



# Hantavirus Pulmonary Syndrome (HPS) Investigation Guideline

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**Revision History:**

<b>Date</b>	<b>Replaced</b>	<b>Comments</b>
05/2018	09/2014	Case definition updated to CDC 2015 definition. Notification section modified with the requirements of revised regulations. Updated link to case report form.
09/2014	05/2013	Added notification section and table of contents. More details added to Investigators Responsibilities and Data Management. Reformatted Standard Case Investigation section to assist with EpiTrax system data entry. Reformatted fact sheet.

# Hantavirus Pulmonary Syndrome (HPS)

## Disease Management and Investigative Guidelines

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### CASE DEFINITION (CDC 2015)

#### Clinical Description for Public Health Surveillance:

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 Case Classification:

- 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 that is laboratory confirmed.
- Probable (Internal KDHE definition): lab confirmed only.
- Suspect (Internal KDHE definition): clinical symptoms with possible environmental exposure concerns

*Comments: 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.*

## LABORATORY ANALYSIS

Laboratory testing should be performed or confirmed at a reference laboratory. Because the clinical illness is nonspecific and ARDS is common, patients are first screened. 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.

- Specimens sent to CDC **must have prior authorization** from the Kansas Department of Health and Environments Bureau of Epidemiology and Public Health Informatics (KDHE-BEPHI).
- Call KDHE-BEPHI at 877-427-7317 before sending specimens. Be prepared to provide information found on the [CDC case investigation form](#), which must be filled out and sent with the specimen(s). (Fax a copy of the form to 877-427-7318.)
- KDHE-BEPHI shall ensure the following agencies are notified or consulted:
  - KHEL to alert them that specimens are being sent to CDC.
  - CDC Special Pathogens Branch (SPB) for consultation, approval and mailing address.
    - 24 hour phone number for consultation: 404- 639-2888
    - During regular business hours: 404-639-1510 or 404-639-1115.
  - Local Health Department with jurisdiction over the suspected case.
- Testing performed and specimens:
  - Serology: serum specimens
  - Immunohistochemistry (IHC): tissues
  - PCR/ Viral Isolation: tissues, clots, buffy coats
  - Refer to [Guidelines for Submitting Specimens to Special Pathogens Branch](#) for further information on types of specimen and testing.
- Packaging:
  - Label sample as diagnostic specimen and include the following information: your name, the patient's name, test(s) requested, date of collection, laboratory or accession number, and the type of specimen,
  - Include a [Specimen Submission form](#),
  - Include a [CDC case investigation form](#),
  - Include a surgical or autopsy report with all tissue specimens,
  - Specify, on the outside of the box, how the specimen should be stored: refrigerated, frozen, or do not refrigerate.
  - Refer to [Guidelines for Submitting Specimens to Special Pathogens Branch](#) for further information.
- Shipping: Ship overnight (Federal Express preferred) and fax airway bill number and packing list to the SPB at 404-639-1509 or 404-639-1118.
- For additional information and/or questions, call 785-296-1620.

## EPIDEMIOLOGY

Hantavirus was first recognized in 1993 in the Southwestern United States; since then, confirmed cases have been reported in 30 additional states. Cases peak in the spring and summer although cases may occur year round. Most cases (75%) live in rural areas. Any person whose occupational activities (e.g., biologists, pest-control workers, etc.) or recreational activities (e.g., hikers, campers, etc.) put them in frequent contact with rodents or their droppings is potentially at risk. Disturbing or living in actively rodent-infested structures are significant risk factors for contracting disease.

## DISEASE OVERVIEW

### A. Agent:

Nine hantaviruses have been identified in North America. Each virus has a distinct rodent host. The Sin Nombre virus was the agent responsible for the 1993 epidemic in the Southwestern United States.

### B. Clinical Description:

Febrile illness characterized by bilateral interstitial pulmonary infiltrates and respiratory compromise usually requiring supplemental oxygen and clinically resembling ARDS. The typical prodrome consists of fever, chills, myalgia, headache, and gastrointestinal symptoms. Typical clinical laboratory findings include hemoconcentration, left shift in the white blood cell count, neutrophilic leukocytosis, thrombocytopenia, and circulating immunoblasts.

### C. Reservoirs:

The primary reservoir for Sin Nombre virus is the *Peromyscus maniculatus* or deer mouse. Hantavirus antibodies have also been found in other *Peromyscus* species including pack rats, chipmunks and other wild rodents.

### D. Mode(s) of Transmission:

Via the bites of infected rodents and/or direct contact of broken skin or mucous membranes with infected rodent excreta or inhalation of aerosolized excreta.

### E. Incubation Period:

Range 3 days to 6 weeks; average 14 days.

### F. Period of Communicability:

There is no evidence of person-to-person transmission.

### G. Susceptibility and Resistance:

All persons without prior infection are presumed to be susceptible. The extent and duration of immunity conferred by previous infection is unknown.

### H. Treatment:

Supportive only; often includes mechanical ventilation, cardiovascular support, and fluid and electrolyte therapy.

## NOTIFICATION TO PUBLIC HEALTH AUTHORITIES

Suspected cases of Hantavirus shall be reported within 24 hours, except if the reporting period ends on a weekend or state-approved holiday, the report shall be made by 5:00 p.m. on the next business day after the 24-hour period:

1. Health care providers and hospitals: report to the local public health jurisdiction or KDHE-BEPHI (see below)
2. Local public health jurisdiction: report to KDHE-BEPHI (see below)
3. Laboratories: report to KDHE-BEPHI (see below)

**Kansas Department of Health and Environment (KDHE)  
Bureau of Epidemiology and Public Health Informatics (BEPHI)  
Phone: 1-877-427-7317  
Fax: 1-877-427-7318**

### **Further responsibilities of state and local health departments to the CDC:**

As a nationally notifiable condition, **confirmed hantavirus pulmonary syndrome cases** require a Routinely, Notifiable report to the Center of Disease Control and Prevention (CDC).

- **Local public health jurisdiction** will report information requested on the disease reporting forms as soon as possible, completing the forms within 3 days of receiving a notification of a report.
- KDHE-BEPHI will file an electronic case report the next regularly scheduled electronic transmission.

## INVESTIGATOR RESPONSIBILITIES

- 1) [Report](#) all confirmed, probable and suspect cases to the KDHE-BEPHI.
- 2) Contact medical provider to collect additional information and confirm diagnosis using current [case definition](#).
  - Collect all information requested in [Step 1](#)) of case investigation.
  - Establish whether it is a case of DF or if symptoms of DHF exist.
  - If necessary, assist KDHE-BEPHI in obtaining additional specimens for confirmatory testing at a reference laboratory.
  - Ensure that case/proxy is aware of the diagnosis.
- 3) Continue the [case investigation](#) to identify potential source of infection.
  - Initiate the case investigation within 1 day of notification of a report.
  - Complete the investigation within 3 days of the notification.
- 4) Conduct [contact investigation](#) to identify additional cases.
- 5) Identify whether the source of infection is major public health concern.
- 6) [Educate](#) on the [environmental](#) measures to prevent disease.
- 7) [Record](#) data, collected during the investigation, in the KS EpiTrax system under the data's associated [\[tab\]](#) in the case morbidity report (CMR).
  - As needed, assist KDHE-BEPHI with the completion of any additional CDC questionnaires.
- 8) As appropriate, use the notification letter(s) and the disease [fact sheet](#) to notify the case, contacts and other individuals or groups.

## STANDARD CASE INVESTIGATION AND CONTROL METHODS

### Case Investigation

- 1) Contact the medical provider who ordered testing of the case and obtain the following information. (This includes medical records for hospitalized patients.)  
**Note:** *If the physician, submitted samples to CDC, a [CDC case investigation form](#) may already be completed or started – try to obtain a copy. The [CDC case investigation form](#) can be used to collect data during any investigation.*
  - Collect case's demographics and contacting information (address, birth date, gender, race/ethnicity, primary language, and phone number(s)) [Demographic]
  - Record onset date (approximate if exact date is not known) [Clinical]
  - Record hospitalizations: location and duration of stay [Clinical]
  - Record outcomes: survived or date of death [Clinical]
    - With death investigation, identify if autopsy was performed.
  - Obtain clinical information on symptoms and signs, including fever >101°F, thrombocytopenia (<150,000 mm platelets), elevated hematocrit, elevated creatinine, and chest x-ray with unexplained bilateral interstitial infiltrates or suggestive acute respiratory distress (ARDS) [Notes]
    - Collect any information that is suggestive of ARDS; i.e., supplemental oxygen use, intubation and any radiographic results.
  - Examine the laboratory testing that was done: fax any Hantavirus results that have not been reported to the state; determine with BEPHI staff if additional testing should occur at a reference laboratory. If needed, assist in the coordination for additional testing. [Laboratory]
- 2) Interview the case or proxy to determine source and risk factors; focus on incubation period 6 weeks prior to illness onset.
  - Occupation and job duties. [Epidemiologic]
  - Travel history, dates and places during the incubation period. [Notes]
    - Include travel history to other counties, states or countries.
    - Record places and dates the case visited.
  - Exposure to rodents or rodent excreta or a residence with signs of rodent infestation; including: exposure to rarely open or seasonally closed buildings (e.g., vacation cabin, storage buildings) [Notes]
    - If yes, indicate type of rodent if known: mouse, rat, rodent nest, other
    - Indicate specific town, county, and state where exposures occurred.
  - With no travel to areas endemic for hantavirus prior to onset:
    - Obtain assistance to search the case's work, home and places visited for any rodents or rodent excreta.
    - Investigate for reports of febrile illness or unexplained deaths in area.
- 3) Examining the epidemiological data, record where the infection was most likely imported from. (Indigenous or out-of-county, state, or U.S.) [Epidemiologic]
- 4) Investigate epi-links among cases (clusters, household, co-workers, etc).
  - Highly suspected local sources should be investigated. Refer to [Environmental Measures](#).
  - For suspected [Outbreak](#) to Managing Special Situations section.

### Contact Investigation

- 1) Consider individuals living in the same household, neighbors, co-workers, and anyone else who might be exposed to rodents or rodent excreta as potentially at risk. Also, consider the following types of contacts:
  - Workers cleaning up heavily rodent infested areas or the rodent infested homes of confirmed Hantavirus cases
  - Travel companions, if there was a high risk of exposure during travel
- 2) ONLY if a risk of transmission exists because of high risk of exposure, create a line listing of contacts at-risk of developing disease. [Contact]

### Isolation, Work and Daycare Restrictions

None

### Case Management

- 1) CDC may request the submission of acute and convalescent sera from cases and the use of a supplemental questionnaire for cases or next of kin.
  - Contact KDHE-BEPHI at (877) 427-7317 for more information.
- 2) Report any changes in patient status: release from hospital, death. [Clinical]
- 3) Refer to the [Special Precautions](#) for cleaning up areas that were the source of infection for persons with confirmed Hantavirus infection. Available online at: [www.cdc.gov/hantavirus/hps/prevention.html](http://www.cdc.gov/hantavirus/hps/prevention.html).

### Contact Management

- 1) If a contact listing was created because of the high possibility of disease after a high risk of exposure, follow-up with the listed contacts to determine if illness occurred [Contact]
  - Collect information on each contact's health status, noting any symptoms
  - Inform contact of possible high risk of exposure to facilitate proper diagnosis and therapy.
  - [Educate](#) the contacts as needed.
- 2) A symptomatic contact is consider a suspect case requiring investigation and [reporting](#) to KDHE-BEPHI [Contact]
  - *On the [Contact] Tab of the CMR, click 'Show' beside the symptomatic contact on the listing. When View Contact Event opens in show mode, select 'Promote to CMR'*
  - Investigate symptomatic contacts with respiratory illness as suspect cases.
- 3) Workers who use proper precautions to clean up heavily rodent infested areas or the rodent infested homes of confirmed Hantavirus cases should be instructed to self-monitor themselves for HPS symptoms 45 days after their last exposure and to seek medical attention if symptoms develop.
  - Workers who failed to use the proper precautions are considered at high risk of infection after a high-risk exposure.

## Environmental Measures

- 1) For cleaning up areas that were the source of infection for persons with confirmed Hantavirus infection; refer to the [Special Precautions](http://www.cdc.gov/hantavirus/hps/prevention.html) available online: [www.cdc.gov/hantavirus/hps/prevention.html](http://www.cdc.gov/hantavirus/hps/prevention.html)
- 2) Prevent hantavirus by eliminating or minimizing human contact with rodents:
  - Clear brush, grass, and garbage from around building foundations to eliminate a source of nesting sites and food.
  - Use metal flashing around the base of wooden, earthen or adobe dwellings to provide a strong metal barrier.
  - Seal all entry holes 1/4 inch wide or wider with metal, cement, wire screening or other patching materials.
  - Elevate hay, woodpiles and garbage cans to eliminate nesting sites.
  - Use an EPA-approved rodenticide with bait under plywood or plastic shelter along baseboards, or trap and properly dispose of rodents; live trapping of rodents is not recommended.
  - 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.
- 3) Refer to the CDC “Rodent Control” website for further information: [www.cdc.gov/rodents/prevent\\_infestations/index.html](http://www.cdc.gov/rodents/prevent_infestations/index.html)

## Education

Those involved in cleaning rodent-contaminated areas should be informed on:

- 1) Using a wet method, rather than a dry method such as sweeping or vacuuming. This would include spraying disinfectant, such as dilute bleach, prior to cleaning and using a wet mop or towels moistened with disinfectant.
- 2) Working in well-ventilated areas.
- 3) Wearing rubber, latex, or vinyl gloves when cleaning up urine, droppings, or nesting materials. A dust mask may provide some protection against dust, molds, and insulation fibers, but does not protect against viruses.
- 4) For heavily infested areas, further protection measures should be considered See CDC guidance: [www.cdc.gov/rodents/cleaning/index.html](http://www.cdc.gov/rodents/cleaning/index.html)
- 5) Additional educational information is available from the CDC on-line at: <http://www.cdc.gov/hantavirus/resources/materials.html>

## MANAGING SPECIAL SITUATIONS

### A. Outbreak Investigation:

- There are no formal outbreak definitions although an outbreak may be considered when  $\geq 2$  cases are clustered in space and/or or time.
- Notify KDHE immediately, 1-877-427-7317.

## DATA MANAGEMENT AND REPORTING TO THE KDHE

- A. Accept the case assigned to the LHD and record the date the LHD investigation was started on the [\[Administrative\]](#) tab.
- B. Organize and collect data, using appropriate data collection tools including:
  - Investigators can collect and enter all required information directly into EpiTrax [\[Investigation\]](#), [\[Clinical\]](#), [\[Demographics\]](#), [\[Epidemiological\]](#) tabs.
  - [CDC case investigation form](#) can be used to collect additional information.
  - During outbreak investigations, refer to guidance from a KDHE epidemiologist for appropriate collection tools.
- C. Report data collected during the course of the investigation via EpiTrax.
  - Verify that all data requested has been recorded on an appropriate EpiTrax [\[tab\]](#), or that notes are recorded for a case lost to follow-up
  - Some data that cannot be reported on an EpiTrax [\[tab\]](#) may need to be recorded in [\[Notes\]](#) or scanned and attached to the record.
  - Paper report forms do not need to be sent to KDHE after the information is recorded and/or attached in EpiTrax. The forms should be handled as directed by local administrative practices.
- D. If a case is lost to follow-up, after the appropriate attempts to contact the case have been made:
  - Indicate 'lost to follow-up' on the [\[Administrative\]](#) tab with the attempts to contact the case recorded.
  - Record at least the information that was collected from the medical records.
  - Record a reason for 'lost to follow-up' in [\[Notes\]](#).
- E. After the requirements listed under [Case Investigation](#) have been completed, record the "Date LHD investigation completed" field located on the [\[Administrative\]](#) tab.
  - Record the date even if the local investigator's [Case](#) or [Contact Management](#) for the contact is not "Complete".
- F. Once the entire investigation is completed, the LHD investigator will click the "Complete" button on the [\[Administrative\]](#) tab. This will trigger an alert to the LHD Administrator so they can review the case before sending to the state.
  - The LHD Administrator will then "Approve" or "Reject" the CMR.
  - Once a case is "Approved" by the LHD Administrator, BEPHI staff will review and close the case after ensuring it is complete and that the case is assigned to the correct event (DF/DHF), based on the reported symptoms reported.

(Review the [EpiTrax User Guide, Case Routing](#) for further guidance.)

## ADDITIONAL INFORMATION / REFERENCES

- A. **Treatment / Differential Diagnosis:** Red Book: 2009 Report of the Committee on Infectious Diseases. 29th Edition. Illinois, Academy of Pediatrics, 2014.
- B. **Epidemiology, Investigation and Control:** Heymann. D., ed., Control of Communicable Diseases Manual, 19th Edition. Washington, DC, American Public Health Association, 2010.
- C. **Case Definitions:** CDC Division of Public Health Surveillance and Informatics, Available at: [www.cdc.gov/nndss/](http://www.cdc.gov/nndss/)
- D. **Kansas Regulations/Statutes Related to Infectious Disease:** [www.kdheks.gov/epi/regulations.htm](http://www.kdheks.gov/epi/regulations.htm)
- E. **CDC Hantavirus Website:** [www.cdc.gov/hantavirus/](http://www.cdc.gov/hantavirus/)
  - **Additional Information (CDC):** [www.cdc.gov/health/default.htm](http://www.cdc.gov/health/default.htm)

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