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Leptospirosis: An emerging zoonotic disease

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ABSTRACT

Abstract

Introduction: Leptospirosis is a globally distributed waterborne zoonosis with significant public health impact, accounting for over one million annual cases and approximately 60,000 deaths. Once considered an occupational disease confined to endemic tropical regions, its epidemiology has recently undergone profound changes.

Methods: This narrative review synthesizes evidence from published literature on the epidemiological transition, ecological drivers, diagnostic challenges, and prevention strategies of leptospirosis, with a focus on recent global trends.

Results: Human infection occurs primarily through contact with urine of carrier animals, particularly rodents, cattle, and pigs. Increasingly, outbreaks are reported among urban populations, recreational water users, and flood-affected communities, indicating a shift beyond traditional occupational risk groups. Climate change—manifested as rising temperatures, extreme flooding, and hurricanes—creates favorable conditions for bacterial survival and amplifies human exposure. Despite advances in understanding *Leptospira* pathogenesis, diagnosis remains difficult due to nonspecific early symptoms that mimic dengue, malaria, and other febrile illnesses, often leading to delayed treatment. Additionally, the high genetic and serological diversity of the pathogen hinders the development of a broadly protective human vaccine.

Conclusion: Leptospirosis is no longer a neglected tropical disease restricted to certain endemic foci; it has evolved into a dynamic global health challenge exacerbated by climate change, urbanization, and complex human-animal-environment interactions. Effective control requires a paradigm shift from reactive outbreak response to proactive integrated surveillance, improved diagnostics, strengthened international collaboration, and sustained investment in research and public health preparedness.

Keywords: *Leptospira*, Leptospirosis, emerging zoonosis.

Leptospirosis is a neglected, reemerging waterborne zoonotic disease of global public health importance, occurring worldwide and imposing a substantial burden of morbidity and mortality in both humans and animals (1). The causative organism was first isolated in Japan as the etiological agent of Weil's disease, which was commonly reported among coal miners, although the pathogen itself remained poorly characterized at the time (2). Human infection mainly occurs through occupational and domestic activities involving contact with carrier animal urine. It is currently estimated that more than one million human cases occur annually, with approximately 60,000 deaths, although these numbers may be underreported due to underdiagnosis and poor surveillance in many endemic and developing countries (1). Although occupational exposure/contacts remain a vital risk factor, the epidemiology of leptospirosis has undergone dramatic changes. Positive cases are increasingly being reported in urban populations, recreational water users, military personnel, travelers, and populations affected by flooding or other natural disasters. This epidemiological shift reflects a profound environmental and socioeconomic change in human contact with contaminated water and animal reservoirs infected with the pathogen. During the last two or three decades, endemic transmission and several seasonal

outbreaks have been reported increasingly in tropical and subtropical climates and even other regions, which have recently changed current insight of this neglected zoonotic disease (3). Rodents remain the principal hosts in many of endemic regions, although cattle, pigs, dogs, and numerous wildlife species also contribute to the normal cycle of the pathogenic *Leptospira*. These normal cycle among the hosts generally develop asymptomatic or mild infections while establishing chronic renal colonization, enabling prolonged urinary shedding of the bacteria into the environment. In contrast, humans and most other incidental hosts typically develop acute infection and generally do not contribute significantly to normal transmission. The emergence and re-emergence of leptospirosis are being driven by multiple interconnected ecological, and environmental dimension. So far, climate change has become one of the most impactful drivers of this unfortunate cycles. In other words, increasing global temperatures, recurrent flooding, hurricanes, and other extreme weather events provide a favorable environmental condition for prolonged bacterial survival while simultaneously increasing human exposure through contaminated floodwaters with this zoonotic bacterium. Consequently, outbreaks are becoming unpredictable and recurrent, geographically widespread, and increasingly severe, particularly in developing countries where exactly surveillance and public health infrastructure are limited (4, 5). The problem with leptospirosis also intensifies how severely environmental changes, and biodiversity changes collectively shape the emergence of infectious diseases in the current century. Despite revolutionary progress in our understanding of *Leptospira* pathogenesis and physiology; the major challenges remain in disease diagnosis (mostly about cases with subclinical manifestations) and prophylaxis. The clinical manifestations of leptospirosis ranged widely (from mild febrile illness to severe multiorgan dysfunction, including Weil's disease and severe pulmonary hemorrhagic syndrome) highlighting the need for accurate and specific diagnostic measurements. Moreover, since its early clinical presentation overlaps with numerous acute febrile illnesses, including dengue, malaria, and other viral and bacterial infections, timely diagnosis remains difficult, frequently resulting in delayed treatment which can ends in increased morbidity rates. Furthermore, the remarkable genetic and serological diversity of *Leptospira* continues to complicate vaccine development, and no universally protective human vaccine is currently available. Addressing the worrying global concern of leptospirosis requires a paradigm shift from reactive outbreak response toward proactive prevention and later integrated surveillance. For many years, public health authorities have emphasized the need to strengthen surveillance systems to improve case detection, monitor epidemiological trends, case-finding and identify emerging transmission hotspots (2, 6). Actually, leptospirosis is no longer only a neglected tropical disease restricted to an endemic region at certain country. The bacterium has been evolved into a full-scale dynamic global health challenge boosted by climate change, rapid urbanization, and increasingly complex human–animal–environment interactions (Novel triangle). Assuming these changing epidemiological patterns is essential for surveillance systems, improving diagnostic settings, strengthening international collaboration, and advancing effective prevention (7). Leptospirosis is one of the newest zoonotic diseases that driving the unpredicted outbreaks in many of the under developing countries with high morbidity and mortality rates. As global environmental change continues to alter the epidemiology of various bacterial zoonotic diseases, therefore, leptospirosis should be recognized as a global public health priority, warranting sustained investment in high-quality research, robust surveillance, and comprehensive public health preparedness.

Author Contributions

A.T.B. (Amin Talebi Bazmin Abadi) conceived the study, drafted the manuscript, and performed the literature review. K.K.S. (Karrar Kadhim Salih) contributed to data collection, revised the manuscript critically for important intellectual content, and approved the final version.

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Data availability

Data available on request from the authors.

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Not applicable. This review article does not involve direct human or animal participants.

Consent for publication

All authors have read and approved the final version of the manuscript and give their full consent for its publication.

Conflict of interests

The authors declare that they have no competing interests.

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AI-Assisted Technology

The authors declare that no artificial intelligence (AI)-assisted technologies (such as ChatGPT or similar tools) were used in the writing, analysis, or generation of this manuscript.

References:

1. Costa F, Hagan JE, Calcagno J, Kane M, Torgerson P, Martinez-Silveira MS, et al. Global morbidity and mortality of leptospirosis: a systematic review. PLoS neglected tropical diseases. 2015;9(9):e0003898.
2. Victoriano AFB, Smythe LD, Gloriani-Barzaga N, Cavinta LL, Kasai T, Limpakarnjanarat K, et al. Leptospirosis in the Asia Pacific region. BMC infectious diseases. 2009;9(1):147.
3. Bradley EA, Lockaby G. Leptospirosis and the Environment: A Review and Future Directions. Pathogens. 2023;12(9):1167.
4. Lau CL, Smythe LD, Craig SB, Weinstein P. Climate change, flooding, urbanisation and leptospirosis: fuelling the fire? Transactions of the Royal Society of Tropical Medicine and Hygiene. 2010;104(10):631-8.
5. Douchet L, Goarant C, Mangeas M, Menkes C, Hinjoy S, Herbreteau V. Unraveling the invisible leptospirosis in mainland Southeast Asia and its fate under climate change. Science of the Total Environment. 2022;832:155018.
6. Organization WH. Human leptospirosis: guidance for diagnosis, surveillance and control: World Health Organization; 2003.
7. Fanelli A, Alglave B, Caporaso L, Cescatti A, Ciscar J-C, Dubois G, et al. Spatiotemporal dynamics of leptospirosis in Europe: a retrospective observational study with prospective projections. The Lancet Regional Health – Europe. 2026;65.