

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 hantavirus pulmonary syndrome 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://www.state.nj.us/health/lh/directory/lhdselectcounty.shtml>.

If the health officer is unavailable, the healthcare provider or administrator shall make the report to the Department by telephone to 609.588.7500, 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.



June 2008



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1 THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

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

B. Clinical Description

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 dust that contains dried contaminated rodent urine or feces. Transmission may also occur 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 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 465 cases have been identified in the United States as of March 2007. 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 had not been any confirmed cases of HPS as of May 2008. 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 REPORTING CRITERIA AND LABORATORY TESTING SERVICES

A. New Jersey Department of Health and Senior Services (NJDHSS) Case Definition

1. Clinical Case Definition

HPS is characterized by at least one of the following clinical features:

- A febrile illness (i.e., temperature higher than 101°F) characterized by bilateral diffuse interstitial edema that may radiographically resemble ARDS, with respiratory compromise requiring supplemental oxygen developing within 72 hours of hospitalization, and occurring in a previously healthy person.
- An unexplained respiratory illness resulting in death, with an autopsy examination demonstrating no cardiogenic pulmonary edema without an identifiable cause.

2. Laboratory Criteria for Diagnosis

Detection of hantavirus-specific immunoglobulin (Ig)M or rising titers of hantavirus-specific IgG, OR

Detection of hantavirus-specific ribonucleic acid sequence by PCR in clinical specimens, OR

Detection of hantavirus antigen by immunohistochemistry.

An ELISA test kit is available commercially that is labeled “for research Use, not for clinical use” and has not been approved or cleared by the U.S. food and Drug Administration. This test kit has been associated with false positive reactivity, characterized by IgM positivity with negative IgG. Typically, a case of HPS would have both positive IgM and IgG serologies by the time the patient developed clinical signs.

3. Case Classification

CONFIRMED

A clinically compatible case, AND

Detection of hantavirus-specific IgM or rising titers of hantavirus-specific IgG, OR

Detection of hantavirus-specific ribonucleic acid sequence by PCR in clinical specimens, OR

Detection of hantavirus antigen by immunohistochemistry.

PROBABLE

Not used.

POSSIBLE

Not used.

The formal CDC surveillance case definition for Hantavirus Pulmonary Syndrome is the same as the criteria outlined in Section 2 of this chapter. CDC case definitions are used by state departments of health and CDC to maintain uniform standards for national reporting. For reporting to NJDHSS, always use the criteria outlined in Section 2.

3 LABORATORY TESTING SERVICES AVAILABLE

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 NJDHSS 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 make arrangements with CDC, Special Pathogens Branch, for hantavirus testing with appropriate authorization from the NJDHSS Infectious and Zoonotic Diseases Program (IZDP). The New Jersey PHEL can forward samples to CDC for hantavirus testing. IZDP, at 609.588.3121, 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:
<http://www.cdc.gov/ncidod/diseases/hanta/hps/noframes/phys/specimen/hlthdept.htm>.

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 8:57-1.6) stipulates that laboratories report (by telephone, confidential fax, or over the Internet using the confidential and secure Communicable Disease Reporting and Surveillance System [CDRSS]) any suspect or confirmed case of HPS 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 NJDHSS IZDP at 609.588.7500 during business hours or 609.392.2020 after business hours or on weekends and holidays.
2. 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 8:57-1.6 stipulates that laboratories report (by telephone, confidential fax, or CDRSS) any suspect or confirmed case of HPS 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 NJDHSS IZDP at 609.588.7500 during business hours or 609.392.2020 after business hours or on weekends and holidays.
2. 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.
3. Physician or hospital staff reporting a possible case of HPS should complete the CDC Hantavirus Pulmonary Syndrome Case Report Form, available at <http://www.cdc.gov/ncidod/diseases/hanta/hps/noframes/phys/specimen/casereport.pdf>.

D. Health Officer 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 NJDHSS 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 NJDHSS.

5 LOCAL DEPARTMENTS OF HEALTH REPORTING

A. Laboratory Reports

1. If the local health department (LHD) receives the lab or provider report, the LHD should investigate the case by contacting the patient or a family member or the healthcare provider and enter the information into CDRSS as instructed below.
2. If the lab or provider report is received by NJDHSS and includes the patient’s address, the report will be entered into CDRSS and not mailed to the LHD.
3. If the lab or provider report received by NJDHSS does not include the patient’s address, the report will be returned to the sending laboratory or healthcare provider or they will be telephoned to obtain a complete address. Once it is received, the report will be entered into CDRSS as “Pending.”

B. Entry into CDRSS

The mandatory fields in CDRSS include: disease, last name, county, municipality, gender, race, ethnicity, case status, report status.

The following table can be used as a quick reference guide to determine which CDRSS fields need to be completed for accurate and complete reporting of HPS cases. The “Tab” column includes the tabs which appear along the top of the CDRSS screen. The “Required Information” column provides detailed explanations of what data should be entered.

CDRSS Screen	Required Information
Patient Info	Enter the disease name (“HANTAVIRUS PULMONARY SYNDROME”), patient demographic information, illness onset date, and the date the case was reported to the local health department (LHD). There are no subgroups for this disease.
Addresses	Enter any alternate address (e.g., a second residence outside NJ). Use the Comments section in this screen to record any pertinent information about the alternate address. Entering an alternate address will allow other disease investigators access to the case if the alternate address falls within their jurisdiction.

CDRSS Screen	Required Information
Clinical Status	Enter any treatment that the patient received and record the names of the medical facilities and physician(s) involved in the patient’s care. If the patient received care from two or more hospitals, be sure that all are entered so the case can be accessed by all infection control professionals (ICPs) covering these facilities. If immunization status is known, it should also be entered here. If the patient died, date of death should be recorded under the Mortality section.
Signs/Symptoms	Check appropriate boxes for signs and symptoms and indicate their onset. Make every effort to get complete information by interviewing the physician, family members, ICP, or others who might have knowledge of the patient’s illness. Also, information regarding the resolution of signs and symptoms should be entered.
Risk Factors	Enter complete information about risk factors to facilitate study of HPS in New Jersey, using the approximate incubation period range of one to six weeks for HPS. Ask the case-patient about contact with rodents or rodent infested structures in western USA, particularly in Four Corners area of Arizona, and New Mexico. HPS has never been diagnosed in New Jersey and contact with rodents or rodent infested structures in this state is not considered a risk factor.
Laboratory Eval	Enter appropriate lab and diagnostic tests. Select HPS antibody if a serology test was performed. Record titer in “VALUE” field. NOTE: Review the case definition in Section 2 for a discussion of an ELISA test offered by commercial laboratories that is associated with false positivity.
Contact Tracing	This is not required for HPS case reports.
Case Comments	Enter general comments (i.e., information that is not discretely captured by a specific topic screen or drop-down menu) in the Comments section. NOTE: Select pieces of information entered in the Comments section CANNOT be automatically exported when generating reports. Therefore, whenever possible, record information about the case in the fields that have been designated to capture this information; information included in these fields CAN be automatically exported when generating reports.

CDRSS Screen	Required Information
<p>Epidemiology</p>	<p>Under the Other Control Measures section, indicate if the patient falls into any of the categories listed under Patient Role(s)/Function(s). Record name of and contact information for case investigators from other agencies (e.g., CDC, out-of-state health departments). Document communication between investigators in the Comments section.</p>
<p>Case Classification Report Status</p>	<p>Case status options are: “REPORT UNDER INVESTIGATION (RUI),” “CONFIRMED,” “PROBABLE,” “POSSIBLE,” and “NOT A CASE.”</p> <ul style="list-style-type: none"> • All cases entered by laboratories (including LabCorp electronic submissions) should be assigned a case status of “REPORT UNDER INVESTIGATION (RUI).” • Cases still under investigation by the LHD should be assigned a case status of “REPORT UNDER INVESTIGATION (RUI).” • Upon completion of the investigation, the LHD should assign a case status on the basis of the case definition. “CONFIRMED” and “NOT A CASE” are the only appropriate options for classifying a case of HPS (see Section 2). <p>Report status options are: “PENDING,” “LHD OPEN,” “LHD REVIEW,” “LHD CLOSED,” “DELETE,” “REOPENED,” “DHSS OPEN,” “DHSS REVIEW,” and “DHSS APPROVED.”</p> <ul style="list-style-type: none"> • Cases reported by laboratories (including LabCorp electronic submissions) should be assigned a report status of “PENDING.” • Once the LHD begins investigating a case, the report status should be changed to “LHD OPEN.” • The “LHD REVIEW” option can be used if the LHD has a person who reviews the case before it is closed (e.g., health officer or director of nursing). • Once the LHD investigation is complete and all the data are entered into CDRSS, the LHD should change the report status to “LHD CLOSED.” • “LHD CLOSED” cases will be reviewed by DHSS and be assigned one of the DHSS-specific report status categories. If additional information is needed on a particular case, the report status will be changed to “REOPENED” and the LHD will be notified by e-mail. Cases that are “DHSS

CDRSS Screen	Required Information
	<p>APPROVED” cannot be edited by LHD staff (see Section C below).</p> <p>If a case is inappropriately entered the case should be assigned a report status of “DELETE.” A report status of “DELETE” should NOT be used if a reported case of HPS simply does not meet case definition. Rather, it should be assigned the appropriate case status, as described above.</p>

C. 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 NJDHSS and marked as “NOT A CASE.”
3. Once an LHD completes its investigation and assigns a report status of “LHD CLOSED,” NJDHSS 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 NJDHSS to reopen the case. This should be done only if the additional information changes the case status of the report.
4. An epidemiologic investigation to identify the source of infection should be initiated. 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.”
5. Include any additional comments regarding the case in the “COMMENTS” section.
6. 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.

6 CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (NJAC 8:57-1.10)

Not applicable.

B. Protection of Contacts of a Case

Exterminate rodents in and around household, if feasible.

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 HPS is not endemic in New Jersey, a single case should be investigated to determine the source of infection and mode of transmission. 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 NJDHSS, local health agency, Department of Environmental Protection's Division of Fish and Wildlife, and CDC.

D. Preventive Measures

1. Environmental Measures

The best way to prevent 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

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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 Preventive 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 NJDHSS IZDP.

A Hantavirus Pulmonary Syndrome Fact Sheet is available at the NJDHSS Web site at <http://www.state.nj.us/health>. Click on the “Health Topics A to Z” link and scroll down to the subject “Hantavirus Pulmonary Syndrome.”

Technical information about HPS is available from CDC at www.cdc.gov/ncidod/diseases/hanta/hps/.

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