

## Hantavirus Pulmonary Syndrome

- Organism:** In the US and Canada, the Sin Nombre hantavirus is responsible for the majority of cases of Hantavirus Pulmonary Syndrome (HPS). The host of the Sin Nombre virus is the [deer mouse](#) (*Peromyscus maniculatus*), present throughout the western and central US and Canada. Indigenous HPS has not been reported in Alaska.
- Incubation period:** The incubation period of HPS is one to six weeks (7–45 days).
- Infectious period:** Person-to-person spread of hantaviruses in the U.S. has not occurred. However, it has been documented in Argentina during an outbreak due to a related Andes virus.
- Transmission:** Transmission is via 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. Nationally, rare transmission has been documented from a bite of a deer mouse.
- Treatment:** There is no antiviral treatment. Supportive care including intubation and ventilation and fluid and pharmacologic support of blood pressure is typically required.

### Information Needed for the Investigation

#### Verify the Diagnosis

- Because the clinical illness is nonspecific 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.

#### Laboratory Testing

- CDC will not accept specimens without prior consultation CDC's Viral Special Pathogens Branch (VSPB) at (404) 639-1510. Alaska State Public Health Laboratory (ASPHL) should also be advised of the testing request and will facilitate shipping specimens to CDC. Guidelines for submitting specimens to CDC's VSPB are available here: <http://www.cdc.gov/hantavirus/pdf/specimen-submission.pdf>
- CDC Webpage Protocol for Specimen Submission: <http://www.cdc.gov/hantavirus/health-care-workers/specimen-submission/protocol.html>

## 2015 Case Definition

<http://wwwn.cdc.gov/NNDSS/script/casedef.aspx?CondYrID=958&DatePub=2015-01-01>

### Clinical Description

Hantavirus Pulmonary Syndrome (HPS) is an acute febrile illness (i.e., temperature greater than 101.0 °F [greater than 38.3° C]) with a prodrome consisting of fever, chills, myalgia, headache, and gastrointestinal symptoms, and one or more of the following clinical features: Bilateral diffuse interstitial edema, or

- Clinical diagnosis of acute respiratory distress syndrome (ARDS), or
- Radiographic evidence of noncardiogenic pulmonary edema, or
- An unexplained respiratory illness resulting in death, and includes an autopsy examination demonstrating noncardiogenic pulmonary edema without an identifiable cause, or
- Healthcare record with a diagnosis of hantavirus pulmonary syndrome, or
- Death certificate lists hantavirus pulmonary syndrome as a cause of death or a significant condition contributing to death

### Laboratory Criteria for Diagnosis

- Detection of hantavirus-specific immunoglobulin M or rising titers of hantavirus-specific immunoglobulin G, or
- Detection of hantavirus-specific ribonucleic acid in clinical specimens, or
- Detection of hantavirus antigen by immunohistochemistry in lung biopsy or autopsy tissues

### Case Classification

Confirmed: A clinically compatible case of HPS with laboratory evidence.

### Comment(s)

Laboratory testing should be performed or confirmed at a reference laboratory. Because the clinical illness is nonspecific and ARDS is common, a screening case definition can be used to determine which patients to test. In general, a predisposing medical condition (e.g., chronic pulmonary disease, malignancy, trauma, burn, and surgery) is a more likely cause of ARDS than HPS, and patients who have these underlying conditions and ARDS need not be tested for hantavirus.

### Hospital Considerations:

- Standard precautions are recommended. HPS has not been associated with health care-associated or person-to-person transmission in the United States.

### Control Measures:

- Care of Exposed People. Serial clinical examinations should be used to monitor people assessed to be at high risk of infection after a high-risk exposure.
- Environmental Control. Hantavirus infections of humans occur primarily in adults and are associated with domestic, occupational, or leisure activities bringing humans into

contact with infected rodents, usually in a rural setting. Eradicating the host reservoir is not feasible. The best available approach for disease control and prevention is risk reduction through environmental hygiene practices that discourage rodents from colonizing the home and work environment and that minimize aerosolization and contact with virus in saliva and excreta. Measures to decrease exposure in the home and workplace include eliminating food sources available to rodents in structures used by humans, limiting possible nesting sites, sealing holes and other possible entrances for rodents, and using "snap traps" and rodenticides. Before entering areas with potential rodent infestations, doors and windows should be opened to ventilate the enclosure.

- Hantaviruses, because of their lipid envelope, are susceptible to most disinfectants, including diluted bleach solutions, detergents, and most general household disinfectants. Dusty or dirty areas or articles should be moistened with 10% bleach or other disinfectant solution before being cleaned. Brooms and vacuum cleaners should not be used to clean rodent-infested areas. Use of a 10% bleach solution to disinfect and wearing rubber gloves before handling trapped or dead rodents are recommended. Gloves and traps should be disinfected after use. The cleanup of areas potentially infested with hantavirus-infected rodents should be carried out by knowledgeable professionals using appropriate personal protective equipment. Potentially infected material removed should be handled according to local regulations as infectious waste.
- Chemoprophylaxis measures or vaccines are not available.

### **Case Reporting**

- CDC HPS Case Report Form: [http://www.cdc.gov/hantavirus/pdf/hps\\_case-report-form.pdf](http://www.cdc.gov/hantavirus/pdf/hps_case-report-form.pdf)
- Enter into AK-STARS

### **Resources:**

1. American Academy of Pediatrics (Hantavirus Pulmonary Syndrome). In Red Book: 2012 Report of the Committee on Infectious Diseases, (pages 352-354).
2. CDC Hantavirus website: <http://www.cdc.gov/hantavirus/index.html>
3. CDC Hantavirus website brochure 'Facts About Hantavirus': [http://www.cdc.gov/hantavirus/pdf/hps\\_brochure.pdf](http://www.cdc.gov/hantavirus/pdf/hps_brochure.pdf)
4. Washington State Department of Health website: <http://www.doh.wa.gov/Portals/1/Documents/5100/420-056-Guideline-Hantavirus.pdf#nameddest=casedef>

# Hantavirus Pulmonary Syndrome

Hantavirus Pulmonary Syndrome (HPS) is a rare but severe, sometimes fatal, respiratory disease in humans caused by infection with hantavirus.

## What are the symptoms of HPS?

### Early Symptoms:

- Fever
- Headaches
- Muscle Aches
- Stomach Problems
- Dizziness
- Chills

Early symptoms include fatigue, fever and muscle aches, especially in the large muscle groups—thighs, hips, back, and sometimes shoulders. About half of all HPS patients also experience headaches, dizziness, chills, and abdominal problems, such as nausea, vomiting, diarrhea, and abdominal pain.

### Late Symptoms:

- Lungs Fill with Fluid
- Shortness of Breath

Four to 10 days after the initial phase of illness, the late symptoms of HPS appear. These include 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.

## How do people get HPS?

People can get HPS when they are exposed to infected rodents. Exposures may include:

- Breathing in the virus. This may happen when rodent urine and droppings containing hantavirus are stirred up into the air.
- Touching eyes, nose or mouth after touching rodent droppings, urine, or nesting materials that contain the virus.
- A bite from an infected rodent.

HPS is not spread from person to person.

## Which rodents can cause humans to get HPS?

Rodents known to carry hantavirus include:



Deer Mouse



Cotton Rat



Rice Rat



White-Footed Mouse

Not all rodents carry hantavirus and there is usually no way to tell when a rodent has the virus. So, it is wise to avoid all contact with rodents when possible.

## How is HPS diagnosed?

Diagnosing HPS in an individual who has only been infected for a few days is difficult, because early symptoms such as fever, muscle aches, and fatigue are easily confused with influenza.

Experiencing all of the following would strongly suggest HPS infection:

- A history of potential rodent exposure
- Fever and fatigue
- Shortness of breath

Anyone experiencing these symptoms and having a history of recent rodent exposure should see their physician immediately and mention their potential rodent exposure.

## How is HPS treated?

There is no specific treatment, cure, or vaccine for HPS.

If infected individuals are recognized early and receive medical care in an intensive care unit, they may do better. In intensive care, patients are intubated and given oxygen therapy to help them through the period of severe respiratory distress.

The earlier the patient is brought in to intensive care, the better. If a patient is experiencing full respiratory distress, it is less likely that the treatment will be effective.

## How can HPS be prevented?

When people get HPS, it's usually because they've been exposed to infected rodents or their droppings. So, the best way to help prevent HPS is to eliminate or minimize contact with rodents in your home, workplace, or campsite.

There's an easy way to do this – it's known as **Seal Up! Trap Up! Clean Up!**

### Seal up!



Seal up holes inside and outside the home to keep rodents out.

### Trap up!



Trap rodents around the home to help reduce the population.

### Clean up



Clean up any food that is easy to get to.

For more information on how to Seal Up! Trap Up! Clean Up! visit [www.cdc.gov/rodents](http://www.cdc.gov/rodents).

## More Information:

For More Information Contact CDC Info: 1-800-CDC-INFO (1-800-262-4636)/TTY 1-888-232-6348 or visit our website at [www.cdc.gov/hantavirus](http://www.cdc.gov/hantavirus)

**\*\* NO SPECIMENS ACCEPTED WITHOUT PRIOR CONSULTATION \*\***  
 Call (404) 639-1510 or (404) 639-1115 for authorization to ship specimens.

## Instructions for submitting Diagnostic Specimens to CDC's Viral Special Pathogens Branch

### 1 Label all samples with the following information: Patient's name or ID number, specimen ID number, date of collection

#### 2 For PCR/virus isolation, submit:

- Preferred: whole blood (purple, yellow, or blue top tube), fresh frozen tissue. Serum can also be used if only sample available.
- Minimum sample volume: 4 mL
- Fresh frozen tissues should be at least 1 cm<sup>3</sup>, except for biopsies.
- Please ship sample frozen on dry ice in a plastic tube. Do not freeze glass tubes.

#### For serologic testing, submit:

- Serum (red top tube or serum separator)  
-- or --
- Whole blood (purple, green, or blue top tube)
- Minimum sample volume: 4 mL
- Please ship sample refrigerated or frozen on ice packs.

#### Immunohistochemistry, submit:

- Formalin-fixed or paraffin-embedded tissues may be submitted:  
Preferred: lung, kidney, liver, spleen  
Other tissues can be submitted if available.
- Paraffin blocks are preferred, particularly if death was not recent.
- Ship paraffin blocks or formalin-fixed tissue at room temperature. Do not freeze.
- An autopsy or surgical report must accompany the specimen.

### 3 The following forms should be completed for each patient:

- CDC Specimen Submission Form
- VSPB Diagnostic Specimen Submission Form, on following page.
- For Hantavirus Pulmonary Syndrome testing, also submit the HPS Case Report Form
- Include a copy of all above Forms with the specimens.

### 4 Specimen packaging requirements:

- Please contact your state health department for approval to submit a specimen to CDC for laboratory testing.
- Package in accordance with the International Air Transport Association, regulations to prevent leakage. (See <https://www.iata.org/publications/dgr/Pages/manuals.aspx> and [http://www.hercenter.org/regsandstandards/Transporting\\_Infectious\\_Substances\\_Safely.pdf](http://www.hercenter.org/regsandstandards/Transporting_Infectious_Substances_Safely.pdf))
- Label package as **Diagnostic Specimen** and include the following information on the Diagnostic Specimen Submission Form: your name, the patient's name, test(s) requested, date of collection, laboratory or accession number, and the type of specimen being shipped.
- On the outside of the box, specify how the specimen should be stored: **Frozen, Refrigerated, or Do Not Refrigerate.**
- Send specimens by overnight courier. International submitters should consider door-to-door shipment via air transport to expedite specimen delivery to CDC.
- Be sure to check '**Saturday Delivery**' if desired.
- Email the tracking number to the Viral Special Pathogens Branch.

### 5 HOW TO SUBMIT THE SPECIMENS AND FORMS TO CDC

#### Specimen submission address (if approved by state):

**Centers for Disease Control and Prevention**  
 ATTN STAT LAB: VSPB, Unit #70  
 1600 Clifton Road NE  
 Atlanta, GA 30333  
 Phone: (404) 639-1115

#### Form submission by email:

Hit the 'Send to CDC' button at the bottom right of page 2. Your computer will generate an email containing the completed information. Hit the 'Send' button in your email application to send the email to CDC. Acknowledgement of receipt is not provided.

#### Form submission by fax:

(404) 639-1118 or (404) 639-1509

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# Viral Special Pathogens Branch Diagnostic Specimen Submission Form

• Hantavirus Pulmonary Syndrome (HPS)* and other hantaviruses	• Tick-borne Encephalitis	<b>PLEASE COMPLETE ONE FORM PER PATIENT</b>
• Ebola HF*	• Lymphocytic choriomeningitis (LCM)	
• Marburg HF*	• Hemorrhagic Fever with Renal Syndrome (HFRS)	
• Lassa Fever*	• Rift Valley Fever	
• Crimean-Congo hemorrhagic fever (CCHF)*	• Other hemorrhagic fevers: _____	

\* indicates a Notifiable Disease

\*\* Please check off boxes to indicate testing request(s).\*\*

PATIENT NAME:	Patient ID no.:
DOB:	DATE OF SYMPTOM ONSET:
CLINICAL DESCRIPTION:	

No.	Specimen ID No.	State Lab ID No.	Date collected	Specimen type
1				
2				
3				
4				
5				

FOR STATE HEALTH DEPARTMENTS	
Report/send results to:	Phone no., fax no., and email address:
Person's name:	
Affiliation:	
State Health Lab:	Phone no. and email address:
Person shipping specimen(s):	
Affiliation:	
Physician's name:	
Affiliation:	
State health department contact:	Phone no. and email address:
	Airway bill # (if known):

**Instructions:** You must have internet access and an email address to submit this Form electronically. Upon hitting the 'Send to CDC' button, a PDF is created, attached to an email, which you should then send to the address which appears in the address header; you may also cc: others. Acknowledgement of receipt by CDC is not provided. To print this form in order to fax or mail it, be sure to Save this form first.

**SEND TO CDC**

For hantavirus/HPS, be sure to provide a copy of this Form to your state Health Department.