# MODERN EPIDEMIOLOGY AND MICROBIOLOGICAL CHARACTERISTICS OF HANTAVIRUSES: ANALYSIS OF THE 2026 OUTBREAK

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**Abstract**

Hantaviruses are rodent-borne zoonotic RNA viruses that cause severe diseases such as hemorrhagic fever with renal syndrome (HFRS) and hantavirus pulmonary syndrome (HPS). Although transmission to humans occurs mainly through rodent excreta, Andes hantavirus shows limited person-to-person transmission.

The 2026 MV *Hondius* outbreak highlighted the epidemiological risk of hantaviruses in closed environments and the importance of rapid detection and control measures. Overall, rodent control, early diagnosis, and strong epidemiological surveillance remain key strategies for preventing hantavirus infections. The findings indicate that early diagnosis, epidemiological monitoring, and control of zoonotic reservoirs remain among the priority directions for global public health in combating hantavirus infections.

**Keywords:** hantavirus, Andes virus, zoonotic infections, outbreak, epidemiology, hantavirus pulmonary syndrome, RNA viruses.

**Introduction**

Hantaviruses are zoonotic RNA viruses belonging to the order *Bunyavirales*. These viruses primarily establish persistent infections in rodents and are transmitted to humans mainly through aerosols contaminated with rodent urine, feces, or saliva. [1][5]

Clinically, hantavirus infections manifest in two major syndromes: HFRS (*Hemorrhagic Fever with Renal Syndrome*) and HPS/HCPS (*Hantavirus Pulmonary Syndrome* or *Hantavirus Cardiopulmonary Syndrome*), which is characterized by severe respiratory failure. [7][14]

While HFRS is more commonly observed in Europe and Asia, HPS predominates in North and South America and is associated with high mortality rates. In particular, the Andes virus (ANDV) is considered one of the most dangerous hantavirus species reported in South America. [2][7]

In recent years, scientific evidence has emerged regarding the possibility of person-to-person transmission of the Andes virus. This feature is regarded as an important epidemiological characteristic distinguishing hantaviruses from classical zoonotic infections. [3][9]. The hantavirus outbreak reported in 2026 aboard the *MV Hondius* cruise ship attracted considerable attention from the perspective of global epidemiological surveillance. This event once again highlighted the risk of viral transmission in closed collective environments. [4][6][21]

**Introduction**

Hantaviruses are viruses with a segmented, negative-sense RNA genome composed of three segments: S, M, and L. These segments encode the nucleocapsid protein, glycoproteins, and RNA-dependent RNA polymerase, respectively. [5][16]

The primary reservoir of hantaviruses is rodents. Each hantavirus species is typically associated with a specific rodent host, forming a well-defined ecological cycle. For example, the Andes virus is primarily associated with *Oligoryzomys longicaudatus*. [5]

The pathogenesis of hantavirus infection is largely driven by endothelial cell damage. The virus increases capillary permeability, leading to leakage of plasma into interstitial tissues. This process may result in severe pulmonary edema and respiratory failure. [7][14]. Literature indicates that one of the key distinguishing features of the Andes virus compared to other hantaviruses is its potential for person-to-person transmission. During the Epuyén outbreak reported in Chile in the 1990s, evidence suggested possible transmission among family members and close contacts. [17][24]

A 2020 study published in the *New England Journal of Medicine* analyzed a superspreader transmission model of Andes virus, reporting that certain patients transmitted the infection to multiple contacts. [3]

According to data published in *Frontiers in Microbiology*, human-to-human transmission may be particularly likely during the prodromal phase of the disease. [9]. Systematic reviews conducted in 2021–2022 also support the possibility of limited interpersonal transmission of Andes hantavirus. [10]

**Methodology**

This study was conducted using an analytical literature review approach. The research included the analysis of up-to-date scientific sources on hantavirus infections, including epidemiological reports from international organizations such as WHO and CDC, as well as articles indexed in PubMed and PMC databases and studies published in high-impact scientific journals. [1][2][7]

During the analysis, the microbiological structure of hantaviruses was examined, including their RNA genome organization, viral protein functions, and cellular mechanisms of pathogenesis. In addition, the ecological relationship between the virus and its rodent reservoirs, as well as zoonotic transmission pathways, were evaluated based on scientific literature. [5][16]

Special attention was given to the epidemiological characteristics of the Andes hantavirus, as several clinical studies have reported its limited capacity for human-to-human transmission, distinguishing it from other hantavirus species. [3][9]

Furthermore, the 2026 outbreak reported on the MV Hondius cruise ship was considered as a distinct epidemiological event and was compared with existing scientific data on transmission dynamics in closed environments. [4][6]

**Results and Discussion**

The literature review indicates that the global epidemiological significance of hantaviruses has been steadily increasing in recent decades, largely driven by ecological and socio-environmental transformations. In particular, climate change has altered the distribution patterns of rodent reservoirs, expanding the geographic range of several hantavirus-carrying species into previously non-endemic regions. Urbanization, deforestation, and agricultural expansion have further intensified human–wildlife interfaces, thereby increasing the probability of zoonotic spillover events. [5][15] These factors collectively contribute to a growing public health concern, as hantaviruses remain highly dependent on ecological conditions that favor rodent population density and human exposure.

According to WHO and CDC epidemiological surveillance data, hantavirus infections are typically sporadic and geographically clustered; however, periodic outbreaks continue to occur, especially in rural or peri-urban environments where human exposure to rodent excreta is more frequent. [1][2] Such outbreaks are often underdiagnosed in the early stages due to non-specific prodromal symptoms, which complicates timely clinical recognition and may delay appropriate supportive interventions.

The 2026 outbreak on the MV *Hondius* cruise ship represents a particularly significant epidemiological event due to its occurrence in a closed and highly interconnected environment. According to WHO Disease Outbreak News, several passengers developed clinical manifestations consistent with Andes hantavirus infection, prompting immediate epidemiological investigations, isolation protocols, and contact tracing measures. [4] The confined nature of cruise ship environments is especially conducive to rapid transmission dynamics, as limited ventilation systems and frequent interpersonal interactions may amplify exposure risk once an infectious case is introduced. ECDC reports further emphasized that the outbreak setting highlights the critical importance of rapid case identification and implementation of infection prevention and control (IPC) strategies in closed collective environments. [6] In such settings, even a small number of cases can lead to disproportionate transmission clusters if containment measures are delayed.

The literature also confirms that Andes virus (ANDV) is epidemiologically distinct from other hantaviruses due to its documented capacity for person-to-person transmission. A study published in the *New England Journal of Medicine* demonstrated that specific individuals may function as “superspreaders,” facilitating secondary transmission across multiple close contacts, particularly within household or healthcare settings. [3] This characteristic significantly elevates the outbreak potential of ANDV compared to other hantavirus species, which are predominantly rodent-to-human transmitted.

Transmission is primarily associated with close, prolonged, and often repeated exposure to infectious respiratory secretions, with evidence suggesting that infectivity may be heightened during the prodromal phase when symptoms are mild and non-specific. [9][10] This phase poses a particular epidemiological challenge, as infected individuals may not yet be isolated, thereby increasing the risk of silent transmission chains. Clinically, hantavirus infections—particularly hantavirus pulmonary syndrome (HPS)—are associated with severe disease progression and high case fatality rates, which may reach 30–40% depending on healthcare access and early intervention capacity. [7][14] The rapid transition from prodromal symptoms to cardiopulmonary deterioration underscores the aggressive pathophysiological nature of the disease.

From a pathogenetic perspective, hantaviruses primarily target endothelial cells, leading to increased vascular permeability, capillary leakage, and subsequent pulmonary edema. This cascade results in hypoxemia, respiratory failure, and, in severe cases, cardiopulmonary collapse. [14] The immunopathological response, rather than direct cytopathic viral effects, is considered a major contributor to disease severity. Currently, there is no specific antiviral therapy with proven efficacy for hantavirus infections, nor is there a globally licensed vaccine available for widespread use. [15] Consequently, clinical management is largely supportive, focusing on early recognition, intensive care unit (ICU) support, mechanical ventilation when necessary, and strict epidemiological containment measures to prevent secondary transmission.

Overall, the 2026 MV *Hondius* outbreak underscores the continuing emergence risk of hantaviruses as zoonotic pathogens with pandemic potential under certain ecological and social conditions. It further highlights the necessity of strengthened global surveillance systems, rapid

outbreak response mechanisms, and integrated One Health approaches that link human, animal, and environmental health sectors for effective prevention and control.

**Conclusion**

Hantaviruses are RNA viruses with high epidemiological significance among modern zoonotic infections. In particular, the limited capacity of the Andes hantavirus for human-to-human transmission distinguishes it from other hantavirus species.

The 2026 outbreak reported on the MV Hondius cruise ship highlighted the need to strengthen global epidemiological surveillance, control zoonotic reservoirs, and improve infection prevention measures in closed collective environments.

The literature review confirms that early diagnosis, epidemiological monitoring, and intensive supportive therapy play a crucial role in managing hantavirus infections. In the future, the development of effective antiviral agents and vaccines against hantaviruses will remain one of the key priorities in global infectious disease control and biosecurity.

## Adabiyotlar, References, Литературы:

1.WHO Hantavirus Fact Sheet (2026 yangilangan) — https://www.who.int/news-room/fact-sheets/detail/hantavirus
2. CDC Andes Virus sahifasi — https://www.cdc.gov/hantavirus/about/andesvirus.html
3. NEJM: “Super-Spreaders” and Person-to-Person Transmission of Andes Virus (2020) — https://www.nejm.org/doi/full/10.1056/NEJMoa2009040
4. WHO DON: Hantavirus cluster linked to MV Hondius cruise ship (2026) — https://www.who.int/emergencies/disease-outbreak-news/item/2026-DON601
5. Jonsson et al. A Global Perspective on Hantavirus Ecology, Epidemiology… (2010) — https://pmc.ncbi.nlm.nih.gov/articles/PMC2863364/
6. ECDC: Hantavirus-associated cluster on cruise ship (2026) — https://www.ecdc.europa.eu/sites/default/files/documents/TAB-hantavirus-06052026.pdf
7. Vial et al. Hantavirus in humans: a review of clinical aspects… (Lancet Infect Dis, 2023) — https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(23)00128-7/abstract
8. Wikipedia: Andes virus — https://en.wikipedia.org/wiki/Andes_virus
9. Pizarro et al. Frontiers in Microbiology (ANDV person-to-person) — https://www.frontiersin.org/journals/microbiology/articles/10.3389/fmicb.2019.02992/full
10. Toledo et al. Evidence for Human-to-Human Transmission of Hantavirus: Systematic Review (2021/2022) — https://pmc.ncbi.nlm.nih.gov/articles/PMC9574657/
11. CDC Hantavirus general information — https://www.cdc.gov/hantavirus/about/index.html
12. MV Hondius hantavirus outbreak (Wikipedia, 2026) — https://en.wikipedia.org/wiki/MV_Hondius_hantavirus_outbreak
13. Alonso et al. Person-to-Person Transmission of Andes Virus (PMC, 2020) — https://pmc.ncbi.nlm.nih.gov/articles/PMC7101103/
14. Hantavirus Pulmonary Syndrome StatPearls (NCBI) — https://www.ncbi.nlm.nih.gov/books/NBK513243/
15. Afzal et al. Hantavirus: an overview and advancements in therapeutic approaches (2023) — https://pmc.ncbi.nlm.nih.gov/articles/PMC10601933/
16. Bi et al. Hantavirus infection: a review and global update (2008) — https://pubmed.ncbi.nlm.nih.gov/19736383/
17. Chaparro et al. Assessment of person-to-person transmission… Chile (1998) —

https://www.sciencedirect.com/science/article/abs/pii/S0195670198903048
18. Martínez et al. Epuyén outbreak detailed analysis (NEJM related) — https://www.nejm.org/doi/full/10.1056/NEJMoa2009040 (qayta)
19. UK Gov Guidance on Andes hantavirus — https://www.gov.uk/guidance/andes-hantavirus-epidemiology-outbreaks-and-guidance
20. CNN: What doctors know about Andes hantavirus (2026) — https://www.cnn.com/2026/05/06/health/andes-strain-hantavirus-explained
21. Clinical Microbiology and Infection: Andes hantavirus outbreak on cruise ship (2026) — https://www.clinicalmicrobiologyandinfection.org/article/S1198-743X(26)00252-1/fulltext
22. News-Medical: Andes hantavirus outbreak highlights global spillover (2026) — https://www.news-medical.net/news/20260511/Andes-hantavirus-outbreak-highlights-global-spillover-and-transmission-risks.aspx
23. PubMed: Hantavirus in humans review (Vial 2023) — https://pubmed.ncbi.nlm.nih.gov/37105214/
24. ResearchGate: Person-to-Person Transmission of Andes Virus — https://www.researchgate.net/publication/7292616_Person-to-Person_Transmission_of_Andes_Virus
25. Temporal Analysis of Andes Virus and Sin Nombre Virus (JVI) — https://journals.asm.org/doi/10.1128/jvi.00238-07