

## Epidemiological Shifts in Infectious Diseases in China: Implications and Policy Recommendations

Binbin Su<sup>1,8,\*</sup>; Zuliyaer Talifu<sup>2,8,\*</sup>; Luzhao Feng<sup>1,3,4,#</sup>

### ABSTRACT

In recent decades, China has experienced significant alterations in its landscape of infectious diseases, with noteworthy reductions in historically prevalent illnesses such as tuberculosis and viral hepatitis. At the same time, emerging pathogens like severe acute respiratory syndrome (SARS), Influenza A virus subtype H7N9 (H7N9), and SARS coronavirus 2 (SARS-CoV-2) pose new challenges. These epidemiological shifts, fueled by fast economic development, urbanization, modifications in the healthcare system, and an aging population, present considerable obstacles to the country's public health infrastructure and policy frameworks. This article provides a comprehensive review of these changes, underscoring the driving forces behind them and the resultant impact on health policy and infrastructure. It stresses the challenges and calls for an intensification of surveillance efforts, the establishment of collaborative partnerships both nationally and internationally, the encouragement of worldwide cooperation, and the reinforcement of public health education as pivotal strategies for managing China's changing spectrum of infectious diseases.

Since the founding of the People's Republic of China, the initiation of national immunization programs, infectious disease surveillance and early warning systems, along with public health education campaigns, has substantially diminished the spread and outbreak of infectious diseases. Consequently, morbidity and mortality rates from major infectious diseases have significantly declined over the past decades (1).

Historically, infectious diseases were the primary cause of mortality in the early days of China. Today, however, the epidemiological profile has drastically evolved. Presently, nine of the top ten causes of death in China are attributed to chronic non-communicable

diseases, with road traffic injuries being the lone exception (2). The risk once associated with numerous infectious diseases has waned, making them rare incidents in contemporary times. These shifts in public health have considerably enhanced the average life expectancy, providing benefits not only to the Chinese population, but also having a positive global impact (3).

The National Health Commission's 2021 report revealed a total of 2,711,785 reported instances of 27 Class A and B notifiable infectious diseases in China. This equates to an incidence rate of 192.58 per 100,000. Among these, bloodborne and sexually transmitted diseases accounted for a rate of 131.03 per 100,000, with intestinal infectious diseases at a markedly low 7.42 per 100,000. In spite of the overall decline in conventional infectious diseases, China continues to be susceptible to the outbreak of new and unpredictable forms of infection. The severe acute respiratory syndrome (SARS) epidemic of 2003, recurring mutations in zoonotic diseases, and the ongoing SARS coronavirus 2 (SARS-CoV-2) pandemic highlight this susceptibility. Such incidents serve as potent reminders of the continuing fight against infectious diseases and emphasize the pressing need for more stringent control measures.

### ISSUES AND CHALLENGES

#### Emerging Infectious Diseases: Uncertainty and Complexity

Emerging infectious diseases present a significant degree of uncertainty and complexity, both in their inherent characteristics and management strategies (4). Determining the origins and transmission pathways of these diseases is an intricate task, necessitating an integration of various methodologies. These include field epidemiological investigations, sample procurement and pathogen identification, as well as molecular or sero-testing, and transmission dynamics modeling studies. Definitive conclusions typically demand extensive and time-consuming research

initiatives.

The acceleration of population mobility has further propagated the dissemination of emerging infectious diseases (5). These novel strains, unrecognizable to the human immune system, can rapidly proliferate within brief periods. Some of these diseases may not immediately produce apparent symptoms in patients, thus posing challenges in monitoring their propagation. Additionally, certain diseases have the potential to disperse through various modes, including airborne, contact, or droplet transmission, thereby complicating containment operations.

The recent surge in zoonotic and respiratory infections underscores the unpredictable character of emerging diseases. The early dissemination of respiratory ailments, taking SARS-CoV-2 for example, posed substantial challenges. Simultaneously, zoonotic diseases like avian influenza and monkeypox, notable for their frequent strain variations, emphasize the importance of vigilance and underscore the value of addressing environmental risks in disease prevention.

### **Delays in Vaccine and Drug Development**

Vaccines and pharmaceuticals serve as crucial tools in the control of infectious diseases, with several such diseases being significantly impaired or effectively managed through large-scale immunization initiatives (6). Nonetheless, the development of these countermeasures is inherently sluggish due to the complex characteristics of infectious agents, rigorous regulatory criteria, protracted research phases, substantial financial commitments, and intrinsic risks. For novel pathogens, an in-depth understanding is essential in crafting specific vaccines or drug regimens. Moreover, exhaustive evaluations ensure safety and effectiveness. However, mutations in pathogens can diminish the efficacy of newly developed vaccines or pharmaceuticals, thereby posing substantial challenges in disease management.

### **The Deficiency in Global Collaboration and Information Sharing**

The worldwide proliferation of emerging infectious diseases has escalated given the amplification in global interconnectivity. Despite this, there remains a lack of robust global systems for cooperation and data dissemination. The SARS-CoV-2 crisis underscored the essentiality of global concordance, yet it also unveiled multiple challenges such as media controversies, technological barriers, and disparities in resource allocation (7). The divergence in cultural

norms, political ideologies, and commercial interests often pose considerable barriers to international unity, subsequently sabotaging cooperative efforts to combat diseases. The global response efforts are further strained by challenges such as inconsistent data sharing, disparate technological capabilities, and issues associated with intellectual property rights.

### **The Dilemma of Talent Cultivation**

Addressing infectious diseases requires persistent commitment, broad-ranging policies, and unwavering governmental backing. The extensive costs associated could dissuade investment, leading to a shortage of specialized professionals. The multidisciplinary and societal-wide strategies needed to combat infectious diseases pose obstacles in training versatile experts. Current public health education may be lacking in areas central to these efforts, including infectious disease control, epidemiology, health policy, and health system management. Deficiencies in curriculum and practical training may limit professionals' preparedness. Further, the absence of interdisciplinary and intersectoral collaboration in education impedes the development of professionals equipped for effective, multifaceted cooperation. A reconsideration and revision of the public health education curriculum and training programs to enhance practical experience, encourage academia-practice collaboration, and bolster multidisciplinary training might better align education with the shifting needs of public health.

### **The Influence of Public Anxiety on Information Distortion**

In today's digital era, the rapid and extensive dissemination of information is possible. Notwithstanding, the emergence of infectious diseases often incites increased public anxiety and the proliferation of distorted information (8). A prevalent lack of comprehension among the public can foster misconceptions about the disease, including its transmission, severity, and preventative strategies. Misinformation can swiftly multiply during disease outbreaks, thereby intensifying public fears and impeding disease control efforts.

## **IMPLICATIONS FOR POLICY**

### **Enhancing the System for Infectious Disease Prevention and Control**

Historical outbreaks such as the SARS epidemic of

2003 emphasize the crucial need for an adaptable response framework. China's implementation of a comprehensive disease prevention and control system, encompassing a broad surveillance network and the creation of a sophisticated early warning platform, is laudable. However, to ensure the efficiency of these systems, continuous policy support, financial investment, and talent engagement are necessary. Capitalizing on the capabilities of detection, risk assessment, and early warning, and maintaining preparedness through regular desktop and practical exercises, is crucial. The eradication of information silos across departments can facilitate "early detection, early prevention, and evidence-based control." Clear policies must be established, mandating interdepartmental data sharing and delineating roles.

### Improving Technological Responses to Emerging Disease Outbreaks

The merging of modern technology with infectious disease control considerably boosts the alacrity and accuracy of response initiatives. Progressive early outbreak warning paradigms feature intelligent systems with multi-trigger, multi-channel capabilities. Cutting-edge sensing technology, remote data monitoring, and real-time analysis form critical components of these forward-thinking strategies. Leveraging big data, artificial intelligence, and machine learning uncovers crucial outbreak patterns, enabling health authorities to make well-informed decisions. Additionally, advancements in genetic engineering and microbiomics accelerate vaccine development processes, fortifying a more robust public health response (9).

### Promoting Global Collaboration: An Empirical Study

The global emergence of infectious diseases underscores the essentiality of international collaboration in the quick detection, comprehension, and mitigation of novel infectious threats. This collaborative effort, epitomized by the Global Health Security Agenda (GHSA), encourages the dissemination of critical information and resources such as pathogen specimens, genetic sequences, and transmission vectors, thereby refining containment strategies. The recent SARS-CoV-2 pandemic underlines this scenario, where international cooperation facilitated the urgent sharing of viral sequences and the development of vaccines and therapeutics. Furthermore, the collaborative efforts

between the Global Vaccine Alliance (GAVI) and the World Health Organization (WHO) demonstrated how global cooperation can deliver vaccines to low-income nations, thereby mitigating the impact of pandemics on a global scale (10).

## Formulating Effective Risk Communication and Public Health Education Strategies

The widespread use of social media platforms has largely eradicated geographical limitations in information dissemination. It is crucial to establish authoritative channels for risk communication and public health education. By accurately conveying scientific information, providing accurate preventive guidance, and promoting public involvement in containment measures, we can mitigate potential public anxiety and misinformation.

## Enhancing Preventative Measures and Sustaining the Patriotic Health Movement

The recent pandemic has underscored the importance of swift, effective preventative measures. Consistent hygiene practices including mask usage and frequent hand cleaning are crucial in curtailing the spread of disease. China's public health strategy is greatly bolstered by the Patriotic Health Movement, which places a strong emphasis on preventative techniques to maintain and improve societal health. Over the years, this initiative has been a key factor in public health successes. Therefore, it is crucial to continuously revise and adapt its guidelines to align with evolving circumstances, truly embodying the principle of preventative health as a societal responsibility.

**Conflicts of interest:** No conflicts of interest.

**Funding:** Supported by the Chinese Academy of Medical Sciences Basic Fund-Talent Introduction and Development Project (2023-RC330-01), the National Key Research and Development Program (SQ2022YFC3600291) and the Non-profit Central Research Institute Fund of the Chinese Academy of Medical Sciences (2021-RC330-002).

doi: 10.46234/ccdcw2023.178

# Corresponding author: Luzhao Feng, fengluzhao@cams.cn.

<sup>1</sup> School of Population Medicine and Public Health, Chinese Academy of Medical Sciences & Peking Union Medical College, Beijing, China;

<sup>2</sup> Department of Population Health and Aging Sciences, School of

Population Medicine and Public Health, Chinese Academy of Medical Sciences & Peking Union Medical College, Beijing, China; <sup>3</sup> State Key Laboratory of Respiratory Health and Multimorbidity, Beijing, China; <sup>4</sup> Key Laboratory of Pathogen Infection Prevention and Control (Peking Union Medical College), Ministry of Education, Beijing, China.

<sup>✉</sup> Joint first authors.

Submitted: August 21, 2023; Accepted: October 15, 2023

## REFERENCES

1. Yang WZ. Dramatic achievements in infectious disease prevention and treatment in China during the past 70 years. *Chin J Epidemiol* 2019;40(12):1493 – 8. <http://dx.doi.org/10.3760/cma.j.issn.0254-6450.2019.12.001>. (In Chinese).
2. Yang GH, Kong LZ, Zhao WH, Wan X, Zhai Y, Chen LC, et al. Emergence of chronic non-communicable diseases in China. *Lancet* 2008;372(9650):1697 – 705. [http://dx.doi.org/10.1016/S0140-6736\(08\)61366-5](http://dx.doi.org/10.1016/S0140-6736(08)61366-5).
3. Murray CJL, Barber RM, Foreman KJ, Ozgoren AA, Abd-Allah F, Abera SF, et al. Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990-2013: quantifying the epidemiological transition. *Lancet* 2015;386(10009):2145 – 91. [http://dx.doi.org/10.1016/S0140-6736\(15\)61340-X](http://dx.doi.org/10.1016/S0140-6736(15)61340-X).
4. Yang WZ, Zhang T. Strategy and measures in response to highly uncertain emerging infectious disease. *Chin J Epidemiol* 2022;43(5):627 – 33. <http://dx.doi.org/10.3760/cma.j.cn112338-20220210-00106>. (In Chinese).
5. Baker RE, Mahmud AS, Miller IF, Rajeev M, Rasambainarivo F, Rice BL, et al. Infectious disease in an era of global change. *Nat Rev Microbiol* 2022;20(4):193 – 205. <http://dx.doi.org/10.1038/s41579-021-00639-z>.
6. Li XD, Li TS. The brief history and current application of vaccines. *Chin J Intern Med* 2022;61(5):588 – 93. <http://dx.doi.org/10.3760/cma.j.cn112138-20210521-00362>. (In Chinese).
7. The Lancet Digital Health. Digital technologies: a new determinant of health. *Lancet Digital Health* 2021;3(11):e684. [http://dx.doi.org/10.1016/s2589-7500\(21\)00238-7](http://dx.doi.org/10.1016/s2589-7500(21)00238-7).
8. González-Padilla DA, Tortolero-Blanco L. Social media influence in the COVID-19 Pandemic. *Int Braz J Urol* 2020;46(S1):120 – 4. <http://dx.doi.org/10.1590/s1677-5538.Ibju.2020.S121>.
9. Barberis I, Myles P, Ault SK, Bragazzi NL, Martini M. History and evolution of influenza control through vaccination: from the first monovalent vaccine to universal vaccines. *J Prev Med Hyg* 2016;57(3):E115 – 20. <http://dx.doi.org/10.15167/2421-4248/jpmh2016.57.3.642>.
10. Ren XP, Li ZY, Zhou XL, Shen YY, Yang Y. The international science and technology collaboration during the prevention and control of the infectious diseases. *Sci Technol Rev* 2021;39(18):72 – 8. <http://dx.doi.org/10.3981/j.issn.1000-7857.2021.18.010>. (In Chinese).