Hantavirus Pulmonary Syndrome (HPS)

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Key facts

To better understand public health terms included in this Disease Tool (e.g. What is a case definition? or What is an infectious agent?), consult our page on Key concepts on epidemiology.

Importance

Hantavirus Pulmonary Syndrome (HPS) is a zoonotic disease transmitted through the inhalation of aerosols or contact with saliva, faeces or urine of infected rodents. It is a severe, sometimes fatal disease in humans caused by infection with a hantavirus (in the *Bunyavirales order)*. The case fatality ratio for HPS is estimated at 35—50 per cent.

Numerous individual cases and small clusters of hantavirus cases have been reported in Argentina, Bolivia, Brazil, Chile, Ecuador, Paraguay, Panama, USA, Uruguay and Venezuela. Large outbreaks have been rare and have usually been associated with human disturbance and land-use changes or with unusual environmental events such as increased rainfall or periodic bamboo flowering (i.e. environmental conditions that influence a growth in the reservoir rodent's population).

Other diseases related to hantaviruses include Haemorrhagic Fever with Renal Syndrome (HFRS) which is found in Europe, Asia and parts of Africa and is generally less severe.

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Case definition

A **case definition** is a set of uniform criteria used to define a disease for public health surveillance. It enables public health officials to classify and count cases consistently.

The following are standard case definitions to allow national health authorities to interpret data in an international context. However, during an outbreak case definitions may be adapted to the local context and the Red Cross Red Crescent should use those agreed/established by national health authorities. NB: Consider that during community surveillance, ***volunteers*** *should use broad (simplified) case definitions to recognize most or all possible cases and encourage them to seek care. Other actors such as* ***healthcare workers or investigators*** *studying the cause of a disease, on the other hand, can use more specific case definitions that may require laboratory confirmation.*

Clinical case definition: An illness characterized by one or more of the following clinical features: respiratory illness with respiratory compromise requiring supplemental oxygen and fever developing

within 72 hours occurring in a previously healthy person. The clinical and radiographic examination resembles the acute respiratory illness distress syndrome (ARDS) with excess of fluids in the lungs (pulmonary oedema); OR an unexplained respiratory illness resulting in death, with an autopsy examination demonstrating noncardiogenic pulmonary oedema without an identifiable cause.

Confirmed case definition: A clinically compatible case that is laboratory confirmed.

Case definition source of information: https://www.who.int

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Alert / epidemic threshold

An **alert threshold** is the pre-defined number of alerts that suggest the beginning of a possible disease outbreak and therefore warrant immediate notification.
Epidemic thresholds are the minimum number of cases indicating the beginning of a particular disease's outbreak.

Single case.

Risk factors

- Anyone who comes in contact with rodents that carry hantavirus is at risk of HPS.
- People living in rural areas where rodents hosting the virus might be found.
- For *Andes virus* only: close contact with individuals with HPS, like caregivers and health workers or crowded settlements where an outbreak occurs.

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Attack rate (AR)

The **attack rate** is the risk of getting a disease during a specific time period (such as during an outbreak).

Attack rates will vary from one outbreak to another. In case of an outbreak, consult the latest information provided by health authorities.

Groups at increased risk of severe illness (most vulnerable)

- People with weakened immune systems.
- Immunosuppressed persons such as those receiving chemotherapy, transplant recipients or HIV carriers.
- People with chronic diseases such as renal disease, cancer, chronic lung or liver disease and diabetes.

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Infectious agent

Infectious agents are bacteria, viruses, fungi, prions and parasites. A disease caused by an infectious agent or its toxic products is defined as an infectious disease.

> *New World hantaviruses (i.e. Sin nombre, New York, Back Creek and Bayou hantaviruses* in Northern America, *Andes viruses* and other *hantaviruses* in Central and South America) cause HPS.
>
> Hantaviruses from the *Bunyaviridae* family cause a group of clinically similar diseases called Haemorrhagic Fever with Renal Syndrome (HFRS), widely distributed in Asia and some parts of Europe. The focus of this Disease Tool however, is HPS.

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Reservoir / host

A **reservoir of infection** is a living organism or material in or on which an infectious agent lives and/or usually multiplies. Reservoirs include humans, animals and the environment.

A **susceptible host** is a person at risk of being infected. The level of susceptibility depends on age, sex, ethnicity and genetic factors, specific immunity also depends on other factors that affect an individual's ability to resist infection or to limit its ability to cause infection.

A **zoonotic disease** or **zoonosis** is an infectious disease that has jumped from a non-human animal to humans.

> **Zoonotic disease:** rodents, specific for each hantavirus (deer mouse for *Sin nombre*, white-footed mouse for *New York*, cotton rat for *Black Creek*, rice rat for *Bayou* and *Andes Hantaviruses*) carrying hantaviruses can shed the virus in their urine and faeces and can transmit it by biting.

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How disease is spread (modes of transmission)

Categorisation of **modes of transmission** varies from one agency to another. In addition, some infectious agents can be transmitted by more than one mode. A list of modes of transmission can be found in the key concepts to serve as guidance to better understand the diseases included in this website.

> **Airborne spread:** Breathing in the virus. This may happen when rodent urine and droppings containing *hantavirus* are stirred up into the air.
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> **Vehicle-borne transmission**:
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> - Hantavirus is transmitted to humans via contact with food or household items contaminated with rodent urine or faeces.
> - Touching eyes, nose or mouth after touching rodent droppings, urine or nesting materials that

contain the virus.
- A bite from an infected rodent can transmit the virus to humans.

Contact transmission: Close contact with individuals with HPS (for *Andes virus* in South America only).

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Incubation period

This time from when infection occurs to the onset of symptoms is called the **incubation period**. It is a range of days and it can be different for each disease.

7—42 days.

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Period of infectiousness

Period of infectiousness is the time interval during which an infected person can transmit the infection to other susceptible persons.

Andes virus is the only hantavirus for which person-to-person transmission has been proven. Person-to-person transmission of *Andes virus* occurs mainly in family clusters or, less commonly, after activities in which close contact with an infected patient has occurred.

Clinical signs and symptoms

- Early symptoms include fatigue, fever and muscle aches, especially in the large muscle groups (thighs, hips, back and sometimes shoulders). Further early symptoms include headache, chills, dizziness and gastrointestinal symptoms.
- Four to ten days after the initial phase appear coughing and shortness of breath, with the sensation of, as one survivor put it, a “tight band around my chest and a pillow over my face” as the lungs fill with fluid. The disease progresses rapidly, necessitating hospitalization and often ventilation within 24 hours. HPS can be fatal.

Other diseases with similar clinical signs and symptoms

Acute respiratory distress syndrome (ARDS), pneumonia, plague, Q fever, anthrax, COVID-19 disease and other diseases.

Diagnosis

- A positive serological test result.
- Evidence of viral antigen in tissue by immunohistochemistry, or the presence of amplifiable viral RNA sequences in blood or tissue, with compatible history of HPS.

Vaccine or treatment

Please refer to the appropriate local or international guidelines for clinical management. All clinical management including the administration of any treatment should be conducted by health professionals.

- There is no specific treatment, cure or vaccine for hantavirus infection. However, if infected individuals are recognized early and receive medical care in an intensive care unit, they may do better.
- In intensive care, patients are often intubated and given oxygen therapy to help them through the period of severe respiratory distress.
- Early symptoms regularly include gastrointestinal symptoms and therefore might require rehydration and monitoring the fluid balance.

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Immunity

There are two types of immunity:
- **Active immunity** results when exposure to an agent triggers the immune system to produce antibodies to that disease.
- **Passive immunity** is provided when a person is given antibodies to a disease rather than producing them through his or her own immune system.

Immune response towards hantaviruses is long-lasting.

Which interventions are most effective for prevention and control?

The following is a list of activities considered for Red Cross Red Crescent volunteers to take part in. It is not an exhaustive list of all prevention and control activities for the specific disease.

- Communicate risks about the disease or epidemic, not only to share information on prevention and mitigation measures, but also to encourage informed decision-making, positive behaviour change and maintenance of trust in the Red Cross Red Crescent response. This includes the identification of rumours and misinformation around disease—frequent during health emergencies—to manage them appropriately. Volunteers should use the most context-appropriate communication techniques (ranging from social media to face-to-face interactions).
- Community education and engagement activities to encourage the adoption of protective behaviours:

    - Preventing contact with rodents and their excrement
    - Sealing any holes at home to reduce chances of rodents burrowing in.
    - Maintaining good hygiene practices at home and workplaces, e.g. by storing food in rodent-proof containers; disposing of rubbish/garbage away from the home; eliminating food or trash that may attract rodents around the home.
- Community based environmental management and clean-up campaigns.
- Use of personal protective equipment when carrying out cleaning work in rodent-infested areas.
- In health facilities, patients with confirmed *Andes virus* must be isolated.

Epidemic characteristics and RCRC indicators and targets

The first table below includes data that should be gathered from health authorities and relevant non-governmental actors to understand the progress and characteristics of the epidemic in the specific country and area of intervention. The second table includes a list of suggested indicators that can be used for monitoring and evaluating Red Cross Red Crescent activities; wording of indicators may be adapted to specific contexts. Target values for a specific indicator can vary widely from one context to another and therefore managers should define them based on the specific population, area of intervention and programmatic capacity. Exceptionally, some indicators in this website may include target values when these are globally agreed as a standard; e.g. 80 per cent of individuals who slept under an insecticide-treated net (ITN) the previous night—the normative World Health Organization benchmark for universal coverage with ITNs.

Epidemic characteristics and progression
Suspected cases per week (disaggregate by age, sex)
Confirmed cases per week (disaggregate by age, sex)
Case fatality rate
Indicators for Red Cross Red Crescent activities
Number of volunteers trained on a specific topic (e.g. Epidemic Control for Volunteers (ECV); Community-based surveillance (CBS); WASH training; CBHFA training, etc.) ***Numerator*:** Number of volunteers trained Source of information: Training attendance sheets

Indicators for Red Cross Red Crescent activities
Suspect cases detected by volunteers who were encouraged to seek healthcare and who arrived at a health facility *(NB. This indicator requires the implementation of a system in collaboration with the health facility, whereby health workers specifically asked the patient how they heard about the service)* ***Numerator:*** HPS suspect cases detected by volunteers in a determined period preceding this survey (e.g. two weeks) for whom advice or treatment was sought from a health facility ***Denominator:*** Total number of people who are HPS suspect cases in the same period preceding the survey Source of information: Survey
Percentage of people recognizing at least one transmission route and at least one measure for preventing it ***Numerator*:** Total number of people who recognized at least one transmission route and at least one measure for preventing it during the survey ***Denominator*:** Total number of people surveyed Source of information: Survey
Percentage of people who know the cause, symptoms, treatment or preventive measures ***Numerator*:** Number of people who cite the cause, symptoms, treatment or preventive measures ***Denominator*:** Number of people surveyed

See also:

- For Community Engagement and Accountability (CEA) indicators for activities accompanying ECV actions, please refer to: IFRC *CEA toolkit (Tool 7.1: Template CEA logframe, activities and indicators).* Available at: https://www.ifrc.org/document/cea-toolkit

Impact on other sectors

Sector	Link to the disease
WASH	Proper personal and environmental hygiene and sanitation measures to discourage rodents from entering homes decrease transmission of hantavirus.
Food security	Hantavirus is transmitted to humans via contact with food contaminated with rodent urine or faeces. Effective prevention measures include storing grains and other food in rodent-proof containers.
Nutrition	Malnutrition increases the risk of severe HPS.

Sector	Link to the disease
Shelter and settlements (including household items)	Maintaining clean households and good waste management by disposing of garbage far from home are effective measures to prevent infection. Reduction of rodent habitat around homes, workplaces and recreational areas, including removal of brush, rock piles, junk, cluttered firewood and possible rodent food supplies reduces the risk of transmission.
Psychosocial support and mental health	As in the case of a range of other diseases, HPS can have several negative impacts on psychological, social and emotional aspects of a person's life, apart from its physical effects only. Psychological reactions may include fear of social stigma, anxiety and worry about the outcome, social withdrawal, among others.
Education	When schools do not have clean running water, good food and garbage management, this can increase the number of rodents and add transmission risks in places where the hantavirus is endemic. Children may then be at risk of getting the disease if attending classes, or at risk of losing out on education if staying at home because of isolation measures.
Livelihoods	HPS leads to reduction in productivity as people may not be able to work due to disease or isolation. This can lead to a loss of income due to the reduction in work activity and to the diversion of resources to seek medical treatment.

Resources:

- CDC (2013) *Hantavirus Pulmonary Syndrome (HPS)*. Available at: https://www.cdc.gov/hantavirus/hps/index.html
- CDC (2017) *Hemorrhagic Fever with Renal Syndrome (HFRS)*. Available at: https://www.cdc.gov/hantavirus/hfrs/index.html
- WHO (2019) *Hantavirus Pulmonary Syndrome – Argentina*. Available at:https://www.who.int/emergencies/disease-outbreak-news/item/23-January-2019-hantavirus-argentina-en#:~:text=HPS%20is%20a%20zoonotic%2C%20viral,or%20saliva%20of%20infected%20rodents