

A feasibility study for implementing a research program  
to investigate the occurrence and prevalence of Sin Nombre Hantavirus  
in the Lewiston/Clarkston Region

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**Introduction:**

In 1993, a previously unknown respiratory disease took the lives of 10 people over an 8-week period in the Four Corners region of the United States (CDC 2006). The Center for Disease Control and Prevention (CDC) identified a previously unknown hantavirus (family Bunyaviridae) to become known as Sin Nombre virus (SNV) as the pathogenic agent. This discovery and the fact that other known hantaviruses are transmitted to humans from rodents led to intense trapping of local rodent populations to determine the host (CDC 2006). They tested many different rodents and found some level of Hantavirus in each, but Hantavirus was most prevalent in the deer mouse (*Peromyscus maniculatus*) with 30% of the mouse population testing positive for the SNV (Nichol et al. 1993). Since that outbreak, there have been 416 reported cases throughout the United States through 2006 with a large proportion of the cases occurring in the Rocky Mountain States, including Idaho (Fig. 1).

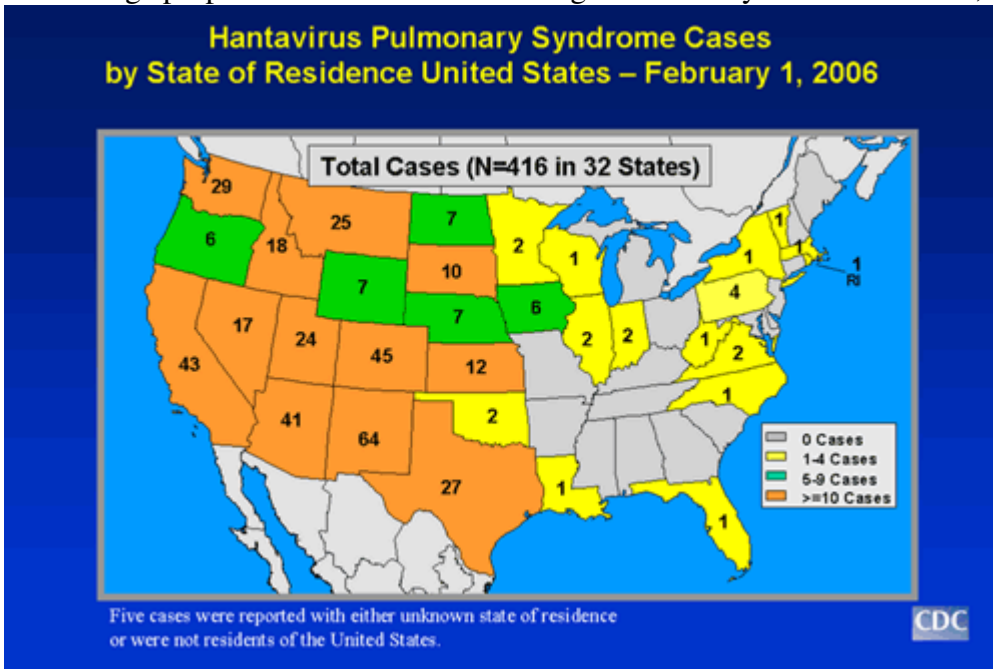


Figure 1. Hantavirus Pulmonary Syndrome Cases by State of Residence United States

Hantaviruses are negative-stranded RNA viruses usually associated with New World mice in the family Muridae (CDC 2006) which are common and widespread throughout North America (Hall 1959). Rodents known to be hosts of the SNV are not usually associated with urban environments, with the exception of some species, such as the deer mouse (*P. maniculatus*) (CDC 2006). The deer mouse is of particular importance due to its widespread distribution (Fig. 2) and its generalist tendencies regarding habitat association, including rural and suburban habitats. The deer mouse is found west of the Appalachian Mountains and north and west of the Southeastern States, where most of the cases of Hantavirus Pulmonary Syndrome (HPS) have been documented (Fig. 2).

The SNV is transmitted to humans through the aerosolization of desiccated mouse feces, urine, and saliva with exposure usually leading to Hantavirus Pulmonary Syndrome (HPS), a potentially deadly respiratory infection with a fatality rate of 38% in known cases (CDC 2006). Symptoms of Hantavirus pulmonary syndrome (HPS) infection include fever, deep muscle aches, and severe shortness of breath (CDC 2006). There is no current evidence to suggest human to human transmission or transmission from non-rodent animals to humans (Wells 1997).

Since the initial description of SNV, numerous investigators throughout the United States have conducted studies to examine the prevalence of the virus in rodent populations and how the ecology of the host species affects the persistence and transmission of virus (Douglass 1996, Jay 1997, Boone et al. 1998, Kuenzi 2001, Yates et al. 2002). Studies have shown that the virus is sporadic in its appearance in some deer mice populations and not associated with fluctuations in rodent populations (Graham and Chomel 1997, Calisher et al. 2005), but a great deal of information is still needed on the relationship between the dynamics of the virus and the populations of its host species.

Many cases of HPS have been documented in all of the Northwestern States (Washington, Oregon, Idaho, and Montana; Fig. 2). The majority of the cases in Idaho have been restricted to the southern half (Hahn and Tengelsen 2002) with one case in northern Idaho in 1994 in which the location of contraction was in question (Desert News 1994). Given the lack of data on Hantavirus in northern Idaho, there is a need to explore the possibilities of its occurrence in the region. Due to the prevalence of documented cases of Hantavirus in surrounding areas (Fig. 1 and Fig. 2), the likelihood of finding the virus in urban and rural populations within the Lewiston-Clarkston valley does exist. However, some studies revealed a trophic cascade effect between precipitation levels, plant productivity, and deer mouse (*Peromyscus maniculatus*) densities, resulting in higher risk of exposure to rodents potentially carrying Hantavirus in areas where precipitation levels and, consequently, primary productivity are high (Yates et al. 2002). Continuation of these studies support this delayed density-dependent association between rodent density, prevalence of SNV, and increased numbers of HPS cases. The relatively dry climate of the Lewis-Clark valley (318 mm average annual rainfall) lends itself to deer mouse populations remaining relatively stable at low densities, leading to low levels of the virus in local populations. The lack of regional data is justification enough for this study, but the long term ramifications regarding human health and welfare are of importance as well.

This preliminary study was to investigate the feasibility of setting up a hantavirus research program at Lewis-Clark State College, involving undergraduate students. In the fall of 2006, I was given an INBRE-funded course release to pursue this endeavor. At the outset of the project, I came up with a list of mileposts to help gauge my progress. Below is a list of those mileposts along with the outcomes of achieving them.

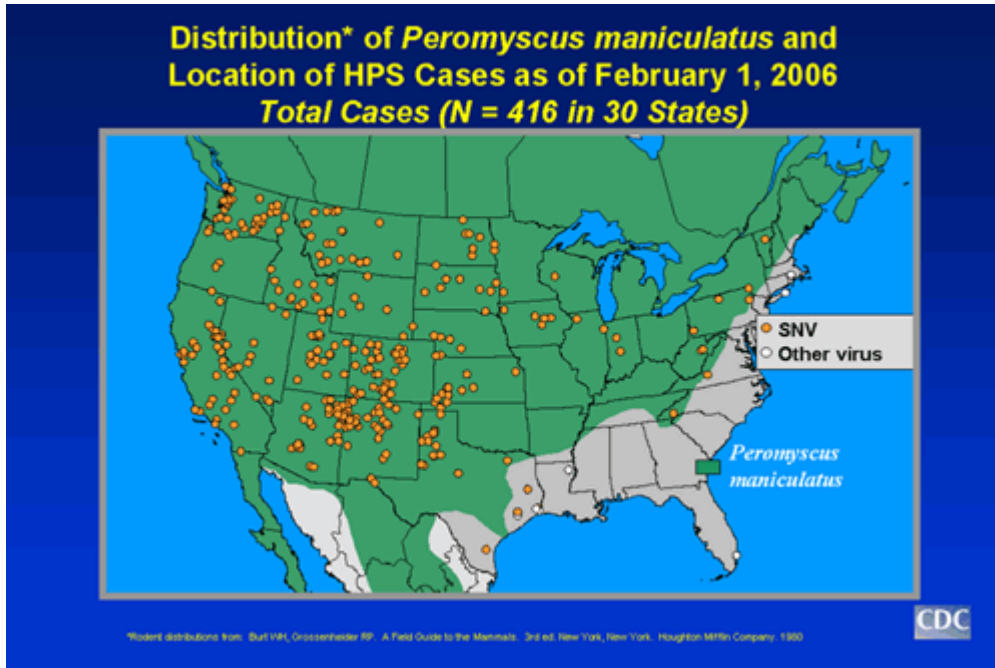


Figure 2. Distribution of *P. maniculatus* and Location of HPS cases as of Feb. 1, 2006.

### Milestones for INBRE course release Fall 2006

**Milestone:**

**Projected date:**

**Completed:**

- |   |                   |                  |
|---|-------------------|------------------|
| 1. <i>Submit proposal for exploratory research</i>    | 1 September 2006  | 1 September 2006 |
| 2. <i>Search primary literature</i>                   | 30 September 2006 | 6 October 2006   |
| 3. <i>Set up study grid at Hell's Gate State Park</i> | 21 September 2006 | 5 October 2006   |
| 4. <i>Pursue required animal handling protocols</i>   | 31 October 2006   | 6 November 2006  |

As part of my ecology class during the Fall semester of 2006, my students and I installed a permanent trapping grid out at Hell's Gate State Park over the course of three weeks (21 Sept.–5 Oct.). We have not commenced trapping yet, due to public disturbance to the grid before trapping could be started. Grid stakes were pulled up and have to be put back in place before any trapping can occur. I will also need to talk with the park ranger, Mike McElhatton, about how to handle future encounters with the public as this site is on public land.

After talking with Carolyn Bohach (the director for the Idaho INBRE grant), this project would require the establishment of an Institutional Animal Care and Use Committee (IACUC) at Lewis-Clark State College (LCSC) if funding from INBRE was to be used. It could be done under the umbrella of the University of Idaho's IACUC, but that would preclude pursuing funding through INBRE, causing me to have to pursue other sources of funding. I am currently looking into the possibility of forming such a committee at LCSC.

5. *Make necessary contacts* 30 November 2006 19 October 2006

As an initial step, I contacted Rick Douglass who conducted studies examining the ecology of hantavirus and its primary host (*P. maniculatus*) in Montana. His advice was very helpful in regards to what protocols were necessary and a number of suggestions in terms of logistics and funding. I also contacted Carolyn Bohach, the director of the Idaho INBRE grant, as to the necessary procedures that I would need to adhere to in order to receive further funding from INBRE.

6. *Investigate cost of research* 30 November 2006 30 November 2006

<b><u>ITEM:</u></b>	<b><u>Quant:</u></b>	<b><u>Price:</u></b>
Sherman live traps (LNG12 7.62 x 8.89 x 30.48 cm) (@18.05 ea) H.B. Sherman traps	100	\$1805.00
Monel no. 1 ear tags (@\$10.14/100) National Band and Tag Co.	500	\$50.70
Compound applicator (1005-1s) (@\$16.22 each) National Band and Tag Co.	2	\$32.44
North Safety CFR-1 Respirator (@ \$11.85 ea.)	5	\$59.25
Field supplies and equipment		<u>\$1000.00</u>
		\$2947.39

7. *Recruit 1–2 students to work on project* 15 December 2006 pending

I had Justin Schultz working with me on this project throughout the fall semester 2006 until he transferred to BSU for the spring semester. As of right now I do not have a student currently working on the project. If I decide to go ahead with pursuing this research, I will recruit students before the end of the spring semester 2007.

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