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Commentary

Emerging Zoonotic Bacterial Diseases: A Global Health Threat

Tian Zhen*

Department of Microbiology, Sichuan University, Sichuan, China

ABOUT TO STUDY

Zoonotic diseases, infections transmitted from animals to humans, continue to represent a significant threat to global public health. Among them, zoonotic bacterial diseases are particularly concerning due to their potential for widespread outbreaks and high mortality rates. In recent decades, the emergence and re-emergence of these diseases have been influenced by several factors, including global environmental changes, increased human-animal interactions, urbanization, and antimicrobial resistance. Emerging zoonotic bacterial diseases pose not only an immediate threat to human health but also challenge existing healthcare systems worldwide. This article explores the key emerging zoonotic bacterial infections, the factors contributing to their spread, and strategies for mitigating their impact.

Understanding emerging zoonotic bacterial diseases

Emerging zoonotic bacterial diseases are those that have newly appeared in a population or have existed but are rapidly increasing in incidence or geographical range. These diseases often arise due to a change in the relationship between humans, animals, and the environment. Zoonotic infections are typically transmitted through direct contact with infected animals or animal products, through vectors such as mosquitoes and ticks, or by consumption of contaminated food and water.

Key examples of emerging zoonotic bacterial diseases include Brucellosis, Leptospirosis, Salmonella, Campylobacteriosis, and Plague.

Brucellosis

Brucellosis is a bacterial infection caused by the genus *Brucella*. It is typically transmitted to humans through direct contact with infected animals or their products (such as milk and meat). The disease is common in livestock, particularly cattle, goats, and sheep, and affects workers in the agricultural, veterinary, and slaughterhouse industries.

The disease is characterized by flu-like symptoms, including fever, fatigue, joint pain, and sweating, and can lead to chronic complications such as arthritis, endocarditis, and infertility. Brucellosis is of particular concern in developing regions of the world, where it remains endemic in livestock populations.

The rise of brucellosis in new geographical areas and the development of antimicrobial resistance among *Brucella* species are raising concerns for both human and animal health. Control measures, including vaccination of livestock and enhanced surveillance in endemic regions, are essential to prevent outbreaks.

Leptospirosis

Leptospirosis is caused by the bacteria *Leptospira*, which is commonly found in the urine of infected animals, particularly rodents. Human infection typically occurs through direct contact with contaminated water, soil, or animal urine. The disease is most prevalent in tropical and subtropical regions, especially in areas with poor sanitation and frequent flooding.

Leptospirosis can manifest as a mild flu-like illness or progress to more severe forms, including liver damage, kidney failure, meningitis, and even death. Outbreaks of leptospirosis are often associated with flooding and poor waste management systems. Urbanization, deforestation, and the encroachment of human settlements into wildlife habitats have increased the potential for human exposure to *Leptospira*.

Public health interventions focusing on improving sanitation, controlling rodent populations, and educating at-risk populations can help mitigate the spread of leptospirosis.

Salmonella infections

Salmonella is a group of bacteria that cause foodborne illnesses and is one of the most common causes of zoonotic bacterial infections. *Salmonella* is typically transmitted to humans through consumption of contaminated food, particularly undercooked meat, eggs, and dairy products. The bacteria can also be transmitted through direct contact with infected animals, particularly reptiles, poultry, and livestock.

The most common clinical symptoms of salmonella infection include diarrhea, fever, and abdominal cramps. While most

Correspondence to: Tian Zhen, Department of Microbiology, Sichuan University, Sichuan, China; E-mail: tianzhen@wchscu.cn

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infections are self-limiting, severe cases can lead to dehydration, septicemia, and organ failure. In recent years, the emergence of antibiotic-resistant strains of *Salmonella*, particularly those resistant to fluoroquinolones and third-generation cephalosporins, has raised significant concerns for the treatment of severe infections.

Efforts to reduce the spread of *Salmonella* include improving food safety standards, promoting proper food handling and cooking practices, and controlling antibiotic use in agriculture.

Campylobacteriosis

Campylobacter is a leading cause of bacterial gastroenteritis worldwide. The bacteria are commonly found in the gastrointestinal tract of poultry, cattle, and other animals, and human infection typically occurs through consumption of contaminated food, particularly undercooked poultry, unpasteurized milk, and contaminated water.

Infections with *Campylobacter* cause symptoms such as diarrhea (often bloody), fever, abdominal pain, and nausea. In severe cases, *Campylobacter* infection can lead to complications like Guillain-Barré syndrome, a rare neurological disorder. The rise of antimicrobial resistance among *Campylobacter* strains, particularly to fluoroquinolones, is concerning for the treatment of severe cases.

Control measures for *Campylobacter* include improving food safety practices, proper handling and cooking of poultry, and reducing antibiotic use in animal husbandry.

Plague

The plague, caused by the bacterium *Yersinia pestis,* is one of the most infamous zoonotic diseases. It is typically transmitted to humans through the bite of an infected flea from wild rodents. The disease can present in three forms: bubonic (swollen lymph nodes), septicemic (bloodstream infection), and pneumonic (lungs).

Although the plague was responsible for devastating pandemics in history, such as the Black Death, the disease has largely been controlled in most parts of the world. However, the plague continues to be a concern in some rural and remote areas, particularly in parts of Africa, Asia, and the Americas. The emergence of *Y. pestis* strains with increased virulence or antibiotic resistance is an ongoing risk for public health.

Early diagnosis, swift antimicrobial treatment, and vector control measures remain key to controlling outbreaks of the plague.

Factors contributing to the emergence of zoonotic bacterial diseases

The emergence of zoonotic bacterial diseases is influenced by several interconnected factors:

Environmental changes

Climate change, deforestation, and urbanization contribute to the spread of zoonotic diseases by altering habitats and increasing human-wildlife contact. Flooding, rising temperatures, and changing ecosystems can create favorable conditions for bacterial pathogens and their vectors.

Increased human-animal interaction

As the human population grows, people increasingly live in close proximity to animals, leading to a higher risk of zoonotic transmission. Agricultural practices, the wildlife trade, and encroachment into natural habitats all contribute to increased contact between humans and animals.

Globalization and travel

The movement of people, animals, and goods across borders has facilitated the spread of zoonotic bacterial diseases to new regions. Infected animals, contaminated food products, and international travel have all contributed to the global spread of zoonotic pathogens.

Antimicrobial resistance

The overuse and misuse of antibiotics in agriculture and human medicine have contributed to the development of antimicrobial-resistant strains of zoonotic bacteria. Resistance complicates treatment, increases healthcare costs, and raises the risk of severe outbreaks.

Preventing emerging zoonotic bacterial diseases

Surveillance and early detection

Enhanced surveillance of both human and animal populations is essential for the early detection of emerging zoonotic diseases. Collaboration between public health, veterinary, and environmental agencies is critical for identifying potential outbreaks before they become widespread.

One Health approach

The One Health approach, which recognizes the interconnectedness of human, animal, and environmental health, is crucial in addressing zoonotic diseases. By integrating human, veterinary, and environmental health efforts, more effective control and prevention strategies can be developed.

Improved hygiene and sanitation

Education and improvement in hygiene practices, particularly in high-risk regions, can significantly reduce the transmission of zoonotic bacterial diseases. Safe food handling, sanitation, and water purification are vital in preventing infections.

Antimicrobial stewardship

Reducing the use of antibiotics in agriculture and promoting responsible antibiotic use in human healthcare can help slow

the development of antimicrobial resistance. Stricter regulations on the use of antibiotics in livestock can reduce the spread of resistant zoonotic pathogens.

CONCLUSION

Emerging zoonotic bacterial diseases represent a growing global health threat, with potential for widespread outbreaks and severe impacts on human health. Understanding the factors contributing to their emergence, early detection, and prompt intervention are essential in reducing their impact. By adopting a One Health approach, improving surveillance systems, and focusing on prevention strategies such as sanitation and antimicrobial stewardship, the global community can work together to mitigate the threat of these diseases. The ongoing challenges of climate change, globalization, and antimicrobial resistance highlight the need for continued vigilance and international cooperation in addressing emerging zoonotic bacterial diseases.