

Hantavirus Pulmonary Syndrome

1. DISEASE REPORTING

1.1 Purpose of Reporting and Surveillance

1. To characterize the epidemiology and clinical aspects of the disease.
2. To monitor disease trends and recognize outbreaks.
3. To target prevention and control messages.

1.2 Laboratory and Physician Reporting Requirements

Health care providers and laboratories: Hantavirus infection is reportable to the local health jurisdiction within 24 hours. Specimen submission is on request only, but confirmation of positive results is recommended (see Section 4).

1.3 Local Health Jurisdiction Investigation Responsibilities

1. Facilitate the submission of specimens to Oregon State Public Health Laboratory (OSPHL) for confirmatory testing.
2. Report all *confirmed* cases (see definition below) to the Oregon Health Authority (OHA). (see definition below). Use the hantavirus pulmonary syndrome report form (<http://public.health.oregon.gov/Diseases/Conditions/CommunicableDisease/ReportingCommunicableDisease/ReportingForms/Documents/hanta.pdf>) or enter the data into Orpheus.

2. THE DISEASE AND ITS EPIDEMIOLOGY

2.1 Etiologic Agent

Multiple hantaviruses have been identified in the Americas. Sin Nombre virus is the predominant hantavirus in North America and has been responsible for all of the cases identified in Oregon.

2.2 Description of Illness

Hantavirus pulmonary syndrome (HPS) is an acute viral disease characterized by a 3–5 day prodrome of fever, myalgias, headache, and gastrointestinal complaints followed by the abrupt onset of acute respiratory distress syndrome (ARDS) and hypotension. The illness progresses rapidly to respiratory failure with bilateral pulmonary infiltrates, pulmonary edema, and shock. Circulating immunoblasts (immature myelocytes), elevated hematocrit and thrombocytopenia are almost always present; a rapid drop in platelets marks onset of the cardiopulmonary phase. About a third of all cases reported in the United States have died. In survivors, recovery from acute illness is rapid, but full convalescence may require weeks or months. Restoration of normal lung function generally occurs, but pulmonary function abnormalities may persist.

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2.3 Reservoirs

The deer mouse (*Peromyscus maniculatus*) is the major reservoir of Sin Nombre virus in the western United States. Deer mice live in all parts of Oregon, but mainly in rural areas. They usually carry the virus without showing any signs of being sick. The deer mouse is about six inches long from the nose to the tip of its tail. It is grayish to light brown on top, with a white belly, large ears and eyes, and a furry tail that is white on the underside.

2.4 Sources and Routes of Transmission

Exposure occurs by inhalation of virus that is excreted in mouse urine, feces or saliva and aerosolized during cleaning of buildings with rodent nests or other rodent contamination. Exposures have occurred in rodent-infested cabins, homes, barns, vehicles, outbuildings, or less commonly, when handling wild rodents without protective equipment. Rarely transmission via bite of a deer mouse has been documented.

2.5 Incubation Period

Seven to 45 days.

2.6 Period of Communicability

Person-to-person spread of hantaviruses in the United States has not been documented. However, person-to-person transmission of the related Andes virus was documented in Argentina during an outbreak of a similar syndrome.

2.7 Treatment

There is no antiviral treatment. Supportive care, including intubation and ventilation, fluid and pharmacologic support of blood pressure, are typically required.

3. CASE DEFINITION, DIAGNOSIS AND LABORATORY SERVICES

3.1 Confirmed Case Definition

Confirmed: a laboratory-confirmed illness characterized by one or more of the following clinical syndromes:

- A febrile illness (temperature >101.0° F [38.3° C]) with a clinical diagnosis of acute respiratory distress syndrome (ARDS) or
 - radiographic evidence of non-cardiogenic pulmonary edema, or
 - unexplained respiratory illness resulting in death, and occurring in a previously healthy person and thrombocytopenia and; OR
- An unexplained respiratory illness resulting in death, with an autopsy examination demonstrating non-cardiogenic pulmonary edema without an identifiable cause.

3.2 Laboratory Criteria for Diagnosis

- Detection of hantavirus-specific immunoglobulin M (IgM), OR
- Detection of hantavirus-specific ribonucleic acid (RNA) sequence by polymerase chain reaction (PCR) in a clinical specimen, OR
- Detection of hantavirus antigen by immunohistochemistry (IHC).

Note: Laboratory testing should be performed or confirmed at OSPHL. Because the clinical illness is non-specific and ARDS is common, a screening case definition should be used to determine which patients to test. In general, a predisposing medical condition (e.g., malignancy, chronic pulmonary disease, trauma, burn, or surgery) is a more likely cause of ARDS than hantavirus pulmonary syndrome. Patients with these underlying conditions and ARDS need not be tested for hantavirus.

3.3 Laboratory Diagnosis

Positive commercial laboratory results should be confirmed at a reference laboratory such as the Oregon State Public Health Laboratory.

Serology: Diagnosis is most commonly made by detection of virus-specific IgM in serum using an enzyme immunoassay (EIA). Most cases have IgM antibodies at time of hospitalization. A test for IgG is used in conjunction with the IgM-capture test.

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Reverse transcriptase-polymerase chain reaction (RT-PCR) can be used to detect hantavirus RNA in fresh frozen lung tissue, blood clots, or nucleated blood cells.

Immunohistochemistry (IHC) testing of formalin-fixed tissues or paraffin-embedded tissues with specific monoclonal and polyclonal antibodies can be used to detect hantavirus antigens. IHC can be useful in fatal cases. This testing is generally available only at CDC.

To date, Sin Nombre virus-like viruses has never been isolated from humans, and, therefore, virus isolation is not a consideration for diagnostic purposes.

There is no test for exposure to the virus nor to determine if rodent urine, droppings or nesting material are infectious. Testing mice is not recommended. Persons concerned about exposure to rodent urine, droppings or nesting material should monitor themselves and seek medical care if they develop symptoms.

Findings of thrombocytopenia and elevated hematocrit or the presence of immature cells (myelocytes or metamyelocytes) in the white blood count are suggestive of hantavirus infection but are not diagnostic.

3.4 Services Available at the Oregon State Public Health Laboratory (OSPHL)

Enzyme immunoassay (EIA) for virus-specific IgM and IgG antibody in serum.

Note that OSPHL requires all clinical specimens to have two patient identifiers, a name and a second identifier (e.g., date of birth) both on the specimen label and on the submission form. Due to laboratory accreditation standards, specimens will be rejected for testing if not properly identified. Also include specimen source and collection date.

3.5 Criteria for Testing HPS Specimens at OSPHL

- Patients with suspected hantavirus pulmonary syndrome (fever, hypotension, hypoxia, bilateral interstitial pulmonary infiltrates, acute respiratory distress syndrome, thrombocytopenia, hemoconcentration without an identifiable cause).
- Any person with laboratory evidence of hantavirus infection from a commercial laboratory to confirm the positive test.
- Deaths due to unexplained respiratory illness with autopsy demonstrating non-cardiogenic pulmonary edema without identifiable cause.

3.6 Specimen Collection

Serum

- Submit at least 1 cc (2.5 cc preferred) of separated serum (not whole blood) for EIA at OSPHL. Serum can be drawn upon hospital admission. If possible, also obtain as late a serum as available before death or hospital discharge.
- Separated serum specimens should be refrigerated and transported cold. Avoid repeated freeze-thaw cycles.
- Specimens should be submitted by the clinical laboratory with a completed OSPHL form. Call OSPHL at 503-693-4100 for information.

4. ROUTINE CASE INVESTIGATION

Interview the case and others who may be able to provide pertinent clinical information.

4.1 Confirm the Diagnosis

If the case tests positive for hantavirus at a laboratory other than a reference laboratory, facilitate transport of the specimen (i.e., serum or tissue) to OSPHL for further testing. If a patient tests IgG positive and IgM negative for hantavirus at a commercial laboratory, this indicates possible past exposure and does not call for further laboratory testing.

4.2 Identify Potential Sources of Infection

Obtain a history about possible exposure to rodent urine, droppings, or nesting material. Exposures generally occur when urine, droppings, or nesting material are stirred up, aerosolized, and inhaled. A rodent bite can also transmit the virus; however, inhaling the virus is a much more common route of transmission to humans.

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4.3 Identify Potentially Exposed Persons

It is very unusual to have multiple cases with the same exposure. However, other persons potentially exposed to the same source as the case should be educated about symptoms of hantavirus infection and told to seek medical attention if they develop such symptoms.

4.4 Environmental Evaluation

It may be appropriate to examine the environment where the case was exposed to make suggestions about rodent removal. However, since the deer mice found throughout Oregon are identified as the reservoir for the Sin Nombre virus, testing of rodents is generally not done.

5. CONTROLLING FURTHER SPREAD

5.1 Education

Educate the case and others sharing the environment about avoiding future exposures (see Section 4.2) and the signs and symptoms of hantavirus pulmonary syndrome; advise them to seek medical attention if symptoms develop. However, it is rare to have two cases sharing an exposure. Person-to-person spread of hantaviruses has not been documented in the United States.

5.2 Protection of Contacts

None; the infection is not spread person-to-person.

5.3 Isolation and Work or Care Restrictions

None.

5.4 Environmental Measures

Keep rodents out of the home and workplace.

- Always take precautions when cleaning, sealing and trapping in rodent-infested areas.
- **Look** for potential rodent entry holes. **Seal up** cracks and gaps in buildings that are larger than 1/4 inch these may be found around window and door sills, under sinks around the pipes, in foundations, or in attics.
- **Trap indoor rats and mice** with snap traps.
- **Remove rodent food sources.** Keep food (including pet food) in rodent-proof containers.
- **Clean up rodent-infested areas:**
 - Wear rubber, latex, vinyl or nitrile gloves.
 - Do not stir up dust by vacuuming, sweeping, or any other dust-generating means.
 - Thoroughly wet contaminated areas including trapped mice, droppings, and nests with a bleach solution or household disinfectant. **Hypochlorite (bleach) solution:** Mix 1½ cups of household bleach in 1 gallon of water. Use only freshly mixed solution.
 - Once everything is soaked for 10 minutes, remove all of the nest material, mice and droppings with a damp towel, and then mop or sponge the area with bleach solution or household disinfectant.
 - Spray dead rodents with disinfectant, and then double-bag along with all cleaning materials. Bury, burn, or throw out rodent in an appropriate waste disposal system.
 - Clean gloves with disinfectant or soap and water before taking them off.
 - After taking off the gloves, thoroughly wash hands with soap and water (or use a waterless alcohol-based hand rub when soap is not available).

Visit CDC's HPS prevention website for more information (www.cdc.gov/hantavirus/hps/prevention.html)

UPDATE LOG

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