zoonotic diseases

Editorial

Bridging the Gap: Exploring the Connection between Animal and Human Health

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Zoonotic diseases, also referred to as zoonoses, are diseases that are transmitted from animals to humans. The primary agents responsible for zoonotic diseases include diverse pathogens such as bacteria, viruses, fungi, and parasites. There are various ways that these zoonotic diseases can spread, including direct contact with infected animals, which can occur through contact with the animal's blood, saliva, urine, feces, or other bodily fluids; the consumption of animal products that are not adequately cooked or handled; vector-borne transmission to humans by vectors that have previously fed on infected animals; and exposure to a contaminated environment, such as soil or water.

Zoonotic diseases are classified according to their etiology, transmission cycle, reservoir hosts, pathogenesis, and primary human symptoms. Furthermore, some zoonotic infections require vectors for transmission [1,2]. As per one estimate, out of 1415 species of infectious agent that are considered pathogenic to humans, 61% were zoonotic and 12% were classified as emerging pathogens, and 75% of those emerging pathogens were zoonotic [3]. Zoonotic diseases that have affected humans include ebola, COVID-19, Lyme disease, anthrax, bovine tuberculosis, zoonotic malaria, yellow fever, swine flu, avian influenza, rabies and monkeypox (Mpox). Ebola is a rare but deadly disease that can cause hemorrhagic fever and is transmitted to humans through infected fruit bats and primates [4]. Anthrax is a zoonotic disease that can spread to humans through contact with infected animals or animal products, including livestock and wild animals [5–10]. Similarly, bovine tuberculosis can infect many animal species as well as humans. Additionally, the causative pathogen for bovine tuberculosis (*M. bovis*) is part of the Mycobacterium tuberculosis complex, including *M. tb*, a human tuberculosis pathogen [11]. SARS-CoV-2 virus, which is suspected to have originated in bats and might have spread to humans via an intermediate host, causes COVID-19 disease [12,13]. COVID-19 has recently substantially impacted human health, with more than 750 million confirmed cases and nearly 7 million fatalities worldwide reported to date [14]. In addition, the economic costs of the pandemic have been substantial, including job losses, business closures, and increased spending on healthcare and stimulus measures [15,16]. Other zoonotic diseases have also significantly impacted human health. Smallpox has killed more than 300 million people in the 20th century alone, a prime example of a zoonotic disease impacting human health [17].

Lyme disease, an emerging healthcare threat in North America and Europe, is caused by a spirochete of Borrelia species [18–21]. It is transmitted to humans by the bite of infected black-legged ticks fed on infected animals, namely, deer [19]. Other tick-borne diseases in humans include relapsing fever, Rocky Mountain spotted fever, epidemic typhus, anaplasmosis, ehrlichiosis, Tick-borne encephalitis, Crimean–Congo hemorrhagic fever, and Powassan virus disease [22–25]. Another emerging zoonotic disease is Mpox (monkeypox). It causes symptoms similar to but milder than smallpox. There is no available treatment specifically for Mpox, but supportive care can be useful [26,27]. Overall, the

Citation: Sharma, A.K.; Dhasmana, N.; Arora, G. Bridging the Gap: Exploring the Connection between Animal and Human Health. *Zoonotic Dis.* **2023**, *3*, 176–178. https://doi.org/10.3390/zoonoticdis3020014

Received: 25 April 2023
Revised: 22 May 2023
Accepted: 24 May 2023
Published: 28 May 2023

impact of zoonotic diseases on animal and human health and the economy can be significant. Zoonotic diseases are estimated to cause 2.5 billion human illnesses and 2.7 million human deaths annually, with annual economic losses running into billions of dollars [28,29].

There are several challenges in controlling zoonotic infections that negatively impact human health. Since new pathogens keep emerging as zoonotic infections, many zoonotic diseases do not have available effective countermeasures such as drugs and vaccines. For instance, supportive care is the only treatment option for many zoonotic diseases, including HPS (hantavirus pulmonary syndrome) and MERS [4,30]. Zoonotic diseases involve multiple hosts and modes of transmission, for example, avian influenza can infect wild and domestic birds as well as humans [31]. The involvement of multiple hosts makes the transmission of zoonotic disease complex. Moreover, zoonotic diseases can occur in many regions of the world with limited surveillance and monitoring, which makes it challenging to detect the outbreaks and implement timely control measures. Finally, the lack of funding, personnel, and infrastructure restrict the effective implementation of control measures. These challenges highlight the importance of investing in research and resources for the timely prevention of emerging zoonotic diseases. The recent COVID-19 pandemic raised the public awareness of the danger posed by zoonotic diseases and accelerated the development of novel therapeutics, vaccines, and diagnostics tests. A notable example includes the rapid commercialization of RNA vaccines for COVID-19 developed by Pfizer-BioNTech and Moderna. This progress made in vaccine development has paved the way for vaccine development for other emerging diseases.

To tackle these hurdles, a multifaceted approach involving increased investment in research, the development of drugs and vaccines, enhanced surveillance systems, and effective public health interventions is of paramount importance. Moreover, it also necessitates the adoption of a One Health strategy, which acknowledges the connection between human, animal, and environmental health and involves collaboration across sectors and disciplines to control the spread of zoonotic diseases [32]. Additionally, similar platforms, namely, ZOVER, need to be used with the genomic data of potential reservoir species to monitor zoonotic diseases [33]. In this Special Issue of *Zoonoses*, we invite studies related to the basic, translational, clinical, and epidemiological aspects of zoonotic diseases.

Conflicts of Interest: The authors declare no conflict of interest.

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