Hantavirus Factsheet

Overview

Hantaviruses are rodent-borne zoonotic viruses that can cause severe and potentially fatal disease in humans (1–3). They are maintained in nature through chronic infection in rodent reservoirs and are transmitted to humans primarily through inhalation of aerosolized virus particles from rodent urine, saliva, or droppings (4–6). Human disease manifestations differ geographically and virologically. In the Americas, hantaviruses cause hantavirus cardiopulmonary syndrome (HCPS), also referred to as hantavirus pulmonary syndrome (HPS), a rapidly progressive disease characterized by pulmonary edema, respiratory failure, and cardiogenic shock (7). In Europe and Asia, hantaviruses are primarily associated with hemorrhagic fever with renal syndrome (HFRS), which affects the vascular endothelium and kidneys and may lead to hemorrhage, hypotension, and acute kidney injury (4,6).

Although hantavirus infections are relatively uncommon compared with other viral zoonoses, they are associated with substantial mortality and outbreak potential (4 - 8). Increasing environmental change, urban expansion into wildlife habitats, climate variability, agricultural intensification, and population displacement are contributing to changing rodent ecology and increased opportunities for human exposure globally (4,8). These factors underscore the importance of strengthened surveillance, laboratory capacity, and integrated One Health approaches, particularly in regions with emerging zoonotic threats such as Africa (11–15).

Viral family and classification

Hantaviruses belong to the family *Hantaviridae* within the order *Bunyavirales* (4,16). They are enveloped, negative-sense single-stranded RNA viruses (16). Each hantavirus species is typically associated with a distinct rodent or small mammal reservoir host in which persistent infection occurs without overt disease (4,6). Viral shedding through urine, feces, and saliva enables environmental contamination and onward transmission to humans (4,5).

More than 50 hantavirus species have been identified globally, though only a subset are known to cause human disease (5,8). Major pathogenic hantaviruses include: Old World hantaviruses (Europe and Asia) causing HFRS: Hantaan virus, Seoul virus, Dobrava-Belgrade virus and Puumala virus; New World hantaviruses (Americas) causing HCPS/HPS: Sin Nombre virus, Andes virus, Laguna Negra virus, Juquitiba virus (5,7,17).

Among these, Andes virus remains unique because it has demonstrated limited human-to-human transmission, particularly among close household or intimate contacts in Argentina and Chile (10). This characteristic raises concerns regarding outbreak amplification and nosocomial transmission in settings with inadequate infection prevention and control (10).

Epidemiology and burden of disease

Globally, hantavirus infections are estimated to cause between 100,000 and 200,000 clinical cases annually, although underdiagnosis and limited surveillance likely result in substantial underestimation (4,8,20). The epidemiology varies considerably by region, reflecting differences in rodent reservoirs, environmental conditions, housing quality, and occupational exposures (4,20).

Asia

Asia bears the largest global burden of HFRS, with China accounting for approximately 70–90% of reported global cases (8,20). Historically, China reported more than 100,000 cases annually during the 1980s and 1990s, though incidence has declined significantly following improved housing, rodent control, vaccination campaigns, and strengthened surveillance systems (3,8). Nevertheless, several thousand cases continue to occur annually, particularly in rural provinces (3,8). The Republic of Korea also remains endemic for HFRS, particularly among military personnel, agricultural workers, and rural populations exposed to rodent habitats (18,20).

Europe

In Europe, thousands of hantavirus infections are reported annually, particularly in northern and central Europe where Puumala virus circulates among bank vole populations (3,6). Finland, Sweden, Germany, Belgium, and France report recurrent outbreaks linked to cyclical increases in rodent populations (3,6). Most European infections are associated with nephropathia epidemica, a milder form of HFRS, though severe disease can occur (6,20).

Climate variability has increasingly influenced transmission dynamics in Europe. Mild winters, mast years (increased seed production), and ecological changes have contributed to rodent population surges and periodic outbreaks (4,20).

Americas

In the Americas, HCPS remains rare but highly lethal (2,7). Since the identification of Sin Nombre virus during the 1993 outbreak in the southwestern United States, over 800 confirmed HCPS cases have been reported in the United States, with a case fatality rate of approximately 35–40% (2,7). Argentina, Chile, Brazil, Paraguay, Bolivia, and Panama continue to report sporadic outbreaks and endemic transmission (7,17).

South American outbreaks have demonstrated particularly high mortality rates and, in some settings, evidence of limited secondary transmission associated with Andes virus (10). HCPS is characterized by rapid clinical deterioration, often requiring intensive care and mechanical ventilation (7,17).

Africa

Data on hantavirus epidemiology in Africa remain limited, fragmented, and likely substantially underestimated (11–13). Serological evidence of hantavirus exposure has been documented in several African countries including Côte d'Ivoire, Guinea, Senegal, Nigeria, Democratic Republic of the Congo, Ethiopia, Kenya, Madagascar, and South Africa (11–13). Rodent reservoirs carrying hantavirus-like viruses have also been identified in parts of West, Central, and East Africa (11–13).

Despite these findings, confirmed human cases remain rarely reported due to weak surveillance systems for zoonotic diseases, limited diagnostic and molecular testing capacity, overlap with other endemic febrile illnesses, low clinician awareness, and inadequate ecological surveillance of rodent reservoirs (11–13). The true burden of hantavirus disease in Africa is therefore unknown (11–13).

Transmission

Transmission to humans occurs primarily through inhalation of aerosolized particles contaminated with rodent excreta (2,4,5). Infection may also occur through direct contact with contaminated materials, rodent bites, or contamination of mucous membranes (4,5).

High-risk exposures include:

- cleaning rodent-infested enclosed spaces
- farming and grain storage activities
- forestry and military activities
- occupational exposure in rural settings
- poor housing and sanitation conditions
- sleeping in rodent-infested dwellings (2,4,20).

Human-to-human transmission has only been conclusively documented for Andes virus and appears to require prolonged close contact, particularly during the prodromal phase of illness (10).

Symptoms and clinical presentation

The incubation period typically ranges from 1–8 weeks after exposure (2,4).

Early symptoms

Initial symptoms are non-specific and may include fever, headache, myalgia, fatigue, dizziness, nausea, vomiting, or abdominal pain (2,4,6).

HCPS/HPS

Patients may rapidly progress within 24–48 hours to severe cough, dyspnea, pulmonary edema, hypoxia, cardiogenic shock, and respiratory failure (2,7,17).

HFRS

Clinical progression may include hypotension, thrombocytopenia, hemorrhagic manifestations, acute kidney injury, oliguria followed by polyuria (4,6,20).

Severe disease is associated with endothelial dysfunction, capillary leakage, and multiorgan involvement (6,7).

Diagnosis

Early diagnosis is challenging because symptoms overlap with other common febrile and respiratory diseases including influenza, COVID-19, malaria, leptospirosis, dengue, Ebola virus disease, and bacterial sepsis (1,2,20). Clinical suspicion should therefore incorporate rodent exposure history, occupational risk factors, environmental exposures, travel history, and epidemiological context (1,2). Laboratory confirmation relies on detection of hantavirus-specific IgM antibodies, rising IgG antibody titres, RT-PCR during acute infection, and viral sequencing in specialized laboratories (1–3). Because hantaviruses are high-risk pathogens, laboratory handling of non-inactivated specimens requires enhanced biosafety procedures and strict adherence to international transport regulations (1,3).

Treatment and clinical management

There is currently no universally licensed specific antiviral treatment for hantavirus disease (1,2). Management remains primarily supportive (1,2,7).

Key components include:

- early recognition and referral
- oxygen therapy
- hemodynamic monitoring
- mechanical ventilation where necessary
- renal replacement therapy for severe HFRS
- intensive care management for severe HCPS (2,7).

Some studies have evaluated intravenous ribavirin for HFRS caused by Hantaan virus, with evidence suggesting potential benefit when administered early (8). However, evidence for effectiveness in HCPS remains limited and inconsistent (7). Early intensive supportive care substantially improves survival outcomes, particularly for HCPS patients (2,7).

Vaccines and vaccine development

At present, there is no WHO-prequalified or globally licensed hantavirus vaccine for widespread international use (1,8). However, several countries have developed region-specific vaccines.

Existing vaccines

China and the Republic of Korea have used inactivated vaccines against Hantaan and Seoul viruses for several decades, particularly among military personnel and high-risk populations (8,20). Evidence suggests these vaccines have contributed to reductions in disease incidence in endemic regions, although long-term effectiveness and duration of immunity vary (8).

Vaccine research pipeline

Research efforts are ongoing for recombinant protein vaccines, DNA vaccines, viral vector vaccines, and mRNA-based vaccine platforms (8). Several vaccine candidates targeting both Old World and New World hantaviruses are under development, though none have yet achieved broad regulatory approval for global deployment (8).

Challenges to vaccine development

Major barriers include geographic diversity of hantavirus strains, limited commercial market incentives, sporadic outbreak patterns, insufficient clinical trial data, and biosafety constraints in research settings (8,20).

Potential challenges for Africa

Africa faces several structural and epidemiological vulnerabilities that could increase susceptibility to hantavirus emergence and hinder effective response efforts. These challenges include:

Weak zoonotic surveillance systems

Many African countries have limited integrated human-animal-environment surveillance platforms capable of detecting emerging rodent-borne diseases early (11–15).

Diagnostic limitations

Few laboratories across the continent possess molecular or serological testing capacity for hantaviruses, resulting in probable underdiagnosis and misclassification (11–13).

Climate and environmental change

Climate variability, flooding, drought, deforestation, and rapid urbanization may alter rodent ecology and increase human exposure risks (4,20).

Competing public health priorities

High burdens of malaria, cholera, tuberculosis, HIV/AIDS, and recurrent outbreaks of viral hemorrhagic fevers can limit attention and resource allocation toward neglected zoonotic diseases (11–15).

Health system constraints

Limited intensive care capacity, shortages of trained workforce, and inadequate infection prevention infrastructure could increase mortality during outbreaks involving severe HCPS (11–15).

Key lessons and best practices from the hantavirus outbreak response

1. **Early detection and clinical recognition are critical**: Rapid identification of suspected cases and early referral for supportive care significantly reduce mortality, particularly for severe HCPS cases.
2. **Integrated One Health surveillance improves preparedness**: Coordinated surveillance across human, animal, and environmental sectors enables earlier outbreak detection and better understanding of transmission dynamics.
3. **Ecological and rodent monitoring support early warning systems**: Tracking rodent populations, climate variability, and environmental changes helps predict periods of increased transmission risk.
4. **Strong laboratory and biosafety capacity are essential**: Timely access to RT-PCR, serology, genomic sequencing, and safe specimen handling strengthens diagnosis, outbreak confirmation, and response coordination.
5. **Community engagement and risk communication reduce exposure**: Public education on rodent control, safe cleaning practices, food storage, and environmental hygiene is central to prevention.
6. **Infection prevention and control (IPC) preparedness protects healthcare workers**: Standard precautions, isolation procedures, PPE use, and safe management of respiratory cases are important, especially where Andes virus transmission is possible.
7. **Critical care readiness improves survival**: Access to oxygen therapy, intensive care, mechanical ventilation, and hemodynamic monitoring is crucial for managing severe disease.
8. **Vaccination can complement prevention efforts in endemic settings**: Targeted vaccination programs used in China and the Republic of Korea have contributed to reducing HFRS incidence among high-risk populations.
9. **Sustained preparedness investment is more effective than reactive response**: Countries with strong surveillance systems, trained workforce, laboratory networks, and emergency coordination mechanisms respond more effectively to outbreaks.
10. **Africa should proactively strengthen zoonotic preparedness systems**: Expanding One Health surveillance, laboratory networks, ecological intelligence, and Africa-led coordination under Africa Centres for Disease Control and Prevention can improve preparedness for hantavirus and other emerging zoonotic threats.

Africa CDC preparedness and response efforts

Africa Centres for Disease Control and Prevention has increasingly prioritized strengthening continental preparedness and response capacities for emerging and re-emerging zoonotic diseases through its Africa's Health Security and Sovereignty agenda.

Key Africa CDC efforts relevant to hantavirus preparedness include:

- strengthening One Health collaboration across sectors
- expanding genomic surveillance and regional laboratory networks
- supporting Field Epidemiology and Laboratory Training Programs (FELTPs)
- enhancing integrated event-based surveillance and epidemic intelligence systems
- improving biosafety and diagnostic capacity
- advancing community engagement and risk communication approaches
- strengthening research and evidence-based responses

Recommendations for Member States and Partners

1. Strengthen integrated One Health surveillance systems linking human, animal, and environmental health sectors
2. Expand laboratory and genomic sequencing capacity for emerging zoonotic pathogens across regional reference laboratories
3. Improve clinician awareness and differential diagnosis of hantavirus syndromes, particularly in endemic and high-risk ecological settings
4. Enhance rodent and ecological surveillance to better understand transmission dynamics and environmental risk factors
5. Strengthen infection prevention, oxygen systems, intensive care readiness, and safe specimen handling procedures
6. Promote evidence generation and research on hantavirus prevalence, reservoirs, and outbreak dynamics in African settings
7. Support equitable participation of African institutions in hantavirus vaccine research and future access initiatives
8. Advance continental coordination under Africa Centres for Disease Control and Prevention leadership to harmonize surveillance standards, mobilize political commitment, and strengthen preparedness for emerging zoonotic diseases

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