







# Hantavirus

## Surveillance and Prevention

*Navajo Nation Department of Health*  
*Navajo Epidemiology Center*

Partnerships for the Prevention and Control of Vector-Borne Disease in Tribal Communities



# 1993 Hantavirus Outbreak in Four Corners area

Scientific success story:

- New virus discovered (1993)
- Rodent reservoir identified (Deer mouse)
- Public health measures/education

Human tragedy:

- 32 deaths
- Disruption
- Stigmatization
- Lingering mistrust



NEW MEXICO'S LEADING NEWSPAPER

## ALBUQUERQUE JOURNAL

HOME-OWNED AND HOME-OPERATED STATE

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### Deer Mouse May Be Illness Culprit

**DEER MICE POSSIBLE LINK TO MYSTERY ILLNESS**

Deer mice, the rodents whose droppings may be linked to the Four Corners mystery illness, can live in a variety of regions of North America, ranging from mountain climates to swampy areas. Sometimes known as white-footed mice, the deer mouse can range from 2 to 8 inches long. The fur on the upper parts of their bodies is gray, with patches of white on the belly.

Reggie Fletcher, regional ecologist from the U.S. Forest Service, said deer mice can be found almost anywhere in New Mexico. They are most common in ponderosa pine regions, and also in northern sage grassland found in the Four Corners area.

"They will store grass seeds, flower heads and nuts in hollow logs," Fletcher said. "They will store what's available and what they can carry." Fletcher said the deer mouse is a key indication of diversity in the ecosystem, since the rodent is a major prey base for larger animals.



**Tests Show Rodent Is Likely Carrier**

By Rex Graham  
JOURNAL STAFF WRITER

In a major breakthrough, test results point to the lowly deer mouse as the possible carrier for spreading the Four Corners mystery illness that's killed at least 16 people.

A preliminary report to be released Friday by the federal Centers for Disease Control and Prevention says 12 deer mice trapped in and near the homes of some of the mystery illness' victims tested positive for exposure to a Hantavirus.

Hantaviruses are known to be carried by rodents, but never to have caused the kind of severe respiratory disease that recently struck about 30 people in New Mexico, Arizona, Colorado and Utah.

The report says 42 rodents of different types were tested, and 12 of them turned up positive for exposure to a Hantavirus. "All 12 were of the species *Peromyscus maniculatus* (deer mouse)," said the report.

A copy of the report obtained by the Journal also gives another strong piece of evidence that links what researchers think is a new type of Hantavirus with the illness. Hantavirus genetic material was isolated from the tissues of two patients who died recently from the disease.

The findings were made possible by a sophisticated new test called a polymerase chain reaction that can detect tiny amounts of viral genetic material in diseased tissue. Officials also credit unprecedented cooperation between dozens of state and federal health experts for eliminating other possible causes of the epidemic.

For state health workers, many of whom have put in 16-hour days for a month, the CDC report is a watershed.

"We're ecstatic," Dr. Gary Simpson, medical director of infectious diseases for the New Mexico Department of Health, said in a telephone interview Wednesday. "We've come so far so quickly. All

of us are tired. A lot of us are still close to patients' families and feel a lot of pain for them."

The tests did not confirm that the same Hantavirus was responsible for infecting both the mice and people. That association will be proved or disproved in the coming weeks.

The report also does not shed light on how people were infected. "That's the piece that's still unknown. We still have that piece to figure out," said Dr. Norton Kalishman, chief medical officer for the state Department of Health.

Experts assume the victims be-

MORE: See ILLNESS on PAGE A2

Navajos face health issue C1

# Hantavirus Background

- Primary cause of Hantavirus in the U.S. is Sin Nombre Virus (SNV)
- Reservoir for SNV is the deer mouse (*peromyscus maniculatus*)
- Transmission is primarily airborne – rodent droppings and urine
- Incubation period of 1-8 weeks





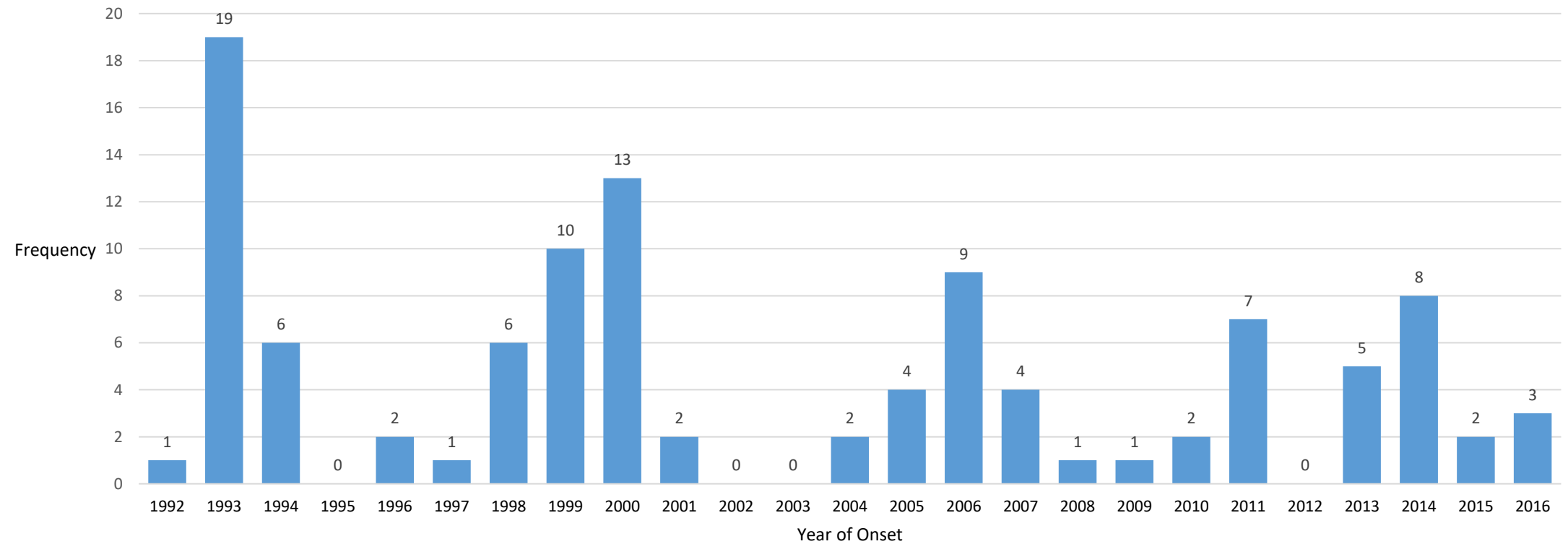


# Incidence



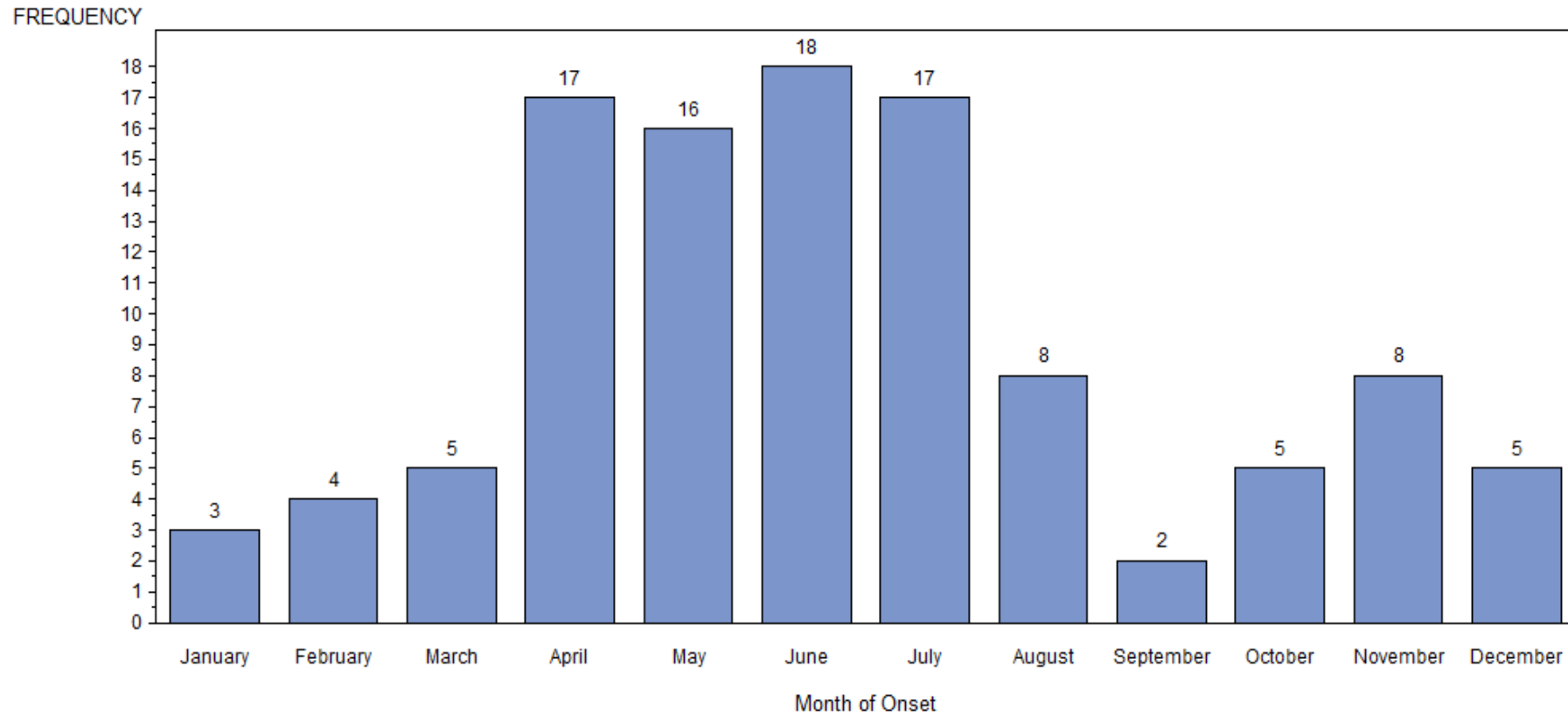
# Incidence by Year

Figure 1. Incidence by Year  
November 1992 - May 2016 (n=108)



# Incidence by Month of the Year

Figure 2. Incidence By Month of the Year, November 1992 - May 2016 (n=108)





# Demographic Distribution

# Distribution by Sex

**Table 2. Distribution by Sex  
(n=108)**

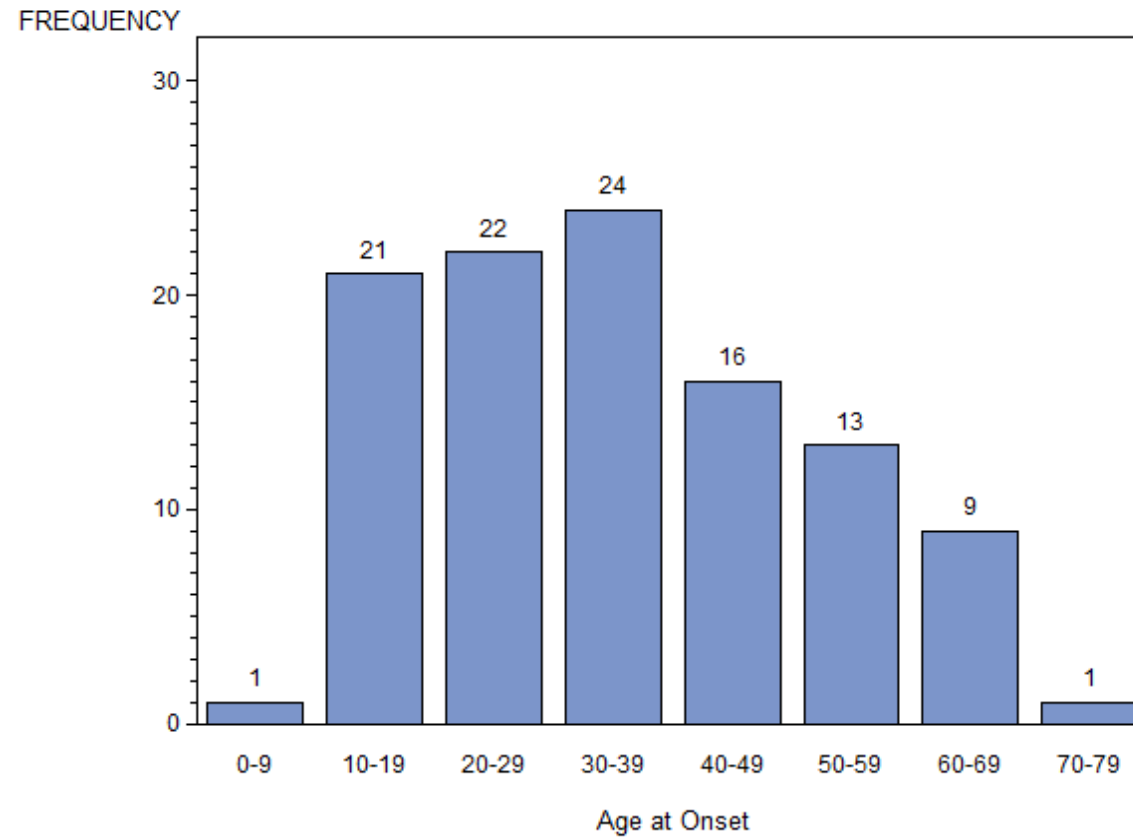
Sex	Count	Percent
Female	56	51.9
Male	52	48.2
Total	108	100

\*Numbers may not sum to 100% due to rounding



# Distribution by Age

**Figure 3. Age at Onset (n=107)**



# Case Fatality Rate

**Table 1. Case Fatality Rate by Year (n=108)**

Year	Total Cases	Non-Fatal Cases	Fatal Cases	Case Fatality Rate
1992	1	0	1	100%
1993	19	10	9	47%
1994	6	3	3	50%
1995	0			N/A
1996	2	2	0	0%
1997	1	1	0	0%
1998	6	2	4	67%
1999	10	5	5	50%
2000	13	9	4	31%
2001	2	1	1	50%
2002	0			N/A
2003	0			N/A
2004	2	1	1	50%
2005	4	2	2	50%
2006	9	7	2	22%
2007	4	2	2	50%
2008	1	1	0	0%
2009	1	1	0	0%
2010	2	1	1	50%
2011	7	4	3	43%
2012	0			N/A
2013	5	4	1	20%
2014	8	2	6	75%
2015	2	1	1	50%
2016	3	1	2	67%
Total	108	60	48	44%



**Table 7. Case Fatality Rate by Age and Sex (n=107)**

Age Group	Gender	Total Cases	Non-Fatal Cases	Fatal Cases	Case Fatality Rate
0-9	Female	1	1	0	0%
	Male	0	0	0	N/A
10-19	Female	12	7	5	42%
	Male	9	6	3	33%
20-29	Female	9	6	3	33%
	Male	13	8	5	38%
30-39	Female	12	6	6	50%
	Male	12	5	7	58%
40-49	Female	9	4	5	56%
	Male	7	6	1	14%
50-59	Female	5	1	4	80%
	Male	8	6	2	25%
60-69	Female	7	1	6	86%
	Male	2	1	1	50%
70-79	Female	0	0	0	N/A
	Male	1	1	0	0%
Total		107	60	47*	44%

\*Number differs from Table 1 because age is missing for one female case

# Geographic Distribution

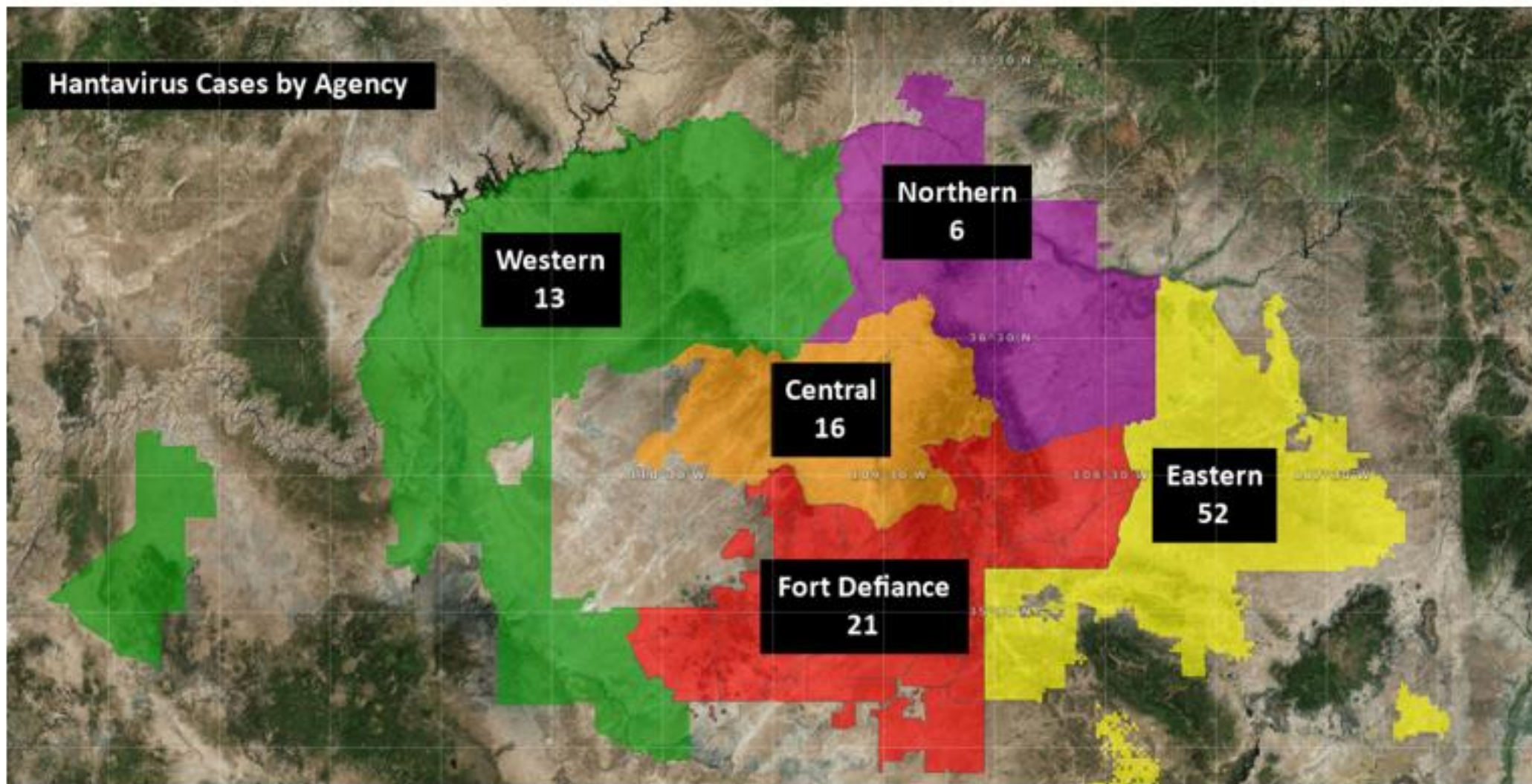


# Distribution by Reporting State

**Table 9. Distribution by Reporting State (n=107)**

Reporting State	Count	Percent
NM	60	56.1
AZ	46	43
CO	1	0.9
Total	107	100

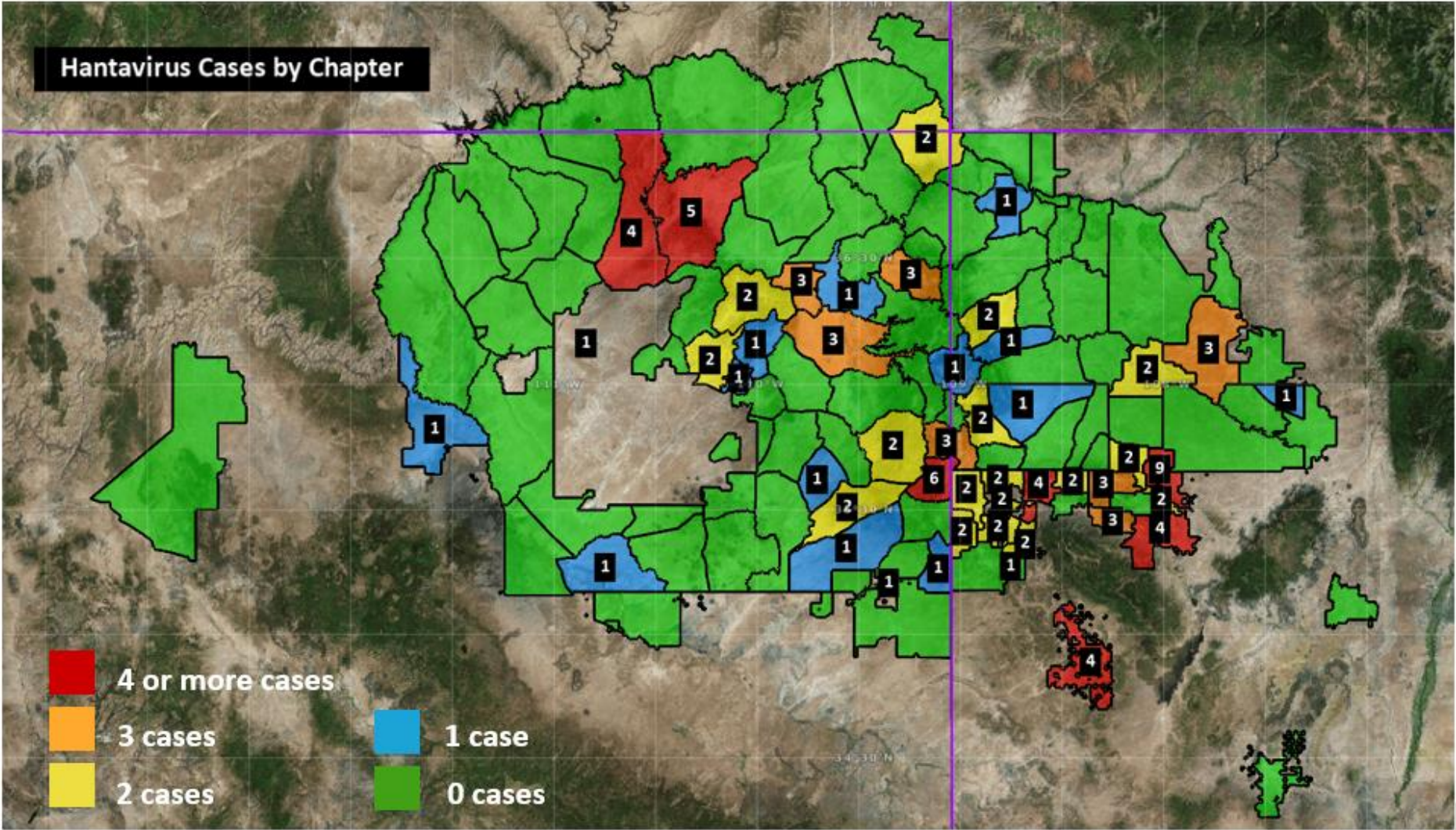
Figure 5. Distribution by Agency (n=108)\*



\*Border town exposures were incorporated into nearest agency (n=4).



Figure 4. Distribution by Chapter (n=107)\*



\*This map does not include one case with probable exposure in Phoenix.



# Exposure Information

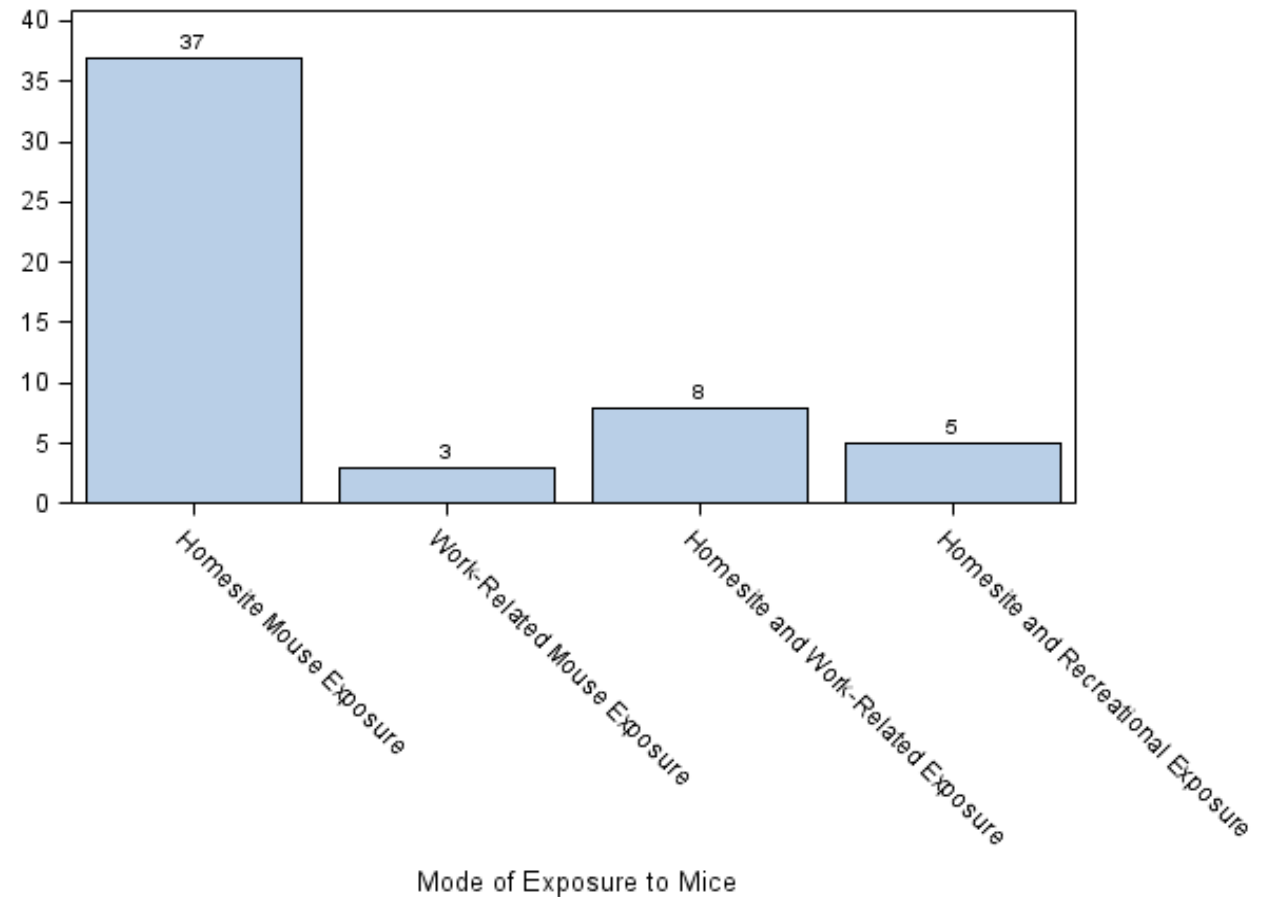


# Mode of Exposure

**Table 10. Distribution by Mode of Exposure (n=53)**

Type of Mouse Exposure	Count	Percent
Homesite	37	69.8
Work-Related	3	5.7
Recreational	0	0
Homesite and Work-Related	8	15.1
Work-Related and Recreational	0	0
Homesite and Recreational	5	9.4
Total	53	100

**Figure 6. Distribution by Mode of Exposure (n=53)**

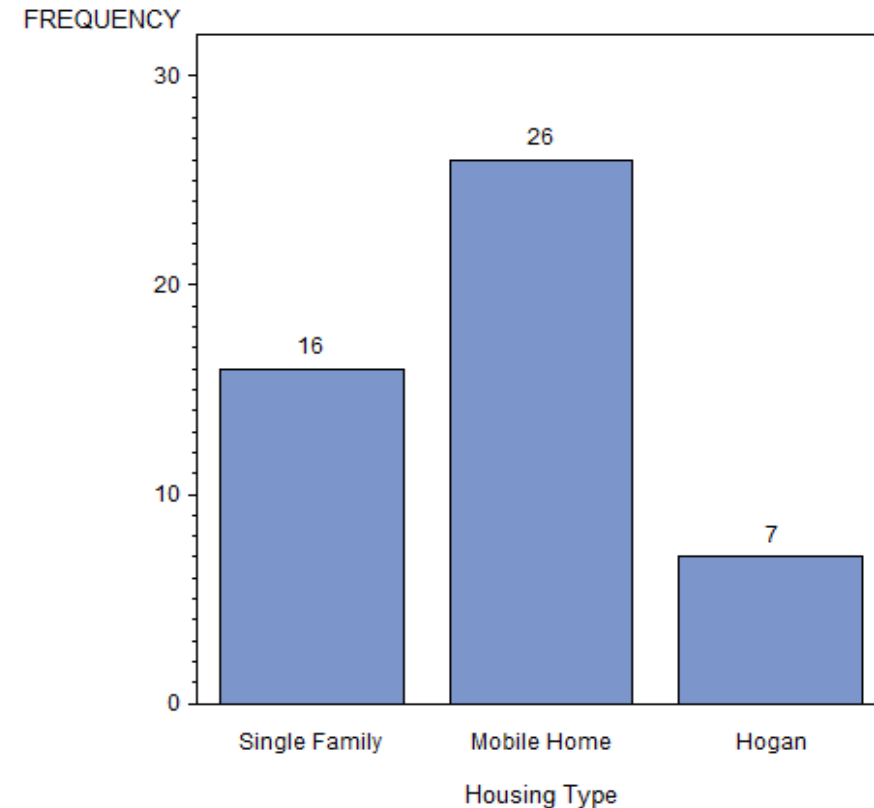


# Housing Type

**Table 11. Distribution by Housing Type (n=49)**

Housing Type	Count	Percent
Single Family	16	32.7
Multiple Unit	0	0
Mobile Home	26	53.1
Hogan	7	14.3
Other	0	0
Total	49	100

**Figure 7. Distribution by Housing Type (n=49)**



# Floor Material

**Table 12. Distribution by Floor Material  
(n=42)**

Material	Count	Percent
Carpet	15	35.7
Cement	1	2.4
Dirt	7	16.7
Tile	3	7.1
Tile, Carpet	1	2.4
Tile, Vinyl, Carpet	1	2.4
Vinyl	5	11.9
Wood	7	16.7
Wood, Tile	1	2.4
Wood, Vinyl, Carpet	1	2.4
Total	42	100



# Ecology and Elevation

**Table 13. Distribution by Ecology (n=48)**

Ecological Type	Count	Percent
Desert Grassland	7	14.6
High Desert	8	16.7
High Desert with Pinon/Juniper Woodland	4	8.3
Pinon/Juniper Woodland	23	47.9
Plains Grassland	2	4.2
Scrub/Chaparral	4	8.3
Total	48	100

**Table 14. Distribution by Elevation (n=41)**

Elevation	Count	Percent	Cumulative Frequency	Cumulative Percent
2001-3000	1	2.4	1	2.4
3001-4000	1	2.4	2	4.9
4001-5000	2	4.9	4	9.8
5001-6000	3	7.3	7	17.1
6001-7001	27	65.9	34	82.9
7001-8000	7	17.1	41	100

# Prevention

- Partnerships (CDC, IHS/638, UNMHSC, States)
- Navajo Epidemiology Infectious Disease Team (NIDET) – epi/data, communication, outbreak, reporting
- Coordination of integration of epi and clinical activities – surveillance, presentations, lab screening, training of IHS clinicians, PHNs, laboratorians, etc.
- Development of educational materials – print materials, PSAs, live radio forums, website, etc.

**Navajo Epidemiology Center**

## Understanding Hantavirus

*Yáát'eh: We encourage everyone to read this information about Hantavirus. We can keep the mice out of our homes. This is not complicated. Let's work together to help each other.*  
- Russell Begaye, President, Navajo Nation  
- Jonathan Nez, Vice President, Navajo Nation

**HOW DO PEOPLE GET HANTAVIRUS DISEASE?**  
People can get Hantavirus disease when they breathe in hantaviruses. This can happen when mouse droppings are stirred up into the air. People can get hantavirus disease when they touch a mouse, or mouse droppings, or nesting materials. People can also get Hantavirus disease from a mouse bite.

**HOW TO PREVENT HANTAVIRUS**  
Keep mice out of your home. Safely clean up mouse droppings and nests.

### HOW TO KEEP MICE OUT OF YOUR HOME

**1 Cover your food**  
• Put food in thick plastic or metal containers with tight lids.  
• Clean up spilled food right away.  
• Put pet food away after use.  
• Do not leave pet-food or water bowls overnight.

**2 Set traps inside**  
• Use snap traps.  
• Put peanut butter on the trap.  
• Put traps where you saw mice or droppings.  
• Do not use glue traps or sticky traps.

**3 Fix holes inside**  
• Check doors for gaps.  
• Look inside cabinets.  
• Look around drain pipes.  
• Use steel wool, caulk, or spray foam to fill holes.

**4 Fix holes outside**  
• Check around doors.  
• Check around windows.  
• Check skirting on trailers.  
• Check around pipes, vents, and siding.

**5 Remove droppings**  
• Wear gloves.  
• Spray droppings with bleach-water to kill Hantavirus.  
• After 5 minutes, wipe up with paper towels. Throw towels in the trash.  
• Wash gloves in bleach-water or soap. Then wash your hands with soap. You can also use hand sanitizer.

**6 Remove dead mice**  
• Wear gloves.  
• Spray the mouse or nest with bleach-water to kill Hantavirus.  
• After 5 minutes, put the mouse and trap into a plastic bag.  
• Put the bag in the trash.  
• To use the same trap again, spray the trap with bleach-water.  
• Wash gloves in bleach-water or soap. Then wash your hands with soap. Or you can also use hand sanitizer.

**7 Sheds**  
• Before entering a shed or outbuilding, air it out for 30 minutes.  
• Wear gloves.  
• Mop floors or spray dirt floors with bleach water.  
• Wash gloves in bleach-water or soap. Then wash your hands with soap. You can also use hand sanitizer.

**8 Clothes**  
• Mice sometimes leave droppings and urine on clothing.  
• Wear gloves.  
• Wash clothing in hot water and detergent. These will kill Hantavirus.  
• If using a dryer, set it on High or hot. You can also dry in the sun.  
• Wash gloves in bleach-water or soap. Then wash your hands with soap. Or you can also use hand sanitizer.

**9 Books & papers**  
• Wear gloves.  
• Leave books and papers outside in sunlight, away from mice, for several hours.  
• Or wipe the books and papers with bleach-water. This will kill Hantavirus.

**10 Old cars**  
• Look for nests, droppings, or mice under the hood and in the interior and trunk.  
• Wear gloves.  
• Spray droppings with bleach-water (1 part bleach and 9 parts water) to kill Hantavirus.  
• After 5 minutes, wipe up with paper towels. Throw towels in the trash.  
• Wash gloves in bleach-water or soap. Then wash your hands with soap. Or you can also use hand sanitizer.

**How to make bleach-water:**  
• Use 1 part bleach and 9 parts water  
• 1-1/2 cups bleach in 1 gallon of water

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# Prevention

- Diné College: teaching undergrads in Principles of Public Health and development of educational materials
- Maintain Hantavirus database and update environmental assessment form
- Home-based rodent exclusion project
- Research





# Partnership and Collaborations





# Partnership and Collaborations



# Navajo Infectious Disease Epidemiology Team (NIDET)

# Goal 1: Develop and conduct infectious disease surveillance on Navajo Nation

## Objectives:

1. Quantify the burden of infectious disease on Navajo Nation<sup>1</sup>
2. Partner with Arizona, New Mexico, and Utah Departments of Health to assist quantifying notifiable infectious disease cases
3. Establish access to NM-EDSS, UT-EDSS, and AZ MEDSIS
4. Strengthen New Mexico Active Bacterial Core surveillance (ABCs) partnership



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EPIDEMIOLOGY  
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ADVANCING PUBLIC HEALTH IN INDIAN COUNTRY

<sup>1</sup> NEC is authorized by Section 214(a)(1), PL 94-437, IHClA, as amended by PL 537 to collect or receive PHI for the purpose of preventing or controlling disease.

## **Goal 2:** Develop and deliver community-informed health promotion campaigns to increase awareness of infectious disease

### Objectives:

1. Create printed educational materials (flyers, posters, brochures)
2. Create educational media content (radio PSAs, social media)
3. Post content on NEC website for public use



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EPIDEMIOLOGY  
CENTERS**



# Goal 3: Enhance collaboration in assisting with disease outbreak response and investigation

## Objectives:

1. Establish a team to implement Public Health Event Notification System (PHENS)
  - a. Develop policy & procedures
2. Establish a team to complete entry of investigations into NM-EDSS, UT-EDSS, and AZ MEDSIS



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**EPIDEMIOLOGY**  
**CENTERS**

# Goal 4: Disseminate information and reports to community and stakeholders

## Objectives:

1. Disseminate infectious disease report with Navajo Nation entities
2. Disseminate infectious disease report with local, state, and federal partners



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**EPIDEMIOLOGY**  
**CENTERS**

# *Naatniih Naalkaah*

(disease surveillance)



## The 7 core functions of the Navajo Epidemiology Center

- Collect data
- Evaluate data and programs
- Identify health priorities
- Make recommendations for health service needs
- Make recommendations for improving health care delivery systems
- Provide epidemiologic technical assistance
- Provide disease surveillance

## Contact us:

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