



## Editorial

# Zoonoses: Changing, Challenging, and Increasing Global Disease Threats

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The public awareness of zoonotic pathogens as well as the threats they pose to global public health have grown significantly, since the emergence of SARS-CoV-2, the causative agent of the COVID-19 pandemic. The COVID-19 pandemic demonstrates the potential for the rapid spread of emerging infectious pathogens and the power of contemporary science to develop novel tools to rapidly ameliorate the magnitude of such threats. Basic, applied, and clinical studies are increasing in their number, rate of reporting, and breadth to address the multitude of biotic and abiotic factors that influence the emergence, epidemiology, diagnosis, pathogenesis, treatment, control, and prevention of zoonoses. These expanding interests are reflected by a near exponential growth in the number of publications identified each year using the search term 'zoonoses' in the PubMed database of the National Library of Medicine: 1990, 105 manuscripts; 2000, 362 manuscripts; 2010, 973 manuscripts; 2015, 1738 manuscripts; and, in 2020, 2779 manuscripts. This increase in the discovery and dissemination of new knowledge will continue due to accelerating scientific advances in diverse, yet interconnected, areas of study; the numerous knowledge gaps that remain to be answered; and the enhanced awareness of the broad ranging implications of zoonoses for world health and economies. Addressing these challenges is more important than ever before.

The World Health Organization, WHO, defines a zoonosis as any disease or infection that is mutually transmissible from vertebrate animals to humans [1]. The transmission of these viral, bacterial, parasitic, and unconventional agents occurs at the human interface with wildlife, livestock, or companion animals through direct contact, food, water, fomites, and mechanical or biological vectors. The WHO states that there are over 200 currently known zoonoses. This diverse community of infectious diseases is not static due to the ongoing and increasing frequency of newly discovered zoonotic pathogens, which are emerging during a time of unprecedented global geoclimatic, demographic, socioeconomic, and technological changes [2,3]. Among the emerging infectious diseases, 75 percent are zoonoses, and among all infectious diseases, 60 percent are zoonotic in origin [4,5]. Overall, arthropod vectors are responsible for the transmission of 23 percent of these emerging infectious diseases. Human suffering attributed to endemic, re-emerging, and emerging zoonotic infections is striking with estimates of more than two billion cases and nearly three million deaths annually that result in commensurate losses in productivity, realization of individual potential, as well as the burden of significant short- and long-term economic costs.

While the WHO definition of zoonoses is both comprehensive and succinct, the underlying factors influencing all aspects of these infections remain increasingly complex, diverse, and wide ranging with impacts across multiple scientific, societal, economic, and public policy issues and questions. An example of these challenges is the ongoing debate about the best approach to prevent future zoonotic pandemics [6]. The prevailing approach relies upon the detection of zoonotic pathogen emergence as a result of human case onset. The next steps include the rapid development of effective, potentially novel, tools and strategies to diagnose and treat emerging pathogens and to quickly develop and administer



**Citation:** Wikel, S.K. Zoonoses: Changing, Challenging, and Increasing Global Disease Threats. *Zoonotic Dis.* **2024**, *4*, 8–10. <https://doi.org/10.3390/zoonoticdis4010002>

Received: 25 December 2023

Accepted: 25 December 2023

Published: 1 January 2024



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vaccines to limit disease spread and protect vulnerable populations. These steps might not be achieved as rapidly as the public and politicians would desire, due to the nature of the scientific, regulatory, production, and financing challenges that will require months or longer to achieve the desired deliverables. These challenges are further influenced by the fact that commitments to public health infrastructure, human and physical, have been declining for decades. Even as the COVID-19 pandemic becomes less of a pressing issue to the public, how many countries will maintain program preparedness, infrastructure, response professionals, and financial commitments to respond effectively to the next emerging zoonotic pathogen with epidemic or pandemic potential? A proactive approach that is increasingly favored is to prevent the actual spillover of the zoonotic pathogen to humans from other vertebrate animal species and thus reduce disease and pandemic potential. This approach requires active surveillance that is broad-ranging, international and ongoing; deep molecular sequencing to analyze microbiomes and viromes of multiple potential reservoir and vector species to identify existing and potential disease threats; the establishment of databases that are standardized in their methodology and readily and easily accessible to stakeholders globally; and, the human capital, physical infrastructure, response capabilities, and financial support to maintain such global initiatives. These two approaches are not mutually exclusive and their synergistic potential is clear in reducing the drivers of zoonotic disease emergence, and responding, in a timely manner, to those disease threats that may arise.

Macro and micro geoclimatic variations, also represent major influences on the ecology of zoonotic diseases; the distributions of arthropod vectors, vertebrate reservoirs, and human interactions; habitat modification and land use change; and pathogen dynamics. All of these influence and potentially drive changes in enzootic cycles and epizootics. The constant state of change among these multiple factors impacts reservoir, arthropod vector, and pathogen population densities and geographic ranges at the local and national levels, and it influences the introduction of zoonotic pathogens into new areas, resulting in infection resurgence and emergence. These environmental changes result in the movement of zoonotic pathogens into new geographic areas and the potential for decline in others where environmental conditions become less favorable due to the multiple factors required to maintain diverse enzootic cycles.

Further research is needed to closely identify knowledge gaps and to develop novel tools and strategies for the control and prevention of zoonotic diseases. As a multidisciplinary journal, *Zoonotic Diseases* (ISSN 2813-0227) is evolving in response to expanding and diverse research initiatives; it attempts to answer multiple complex questions, address challenges, and provide advances surrounding zoonoses, as well as meet the needs and interests of the scientific community. The scope of the journal reflects these changes and emphasizes the broadly inclusive, diverse, and multidisciplinary nature of the manuscripts this forum seeks to publish. *Zoonotic Diseases* is an international, multidisciplinary, scholarly, peer-reviewed, open access journal that publishes high-quality original research, review articles, brief reports, opinion pieces, editorials, and perspectives offering new insights into aspects of zoonoses.

The scope of *Zoonotic Diseases* (ISSN 2813-0227) includes original manuscripts ranging from basic molecular and cellular research to applied biomedical and clinical studies on topics related to zoonotic pathogens and the diseases they cause. *Zoonotic Diseases* is a global forum for zoonoses and zoonotic pathogens and is focused manuscripts on One Health, EcoHealth, public health, diagnosis, pathogenesis, epidemiology, ecology, geography, surveillance, prevention, control, wildlife and pathogen spillover, and arthropod vectors. We also encourage the submission of manuscripts that address the broader issues of climate, economics, technological advances, and societal discussions and debates about local, national, and international policies and infrastructure for preparedness, as well as responsiveness to the emergence, early detection, containment, prevention, control, and mitigation of epidemics and pandemics.

The Editorial Office and Editorial Board look forward to receiving your manuscript submissions and to working with you to disseminate new knowledge about these important pathogens and diseases.

**Conflicts of Interest:** The author is a consulting Senior Scientist at US Biologic, Inc., and he is a stockholder of US Biologic, Inc.

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