

Laboratory Perspective in the Response to the 2012 Yosemite Hantavirus Infection Outbreak



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Speaker Disclosure

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Dongxiang Xia: Nothing to disclose

Presentation: Laboratory Perspective in the Response to the 2012 Yosemite Hantavirus Infection Outbreak

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Acknowledgments

- ❑ **California Department of Public Health (CDPH)**
 - Viral and Rickettsial Disease Laboratory Branch (VRDL)
 - Infectious Diseases Branch (IDB)
 - Occupational Health Branch (OHB)
- ❑ **U.S. Centers for Disease Control and Prevention**
 - Viral Special Pathogens Branch (VSPB)
- ❑ **National Park Service (NPS)**
 - Yosemite National Park (YNP)
 - Office of Public Health (OPH)
 - Delaware North Corporation
- ❑ **Local health departments**
- ❑ **Reporting clinicians and laboratories**



Hantavirus - Sin Nombre Virus (SNV)

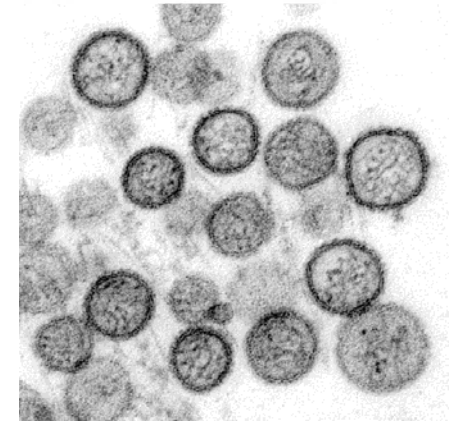
❑ A Genera in Family Bunyaviridae

- Genome of 3 single-stranded, negative sense RNA segments (L, M, S)
- Spectrum of illness
 - Old World, hemorrhagic fever with renal syndrome (HFRS), caused by Hantaan, Dobrava, Saaremaa, Seoul, and Puumala viruses
 - New World, hantavirus pulmonary syndrome (HPS) or hantavirus cardiopulmonary syndrome (HCPS), caused by SNV
 - HPS is a nationally notifiable disease



❑ Transmission

- In California, Deer mice (*Peromyscus maniculatus*) are the primary reservoir of SNV
- Infected mice shed virus in feces, urine, saliva
- Inhalation of aerosolized excreta
- Ingestion of contaminated food

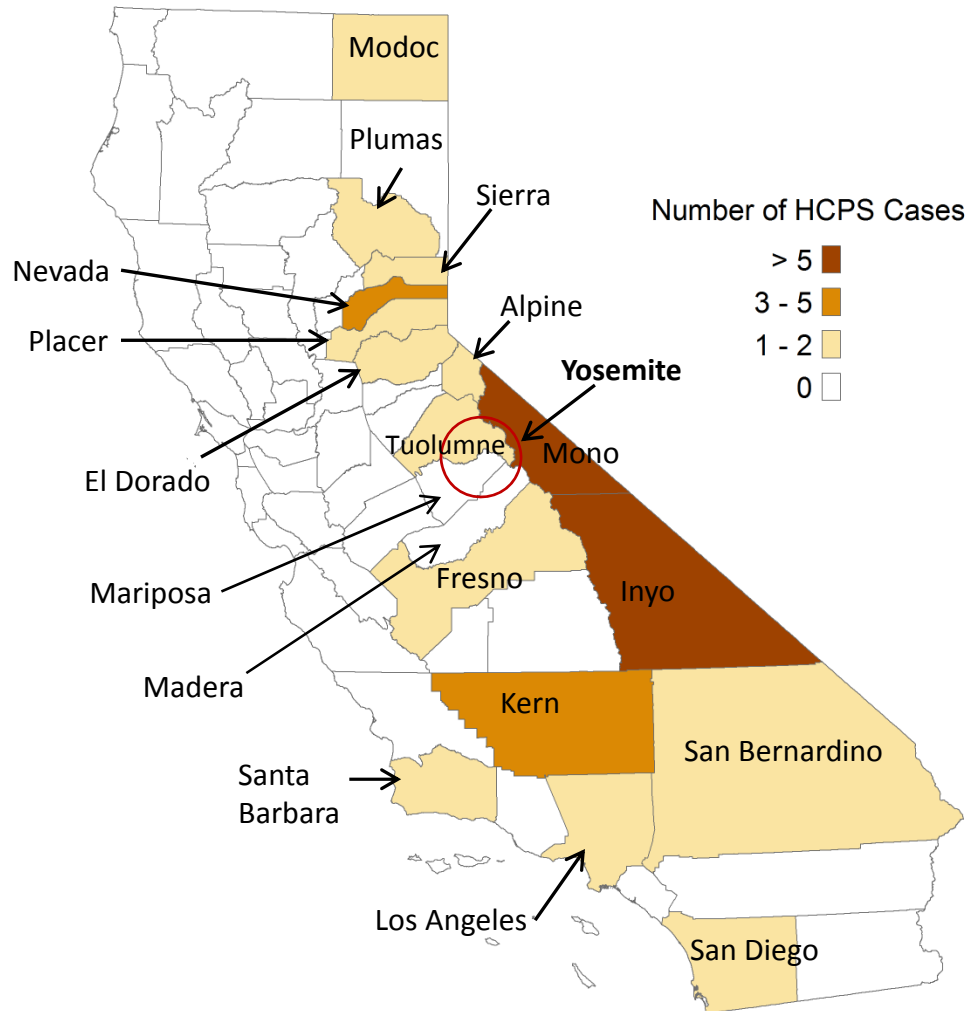


❑ Incubation period (SNV)

- 14 – 17 days (range 9 to 33 days)

❑ 1st recognized in 1993 in Four Corners outbreak

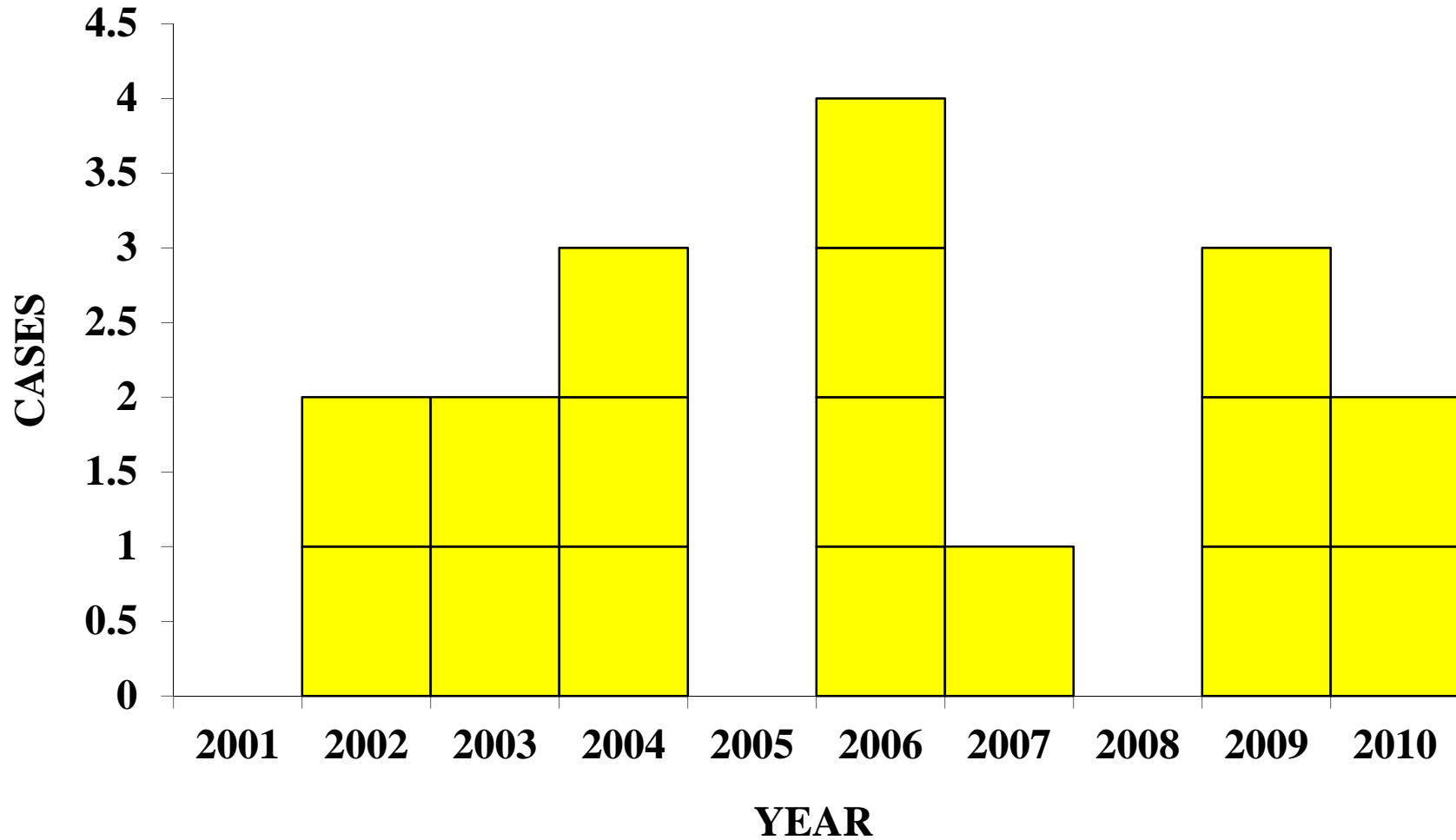
Distribution of 44 Reported Cases of Hantavirus Cardiopulmonary Syndrome (HCPS) in California Residents by Most Likely County of Exposure, Through June 2012*



Total 58 cases reported
Feb 1980 - June 2012 in
CA residents

*Most likely county of exposure was determined based on patient history, epidemiologic investigation, and environmental evaluation. Of 58 total HCPS cases reported February 1980 through June 2012, most likely county of exposure could not be determined for 10, and 4 were likely exposed outside California. Deer mice (*Peromyscus maniculatus*), the principal reservoir and vector for the causative agent of HCPS, can be found throughout California. Individuals should always take appropriate precautions anywhere mice and other rodents are present to reduce the risk of exposure to HCPS and other rodent-borne diseases.

HPS Cases by Year, California, 2001-2010



Maximum 4 cases/year between 2001-2010

Hantavirus Testing at VRDL

□ **VRDL provides:**

- Diagnostic testing for SNV by serology (CDC ELISA)
 - IgG and IgM for human specimens
- Lab testing for rodent surveillance studies (support Vector Born Disease Section, VBDS)
 - IgG for animal specimens
 - RT-PCR for genotyping studies
- Consultation and liaison to epidemiology
- Reporting and interpretation of laboratory results



□ **VRDL is the only lab in CA performing confirmatory testing**

- Local health department-referred suspect human cases
- Provisionally-positive samples referred by commercial labs
- Rodents trapped by VBDS

First Two HPS Cases Triggering Investigation in 2012

	First Case	Second case
CDPH/VRDL was alerted	July 9	July 31
Status when alerted	Hospitalized	Fatal
VRDL confirmed	July 11	Aug 7
Residence	Southern CA	San Francisco Bay area
Resident rodents	No or only urban rodents	No or only urban rodents
Yosemite visit	June	June
Lodge	Signature Tent Cabin, Curry Village (CV)	

Concurrence of otherwise two unrelated HPS cases, both with travel to and lodging in the CV area of Yosemite National Park (YNP) in June, suggested a possible outbreak associated with YNP

Yosemite National Park

❑ Park statistics:

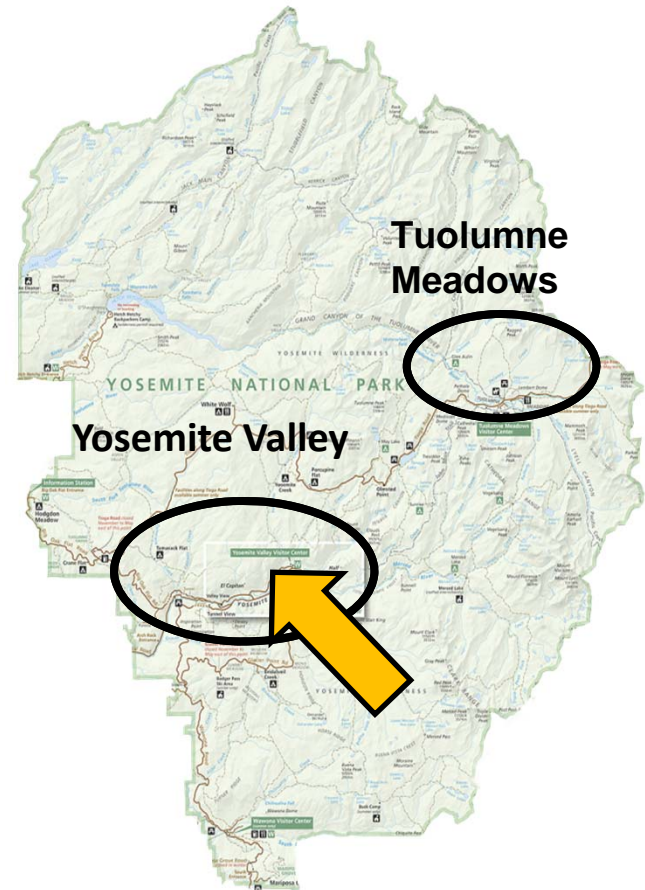
- Roughly the size of Rhode Island
- Nearly 4 million visitors in 2012
- About 3,000 employees

❑ Tuolumne Meadows

- Two previous cases (2000, 2010)

❑ Yosemite Valley:

- Major tourist attractions: Half Dome and El Capitan
- Majority of visitors
- Includes Curry Village campground and cabin area where first two cases in 2012 outbreak stayed
- An area not previously associated with disease
- Concerns for investigation



Outbreak Investigation

- ❑ **Initiated:** 14 August 2012
- ❑ **Participating agencies**
 - CDPH: IDB, VRDL, OHB
 - CDC: Viral Special Pathogens Branch
 - NPS: Office of Public Health
- ❑ **Teams and tasks:**
 - Laboratory
 - Epidemiology
 - Environmental
 - Occupational Health



Peromyscus maniculatus
(Deer mouse)

Sequence of Outbreak Activities

Aug 14:
Investigation
initiated

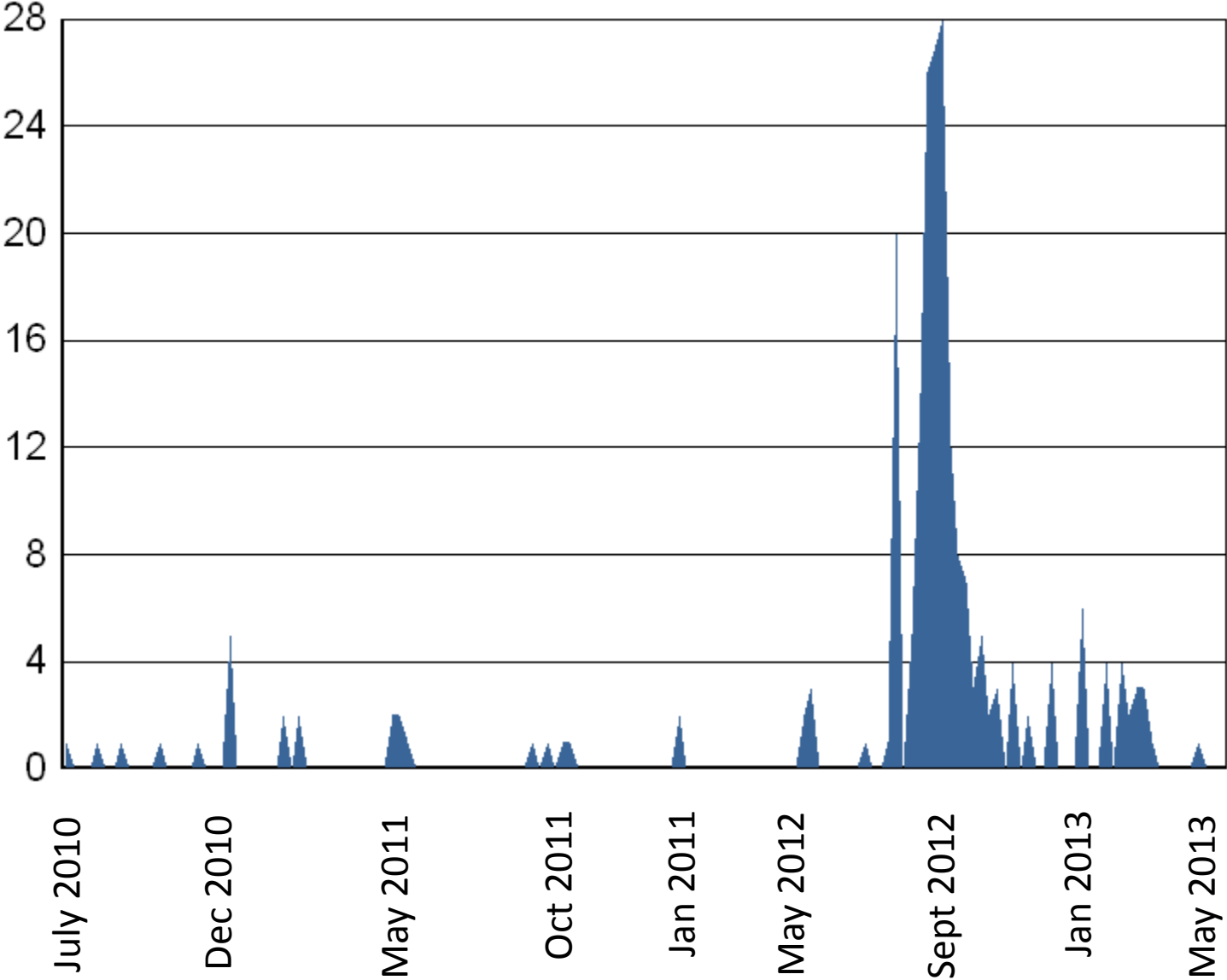
Aug 26:
Health Alert Network/Epi-X:
Medical community alerted of HPS

Aug 16:
CDPH Press Release:
Notified public of HPS
Cases

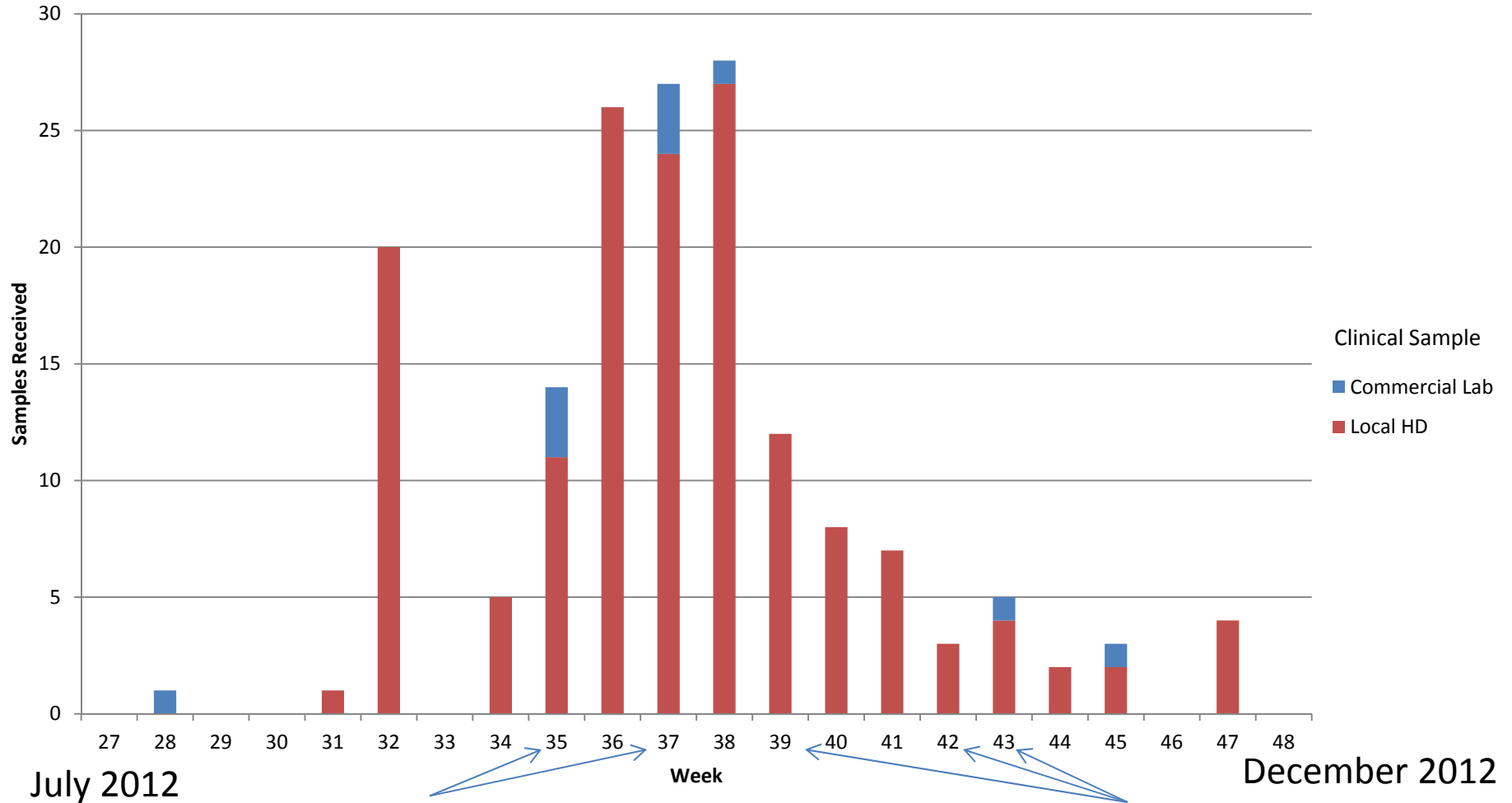
Aug 27, 28:
Previous overnight
visitors of Curry Village
notified of HPS

The CDPH-led epidemiological investigation prompted a surge in laboratory testing

Hantavirus Clinical Samples Received per Week



Hantavirus Samples Received per Week



Week 35: 95 Rodents
 Week 37: 58 Rodents

Week 39: 95 Occupational Health Samples
 Week 42: 294 Occupational Health Samples
 Week 43: 180 Occupational Health Samples

Positive Cases (10/67) including 3 Deaths

Case	Sex	State	Date of Onset	Status*	Result	Lab	Yosemite	Comment
1	F	CA	Jul 2012	R	IgM + / IgG + SNV	VRDL	Jun 2012	Signature Cabin
2	M	CA	Jul 2012	D	IgM + / IgG +/- SNV	VRDL	Jun 2012	Signature Cabin
3	M	PA		D	lung tissue IHC	CDC	Jun 2012	Signature Cabin
4	M	CA	Jul 2012	R	IgM + / IgG + SNV	VRDL	Jun 2012	Signature Cabin
5	M	CA	Aug 2012	R	IgM + / IgG + SNV	VRDL	Jul 2012	Signature Cabin, rodent nest
6	M	CA	Aug 2012	R	IgM + / IgG - SNV	VRDL	Jul 2012	Tuolumne Meadows
7	F	WV		D	lung tissue IHC	CDC	?	Signature Cabin
8	M	CA	Jul 2012	R	IgM + / IgG + SNV	VRDL	Jun 2012	Signature Cabin
9	F	CA	Aug 2012	R	IgM + / IgG + SNV; Focus = IgM screen +	VRDL	Jun 2012; Jul 2012	Signature Cabin
10	F	CA	Jul 2012	R	IgM + / IgG + SNV	VRDL	Jun 2012	Signature Cabin

*R = Recovered

*D = Death

VRDL confirmed all cases from California

CDC tested and confirmed all non-California cases

2012 Rodent Surveillance Results

	Aug	Sept
Curry Village		
Overall trap success	95/185 (51%)	19/133 (14%)
Boystown trap success	20/40 (50%)	11/117 (9%)
SNV seroprevalence *	10/73 (14%)	0
Tuolumne Meadows		
Overall trap success	N/A	41/89 (46%)
Lodge and Tent Cabins	N/A	26/54(48%)
SNV seroprevalence *	N/A	2/26 (8%)

Trap Success is + Traps / No. of Traps (%)

* Seroprevalence results for *Peromyscus maniculatus* only, tested by ELISA at VRDL



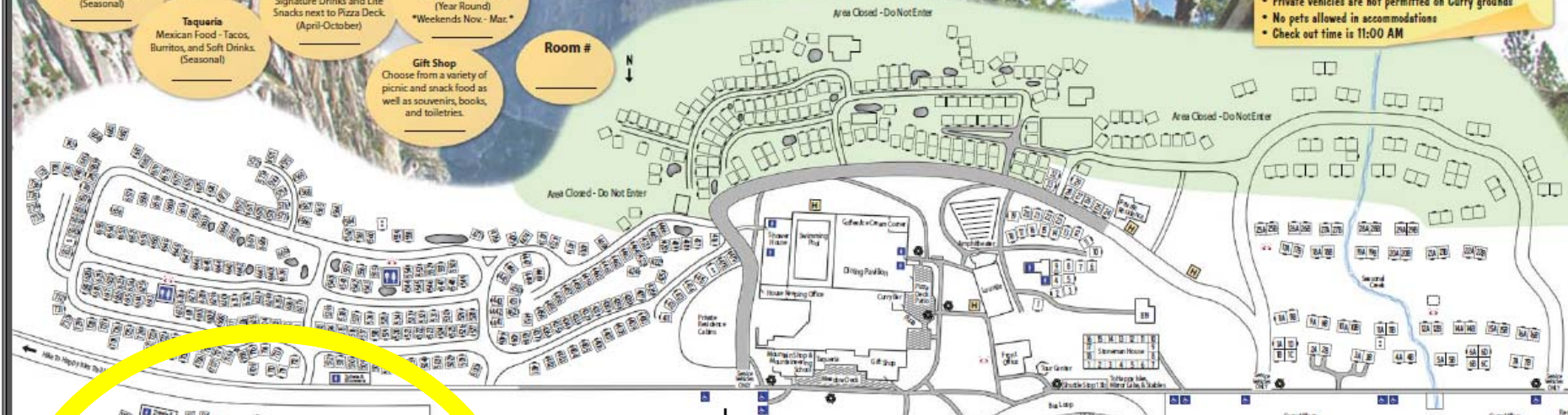
welcome to CURRY VILLAGE

Mother Curry's Camp Etiquette Fast Facts:

- Curry Village Front Offices: (209) 372-8333 or ext. 8333
- Quiet hours 10:00 PM to 6:00 AM
- Food or other related items are not allowed in tent cabins
- Cooking is not permitted in or around accommodations
- Please consider disarming your vehicle's alarm system
- Private vehicles are not permitted on Curry grounds
- No pets allowed in accommodations
- Check out time is 11:00 AM

- Dining Pavilion**
All-You-Can-Eat Buffet.
Breakfast and Dinner served Daily. (April - October)
- Curry Village Dining**
- Coffee/Ice Cream Corner**
Gourmet coffee, Espresso Pastries, Ice Cream Cones, Sundaes and Sodas. (Seasonal)
- Curry Bar**
Frosty Beverages, Signature Drinks and Lite Snacks next to Pizza Deck. (April-October)
- Pizza Deck Patio**
Freshly baked Pizza, Salad, Soup, Beer and Wine. (Year Round)
Weekends Nov. - Mar.
- Taqueria**
Mexican Food - Tacos, Burritos, and Soft Drinks. (Seasonal)
- Gift Shop**
Choose from a variety of picnic and snack food as well as souvenirs, books, and toiletries.

Room #



Cabin Etiquette

Hard Shell Cabin
You may store food inside your cabin. However, when you're away from your cabin, keep food, toiletries, and trash in a locked container and take it with you when you leave.

Canvas Tent Cabins
You must store all food, drinks, toiletries, and other scented items in the food locker outside your tent cabin. The locker must remain closed all the time (like a freezer).

Food includes (but is not limited to):
Any item with a scent, regardless of packaging. This may include items that you do not consider food, such as perfumes, lotions, deodorant, toothpaste, soap, shampoo, hairbrush, hairbrush, ice chests (even when empty), and unwashed items used for preparing or eating meals.

Cooking is not permitted anywhere in Curry Village.
Clean up trash and food if eating around cabin.

The Bear Facts!

You are required to store all food, drinks, and toiletries inside your food locker (or inside your hard shell cabin, as long as windows are closed when you're away). Failure to store your food properly may result in a fine (up to \$5,000), your food or vehicle being impounded at owner's expense, and/or eviction from Curry Village. Bears regularly visit Curry Village looking for food left out or stored inside cars. They can find food they can't see (their sense of smell is perhaps seven times stronger than a bloodhound).

If you see a bear in Curry Village (or any developed area), act immediately to scare it away - make as much noise as possible by yelling as loudly as you can. If there are others with you, stand together to present a more intimidating figure, but do not surround the bear. Your goal is not to harm the bear, but to scare it from the area and restore its natural fear of people. Report all bear sightings to a ranger or by calling (209) 372-0322. Protect yourself and **save bears' lives** by storing your food properly!

DNC Parks & Resorts at Yosemite are not responsible for lost or stolen items.



Mother Curry's Camp Etiquette

- Camp quiet hours are from 10:00 PM to 6:00 AM. All guests are expected to be respectful of their fellow campers and abide by these hours. Socializing and/or loud music need to take place away from accommodations during this time. Failure to do so may result in the noisy party being asked to leave. Should you encounter a guest not respecting the quiet time, please do not hesitate to contact the front desk via any house phone by calling ext. 8333, dialing (209) 372-8333 on your cell phone or stopping by the front desk.
- Food and other related items are not permitted in your canvas tent cabins at any time. In addition, cooking is not permitted anywhere in Curry Village for the safety of everyone. Our front desk agents can tell you more about proper picnic and cooking sites.

- Pets are not permitted in any Yosemite lodging facility. Dog kennels are available through the Valley Stables between (approximately) Memorial Day and Labor Day. Please inquire about kennels and other pet policies at any Tour/Activities or Front Desk.
- For the safety of everyone, privately-owned vehicles are not permitted on Curry Village grounds. If you should need luggage assistance, we have a bellman to assist you between the hours of 7 AM to 10 PM. Please consider disarming your vehicle's alarm system.
- Linens, pillows, and blankets are provided upon your arrival and linen services are available upon request, beds are not made up. Trash will be emptied and fresh towels are provided daily. Should you need assistance or full hospitality services please contact the front desk.

What is unique about signature cabins?



Evaluation of the Signature Cabin



All signature tent cabins were vacated and closed indefinitely on August 28, 2012.

Serosurvey of Park Employees

- ❑ **CDPH Occupational Health Branch led**
 - Survey of work-related duties
 - Blood draw for serological testing
- ❑ **Total of 569 park staff tested by VRDL**
- ❑ **Less than 1% positive**



Summary

- ❑ Largest outbreak since 1993
 - 10 confirmed cases
 - 9 stayed in Signature tents during incubation period
- ❑ Shorter timeframe & smaller geographic area
- ❑ Laboratory role in outbreak investigation
 - Diagnostic testing of patients
 - Serum testing for rodent seroprevalence
 - Serum surveillance testing of park employees
 - Prompt consultation, reporting and liaison
- ❑ Importance of prepared response capability to EID
- ❑ Well organized teamwork among all partners

