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One Health Concept: An Integrative Approach to Combat Zoonotic Diseases at the Human-Animal-Environment Interface

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Abstract: Zoonotic diseases are transmitted between humans and animals, constitute a significant proportion of emerging infectious threats. These diseases often arise from complex interactions among humans, animals and the environment. The One Health concept provides a holistic framework to address these interactions by promoting interdisciplinary collaboration. This article reviews the principles of One Health, highlights key zoonotic diseases and discusses global and regional strategies for implementation, emphasizing the need for integrated surveillance, policy harmonization, and community engagement.

Keywords: Zoonosis, One Health, Zoonotic Diseases, Human Health.

Review Paper

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1. INTRODUCTION

The world has witnessed a surge in zoonotic diseases, those transmitted between human and animals. The newly emerged diseases in humans in recent decades were directly associated with animal origin foods (Slingenbergh, 2013) having worldwide impact on public health and socio-economic issues directly or indirectly (Bao *et al*., 2017). Epidemics like Ebola, Avian influenza and current COVID-19 wave have highlighted the urgency for a cohesive approach. The rise of emerging infectious diseases (EIDs), notably those of zoonotic origin, has reinforced the necessity of a collaborative approach to global health. This concept becomes particularly vital in managing zoonotic pathogens, which constitute over 70% of all EIDs in recent decades (Jones *et al*., 2008). One Health is a strategic outline that integrates the efforts of human, animal, and environmental health sectors (Destoumieux-Garzón *et al*., 2018) with collaborative and multi-sectoral approaches at the local, regional, national, and ultimately global levels to attain optimal health outcomes. It recognizes the complicated and tangled links between human beings, animals, plants, and their shared environments (Centers for Disease Control and Prevention, 2023). Worker with animals as part of job or hobbies (like in a veterinary office or on a farm), hunter or consumer of wild animals with weak immune system are more vulnerable to zoonosis. Endemic zoonotic diseases have the dual impact of causing illness and death in humans and animals where livestock farming is an instrument engine of economic growth.

2. The Zoonotic Disease Burden

Assessing the burden and impact of zoonotic diseases is a critical step involving the economic effects on the food supply. Surveys on cases of illness including deaths due to a specific cause and route of transmission or life pattern and economic impacts may establish a guide line in assessment. The burden of zoonotic diseases can be ascertained by various studies where zoonotic disease data is not readily available. Studies may be prioritized on prevalence and epidemiology based.

Human and animals share the same ecosystem, leading to a higher risk of pathogen transmission. WHO claims that more than 60% of human pathogens are zoonotic in nature. Most of these are spread due to environmental disruption and human encroachment. On the other hand, excessive use of antibiotics contributing to the rise in resistant pathogens. A series of social and environmental factors provides conditions to expand pathogens including land-use change, wildlife trade, meat consumption and intensified livestock production (Ferreira *et al*., 2021). Approximately, 2.4 billion cases of illness and 2.7 million deaths in humans per year has

been reported by Grace and his fellows, in addition to negative effect on overall health, through most common zoonosis, affecting poor livestock workers (Grace *et al*., 2012). More than 200 zoonotic importance diseases have been reported during the last 70 years. Jeff along with public health organizations, compiled comprehensive observations from 1966 to 2000 data and identified 11 published and 16 unpublished zoonotic diseases. 12 of the 16 outbreaks involved enteric pathogens occurred during March and November (Jeff *et al*., 2004). World Health Organization (WHO), Food and Agriculture Organization (FAO) and World Organization for Animal Health formalized their collaboration in year 2010 on zoonotic diseases to address health threats at the human–animal–ecosystem interface. Major outbreaks illustrate the devastating effects of unmonitored animal-human-environment interactions (Woolhouse & Gowtage-Sequeria, 2005). Demography, land pressure and production escalation leading to unstable epidemiology. Bacteria, Virus, Fungi, Prions and various types of parasites are major source of infection linked with zoonosis. Important zoonotic diseases are listed in Table – 1.

Table 1: Zoonotic Diseases

Bacterial	Viral	Fungi	Parasitic
Anthrax	Influenza	Histoplasmosis	Toxoplasmosis
Brucellosis	Rabies	Cryptococcosis	Trypanosomiasis
Ct Scratch	Arbovirus	Dermatophytes	Leishmaniosis
Lyme	KFD	Skin Rashes	Echinococcosis
Mycoplasmaosis	Yellow Fever		Taeniasis
Plague	COVID 19		Schistosomiasis
Q Fever	Nipah Virus		Dracunaculiasis
Psittacosis			Scabies
Salmonellosis			Myiasis
Tularemia			
Tuberculosis			
E.coli			

Due to limited resources, the strategic control of zoonotic diseases is a major challenge. Collaborative efforts having all relevant sectors on board to jointly identify zoonotic diseases can be track to as an essential step. Success is conceivable, if human and animal health sector develop a prioritization mechanism to control zoonotic diseases by joining hands together by sharing public and animal health resources together. Developed systems to address the prioritized diseases can be empowered to hold zoonotic infections and emerging health threats. Recent outbreaks of zoonotic diseases associated with animal contact. Supply and demand imbalance especially in meat and dairy products is one of the instigating factor in zoonosis. Sufficient supply of healthy animal products is to be made available for consumers to reduce the zoonotic diseases and this could be possible by taking legislative measures at micro level. Evolving animal health monitoring system including strict quarantine, farm biosecurity, decontamination of infected animals, disease reporting, vigilance through ante-mortem / post-mortem may give support to achieve the targets (Rehman *et al*., 2020). Reliable laboratory tests and follow-up on the lab directions may trigger the diagnostic mechanism to break the pathogen transmission chain. Hygienic conditions in food processing, personal hygiene of workers need to be monitored for the production of safe food. In addition, financial constraints of developing countries lack disease control programs to minimize the incidents of zoonotic occurrence. Human health and nutrition are badly affected due to the reduced supply of high-protein food of animal origin such as milk, meat and eggs (ARÁMBULO & Thakur, 1992). Most of the zoonotic diseases are endemic, which negatively impacts the health conditions and livelihoods of farmers. Data collection is sometime restricted due to under-reporting and neglected as compared to emerging and re-emerging zoonosis (Maudlin *et al*., 2009). Tropical countries are more vulnerable for neglected diseases due to economical constraints and weak infrastructure of research facilities. Since the neglected zoonotic diseases initiated morbidity due to low priority in the health systems. Rabies, Echinococcosis, Taeniasis (Taenia solium), Leishmaniasis, Cysticercosis and Trematods are commonly considered neglected diseases [WHO, 206]. Impact of zoonosis is hard to quantify but can be assessed by the influence on human livelihood. In under developed countries, the performance of the animal handlers is adversely affected due to zoonotic issues because they don't take this subject as a serious matter while dealing with the animals. Individuals mostly stay isolated from the rest of the community and thus are more prone to health issues. Workers suffering from diseases, need special attention of treatment ultimately causing the economic losses.

4. Strategies for One Health Implementation

4.1 Integrated Surveillance

Early detection systems that combine human and animal health data improve the response to disease outbreaks. Systems like the Global Early Warning

System (GLEWS) exemplify effective data sharing among FAO, WHO, and OIE (FAO, 2015).

4.2 Joint Training and Education

Cross-training programs for veterinarians, physicians, and ecologists are essential to ensure a unified response during health crises (Gibbs, 2014).

4.3 Policy and Governance

Unified health policies and legislation supporting inter-ministerial collaboration are needed to sustain One Health initiatives (Lee & Brumme, 2013).

4.4 Community Involvement

Sustainable One Health interventions require the inclusion of local communities in surveillance, education and behavior change programs (Zinsstag *et al*., 2011).

5. Challenges and Gaps

- Fragmented infrastructure and operations among sectors.
- Limited funding for collaborative programs.
- Data sharing constraints.
- Inadequate spirit and legal frameworks.

6. Recommendations

Fortunately, several effective control and prevention strategies are available for managing common zoonotic diseases prevalent in affected communities—such as rabies, anthrax, and brucellosis. Notably, four published sets of guidelines focus on reducing zoonotic disease transmission during educational farm visits and petting zoo interactions. Most published recommendations emphasize the prevention of enteric diseases. Common preventive themes include the dissemination of educational materials, risk minimization strategies—particularly for children—provision of appropriate handwashing facilities and discouragement of behaviors such as eating, drinking, smoking or using pacifiers in animal-contact areas. Furthermore, they advise against the consumption of unpasteurized milk. Some documents go further to detail the type and placement of handwashing stations, layout of visitor areas, signage content and manure management practices.

However, there is a notable gap in guidance related to the prevention of animal bites and other non-enteric zoonotic diseases.

7. CONCLUSION

The One Health paradigm represents a proactive, inclusive and sustainable model to manage zoonotic diseases. With rising threats from EIDs, antimicrobial resistance and ecological disruption, global health systems must embrace integrated, evidence-based and cooperative strategies. Future success lies in strengthening inter-sectoral networks and ensuring social commitment to One Health principles.

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