

# Catching the Next Wave: Pertussis in Orange County in 2018

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**No Conflicts**

# Topics to Be Covered

- Pertussis clinical disease
- Current pertussis epidemiology in Orange County and California
- Pertussis vaccine
- Public health investigation of cases
- Current status of maternal vaccination

# Pertussis Illness: Catarrhal Stage

- Follows an incubation period of 5-21 days
- Characterized by:
  - Runny nose
  - Sneezing
  - Cough
  - Fever often mild or absent
  - Lasts about two weeks

# Pertussis Paroxysmal Stage

- Follows catarrhal stage
- Characterized by persistent cough
  - Paroxysms 82-100 %
  - Post-tussive emesis 45-71%
  - “Whoop” 30-67%
  - Lower respiratory tract symptoms unusual
- Other systemic symptoms rare
- Patient usually appears well between coughing spells

# Pertussis Convalescence Stage

- Convalescence is gradual and protracted
- Severity of illness wanes
- Frequency of coughing bouts decreases
- Nonparoxysmal cough can continue for weeks or months
- Superimposed viral respiratory infections can trigger a recurrence of paroxysms

# Pertussis Complications

- Bacterial pneumonia
- Pneumothorax
- Rib fracture
- Weight loss
- Sleep disturbance
- Epistaxis
- Hypoxic encephalopathy in infants
- Hernia
- Urinary incontinence
- Otitis media
- Seizures
- Subdural hematoma
- Subconjunctival hemorrhage

# Pertussis in the Infant

May present differently:

- Shorter catarrhal stage
- May not have noticeable cough or “whoop”
- Gagging, gasping or apnea
- Facial color changes (may turn blue, purple or red)
- Will frequently have leukocytosis with an increased absolute lymphocyte count



## *B. Pertussis* Transmission

- Spread by droplets from coughing person
- Droplets reach upper respiratory tract of susceptible person
- Patients considered infectious for 21 days after cough begins
- Contact with environmental secretions can also lead to spread of disease
- Standard and droplet precautions should be observed in clinical settings

# Reported NNDSS pertussis cases: 1922-2016



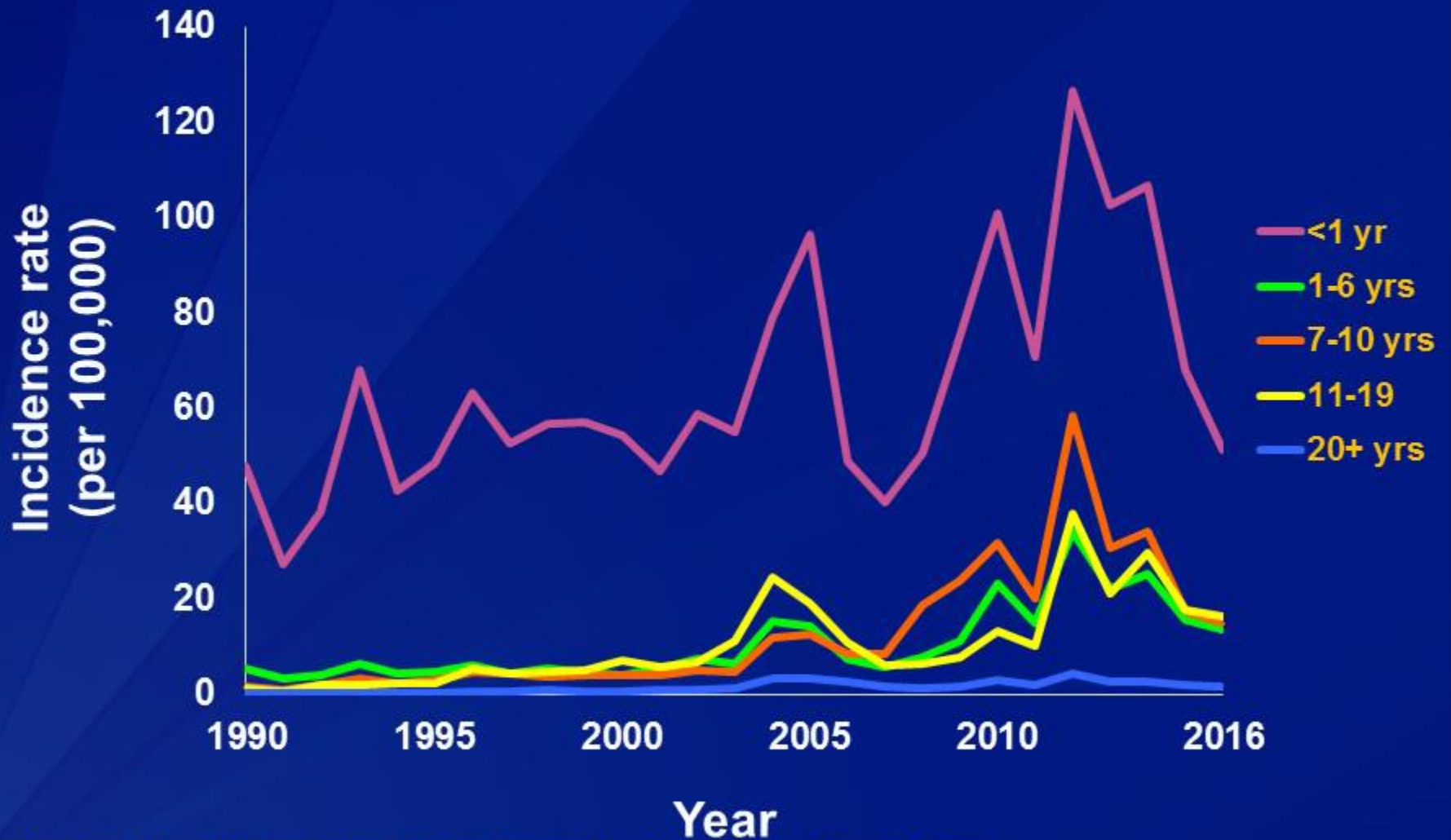
SOURCE: CDC, National Notifiable Diseases Surveillance System and Supplemental Pertussis Surveillance System and 1922-1949, passive reports to the Public Health Service

# Pertussis Mortality Trends

- From 1926-1930, 36,013 deaths reported in the United States, primarily in <1 year olds
- From 1990 to 1996, 57 persons died from pertussis
- Reduction in pertussis mortality due to:
  - Vaccination
  - Improved care of infants with disease

Gordon je, am j med sci 1951  
Ra haward lancet 1973; 1:873

## Reported pertussis incidence by age group: 1990-2016



SOURCE: CDC, National Notifiable Diseases Surveillance System and Supplemental Pertussis Surveillance System

# Infants Experience the Most Severe Pertussis Disease

In 2015 and 2016:

- 44% of infants under 6 months of age who get pertussis are hospitalized
- 6 of 7 pertussis deaths occurred in infants under 6 months





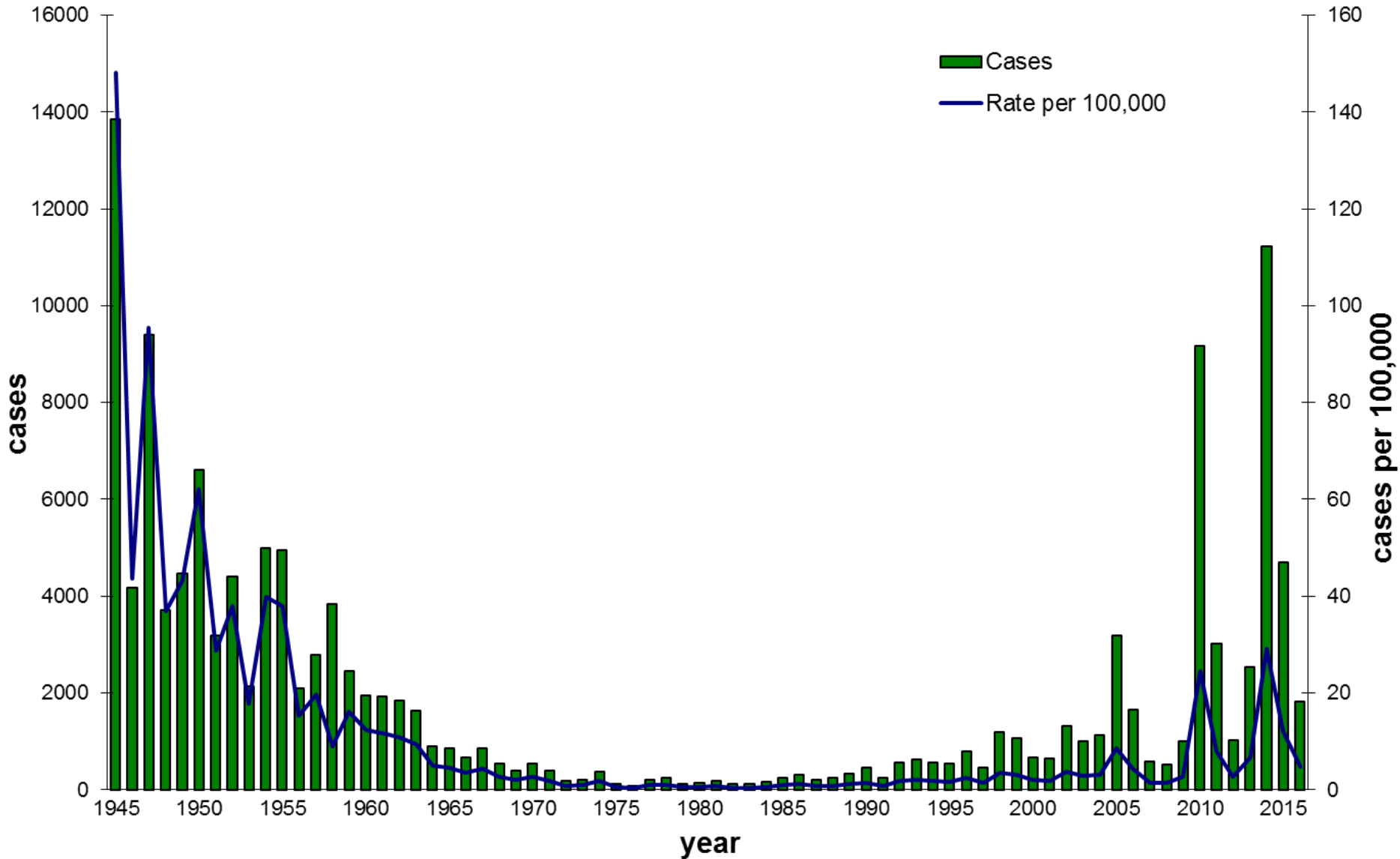
# Pertussis Vaccine Limitations

- Not 100% effective
- Immunity wanes
- May only attenuate disease
- Without boosting, adolescents and adults have no apparent immunity

# Tdap Recommendations in 2005

- Children:
  - Tdap is indicated for a single booster dose at age 11 or 12 years, or catch-up dose later if not given
- Ages 19 and older:
  - Substitute Tdap for one booster dose of Td

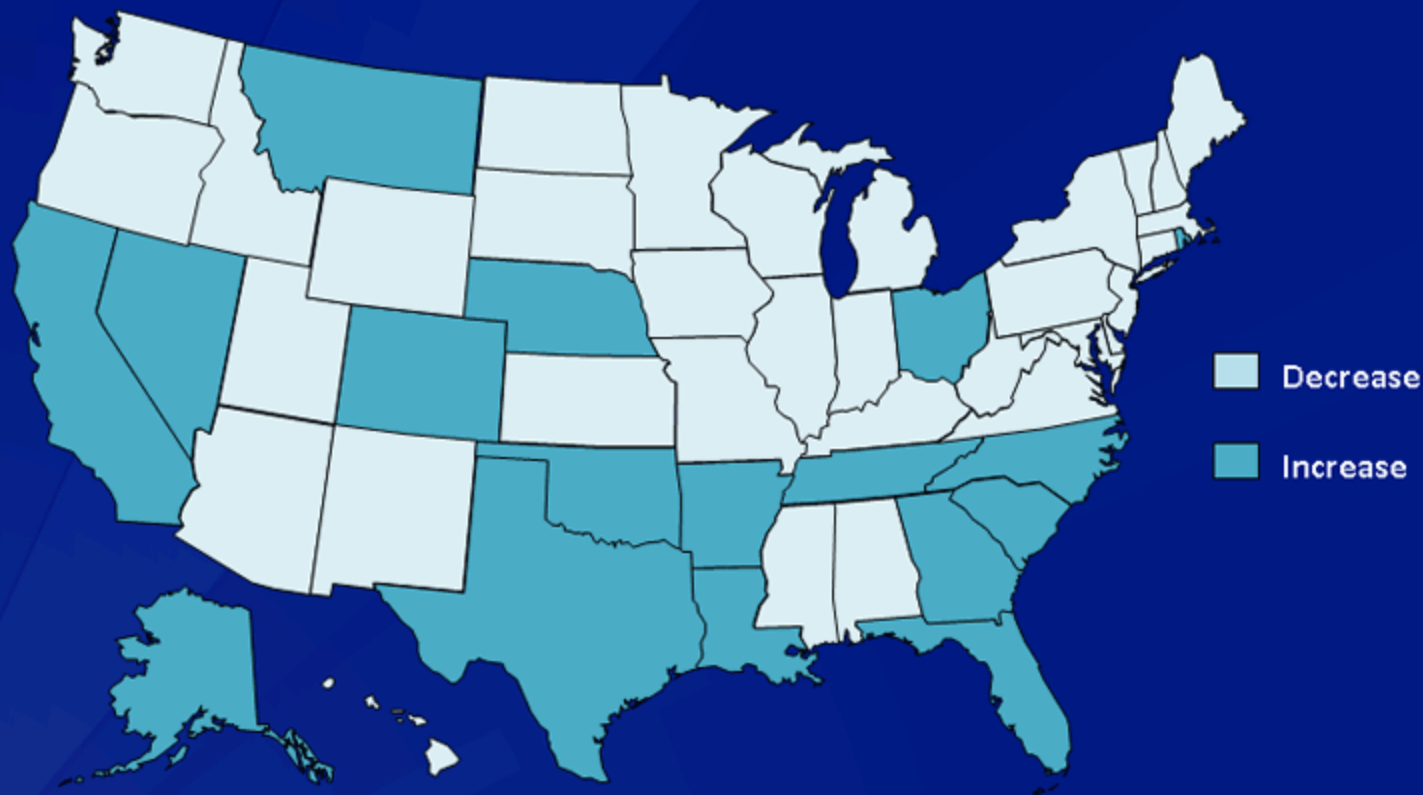
# Number and incidence of reported pertussis cases by year of onset -- California, 1945-2016\*



\*Includes cases reported to CDPH as of 5/11/2017



## Changes in Pertussis Reporting by State from 2012 to 2013\* †



\*Data for 2012 and 2013 are provisional and subject to change.

†Cases reported through Week 30 in 2012 were compared with cases reported through Week 30 in 2013; fold-changes were calculated for each state.



# Risk factors for infant pertussis in CA (2013-2014)\*

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- Hispanic case-infants were more likely to:
  - Younger mother  $\leq 18$  years of age
  - Have more than 1 sibling (estimated through maternal parity); an increase in risk was observed for higher maternal parity
  - Medicaid as the payer for prenatal care [RR=1.7 (95% CI: 1.4-2.0)] compared to privately insured mothers
    - No difference in # of prenatal visits
  - Preterm birth [RR=1.6 (95% CI: 1.1-2.1)]
- Non-Hispanic case-infants were more likely to:
  - Younger mothers  $\leq 18$  years of age
  - Have any siblings (estimated through maternal parity); an increase in risk was observed for higher maternal parity

\*Winter K, et al. Risk markers for pertussis among infants <4 months of age: Understanding the Hispanic disparity. PIDJ. 2017. in press



# *Bordetella pertussis*

**B. pertussis** disease is mediated by a variety of antigens and toxins:

## Antigens

- Fimbriae
- Filamentous hemagglutinin
- Pertactin

## Toxins

- Pertussis toxin
- Adenylate cyclase
- Tracheal cytotoxin



# Composition\* of Acellular Pertussis Vaccines

Product	PT	FHA	PERT	FIM
Infanrix	25	25	8	---
Daptacel	10	5	3	5
Boostrix	8	8	2.5	---
Adacel	2.5	5	3	5

\*mcg per dose

**Figure 1. Recommended immunization schedule for persons aged 0 through 18 years – United States, 2014.**

**(FOR THOSE WHO FALL BEHIND OR START LATE, SEE THE CATCH-UP SCHEDULE (FIGURE 2)).**

These recommendations must be read with the footnotes that follow. For those who fall behind or start late, provide catch-up vaccination at the earliest opportunity as indicated by the green bars in Figure 1. To determine minimum intervals between doses, see the catch-up schedule (Figure 2). School entry and adolescent vaccine age groups are in bold.

Vaccine	Birth	1 mo	2 mos	4 mos	6 mos	9 mos	12 mos	15 mos	18 mos	19–23 mos	2-3 yrs	4-6 yrs	7-10 yrs	11-12 yrs	13–15 yrs	16–18 yrs
Hepatitis B <sup>1</sup> (HepB)	1 <sup>st</sup> dose	← 2 <sup>nd</sup> dose →		← 3 <sup>rd</sup> dose →						[Catch-up]						
Rotavirus <sup>2</sup> (RV) RV1 (2-dose series); RV5 (3-dose series)		1 <sup>st</sup> dose	2 <sup>nd</sup> dose	See footnote 7												
Diphtheria, tetanus, & acellular pertussis <sup>3</sup> (DTaP; <7 yrs)		1 <sup>st</sup> dose	2 <sup>nd</sup> dose	3 <sup>rd</sup> dose	← 4 <sup>th</sup> dose →				5 <sup>th</sup> dose	(Tdap)						
Tetanus, diphtheria, & acellular pertussis <sup>4</sup> (Tdap; ≥7 yrs)													(Tdap)			
<i>Haemophilus influenzae</i> type b <sup>5</sup> (Hib)		1 <sup>st</sup> dose	2 <sup>nd</sup> dose	See footnote 5		← 3 <sup>rd</sup> or 4 <sup>th</sup> dose → See footnote 5										
Pneumococcal conjugate <sup>6</sup> (PCV13)		1 <sup>st</sup> dose	2 <sup>nd</sup> dose	3 <sup>rd</sup> dose	← 4 <sup>th</sup> dose →											
Pneumococcal polysaccharide <sup>6</sup> (PPSV23)																
Inactivated poliovirus <sup>7</sup> (IPV) (<18 yrs)		1 <sup>st</sup> dose	2 <sup>nd</sup> dose	← 3 <sup>rd</sup> dose →						4 <sup>th</sup> dose						
Influenza <sup>8</sup> (IIV; LAIV) 2 doses for some: See footnote 8	Annual vaccination (IIV only)					Annual vaccination (IIV or LAIV)										
Measles, mumps, rubella <sup>9</sup> (MMR)	← 1 <sup>st</sup> dose →						2 <sup>nd</sup> dose									
Varicella <sup>10</sup> (VAR)	← 1 <sup>st</sup> dose →						2 <sup>nd</sup> dose									
Hepatitis A <sup>11</sup> (HepA)	← 2-dose series, See footnote 11 →															
Human papillomavirus <sup>12</sup> (HPV2: females only; HPV4: males and females)														(3-dose series)		
Meningococcal <sup>13</sup> (Hib-Men-CY ≥ 6 weeks; MenACWY-D ≥ 9 mos; MenACWY-CRM ≥ 2 mos)	See footnote 13											1 <sup>st</sup> dose	Booster			

Range of recommended ages for all children

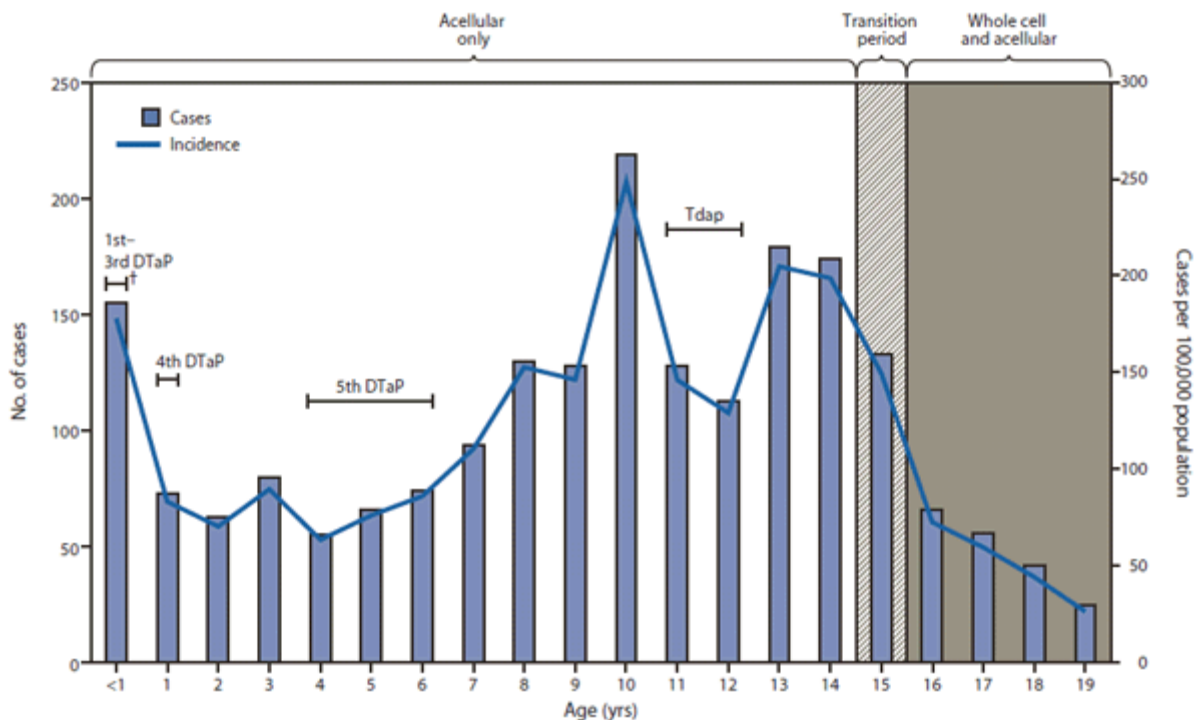
Range of recommended ages for catch-up immunization

Range of recommended ages for certain high-risk groups

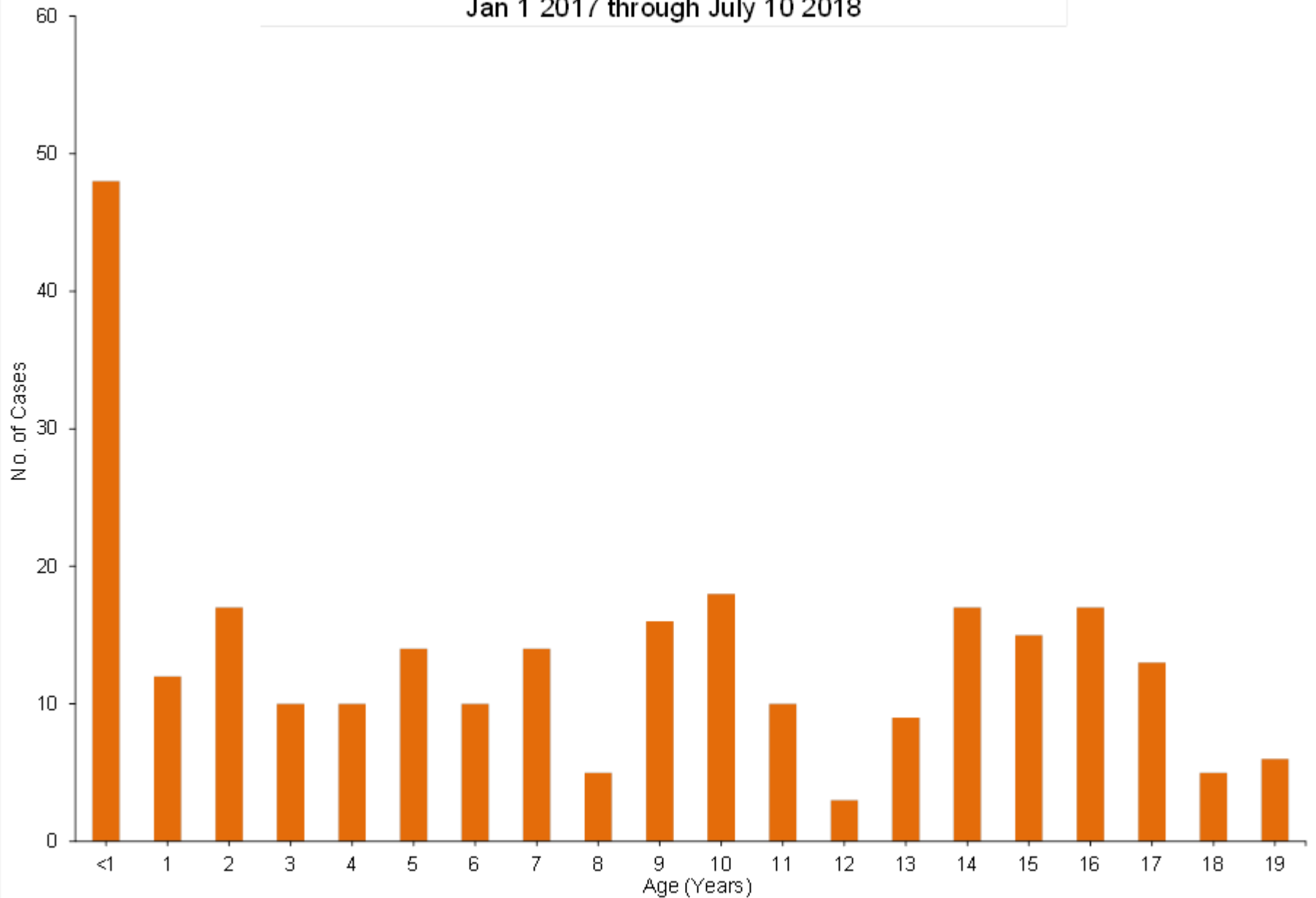
Range of recommended ages during which catch-up is encouraged and for certain high-risk groups

Not routinely recommended

# Number and incidence of confirmed and probable pertussis cases among persons aged $\leq 19$ years, by patient age and vaccines received — Washington State, January 1–June 16, 2012

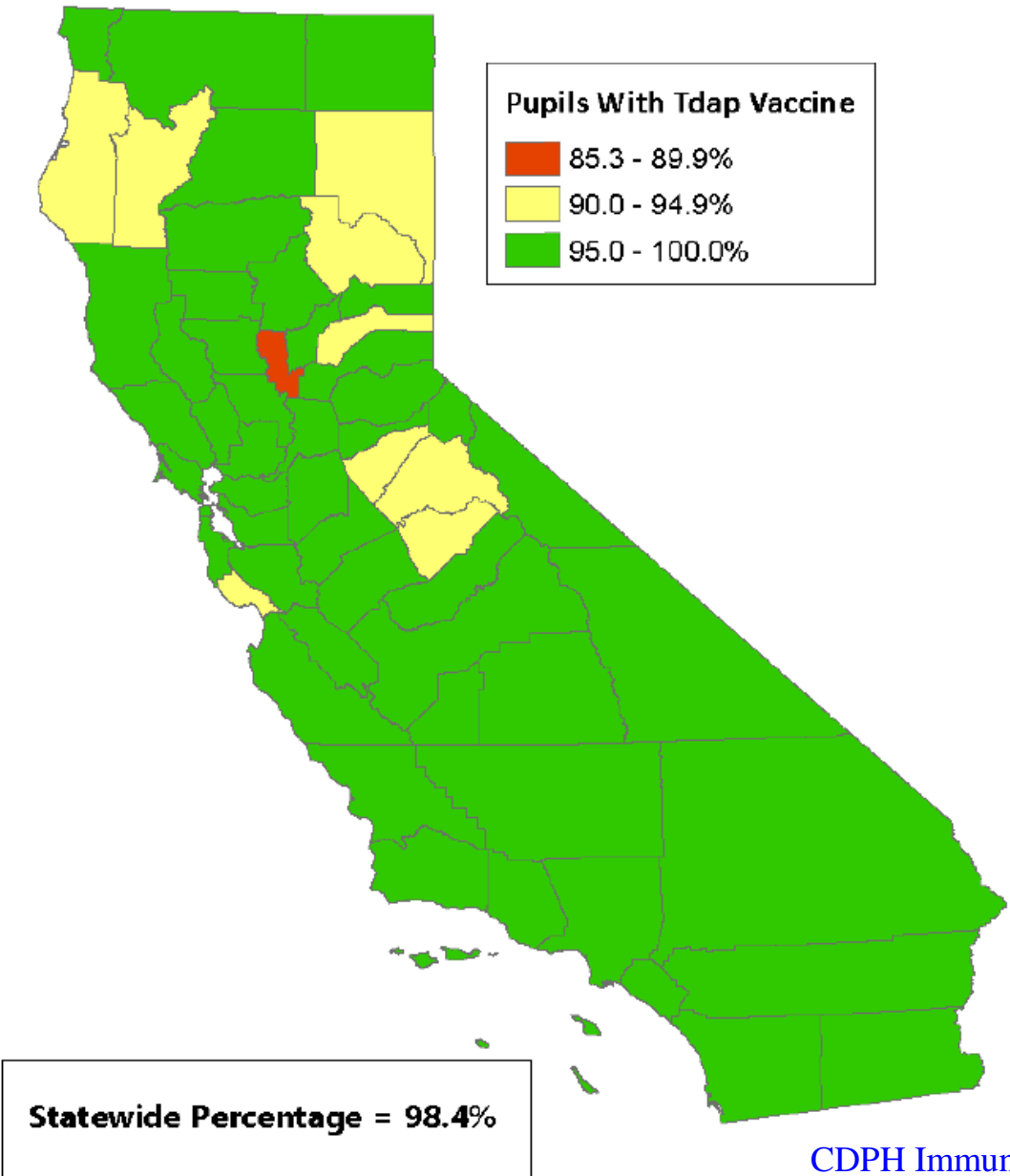


Pertussis in Orange County Residents Under the Age of 20 Years,  
Jan 1 2017 through July 10 2018





2016-2017 School Year



# AAP and CDC Recommendations:

- A 5-day course of azithromycin is the appropriate first-line choice for treatment and postexposure prophylaxis
  - Antibiotics during the catarrhal stage may ameliorate symptoms
  - After the paroxysmal cough is established, antimicrobial agents have no discernable effect on course of illness but are recommended to limit spread to others
- Cases are considered infectious for 21 days from onset of cough or until 5 days of antibiotics are begun
- Children in child care or school should be excluded until 5 days of antimicrobial therapy are completed

## **Time (Days) From Onset of Cough to PCR Obtained by Age Group, 2017 in Orange County:**

	<1yr	1-5 years	6-13 years	14-18 years
Median	8	14	15	3

## **Time (Days) From PCR Obtained to Start of Rx**

	<1yr	1-5 years	6-13 years	14-18 years
Median	1	0	0	0

## **Time (Days) From RX Start to HCA Contact**

	<1yr	1-5 years	6-13 years	14-18 years
Median	1	1	4	3

# California Department of Public Health Recommendations:

The CDC and the American Academy of Pediatrics recommend school exclusion for children with pertussis until they have completed 5 days of antibiotic treatment. However, many cases will be undiagnosed and untreated and the benefit of school exclusion of known cases is unclear. In these situations, LHJs may consider permitting cases who have started but not completed 5 days of antibiotic treatment to attend school if they are well enough to participate in school activities.

# OCHCA Protocol for Exclusion of Pertussis Cases from School or Daycare

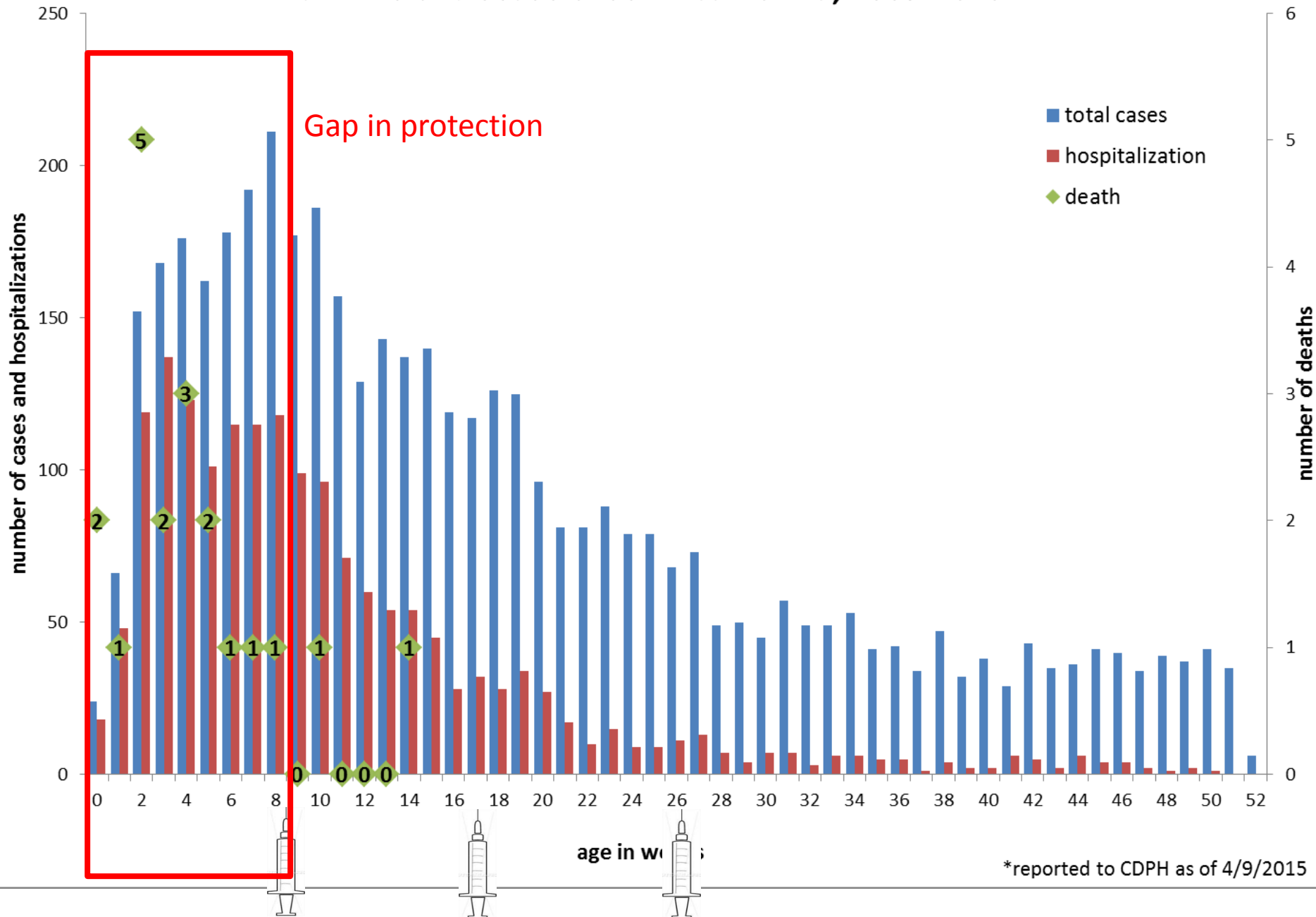
- Exclude case from **childcare settings** until 5 days of appropriate antibiotic treatment.
- Orange County Public Health will permit cases who have started antibiotics to attend K-12 school if they are well enough to participate in school activities without exclusion period.
  - **Note that AAP continues to recommend exclusion from school until 5 days of antibiotic therapy has been completed– OCPH will adhere to physicians' recommendations in this situation**
- School exclusion of unvaccinated students is rarely indicated.

# Healthcare Providers and Tdap

- All persons in contact with infants should be up-to-date for pertussis vaccine.
- Although only one dose of Tdap is recommended by ACIP for adolescents and adults, persons may choose to be revaccinated if it has been several years since receipt of Tdap

# Tdap during Pregnancy

# Pertussis cases, hospitalizations and deaths in infants, by age in weeks at time of disease onset -- California, 2009-2015\*





# Vaccination of Pregnant Women

- Protects mom from developing illness and passing to child
- Passes maternal antibodies to baby, providing protection in the first months of life
- Vaccinating at delivery does NOT provide equivalent protection to vaccination during 27-36 weeks' gestation

# Tdap Vaccine Safety

- One study found a small but statistically significant association with chorioamnionitis; two subsequent smaller studies did not identify an association
- Recent metaanalysis of a total of 21 studies found no evidence for adverse events associated with maternal Tdap vaccination
- No studies have do not suggested an increased risk after antenatal Tdap exposure for adverse birth outcomes such as: preterm birth, SGA (birth weight less than the 10<sup>th</sup> percentile), stillbirth, low birth weight, and congenital anomalies
  - Studies are retrospective and hindered by low incidence of these adverse outcomes

## Tdap vaccination leads to higher antibody levels in infants

Outcome Antibodies	Mother did not receive Tdap, mean (SEM) n=52	Mother received Tdap, mean (SEM) n=52	P value <sup>a</sup>	Pearson correlation coefficient (P value <sup>a</sup> )
PT	11.010 (1.796)	28.220 (2.768)	< .001	0.158 (.055)
FHA	26.830 (4.022)	104.15 (21.664)	.002	0.165 (.045)
PRN	24.700 (5.765)	333.01 (56.435)	< .001	0.965 (< .001)
FIM 2/3	82.83 (14.585)	1198.99 (189.937)	< .001	0.293 (< .001)

FHA, filamentous hemagglutinin; FIM, fimbriae; PRN, pertactin; PT, pertussis toxin;

<sup>a</sup> Significant at .05 level.

# Pertussis Vaccination and Infant Antibody Levels

- Infant pertactin, fimbriae, and pertussis toxin antibody titers are greater than maternal levels after maternal vaccination
- Blunting of immune response after infant vaccination series is mild and resolves by third dose
- >90% of infants achieve apparent protective antibody

# Tdap Vaccination During Pregnancy and its Effectiveness

- Data from Wales and England
  - Maternal vaccination implemented on a national level
- About 60% coverage during pregnancy achieved
- Mothers of 10 cases (17%) and 39 controls (71%) received pertussis vaccine in pregnancy
- Adjusted VE was 93% (95% CI, 81%–97%)
- Maternal vaccination prevented 93% of cases in infants under two months of age

# Effectiveness of Prenatal Tetanus, Diphtheria, Acellular Pertussis Vaccination in the Prevention of Infant Pertussis in the U.S.

- Nationwide cohort study of pregnant women with deliveries in 2010–2014 and their infants
  - Truven Health Analytics MarketScan<sup>®</sup> Commercial Claims and Encounters Databases
- 675,167 mother–infant pairs in the cohort
- Among infants whose mothers received prenatal Tdap:
  - Rate of pertussis was 43% lower (HR=0.57, 95% CI=0.35, 0.92)
  - Rate of inpatient-only pertussis was 75% lower (HR=0.25, 95% CI=0.08, 0.80)
- Infants whose mothers received Tdap at <27 weeks of gestation did not experience reductions in pertussis rates (HR=1.10, 95% CI=0.54, 2.25).

# CDC Recommendation

Pregnant women should get a dose of Tdap during each pregnancy, preferably during the early part of gestation weeks 27 through 36.

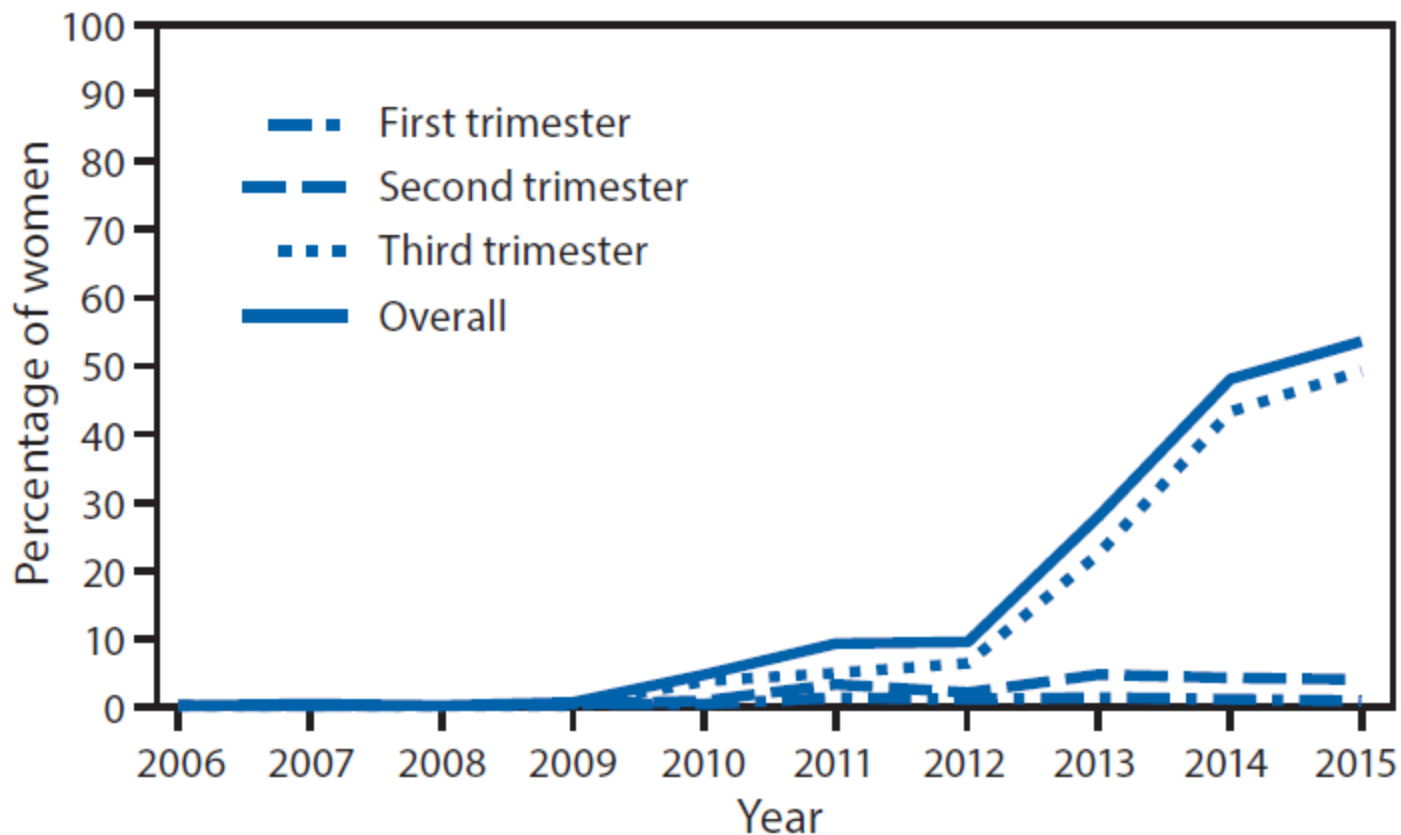
# American College of Obstetricians and Gynecologists

## (ACOG) Recommendations:

- Obstetric care providers should administer Tdap vaccine to all pregnant patients during each pregnancy, as early in the 27–36-weeks-of-gestation window as possible.
- Pregnant women should be counseled that the administration of the Tdap vaccine during each pregnancy is safe and important
- Obstetrician–gynecologists are encouraged to stock and administer the Tdap vaccine in their offices.

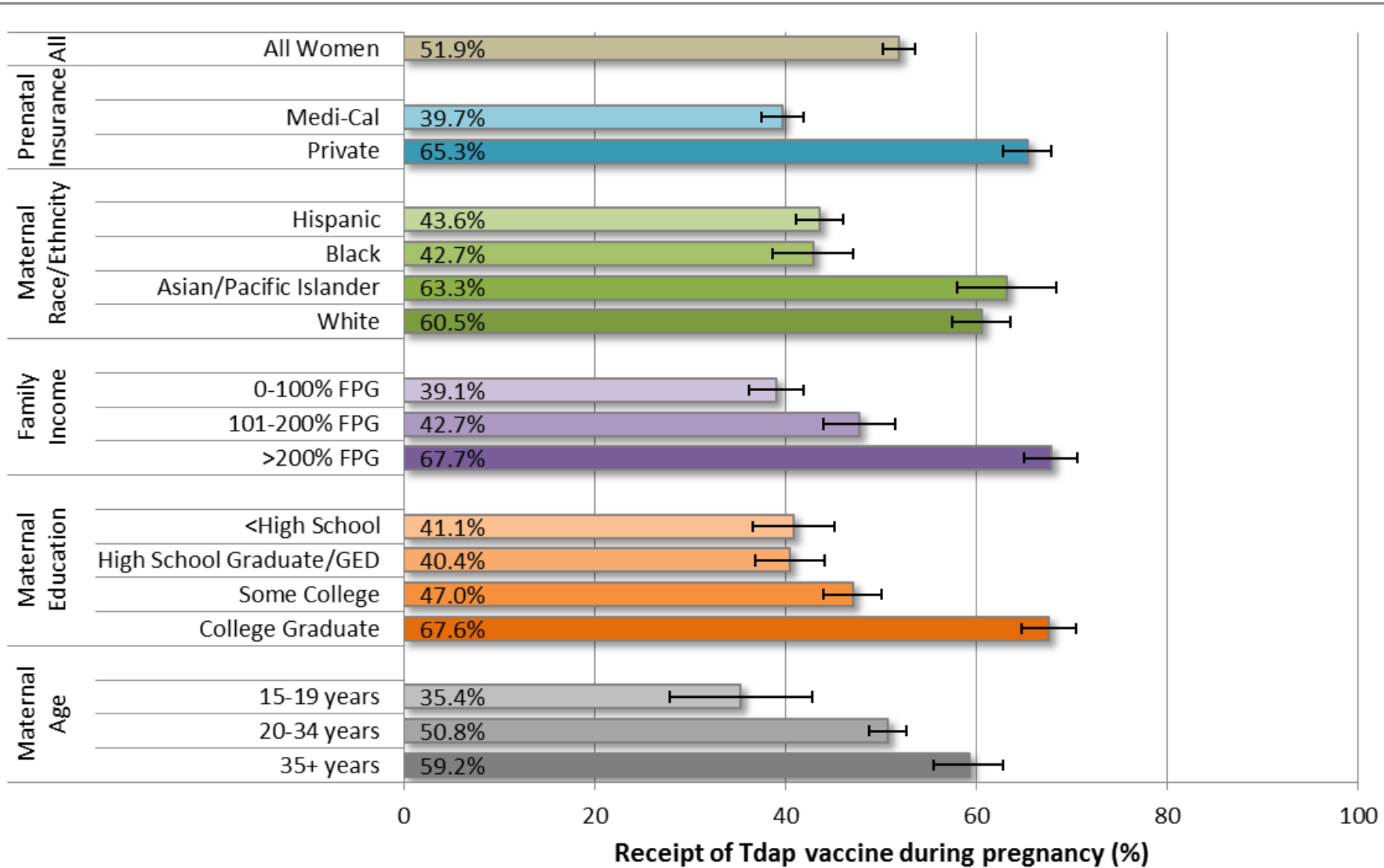


**FIGURE.** Percentage of women receiving tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccination during pregnancy, by trimester — selected sites,\* United States, 2006–2015

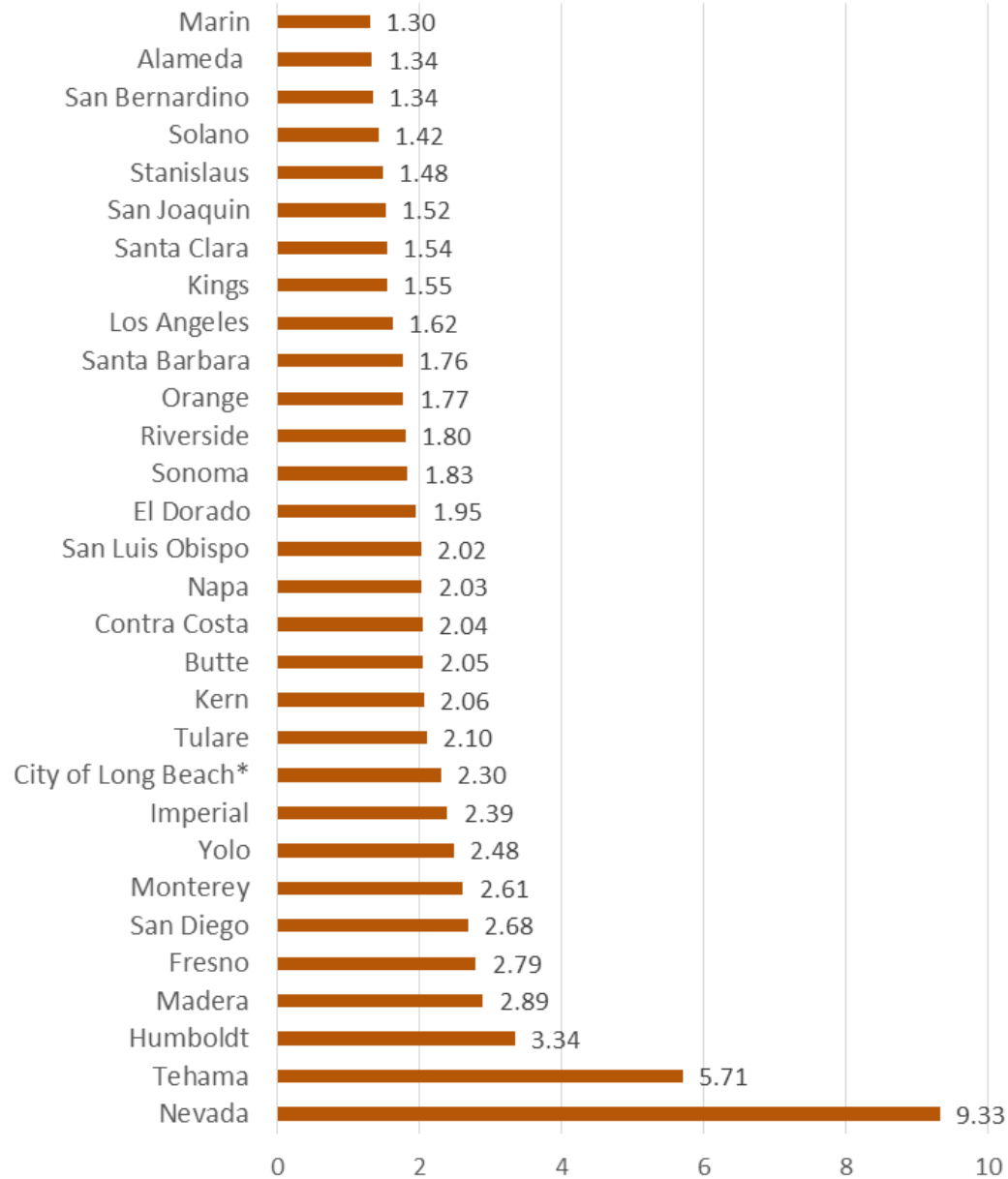


\* Birth Defects Study, Slone Epidemiology Center, Boston University. Study sites included participating hospitals in the areas surrounding Boston, Massachusetts, Philadelphia, Pennsylvania, and San Diego, California, as well as birth defects registries in New York and Massachusetts. Women included in the analysis were mothers of control infants (infants born without a structural birth defect).

# Survey data - receipt of Tdap vaccine during pregnancy among women with a live birth in 2016 in California



Average incidence of pertussis in infants <4 months of age per 1,000, by local health jurisdiction - 2012-2016\*




\*only showing LHJs with  $\geq 5$  total infant cases during time period

Courtesy Kar



# Infant Pertussis Surveillance Efforts

 **PERTUSSIS SUPPLEMENTAL FORM**  
for cases <4 months of age

California Dept. of Public Health  
Immunization Branch  
850 Marina Bay Parkway  
Building P, 2nd Floor, MS 7513  
Richmond, CA 94804-6403  
Fax: (916) 440-5973

**Contact Mother of Infant Pertussis Case to complete Sections A and B**

**Section A.**

Infant's name (last, first, middle initial)	Infant DOB (mm/dd/yyyy)	CalREDIE ID	Local ID
Mother's name (last, first, middle initial)	Mother DOB (mm/dd/yyyy)	CalREDIE ID (if applicable)	Local ID (if applicable)

A1. Do you live with your baby?  Yes  No If no, in which county do you reside?   Unknown

**Prenatal Care Information**

A2. Who provided your prenatal care during this pregnancy?   
(If >1 practice, list others at bottom of page)

A3. Prenatal care practice name/location

A4. Prenatal care phone number

**Mother's History**

A5. Did you participate in WIC during this pregnancy?  
 Yes - if yes, at what site?   No  Don't know

A6. Did you receive Tdap (the shot that protects against whooping cough, tetanus, and diphtheria) during this pregnancy?  
 Yes - if yes, during which trimester did you receive it?  First  Second  Third  Don't know (Skip to Section B)  
 No  
 Don't know  
 Received it after delivery

A7. Did your prenatal care provider recommend that you receive Tdap during this pregnancy?  
 Yes - if yes, why didn't you get it?  I didn't want to get it - if so, why?   
 I didn't or couldn't go to alternate site recommended  
What was alternate site?   
 Insurance/payment issues (describe in detail):   
 I delivered my baby before I could get it  
 Other reason:   
 No (Skip to section C)  
 Don't know (Skip to section C)

A8. When your provider recommended the whooping cough shot, do you feel she/he gave you all of the information you needed?  
 Yes  
 No - If no, what was missing?

**Section B. If mother received Tdap during this pregnancy, complete this section**

B1. Where did you receive Tdap during this pregnancy?  
 At a routine OB visit  
 At a primary care physician visit  
 At a pharmacy (specify name of pharmacy):   
 At other site (specify name of site or clinician):   
 Don't know

Name of person completing mother's form:  Phone number and/or Email address:  Date mother's interview completed:

Other prenatal care provider practice(s) where care received during this pregnancy and their contact information:

1. Identify and begin to address **vaccination barriers** for > 20 infants reported with pertussis since Jan. 2016
2. Create a **prioritized list of state level policy, finance, and program changes** and implement the **highest priority state-level policy changes**

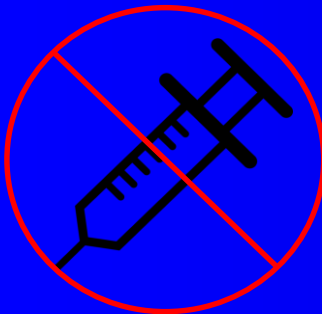
# Findings

## Case-Mother Interviews (n=71)



29 (41%) case-mothers **received Tdap during pregnancy**

- 24 (83%) were vaccinated during their routine OB visit



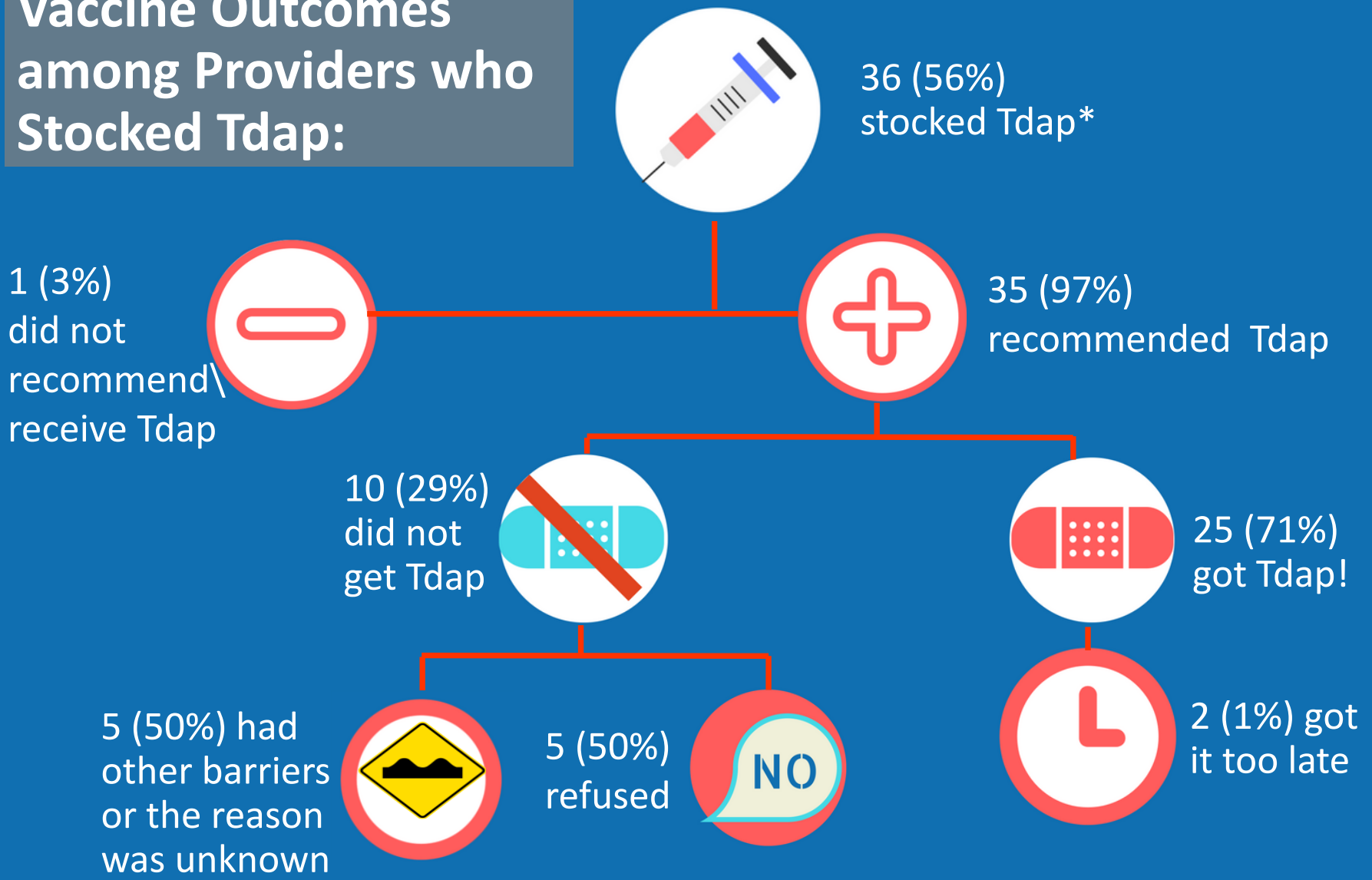
42 (59%) case-mothers **did not received Tdap during pregnancy**

- Many vaccinated postpartum

**Why not vaccinated during pregnancy?** Of the 21 case-mothers who responded:

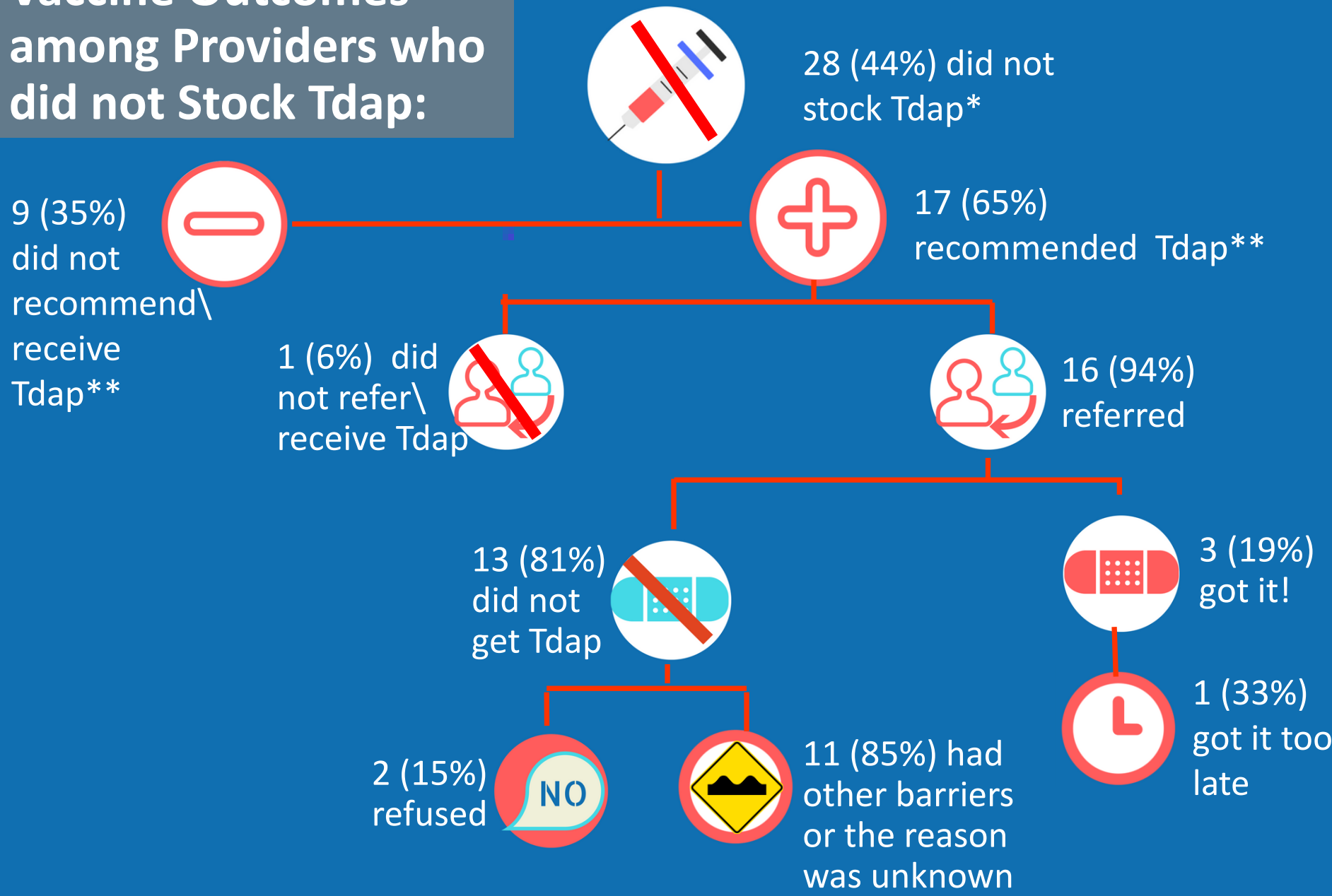
- 9 (43%) mothers were offered Tdap but refused
- 12 (57%) mothers did not receive Tdap due to vaccine misconceptions or lack of referral follow-up

# Vaccine Outcomes among Providers who Stocked Tdap:



\*7 providers were missing information

# Vaccine Outcomes among Providers who did not Stock Tdap:



\*7 providers were missing information; \*\*2 providers were missing information

# Findings

## Summary

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- **Not all providers recommended Tdap during pregnancy:** 10 (15%) providers did not recommend Tdap; none of these case-mothers were vaccinated.\*
- **Current referrals are not working:** only 3/18 women who were referred off site received a Tdap
- **Stocking Tdap onsite is essential!**
  - Case-mothers whose prenatal clinics stocked Tdap were 3 times more likely to receive Tdap during pregnancy than those whose clinics did not stock Tdap [RR=2.9; 95% CI: 1.8-4.9]
- **Insurance type makes a difference.**
  - Case-mothers with private insurance were nearly 2 times more likely to receive Tdap during pregnancy compared to case-mothers with Medi-Cal [RR=1.9; 95% CI: 1.1-3.1]

\*3 providers were missing information



# Local Outreach Efforts

- Orange County Immunization Coalition met with OCMA obstetricians
- OCIC executive members attended OB staff meetings at local hospitals
- CDPH is offering outreach to provide assistance to offices to begin providing vaccine



Prescriber Name, Address, Phone Number:

Patient Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Vaccines recommended during pregnancy:**

- Tdap** (tetanus, diphtheria, pertussis [whooping cough]) during 3rd trimester  
0.5 mL IM x 1
- Inactivated Influenza**  
0.5 mL IM x 1

Prescriber's Signature: \_\_\_\_\_

License #: \_\_\_\_\_

These vaccines may be available from your primary care physician, local health department, or pharmacy. To find a nearby location, please visit [www.vaccine.healthmap.org](http://www.vaccine.healthmap.org).

**Your baby is counting on you for protection. Get vaccinated.**

# Infant Cases in Orange County

- 103 cases of pertussis have occurred in Orange County since January 1, 2018
- 13 cases in infants  $\leq 4$  months of age.
  - 10 of these infants ( $\leq 4$  months) required hospitalization
  - 3 visited a pediatric intensive care unit
- Only one of the hospitalized cases' mothers had been vaccinated during pregnancy, but was vaccinated in the first trimester.

# In Summary

- Pertussis rates are likely increase in the next 1-2 years
- It will be important to maintain high immunization rates of infants and children
- Protecting infants by immunizing pregnant mothers will be OCPH's primary goal



# Epidemiology

- Infants most commonly experience significant morbidity and mortality
- Children 1-5 years most widely affected prior to vaccine
- Increasing data in 1990's demonstrating pertussis' presence in the adolescent and adult community

# National Data

- Pertussis rates gradually increased in 1990's-2000's
- Combination of increased disease and improved diagnostic capacity

## **Whooping cough making a comeback**

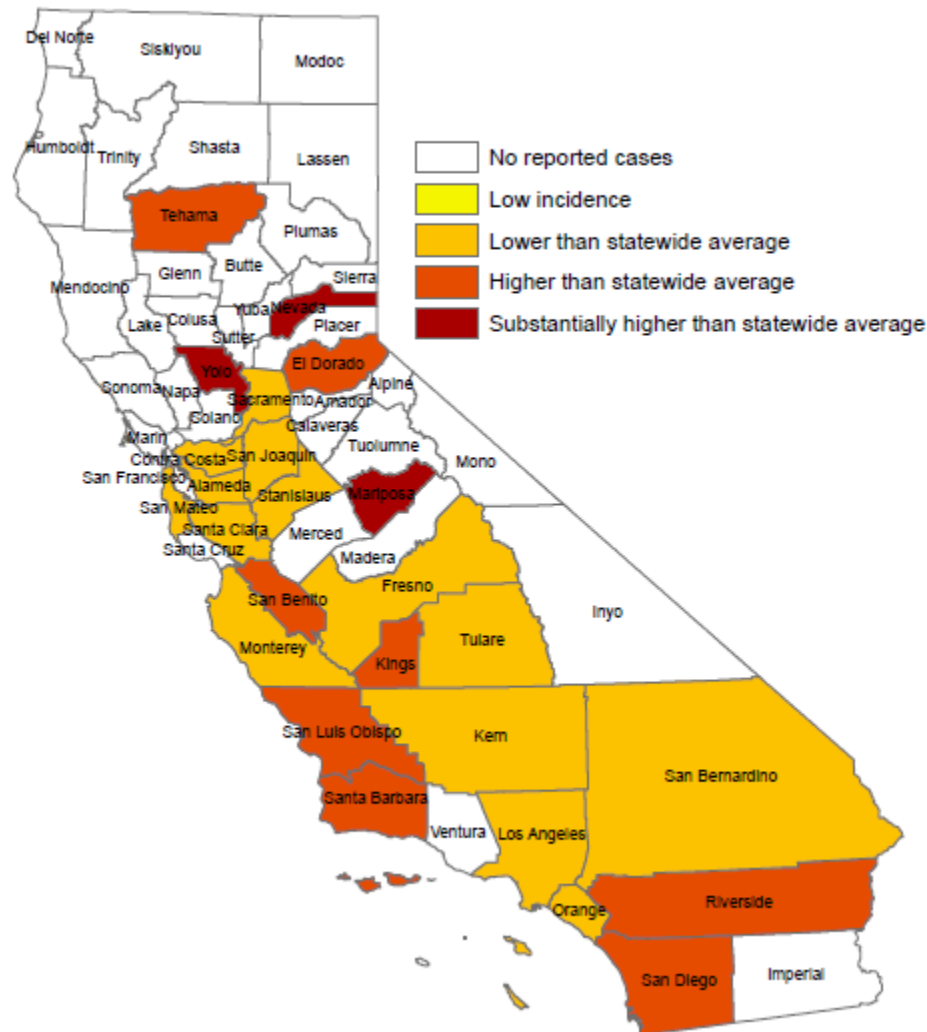
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Highest number of cases in  
30 years reported.

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--Infectious Diseases in Children, September  
2004

# Pertussis Incidence among infants <4 months of age per 1,000 population, by county - California, 2016



# Prophylaxis in an Epidemic

- Public health will prioritize high-risk contacts for postexposure prophylaxis
- High risk contacts include
  - Infants
  - Women in third trimester of pregnancy
  - Contacts of above cases
- Low-risk contacts may be advised to monitor for symptoms and seek treatment if symptoms develop

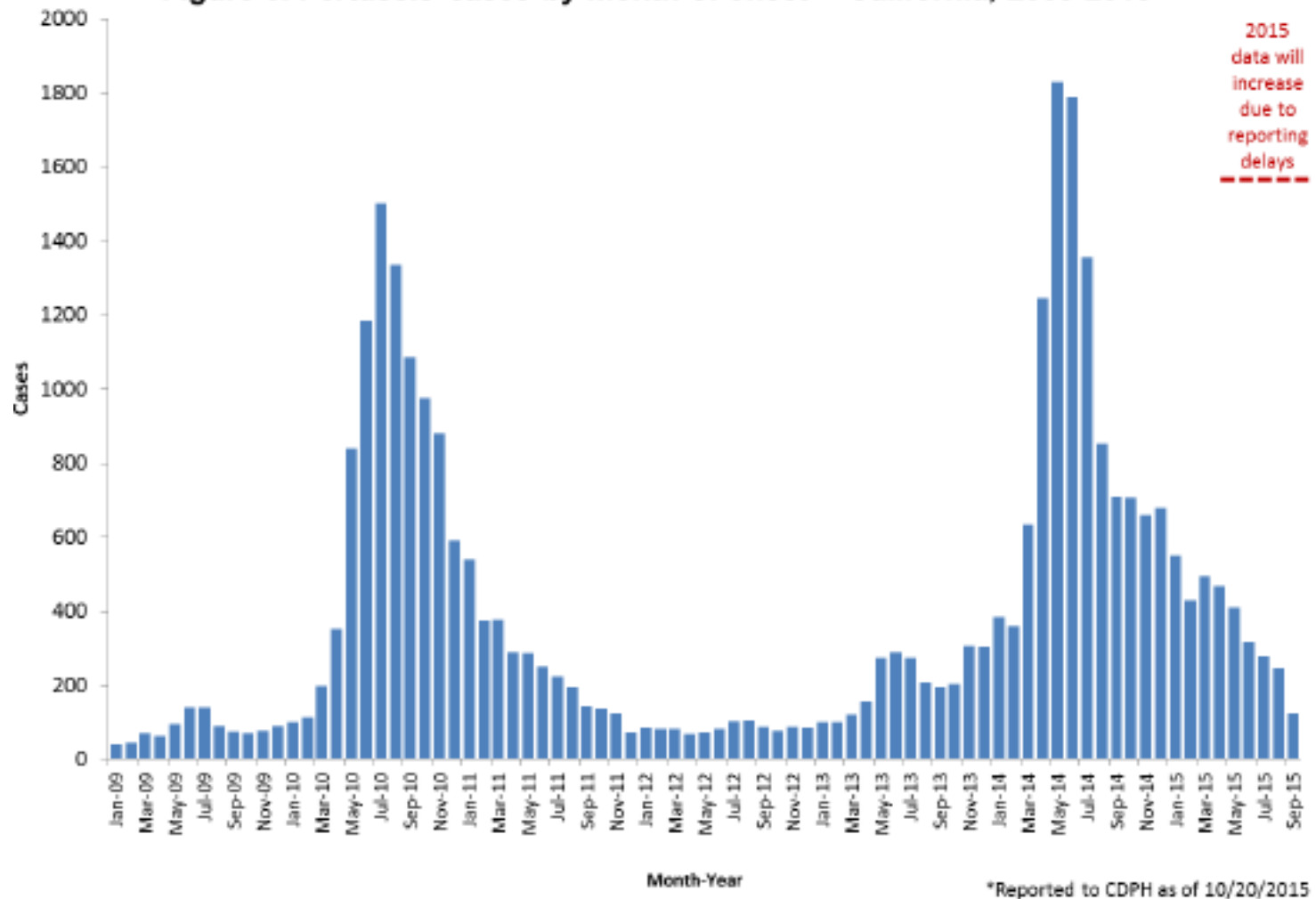




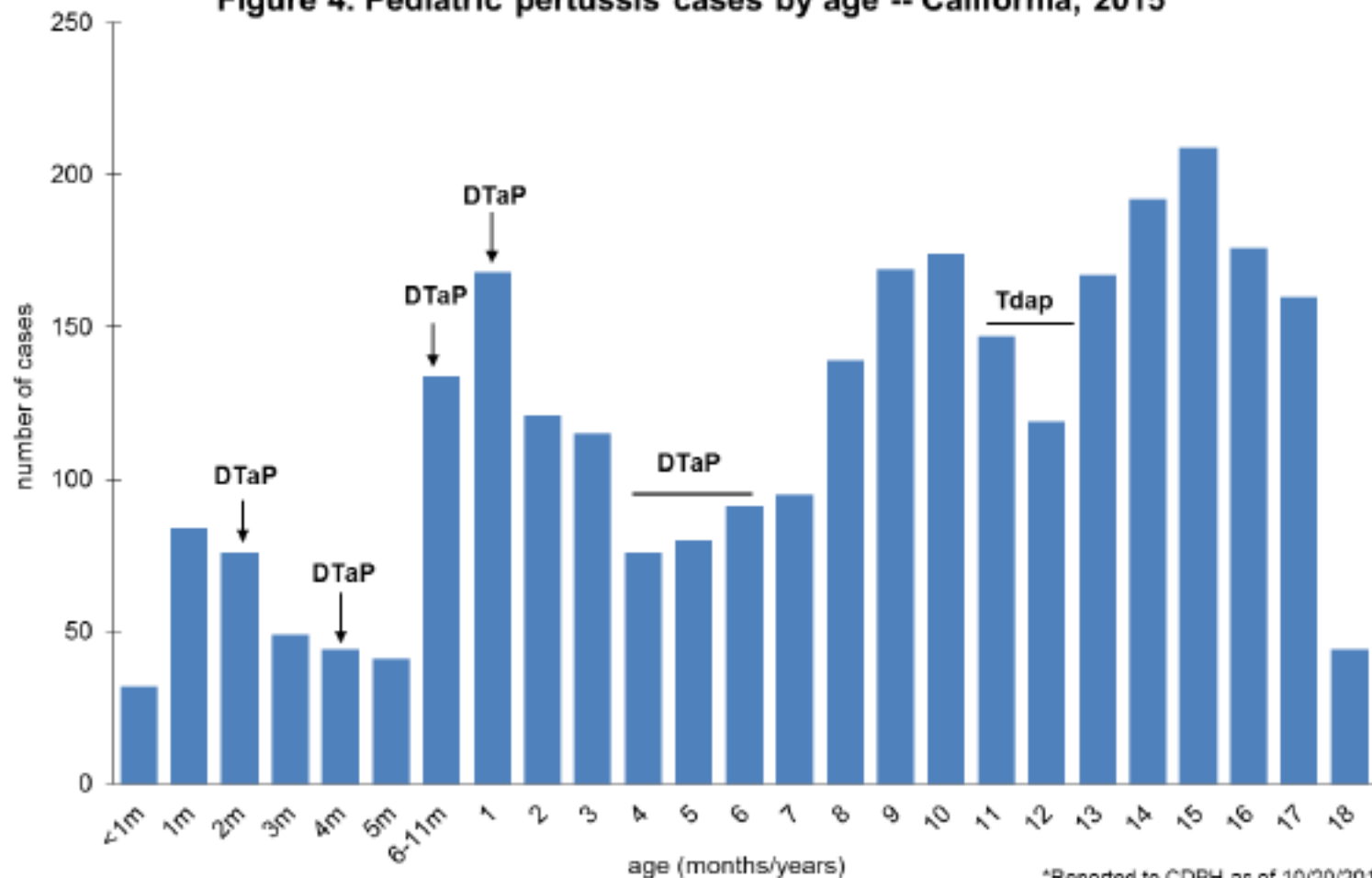
# Healthcare Worker Post-Exposure Prophylaxis

- Healthcare workers with unprotected (i.e., unmasked) exposure to pertussis cases may be managed in two ways:
  - They may be offered postexposure prophylaxis; or
  - They may self-monitor for symptoms for 21 days from the time of exposure

**Figure 3. Pertussis cases by month of onset -- California, 2009-2015\***



**Figure 4. Pediatric pertussis cases by age -- California, 2015\***



\*Reported to CDPH as of 10/20/2015  
 annotations in black indicated recommended vaccine doses

# Pertussis in California

- Overall pertussis rates are highest for:
  - Infants <1 year of age
  - Adolescents and teens 10-17 years of age
- Rates by race/ethnicity are highest for:
  - Hispanic infants <1 year of age
  - White, non-Hispanic adolescents and teens aged 7-17 years of age

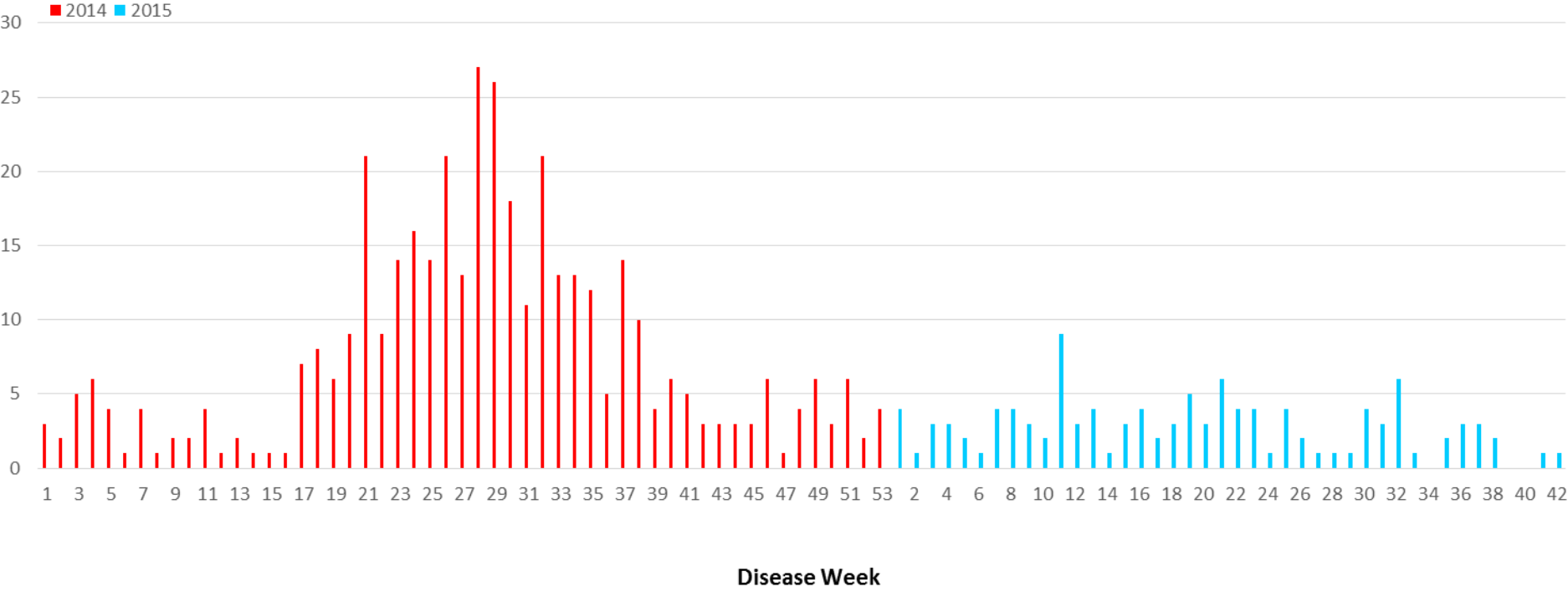
# Pertussis in California, 2014

- 89% of cases in infants and children
- Peak age 15 years
- 490 (8%) of pediatric cases were infants <6 months of age
- 169 (63%) of hospitalized were infants <4 months of age
- One death in a 5 week old infant

# Pertussis in California, 2015

- 4,211 cases reported to CDPH in 2015
- 171 cases hospitalized
  - 50 (29%) required intensive care
  - 120 (70%) of hospitalized were infants <4 months of age.
- One death reported, in an infant that was <3 weeks of age at the time of disease onset.
- Overall pertussis rates highest for infants <1 year of age and older children and adolescents and teens 14-17 years of age
- Rates highest for:
  - White and Hispanic infants <6 months of age
  - White, non-Hispanic adolescents and teens aged 10-17 years of age

# Orange County Closed Pertussis Cases



- **2014: 404 Total Pertussis Cases**
- **2015: 119 (closed and under investigation meet case definition)**
  - **86 Under 1 year old (2014)**
  - **23 Under 1 year old (2015)**



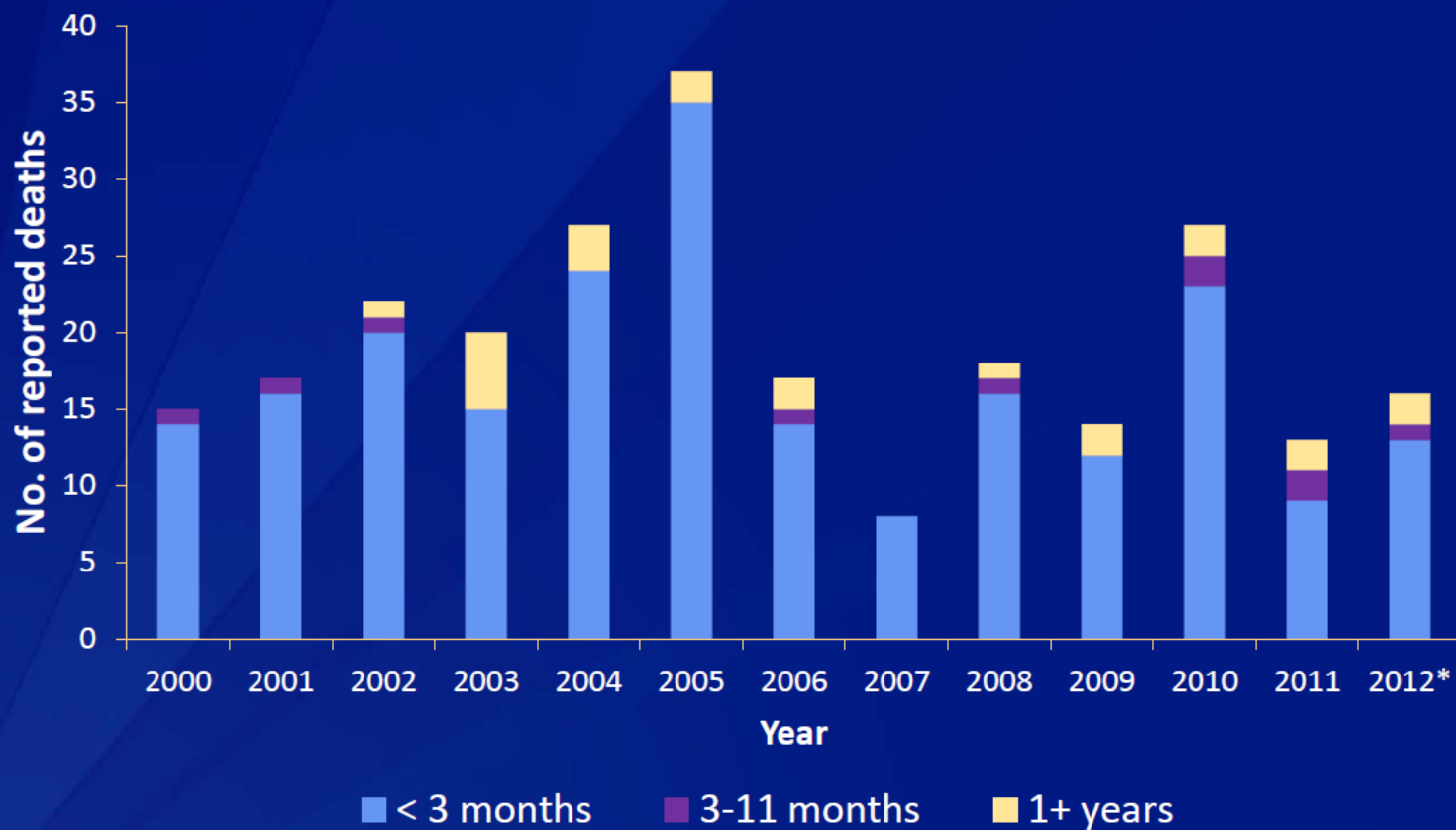
# Ideally, Pregnant Women Would Receive Vaccine at Provider's Office

- But multiple issues in provider setting:
  - Obstetricians do not routinely provide vaccines
  - Not financially advantageous
  - Immunization rates in pregnant women remain stubbornly low

# Survey of Orange County Pharmacists, 2014

- 38 pharmacies called by Epidemiology intern and asked for repeat Tdap for pregnancy
  - 13 said vaccination not necessary
  - 2 were not sure
  - 4 said yes if obstetrician recommends
  - 9 said yes but not necessary
  - 10 said yes

## Pertussis deaths by age group, 2000-2012\*



\*2012 data are provisional and reflect deaths reported to NNDSS as of October 19, 2012.

Source: CDC. National Notifiable Diseases Surveillance System, 2012.

# Pertussis Epidemic in California, 2014

- 11,203 cases in 2014
  - 29.3 cases per 100,000
  - 456 hospitalized
  - 278 (61%) of hospitalized patients were infants <4 months of age
  - Three deaths with disease onset in 2014 were reported; all were infants who were < 5 weeks old at time of disease onset.

# American College of Obstetricians and Gynecologists

## (ACOG) Recommendations:

- Partners, family members, and infant caregivers should be offered the Tdap vaccine if they have not previously been vaccinated. Ideally, all family members should be vaccinated at least 2 weeks before coming in contact with the newborn.
- If not administered during pregnancy, the Tdap vaccine should be given immediately postpartum if the woman has never received a prior dose of Tdap as an adolescent, adult, or during a previous pregnancy.
- There are certain circumstances in which it is appropriate to administer the Tdap vaccine outside of the 27–36-weeks-of-gestation window. For example, in cases of wound management, a pertussis outbreak, or other extenuating circumstances, the need for protection from infection supercedes the benefit of administering the vaccine during the 27–36-weeks-of-gestation window.
- If a pregnant woman is vaccinated early in her pregnancy (ie, before 27–36 weeks of gestation), she does not need to be vaccinated again during 27–36 weeks of gestation.

# Tdap and Pregnancy Safety

- Killed vaccines are considered to be very safe for pregnant women
- Tetanus and influenza vaccines recommended during pregnancy
- Passive data of pregnant women inadvertently given Tdap indicates no evidence of association with adverse events

# Tdap and Pregnancy: Immunizing Pregnant Moms vs. Cocooning

- Immunizing family members in close contact with infants has been advocated by CDC recently
- Vaccinating family members likely prevents disease
- Infrastructure does not exist for implementation on a national level
- Even if executed well, will not protect infants in first few weeks of life
- Immunizing pregnant mothers may be more practical and cost-effective than cocooning

# Reported Pertussis Cases

2015: **20,762**

2016: **17,972**

## Reported Pertussis Cases and Percent Hospitalization by Age Group

Age	No. of Cases (% of total)	Age Inc /100,000	% Hospitalized by age**
< 6 mos	1407 (7.8)	70.9	44.3
6-11 mos	634 (3.5)	31.9	11.7
1-6 yrs	3279 (18.3)	13.7	2.7
7-10 yrs	2450 (13.7)	14.8	1.5
11-19 yrs	6135 (34.1)	16.3	0.9
20+ yrs	4046 (22.5)	1.7	7.8
Unknown Age	21 (0.1)	N/A	N/A
<b>Total</b>	<b>17,972 (100)</b>	<b>5.6*</b>	<b>6.7</b>

## Reported Pertussis Deaths

Age	Deaths*
Cases, aged < 1 yr	6
Cases, aged ≥ 1 yr	1
<b>Total</b>	<b>7</b>

\*4 of the 7 deaths were female.

\*Total age incidence per 100,000 calculated from 17,951 cases with age reported.

\*\*Age-specific proportion of cases that were hospitalized, calculated from those with a known hospitalization status.