Study on the Review of Literature on Zoonotic Diseases

Sangapillai Rajendran and Dr. Devender Kumar
[1]Research Scholar, Department of Zoology, SunRise University, Alwar, Rajasthan (India)
[2]Associate Professor, Department of Zoology, SunRise University, Alwar, Rajasthan (India)
Corresponding author Email: sangapillairajendran2@gmail.com

Abstract: Zoonotic Diseases (ZD) are defined as the diseases originating from animals wherein humans acquire infectious diseases from Zoonotic Reservoirs (ZR) either naturally or through zoonotic vectors. The emerging ZD can be newly evolved diseases most particularly in the developing nations, or may have been occurred in the past and are now expanding rapidly to new geographic, host or vector ranges due to their changing ecology, such as Scrub typhus, Cutaneous Leishmaniasis and Japanese Encephalitis. ZD are major public health issue in several countries of the world and India is among the top geographical hotspots for such diseases. Poor personal hygienic practices, improper farming practices, lack of awareness, poor diagnostic facilities, under reporting system, poverty and lack of medical facilities, all this causes high burden of morbidity and mortality, particularly in infants and children [4] living in rural parts of developing countries. In India, incidence and prevalence of ZD like Plague, Rabies and Anthrax have affected human health throughout times. In recent past, India has seen emergence and reemergence of high priority and neglected Zoonoses. As a case of point a highly infectious disease called Nipah Virus was first emerged in West Bengal (India) in 2001 and recently it has been reported from Kerala in May 2018.

[Rajendran, S. and Kumar, K. **Study on the Review of Literature on Zoonotic Diseases.** *The International Journal of Interpretation, Observation and Analysis*, 2023; Volume 2, Issue 1:25-29 (April-June). ISSN 2349-0713, Peer-reviewed (online/offline), Refereed, Indexed and International Journal (Since 2013), Global Impact Factor: 5.776

Keywords: Review of Literature, Zoonotic Diseases, Rabies

Introduction:

Human activities and stressed ecosystems create opportunities for the emergence and spread of viral diseases. The stress factors such as habitat fragmentation, animal trafficking, agriculture, cattle farming, urbanization, mining industries, climate change, and environmental degradation.[1,2] In recent years, the global community has borne witness to the profound ramifications of emergent viral diseases such as Zika, COVID-19, and Ebola. These diseases not only engender significant threats to human health but also exert considerable impacts on the environmental and animal well-being.[3] This paradigm embodies a collaborative attempt to acknowledge the intricate interrelations among human, animal, and environmental health domains. Through interdisciplinary cooperation, experts from diverse fields can identify and address the fundamental causes of emergent viral diseases, including factors such as deforestation, climate perturbations, and the proliferation of globalized networks.[4] The efficacy of the OH framework has been substantiated through its successful implementation across numerous nations, bringing advancements in disease surveillance, prophylaxis, and mitigation strategies.[5]

Antimicrobial resistance (AMR) stands out as one of the most significant global health challenges within the OH framework.[6] AMR is linked to all three components due to the excessive use of antimicrobials across diverse sectors, including human medicine, livestock farming, and agriculture. Bacteria acquire resistance genes and mobile genetic elements in response to selection pressure from antimicrobials. These genes can be transferred to other bacteria within the same genus or to new species.[7] Due to factors such as mismanagement, lack of infection control, agricultural waste, environmental pollution, and the migration of persons and animals, antimicrobial-resistant bacteria have an increased capability to spread to humans, animals, and the environment.[8]

Review of literature:

One health is a concept that aims to bring together human, animal, and environmental health. Researchers including Louis Pasteur and Robert Koch and physicians such as William Osler and Rudolph Virchow demonstrated the collaborative links between animal and human health. More recently, Calvin Schwabe revived the concept of One Medicine [1]. As the traditional boundaries between medical and veterinary practice continue to pervade society there is a need for the practical application of

one health. One health is defined by the One Health Commission [2] as "the collaborative effort of multiple disciplines to obtain optimal health for people, animals, and our environment." In another definition, the One Health Initiative Task Force (OHITF) [3] defines one health as "the promotion, improvement, and defense for the health and well-being of all species by enhancing cooperation and collaboration between physicians, veterinarians, and other scientific health professionals and by promoting strengths in leadership and management to achieve these goals." The one health approach plays a significant role in the prevention and control of zoonoses. It has been noted by the World Health Organization (WHO) [4] and Graham et al. [5] that approximately 75% of new emerging human infectious diseases are defined as zoonotic, meaning that they may be naturally transmitted from vertebrate animals to humans. New and reemerging zoonoses have evolved throughout the last three decades partly as a consequence of the increasing interdependence of humans on animals and their products and our close association with companion animals. Zoonoses should therefore be considered the single most critical risk factor to human health and well-being, with regard to infectious diseases. Of the 1,461 infectious diseases recognized to occur in humans by the National Academy of Sciences, Institute of Medicine [6], approximately 60% are caused by multihost pathogens, characterized by their movement across various species. This gives significant credence to the importance of examining health effects across species, in order to fully understand the public health and economic impact of such diseases and to help implement treatment and preventive programs.The one health concept is a broad term that covers a variety of subcategories identified as bioterrorism, animals as predictors for disease, and the psychological bonds that can exist between an animal and a human [7]. Zoonoses comprised the primary focus for this review with the overall objective to determine the status of the one health approach and its applications to zoonoses, using scholarly peer-reviewed literature that has been published since the global adoption of the concept in 1984 (for study purposes, January 1, 1984, until December 31, 2012). Four subobjectives were considered. The first assessed scholarly resources on the one health approach published works between January 1, 1984, and December 31, 2012. One health scholarly resources were classified as peer-reviewed publications, professional presentations, grants or funding allocations, reports from the WHO, and books or book chapters. The second objective examined the preferred scope of one health published works within the period of study. Scopes of one health subject categorizations were, namely, zoonoses, food safety, agriculture, environmental health and global health.

Zoonoses, agriculture, and food safety are all interconnected topics in that they all directly impact the health of humans. In the last 30 years, there has been an average of one newly discovered emerging infectious disease every year [4]. A total of 335 emerging infectious diseases were identified between 1940 and 2004 [13]. Considering that more than 60% of infectious diseases are zoonotic, they have an important and increasing impact on human health. Agriculture, livestock production, and food safety practices are intimately linked with the prevention and control of zoonoses through the one health approach [14]. Considering the significance of agriculture and food safety, it was surprising that these scopes did not have a greater representation in the literature reviewed. Developed countries, by virtue of their greater institutional facilities, trained personnel and financial resources are able to address the issues of one health approach. This is extremely beneficial as it enables developed nations to gain an awareness of one health initiatives and the added synergistic value of this approach. The One Health Initiative Task Force [3] has reported that while the developed countries prevail in making one health discoveries, it is the developing countries that suffer the most from the effects of zoonoses. It has been estimated that 70% of the reasons for poverty in Africa can be attributed to poor livestock production practices [15]. Zoonotic infections significantly impact animal production in this region further jeopardizing human and animal livelihoods. The dependency of the initiative year, initiative, scope, and country locale on one another revealed that the incidence of the scope or country location is somewhat dependent on the year. In other words, it can be argued that the scope or country locale was represented due to that particular year, namely, due to the associated events during that year. Immediate action and scholarly resources are commonly implemented after a devastating event occurs [16]

Pet ownership is associated with mental and physical health benefits in people (Allen et al, 2001; Baun and Mccabe, 2003; Carr et al, 2020; Ein et al, 2018; Kertes et al, 2017; Maugeri et al, 2019). Pets can increase feelings of well-being, encourage more active lifestyles, and play a role in forming social support networks (Arhant-Sudhir et al, 2011; Wood

et al, 2015). According to the American Heart Association, pet ownership, particularly dog ownership, may be associated with decreased cardiovascular disease risk (Levine et al, 2013). Asking about pets during a medical exam was shown in a recent study to have positive effects on practice and patient-provider relationships (Hodgson et al, 2017). The National Association of State Public Health Veterinarians (NASPHV) and the Centers for Disease Control and Prevention (CDC) recognize the many benefits of pets and support safe, healthy, and responsible pet ownership. Responsible pet ownership can prevent pet injury to people, reduce animal stress, and improve animal health. This includes avoiding impulsive decisions when selecting a pet, researching what the pet needs to be healthy, choosing a pet appropriate for a particular household, and providing appropriate husbandry, food, housing, handling, veterinary medical care, and socialization for the pet to keep it healthy. Responsible pet ownership also includes preventing zoonotic disease transmission from people to pets; it is important to separate sick people from pets to avoid transmission of germs such as human (seasonal) influenza viruses or severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Animals and COVID-19, 2022).

The recurrence of novel infectious diseases emphasizes the need to consider human, animal, and environmental health in disease prevention and control (Kelly et al. 2020). The highly pathogenic avian influenza and severe acute respiratory syndrome viruses have shown that biological agents and animal breeding practices can threaten public health. Leptospirosis, brucellosis, Nipah virus, and rabies are all endemic; these infectious agents can cause epidemics (Rabozzi et al. 2012; Ahmad M et al, 2023). Emerging infectious diseases (EIDs) originate from wild animal reservoirs under considerable anthropogenic stresses. Thus, the One Health technique has gained popularity in managing EIDs (Kelly et al. 2020). Academic institutions, the human and animal health industries, and other stakeholders are working together to promote this strategy to prevent and control emerging issues. The goal is to enhance interdisciplinary collaborations and communication across various healthcare domains, focusing on individuals, animals, and the environment. So, it is imperative to establish a strong and cohesive partnership among veterinarians, occupational health physicians, and public health experts (Rabozzi et al. 2012). Avoiding emerging illnesses is of utmost importance, as is establishing a specialized early warning system to predict the likelihood of an epidemic or detect the signs of its onset.

Brucellosis, a zoonotic bacterial disease, has been neglected in scientific and public health initiatives. An etiology of this condition can be attributed to a distinct strain of bacteria characterized by gram-negative properties, facultative intracellular behavior, absence of spore formation, lack of motility, and absence of a capsule (Ameen et al. 2023; Deb Nath et al. 2023). Various species of Brucella can cause brucellosis; Brucella abortus is the predominant cause of infection in animals; B. melitensis is the most frequently observed pathogen in humans; B. melitensis, B. abortus, B. suis, and B. canis are also known to cause infections in humans (Bardenstein et al. 2023). The Brucella genus presents a notable public health hazard and incurs considerable economic losses within the livestock sector (Ameen et al. 2023). The incidence of brucellosis exhibited variation contingent upon the occupational activities of individuals and the specific species of animals involved. According to Nasinyama et al. (2014), veterinarians, farmers, and laborers risk contracting brucellosis, an occupational hazard.

Q fever was first discovered in 1935 in Queensland, Australia, during an outbreak of a febrile illness of unknown origin (Query fever) among abattoir workers (Hirschmann 2019). Q fever, a zoonotic disease, has become a significant public health concern in countries associated with the South Asian Association for Regional Cooperation SAARC (Siengsanan-Lamont and Blacksell 2021). One of the concerning aspects of this bacterium is its ability to survive in the environment for extended periods, which makes it highly resistant and a significant public health concern (Hadush et al. 2016). It is vital to address the presence of Coxiella burnetii to prevent the spread of Q fever and Coxiellosis. Q fever is primarily transmitted to humans through inhalation of aerosols from contaminated soil or animal waste (Anderson et al. 2013). In SAARC-associated countries, where agriculture and livestock farming are prevalent, the risk of Q fever transmission from animals to humans is exceptionally high (Porter et al. 2011). The zoonotic impact of Q fever is significant. Infected animals shed C. burnetii in their birth products, urine, feces, and milk, and people can get infected by breathing in dust that these materials have contaminated (Berri et al. 2001). The occurrence of Q fever is comparable among SAARC nations. The frequency of Q fever ranges from 0.1 to 0.5 cases per 100,000 individuals, and the prevalence varies from 0.005 to 0.02%. Living close to livestock

can increase the risk of Q fever as it increases the likelihood of contact with the bacteria that causes the disease (Smit et al. 2012). A country's livestock prevalence is also a significant risk factor for Q fever, and a study in northeastern Thailand found that rice farmers with farm animals such as chickens and cattle had a higher prevalence of acute Q fever (Burns et al. 2023). Environmental factors also affect humans' risk of Q fever infection (Dorko et al. 2012). Warm weather with dry soils and a particular wind direction can increase the risk of exposure to the bacteria (Porter et al. 2011). Wind can carry dust particles in the air that bacteria can attach to, which can be inhaled by humans and animals nearby (Van Leuken et al. 2016) Found that soil texture, roughness elements, and vegetation density were essential predictors of Q fever incidence rate. Certain occupations, such as farmers, veterinarians, and abattoir workers, are at an increased risk of Q fever due to their close contact with livestock (Eastwood et al. 2018). People who process milk, such as dairy farmers and cheesemakers, are also at an increased risk of exposure to Q fever (Esmaeili et al. 2016). People who work in construction and disturb soil or rocks could be exposed to Q fever if the soil or rock contains bacteria. Through contact with infected animal feces, milk, urine, and birth products, Q fever-causing bacteria can be transmitted directly from animals to humans (Esmaeili et al. 2016). Older individuals, particularly men, are more frequently reported for Q fever cases (Maurin et al. 1999)

Lyme disease is a significant emerging infectious disease most frequently found in North America and Europe (Steere et al. 2016), but is also present in some regions of Asia (Mead 2015). Although the disease has primarily been recorded in temperate areas, the incidence has increased globally due to increased travel and shifting vector habitats (Sharma et al. 2017). Lyme disease is the most prevalent vector-borne disease in the temperate areas of the northern hemisphere. Europe reports about 85000 instances a year, according to estimates based on national statistics. However, this number needs to be more accurately stated because case reporting is so uneven in Europe, and so many Lyme infections go undetected. Between 15000 and 20,000 cases are reported annually in the United States, and the disease is endemic in 15 states (Lindgren et al. 2006). The sole pathogen that causes Lyme disease in the United States is the spirochete Borrelia burgdorferi. However, besides B burgdorferi, other closely related species, such as Borrelia afzelii and Borrelia garinii, cause Lyme disease in Europe and Asia. These bacteria are spread throughout the United States by hardbodied ticks, such as Ixodes pacificus on the Pacific Coast and Ixodes scapularis in the East and Midwest. Ixodes ricinus and Ixodes persulcatus are vectors in Europe and Asia (Shapiro 2009). Ticks have become more common and expanded to higher latitudes and elevations over the past few decades. It has been demonstrated that changes in tick density and dispersion are related to climatic changes. Lyme disease cases and other tick-borne illnesses have also grown during the same period. This might result from improved reporting over time in some regions (Lindgren et al. 2006).

Conclusions: The majority of infectious diseases that affect people are animal-borne. These pathogens not only infect animals with diseases but also provide a major risk to human health. Because of the increased contact between people and wild animals, it is often the case that altered eating habits, climate change, and environmentally unfavourable human activities impact the establishment and re-emergence of many zoonotic diseases. The present COVID-19 epidemic makes clear how catastrophic zoonosis is for the human population. Research concentrating on the one health approach needs to be prioritised in order to uncover crucial intervention steps in the transmission of infections because of the close ties between animals, humans, and the environment. To effectively detect zoonoses and conduct effective control actions, robust active surveillance encompassing all one health approach components must be deployed.

References

1. Adesokan HK, Akinseye VO, Streicher EM, Van Helden P, Warren RM, Cadmus SI. Reverse zoonotic tuberculosis transmission from an emerging Uganda I strain between pastoralists and cattle in South-Eastern Nigeria. BMC Vet. Res. 2019;15:1-7.

2. Aenishaenslin C, Hongoh V, Cissé HD, Hoen AG, Samoura K, Michel P, et al. Multi-criteria decision analysis as an innovative approach to managing zoonoses: Results from a study on Lyme disease in Canada. BMC Public Health. 2013;13:897.

3. Al-Tayib OA. An overview of the most significant zoonotic viral pathogens transmitted from animal to human in Saudi Arabia. Pathogens. 2019;8:25. 4. Bae SE, Son HS. Classification of viral zoonosis through receptor pattern analysis. BMC Bioinform. 2011;12:96.

5. Bayraktar B, Bulut E, Barı¸s A.B, Toksoy B, Dalgıc N, Celikkan C, et al. Species distribution of the Mycobacterium tuberculosis complex in clinical

isolates from 2007 to 2010 in Turkey: A prospective study. J Clin. Microbiol. 2011;49:3837-3841.
6. Bayraktar B, Togay A, Gencer H, Kockaya T, Dalgic N, Bulut E. Mycobacterium caprae causing lymphadenitis in a child. Pediatr. Infect. Dis. J. 2011;30:1012-1013.
7. Beaty BJ, Marquardt WC. The Biology of Disease Vector; University Press of Colorado: Niwot, CO, USA, 1996.
8. Belchior E, Barataud D, Ollivier R, Capek I, Laroucau K, De Barbeyrac B, et al. Psittacosis out tuberculosis real after participation in a bird fair, Western France, December 2008. Epidemiol. Infect. 2011;139:1637-1641.
9. Boseret G, Losson B, Mainil JG, Thiry E, Saegerman C. Zoonoses in pet birds: Review and perspectives. Vet. Res. 2013;44:36.
10. Burgos-Cáceres S. Canine rabies: A looming threat to public health. Animals. 2011;1:326-342.
11. Cerdà-Cuéllar M, Moré E, Ayats T, Aguilera M, MuñozGonzález S, Antilles N, et al. Do humans spread zoonotic enteric bacteria in Antarctica? Sci. Total Environ. 2019;654:190-196.
12. Chomel BB, Sun B. Zoonoses in the bedroom. Emerg. Infect. Dis. 2011;17:167-172.
13. Chomel BB. Control and prevention of emerging parasitic zoonoses. Int. J Parasitol. 2008;38:1211-1217.
14. Chomel BB. Emerging and Re-Emerging Zoonoses of Dogs and Cats. Animals. 2014;4:434-445.
15. Corbel MJ, Alton GG, Banai M, Díaz R, Dranovskaia BA, Elberg SS, et al. Brucellosis in Humans and Animals; WHO Press: Geneva, Switzerland, 2006.
16. Dimaano EM, Scholand SJ, Alera MTP, Belandres DB. Clinical and epidemiological features of human rabies cases in the Philippines: A review from 1987 to 2006. Int. J Infect. Dis. 2011;15:e495-e499.
17. Dorrestein GM. Bacterial and parasitic diseases of passerines. Vet. Clin. North Am. Exot. Anim. Pract. 2009;12:433-451.