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Silent Spillovers: India's Hidden Battle Against Zoonotic Diseases

G. Bhuvaneswari[1], Siddanna Manashetti [2], P. Ponnuvel[1]
[1]Department of Livestock Production and Management,
[2]Department of Veterinary Medicine,
RIVER, Puducherry – 605009
***Corresponding Author:** galibhuvaneswari@gmail.com
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Abstract:

Zoonotic diseases, infections transmitted from animals to humans, remain a major public health challenge in India despite progress in vaccination and control strategies. This paper explores the significance of World Zoonosis Day, India's livestock landscape, the hidden burden of underreported zoonoses, and the emerging threats posed by climate change, antimicrobial resistance, and the wildlife-livestock interface. It highlights the gaps in biosecurity, vaccination, and farmer awareness, emphasizing the need for integrated One Health strategies that link human, animal, and environmental health. The paper also discusses the crucial role of young professionals, veterinarians, and extension educators in disease surveillance, research, and community awareness. Strengthening cross-sector collaboration and implementing sustainable control measures are essential to reduce the impact of zoonotic diseases and safeguard both human and animal health in India.

Introduction:

A milestone in the worldwide battle against zoonotic diseases, World Zoonosis Day is celebrated annually on July 6 to honour Louis Pasteur's successful administration of the first rabies vaccine to a young boy in 1885. With over 200 known zoonoses that affect humans, zoonotic diseases—infections spread from animals to humans—pose a serious threat to global health. About 59000 people die from rabies alone each year, mostly in Asia and Africa. With historical allusions in the Babylonian Eshnunna Code, rabies has been a public health concern since ancient times and is almost always fatal once symptoms manifest. Rabies is still spreading to new species and geographical areas in spite of widespread vaccination campaigns, demonstrating the continuous difficulty in zoonotic disease control. The majority of newly emerging infections, including COVID-19, HIV, and, Ebola are animal-borne, and the WHO estimates that zoonoses make up 60% of all infectious diseases that affect humans. Addressing the environmental and socioeconomic factors that contribute to zoonoses requires the One Health

approach, which acknowledges the intimate connection between human, animal, and environmental health. Reducing the global burden of zoonotic diseases requires adopting integrated multidisciplinary strategies and learning from previous attempts as the world strives to eradicate dog-mediated human rabies by 2030.

India's Livestock Landscape:

A large number of different animal species make up India's livestock landscape, and these animals are vital to the socioeconomic structure of rural communities. With a sizeable portion of the nation's gross value added (GVA), the livestock industry makes a significant contribution to the agricultural economy. Nevertheless, the industry has to deal with issues like zoonotic diseases which endanger the health of both people and animals. A thorough review of India's common zoonotic diseases rural demographics and livestock population statistics is given in the sections that follow.

Livestock Population Statistics:

One of the world's top producers of livestock, India is home to 11. 6 percent of all livestock worldwide. The sector has grown at a faster rate than the crop sector, making a substantial contribution to both agricultural growth and the fight against poverty.

Rural Livestock Farming Demographics:

Because it provides fuel, manure, and draft power, livestock farming is essential to rural livelihoods. The sector is under pressure to increase production as a result of the growing demand for animal food products brought on by urbanization and rising incomes.

Common Zoonotic Diseases:

Pigs and other livestock serve as reservoirs for viruses such as Hepatitis E and Japanese encephalitis, which cause a large percentage of infectious diseases to be zoonotic.

Public health issues are brought on by the prevalence of zoonotic diseases, which calls for efficient control methods and a One Health strategy to manage the interface between humans and animals. Despite being strong and expanding India's livestock industry is susceptible to a number of problems, such as the spread of zoonotic illnesses. For sustainable livestock production and public health safety, addressing these issues calls for concerted efforts in disease control policy implementation and the adoption of cutting-edge technologies for monitoring and surveillance.

The 'Silent' Problem:

In India, the underreporting of zoonoses is a serious public health issue that is made worse by the dangers of backyard livestock and a lack of farmer awareness. This problem is made worse by insufficient surveillance systems and the intricate interactions between socioeconomic and environmental factors. The essential elements of this issue are examined in the sections that follow.

Underreporting of Zoonoses:

- With India serving as a hotspot for newly emerging zoonotic diseases, zoonotic diseases make up around 60% of all infectious disease pathogens worldwide.
- The existence of asymptomatic carriers and inadequate surveillance has led to an underestimation of the prevalence of zoonotic parasites.
- Emerging diseases like Kyasanur Forest Disease and Nipah virus underscore the critical need for improved reporting systems.
- Awareness of farmers. Efforts at prevention are hampered by livestock farmers' extremely low awareness of zoonotic diseases. It is imperative to implement educational programs to educate farmers about zoonotic hazards and encourage safe livestock management techniques. The risk of zoonotic disease and backyard livestock.
- Because backyard livestock farming is becoming more popular, there is a greater chance that zoonotic diseases will spread because of the close contact between humans and animals.
- These hazards are made worse by elements like urbanization and climate change, which call for an all-encompassing One Health strategy to address the connections between environmental, animal, and human health. However, others contend that the emphasis on zoonotic illnesses could obscure other urgent health concerns in India and take funds away from more pressing public health issues.

Livestock Management: First Barrier

Significant obstacles stand in the way of effective livestock management in India, especially about biosecurity procedures, vaccination rates, and zoonotic disease education for farmers. It is imperative to address these problems in order to improve animal welfare and public health. Procedures for biosecurity. For smallholder farms to avoid the spread of zoonotic diseases, biosecurity measures are crucial. According to studies, a large number of smallholder farmers are ignorant of good biosecurity procedures like disease segregation and appropriate sanitation. For example, a significant gap in farm management was revealed when only 60. 9 percent of pig farmers used fencing and other basic biosecurity measures. Immunization coverage.

A key element of managing the health of livestock is vaccination. However, India still has a low vaccination rate, especially for smallholder farms, which can result in higher rates of disease and financial losses. This problem is made worse by limited access to vaccines and information about their significance. Farmer Education on Zoonoses.

Farmers' must be educated about zoonotic diseases to comprehend the dangers of managing livestock. Poor management practices may result from farmers ignorance of zoonosis symptoms and sources. Putting in place educational initiatives can greatly raise awareness and advance biosecurity procedures. On the other hand, some contend that even though biosecurity and education are important

their implementation may be hampered by financial limitations and restricted access to resources, indicating the need for structural adjustments to agricultural policy and assistance for smallholder farmers.

Emerging Challenges:

Significant challenges are presented by the confluence of antimicrobial resistance, zoonotic disease emergence, and climate change in India. The spread of zoonotic diseases is made worse by climate change because the loss of biodiversity and changing ecosystems allow pathogens to spread from wildlife to people. Because interactions between domestic animals and wildlife can increase the spread of zoonoses, the wildlife-livestock interface makes matters more complicated. Furthermore, a serious risk to public health is the emergence of antibiotic resistance in livestock, which makes treating zoonotic infections more difficult.

Climate Change and Zoonotic Disease Emergence:

- Because climate change modifies habitats, zoonotic spillover events—like Nipah virus outbreaks in India—are more likely to occur.
- Vector-borne diseases are impacted by climate change with rising temperatures increasing dengue transmission.

Wildlife-Livestock Interface:

- Japanese encephalitis in pigs is an example of how zoonotic diseases can spread through the interface between livestock and wildlife.
- These interactions are exacerbated by urbanization and agricultural practices, raising the likelihood of disease emergence.

Antimicrobial Resistance in Livestock:

Overuse of antibiotics in cattle makes managing zoonotic diseases more difficult by causing antimicrobial resistance. Since infections are more difficult to treat due to this resistance, there is a serious risk to public health as morbidity and mortality rise. On the other hand, despite the complexity of these issues, they also offer chances to apply integrated health strategies like the One Health approach, which stresses cooperation between the environmental, animal, and human health sectors in order to successfully reduce these risks.

One Health: The Solution

In India, the One Health approach is becoming more widely acknowledged as an essential tactic for controlling zoonotic diseases—diseases that are spread from animals to people. By highlighting the connections between environmental, animal, and, human health, this strategy seeks to develop long-term solutions for illness prevention and management. The One Health framework is being used in India to address issues in areas like waterborne illnesses and poultry with an emphasis on stakeholder

collaboration to improve health outcomes in these areas.

One Health Approach in Poultry Sector:

The zoonotic diseases that affect both the economy and public health pose serious threats to the Indian poultry industry. A long-term solution to lessen these risks is the One Health approach, which encourages cooperation between governmental organizations, veterinary and medical specialists, and the chicken sector.

This strategy seeks to protect human and environmental health by enhancing bird welfare, averting zoonotic outbreaks, and promoting sustainable practices in the poultry sector.

Integrated Management of Waterborne Zoonotic Diseases:

The health risks associated with waterborne zoonotic diseases like Salmonella enterica and Escherichia coli are substantial. Preventive measures like water sanitation and hygiene (WASH) are part of India's One Health approach to deal with these problems.

Public awareness campaigns about antimicrobial resistance (AMR) and the draft national One Health mission are important initiatives for improving biosecurity and lowering the risk of contamination.

Success Stories and Challenges:

With efforts to address zoonotic diseases and antibiotic resistance, India has advanced the One Health approach. Notwithstanding certain obstacles that persist such as the requirement for enhanced monitoring data-sharing systems and a legislative structure to bolster One Health endeavours.

One example of a successful initiative is the national-level workshop that prioritized zoonotic diseases, identifying the most critical diseases and stressing the importance of multi-sectoral cooperation. India's zoonotic disease management could benefit from the One Health approach, but there are a number of obstacles to overcome in its implementation, including inadequate agency coordination and a lack of funding. To effectively address these problems and ensure that One Health principles are applied throughout the nation, a concentrated effort must be made to improve cross-sector collaboration and resource allocation.

Role of Young Professionals:

Young professionals play a critical role in combating zoonotic diseases in India, especially veterinary students and extension educators. These people are well-positioned to advance knowledge investigation and prevention strategies concerning zoonoses which pose serious risks to public health. Their participation can result in better human and animal health outcomes, especially when it comes to managing livestock and interacting with wildlife.

Veterinary Students and Zoonoses:

- The ability of veterinary students to identify and control zoonotic disease risks in both domestic and

wild animals makes them crucial to our understanding of these conditions.

- Given that wildlife serves as reservoirs for more than 70% of newly emerging zoonotic diseases, they can aid in research on zoonotic diseases, concentrating on transmission pathways and control measures.

Livestock Research and Disease Control:

- Young researchers in livestock are essential in detecting zoonotic diseases that impact animals and cause large financial losses.
- By ensuring that livestock health is given priority in order to prevent zoonotic transmission to humans, their research can help shape policies targeted at disease control.

Extension Education and Public Awareness:

- By teaching farmers and the general public about zoonotic risks and prevention techniques, extension educators play a crucial role in bridging the gap between research and community awareness.
- They can improve community resilience by putting in place educational initiatives that tackle the difficulties in identifying and controlling zoonotic illnesses.
- Even though young professionals' participation is crucial, there are still issues that need to be addressed, like the need for improved zoonotic disease surveillance and data collection, which can impede the implementation of efficient control measures.

Conclusion:

Zoonotic diseases continue to pose a persistent threat to India's public health and livestock sectors, undermining rural livelihoods and national development goals. Despite advancements in vaccination campaigns and awareness initiatives, underreporting, poor biosecurity practices, and emerging challenges like antimicrobial resistance and climate change hinder effective control. The One Health approach offers a sustainable path forward by promoting collaboration across human, animal, and environmental health domains. Empowering young professionals, improving farmer education, enhancing surveillance systems, and supporting smallholder farmers with resources and policy reforms are vital steps toward addressing these silent spillovers. A committed, multidisciplinary effort is necessary to break the cycle of transmission and build resilient systems capable of managing current and future zoonotic threats in India.

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