



# Zoonoses Associated with Wild Rodents, including *Peromyscus leucopus* (White-footed mouse) and *P. maniculatus* (Deer mouse)

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This information is for field researchers whose contact with rodents occurs primarily in open field environments.

Wild mice, including *Peromyscus leucopus* (white-footed mouse) and *P. maniculatus* (deer mouse) voles, rats and other wild rodent species can spread diseases to people. Often these diseases do not make the animal appear sick but can cause serious illness in humans. Staff, students and faculty must receive clearance from University Health Services prior to conducting field research with wild rodents.

Zoonotic diseases associated with wild rodents include rat bite fever, tularemia, hantavirus, lymphocytic choriomeningitis virus, other arenavirus infections, leptospirosis, salmonellosis, yersiniosis, pathogenic *E. coli* infections, campylobacteriosis, giardiasis, and Lyme disease.

## Hantavirus

Hantaviruses in the Americas are known as “New World” hantaviruses and may cause hantavirus pulmonary syndrome (HPS). Other hantaviruses, known as “Old World” hantaviruses, are found mostly in Europe and Asia and may **cause** hemorrhagic fever with renal syndrome (HFRS).

In North America, hantavirus can be transmitted from white-footed and deer mice (*Peromyscus leucopus* and *P. maniculatus*), harvest mice (*Reithrodontomys*), rice rats (*Oryzomys*), cotton rats (*Sigmodon*), other rodents such as voles (*Microtus*). Transmission of hantaviruses to humans is believed to result primarily from inhalation of aerosolized feces, urine or saliva from infected mice in mouse-infested structures (cabins, sheds, etc.). Detection of high viral titers in the saliva of deer mice suggests that transmission via a bite from an infected mouse also is a probable means of transmission. Fresh feces and urine in and on traps, although not easily aerosolized, still have the potential for transmission via scratches or contact with the mouth or eyes via the hands.

Early symptoms include fatigue, fever and muscle aches, especially in the large muscle groups—thighs, hips, back, and sometimes shoulders. These symptoms are universal. There may also be headaches, dizziness, chills, and abdominal problems, such as nausea, vomiting, diarrhea, and abdominal pain. About half of all patients experience these symptoms. Four to 10 days after the initial phase of illness, the late symptoms of HPS appear. These include coughing and shortness of

breath, with the sensation of, as one survivor put it, a "...tight band around my chest and a pillow over my face" as the lungs fill with fluid. HPS can be fatal. It has a mortality rate of 38%.

### **Lymphocytic Choriomeningitis Virus (LCMV)**

Humans become infected by inhaling infectious aerosolized particles of rodent urine, feces, or saliva; by ingesting food contaminated with virus; by contamination of mucous membranes with infected body fluids; or by directly exposing cuts or other open wounds to virus-infected blood. Symptoms are flu-like and include fever, headache, muscle pain and malaise and may progress to more serious illness including meningoencephalitis, lymphadenopathy and neurologic impacts.

### **Rat-Bite Fever**

Rat Bite Fever caused by *Streptobacillus moniliformis* or *Spirillum minus* is a bacterial infection of rodents that is transmitted through bites, scratches, direct contact with animals and their urine, saliva and feces or ingestion of contaminated food or water. Infected rodents typically exhibit no symptoms of disease. Symptoms develop within 3-10 days, are flu-like and include fever, chills, muscle pain and headache. A rash may develop after fever onset. Without treatment, rat-bite fever can be serious or potentially fatal. Severe illnesses can include infections involving the heart, brain, lungs and abscesses in internal organs.

### **Tularemia**

Infected rodents appear lethargic, but they may shed bacteria before showing illness. Any wild rodent may carry tularemia but aquatic rodents such as beaver and muskrats have higher carriage rates. Tularemia is transmitted to people in the same manner as rat bite fever but in addition can be transmitted through the bite of an infected tick and via airborne transmission if feces, urine or body fluids are aerosolized. Both diseases in humans initially present as a fever, headache, swollen lymph nodes and possibly a rash or ulcer in the area of a recent bite or scratch wound. Any bites or scratches should be thoroughly washed immediately to minimize the chance of infection.

### **Enteric Pathogens**

Salmonellosis, pathogenic *E. coli* infections, campylobacteriosis, and giardiasis are acquired by contact and accidental ingestion of fecal material from infected rodents. Animals infected with these diseases may have diarrhea, but some may show no symptoms of disease. Any animal with diarrhea should be suspected of having a zoonotic disease. Symptoms in people include diarrhea, vomiting, and abdominal cramps.

### **Lyme Disease**

Wild rodents, like other wildlife, can serve as a reservoir for Lyme disease. The causative agent is the bacterium *Borrelia burgdorferi*, which is transmitted to animals and people through the bite of an infected tick. Symptoms in people include a characteristic skin rash known as erythema migrans that appears at the site of the tick bite, as well as fever, headache, and fatigue. If not treated, the disease can progress to affect the joints, the heart, and the nervous system.

## Prevention

Transmission of zoonotic diseases from rodents is primarily by direct contact, bites, indirect contact with contaminated objects, oral ingestion or inhalation of aerosolized bedding, feces and urine.

1. Do not eat, drink, apply cosmetics or use tobacco products while handling animals, traps or materials that have come in contact with rodent feces, urine or saliva.
2. Field researchers should not use a cabin or structure that shows evidence of current or prior occupation by rodents until the structure is thoroughly cleaned. Because feces and other signs of rodents known to transmit hantaviruses can be difficult to distinguish from those of nonhantavirus-transmitting species, workers should be conservative and assume that small feces and other rodent signs pertain to hantavirus-transmitting species. Because *Hantavirus* infection is thought to be acquired primarily by inhalation, efforts should be made to minimize aerosolization of dust inside the dwelling; don't dry sweep; spray surfaces with disinfectant, use a mop rather than a broom, and wear an EHS-assigned respirator and coveralls that can be laundered or disposed of after the initial cleaning. Once the dwelling is cleaned, workers should maintain a program of removal of small mammals from the structure by live or kill trapping, following the recommendations below. Hantaviruses are readily killed by contact with common disinfectants (e.g., 10% bleach).
2. When handling rodents or soiled live traps, wear an EHS- assigned respirator. All handling of rodents known to transmit viruses should be done in the open.
3. Live traps containing rodents known to transmit zoonotic agents, including hantavirus, should not be transported within a vehicle unless they are securely isolated in intact plastic bags (e.g., large garden bags) or otherwise placed in an area in which air circulation is separate from that of the driver and any passengers.
4. Researchers should avoid direct contact with urine, feces, saliva, blood, and internal organs of rodent species associated with hantavirus and other zoonotic diseases. Eye protection, rubber or nitrile gloves and EHS-assigned respirators are recommended when handling or doing invasive procedures.
5. In the unlikely event that a field researcher is bitten, scratched, or comes into direct contact with the fluids of rodents, the affected area should be washed thoroughly with soap and water, then disinfected with an alcohol-based hand sanitizer.
6. Be aware of the symptoms of hantavirus infection which include severe muscle aches, fever, and headaches. If these flu-like symptoms appear within 6 weeks after fieldwork, the person should see a physician immediately and report that he or she might have been exposed to *Hantavirus* or other rodent-associated zoonotic diseases.

**Hand washing** is the most important measure you can take to prevent transmission of zoonotic organisms. Wash your hands with warm water and soap after handling rodents, soiled bedding or soiled cages.

## Report injuries or illnesses to your supervisor and University Health Services

Cleanse bite and scratch wounds immediately with soap and warm water. Report rodent bites and scratches, no matter how minor, to University Health Services.

### University Health Services

- Student Health: 609-258-3141
- Occupational Health: 609-258-5035

**Note:** Persons with specific medical conditions such as a chronic illness, immunodeficiency and pregnancy may be at higher risk of developing disease or complications from a zoonotic disease and must consult with a University Health Services clinician before working with animals.

**Always tell your treating physician about your research.** Regardless of your symptoms, tell your physician about the work you do in the laboratory.

### References

Barbour AG. Infection resistance and tolerance in *Peromyscus* spp., natural reservoirs of microbes that are virulent for humans. *Semin Cell Dev Biol.* 2017;61:115-122. doi:10.1016/j.semcdb.2016.07.002

Douglas A. Kelt, Mark S. Hafner, The American Society of Mammalogists' ad hoc Committee for Guidelines on Handling Rodents in the Field, Updated guidelines for protection of mammalogists and wildlife researchers from hantavirus pulmonary syndrome (HPS), *Journal of Mammalogy*, Volume 91, Issue 6, 16 December 2010, Pages 1524–1527, <https://doi.org/10.1644/10-MAMM-A-306.1>

Kelt DA, Van Vuren DH, Hafner MS, et al. Threat of Hantavirus Pulmonary Syndrome to Field Biologists Working with Small Mammals. *Emerging Infectious Diseases.* 2007;13(9):1285. doi:10.3201/eid1309.070445.