

Major effort to stave off hantavirus at Yosemite National Park

May 28 2013, by Eryn Brown

Sisters Lauren Scott and Patrice Fambrini stood near the check-in desk of Curry Village, a quaint collection of tents and cabins in Yosemite National Park, and considered the merits of their lodgings.

Last year, three people died and six more became ill after staying at the campground - infected by a rare, mysterious and usually dangerous rodent-borne illness known as hantavirus.

"The way these were constructed created a habitat for the mice to be there," Fambrini said nervously.

Scott, a longtime fan of the camping area, was unfazed: "You're in the woods!"

It may not have been apparent to the sisters, but Curry Village has become ground zero of a multimillion-dollar effort to make Yosemite safe - or as safe as any rural place can be - from an illness carried by creatures who can burrow into a hole the width of a pencil. Changes to the park's far-flung facilities will get tested this summer, as an expected 1.8 million visitors fan out across its 1,200 square miles and share turf with all sorts of wild beasts.

The park visitors who contracted hantavirus had inhaled large quantities of dust containing urine, saliva and fecal matter from infected [deer mice](#). To try to keep that from happening again, workers have been plugging crannies in buildings, hanging screens on staff and guest lodgings, and

reinforcing "bear boxes," all to keep the little critters from nesting anywhere near people.

It's an undertaking that's considerably more difficult than guarding against ferocious predators, said Mark Gallagher, environmental manager at Yosemite for Delaware North Cos., which operates Curry Village and other lodging facilities in the park.

"Keeping a bear out is easy - your enclosure just has to be strong," Gallagher said. "With a mouse, you really have to pay attention to detail."

Signs that something was awry in Yosemite began with the case of a visitor who had stayed in Curry Village's so-called signature cabins - canvas tents fortified with sheetrock walls - in June. The patient suffered fatigue and fever, and had trouble breathing. Tests revealed hantavirus. The patient recovered.

The Sin Nombre strain of hantavirus was identified in the Four Corners region of the Southwest in 1993, and it's typical for a handful of people to fall ill each year. But those cases are usually isolated. So when a second patient who had stayed at Curry Village in June tested positive for the virus, public health investigators began to worry about an outbreak.

The second patient died, according to media reports.

Investigators from the California Department of Public Health, the National Park Service and the U.S. Centers for Disease Control and Prevention started pouring into Yosemite. Park operators fielded hundreds of worried calls each day from recent visitors who now had a case of the chills, or a child with a cough. Staff shut down the signature cabins and began contacting the 250,000 people who had stayed

overnight in the park that summer.

State health officials drew blood from 569 Yosemite employees to see if any of them had been exposed. Fewer than 1 percent showed evidence that they had.

Across the country in Atlanta, CDC biologists retreated into high-security laboratories to test blood from the sick and tissue from the dead.

Hantavirus is deadly because it provokes a very strong response from the body's immune system, said Dr. Barbara Knust, an investigator in the CDC's viral special pathogens branch who was involved in the Yosemite response.

When a person is infected, white blood cells release chemicals that work to kill the virus. But organs can suffer collateral damage. In the lungs, Knust said, the chemicals cause the cells that line blood vessels to leak fluid into air spaces, making it hard to breathe. They also interfere with the heart's ability to pump blood and maintain pressure in the circulatory system.

Ultimately, 10 hantavirus cases were confirmed: nine in people who had lodged in the signature cabins and one in a man who had stayed at the park's High Sierra Camps, about 15 miles away.

To gauge the extent of the deer mouse infestation, experts from the state health department drew blood samples from more than 100 wild mice. In Curry Village, 14 percent tested positive for the virus. That was in line with historical averages in the state.

"The problem was something else," said Tom Medema, chief of interpretation at Yosemite.

One potential culprit was the design of the signature cabins. When state health investigators peered between their canvas tent exteriors and sheetrock interiors, they found droppings and shredded insulation.

Mice - and possibly, hantavirus - had been making themselves at home.

By February 2013, Delaware North had torn down all 91 of Curry Village's signature cabins. The company was still building replacement cabins when the new season officially began in March. On the western end of the village near the Happy Isles trail head, workers had draped yellow caution tape from tree to tree and had posted a "Stay out" sign. Bright white canvas draped new tent-cabins built without inner walls.

Older tent-cabins that were built without sheetrock walls were also getting retrofits.

In all, 424 tent-cabins were supposed to be ready by Memorial Day, said Steve Ullmann, director of facilities for Delaware North at Yosemite.

Inside cabin 326, a "traditional heated tent" that was getting a retrofit, Ullmann pointed out some of the improvements his crews were putting in place.

A poster with details about hantavirus was secured to a wall above a gas heater. Gas lines to the heater were now routed through the floor instead of punched through the tent's canvas walls, which were now heavier. Edges of canvas were reinforced with doubled layers of material. Door stays and thresholds were thicker and tougher.

"If a mouse gets in, it's coming through the open door," Ullmann said, adding that if a rodent somehow did prance over the threshold, it wouldn't have anywhere inside to get comfortable.

Crews had installed screens to keep mice from hunkering down in heating units. The bottoms of tent platforms were now a foot off the ground, creating a big enough gap that a mouse wouldn't want to hide there even if it could. Decks on wheelchair-ready cabins, which also created nice nesting spaces, had been removed and replaced with asphalt ramps.

Housekeepers had been trained to recognize signs of mouse activity during their daily cleanings and report any infestations they saw; more thorough inspections would take place twice a season, said Dan Cornforth, general manager of Curry Village.

Following the advice of state health officials, no one would use brooms to sweep. Staff responsible for regular cleaning would wear masks and gloves, spray surfaces with a disinfectant, and use rags and dust mops to wipe everything down.

Other National Park Service contractors were patching up any hole in park-operated facilities that was more than a quarter-inch across. Their territory included the administration building, the visitors center, museums, 200 employee houses, day-care centers, the towering Ahwahnee Hotel and the 2,197 metal bear boxes around the park where visitors are supposed to secure their food.

"You can imagine, these places are decades and decades old," said Medema, the park's interpretation chief. "There's a lot to do."

But no amount of elbow grease can guarantee that people won't get hantavirus again in Yosemite. Mice - including mice with disease - thrive when people are around.

"In a natural habitat, there's very little presence of hantavirus," said Dr. Danielle Buttke, who coordinates the "One Health" effort for the

National Park Service. "It becomes more present in mice when you lose predators."

In Yosemite, those include ring-tailed cats, raccoons, gray foxes, possums, coyotes and bears - all of which tend to stay away from places where people congregate, such as Curry Village. In the predators' absence, Buttke said, mice become bold and gregarious, fighting in public and living in bigger nests. That promotes disease spread.

The situation is even worse when people leave food out. Mice eat the food and multiply. Meanwhile, predators ignore the mice and "go for the Oreos," Buttke said.

A veterinarian who was part of the rapid response team that launched the reconnaissance investigation in Yosemite, Buttke said she wished there was more money for ongoing testing and monitoring that might help scientists better understand the complicated interplay between mice, predators and people in the parks.

The CDC's Knust said that epidemiologists had learned more about hantavirus by studying the Yosemite outbreak. For instance, one of the cases involved a person who seemed healthy but chose to get tested after hearing about the outbreak.

"Severe symptoms are the most common form of the disease, but this did demonstrate that on occasion we do see a less severe form," she said. "Hantavirus cases may be missed because the symptoms can be quite general."

On a recent spring day, most guests checking in at Curry Village were sanguine about the virus' continuing threat.

Santa Rosa resident Matthew Channing practically skipped down the

sidewalk as he prepped for his weekend.

"We are so excited to be here!" he said. "I've camped all my life. You accept the risk."

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