



Perspectives

Challenges and response to pandemics as seen in a One Health perspective

Jin Chen^{a,b}, Jian He^{c,d}, Robert Bergquist^{e,*}^a National Institute of Parasitic Diseases, Chinese Center for Disease Control and Prevention; Chinese Center for Tropical Diseases Research; NHC Key Laboratory for Parasites and Vectors Biology; WHO Collaborating Center for Tropical Diseases, Shanghai 200025, People's Republic of China^b School of Public Health, Fudan University, Shanghai 200025, People's Republic of China^c School of Global Health, Chinese Center for Tropical Diseases Research, Shanghai Jiao Tong University School of Medicine, Shanghai 200025, People's Republic of China^d Jiangsu Institute of Parasitic Diseases, Wuxi 214064, People's Republic of China^e Geospatial Health, Department of Veterinary Medicine and Animal Production, University of Naples Federico II, Naples, Italy

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ABSTRACT

The global pandemic caused by the coronavirus disease 2019 not only exposed the fragility of global preparedness and response to public health emergence, but also illustrated the fragmentation and gaps of research and development ecosystem. This emphasizes the need for planned actions against the potentiality of new pandemics and requires research to better understand how viruses bridge the animal/human divide making human-to-human transmission of new diseases possible. Major challenges to response to new epidemics under the current health framework reside in the so called 4-CC approach that focuses on Concept, Communication, Coherence, and Continuity. There is a need to also add a One Health perspective with emphasis on governance, surveillance, capacity building and multi-disciplinary research to achieve a holistic and better integrated system. Using a regulatory framework to equip professionals might facilitate the function of a multi-sector approach that recognizes the value of their mandates and a One Health approach in their work. Collaborative, multisectoral actions under the global regulations and guidance would make evidence-based One Health approaches sustainable and accessible to everyone.

1. Introduction

The accidental finding of the antibacterial effect of penicillin by Alexander Fleming in 1928 and the observation of a similar action by a sulfonamide dye by Gerhard Domagk in 1932 opened the world to new approaches to medical treatment. Further work has given a spectrum of antibiotics, but viral infections remain difficult to cure. On the other hand, preventive approaches using vaccination actually predate bacterial therapy by more than a century when famously pioneered by Edward Jenner when he, at the very end of the 18th century, demonstrated the usefulness of vaccination against smallpox. In the first half of the 20th century, safe and highly effective vaccines had been developed against a wide spectrum of virus infections. Work that continues to this day with the recent release of vaccines against coronavirus disease 2019 (COVID-19) caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The genetic sequence of which was done just days after the first report of the disease in the end of 2019. The quick genetic mapping and the use of the successful messenger RNA approach for the first time in vaccine production cut the time of development and testing

from a decade or more to less than one year, thereby saving thousands of lives.

The recent emergence of three coronavirus diseases has raised concern from public health, society and environment sectors. This severe acute respiratory syndrome originated from civet cats or bats in late 2002 [1]. The epidemic caused 8096 cases and 774 deaths across 26 countries but came to a halt by 2003 thanks to isolation and quarantine [2]. The Middle East respiratory syndrome, proved to transmit from camels to humans, has not yet been fully contained [3]. SARS-CoV-2, on the other hand, reached the entire inhabited world within a few months and became a pandemic but the original source is still not known with certainty. The devastating damage of COVID-19 to all sectors of society emphasizes the urgent need to plan to strengthen a One Health approach against the potentiality of new pandemics. The World Health Organization, the World Organization for Animal Health (formerly Office International des Épidémiologies), the United Nations Environment Programme and the Food and Agriculture Organization all agree that the rapid appearance of the latest coronaviruses require research to better understand how they bridged the animal/human divide and swiftly making

* Corresponding author.

E-mail address: robert.bergquist@outlook.com (R. Bergquist).<https://doi.org/10.1016/j.soh.2023.100010>

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human-to-human transmission possible. The overall question is how to respond and prevent to new viral pandemics emerging from the fauna.

2. Challenges in four “C” areas (4-CC)

To implement One Health approach in response to possible zoonotic pandemics under the current health system, there are major challenges in each of the four areas described by the 4-C approach, called so because it has four target areas: Concept, Communication, Coherence and Continuity.

2.1. Absence of a holistic Concept

In the field of preparedness and zoonotic control, international policies and frameworks usually first focus on the disease-specific needs. However, the complexity of interrelations between animal spill-over and human transmission combined with population demographics, public health interventions and environmental factors, makes it difficult to integrate all these complex factors and interactions into one policy, including its implementation and evaluation [4]. Therefore, while addressing the epidemic aspects, existing health policies and frameworks, current approaches are insufficient, in particular with respect to handling risks and assessing outcomes. Nevertheless, several recent assessments indicate that combating epidemics, international communities require an evidence-based and comprehensive One Health policy to bridge all sectoral mandates and aligning national actions holistically. For example, International Health Regulation, a multi-dimensional and multi-sectoral international set of guidelines to address public health events, including public health emergencies arising at the interfaces of human, animal, and environmental ecosystem, probably could provide a reference for multisectoral actions [5].

The One Health approach not only focuses on the epidemiological factors, but also the social context of occurrence, transmission and interventions and its implications for different groups and particular environment, which are further influenced by macro factors such as power distribution, economy, cultural norms, beliefs and values [6]. In order to avoid the possible risks exaggerated by this dynamic complexity, a holistic concept is necessary to clearly understand the shifting risks during the process of the prevention, detection, response and recovery from a pandemic [7].

2.2. Insufficient Communication

Most countries have not developed mechanisms for administrative and technical communication and programme planning in response to pandemics. Lack of established mechanisms for information sharing, joint preparation and coordinated actions might result in information mismatch or task overlap leading to delayed effective containment of epidemics at the initial stage, thus impeding the course of implementing effective interventions [3]. When making decisions, even if relevant to transmission cycle and control measures, opinions from the animal health and environment sectors might fail to those in charge of human public health. Transparent, effective, sufficient and continuous communication, between government and all relevant stakeholders, including those leading civic engagement, is needed to establish credibility among multi-stakeholders and effective cooperation mechanism at the community, national and international levels [3,8].

Appropriate containment and control depend strongly on the application of evidence-based measures for all stakeholders. However, at the initial stage of pandemic, frontline medical personnel might not be properly equipped with protective practices and thus stand the risk of causing nosocomial infection. Police officers and other staff might be dispatched to assist with response to health disasters without clear and relevant operational tools or knowledge of the relevant technical policy. Modern communication technology (e.g., the Internet, mobile phone networks, etc.) allows people to receive epidemic information from many

sources via many channels, unfortunately even misinformation that would confuse and hinder rapid, correct activities. Some approaches may be counterproductive for the preparedness and proper response to the control of an outbreak. When delivering epidemic relevant information to stakeholders, it is necessary and important to enhance dissemination of science-based information and consider the possible negative consequences, for example, hesitancy to report possible symptoms and personal trace for fear of forced quarantine or resistance to valued public health practices [7]. Identifying and training spokespersons from all sectors carefully might ensure these accurate, authoritative and comprehensive messages are timely delivered.

2.3. Lax Coherence

Given the risk of local and global multi-sectoral COVID-19 infiltration, the control of existing and potential pandemic threats needs a coherent emergency response system, particularly at the juncture of human, animal and environment sectors. The division among public institutions makes them operate a segmented mandate based on the angle of their respective disciplines, which constitutes a problem that unavoidably remains or leads to overlaps or gaps [7]. To avoid such strenuous but still weak action, fundamental connections between these interfaces should be recognized and coped “upstream” in public health systems. The interconnected and coordinated public health systems should develop policies by incremental steps providing managers with a strong context for informing decision makers; practitioners can find support relevant to their situation and operational teams should search approaches that can be integrated into their ongoing programmes. On the other hand, the improvement of human capacity is a prerequisite to improve the coherence to respond to the pandemic. Nevertheless, most capacity-building tools and workshops have still largely focused on mandates that do not matched the need of One Health approaches [5].

2.4. Inconsistent Continuity

Some projects have implemented the multisectoral One Health approach to address zoonotic epidemic threats, but abandoned the approach when emergencies relented or disappeared. To ensure effective sustainability, such approaches must be considered to be institutionalized as routine activities and thus be made sustainable [3]. An effective way to sustain the ability of a One Health approach might reside in aligning with proceeding international and regional regulations, initiatives, frameworks and operational tools, e.g., International Health Regulations and Sustainable Development Goals. By complying with these international references, standards and regulations, collaborative operations should be easier to implement at regional and global levels and facilitate promotion of joint work to diminish overall disease burdens leading to better global consistency and attainment [7]. Meanwhile, establishing strong cooperation and multisectoral programmes within governments, scientific institutions, academia, entrepreneurs and hospitals would indeed help managing epidemics and thereby keep the One Health approach sustainable.

3. Response

In response to the 4-CC under possible pandemic threats, adding One Health governance, improved surveillance, multidisciplinary research, capacity building as a whole would lead to a more holistic and resilient system.

3.1. One Health governance

Many reports and publications already propose the urgent need to move One Health into mainstream at global governance. A more comprehensive, coordinated, effective One Health governance structure should be built with high-level leadership and strong governance and

accountability of functions and policies to ensure the joint participation between sectors and disciplines [9,10]. Actions related to political will, intersectoral governance and regulatory framework based on International Health Regulation could become the first priority for consideration to develop a worldwide and united vision of One Health. A possible specific start may include expanding reporting obligations, creating and clarifying channels for scientific input and information/data sharing, raising financial investment, engaging community to promote top-down and bottom-up approaches.

3.2. Improved surveillance

An overarching surveillance framework and strengthened intelligence systems is needed to monitor the spill-over of a zoonotic disease before it becomes a possible pandemic. An optimised surveillance system capable of predicting the emergence and scale of a zoonotic pandemic should rely on three factors, 1) identification of how viruses transfect by bridging the gap between the wildlife ecosystem to human hosts; 2) early detection of infection in exposed humans; and 3) investigate the transmissibility of each virus posing a threat.

3.3. Multidisciplinary research

The global spread of COVID-19 not only exposed the fragility of the global preparedness and response to the pandemic, but also illustrated gaps in dedicated scientific research. Research in One Health knowledge is a key driver of preventing and containing the pandemics. This should connect with multidisciplinary and multisectoral international programmes, which would accelerate the accumulation of knowledge in a coordinated manner [11]. End-to-end research are crucial to figure out transmission mechanism and explore evidence-based approaches. Long-term implementation research would also ensure sustainability and equitable access to the latest progress worldwide. With the daily reminder of COVID-19 disaster, the time has come to identify which scientific advances are most needed, and how they should be promoted, funded and mobilised [12].

3.4. Capacity building

Although there is no fit-all approach to implement the One Health approach, operational framework and tools are expected to provide key approaches based on available instrumentation and guidance in the One Health context. This would assist an understanding of the links and nexus between human and animal health in a sound environment. Attention should be paid to the improvement of capability with regard to building bridges and enhancing communication and cooperation between the three sectors. Furthermore, it is urgent to install the requisite capability in the developing countries that are challenged by a low-income context. Since “the chain is only as strong as its weakest link,” it is necessary to not only prepare for epidemics and pandemics but also for many different neglected diseases [7]. Fortunately, some organisations, for example, the One Health High-Level Expert Panel and World Bank have started to develop a broad scope of such files: *One Health Theory of Chance* and *One Health: Operational Framework for Strengthening Human, Animal, and Environmental Public Health Systems at their Interface* [7,13].

4. Conclusion

Future conditions with regard to the risk for emerging zoonotic diseases have been discussed in the context of the ongoing climate change and the increasing interaction between hosts and environment [14,15]. The One Health perspective emphasizes the need to look for mechanisms of prevention considering both with regard to animal-human transmission and the ensuing human-human one, perhaps also taking in account the animal-animal situation. Integrated surveillance and response systems supported by rapid laboratory testing followed by adequate

prevention and control measures should oppose rapid spread of emerging zoonoses [16,17]. Various other actions, such as control strategies including a broad spectrum of stake-holders including general public, research institutes and governmental departments would be needed for effective control of emerging zoonotic threats (Bonilla-Aldana et al., 2020). Another direction of the One Health is to evaluate the global actions by employing the global One Health Index that can find the gaps in One Health research approaches as well as guide and promote One Health actions at the country level [18].

Many zoonotic pathogens have pandemic potentials, but equipment of professionals with regulatory frameworks would ensure multi-sectors to understand the value of their mandates in the holistic concept and operationalize work using the One Health approach in coherent multi-sectoral system. Collaborative, multisectoral actions under the global regulations and guidance will hopefully empower the evidence-based approaches sustainable and accessible to everyone.

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Conflict of interest

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Abbreviations

COVID-19 Coronavirus disease 2019

SARS-CoV-2 Severe acute respiratory syndrome coronavirus 2

4-CC Challenges in four "C" areas

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