

# Hantavirus Infection and Hantavirus Pulmonary Syndrome

## IMMEDIATELY REPORTABLE DISEASE

Per N.J.A.C. 8:57, healthcare providers and administrators shall immediately report **by telephone** confirmed and suspected cases of rabies to the health officer of the jurisdiction where the ill or infected person lives, or if unknown, wherein the diagnosis is made.

The health officer (or designee) **must immediately institute the control measures listed below in section 6, “Controlling Further Spread,”** regardless of weekend, holiday, or evening schedules. A directory of local health departments in New Jersey is available at <http://localhealth.nj.gov>.

If the health officer is unavailable, the healthcare provider or administrator shall make the report to the Department by telephone to (609) 826-5964 or 4872, between 8:00 A.M. and 5:00 P.M. on non-holiday weekdays or to (609) 392-2020 during all other days and hours.



## 1 THE DISEASE AND ITS EPIDEMIOLOGY

### A. Etiologic Agent

Hantavirus pulmonary syndrome (HPS) and Hantavirus infection, non-Hantavirus pulmonary syndrome (non-HPS) occurs in the United States. Several hantaviruses are associated with infection: Sin Nombre virus (SNV), Black Creek Canal virus, Bayou virus, and New York-1 virus.

### B. Clinical Description and Laboratory Diagnosis

The Sin Nombre hantavirus, which can cause HPS and non-HPS, was first recognized in the U.S. in 1993. Patients with non-HPS typically present in a nonspecific way with a relatively short febrile prodrome lasting three to five days. In addition to fever and myalgias, early symptoms include headache, chills, dizziness, non-productive cough, nausea, vomiting, and other gastrointestinal symptoms. Malaise, diarrhea, and lightheadedness are reported by approximately half of all patients, with less frequent reports of arthralgias, back pain, and abdominal pain.

HPS is an acute febrile illness that progresses rapidly to severe respiratory failure (acute respiratory distress syndrome [ARDS]) and shock. Initial symptoms are nonspecific flu-like symptoms, including fever, fatigue, and muscle aches, especially in large muscle groups. Gastrointestinal manifestations or dizziness may also accompany these symptoms. As the disease progresses, symptoms can include cough and shortness of breath. Once the cardiopulmonary phase begins, the disease progresses rapidly, necessitating hospitalization and, often, assisted ventilation within 24 hours. Renal failure and hemorrhagic manifestations have been mild or absent in most recognized cases of HPS. The mortality rate is still not well defined but appears to be approximately 40% to 50%. In survivors, recovery from the acute illness is rapid with apparent restoration of normal lung function.

Laboratory diagnosis is based on identification of serum antibodies to hantaviruses using enzyme-linked immunosorbent assay (ELISA), Western blot assay, or recombinant

immunoblot assay (RIBA), and/or identification in tissues of specific hantavirus DNA using polymerase chain reaction (PCR) or antigens using immunohistochemistry.

### **C. Reservoirs**

The main reservoir for SNV is the deer mouse, *Peromyscus maniculatus*, native to most of the United States. Black Creek Canal virus is associated with the cotton rat, *Sigmodon hispidus*, found in the southeast. The rice rat, *Oryzomys palustris*, found in the southern United States, acts as a reservoir for Bayou virus. In the northeastern states, the white-footed mouse, *Peromyscus leucopus*, and the deer mouse have been associated with New York-1. The white-footed mouse is common throughout New Jersey, while the deer mouse may be found in the far northern parts of the state. A serologic survey of small mammals conducted in 1996 in cooperation with the New Jersey Division of Fish and Wildlife and Centers for Disease Control and Prevention (CDC) indicated that less than 5% of white-footed mice had been exposed to SNV.

### **D. Modes of Transmission**

Infected rodents shed live virus in their saliva, feces, and urine. Humans are infected when they inhale or ingest dust contaminated with rodent urine or feces. Transmission may also occur from rodent bites and when dried materials contaminated by rodent feces or urine are disturbed and are directly introduced into the eyes, nose, mouth, or nonintact skin. There is no evidence of person-to-person transmission of HPS in the United States.

### **E. Incubation Period**

Since non-HPS and HPS is relatively uncommon, the incubation period has not yet been well defined, but it is believed to range from about one to six weeks after exposure, with an average of about two weeks.

### **F. Period of Communicability or Infectious Period**

There has been no evidence of person-to-person spread of this disease in the United States.

### **G. Epidemiology**

SNV is the agent responsible for the 1993 HPS epidemic in the southwest. Black Creek Canal virus was implicated in a single HPS case in Florida. Bayou virus was discovered from cases in Louisiana and Texas. New York-1 virus is similar to SNV, but is distinct enough to suggest that it is a variant found in the eastern third of the United States. Most cases of HPS have been associated with SNV.

HPS was first recognized in 1993; approximately 690 cases have been identified in the United States as of January 2016. Cases have been reported in 30 states, including most of the western half of the country and some eastern states as well. About 75% of patients with

HPS have been residents of rural areas. The distribution of identified cases reflects a spring-summer peak seasonality, although cases have occurred throughout the year. Cases of HPS have also been reported in Canada and in several countries in South America. Any person whose occupational activities (e.g., biologists, pest-control workers) or recreational activities (e.g., hikers, campers) put them in frequent contact with rodents or their droppings is potentially at risk of disease. Disturbing or inhabiting closed, actively rodent-infested structures is an important risk factor for contracting HPS. In New Jersey, there has not been any confirmed cases of HPS. The white-footed mouse, a reservoir species for the virus, is the most common woodland mammal in the state and readily enters homes, particularly in suburban and rural areas. Therefore, residents of infested buildings, as well as persons involved in the occupational and recreational activities noted above, are at potentially elevated risk of disease.

## **2 CASE DEFINITION**

### **A. New Jersey Department of Health (NJDOH) Case Definition**

The NJDOH Zoonotic Disease Program follows the most current case definition as published on the CDC National Notifiable Disease Surveillance System (NNDSS) website.

Hantavirus infection, non-Hantavirus pulmonary syndrome and Hantavirus pulmonary syndrome Case Definitions: <https://wwwn.cdc.gov/nndss/conditions/search/hantavirus/>

Case definitions enable public health to classify and count cases consistently across reporting jurisdictions, and should not be used by healthcare providers to determine how to meet an individual patient's health needs. Every year, case definitions are updated using CSTE's Position Statements. They provide uniform criteria of nationally notifiable infectious and non-infectious conditions for reporting purposes. To search for other notifiable diseases' case definitions by name and by year, use the search tools on the left side of the NNDSS website: <http://wwwn.cdc.gov/nndss/>

#### **1. Clinical Description – Hantavirus infection, Non-Hantavirus Pulmonary Syndrome**

Non-HPS Hantavirus infection is a febrile illness with non-specific viral symptoms including fever, chills, myalgia, headache, and gastrointestinal symptoms, but no cardio-pulmonary symptoms. Typical clinical laboratory findings include hemoconcentration, left shift in the white blood cell count, neutrophilic leukocytosis, thrombocytopenia, and circulating immunoblasts. Patients that develop cardio-pulmonary symptoms should be classified as having HPS.

**Laboratory Criteria for Diagnosis – Hantavirus infection, Non-Hantavirus Pulmonary Syndrome**

- 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 – Hantavirus infection, Non-Hantavirus Pulmonary Syndrome**

**Confirmed**

A clinically compatible case of Non-HPS Hantavirus Infection with laboratory evidence.

**2. Clinical Description – Hantavirus Pulmonary Syndrome**

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 – Hantavirus Pulmonary Syndrome**

- 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 – Hantavirus Pulmonary Syndrome

#### Confirmed

A clinically compatible case of HPS with laboratory evidence.

## 3 LABORATORY TESTING SERVICES AVAILABLE

The NJDOH Public Health and Environmental Laboratories does not provide testing for Hantavirus.

In patients, laboratory diagnosis is based on identification of serum antibodies to hantaviruses using ELISA, Western blot assay, or RIBA and/or identification in tissues of specific hantavirus DNA using PCR or antigens using immunohistochemistry.

Laboratory testing should be performed or confirmed at CDC's Special Pathogens Branch. The surveillance and reporting system for HPS requires NJDOH to be consulted before any specimens are submitted and that two diagnostic specimens and other information accompany the specimens.

- Laboratory testing should be performed or confirmed at a reference laboratory. The Public Health and Environmental Laboratories (PHEL) does not provide services for hantavirus testing. PHEL will arrange with CDC, Special Pathogens Branch, for hantavirus testing with appropriate authorization from the NJDOH Infectious and Zoonotic Diseases Program (IZDP). PHEL can forward samples to CDC for hantavirus testing. IZDP, at 609.826.5964, must approve submission of samples to PHEL. All samples must be accompanied by a CDC Hantavirus Pulmonary Syndrome Case Report Form and National Surveillance Laboratory Specimen Form, which are available at: [https://www.cdc.gov/hantavirus/pdf/hps\\_case-report-form.pdf](https://www.cdc.gov/hantavirus/pdf/hps_case-report-form.pdf) and <https://www.cdc.gov/hantavirus/pdf/specimen-submission-form.pdf>

# 4 DISEASE REPORTING AND CASE INVESTIGATION

## A. Purpose of Surveillance and Reporting

- To assess the magnitude of the disease in different areas and among different risk groups.
- To identify individual cases or outbreaks as soon as possible.
- To identify rodent sources of infection.
- To monitor the emergence of HPS in new areas and new risk groups.
- To design more effective control or prevention methods.

## B. Laboratory Reporting Requirements

1. The New Jersey Administrative Code (NJAC 8:57-1.7) stipulates that laboratories **immediately** report (by telephone, confidential fax, or over the Internet using the confidential and secure Communicable Disease Reporting and Surveillance System [CDRSS]) any positive culture, test or assay result for Hantavirus to the local health officer having jurisdiction over the locality in which the patient lives or, if unknown, to the health officer in whose jurisdiction the healthcare provider requesting the laboratory examination is located. If this is not possible, call NJDOH IZDP at 609.826.5964 during business hours or 609.392.2020 after business hours or on weekends and holidays.

The report shall contain, at a minimum, the reporting laboratory's name, address, and telephone number; the age, date of birth, gender, race, ethnicity, home address, and telephone number of the person tested; the date of testing; the test results; and the healthcare provider's name and address.

## C. Healthcare Provider Reporting Requirements

1. NJAC 8:57-1.4 stipulates that healthcare providers immediately report (by telephone, confidential fax, or over the Internet using CDRSS) any suspect or confirmed case of brucellosis to the local health officer having jurisdiction over the locality in which the ill or infected person lives or, if unknown, to the health officer in whose jurisdiction the healthcare provider requesting the laboratory examination is located. If the health officer is unavailable, call IZDP. The report shall contain, at a minimum, the age, date of birth, gender, race, ethnicity, home address, and telephone number of the ill or infected person; date of onset of illness; clinical laboratory data (e.g., date of testing, test results, reporting laboratory's name, address, and telephone number); and the healthcare provider's name, address and phone number.

## Communicable Disease Service Manual

2. Physician or hospital staff reporting a possible case of HPS should complete the CDC Hantavirus Pulmonary Syndrome Case Report Form, available at [https://www.cdc.gov/hantavirus/pdf/hps\\_case-report-form.pdf](https://www.cdc.gov/hantavirus/pdf/hps_case-report-form.pdf)

### D. Local Health Departments Reporting and Follow-Up Responsibilities

1. NJAC 8:57 stipulates that each local health officer must report the occurrence of any case of HPS, as defined by the reporting criteria above, to NJDOH IZDP by entering it electronically over the Internet using CDRSS.
2. NJAC 8:57 also stipulates that a health officer shall, upon receipt of a suspect or confirmed report of HPS, investigate the facts contained in the report. See Section 5 below. Additionally, a health officer shall follow such direction regarding the investigation as may be given by the NJDOH.

# 5 LOCAL DEPARTMENTS OF HEALTH REPORTING

## A. Investigation

It is the Health Officer's responsibility to investigate the case by interviewing the patient, physician and others who may be able to provide pertinent information. **The [NJDOH Hantavirus Investigation Worksheet](#)** may be used to help guide the patient or physician interview. Specifically, focus on the period beginning about one week before onset of disease date back to approximately six weeks before onset for the following exposures:

- Travel history: Determine the date(s) and geographic area(s) visited by the patient.
  - Rodent contact: Ask the patient about potential direct or indirect residential, occupational, or recreational exposure to rodents and/or rodent droppings.
  - Indicate where HPS was acquired. If unsure, state "UNKNOWN."
3. Include any additional information gathered that does not have a designated field in the comment section of CDRSS.
4. Institution of disease control measures is an integral part of case investigation. It is the responsibility of the local health officer to understand and, if necessary, institute the control guidelines listed below in Section 6.

## B. Other Reporting/Investigation Issues

1. It is not always possible to obtain all the information necessary to determine the case status of a patient. A minimum of three attempts (not necessarily to the same person, not at the same time during the day, and only one attempt through a letter/form by

mail) should be made to obtain necessary information. If at this time information is not acquired, the case should be entered into CDRSS with as much information as is known, with attempts (dates and results of attempts) documented in the “COMMENTS” section and the case status changed to “NOT A CASE” and report status to “LHD CLOSED.”

2. Every effort should be made to complete the investigation within three months of opening a case. Cases that remain open for three months or more and have no investigation or update notes will be closed by NJDOH and marked as “NOT A CASE.”
3. Once an LHD completes its investigation and assigns a report status of “LHD CLOSED,” NJDOH will review the case, and when it is complete will change the report status to “DHSS APPROVED.” At this time, the case will be locked for editing. If additional information is received after a case has been placed in “DHSS APPROVED,” an LHD will need to contact NJDOH to reopen the case. This should be done only if the additional information changes the case status of the report.

## **6 CONTROLLING FURTHER SPREAD**

### **A. Isolation and Quarantine Requirements**

None.

### **B. Protection of Contacts of a Case**

Exterminate rodents in and around the household, if feasible and secure the home to exclude rodents.

### **C. Managing Special Situations**

#### **1. Reported Incidence is Higher than Usual/Outbreak Suspected**

In the event a case is confirmed by CDC, IZDP staff can help determine a course of action to conduct further surveillance and prevent additional cases.

Because non-HPS and HPS is not endemic in New Jersey, a single case should be investigated to determine the source of infection and mode of transmission. The NJDOH Hantavirus Investigation Worksheet may be used to help guide the patient or physician interview. A travel history should be established and an environmental assessment including detection of rodent signs and identification of rodents present; points of rodent entry; and sources of food, water, and harborage for rodents at the possible site(s) of exposure would be part of the investigation. This will be done in cooperation between

NJDOH, local health agency, Department of Environmental Protection's Division of Fish and Wildlife, and CDC.

## **D. Prevention Measures**

### **1. Environmental Measures**

The best way to prevent non-HPS or HPS is to eliminate or minimize human contact with rodents, particularly white-footed mice.

- Clear brush, grass, and garbage from around building foundations to eliminate a source of nesting materials. Keep tight-fitting lids on all garbage.
- Use metal flashing around the base of wooden, earthen, or adobe dwellings to provide a strong metal barrier.
- Seal all entry holes one-fourth inch wide or wider with lath screen or lath metal, cement, wire screening, or other patching materials, inside and out.
- Elevate hay, woodpiles, and garbage cans to eliminate possible nesting sites.
- For the control of mice inside a building, snap traps are recommended. Using bait such as peanut butter, place the traps perpendicular to the wall or other location used as a runway or harborage by the mice. For the control of rats, rodenticide baits are usually more effective. Use an Environmental Protection Agency-approved rodenticide bait according to label directions, in a bait station or area otherwise inaccessible to children and pets, along baseboards, and behind harborage such as appliances. Properly dispose of dead rodents. Live trapping of rodents is not recommended. A certified pesticide applicator may also be hired to eliminate the infestation.
- Clean all food preparation areas. Store all food (both human and pet) in rodent-proof containers.
- Do not leave open bowls of pet food outside. Discard any uneaten pet food properly at the end of the day.

### **2. Personal Prevention Measures**

People involved in cleaning rodent-contaminated areas should keep the following things in mind:

- Clean droppings using a wet method, rather than a dry method such as sweeping or vacuuming. Spray disinfectant, such as diluted bleach, before cleaning, and use a wet mop or towels moistened with disinfectant to clean.
- Work in well-ventilated areas.

- Gloves, dust mist masks, long-sleeved clothing, and protective eyewear may help prevent exposure.

### **Additional Information**

Informational materials regarding hantavirus and rodent control may be obtained from NJDOH IZDP.

A Hantavirus Pulmonary Syndrome Fact Sheet and Hantavirus Investigation Worksheet is available at the NJDOH Web site at <http://www.nj.gov/health/cd/topics/hanta.shtml>

Technical information about HPS is available from CDC at <https://www.cdc.gov/hantavirus/>

### **References**

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