

ANIMAL AND HUMAN HEALTH PREVENTION OPPORTUNITIES

Sin Nombre Virus

Hantavirus pulmonary syndrome (HPS) is a severe, sometimes fatal, viral respiratory disease in humans. Most cases of HPS in the United States and Canada are caused by the Sin Nombre virus (SNV; family *Bunyaviridae*, genus *Hantavirus*). SNV emerged in the spring of 1993 in the Southwest U.S., causing 10 fatalities during an 8-week period in May and June. Through January 6, 2016, there have been a total of 690 HPS cases in the United States, including 248 (39%) that were fatal. Forty-two of these cases, and 10 fatalities, were Montana residents. In this issue of *Montana One Health*, we will describe human SNV infections and steps to reduce the risk of infection.

Human Sin Nombre Virus Infections

Hantaviruses are distributed worldwide and can be found on every continent except Antarctica. However, SNV is the primary Hantavirus found in the U.S. The primary host of SNV is the common deer mouse (*Peromyscus maniculatus*); however, other species of wild rodents, including the white-footed mouse (*Peromyscus leucopus*), the rice rat (*Oryzomys palustris*), and the cotton rat (*Sigmodon hispidus*), can carry Hantaviruses. Rodents infected with Hantaviruses are asymptomatic and shed the virus in their urine, saliva, and feces.

Human infections occur primarily through inhalation of aerosolized rodent saliva, urine, or feces. Transmission can also occur when rodent excreta come in contact with broken skin or conjunctiva, by ingestion of contaminated food, or rarely through rodent bites. The Hantaviruses found in the U.S. have not been shown to be transmitted by domestic animals or any species other than some specific rodent hosts. Domestic pets, including cats and dogs, can put humans at-risk if they bring infected rodents into contact with people. No evidence exists that HPS can be passed through human-to-human transmission.

About 90% of human Hantavirus infections are caused by household or occupational exposure including sweeping and other cleaning activities in a peridomestic setting (e.g., homes, sheds, barns). Potentially occupationally acquired cases of HPS are infrequent and many individuals had concurrent peridomestic exposures. However, potentially occupationally acquired HPS patients have included grain farmers, an extension livestock specialist, field biologists, and agricultural mill, construction, utility, and feedlot workers. While the majority of HPS cases are caused by peridomestic exposure, humans can also be exposed during recreational activities.

Even though the exact the incubation period for HPS is unknown, symptoms may develop between 1 and 5 weeks after exposure. Early symptoms are flu-like including fever, myalgia, and chills. Other frequently reported symptoms are headache, nausea and vomiting, abdominal pain, diarrhea, cough, and malaise. Between four to ten days after the initial

flu-like symptoms, the late symptoms of HPS appear. HPS targets the lungs and can cause respiratory distress, including coughing and shortness of breath. HPS can be diagnosed by serologic assays or immunohistochemistry. Treatment of HPS is supportive as no specific treatment or cure exists. Early identification of HPS and prompt intensive medical care results in better patient outcomes. Eliminating or minimizing contact with rodents is the best way to help protect yourself from HPS.

Veterinarians & Clinicians can encourage the public to reduce their risk for HPS by taking the following actions:

- **Seal Up:** Seal up holes and gaps inside and outside the home and other buildings to keep rodents out.
- **Trap Up:** Trap rodents around the home to reduce the population.
- **Clean Up:** Take precautions while cleaning rodent-infested areas.
 - Never sweep or vacuum mouse droppings, urine, or nesting material.
 - If you are cleaning an outbuilding, air out the building for at least thirty minutes before cleaning.
 - Wear rubber or plastic gloves.
 - Soak the potentially infected area with a mixture of bleach and water (1:9 ratio). Let the mixture sit for at least five minutes, then use a paper towel to wipe up the droppings, urine, or nesting material and throw away the paper towel. Finish cleaning with disinfectant or bleach solution.
 - Disinfect your gloves and throw them away and wash hands thoroughly.

The Deer Mouse



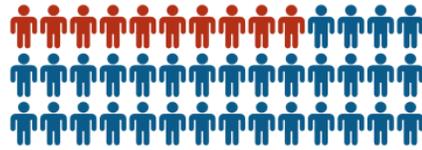
- Found throughout North America.
- Has large eyes and ears.
- 4–9 inches long from head to tip of tail.
- Pale grey to reddish brown. It always has white fur on its belly, feet, and underside of its tail.

Animal Sin Nombre Virus Infections

In Montana, the deer mouse is the major host of Hantavirus. Although Hantavirus infected deer mice are asymptomatic, a field study conducted in Montana found a decrease in the survival of infected deer mice.

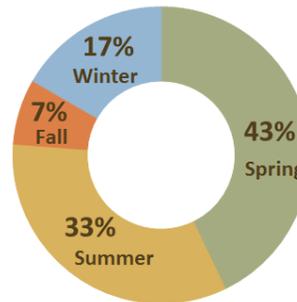
Hantaviruses are shed in the infected rodent's urine, feces, and saliva. The virus is transmitted horizontally and directly in the population. Transmission occurs during aggressive encounters or through inhalation of aerosolized virus. Once a mouse has contracted the virus, the infection appears to be lifelong. However, some studies indicate that infected mice move from an acute phase to a chronic phase. Long-term studies of the rodent reservoir population in Montana demonstrate that deer mice with antibodies to Hantaviruses tend to be male, older, sexually mature, and involved in aggressive encounters. Recently infected mice shed a large amount of virus and might be most infectious in the first few months after the virus is contracted.

Hantavirus in Montana



From 1993 through 2015, 42 cases of Hantavirus were reported in Montana. 10 (24%) cases were fatal.

Hantavirus cases by season — Montana, 1993-2015



Hantavirus can occur in Montana during any time of year. Studies suggest that humans are at the most risk for acquiring SNV in the early to middle period of the deer mouse breeding season (spring -summer).

Sin Nombre Virus Key Points

Human Health

- Clinicians, veterinarians, and animal health care workers should counsel clients about Hantavirus pulmonary syndrome and measures to reduce their risk of infection.
- Clinicians should ask patients with clinical signs and symptoms consistent with HPS about their potential exposure to rodents and rodent droppings, urine, or nesting materials.
- Report all suspected cases of Hantavirus pulmonary syndrome or infection immediately to the local health departments (ARM 37.114.101).

References:

1. Calisher CH, Mills JN, Root JJ, Doty JB, Barry BJ. The Relative Abundance of Deer Mice with Antibody to Sin Nombre Virus Corresponds to the Occurrence of Hantavirus Pulmonary Syndrome in Nearby Humans. *Vector-Borne and Zoonotic Diseases*. 2011;11(5):577-582.
2. Centers for Disease Control and Prevention. Facts About Hantaviruses: What You Need To Know to Prevent the Disease Hantavirus Pulmonary Syndrome (HPS). http://www.cdc.gov/hantavirus/pdf/hps_brochure.pdf [Accessed March 2, 2016]
3. Centers for Disease Control and Prevention. Hantavirus. <http://www.cdc.gov/hantavirus/> [Accessed March 2, 2016]
4. Centers for Disease Control and Prevention. Hantavirus Pulmonary Syndrome (HPS). <http://www.cdc.gov/hantavirus/hps/index.html> [Accessed March 2, 2016]
5. Centers for Disease Control and Prevention. Information for Health Care Workers. <http://www.cdc.gov/hantavirus/health-care-workers/index.html> [Accessed March 2, 2016]
6. Centers for Disease Control and Prevention. Reported Cases of HPS. <http://www.cdc.gov/hantavirus/surveillance/index.html> [Accessed March 2, 2016]
7. Centers for Disease Control and Prevention. Rodents in the United States that Carry Hantavirus. <http://www.cdc.gov/hantavirus/rodents/index.html> [Accessed March 2, 2016]
8. Centers for Disease Control and Prevention. Technical/Clinical Information. <http://www.cdc.gov/hantavirus/technical/index.html> [Accessed March 2, 2016]
9. Cline BJ, Carver S, Douglass RJ. Relationship of Human Behavior within Outbuildings to Potential Exposure to Sin Nombre Virus in Western Montana. *Ecohealth*. 2010;7(3):389-393
10. Douglass RJ, Van Horn RC, Coffin KW, Zanto SN. Hantavirus in Montana Deer Mouse Populations: Preliminary Results. *Journal of Wildlife Diseases*. 1996;32(3):527-530.
11. Douglass RJ, Calisher CH, Wagoner KD, Mills JN. Sin Nombre Virus Infection of Deer Mice in Montana: Characteristics of Newly Infected Mice, Incidence, and Temporal Pattern of Infection. *Journal of Wildlife Diseases*. 2007;43(1):12-22
12. Knust, B., Rollin PE. Twenty-Year Summary of Surveillance for Human Hantavirus Infections, United States. *Emerg Infect Dis*. 2013;19(10):1934-37.
13. Luis AD, Douglass RJ, Hudson PJ, Mills JN, Bjørnstad ON. Sin Nombre Hantavirus Decreases Survival of Male Deer Mice. *Oecologia*. 2012;169:431-39.
14. Richardson KS, Kuenzi A, Douglass RJ, Hart J, Carver S. Human Exposure to Particulate Matter Potentially Contaminated with Sin Nombre Virus. *Ecohealth*. 2013;10(2):159-165.
15. Yates TL, et al. The Ecology and Evolutionary History of an Emergent Disease: Hantavirus Pulmonary Syndrome. *BioScience*. 2002;52(11):989-998.