

California 2010 Pertussis Epidemic



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Overview

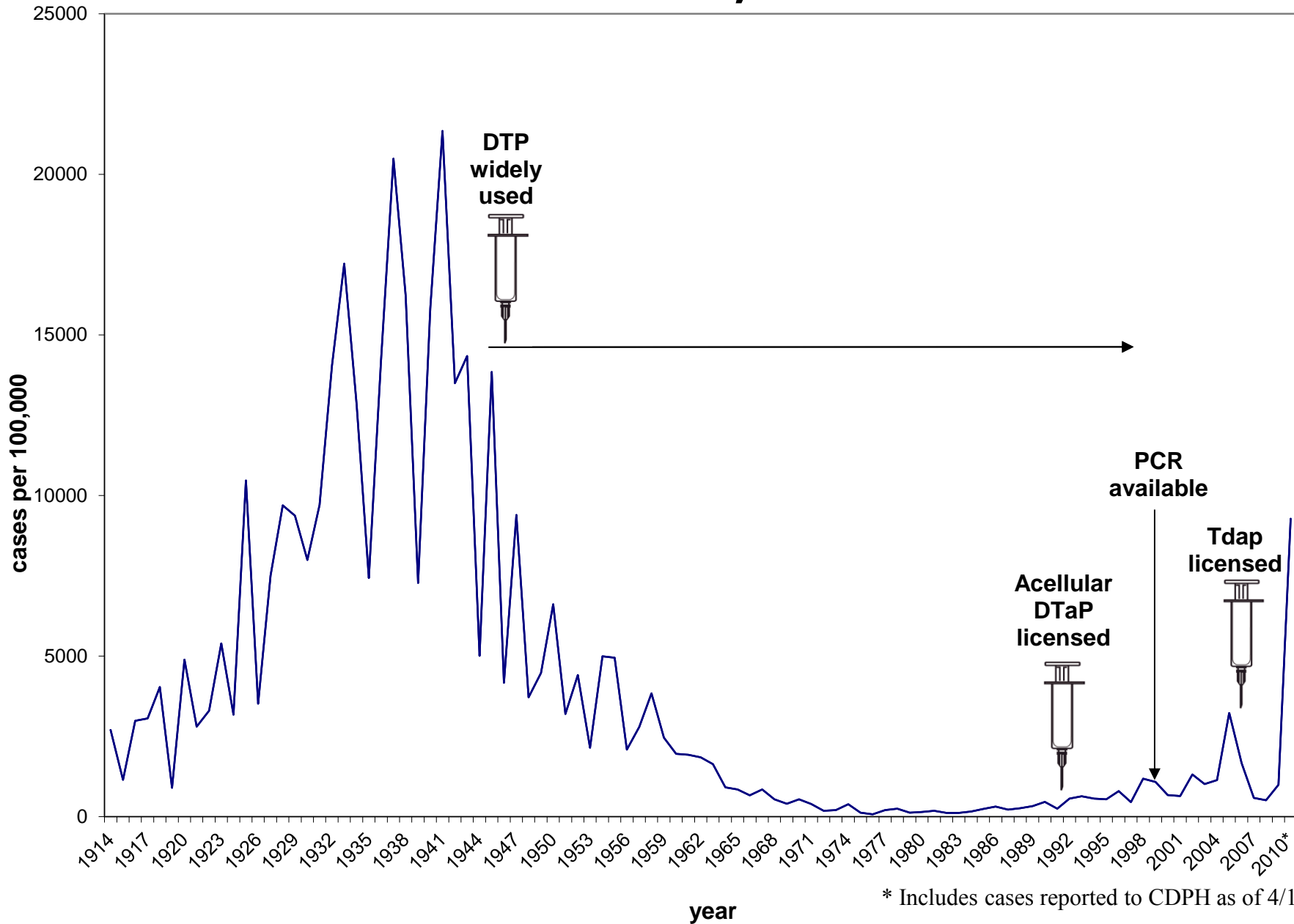
- Pertussis Background
- California Pertussis Epidemic
- Challenges and Success
- Ongoing Efforts
- Questions

Pertussis Background

- Pertussis is one of the most poorly controlled vaccine-preventable diseases
 - Incidence increasing since the 1990s
 - Cyclical with peaks every 2-5 years; last prior peak year was 2005 with 25,616 U.S. cases, a 45 year high at the time
- Very contagious: basic reproduction number (R_0) estimate is 12-17; approximately 80% of susceptible household contacts become infected
- Minimum proportion of population that must be immune to eliminate transmission estimated to be 92-95%

* Weiss and Hewlett. *Ann Rev Microbiol.* 1986;40:661-86

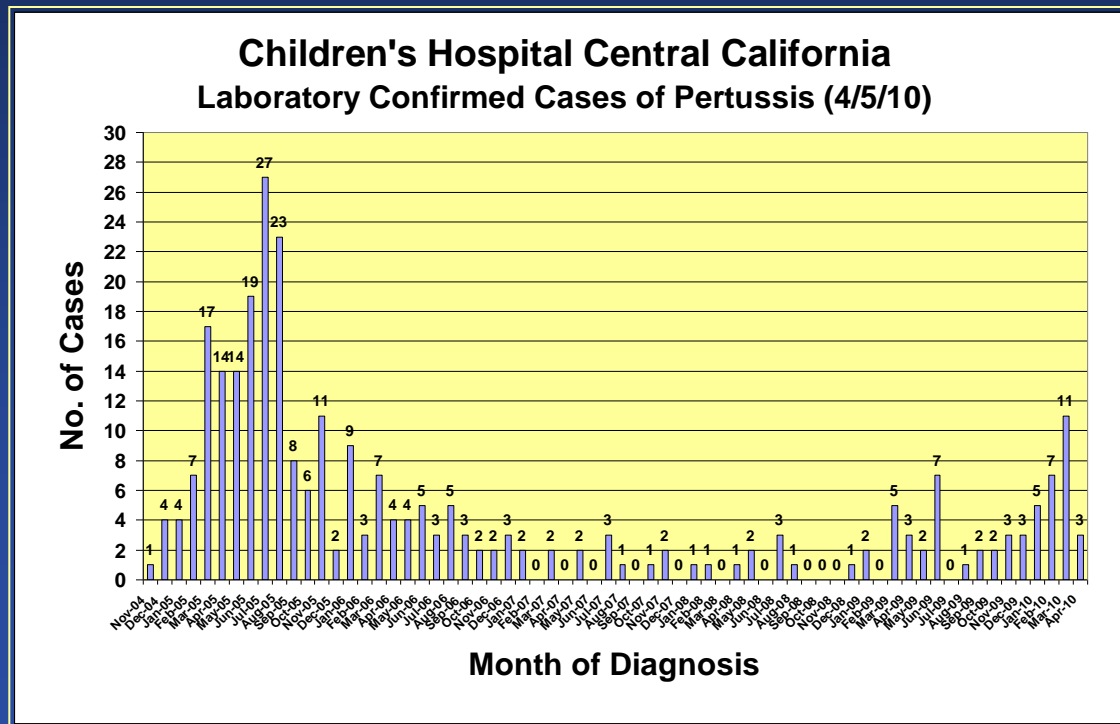
Number of reported pertussis cases by year of onset – California, 1914-2010*



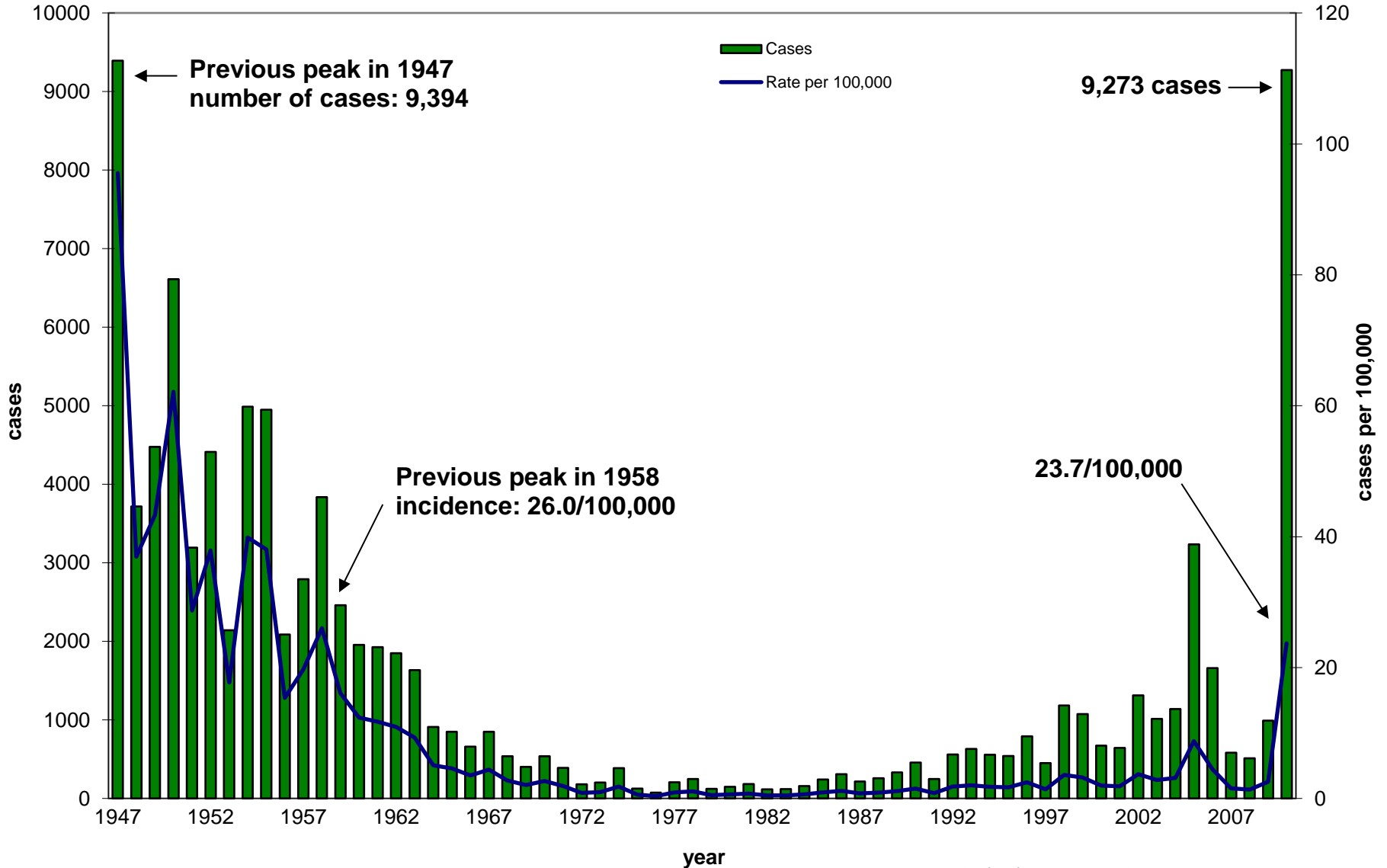
* Includes cases reported to CDPH as of 4/13/2011

Early Warning of the 2010 Epidemic

- In early April 2010, the California Department of Public Health (CDPH) was notified by the Children's Hospital of Central California of an increase in pertussis cases similar to that seen in early 2005, the last peak year for pertussis



Number of reported pertussis cases by year of onset -- California 1945-2010*

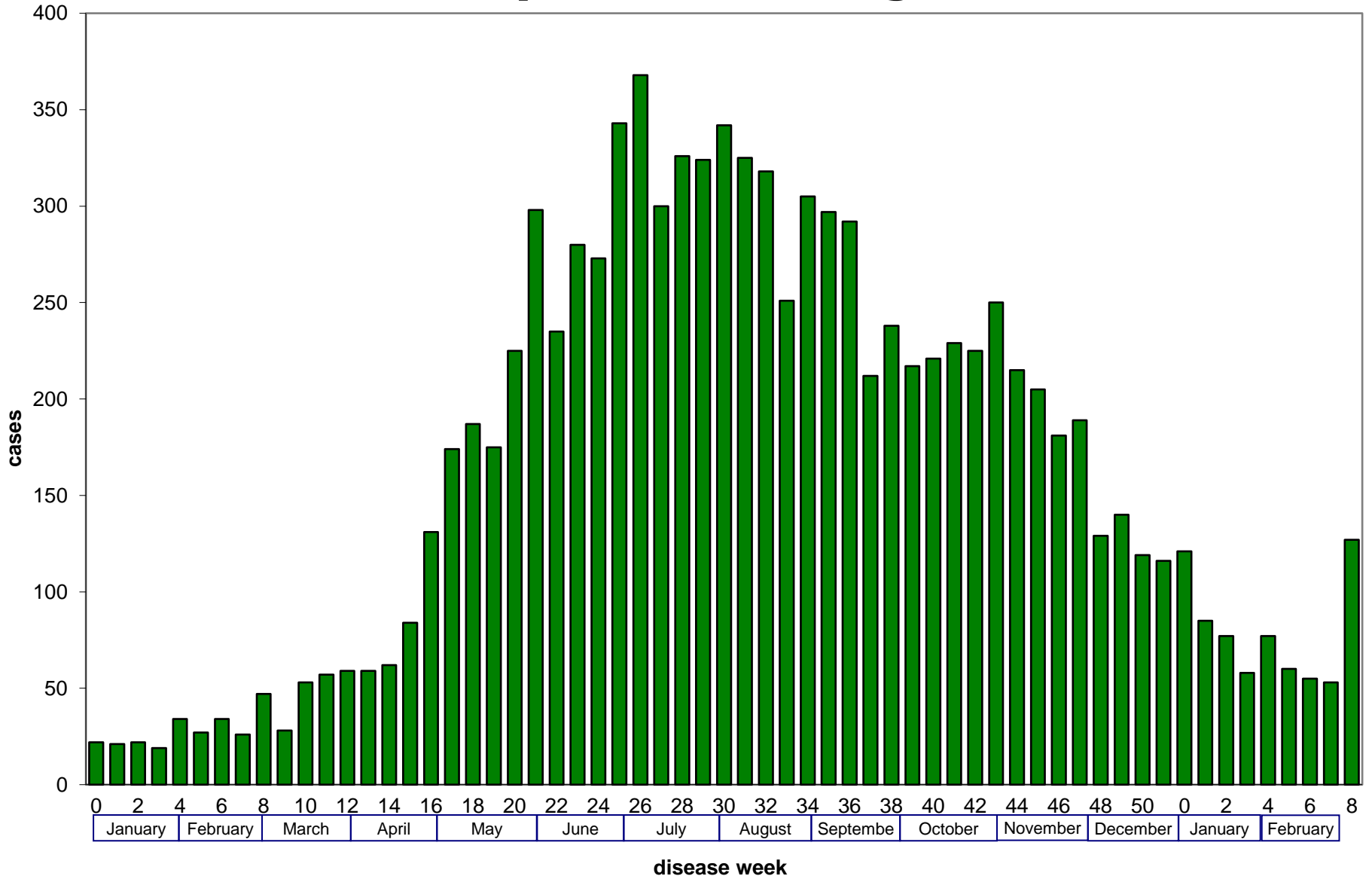


*As of 4/13/2011; data for 2010 are still preliminary

Case counting

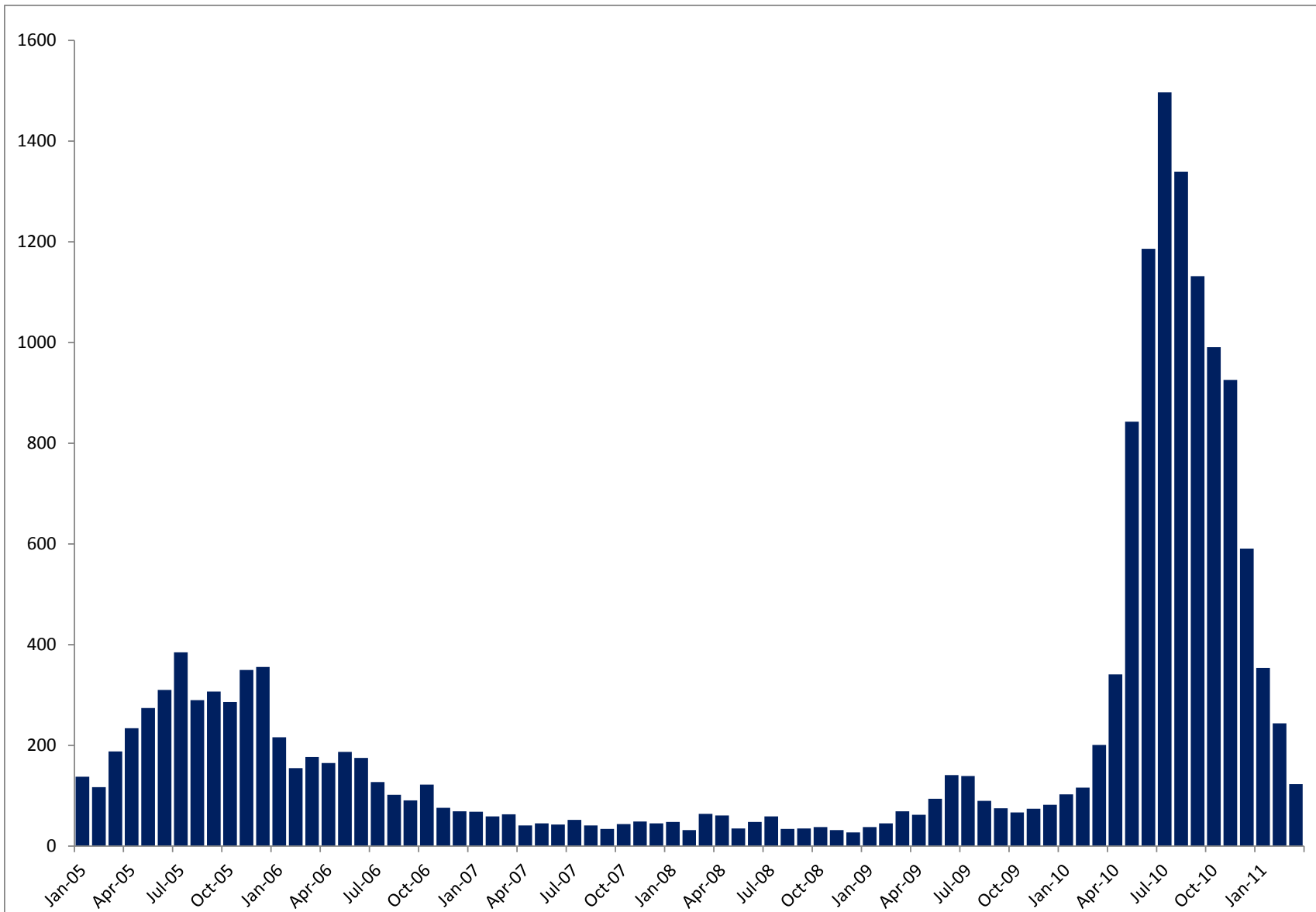
- CDC/CSTE case definitions for 'Confirmed' and 'Probable' cases
- 'Suspect' case defined as a person with acute cough illness of any duration with:
 - detection of *B. pertussis*-specific nucleic acid by PCR;
or
 - at least one of the following: paroxysms, whoop or post-tussive vomiting who is epi-linked to a lab-confirmed case
- Case classification breakdown:
 - 61% Confirmed
 - 18% Probable
 - 21% Suspect

Epidemic curve of pertussis cases* by week of onset -- California, January 1, 2010 through March 6, 2011



*Includes cases reported to CDPH as of 4/13/2011

Pertussis cases by month of onset -- California, January 2005 - March 2011*

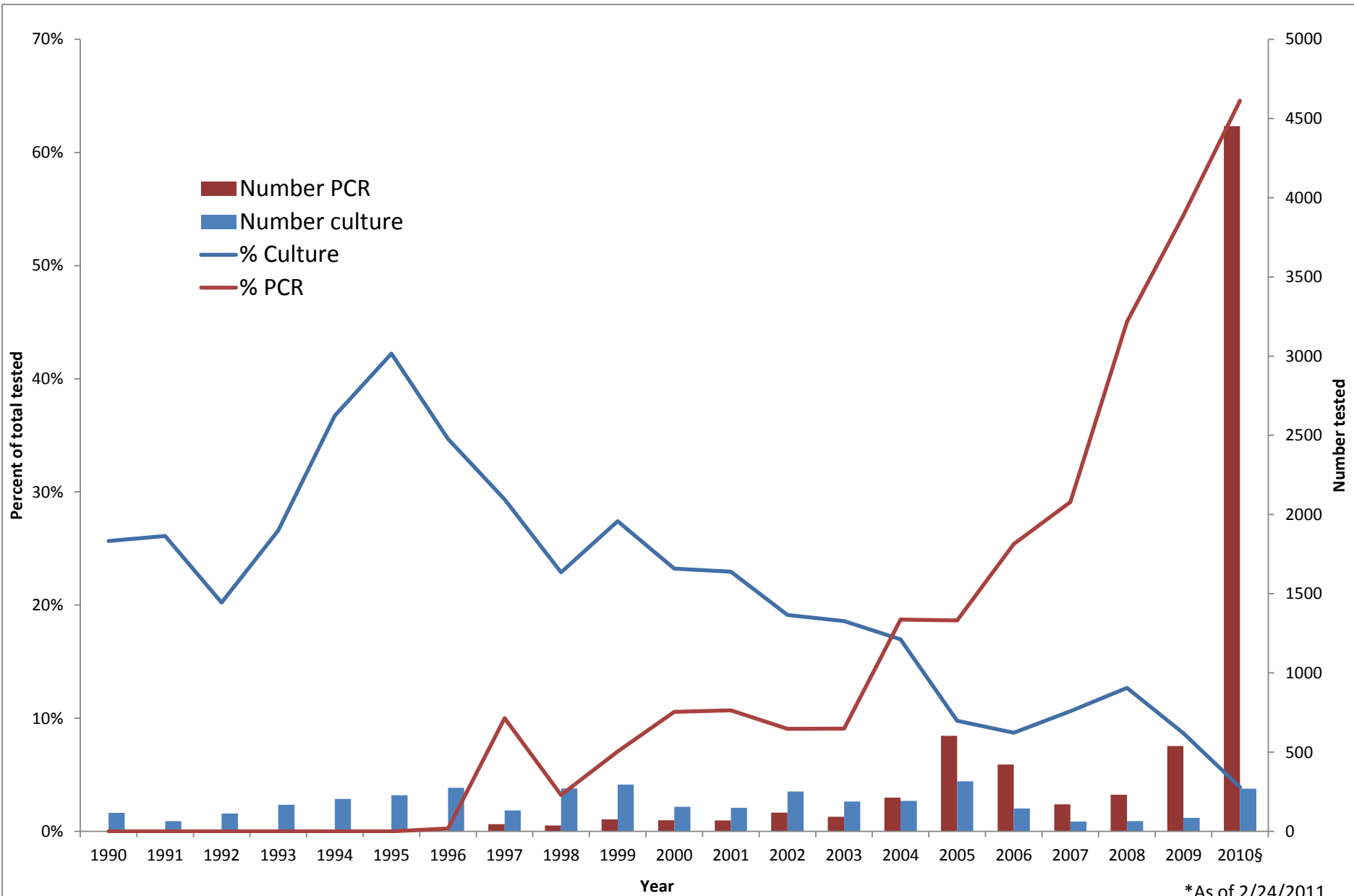


*Includes cases with onset through 3/31/2011 and reported to CDPH by 4/13/2011

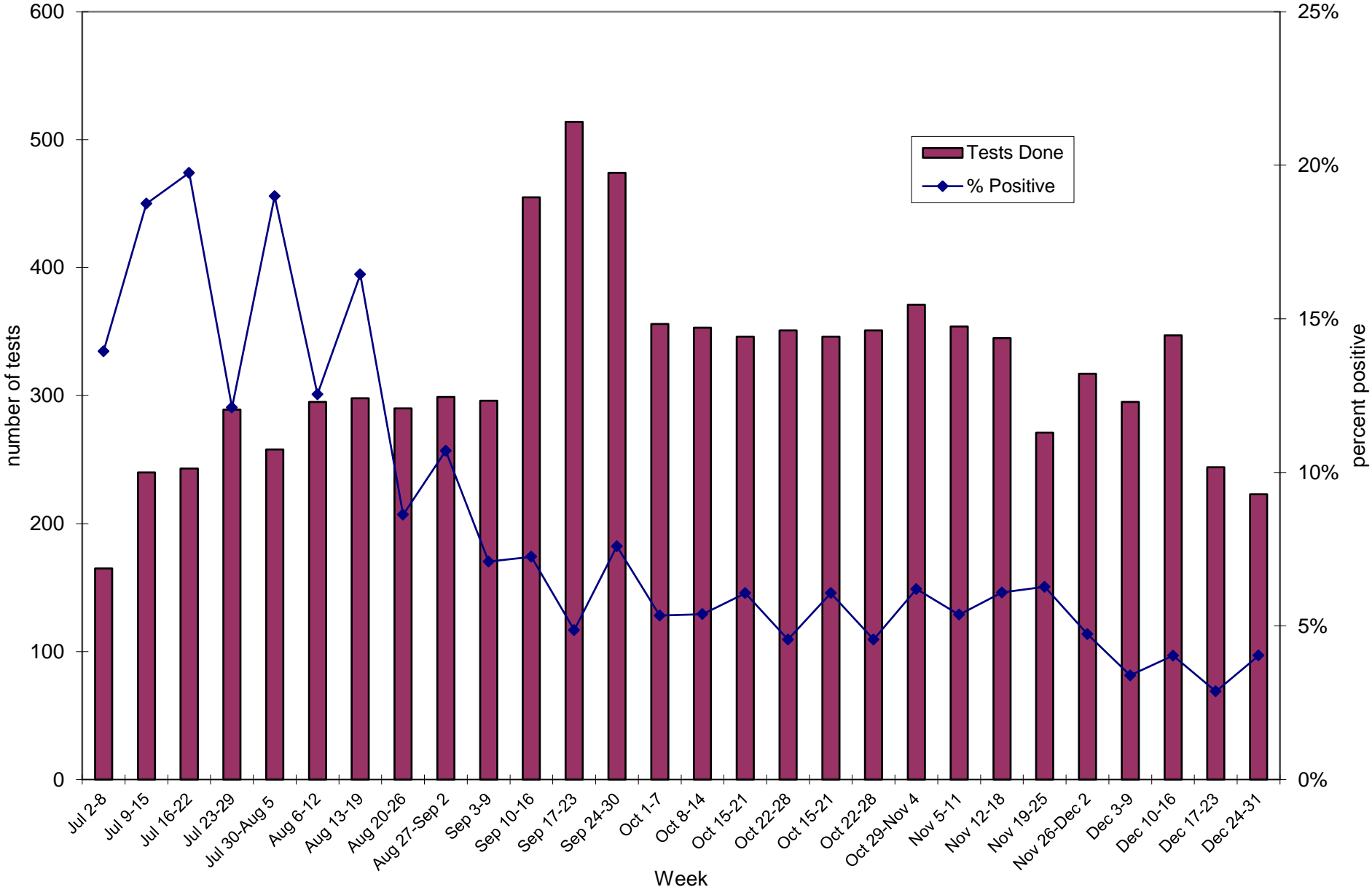
2011 – heightened disease activity

- 733 cases have been reported in 2011
- Number of cases occurring in January was equal to the number reported during the peak months in 2005
- Cases are still being reported all over California
 - 40 / 58 counties have reported cases with onset in 2011

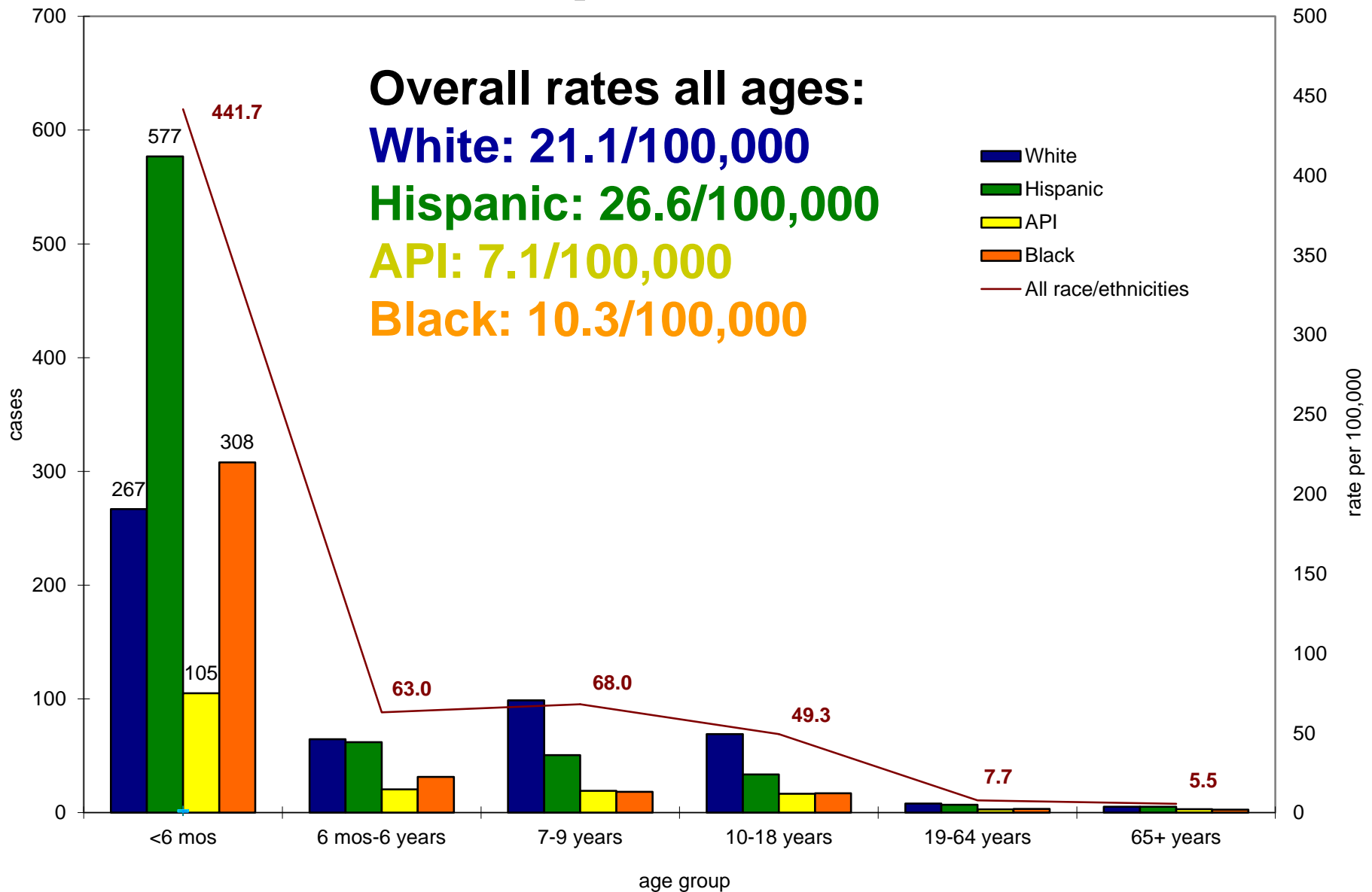
Proportion of pertussis cases diagnosed by culture and PCR -- California, 1990-2010*



***Bordetella pertussis* PCR percent positive by week - Southern California Kaiser, July -- December 2010**

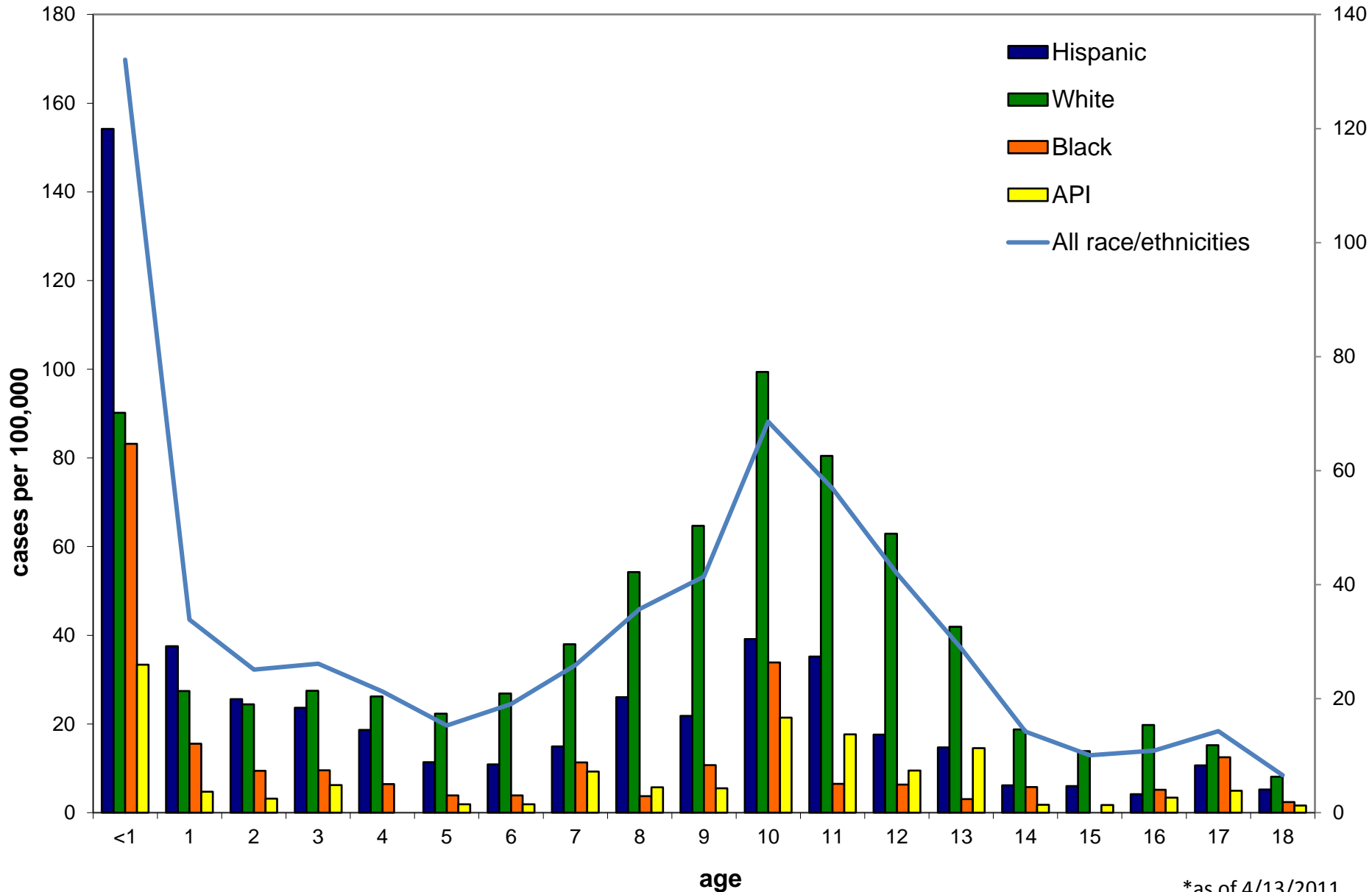


Pertussis cases/rates by age and race/ethnicity – California, 2010*



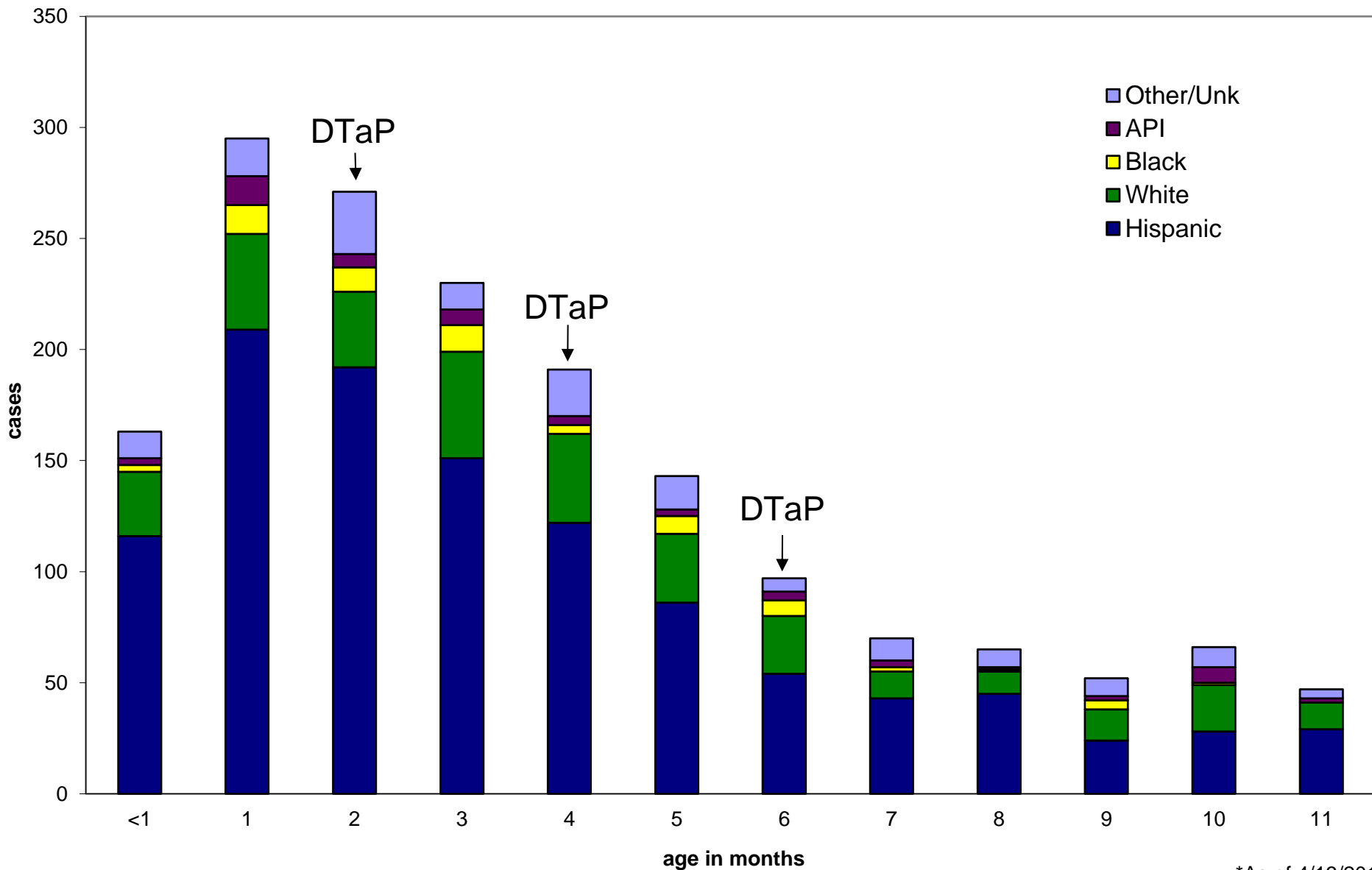
*As of 4/13/2011

Pediatric pertussis rates by age and race/ethnicity – California, 2010*



*as of 4/13/2011

Infant pertussis cases by age in months and race/ethnicity – California, 2010*



*As of 4/13/2011

2010 Pertussis Hospitalizations

as of 4/13/2011

- 733 (9%) cases are known to have been hospitalized (of the 92% with known status)
 - Most 547 (72%) hospitalized cases were infants <6 months of age; 419 (55%) were <3 months of age
 - 57% of infants <3 months of age were hospitalized
- 414 (76%) of the hospitalized infants <6 months of age were Hispanic
 - ~50% of CA birth cohort is Hispanic
- Some have had co-infections (RSV/adenovirus/influenza), which can confuse the diagnosis

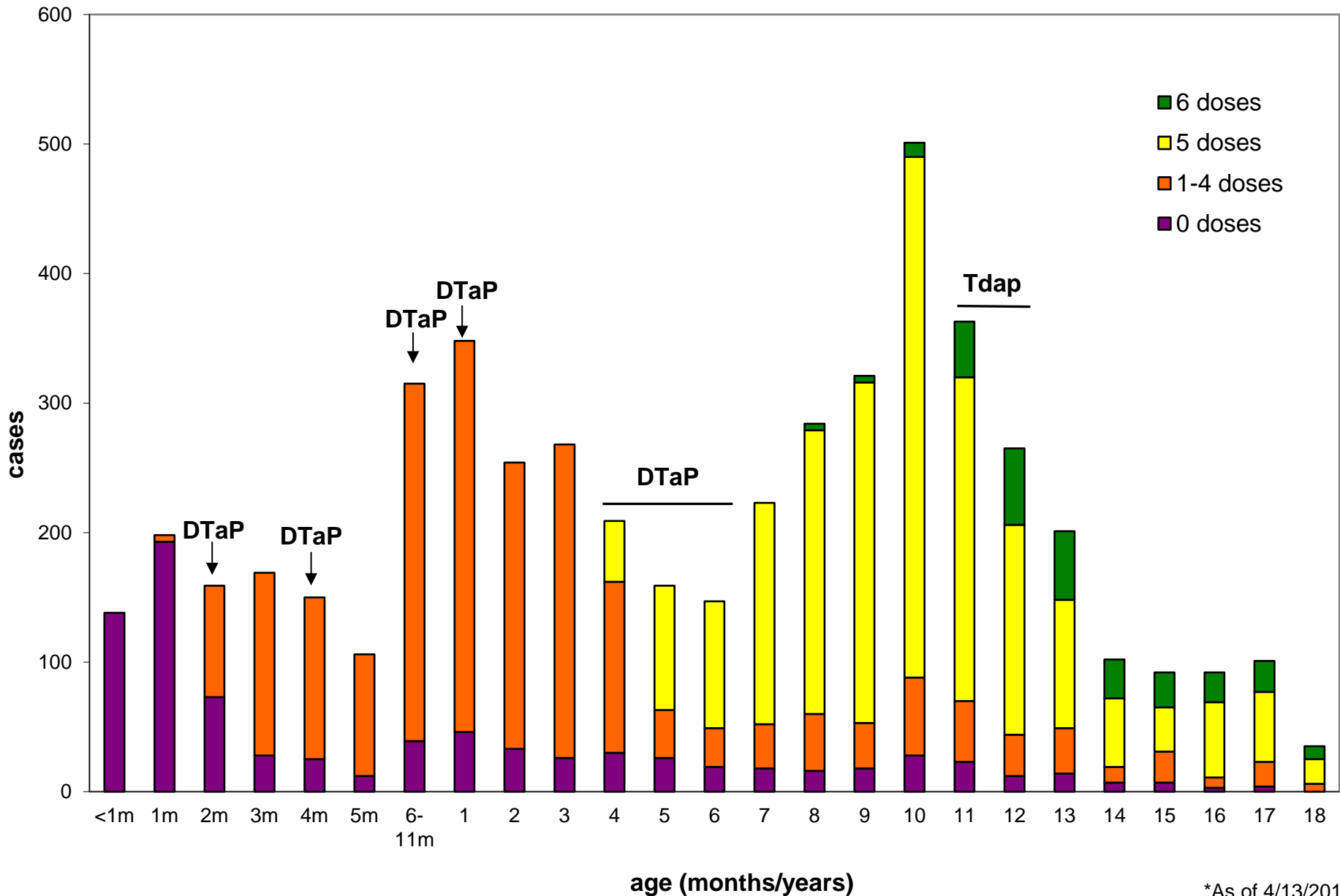
2010 Pertussis Deaths

- 10 deaths; 9 Hispanic infants, 1 White (30 deaths were reported in 1950)
 - The overall case fatality rate among infant cases <3 months of age is 1.4%
- Most (9) were infants <2 months of age at time of disease onset who had not received any doses of pertussis-containing vaccine
- One death occurred in a former preemie who received the first dose of DTaP at 2 months of age, 15 days prior to disease onset, and had 3 older siblings with cough illness
- Many of the fatal cases had multiple contacts with healthcare providers before pertussis was diagnosed, several had family members with cough illness

California Pertussis Deaths

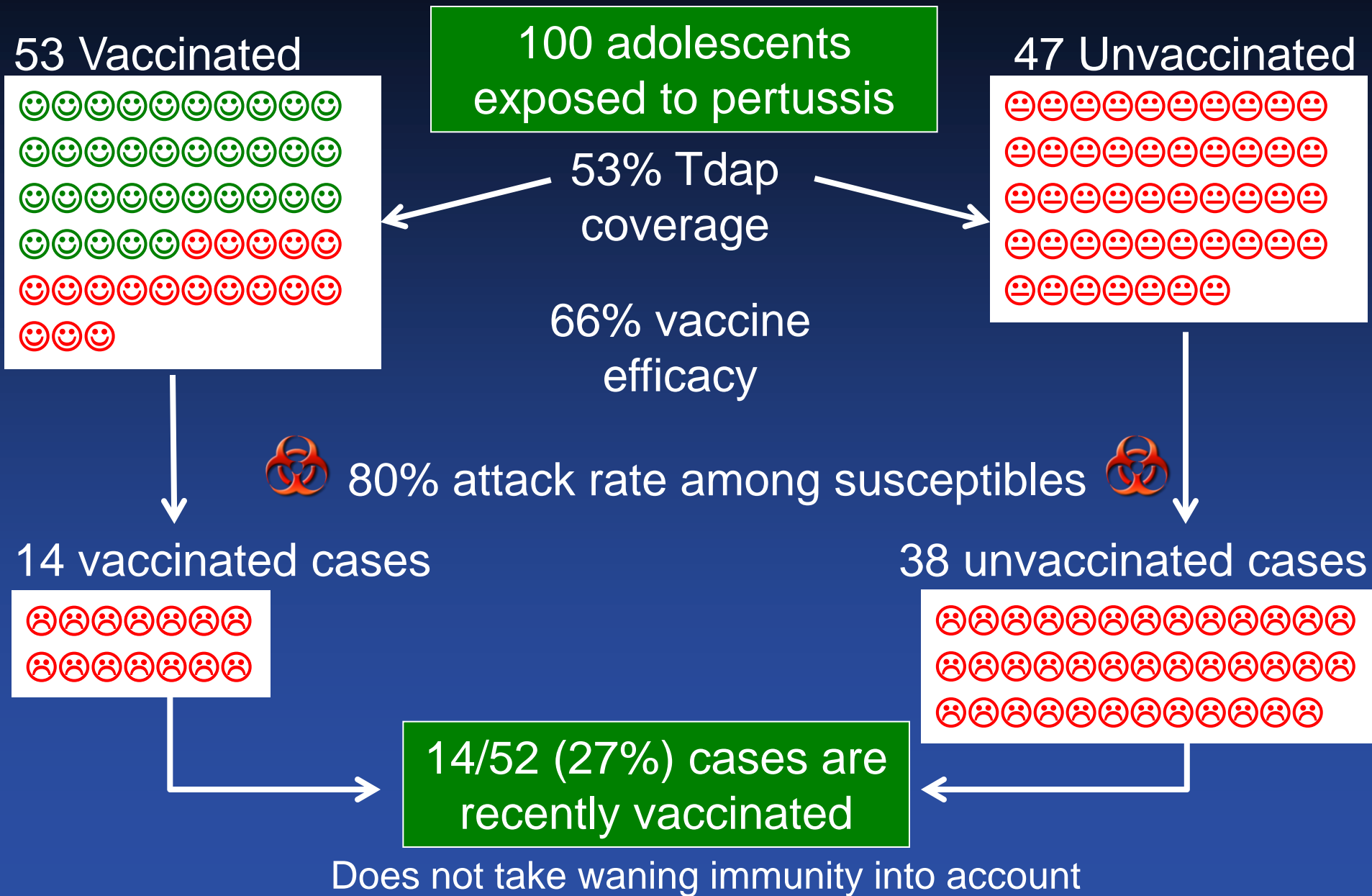
- All CA pertussis deaths (~ 3 /year) since 1996 have been in infants ≤ 3 months of age
- 80% Hispanic
- Of those with known status, all had pneumonia and pulmonary hypertension
- Pertussis toxin elicits a dose-dependent leukocytosis; the mean WBC of fatal cases in 1998-2009 was 75,000 (range 15,000-148,000)
- Increases in leukocyte mass can diminish blood flow by increasing vascular resistance; some experts recommend exchange transfusion to lower the WBC and possibly reduce pertussis toxin

Pertussis cases in children and adolescents aged 0-18 years with known vaccine history – California, 2010*



*As of 4/13/2011

Why are so many cases vaccinated?



Challenges

- Gaps and implementation barriers in ACIP vaccine recommendations
- Clinical recognition, diagnostic and reporting challenges
- Determination of effective outbreak control strategies
 - Targeted (cocooning) vs. community-wide vaccination strategies

Primary goal: to prevent deaths and hospitalizations
in young infants

CDPH Expanded Tdap Recommendations - July 2010

- Immunize pre-teens, teens and adults with Tdap vaccine
 - underimmunized 7-9 year olds
 - those ≥ 10 years of age who have not yet received Tdap, especially
 - ✓ women of childbearing age, preferably before, or else during or immediately after pregnancy
 - ✓ others with close contact with young infants
 - ✓ includes persons >64 years of age
- No minimum interval between Td and Tdap; OK to vaccinate if vaccination history is unknown

Hospital Tdap Vaccination Policy Survey

April 2010

- Surveyed Infection Preventionists and Labor & Delivery Managers
- 240 (91%) of 256 birth hospitals responded
 - 31% had postpartum Tdap policy
 - 38% of facilities with an ER offer Tdap for wound management
 - 11% of facilities with a NICU have a policy to offer vaccine to parents/siblings of NICU patients
 - 26% offer Tdap to HCWs
 - ✓ As of September 1, 2010, all California hospitals and outpatient medical facilities required to offer Tdap under Cal/OSHA's aerosol-transmissible disease standard
- Barriers:
 - Cost of vaccine/reimbursement issues
 - Physician/staff resistance
 - Determination of patient eligibility – unknown vaccination history

CDPH Tdap Expansion Program

- Free Tdap vaccine offered to immunize postpartum mothers and close contacts/care givers of newborns
- Vaccine purchased using American Recovery & Reinvestment Act of 2009 (ARRA) funding
- Open to birth hospitals and hospitals with neonatal intensive care units (NICUs) on 5/28/2010
 - Extended program to community health centers, tribal clinics on 7/8/2010.
 - No age/insurance limitations.

CDPH Tdap Expansion Program

- 180 hospitals enrolled (70% of total birth hospitals)
 - 71,615 doses administered
 - Most only able to vaccinate mothers (patients) but some able to vaccinate other household members
- 525 Community Health Centers enrolled
 - 112,189 doses administered
- Program ended 12/31/2010
- Conducting follow-up survey of hospitals to determine if facilities can continue postpartum Tdap vaccination programs

Pertussis Mitigation: Vaccination

- Tdap use encouraged in Emergency Departments for wound management
 - Reimbursement barriers for Tdap vs. Td
- Worked with payers re: Tdap reimbursement
 - Medicare Part D for adults >64 years of age
- Encouraged use of accelerated DTaP schedule for infants with first dose at 6 weeks of age
- Contracted with health care services company for special Tdap immunization clinics through LHDs targeting those with close contact with infants

Pertussis Mitigation: Provider education

- Provider education
 - Clinical recognition – pertussis signs and symptoms
 - Specimen collection and laboratory testing
 - Treatment recommendations for young infants



Pertussis is Peaking: Take Action!



The California Department of Public Health Presents:
**Addressing an Epidemic:
Clinicians' Role in
Preventing Pertussis** September 2, 2010
12:30pm to 1:30pm

Consider the diagnosis of pertussis in your patient

Young infants: The diagnosis of pertussis is often a deceptively mild onset of runny nose. There usually is an undetectable or mild illness. A few days after onset, a few days, mild illness may suddenly transform into a severe illness with a white blood cell count of $>20,000$ cells/mm³ with $>10\%$ of white blood cells being lymphocytes, which is an indication of pertussis.

Adolescents and adults: Most cases are not diagnosed until after the onset of bronchitis or asthma is common. The patient may have a choking sensation or of sweating. Leukocytosis/lymphocytosis occur in this population.

Delays in recognition of pertussis may contribute to

Think
pertussis

Tdap or DTaP

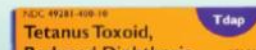
Pertussis is widespread—are your patients protected?

Tdap: Tetanus toxoid, Reduced Diphtheria toxoid, and Acellular Pertussis vaccine

7 Years of Age or Older

ADACEL™ (sanofi pasteur)

Boostrix® (GlaxoSmithKline)



Pertussis Mitigation: Public education

- Vaccination/cocooning
- Pertussis signs and symptoms
- Infants at greatest risk - keep ill people away from infants

父母：



為什麼百日咳很嚴重：
百日咳（也稱為 pertussis）是一種傳染病，很容

女遠離百日咳
保護您自己和

Is it just
a cough?

Or is it whooping cough?



LA TOS FERINA
está aumentando en Cali
Protege a tu bebé

ocurren más

provoca ataques de
que causan dificul-
tar.

California, cientos
hospitalizados por
algunos mueren.

bebé de protec-

ontra la tos ferina
ero tu bebé está
queño para obte-

bebé al asegurarte
onas estén al día
as contra la tos

persona que viva
é
persona que cuide

Las nuevas mamás necesi-
tan la vacuna Tdap
Regularmente los bebés se conta-
gian de tos ferina de algún fami-
liar. Al protegerte de la enferme-
dad también estás protegiendo a
tu bebé.

Pregunta a tu doctor por la va-
cuna Tdap.
La puedes obtener:
• Antes de quedar embarazada
(lo mejor)
• Durante tu embarazo
• Después de dar a luz

Si no te has puesto la vacuna
Tdap, obténla antes de que
salgas del hospital con tu recién
nacido.

Es seguro vacunarte con Tdap
cuando estás amamantando.

Trata la tos ferina lo antes
posible



La historia
Antes de que
estaba enfer-
fuerte. Tosi ta-
ciones se me-
nació hermos-
tos continuab-
difícil manten-
cuando lo am-
señal de tos fe-

Dos semanas
Dylan murió p
contrajo de m
de nacido. Es
bebés como D
con la tos ferin
los padres a

CDPH/CDC DTaP Vaccine Effectiveness Assessment

- Objectives:
 - Assess overall VE of DTaP following the 5 dose series
 - Determine duration of protection at specific time points after vaccination - is vaccine waning earlier than expected?
 - Evaluate the impact of the timing of administration of 5th dose (can be given from age 4 through age 6)
 - Evaluate effect of vaccine product on VE and duration of protection (two manufacturers of DTaP and vaccine formulations are different)
- Methods:
 - ~1000 2010 pertussis cases in 15 CA counties and ~3000 unmatched controls aged 4-10 years with same providers
 - In-person collection of vaccine history data

Interim Analysis* DTaP Vaccine Effectiveness Estimates, by Age Group

Model**	Case (n)	Control (n)	VE, %	95% CI
Age 4 - 5 years				
0 dose	19	8	Ref	--
5 doses	75	598	94.7	85.6 - 98.1
Age 6 - 7 years				
0 dose	10	8	Ref	--
5 doses	138	733	84.9	70.1 - 92.4
Age 8 - 10 years				
0 dose	23	8	Ref	--
5 doses	444	820	81.1	60.8 - 91.0

* VE estimates are preliminary and based on interim data.

** Adjusted for county and provider clustering.

CA Postpartum Tdap Effectiveness Study

- Evaluate whether vaccinating postpartum women with Tdap is an effective strategy to reduce transmission of *B. pertussis* to young infants
- Survey done to determine which CA birth hospitals have postpartum Tdap policies
- Hospital of birth was ascertained for infant pertussis cases to determine if infants born in hospitals with postpartum Tdap policies were less likely to become infected with pertussis
- Preliminary data suggest this is the case; additional data are being collected

CDC Emerging Infections Program Cocooning Study

- Six states, including CA and MN, will participate in a study to evaluate the effectiveness of the cocooning strategy
- Infected infants and three uninfected controls <6 months of age will be enrolled
- Parents/guardians of cases and controls will be interviewed to assess pertussis vaccination history of infant contacts; potential confounding factors will also be assessed

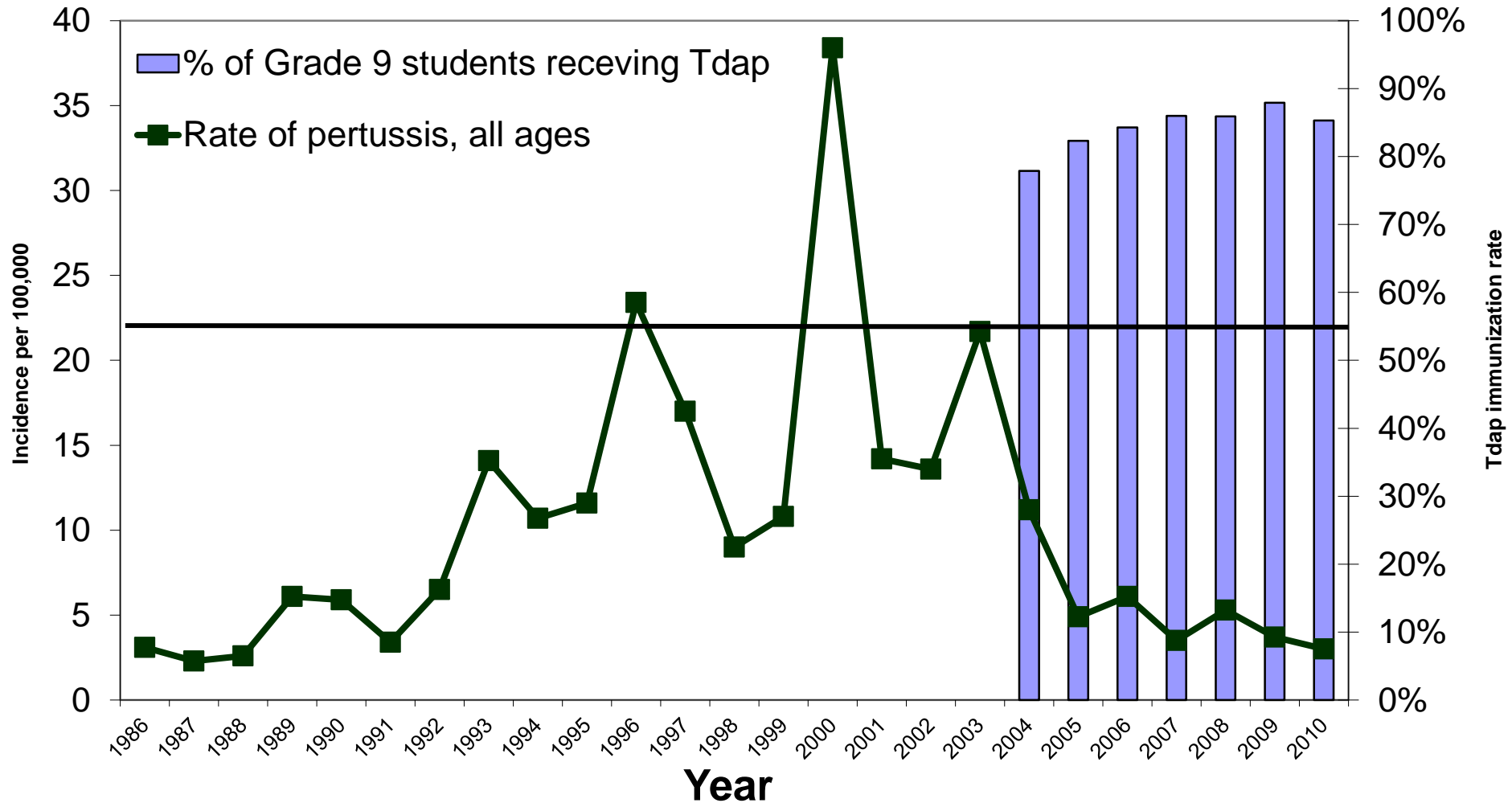
Cocooning vs. Community-wide Vaccination

- No good studies exist to demonstrate efficacy of using a cocooning strategy or of increasing vaccination rates using a community wide approach
 - Herd immunity levels required >90%
 - Only 6% of adults with Tdap coverage leaving a very large pool of susceptibles
- Cocooning has following advantages:
 - Targeted use of resources
 - Family members most likely to transmit to vulnerable infants so may prevent transmission to those at highest risk for morbidity and mortality

Community Vaccination – Natural Experiment

- AB 354 - new school law effective 2011-2012 academic year
- All students entering 7-12th grades in 2011-2012 required to have a dose of pertussis-containing vaccine
- All subsequent years, newly entering 7th grade students will have pertussis vaccine requirement
- Affects ~3 million adolescents in California
 - Current Tdap coverage estimated at 53%
- Will this help reduce community transmission?

Incidence of Pertussis and Tdap Immunization Rates in British Columbia, 1986-2010



Data: British Columbia Centre for Disease Control

2010-2011 ACIP Pertussis Recommendations

- October 2010
 - No interval necessary between Td and Tdap
 - Tdap for adults 65 years of age and older with infant contact
 - One dose of Tdap for un- and under-immunized children 7-10 years of age
- February 2011
 - All healthcare personnel (HCP) who have not received Tdap should receive it as soon as possible
 - Healthcare facilities should take steps to encourage Tdap, including providing it at no cost
 - Postexposure prophylaxis recommended for all HCP exposed to pertussis (regardless of their vaccination status) who are likely to expose patients at risk for severe pertussis (e.g., hospitalized neonates)

Thank you!

- CDPH colleagues
- California local health departments
- California hospital infection preventionists
- CDC Meningitis and Vaccine Preventable Diseases Branch

Questions?

