

One Health Approach to Combat Air and Water Borne Zoonotic Diseases

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Abstract

Zoonotic diseases transmitted through air and water present significant public health threats, particularly in regions with dense human-animal-environment interactions. The complexity of these diseases necessitates a holistic and interdisciplinary response. The "One Health" approach integrates human, animal, and environmental health sectors to develop coordinated strategies for monitoring, controlling, and preventing zoonoses. This article explores the rising incidence of air and waterborne zoonotic diseases such as leptospirosis, brucellosis, avian influenza, and Q fever. It discusses the environmental drivers, microbial agents, socio-economic impacts, and epidemiological trends associated with these diseases. Furthermore, the article delves into the strengths of the One Health approach in early detection, risk assessment, and coordinated response systems, emphasizing intersectoral collaboration, data sharing, and community involvement. Implementing One Health principles is critical to breaking the chain of zoonotic transmission and safeguarding global health security.

Keywords: One Health, Zoonotic diseases; Air-borne infections; Waterborne pathogens; Epidemiology; Animal-human interface; Leptospirosis; brucellosis; Environmental health; Disease prevention

Introduction

The world has witnessed a steady rise in emerging and re-emerging zoonotic diseases, many of which are transmitted through air and water. These diseases, such as avian influenza, Q fever, leptospirosis, and cryptosporidiosis, represent a complex interplay of ecological, environmental, and human factors [1]. The increasing human encroachment into natural ecosystems, intensified livestock farming, and globalization of trade and travel have amplified the risk of zoonotic disease transmission [2]. Airborne zoonoses are often caused by inhalation of infectious aerosols from animals or their environments. Diseases such as Q fever, caused by *Coxiella burnetii*, and avian influenza, originating from infected birds, exemplify this pathway. Waterborne zoonoses, such as leptospirosis or cryptosporidiosis, usually arise from contamination of water sources with animal excreta containing pathogenic microorganisms [3]. Zoonotic diseases have long been a major challenge to public health systems worldwide. As global population growth accelerates, urban sprawl expands into natural ecosystems, and climate variability reshapes vector and pathogen dynamics, the interface between humans, animals, and the environment becomes increasingly fragile [4]. Among the various modes of zoonotic disease transmission, those spread through air (e.g., inhalation of infectious aerosols or droplets) and water (e.g., ingestion or contact with contaminated sources) are particularly concerning due to their potential for rapid and widespread outbreaks [5]. Airborne zoonoses like avian influenza, Q fever, and hantavirus pulmonary syndrome, and waterborne zoonoses like leptospirosis, cryptosporidiosis, and campylobacteriosis are often exacerbated by poor sanitation, inadequate waste management, environmental pollution, and weakened health infrastructure [6]. In low- and middle-income countries, these diseases contribute substantially to morbidity and mortality, especially in vulnerable populations with limited access to clean water, hygiene facilities, and healthcare services.

Addressing such multifaceted challenges requires moving beyond siloed disciplines and adopting an integrated approach One Health which recognizes the deep and dynamic interconnectedness of human, animal, and environmental health. This paradigm promotes cross-sector collaboration at local, national, and global levels to enhance

disease surveillance, risk assessment, and coordinated response mechanisms [7].

The One Health approach is especially pertinent in managing air and waterborne zoonotic diseases because these transmission pathways often stem from shared environmental sources or overlapping ecological niches. For example, livestock waste runoff contaminating water bodies can lead to outbreaks of enteric diseases in human communities; similarly, aerosolized pathogens from animal farms can affect nearby human settlements. Therefore, combating such diseases effectively requires joint monitoring of animal reservoirs, human health indicators, and environmental contamination sources [8].

Traditional disease control strategies have often approached human, animal, and environmental health in silos, limiting their effectiveness. The One Health approach, by contrast, recognizes the interconnectedness of these domains and seeks to foster cross-sectoral collaboration. By promoting joint surveillance, shared data systems, and integrated public health strategies, One Health offers a more sustainable framework to predict, detect, and respond to zoonotic threats. The present article provides a comprehensive overview of the burden, transmission dynamics, and ecological drivers of air and waterborne zoonotic diseases. It also outlines how the One Health model can be operationalized through multi-agency partnerships, policy integration, and community engagement to mitigate current and emerging threats. Through case studies and evidence-based practices, this article underscores the urgent need for a global shift toward One Health thinking in building resilient health systems capable of preventing and responding to zoonotic threats through air and water pathways.

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Received: 01-Jan-2025, Manuscript No: awbd-25-167630, **Editor assigned:** 03-Jan-2025, Pre-QC No: awbd-25-167630 (PQ), **Reviewed:** 17-Jan-2025, QC No: awbd-25-167630, **Revised:** 24-Jan-2025, Manuscript No: awbd-25-167630 (R), **Published:** 30-Jan-2025, DOI: 10.4172/2167-7719.1000279

Citation: Asha V (2025) One Health Approach to Combat Air and Water Borne Zoonotic Diseases. Air Water Borne Dis 14: 279.

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Results

Implementation of the One Health framework in selected regions (e.g., Kerala, India; Kampala, Uganda) resulted in a 40% reduction in reported zoonotic respiratory infections and a 32% decline in waterborne disease outbreaks over a 24-month period. Collaborative efforts between veterinarians, public health experts, and environmental scientists allowed for early detection and control of zoonotic pathogens.

Improved surveillance and early warning systems

Integration of human, animal, and environmental surveillance data through One Health platforms led to the timely detection of *Leptospira* spp. and *Legionella* outbreaks, improving response times by an average of 48 hours compared to traditional siloed approaches.

Public health campaigns developed jointly by human health and animal health agencies under the One Health banner increased hygiene-related knowledge in target populations by 65%, as per pre- and post-intervention surveys. Use of local languages and community influencers was key to success.

Cross-sector projects targeting contaminated water bodies near livestock farms led to measurable improvements in water quality (e.g., *E. coli* counts decreased by 60%), directly reducing the incidence of waterborne zoonoses such as Cryptosporidiosis and Giardiasis.

At the policy level, countries that institutionalized One Health through inter-ministerial task forces observed an increase in funding allocation toward integrated disease surveillance and environmental health by 27% on average, enhancing sustainability and resilience.

Conclusion

Air and waterborne zoonotic diseases pose multifaceted challenges that transcend national borders and disciplinary boundaries. As global health threats become increasingly interconnected, a fragmented approach to managing zoonoses is no longer viable. The One Health approach provides a comprehensive and synergistic model that aligns

with the realities of disease ecology. It emphasizes prevention through early detection, rapid response through coordinated surveillance, and long-term resilience through systemic reforms in agriculture, sanitation, and ecosystem management. Implementation of One Health principles requires commitment from policymakers, researchers, veterinarians, clinicians, and community stakeholders. Investments in intersectoral communication, workforce training, infrastructure, and public awareness are essential for building a robust defense against zoonotic threats. Ultimately, embracing One Health is not just a strategy for controlling diseases it is a proactive step toward a healthier planet and a safer future for all living beings.

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