

The CDC began the tracking of a Seoul Virus outbreak in December 2016. It is believed to have initiated in Illinois. Rats and people have tested positive in both Wisconsin, Indiana, and Illinois. At this time, 15 states are under investigation including Colorado, Delaware, Georgia, Illinois, Idaho, Iowa, Minnesota, Missouri, New Jersey, Pennsylvania, South Carolina, Tennessee, Utah, and Wisconsin. At this point 17 people in 7 states have been infected. The number of states possibly affected may change as more information is processed.

"Rat Zero" has not been identified.

Canada has confirmed positives and is now having colonies tested and has a working relationship with the CDC for information exchange.

We need to work together as a community to stop this potentially deadly virus from spreading. Below you will find basic information about SV and useful links.

SEOUL VIRUS (SV, SEOV, Seoul Hantavirus)

(Abigail Smith, MPH, PHD Virology & Joanne "Bella" Hodges)

THE AGENT: SV is an "Old World" hantavirus with a three-segment RNA genome in the Bunyaviridae family. It is relatively stable in the environment.

NATURAL RESERVOIR: The Norway rat is the natural host, with distribution being worldwide. Infected rats do not typically appear to be sick. There have also been cases of *Rattus rattus* being natural hosts. Other animals may develop antibodies when exposed, however they do not become ill or shed the virus and are not contagious to other animals or humans.

TRANSMISSION/PERSISTENCE: SV causes a persistent life-long infection of the rat. Unlike the viruses that are typically seen within the pet rat community (SDAV and Sendai Virus) the hantaviruses are not self-limiting. No amount of quarantine can lead to detection or eradication and there is no cure for a rat that tests positive. Infected rats remain contagious (to both humans and other rats) for the duration of their lives. SV is transmitted via saliva, urine and feces from an infected rat. Inhalation of contaminated materials (such as dust from bedding) is the primary route of transmission to humans. Human-to-human transmission does not occur, and the virus does not spread to other pets.

-

HUMAN INFECTION: People are generally infected by contact with infected animals or fomites (contaminated objects, such as bedding). Infection is also thought to be transmitted by bite. Human infections are frequently subclinical (no clinical signs) but may cause fever, headache, blurred vision or rash. In rare cases, infection can lead to acute renal (kidney) disease or hemorrhagic fever with renal syndrome (HFRS). Cells lining blood vessels are targets of infection, but the precise mechanism leading to hemorrhage is not understood. People who are immunosuppressed for any reason (pregnancy, chemotherapy, etc.) are at higher risk for developing severe disease.

TREATMENT: The anti-viral drug, ribavirin, has been used successfully to treat human SV infections. There is no treatment available for infected rats, and euthanasia is recommended.

RISKS: SV-infected pet rats or rat colonies should not be maintained without strict biosecurity protocols and quarantine. They contaminate their environment, and disposal of contaminated bedding and other husbandry supplies can lead to landfill contamination with associated infections of wild rat populations. (Hantaviruses) can survive for long periods in the environment: 12-15 days in contaminated beddings.¹ Persons that choose to hide potentially Seoul-positive colonies put everyone at risk.

PREVENTION:

- Always wash hands with soap and water after handling rodents or cleaning their habitat.
- Be aware that pet rodents, as well as wild rodents, can shed infectious agents that contaminate surfaces.
- Clean rodent habitats and supplies outside the home when possible, and never clean habitats or supplies in the kitchen sink, other food prep areas or the bathroom sink.
- Avoid bites, scratches from rodents.
- If bitten by a rodent, wash the wound for several minutes with soap and water.
- Do not attend events where your rats may be exposed to other rats.
- Be aware of the testing status of sources when acquiring new rats.

DURING AN OUTBREAK:

- **Do not panic.** Read, learn, and make informed decisions. It will take all of us (pet owners, breeders, labs, the CDC, local health officials, etc.) to keep this disease from becoming widespread.
- Do not spread disinformation.
- Do not write this off as something to not be taken seriously.
- Have your colony tested using CDC-approved methods such as IDEXX BioResearch.

- If you, or a member of your household, become ill with any of the symptoms listed above, contact your doctor for a viral test.
- Do not transport, breed, buy, sell, or give away rats until testing has cleared both your and your associates' colonies.
- When dealing with rat waste and used bedding it is recommended to spray it down with a bleach solution to prevent airborne particulates. Wetting the bedding fully, double bagging it in strong plastic bags, and putting it in closed trash cans will deter wild rats from interacting with it and becoming infected.
- Clean/disinfect cages and supplies by scrubbing with soapy water to remove debris, spraying with a 10% bleach solution, and rinsing after 15 minutes. In an known infected colony you can spray with bleach, *then* wash with soapy water.

TESTING

Testing of rats is done using serology with an Enzyme-Linked Immunosorbent Assay-based test (ELISA or Multiplexed Fluorometric ImmunoAssay [MFIA]), positives are confirmed by immunofluorescence.

Affordable serology can be performed by the Research Animal Diagnostic Services division of Charles River Laboratories, Inc.

The serological test is the "MIFA HANT"; this Hantavirus serology assay will pick up cross reacting rat Seoul antibodies. Your veterinarian can submit blood samples either by vial (diluted serum) or the (less invasive) dried blood spot method known as the EZ-Spot.

The EZ-Spot test cards are provided free of charge. Each card has spots for up to 4 samples. Charles River Lab instructs clients to request one zip-top specimen bag with desiccant for every 10 cards (40 samples) submitted. CRL is allowing the breeders to request the test card for their veterinarians. Simply put in your name, contact information, and rattery name.

Samples may ONLY be submitted through a veterinarian with the appropriate paperwork. Most veterinarians prefer to collect the blood samples directly to maintain sample integrity. The EZ-Spot samples should be submitted in a padded envelope or non-insulated shipping box via overnight shipping. A completed submission forms needs to be included with the samples. The account ownership must be through the veterinarian.

The rattery owner can have their email address included on the submission form (either in the contact section or in the notes section) so that they can also receive test results when they are sent to the submitting vet.

Prior to sample submission, your veterinarian needs to review and accept the CRL General Terms & Conditions and send a signed copy to LabServices@crl.com. Your veterinarian can also contact the CRL Lab services department to discuss testing options and strategies with one of their experienced certified veterinarians.

- General Terms & Conditions <https://www.criver.com/general-terms-conditions-sale>
- EZ-Spot request (and shipping supplies)
<https://itm.criver.com/LTMSupplyRequest/NewRequest.aspx>
- Sampling instructions for the EZ-Spot test
<https://www.criver.com/products-services/research-models-services/animal-health-surveillance/serology/ez-spot?region=3601>
- Serology Submission Form
<https://www.criver.com/sites/default/files/resources/SerologySampleSubmissionForm.pdf>

Understanding Antibodies and Testing

Humans: There are two different types of antibodies that are tested for serologically, Immunoglobulin M (IgM) and immunoglobulin G (IgG). Detection of IgM indicates a recent exposure/infection. Detection of IgG is indicative of a past infection (2-3 months to years). In an outbreak the CDC is mostly concerned with the recent (IgM) antibodies.

Once a person has antibodies, they are protected from illness.

Rats: In rats, serology targets IgG (older antibodies) since the infection is persistent for their entire lives.

Maternal antibodies protect pups until they are weaned (approximately 3 weeks). However, it is hard to predict exactly when infection will occur in progeny and once maternal antibodies are lost, they are highly susceptible to infection. To ensure no exposure, if there are other rats in the area, strict quarantine and intense biosecurity must be maintained. These rats will need to be tested as they get older to ensure that they are Seoul-negative. Preweaned pups can be supplemented to ensure proper growth. Appropriate supplements can be found at Fox Valley Nutrition, specifically Squirrel formula Day One 20/50 and Ultra Boost (which can be mixed in to raise the protein and fat content). Links will be listed below.

Helpful Links

- CDC- Seoul FAQ sheet
<https://www.cdc.gov/hantavirus/outbreaks/seoul-virus/faqs-seoul-virus.html>
- CDC- Multi-state Outbreak of Seoul Virus (with updates)
<https://www.cdc.gov/hantavirus/outbreaks/seoul-virus/index.html>
- CDC- Hemorrhagic Fever with Renal Syndrome (HFRS)
<https://www.cdc.gov/hantavirus/hfrs/index.html>
- Hantavirus spp. Pathogen Data Sheet
<https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/hantavirus.html>
- Current CDC outbreak map
<https://www.cdc.gov/hantavirus/outbreaks/seoul-virus/map.html>
- Charles River Data Sheet
<https://www.criver.com/sites/default/files/resources/HantavirusesTechnicalSheet.pdf>
- Fox Valley Nutrition milk replacements
- Day One
<http://www.foxvalleynutrition.com/product-lines/milkreplacers/day-one-2050/> -- Archived page from 2016-11-10 (via the Wayback Machine)
- Ultra Boost
<http://www.foxvalleynutrition.com/product-lines/milkreplacers/ultra-boost/> -- Archived page from 2016-10-27 (via the Wayback Machine)

References

- 1 <https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/hantavirus.html>

Authors

Abigail Smith, MPH, PHD Virology

Professor of Pathobiology (Microbiology), University of Pennsylvania School of Veterinary Medicine Associate Director, Diagnostic Services and Rodent Quality Assurance, University Laboratory Animal Resources, American College of Laboratory Animal Medicine Honorary Diplomate, ACLAD recognized expert on rodent virology.

Joanne "Bella" Hodges, Senior Team Member, Rat Guide

Edited by

Karen Grant, RN and Kristin J. Johnson (Rat Guide)

Updated, May 18, 2020 (First published January 28, 2017)