

5. TRANSMISSION TO HUMANS

Although rodent infection is apparently asymptomatic, human infection is often associated with disease. The main route of transmission is likely respiratory via small-particle aerosols generated from rodent excreta, particularly freshly shed urine. However, it is also possible that infectious airborne particles may be generated during human activities that disturb contaminated soil, litter, or nesting materials. The chance of exposure to hantaviruses is greatest when individuals work, play, or live in closed spaces where there is an active rodent infestation. Human infection does not appear to be limited to a particular age, race, ethnic group, or gender.

It is unknown if direct transmission can occur when larger particles contact ocular, nasal, or oropharyngeal mucous membranes. However, small skin breaks and rodent bites are probably effective but uncommon routes of human infection. Ticks, fleas, mosquitoes, and other biting arthropods are not known to have a role in the transmission of hantaviruses. Although cats and dogs are not known to be a reservoir host of hantaviruses, these domestic animals may bring infected rodents into contact with humans.

Hantaviruses have lipid envelopes and are susceptible to 10% bleach, detergents, and common hospital disinfectants. How long these viruses survive in the environment after being shed is uncertain (24). In laboratory experiments simulating environmental conditions,

Hantaan virus could still be recovered for several days after drying at room temperature. The virus was viable for short periods of time in temperature ranges of 4 °C to 42 °C and pH ranges of 6.6 to 8.8. These findings indicate that Hantaan virus and presumably all other hantaviruses may remain infectious for up to several days in natural conditions (55).

Hantaviruses have never been implicated in nosocomial transmission in European or Asian settings despite the large number of cases observed and hospitalized. During the 1993 SNV outbreak in the United States, neither clinical disease nor seropositivity was found among more than 266 health care workers, including persons who had performed mouth-to-mouth resuscitation or endotracheal intubation (27).

Person-to-person transmission was documented in a South American outbreak of Andes virus in 1996 (43, 44, 48). It is unknown if this represents a unique event or whether other such cases may occur. A retrospective analysis of the United States HPS Case Registry failed to find definitive evidence for interhuman or nosocomial spread; the few case clusters observed could well have originated from common exposure to rodent-infested living conditions. Further study of the epidemiology of naturally occurring infections is needed in order to understand the potential that the newly discovered American hantaviruses have for contagion.