ISRG JOURNAL OF CLINICAL MEDICINE AND MEDICAL RESEARCH [ISRGJCMMR]

ISRG PUBLISHERS
Abbreviated Key Title: ISRG J Clinic.Medici.Medica.Res.
ISSN: 3048-8850 (Online)
Journal homepage: https://isrgpublishers.com/cmmr/
Volume – II, Issue - VI (November-December) 2025
Frequency: Bimonthly

From Spillover to Spread: Nipah Virus and the Urgent Need for a One Health Response

Dr Rajesh Kanna K[1*], Dr Arjun Banerjee[2]

[1] Department of Microbiology, All India Institute of Medical Sciences, Bibinagar, Hyderabad, Telangana.

[2] Department of Microbiology, Institute of liver and Biliary Sciences New Delhi.

| **Received:** 25.12.2025 | **Accepted:** 26.12.2025 | **Published:** 27.12.2025

***Corresponding author:** Dr Rajesh Kanna K

Department of Microbiology, All India Institute of Medical Sciences, Bibinagar, Hyderabad, Telangana.

Abstract

Nipah virus is a highly virulent zoonotic pathogen belonging to the genus Henipavirus and family Paramyxoviridae that causes severe encephalitic and respiratory illness in humans. With mortality rates ranging from 40% to more than 70%, the absence of licensed vaccines or specific antiviral therapies, and established human-to-human transmission poses Nipah virus a substantial epidemic and pandemic risk. Recurrent outbreaks across South and Southeast Asia, particularly in India and Bangladesh, underscore ongoing weaknesses at the human–animal–environment interface. In response to these concerns, the World Health Organization has identified Nipah virus as a priority pathogen under its Research and Development Blueprint. The intricate transmission ecology of Nipah virus, involving wildlife reservoirs, intermediate animal hosts, environmental influences, and healthcare-related spread, emphasizes the urgent need for a coordinated One Health approach to support effective prevention and control efforts.

Keywords: *Nipah virus, One Health, Spillover transmission, Zoonotic disease.*

Short communication

Nipah virus (NiV) infection is one of the most lethal emerging zoonotic diseases, with reported case fatality rates ranging from 40% to over 70%. Owing to its epidemic potential, lack of licensed vaccines or targeted antivirals, and ability to cause severe outbreaks with human-to-human transmission, the World Health Organization has prioritized Nipah virus under its Research and Development Blueprint for emerging pathogens[1]. The repeated re-emergence of Nipah virus in South and Southeast Asia highlights critical vulnerabilities at the human–animal–environment interface and underscores the urgent need for a One Health response.

DOI: 10.5281/zenodo.18067324

Nipah virus is a highly pathogenic *Henipavirus* belonging to the family *Paramyxoviridae*, first identified during an outbreak of encephalitis among pig farmers in Malaysia in 1998–1999[2]. Fruit bats of the genus *Pteropus* are the natural reservoirs, shedding the virus asymptomatically through saliva, urine, and feces[3]. Human infection occurs via multiple routes, including direct contact with bats, consumption of food contaminated with bat secretions, exposure to infected intermediate hosts, and person-to-person transmission[4]. These diverse transmission pathways reflect the virus's ecological adaptability and complicate control measures.

The epidemiology of Nipah virus varies across regions. In Malaysia, intensive pig farming facilitated amplification and spillover to humans[2]. In contrast, outbreaks in Bangladesh and India have been associated with direct bat-to-human transmission and sustained human-to-human spread, particularly within households and healthcare settings[3,8]. These patterns raise concerns regarding the potential for wider dissemination should the virus acquire enhanced transmissibility[9].

India has emerged as a critical region for Nipah virus surveillance, with recurrent outbreaks reported predominantly from Kerala since 2018[5]. Although the absolute number of cases has remained limited, the outbreaks have been characterized by high mortality and significant nosocomial transmission risk[5,11]. Rapid laboratory confirmation, strict infection prevention and control practices, aggressive contact tracing, and coordinated public health interventions have been instrumental in outbreak containment. However, these responses have largely relied on emergency mobilization rather than sustained preparedness.

The concurrence of Nipah virus outbreaks with the COVID-19 pandemic further exposed the fragility of health systems when faced with overlapping public health threats[10,11]. South India, in particular, has experienced the simultaneous emergence of multiple high-fatality infectious diseases, including Nipah, Zika, and kala-azar, highlighting the compounded risks posed by ecological disruption and strained surveillance systems[12]. These observations emphasize the need to move beyond pathogen-specific responses toward integrated preparedness frameworks.

Nipah virus exemplifies the rationale for the One Health approach, which recognizes the interconnectedness of human, animal, and environmental health. The virus circulates silently in wildlife reservoirs, spills over under favorable ecological and behavioral conditions, and may spread further through healthcare-associated transmission[6]. Surveillance systems for human disease, animal health, and environmental risk factors often operate in silos, limiting early detection and timely risk mitigation.

Operationalizing One Health for Nipah virus prevention requires coordinated action across sectors. Wildlife surveillance of *Pteropus* bat populations could help identify periods of increased viral shedding and spillover risk. Strengthening veterinary health systems and biosecurity measures can reduce the likelihood of amplification through intermediate hosts. Environmental interventions addressing deforestation, land-use change, and climate variability are essential to minimize human–bat interactions[6]. At the human health level, integrated early warning systems, laboratory capacity, infection prevention and control, and community engagement remain critical.

International agencies have emphasized that prevention of zoonotic diseases is most effective when human, animal, and environmental sectors collaborate systematically rather than episodically[7]. Community participation is equally important, as behavioral practices such as consumption of raw date palm sap and close contact with wildlife habitats have been implicated in Nipah virus transmission[3,8]. Sustained risk communication and culturally appropriate interventions are therefore central to spillover prevention.

Despite its high mortality and pandemic potential, Nipah virus remains under-researched compared with other emerging pathogens[9]. Accelerated research on vaccines, therapeutics, and diagnostics, embedded within One Health research frameworks, is urgently needed[1]. India's experience with recurrent outbreaks provides an opportunity to develop integrated surveillance and research models that can inform both national and global preparedness strategies.

In conclusion, Nipah virus represents a continuing threat at the human–animal–environment interface. The progression from zoonotic spillover to human spread reflects systemic vulnerabilities that cannot be addressed by the human health sector alone. A coordinated One Health response—integrating public health, veterinary services, environmental management, and community engagement—is essential to prevent future outbreaks. Strengthening such integrated systems will not only improve preparedness against Nipah virus but also enhance resilience against future emerging zoonotic diseases.

References

1. World Health Organization. Prioritizing diseases for research and development in emergency contexts. Geneva: WHO; 2018.
2. Chua KB. Nipah virus outbreak in Malaysia. *J Clin Virol.* 2003;26:265–275.
3. Luby SP, Gurley ES, Hossain MJ. Transmission of human infection with Nipah virus. *Clin Infect Dis.* 2009;49:1743–1748.
4. Ang BSP, Lim TCC, Wang L. Nipah virus infection. *J Clin Microbiol.* 2018;56:e01875-17.
5. Arunkumar G, Chandni R, Mourya DT, Singh SK, Sadanandan R, Sudan P, et al. Outbreak investigation of Nipah virus disease in Kerala, India, 2018. *J Infect Dis.* 2019;219:1867–1878.
6. Plowright RK, Parrish CR, McCallum H, Hudson PJ, Ko AI, Graham AL, Lloyd-Smith JO. Pathways to zoonotic spillover. *Nat Rev Microbiol.* 2017;15:502–510.
7. World Health Organization, Food and Agriculture Organization of the United Nations, World Organisation for Animal Health. One Health Joint Plan of Action (2022–2026). Geneva: WHO; 2022.
8. Gurley ES, Montgomery JM, Hossain MJ, Bell M, Azad AK, Islam MR, et al. Person-to-person transmission of Nipah virus in a Bangladeshi community. *Emerg Infect Dis.* 2007;13:1031–1037.
9. Lo MK, Rota PA. The emergence of Nipah virus, a highly pathogenic paramyxovirus. *J Clin Virol.* 2008;43:396–400.
10. Kaliappan A, Kaliappan V, Lakshmi JT, Raja S, Nikhat SS, Vidya MS, Saranya M, Sagar T, Chenna KD. Nipah amidst the COVID-19 pandemic: another re-emerging

DOI: 10.5281/zenodo.18067324

infectious disease of pandemic potential—a narrative review. *Maedica (Bucur).* 2022;17(2):464–472.

11. Yadav PD, Sahay RR, Balakrishnan A, Mohandas S, Radhakrishnan C, Gokhale MD, Balasubramanian R, Abraham P, Gupta N, Sugunan AP, Khobragade R. Nipah virus outbreak in Kerala State, India amidst the COVID-19 pandemic. *Front Public Health.* 2022;10:818546.
12. Uday U, Tadi LJ, Islam Z, Mohanan P, Ghazanfar S, Babar MS, Ismail S. Zika, Nipah and kala-azar: emerging lethal infectious diseases amid COVID-19 as an escalating public health threat in South India. *Ann Med Surg (Lond).* 2022;79:103972.

DOI: 10.5281/zenodo.18067324