

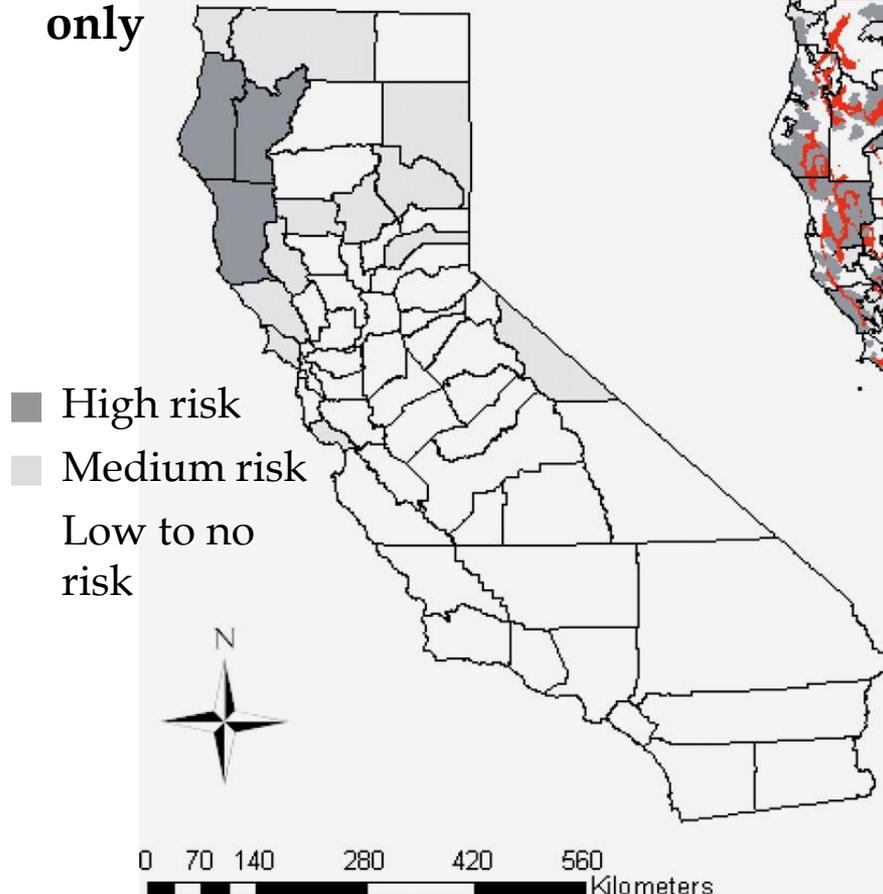
# Vector-Borne Disease Surveillance and Investigation

A Local Perspective on  
Lyme, Typhus, and Emerging Rickettsiae

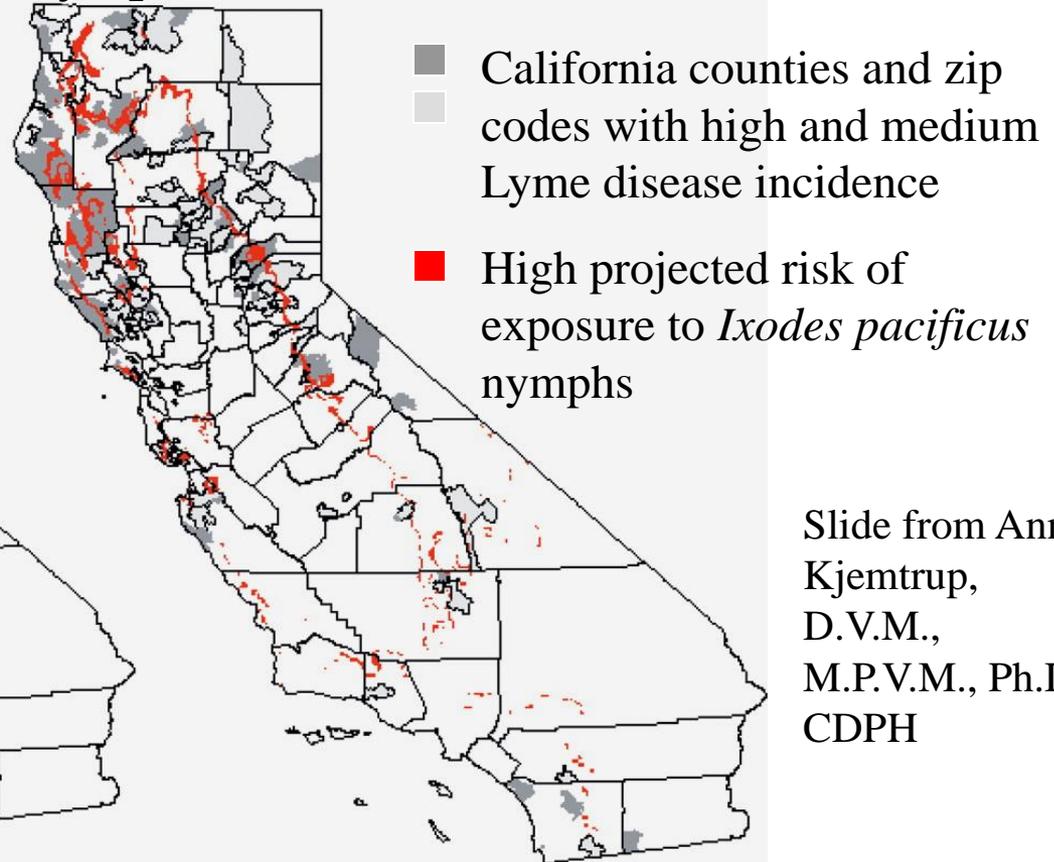
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Orange County Health Care Agency

# Human case distribution: human risk of exposure to potentially infected *Ixodes pacificus* nymphs can be highly focal\*.

County level human Lyme Disease risk based on human incidence data only



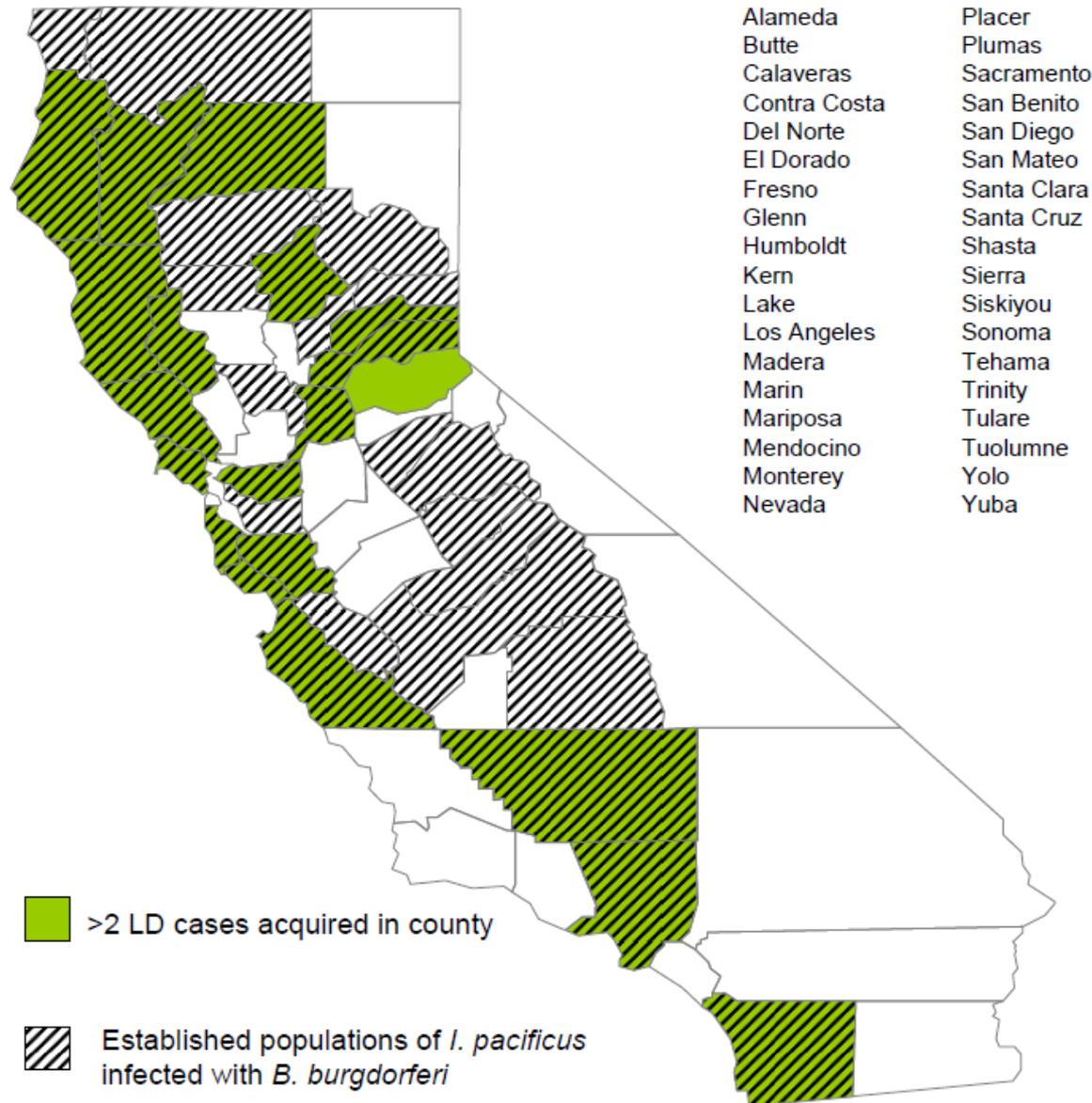
Focal (zip code) level human Lyme Disease exposure potential based on human incidence and nymphal tick habitat



Slide from Anne Kjemtrup, D.V.M., M.P.V.M., Ph.D., CDPH

\*Eisen et al., 2006 Am. J. Trop. Med Hyg

# Lyme disease endemic counties, California



# Lyme in OC

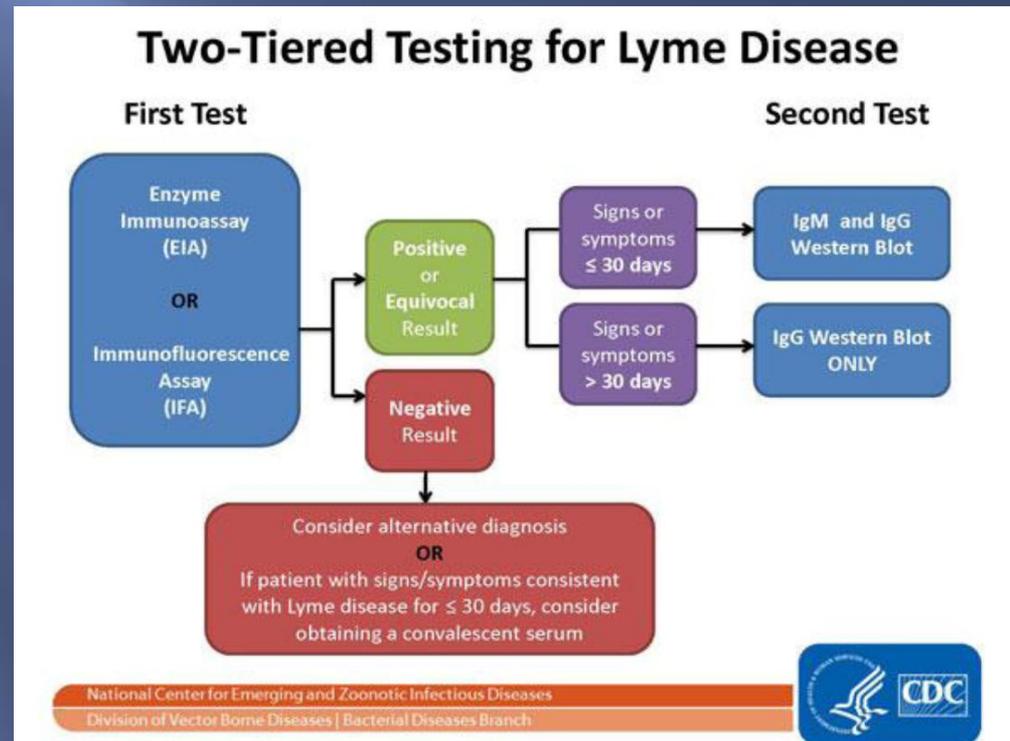
- ▣ One positive tick in 1991 (San Clemente)
  - Almost 3000 ticks tested by OCVCD since 1988
- ▣ 4 deer positive 1989-90
- ▣ 2-8 confirmed human cases/year, acquired elsewhere

# Lyme in OC (2)

- Often more than one lab report on same patient
- Repeat testing same year or later year
- Mainly Western Blot IgM positive only
  - Have to request Western Blot IgG result (usually negative)
  - EIA/IFA often not done
  - One laboratory uses own criteria (not CDC) for interpretation

□ 502 unique reports between 2008-2011

- 2008: 114
- 2009: 130
- 2010: 138
- 2011: 120



Laboratory Reporting Source	Year		Total
	2009	2011	
IGeneX, Inc	37	26	63 (31%)
LabCorp San Diego	6	16	22 (11%)
Quest Diagnostics	35	46	81 (40%)
Specialty Laboratories, Inc	24	0	24 (12%)
Other	4	10	14 (7%)
Total	106	98	204

# Lyme process in OC Prior to 2010

- ▣ PHNs investigated Lyme reports
- ▣ Low priority, inconsistent follow-up
  - ▣ ~3 faxes to provider for additional info, 2 phone calls
  - ▣ Usually did not receive information back
- ▣ Cases stayed open up to 473 days in 2008
  
- ▣ PHMOs started to take cases including Lyme from PHNs in 2010 as OC Epidemiology PHNs decreased from 8 in 2007 to 5 in 2008; transiently down to 4 PHNs in late 2009-2010

# Lyme process in OC 2010-2011

- PHMO trained Staff Assistant to manage preliminary information gathering
  - Utilized CDPH Lyme algorithm

## A suggested algorithm for evaluating reported Lyme disease cases relative to the CSTE national surveillance case definition (rev. 2008)

In order to use this flowchart, you will need the completed Lyme disease case history form and copies of the laboratory reports that include observed banding patterns of Western immunoblots.

**A.** Serum specimen tested for *B. burgdorferi* antibodies?  
Yes --> Go to **B**  
No --> Go to **G1**

**B.** EIA/IFA Lyme disease screening test  
Positive or Equivocal --> Go to **C1**  
Negative --> Go to **G1**  
Unknown or Not Done --> Go to **C2**

**C1.** Serum specimen collected  
≤ 30 days after onset --> Go to **D**  
> 30 days after onset --> Go to **F**

**C2.** Serum specimen collected  
≤ 30 days after onset --> Go to **E**  
> 30 days after onset --> Go to **F**

**D.** IgM Western immunoblot diagnostic bands: 24, 39, 41 kDa<sup>1</sup>  
0 or 1 band present --> Go to **F**  
2 or 3 bands present --> Go to **G2**  
Unknown or Not Done --> Go to **F**

**E.** IgG Western immunoblot diagnostic bands: 20, 24, 35, 39, 88 kDa<sup>1,2</sup>  
0 or 1 band present --> Go to **G1**  
2 to 5 bands present --> Go to **G2**  
Unknown or Not Done --> Go to **G1**

**F.** IgG Western immunoblot diagnostic bands: 18, 21, 28, 30, 39, 41, 45, 58, 66, 93 kDa<sup>1,2</sup>  
0 to 4 bands present --> Go to **G1**  
5 to 10 bands present --> Go to **G2**  
Unknown or Not Done --> Go to **G1**

**G1.** Erythema migrans diagnosed?  
Yes --> Go to **H1**  
No --> **Not a case:** Do not report to CDPH

**G2.** Erythema migrans diagnosed?  
Yes --> Go to **H2**  
No --> Go to **J**

**H1.** Erythema migrans measured at ≥ 5 cm?  
Yes --> Go to **I**  
No or Unknown --> **Not a case:** Do not report to CDPH

**H2.** Erythema migrans measured at ≥ 5 cm?  
Yes --> **Confirmed case:** Report to CDPH  
No or Unknown --> Go to **J**

**I.** Patient has history of being in wooded, brushy, or grassy area in a Lyme disease-endemic county ≤ 30 days prior to onset of erythema migrans?  
Yes --> **Confirmed case:** Report to CDPH  
No --> **Suspect case:** Report to CDPH

**J.** One or more disseminated manifestations diagnosed (brief bouts of swelling in one or a few joints, VII palsy, radiculoneuropathy, lymphocytic meningitis, encephalomyelitis/encephalitis, and/or II or III degree atrioventricular conduction deficits)?  
Yes --> **Confirmed case:** Report to CDPH  
No --> **Probable case:** Report to CDPH  
Unknown --> **Suspect case:** Report to CDPH

### Footnotes

1. The molecular mass of outer surface protein C (OspC) can vary depending on the strain of *B. burgdorferi*. Serum antibodies detected that react with antigens in the range of 21 to 25 kDa, inclusive, may be considered equivalent and fulfill criteria for required bands of 21 kDa (Step F) or 24 kDa (Steps D and E).

2. The 18 kDa and 20 kDa antigens may be identical and represent the same protein variably expressed in *B. burgdorferi*. Serum antibodies detected that react with antigens in the range of 18 to 20 kDa, inclusive, may be considered equivalent and fulfill criteria for required bands of 18 kDa (Step F) or 20 kDa (Step E). Note that antigens in the 18-20 kDa range are clearly separate and distinct from OspC (21-24 kDa).

# Lyme process in OC 2010-2011 continued

- ▣ PHMO and Staff Assistant developed procedures and forms so non-medical staff could assist.
  - Developed battery of fax request forms for different situations
    - ▣ Request additional lab results from lab and provider
    - ▣ Request EM history and onset date from provider
    - ▣ Request case history form (symptoms) if lab results meet criteria
  - Staff Assistant reviewed each case with PHMO after obtained all preliminary information
  - PHMO called providers/patients as needed, determined resolution status for closing/reporting case
- ▣ December 2011, Staff Assistant started reviewing cases with PHNs (instead of PHMOs) after obtaining all preliminary information

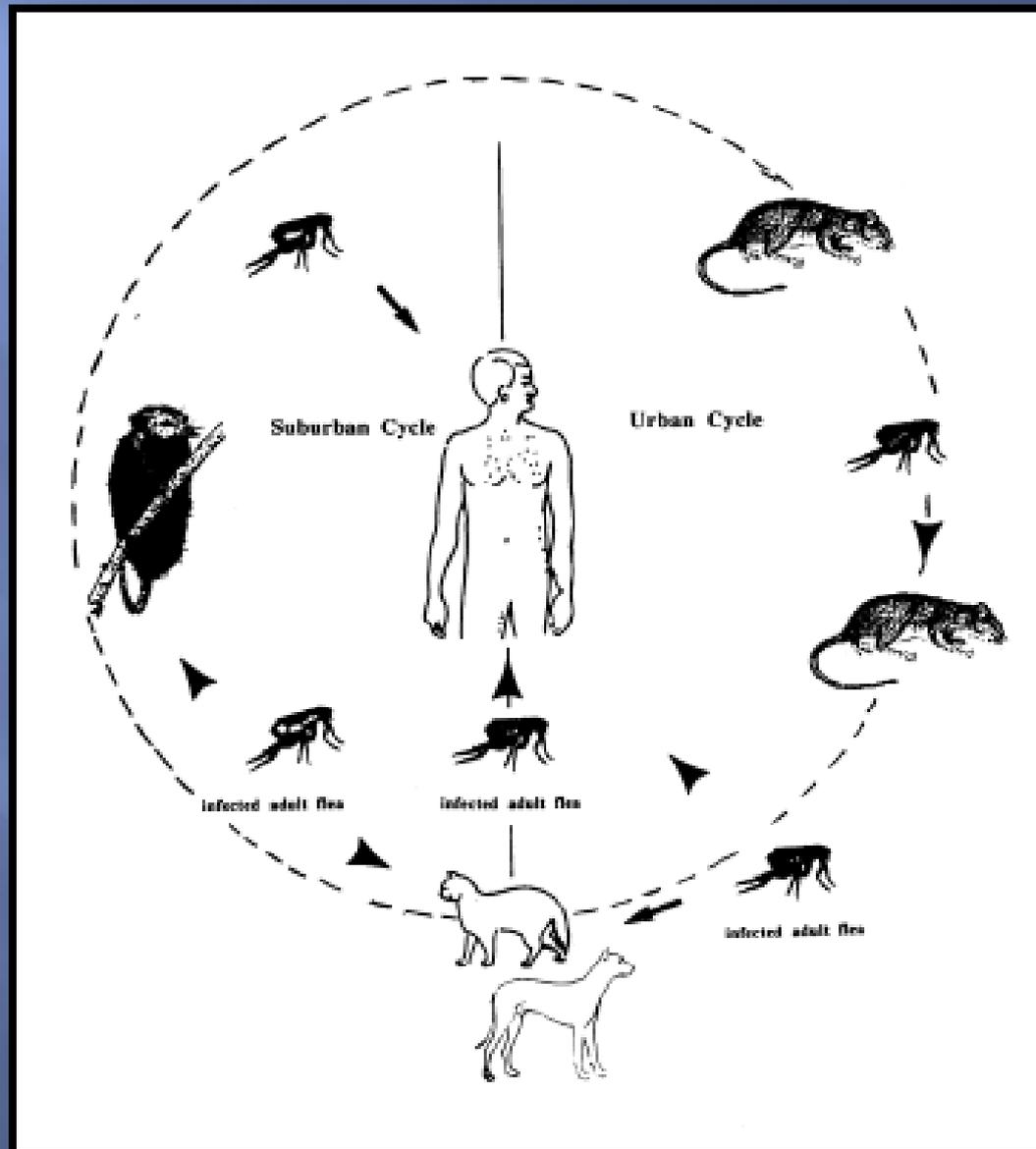
# Time (Days) from Date Created to Closed, Lyme Reports

- ▣ 2009: Median 61.50 (0.00-370.00)
- ▣ 2010: Median 42.50 (0.00-197.00)
- ▣ 2011: Median 43.00 (0.00-148.00)

# Lyme - Ongoing Issues

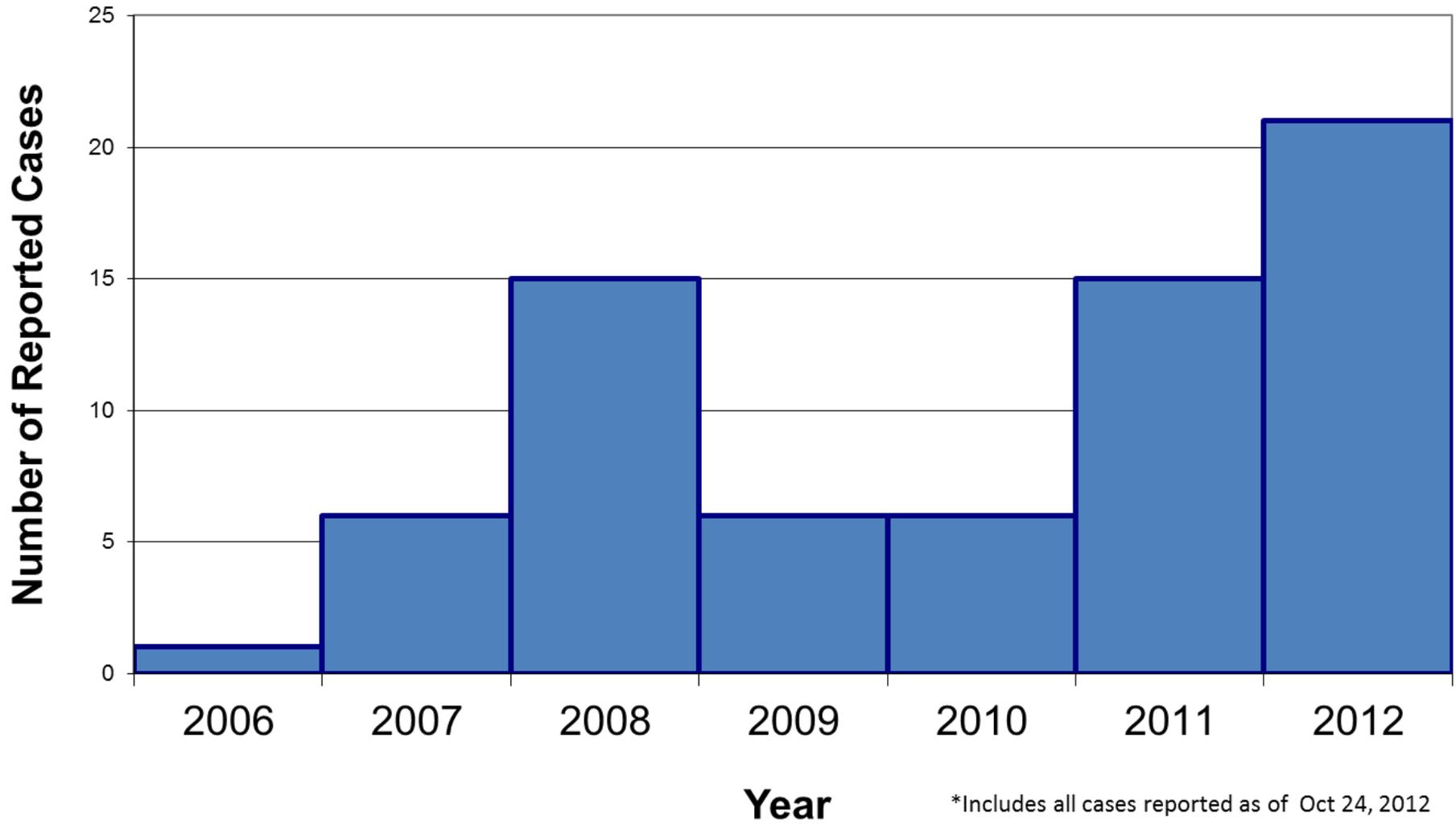
- ▣ Specific types of providers sending many of the tests
  - Centers for alternative/integrative medicine, wellness; doctors of naturopathy
- ▣ Still poor response to requests for information
- ▣ Still very time consuming
  - Staff Assistant ~ 8 hours/week
  - PHN ~ 1/2 hour/week
- ▣ Fortunate to have Staff Assistant support
- ▣ Now receiving “Borrelia culture” reports.....

# Endemic (Murine) Typhus



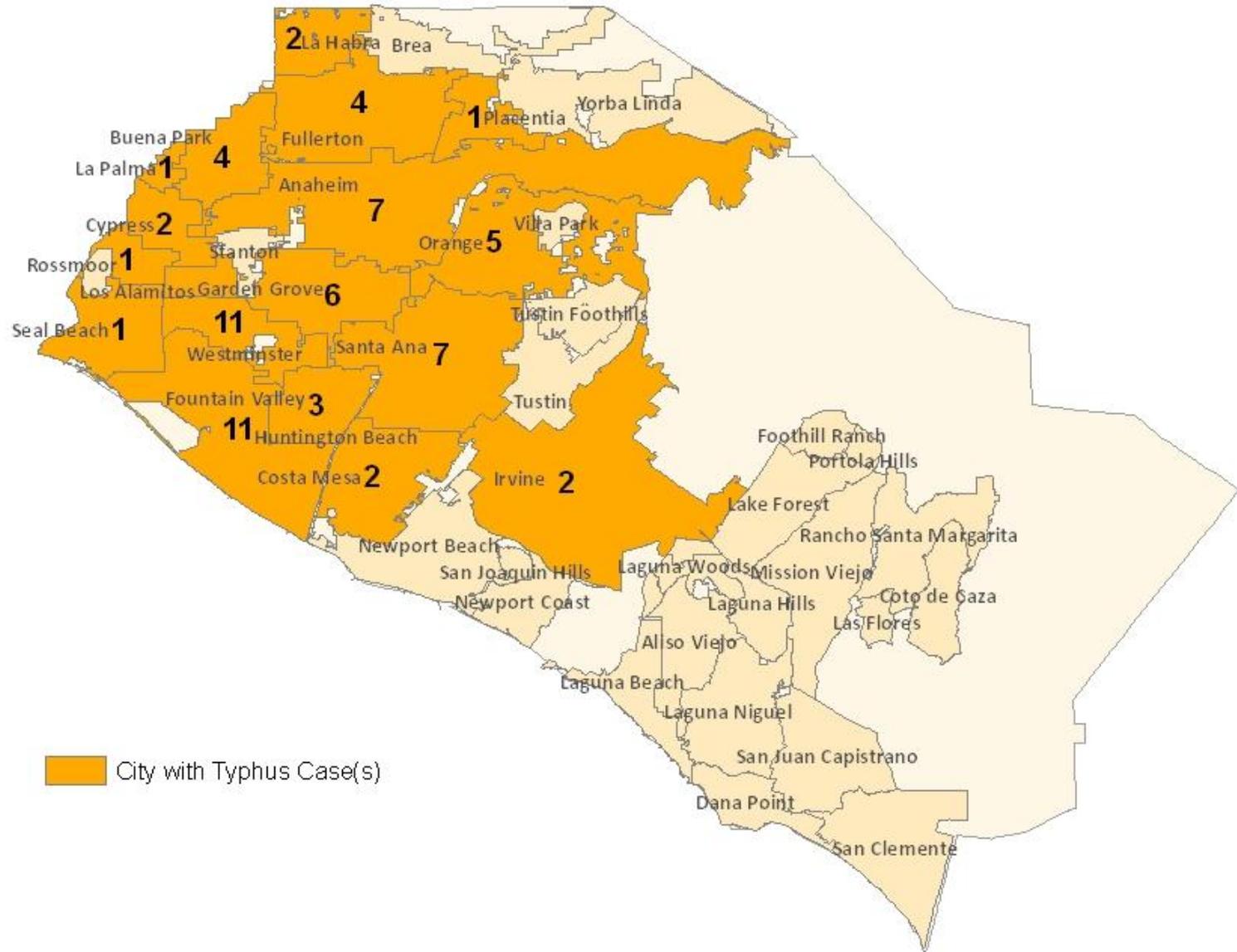
Slide courtesy of  
Laura Krueger,  
OCVCD

# Endemic Typhus Cases by Year of Report\* Orange County, CA



# Laboratory Confirmed Typhus Cases by Place of Residence

## Orange County, CA 2006 - 2012



# Typhus process

- ▣ PHN interviews case history and exposures
- ▣ Case referred to OCVCD for environmental investigation
  - Trapping of opossums – flea index; feral cats, rats
  - Flea control
  - Other recommendations for environment
  - Flea testing for *Rickettsia*?
- ▣ No ongoing animal surveillance
- ▣ Role of feral cat and opossum control?
  - Does it decrease risk of future cases?
  - If so, whose responsibility is it?



# CASE PRESENTATION

# *Rickettsia philipphi* (364D)

- ▣ Newly described; first human case in CA in Lake County, 2008 – 3 other possible cases 2002-2008
- ▣ Spotted Fever Group rickettsia
  - 364D identified in *Dermatocenter occidentalis* ticks in CA
  - Closely related to *R. rickettsii* but distinct serotype
  - One study with 7.8% of *D. occidentalis* ticks in SoCal infected with 364D; <1% with *R. rickettsii*
- ▣ Five human cases confirmed in CA in 2011
- ▣ Per CDPH, 364D previously reported in ticks in Lake, Mendocino, Contra Costa, Santa Clara, Los Angeles, Orange, Riverside, Ventura, Monterey, and San Bernardino counties

# *Rickettsia philipphi* (364D) continued

- ▣ Clinical description:
  - Isolated ulcer with raised erythematous margins and core black eschar
  - Usually with surrounding edema and erythema
  - 3-14 days after tick bite; site of bite
- ▣ Diagnosis
  - Paired acute and convalescent serum for *R. rickettsii* (spotted fever group; cross-reacts)
  - Eschar/scab or swab of open lesion, pustule or vesicle for rickettsial PCR
- ▣ Cases appear to respond to doxycycline

# Emerging Rickettsiae

- ▣ Similar presentation; no specific serology --  
?human cases misdiagnosed as RMSF or typhus
- ▣ Role of surveillance to identify new pathogens, describe spectrum of clinical presentation
- ▣ Need for more specific diagnostics