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THE RISE AND FALL OF HANTAVIRUS IN THE LAST DECADE: A NARRATIVE REVIEW

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Abstract

Hantavirus has not followed a single global rise-and-fall curve during the past decade. Instead, its epidemiology has been shaped by three overlapping patterns: sustained but declining haemorrhagic fever with renal syndrome (HFRS) in parts of Asia, cyclical nephropathia epidemica and HFRS activity in Europe, and low-incidence but high-fatality hantavirus cardiopulmonary syndrome (HCPS) in the Americas. China remains the largest contributor to global HFRS burden, but national incidence has declined substantially, even as affected counties and viral diversity remain geographically broad. In the EU/EEA, notification rates fluctuated without a clear long-term trend, with prominent peaks in 2017 and 2021 and low rates in 2020 and 2023. In the United States and much of the Americas, cases remain uncommon but clinically severe; Andes virus has sustained particular concern because it can rarely transmit between people during close or prolonged contact. The apparent ‘rise’ of hantavirus reflects ecological disturbance, climate-sensitive rodent cycles, land-use change, improved surveillance, pet-rat and occupational exposures, and highly visible travel-associated clusters. The apparent ‘fall’ reflects vaccination and rodent-control programmes in parts of Asia, better public awareness, case containment, and the natural collapse of rodent-amplified epidemic years. The next decade should move beyond passive case counting towards One Health surveillance, reservoir mapping, rapid diagnostics, safer rodent-control practices, and vaccine and therapeutic development.

Keywords

hantavirus; orthohantavirus; haemorrhagic fever with renal syndrome; hantavirus cardiopulmonary syndrome; HFRS; HCPS; zoonoses; rodent-borne viruses; One Health

Search strategy and selection criteria. This narrative review was developed from searches of PubMed, Google Scholar, WHO, CDC, ECDC, China CDC Weekly, and major peer-reviewed infectious-disease journals for English-language material published mainly from Jan 1, 2015, to May 8, 2026. Search terms included 'hantavirus', 'orthohantavirus', 'HFRS', 'HCPS', 'hantavirus pulmonary syndrome', 'Puumala virus', 'Andes virus', 'Seoul virus', 'China hantavirus surveillance', 'Europe hantavirus annual epidemiological report', 'hantavirus vaccine', and 'hantavirus climate'. Priority was given to systematic

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reviews, major clinical reviews, national or regional surveillance reports, official public-health guidance, and outbreak investigations. Older landmark studies were used only when necessary to interpret transmission, clinical syndrome, or vaccine history.

Introduction: an old virus with a new pattern of visibility

Hantaviruses are enveloped, tri-segmented, negative-sense RNA viruses maintained mainly in rodent reservoirs. Human infection usually follows inhalation of aerosolised virus from rodent urine, faeces, saliva, or contaminated dust, although bites, contaminated food, and direct contact can also occur. The clinical expression is geographically patterned. In Europe and Asia, Old World hantaviruses cause HFRS or the usually milder nephropathia epidemica; in the Americas, New World hantaviruses cause HCPS, also called hantavirus pulmonary syndrome. The distinction is useful but imperfect because vascular leakage, thrombocytopenia, shock, renal impairment, and pulmonary involvement can overlap across syndromes [1,2].

The phrase 'rise and fall' is attractive, but it can mislead. Hantavirus incidence does not behave like a respiratory pandemic driven by sustained human-to-human transmission. It behaves like a zoonosis whose human incidence rises when reservoir abundance, environmental contamination, and human exposure converge, and falls when rodent populations, weather, land use, or human behaviour shift. The last decade has therefore produced regional rises, regional declines, and repeated short-lived spikes rather than a universal global wave.

Global burden and the problem of measurement

WHO estimates that 10,000 to more than 100,000 hantavirus infections occur worldwide each year, with the largest burden in Asia and Europe. Case-fatality differs sharply by syndrome and setting: HFRS in Asia and Europe is associated with case-fatality generally below 1-15%, whereas HCPS in the Americas can reach much higher fatality, sometimes approaching 40-50% in severe series [1]. These broad ranges reflect heterogeneity in viral species, access to care, diagnostic capacity, reporting rules, and case ascertainment.

Surveillance data also understate the true burden. Mild Puumala virus infection in Europe can be missed, Seoul virus infection can be subclinical or mistaken for nonspecific febrile illness, and HCPS may be diagnosed late because early symptoms resemble influenza, dengue, leptospirosis, or sepsis [2,4]. Conversely, highly visible outbreaks can create the impression of a global resurgence when the underlying incidence remains low. A Lancet-standard interpretation must therefore separate disease burden from attention burden: the virus may become more visible without becoming more common everywhere.

Asia: decline in incidence, persistence of risk

The most convincing 'fall' during the last decade is found in parts of Asia, especially China. China remains the most important HFRS-endemic country, but the national trajectory has moved downward from the high-incidence era of the late 20th century. China CDC Weekly reported 91,388 HFRS cases

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across 31 provincial-level administrative divisions during 2014-2023, with average incidence of 0.65 per 100,000. Incidence fluctuated between 0.37 and 0.86 per 100,000, peaked in 2018, reached its lowest point in 2022, and remained widely distributed across counties [11]. The same report noted that incidence decreased from 1.01 per 100,000 to below 0.4 per 100,000 during the decade, even while areas with recognised transmission expanded and diverse Hantaan and Seoul virus genotypes continued to circulate [11].

Several factors plausibly explain the decline: vaccination in endemic settings, rodent-control campaigns, agricultural modernisation, improved housing, occupational-risk communication, and better case management. Inactivated vaccines against Hantaan and Seoul viruses are licensed in China and South Korea, although they are not widely licensed in Europe or the Americas [15,16]. The fall is therefore incomplete. High-risk provinces, older adults, farmers, soldiers, forestry workers, and people living near rodent habitats remain vulnerable. A fall in national incidence should not be mistaken for elimination; it is better understood as suppression of a persistent natural-focus infection.

Europe: cyclical peaks rather than sustained emergence

Europe illustrates the limits of the rise-and-fall metaphor. In the EU/EEA, annual notifications vary with rodent ecology, mast years, weather, outdoor exposure, and diagnostic practices. ECDC reported 4,239 cases in 2017, with Finland and Germany accounting for most reports [6]. In 2020, 28 countries reported 1,647 cases, mainly caused by Puumala virus, and ECDC concluded that the 2016-2020 notification rate fluctuated between 0.4 and 1.0 per 100,000 with no obvious long-term trend [8]. In 2021, the EU/EEA recorded 4,860 cases, the highest notification rate in 2017-2021 [7]. By 2023, cases had fallen again to 1,885, or 0.4 per 100,000, one of the lowest rates in 2019-2023, with Finland and Germany accounting for 60.5% of cases [5].

This pattern is not a simple rise followed by eradication. It is a boom-and-bust zoonotic cycle. Bank vole population dynamics influence Puumala virus transmission; warmer winters, food pulses, and human activity in forests and rural dwellings can increase exposure [3,4]. The public-health response is mostly preventive rather than pharmaceutical: reduce rodent contact, ventilate and disinfect contaminated areas, use protective equipment when cleaning rodent-infested spaces, and communicate seasonal risk [4,5].

The Americas: low incidence, high consequence

The Americas carry a smaller numerical burden but a larger case-severity signal. In the United States, CDC surveillance began after the 1993 Four Corners outbreak and, by the end of 2023, 890 laboratory-confirmed hantavirus disease cases had been reported. Of these, most were HPS, 35% resulted in death, and 94% occurred west of the Mississippi River [9]. CDC guidance emphasises that U.S. hantaviruses are not known to spread between people, and that risk is primarily linked to rodent infestation in and around homes, cabins, worksites, and recreational spaces [10].

South America is epidemiologically distinct because Andes virus, endemic in Argentina and Chile, has documented limited person-to-person transmission. The 2018-2019 Epuyen outbreak in Argentina produced 34 confirmed cases and showed superspreading within close-contact networks [12]. Earlier and subsequent genomic investigations further supported person-to-person transmission in selected

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Andes virus clusters [13]. This exception matters: hantavirus is generally not a pandemic-prone respiratory virus, but Andes virus can create outbreak-management problems resembling those of other severe zoonoses, including contact tracing, isolation, diagnostic logistics, and risk communication.

Travel-associated clusters and the return of global attention

The 2026 cruise-ship cluster illustrates how a rare disease can rapidly regain global visibility. WHO reported that, as of May 4, 2026, seven cases linked to a Dutch-flagged cruise ship had been identified, including two laboratory-confirmed hantavirus cases, five suspected cases, three deaths, and one critically ill patient. WHO assessed the global-population risk as low while noting that Andes virus has caused limited human-to-human transmission in previous outbreaks [14]. WHO subsequently deployed an expert to the ship and arranged shipment of 2,500 diagnostic kits to laboratories in five countries [15].

This incident should not be interpreted as evidence that hantavirus has become broadly transmissible. Its importance is different: travel can move exposed people across borders during the long incubation period, can scatter contacts before diagnosis, and can force public-health systems to coordinate across maritime, aviation, laboratory, and clinical networks. The rise here is not necessarily incidence; it is complexity.

Drivers of the apparent rise

Several forces have increased hantavirus visibility during the past decade. First, climate variability influences reservoir abundance through rainfall, temperature, vegetation, snow cover, food availability, and overwinter survival [3]. Second, land-use change, agricultural expansion, deforestation, peri-urban growth, and rural housing conditions increase contact between humans and reservoir rodents. Third, occupational and recreational exposures remain important: farming, forestry, construction, military activity, cleaning unused cabins, and entering rodent-infested spaces are recurrent risk contexts [4,10]. Fourth, global trade and pet ownership can move infected rats. The 2017 Seoul virus outbreak in the United States and Canada linked pet-rat facilities across multiple states and ratteries; 31 facilities had human or rat infection, 17 U.S. residents had recent infection, eight were ill, and three were hospitalised [17].

Finally, improved diagnostics and surveillance can make incidence appear to rise. Molecular diagnostics, notifiable-disease definitions, wider clinician awareness, and international event-based surveillance all increase detection. This creates a paradox: better control systems can initially produce more reported disease.

Drivers of the apparent fall

The decline in many settings reflects a combination of real epidemiological gains and ecological regression to baseline. Vaccination programmes in parts of China and South Korea, rodent-control campaigns, improved food storage, safer housing, occupational education, and better environmental hygiene have probably contributed to falling HFRS incidence [11,15,16]. In outbreak settings, rapid

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diagnosis, isolation where Andes virus is suspected, contact tracing, and public education can interrupt chains of exposure [12,14,15].

However, the fall is fragile. Hantaviruses persist in reservoirs without requiring sustained human transmission. Once ecological conditions again favour rodent amplification or human exposure, incidence can rebound. The appropriate public-health goal is not eradication but risk compression: fewer high-risk encounters, earlier diagnosis, lower fatality, and better containment of unusual clusters.

Clinical lessons from the decade

The clinical lesson is that hantavirus outcomes depend on suspicion and supportive capacity. Early disease is nonspecific: fever, myalgia, headache, gastrointestinal symptoms, and malaise can precede abrupt respiratory failure, shock, renal dysfunction, or thrombocytopenia [2,10]. HCPS can deteriorate quickly and requires early transfer to facilities capable of intensive monitoring, ventilatory support, vasopressor support, cautious fluid management, and, in selected cases, extracorporeal membrane oxygenation. HFRS management focuses on haemodynamic support, careful fluid and electrolyte management, platelet or blood-product support when indicated, and renal replacement therapy for severe acute kidney injury [2,15].

There is still no widely licensed, broadly protective vaccine for global use and no universally accepted specific antiviral treatment for either HCPS or HFRS. Existing vaccines are geographically limited, and candidate platforms remain in development [15,16]. This therapeutic gap is one reason the case-fatality signal remains prominent even when incidence is low.

Public-health priorities for the next decade

The last decade suggests five priorities. First, surveillance should integrate human cases, rodent reservoirs, viral genomics, climate indicators, and land-use change. Second, occupational and household prevention should be treated as core health protection, not as occasional outbreak messaging. Third, laboratory networks need rapid serology and PCR capacity, especially in endemic regions and travel hubs. Fourth, Andes virus preparedness should include protocols for contact tracing, safe evacuation, isolation, and risk communication without implying pandemic-level transmissibility. Fifth, vaccine and therapeutic development should be re-energised, with attention to cross-protection across Hantaan, Seoul, Puumala, Dobrava-Belgrade, Sin Nombre, and Andes viruses [2,15,16].

Conclusion

Hantavirus has risen and fallen during the last decade, but not as one disease curve. It rose in visibility through ecological change, surveillance, pet-rat outbreaks, South American person-to-person Andes virus clusters, and the 2026 travel-associated event. It fell in parts of Asia through sustained control and vaccination, and in Europe through cyclical movement from high rodent-amplified years to low-incidence years. The central lesson is that hantavirus is a persistent One Health threat: often rare, sometimes cyclical, occasionally explosive, and frequently severe. Public health should resist both complacency and exaggeration. The virus is unlikely to behave like a pandemic respiratory pathogen,

but it will continue to exploit the interfaces between rodents, climate, land use, housing, travel, and diagnostic preparedness.

Panel: Key messages

- Hantavirus epidemiology in the last decade is regional and cyclical, not a single global rise-and-fall curve.
- China shows a meaningful decline in HFRS incidence but continuing geographic spread and viral diversity.
- Europe shows recurrent peaks and troughs driven largely by Puumala virus ecology and rodent population cycles.
- The Americas have fewer cases, but HCPS remains highly severe; Andes virus is exceptional because limited person-to-person transmission can occur.
- The next decade requires One Health surveillance, safer rodent exposure prevention, rapid diagnostics, and renewed vaccine and therapeutic development.

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Declaration of interests
The author declares no competing interests.

Data sharing
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