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PUBLIC HEALTH SIGNIFICANCE OF HANTAVIRUS RE-EMERGENCE: A NARRATIVE REVIEW

Emmanuel Edegbo[1], Abdullahi Adeiza Joseph[1], Alabi Motunrayo Zainab[1] Onah Hillary Chigozie[1]
[1]Department of Microbiology, Faculty of Natural Science, Kogi State (Prince Abubakar Audu) University, Anyigba. PMB 1008, Anyigba, Kogi State, Nigeria.

Corresponding author: Emmyedegbo4all@gmail.com.
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Abstract

Hantaviruses are rodent-borne orthohantaviruses that continue to re-emerge through a convergence of ecological disruption, changing land use, climate variability, occupational exposure, expanding eco-tourism, and uneven surveillance. Human disease is classically grouped into haemorrhagic fever with renal syndrome (HFRS), seen mainly in Europe and Asia, and hantavirus cardiopulmonary syndrome (HCPS), also called hantavirus pulmonary syndrome, seen mainly in the Americas. Although global incidence is low compared with many respiratory or arboviral infections, public health significance is disproportionate because HCPS can progress within hours to shock and respiratory failure, case fatality in the Americas is high, early symptoms are non-specific, and no approved curative antiviral treatment exists. The 2026 multi-country cluster linked to cruise-ship travel illustrates a modern re-emergence pattern: rare zoonotic infections can be exported rapidly through travel networks, creating diagnostic, infection-prevention, risk-communication, and International Health Regulations coordination challenges. Re-emergence should therefore be framed not as a constant pandemic threat but as a sentinel of human-rodent-environment interface failure. Priorities include integrated human-animal-environment surveillance, locally adapted rodent control, safer housing and occupational practices, rapid diagnostics, clinician awareness, culturally respectful community engagement, and research on vaccines, therapeutics, and correlates of protection.

Search strategy and selection criteria

This narrative review used English-language sources identified from PubMed, WHO, CDC, ECDC, PAHO-linked materials, and reference chaining from major reviews. Search terms included “hantavirus”, “orthohantavirus”, “hantavirus pulmonary syndrome”, “hantavirus cardiopulmonary syndrome”, “haemorrhagic fever with renal syndrome”, “Andes virus”, “Sin Nombre virus”, “re-emergence”, “climate”, “land use”, “rodent reservoir”, “surveillance”, “diagnosis”, “vaccine”, and “public health”. Priority was given to Lancet or major infectious-disease reviews, systematic reviews, public health agency reports, and peer-reviewed studies from 2020–2026, with older landmark papers used where they remain foundational. The review is narrative rather than systematic; no formal meta-analysis or risk-of-bias scoring was performed.

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Introduction

Hantavirus re-emergence is a public health problem at the boundary of infectious diseases, environmental health, occupational safety, travel medicine, and health-system preparedness. Hantaviruses belong to the family Hantaviridae within the order Bunyavirales; pathogenic human infections are usually associated with persistently infected rodents that shed virus in urine, faeces, and saliva [1,2]. Transmission to humans occurs mainly through inhalation of aerosolised contaminated material or contact with contaminated surfaces; rodent bites are uncommon routes [2,3]. Unlike influenza or SARS-CoV-2, hantaviruses generally do not sustain efficient human-to-human transmission. The important exception is Andes virus, for which limited transmission among close and prolonged contacts has been documented or strongly suspected in Argentina and Chile [2,9-11].

The term "re-emergence" is appropriate because hantaviruses are not new pathogens. HFRS has long been recognised in Asia and Europe, and HCPS was recognised as a severe syndrome in the Americas after the 1993 Four Corners outbreak in the southwestern United States [12]. Re-emergence now describes renewed outbreaks, changing geographical risk, increased recognition of previously missed infections, and exportation of disease through travel. WHO estimates that hantavirus infections range from 10,000 to more than 100,000 annually worldwide, with the largest burden in Asia and Europe, while HCPS in the Americas remains rarer but has a commonly reported case fatality of 20–40% [2]. In the United States, CDC surveillance recorded 890 laboratory-confirmed hantavirus disease cases through 2023, including 859 HPS cases, with 35% fatality and 94% of cases west of the Mississippi River [4]. In the European Union and European Economic Area, 1,885 cases were reported in 2023, corresponding to 0.4 per 100,000 population [5]. These figures show that hantavirus is usually focal and infrequent, but severe enough to justify high-priority preparedness in endemic and travel-linked settings.

Clinical and virological basis of public health risk

The public health significance of hantavirus derives from a mismatch between low probability of infection and high consequence once severe disease occurs. HCPS initially resembles common febrile illnesses, with fever, myalgia, headache, and gastrointestinal symptoms; it can then progress abruptly to capillary leak, pulmonary oedema, shock, and cardiopulmonary collapse [1,2,13]. HFRS is more kidney-predominant, with fever, hypotension, haemorrhagic manifestations, and acute kidney injury, although overlap between syndromes occurs [1,2]. Early diagnosis is difficult because the differential diagnosis includes influenza, COVID-19, leptospirosis, dengue, bacterial sepsis, atypical pneumonia, and other viral haemorrhagic fevers [2,13]. Laboratory confirmation relies on serology, including IgM or rising IgG titres, and RT-PCR during acute infection when viral RNA is detectable [2,3].

There is no approved specific antiviral treatment for HCPS, and management is supportive: early recognition, careful fluid management, haemodynamic monitoring, respiratory support, vasopressors, dialysis when indicated, and extracorporeal membrane oxygenation for selected severe cardiopulmonary failure [1,3]. Ribavirin has evidence of benefit in some HFRS contexts but has not shown established effectiveness for HCPS and is not licensed for HCPS treatment or prophylaxis [3]. This therapeutic gap makes prevention and early clinical suspicion central public health interventions rather than optional add-ons.

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Why re-emergence is occurring

Hantavirus ecology is shaped by reservoir host population dynamics, habitat structure, food availability, climate anomalies, land use, and human behaviour. Environmental conditions that increase rodent abundance can amplify virus circulation and increase human exposure [7,8,14]. The 1993–94 Four Corners outbreak remains a landmark example: increased precipitation associated with El Nino-Southern Oscillation was hypothesised to increase vegetation and rodent densities, raising the probability of human exposure [12]. Climate change does not create hantavirus de novo, but it can alter precipitation, temperature, vegetation, food pulses, rodent survival, and human land-use patterns in ways that change contact rates [14,15].

Land use is equally important. A systematic review found that agricultural land use was positively associated with increased human hantavirus infection risk in China and Brazil, while forest cover was positively associated with risk in Europe; evidence on built-up areas was more variable [7]. A 2025 ecological niche modelling study in the United States associated higher relative risk with aridity, social vulnerability, rodent richness, and open low-intensity development, mapping risk predominantly to the western United States [8]. These findings emphasise that hantavirus emergence is not merely "wildlife disease"; it is also a housing, labour, infrastructure, and inequality issue. Poorly sealed dwellings, barns, grain storage, deforestation margins, informal settlements, and occupational settings such as farming, forestry, military training, pest control, and construction can all increase exposure.

Travel, eco-tourism, and the changing geography of response

The 2026 cruise-ship-associated cluster shows how a focal zoonosis can become a multi-country public health event. WHO reported that, as of 4 May 2026, seven cases, including three deaths, were identified among 147 passengers and crew after a vessel departed Ushuaia, Argentina, with illness onset from 6 to 28 April; later WHO media updates described eight reported cases, five confirmed as hantavirus [3,6]. ECDC assessed the event as a rapidly evolving incident and highlighted Andes virus confirmation in some patients, isolation, contact management, ship sanitation, and international coordination [6]. WHO assessed global population risk as low, while recommending detection, investigation, reporting, case management, infection prevention and control, symptom monitoring, and risk communication [3].

The public health lesson is not that hantavirus has become a COVID-19-like pandemic threat. It has not. Rather, the event illustrates that rare zoonoses can exploit cruise ships, expedition travel, remote itineraries, delayed diagnosis, and long incubation periods. Cruise and expedition operators, ports, national focal points, emergency medical teams, laboratories, and travel medicine services need protocols for febrile illness after rodent exposure, ecotourism excursions, and travel in endemic regions. Andes virus also requires a higher index of suspicion for limited close-contact transmission than other hantaviruses [2,3,9-11].

Equity, Indigenous health, and risk communication

Re-emergence can magnify social harms when communication is imprecise. The Four Corners outbreak showed that disease naming, media framing, and outsider-led investigation can stigmatise Indigenous communities if public health action is not culturally respectful [12]. Modern response should avoid

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associating disease with ethnicity, nationality, or a single community when the true driver is ecological exposure. Risk communication should be specific: avoid rodent excreta, do not dry sweep contaminated spaces, ventilate closed areas, wet-clean with disinfectant, seal houses and food storage, and seek urgent care for febrile illness with respiratory symptoms after rodent exposure [3,16]. Messages should be co-produced with local leaders, workers, tourism operators, and clinicians so that prevention is credible and actionable.

Surveillance, preparedness, and One Health control

A public health response to hantavirus re-emergence should be explicitly One Health. Human case surveillance alone is insufficient because severe cases represent the end of a chain beginning with reservoir ecology, land use, housing, and behaviour. Integrated surveillance should combine clinical reporting, rapid laboratory referral pathways, environmental and rodent monitoring in high-risk settings, and climate or land-use early-warning indicators [2,3,7,8]. Surveillance must also recognise underdiagnosis: mild or non-pulmonary infections may be missed, and severe cases can be misclassified as sepsis or viral pneumonia without exposure history and laboratory testing.

Prevention remains the most effective intervention. CDC identifies rodent control and avoidance of contact with rodent urine, droppings, saliva, and nesting materials as the primary prevention strategy [16]. Practical measures include rodent-proofing buildings, safe food storage, traps and exclusion rather than indiscriminate disturbance, wet disinfection before cleaning contaminated areas, personal protective equipment for heavy infestations or occupational tasks, and targeted education for farmers, forestry workers, cleaners, pest controllers, military personnel, campers, and expedition travellers [3,16]. In healthcare, standard precautions apply to all patients, with transmission-based precautions for suspected or confirmed hantavirus cases and airborne precautions during aerosol-generating procedures, especially when Andes virus is possible [3].

Research and policy gaps

The research agenda is urgent but should be realistic. Vaccines exist or are licensed in parts of Asia for HFRS, but there are no FDA-licensed vaccines for HFRS or HPS; recent phase 1 DNA vaccine studies for Hantaan and Puumala viruses have shown safety and immunogenicity, but regional effectiveness, durability, cross-protection, and deployment strategies remain unresolved [17]. Therapeutic development is similarly limited. Priorities include host-directed therapies, neutralising antibodies, antiviral candidates, better prognostic biomarkers, and clinical algorithms for early transfer to intensive care [1,17]. Genomic surveillance can clarify chains of transmission, especially for Andes virus, but identical sequences in endemic areas must be interpreted cautiously because shared environmental exposure can mimic person-to-person transmission [9-11].

Policy should focus on risk-stratified preparedness rather than broad travel restrictions. WHO advised against travel or trade restrictions for the 2026 cruise-linked event based on available information [3]. More useful policy levers include mandatory rodent-control standards in ships and high-risk accommodation, occupational health guidance, outbreak simulation exercises in endemic regions, laboratory networks capable of safe sample handling, and public funding for neglected zoonoses. Re-

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emergence should also be incorporated into climate adaptation and land-use planning because housing quality, agricultural expansion, forest fragmentation, and extreme weather can shift exposure risk [7,8,14,15].

Conclusion

Hantavirus re-emergence is a high-consequence zoonotic warning signal. Its public health significance lies in severe disease, high HCPS fatality, diagnostic delay, absence of curative therapy, ecological sensitivity, occupational and housing-related exposure, and capacity for international alarm when rare events intersect with travel networks. The appropriate response is neither complacency nor panic. Hantavirus should be managed through One Health surveillance, safer environments, clinician awareness, culturally competent risk communication, rapid diagnostics, supportive critical care, and sustained research into vaccines and therapeutics. In an era of climate instability and expanding human pressure on rodent habitats, hantavirus re-emergence should be treated as a measurable failure of prevention at the human-environment interface and a practical test of zoonotic preparedness.

Key messages

- Hantavirus infections are usually rare and focal, but HCPS can be rapidly fatal and requires early intensive supportive care.
- Re-emergence reflects changes in rodent ecology, climate variability, land use, housing, occupational exposure, and travel, not simple pathogen novelty.
- Andes virus is the major exception to the rule that hantaviruses do not spread between people; even then, transmission appears limited and associated with close, prolonged contact.
- Prevention depends on rodent exclusion, safe cleaning, occupational protection, and clear risk communication more than on clinical treatment.
- A One Health approach linking human surveillance, rodent ecology, climate and land-use data, and community action is central to preparedness.

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Declarations

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