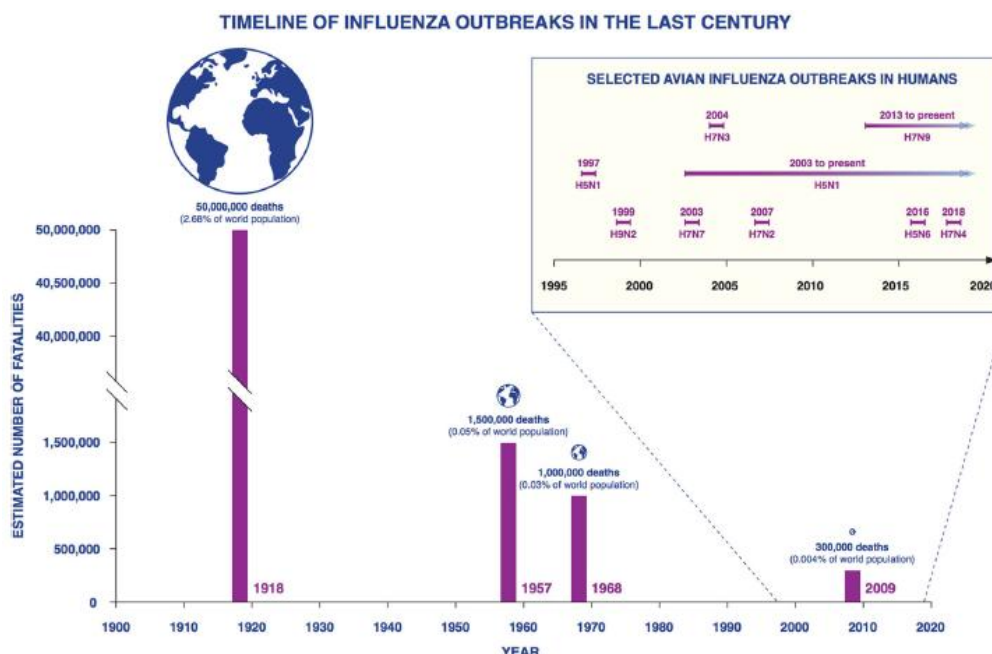


Figure 3: Timeline of recorded influenza outbreaks in the past century as well as selected avian influenza outbreaks in humans. In the main figure, globe size corresponds to the estimated number of fatalities relative to global population size at the time, with vertical bars representing the estimated absolute number of fatalities. Numbers are averages from various approximations. In inset, horizontal bars represent time frame that cases from the influenza A virus strain were recorded. (8)

Pandemic Preparedness

Pandemic preparedness is a key function of any healthcare facility. Activities pertaining to pandemic preparedness should be developed and maintained within a broader emergency management plan. The use of a Hospital Incident Command System can centralize coordination of the response and facilitate internal and external communication. (14) Since the World Health Organization (WHO) declared COVID - 19 a Public Health Emergency of International Concern in January 2020, there has been no shortage of assessments of pandemic preparedness and response. (15) There is consensus among experts that India’s response to COVID - 19 pandemic has been successful thus far. India

acted early and acted decisively. This is not an opinion but an evidence - based conclusion. (11)

To address the lack of preparedness by countries and the world for COVID - 19 and future pandemics, there is now a global push for a new health treaty on preparedness and response that would supplement and strengthen the WHO International Health Regulations. (16) Progress will require not only more and sustained leadership and funding from governments but also better technical capacity and improved operational excellence in public health systems across the globe. Strengthening our global health architecture will require country commitment and effective governance,

effective use of increased financing, robust technical support, and the support of strong and accountable global leadership. (17)

‘Preparing for the next epidemic’ has been a recurrent theme in global health in recent years. This concern has never been as visible as it was during the last two Davos Summits. The most recent World Economic Forum (WEF) featured a session specially dedicated to the Coalition for Epidemic Preparedness Innovations (CEPI), which had been created at the previous year’s summit. CEPI’s mission is ‘to stop future epidemics by developing new vaccines for a safer world’ by bringing together private and public investors: the governments of Germany, Norway, Japan and India; the European Commission; the Bill and Melinda Gates and the Wellcome Trust Foundations; and a consortium made up of large pharmaceutical companies, such as Pfizer and Johnson & Johnson, research laboratories and biotechnology start-ups. (18)

Implementing these five steps can enhance our ability to address pandemic threats more effectively than in previous instances.

1) **Safeguarding Against Zoonotic Threats: A Call for Vigilance and Action**

The primary threat arises from pathogens circulating among animals that can jump to humans, as exemplified by the rapid global spread of COVID - 19 through trade and travel. Identifying likely candidates for interspecies transmission is crucial for developing vaccines and treatments. The World Health Organization has pinpointed various diseases with pandemic potential, including Crimean–Congo haemorrhagic fever, Ebola, Marburg, Lassa fever, MERS, SARS, Nipah virus infection, and Zika.

However, many potential pandemic pathogens in animals remain unidentified. It is imperative to locate areas where human - animal interaction is high and implement measures to mitigate the risk. One approach is to enhance regulations on hygiene standards in markets where animals are slaughtered and sold.

2) **Global Genetic Sequencing: Essential for Pandemic Preparedness**

In order to equip ourselves with the necessary tools to combat pandemics, including diagnostic tests, vaccines, and therapeutics, it is imperative to understand the nature of the threat. Rapid acquisition and dissemination of the genetic sequences of emerging viruses are crucial. While the handling of SARS - CoV - 2’s genetic data was exemplary, not all nations possess the capacity for such sequencing. If a virus emerges in a country lacking sequencing capabilities, it could silently propagate for weeks, as witnessed during the Ebola outbreak in Guinea in 2014. To prevent potential delays in crucial pandemic responses, such as adapting vaccines, there is a need for global investment in genetic sequencing capabilities.

3) **Empowering Global Vaccine Manufacturing for Equitable Access**

The inadequacy of relying on charitable vaccine donations from affluent nations, exemplified by the experiences with

swine flu, COVID - 19, and monkeypox, underscores the issue of vaccine inequality. Access to the majority of vaccine supply is controlled by high - income countries, leaving low - income nations with minimal access. COVID - 19 has brought to light the vulnerabilities in vaccine production, with heavy reliance on a handful of manufacturers like the Serum Institute of India in Pune. To address this, there is a need for a more equitable distribution of vaccine and therapeutic manufacturing capabilities. Establishing regional hubs equipped to mass - produce high - quality medical products during emergencies is crucial. Achieving this requires actions such as waiving intellectual - property rights, constructing new manufacturing facilities, and providing training in low - resource settings. Collaboration between the private sector and governments is essential, acknowledging the private sector’s pivotal role in vaccine research, production, and distribution.

4) **Advancing Vaccine Preparedness for Swift Production**

The key to overcoming viral pandemics lies in effective vaccination strategies. By having vaccines ready in advance, their rapid deployment becomes feasible when new threats arise, aiding in containment efforts. For pathogens like influenza, recognized for their pandemic potential, governments should allocate resources to develop vaccines capable of providing broad protection against diverse variants. Ongoing clinical trials of universal flu vaccines, designed to elicit a comprehensive immune response by incorporating multiple flu strains, exemplify this approach. Additionally, for unforeseen threats, scientists are developing versatile technical platforms, such as mRNA technology or adenovirus vectors, allowing for swift modifications tailored to combat specific emerging dangers.

5) **Preventing Respiratory Pathogen Transmission: Rethinking Inevitability**

Governments need to shift away from the notion that the spread of respiratory pathogens is unavoidable. Throughout the COVID - 19 pandemic, some countries, like Sweden and the United Kingdom, initially dismissed the possibility of quickly developing a vaccine to protect the majority of the population. However, multiple vaccines were successfully created, tested, and approved within a relatively short timeframe. Consideration must be given to the potential lives saved if governments had actively worked to curb transmission until mass vaccination efforts could be implemented. Taking every reasonable measure to delay virus spread until medical interventions are widely available is crucial. This may involve implementing emergency mask mandates in public spaces, such as shops and transport hubs, and devising plans to maintain school operations by relocating classes to larger venues like stadiums and museums that offer a safer environment.

2. **Funding and Governance**

Funds are needed not only to build public health laboratories, emergency response capacities and train staff—one time or episodic costs that traditionally have been the primary areas development banks and bilateral donors have funded—but also for ongoing staff salaries, supplies, equipment maintenance and other recurring costs needed to

find and stop both everyday and extraordinary threats. A crucial lesson from preparedness work over the past 20 years has been that the most effective emergency response systems build on robust, scalable systems that respond to everyday events.

These funds are in addition to financing needed to strengthen research and development which is being addressed, in part, through groups such as the Coalition for Epidemic Preparedness and Innovation and the Foundation for Innovative New Diagnostics, which also require additional, sustained resources. And the improvements go beyond changes needed to further strengthen WHO, which is pivotally important for a more effective global response. (17)

3. Objective

Pandemics and large - scale outbreaks can claim millions of lives, disrupt societies and devastate economies. WHO's Health Emergencies Programme (WHE) is working with Member States to help countries to prepare for large - scale outbreaks and pandemics. As the next pandemic is most likely to be caused by influenza, the disease continues to be the priority public health threat in the region. WHE continues to work with Member States to strengthen prevention, surveillance, and response capacities for seasonal and zoonotic influenza with pandemic potential.

This review article aims to shed light on the preparedness for the next pandemic.

4. Methods and Materials

This article was written after collecting required data from secondary sources such as different websites, OpenAI chat GPT, and referred journals from Pubmed, Google Scholar, Frontiers in medicine, Journals of specialised medicine.

The research article reviewed here includes - Health is more than Influenza (Bonneux L, 2011); What is a pandemic? (Morens DM, 2009); Protecting the world from infectious disease threats: now or never (Shahpar C, 2019); Emerging viral diseases from a vaccinology perspective: preparing for the next pandemic (Graham BS, 2018); On the centenary of the Spanish flu: being prepared for the next pandemic (Liu WJ, 2018); Disease X: accelerating the development of medical countermeasures for the next pandemic (Simpson S, 2020); COVID - 19 and Pandemic Preparedness: Foresight Narratives and Public Sector Responses (Milojević I, 2021); Preparing intensive care for the next pandemic influenza (Kain T, 2019); Sustained research fund and dedicated research center to prepare for the next pandemic (Jia H, 2020); Pandemic preparedness and response to COVID - 19 in South Asian countries (Babu GR, 2021); India's response to coronavirus pandemic: nine lessons for effective public management (Trivedi P, 2020); Strengthening public healthcare systems in India; Learning lessons in COVID - 19 pandemic (Garg S, 2020); The Political Economy of the Next Pandemic (PAGv B, 2021); Pandemic preparedness (Godshall CE, 2021); Reconceptualizing successful pandemic preparedness and response: A feminist perspective (Smith J, 2022); Will a global preparedness treaty help or hinder pandemic preparedness? (Frieden TR, 2021); The

world must prepare now for the next pandemic (Frieden TR, 2021); Preparedness for the next epidemic: health and political issues of an emerging paradigm (David PM, 2019).

5. Discussion

Stepping up preparedness is difficult, and requires that many incremental activities be done to achieve meaningful change. This is nearly impossible without prioritisation, and countries need coherent guidance and practical tools to identify where to begin. To reduce epidemic risk, countries must ensure prioritisation of core capacities of laboratory, surveillance, workforce and emergency response operations, as well as critical enabling areas including emergency preparedness, risk communications, and national legislation, policy and financing. Health cannot be protected by Ministries of Health alone. Many sectors need to be involved in order to increase and sustain investment, build long - term capacity and implement policies affecting health in the food, security and animal sectors. High - level support (eg, from presidential or prime minister offices) is essential for countries to take action. Engagement by journalists and civil society can convey that increased health security is essential. This support can help counter the pattern of a temporary surge of activity followed by waning interest, as typically seen after a major outbreak. (3)

COVID - 19 demonstrated that even robust public health institutions are not immune from inappropriate political interference. WHO is the essential anchor of our global health architecture and must be reinforced by human resource policy improvements, increased resources, and functional partnerships with development banks and other organisations. Yet the scope of financial, technical and operational support required to respond effectively to the next pandemic is likely to remain beyond the reach of any single institution. Further improvements in WHO are necessary but not sufficient to greatly improve global readiness. (17)

6. Conclusion

To solve this problem, we recommend two major reformations: 1. Invest heavily and continuously into development of countermeasures to control emerging pathogens that cause massive population infections, and 2. Build multiple international and state - level research centers to deal with the next pandemics. (9) What is needed—improved governance, more money, greater technical skill and operational excellence—is clear. (17)

In summary, the critical lesson learned from past experiences and the new pandemic infection is that we cannot continue to do the same as we have done before. Instead, we genuinely need urgent, radical, and fundamental change for preparedness for next pandemic. (9)

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