The Changing Face of Pertussis

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- Medical Practice at: Boston Medical Center, Tufts-New England Medical Center, and Franciscan Hospital for Children
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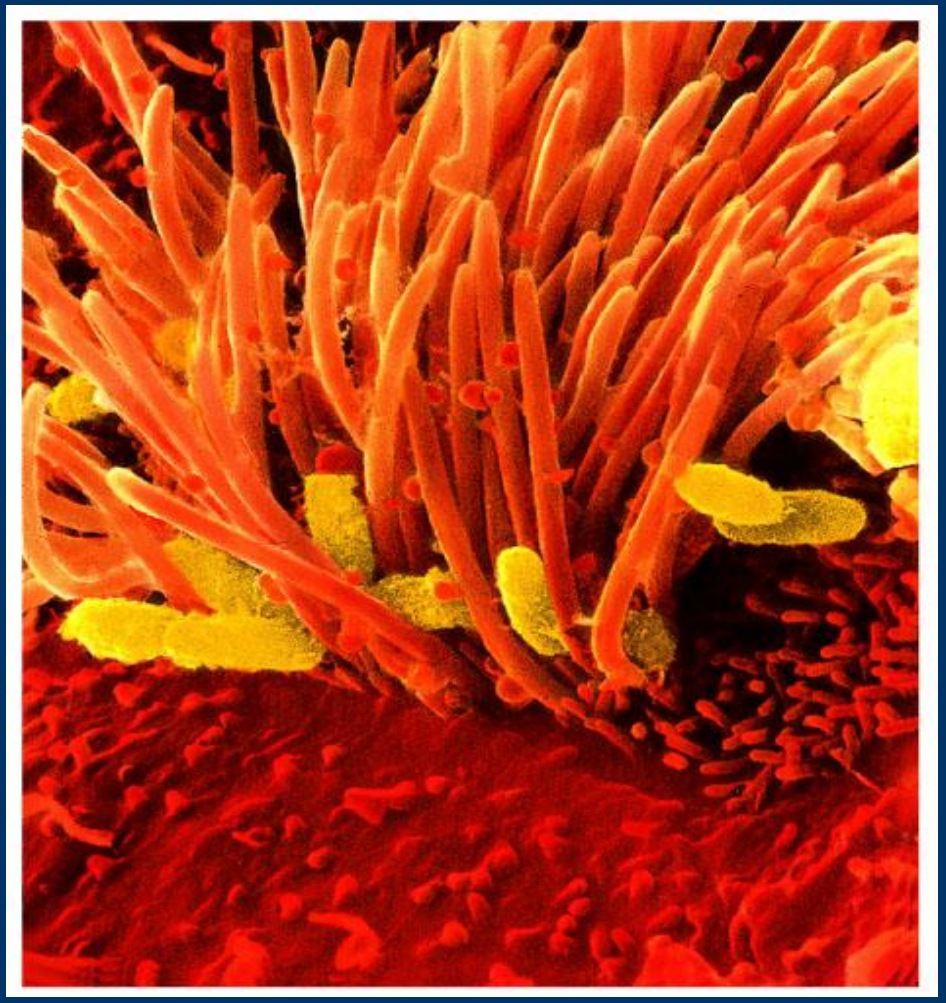
- No patents for drugs, vaccines or medical devices
- No direct stock ownership in any pharmaceutical or healthcare company

Bordetella pertussis – Whooping Cough

- Fastidious gram-negative coccobacillus
- Antigenic and biologically active components:
  - pertussis toxin (PT)
  - filamentous hemagglutinin (FHA)
  - agglutinogens
  - adenylate cyclase
  - pertactin
  - tracheal cytotoxin
- Reservoir: humans only
- Transmission: via aerosols, highly contagious



Morbidity of Pertussis in Adolescents

- Coughing 100%
- Paroxysms of cough 74%
- Vomiting 56%
- Weight loss 33%
- Problems sleeping 77%

- Still coughing at 108 days 38%
- Missed school 83%
  - Mean number of missed days: 5.5
  - Range: 0.4 to 32 days

Lee GM et al. *CID*. 2004;39:1572-1580

Morbidity of Pertussis in Adults

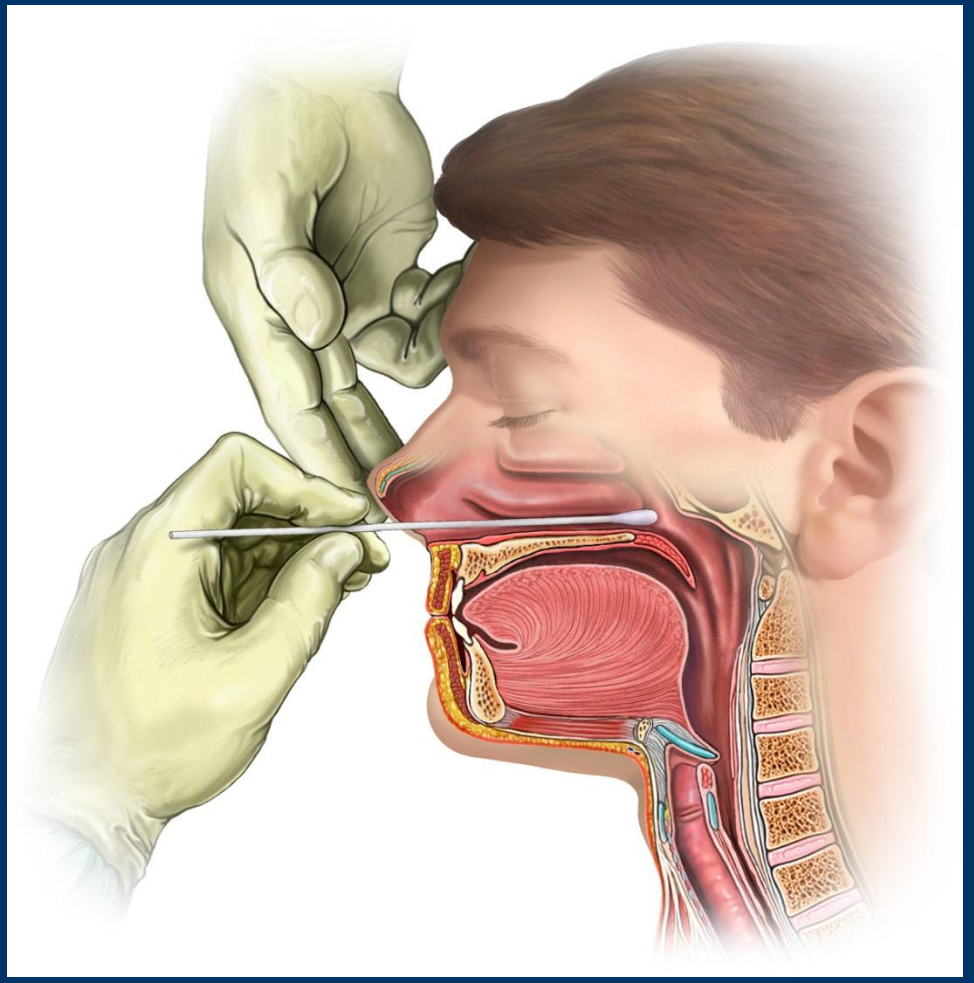
- Coughing 100%
- Paroxysms of cough 84%
- Vomiting 54%
- Weight loss 33%
- Problems sleeping 84%

- Still coughing at 94 days 61%
- Missed work 61%
  - Mean number of missed days: 9.8
  - Range: 0.1 to 180 days

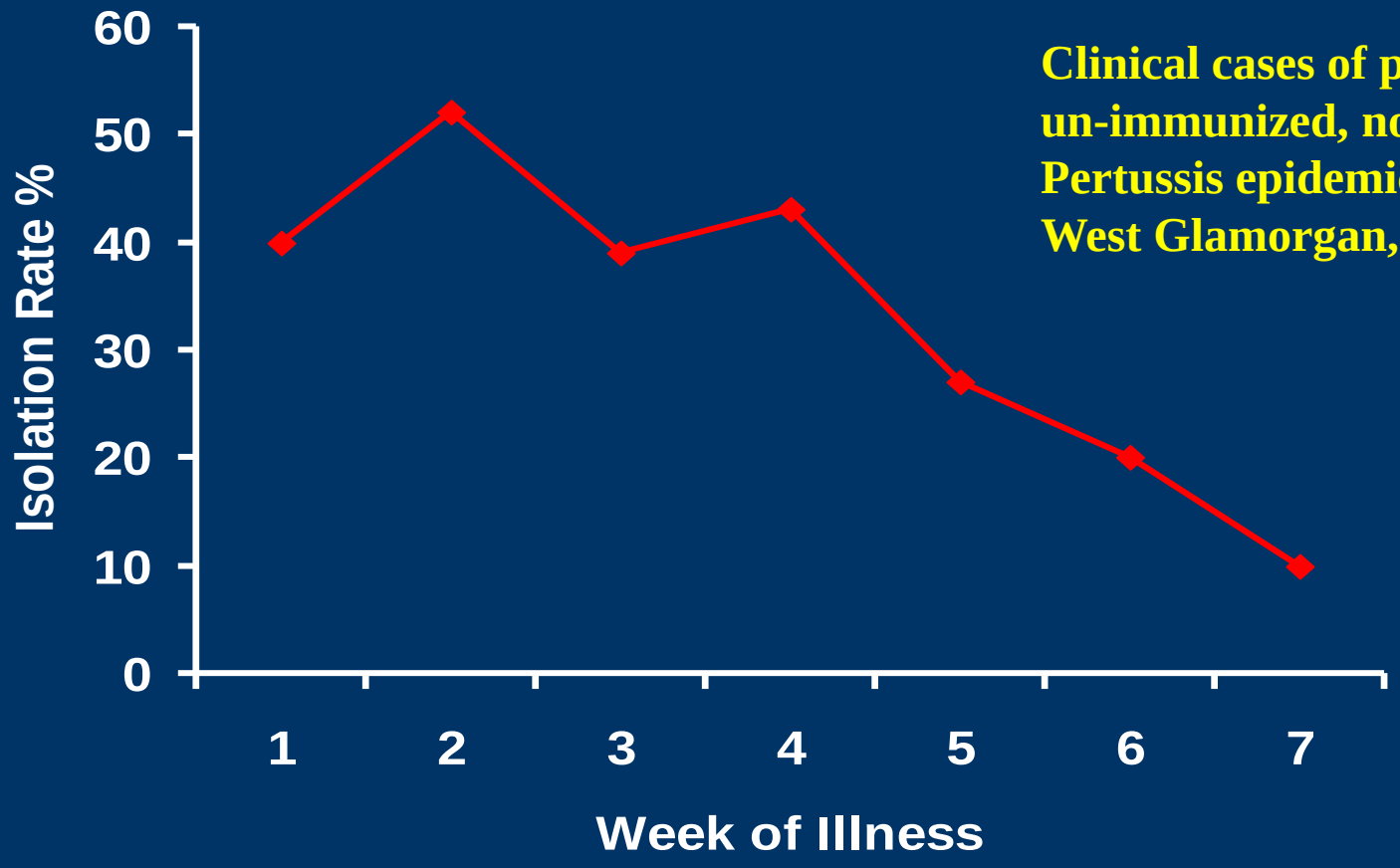
Lee GM, et al. *Clin Infect Dis*. 2004;39:1572-1580.

Diagnostic Tests for Pertussis

- Nasopharyngeal (NP) culture on special media (Regan-Lowe, Bordet-Gengou)
- Polymerase chain reaction (PCR)
- Serologic tests
- Increased white blood cell (WBC) count with absolute lymphocytosis
- Direct fluorescent antibody (DFA)—variable sensitivity/specificity



Isolation of *Bordetella pertussis* by week of illness



Clinical cases of pertussis,
un-immunized, no antibiotic therapy
Pertussis epidemic
West Glamorgan, Wales, UK, 1977-79

from Kwantes et al J Hyg Camb 1983;90:149-58

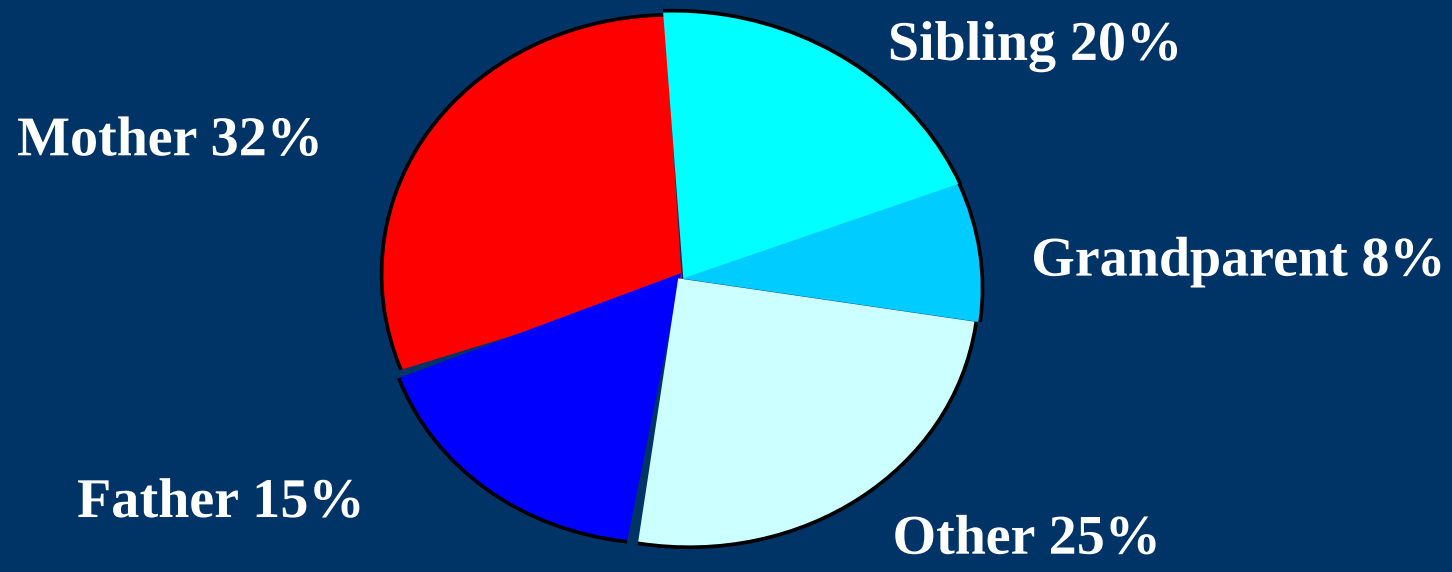
Intrafamilial spread of pertussis

- 21 families (97 individuals) of patients with whooping cough diagnosed by culture or by ELISA serology
- Follow-up (average 6 months): 83% infected (ELISA)
- 46% of secondary cases asymptomatic, mostly adults or vaccinated children.
- Unvaccinated infants had classic whooping cough
- Classic symptoms of pertussis decreased with age; atypical pertussis was usually culture negative (diagnosed by ELISA)

Mertsola J, et al J Pediatr. 1983 ;103:359-63;
see also Long SS et al J Infect Diis 1990; 161:480-86

Infant Pertussis: Who Is the Source?

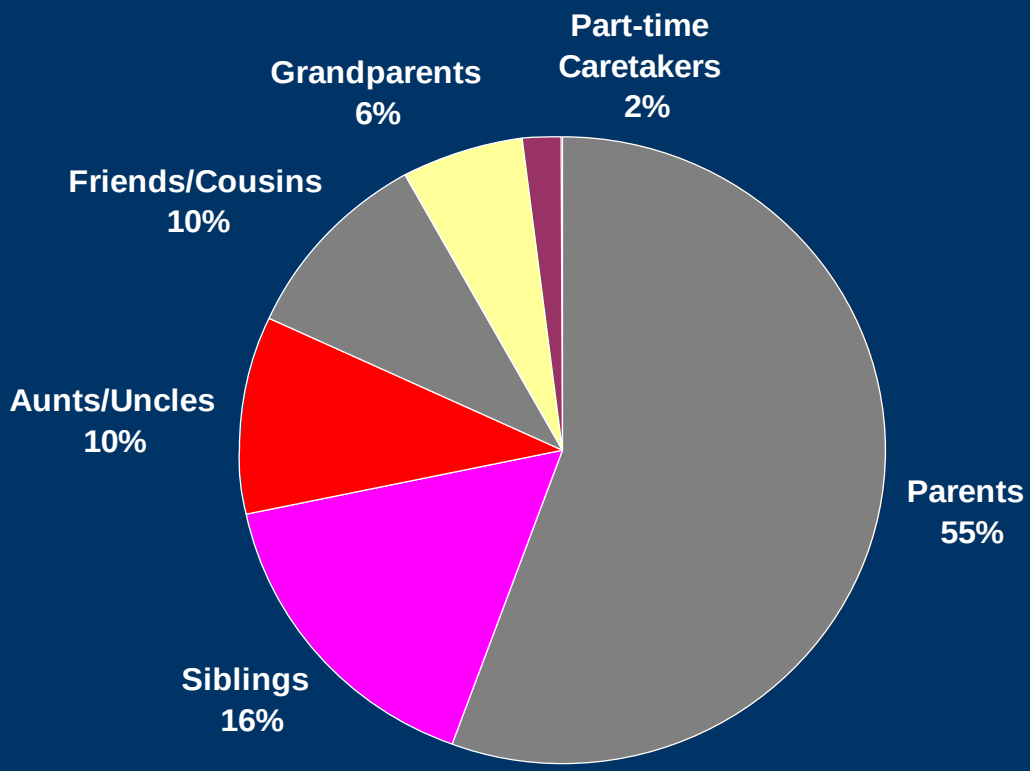
- 774 infant cases from 4 states (GA, IL, MA, and MN)
  - 616 families interviewed
- 264 cases had known or suspected source identified
- Sources:



Reference:
1. Bisgard KM, et al. *Pediatr Infect Dis J.* 2004;23:985-989.

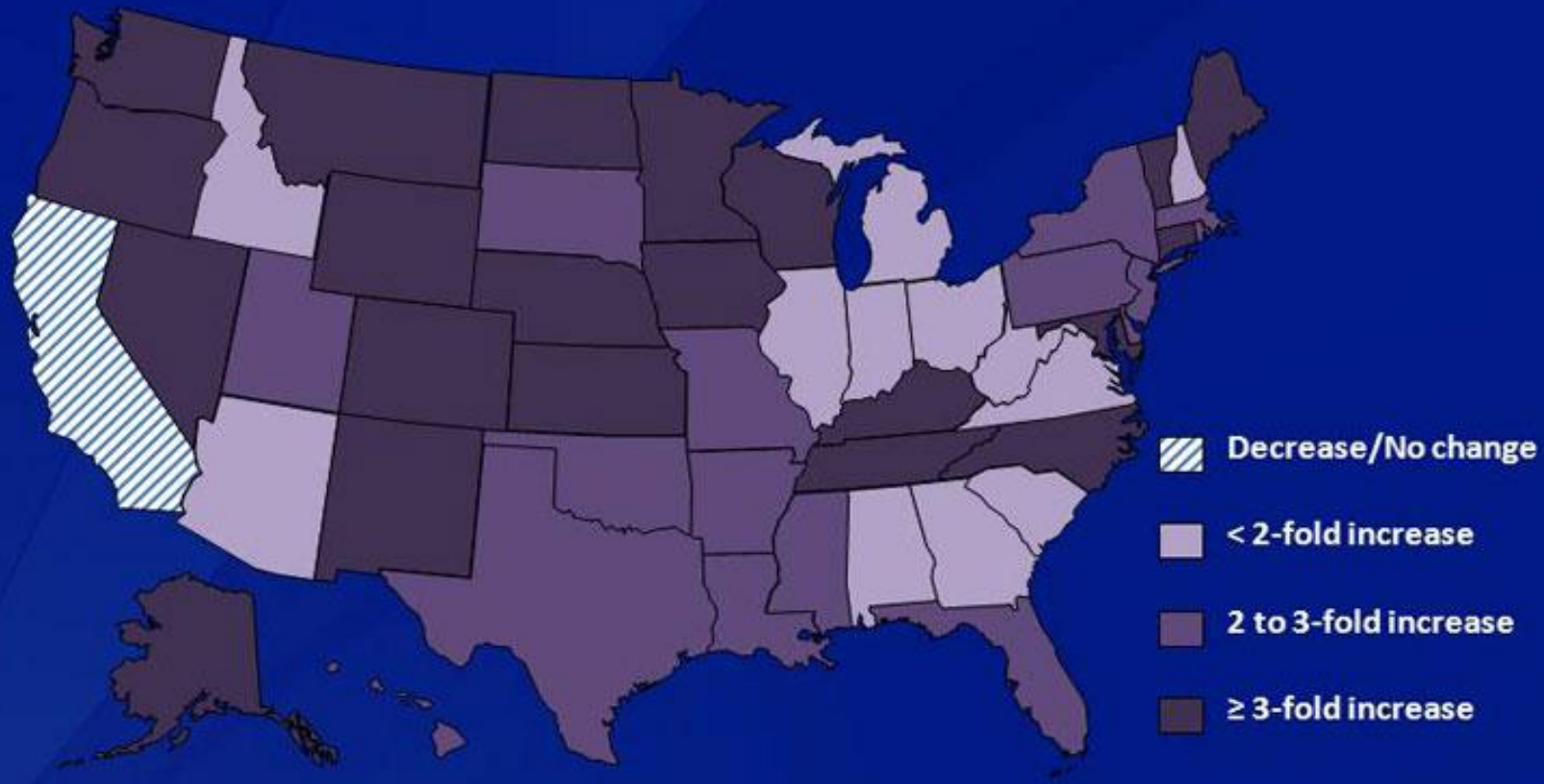
Infant Pertussis: Who Is the Source?

- Multicenter study in France, Germany, Canada, and the United States
- 95 infants ≤6 months of age with laboratory-confirmed pertussis and 404 household and close non-household contacts
- Household members responsible for 76%-83% of transmission to infants



Wendelboe AM, et al. *Pediatr Infect Dis J*. 2007;26:293-299.

Changes in Pertussis Reporting by State from 2011 to 2012* †



*Data for 2012 are provisional.

†Cases reported through Week 52 in 2011 were compared with cases reported through Week 52 in 2012; fold-changes were calculated for each state.

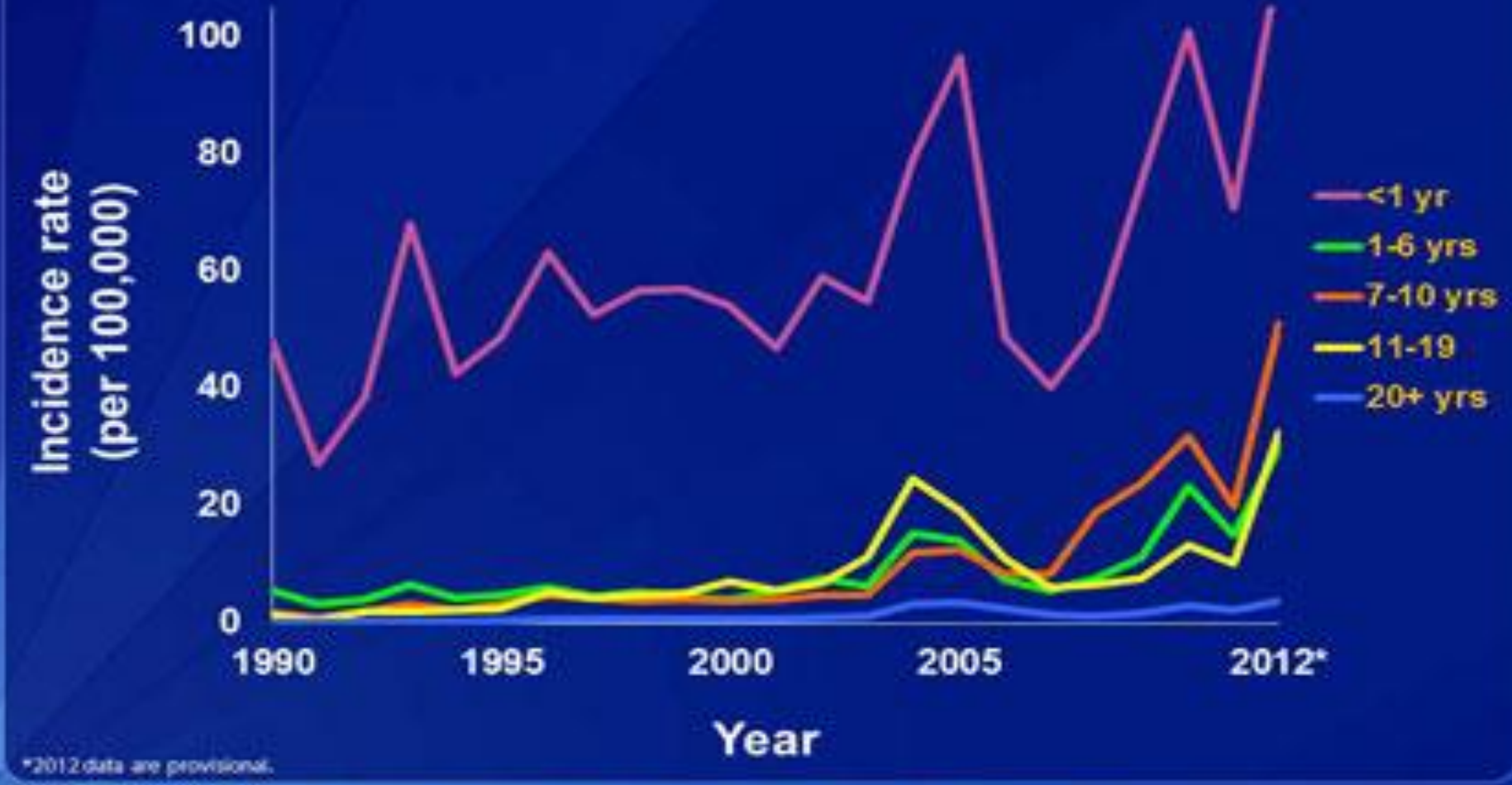
CDC

Reported NNDSS pertussis cases: 1922-2012*

*2012 data are provisional.

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

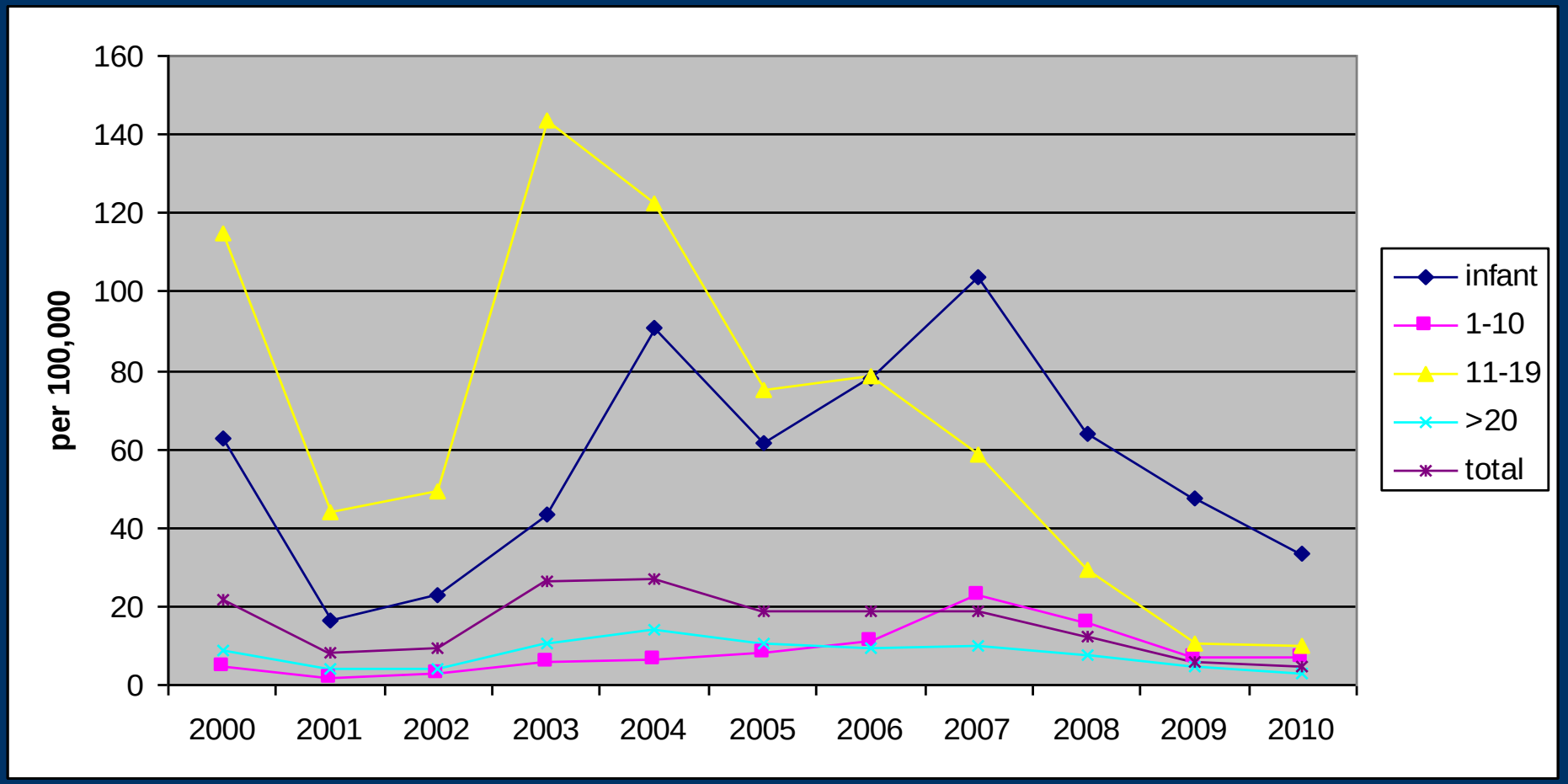
Reported pertussis incidence by age group: 1990-2012*



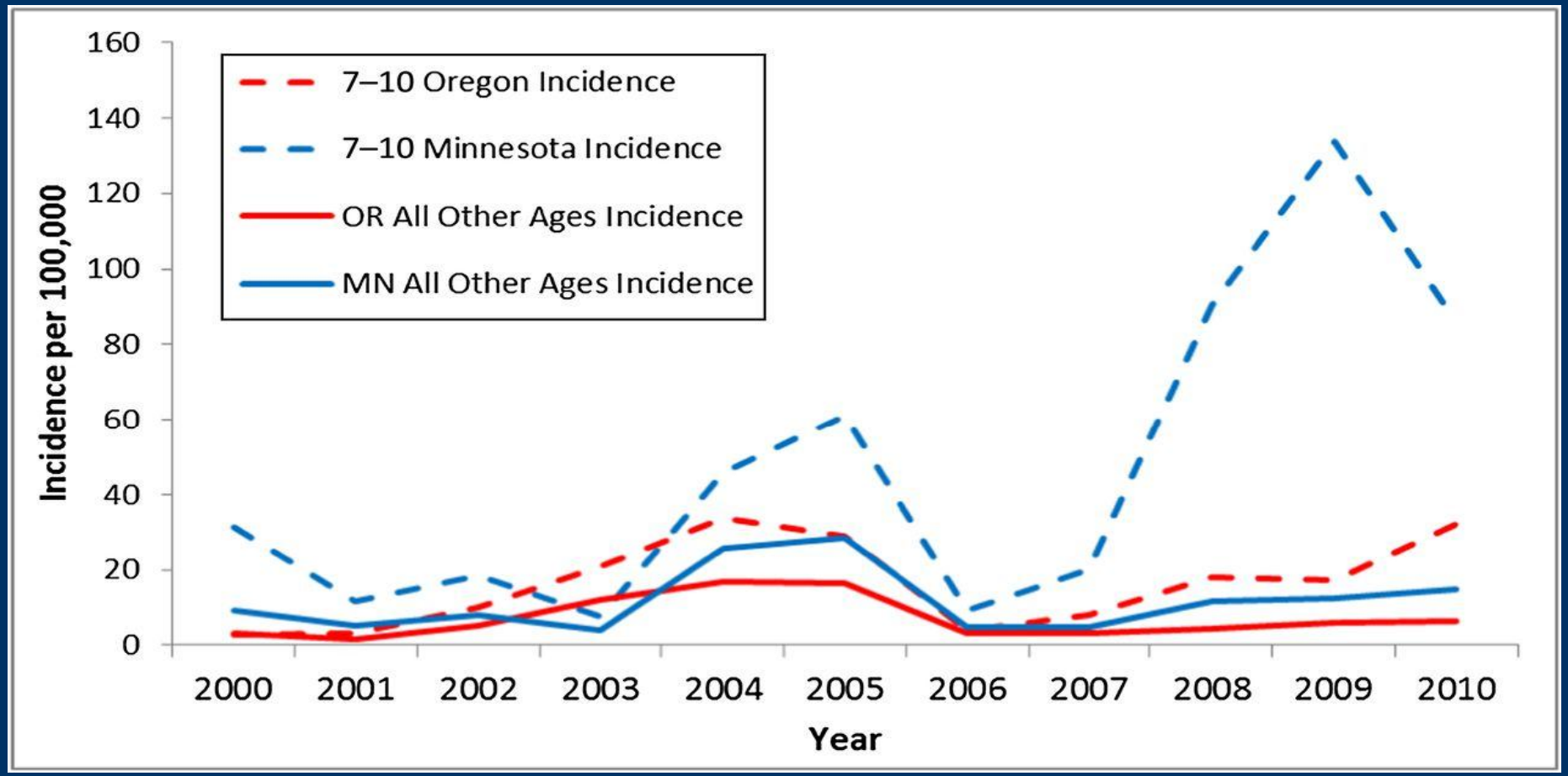
*2012 data are provisional.

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

Pertussis Incidence by Age Massachusetts 2000 -20010



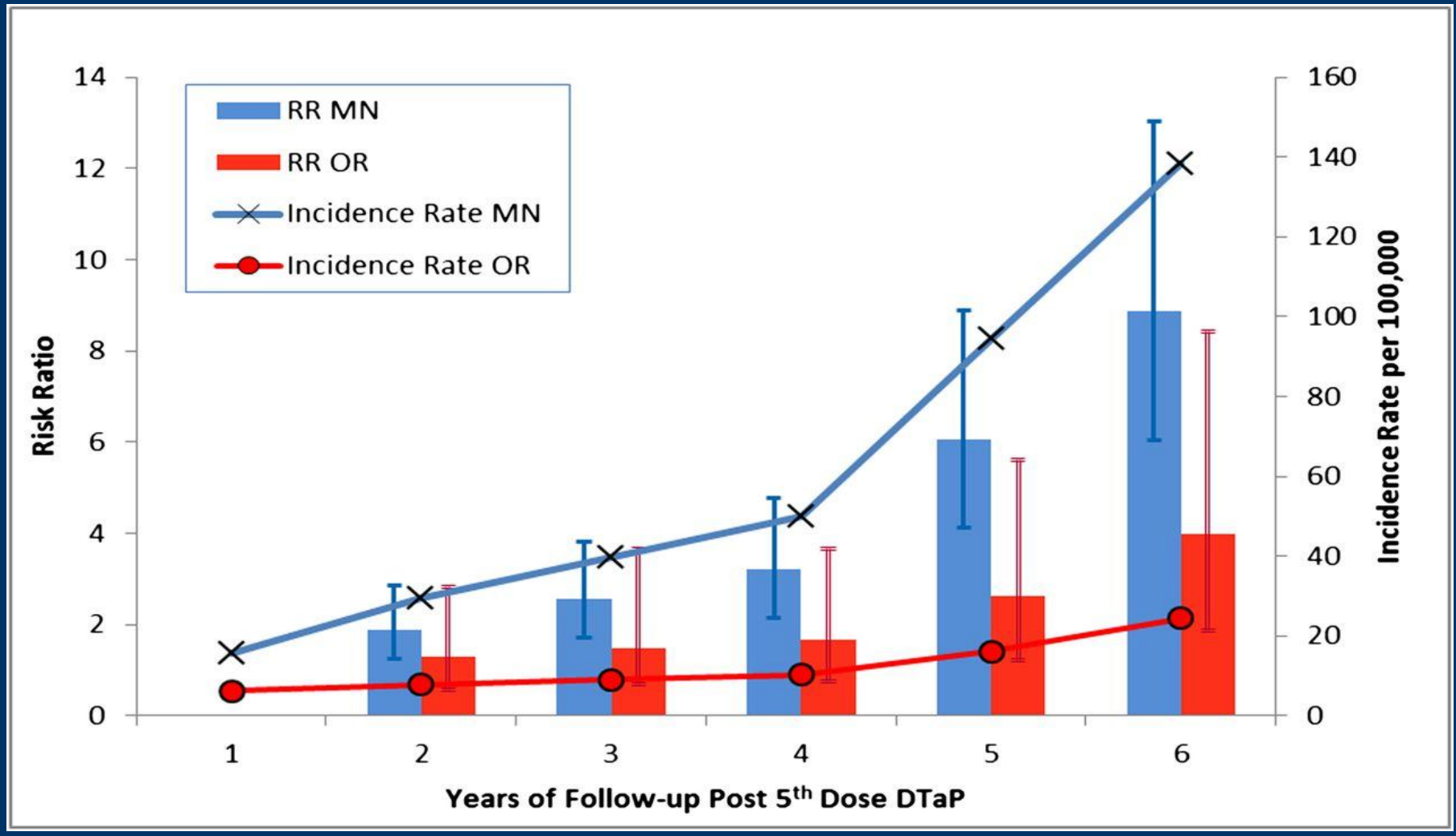
Statewide pertussis incidence and incidence of cases in 7- to 10-year-olds, Oregon (OR) and Minnesota (MN), 2000–2010.



Tartof S Y et al. Pediatrics 2013;131:e1047-e1052

PEDIATRICS®

Risk ratios and incidence rates for pertussis by year of follow-up post fifth-dose DTaP, Minnesota (MN) and Oregon (OR), 2010.



Tartof S Y et al. Pediatrics 2013;131:e1047-e1052

PEDIATRICS®

Waning Vaccine Effectiveness after the 5th Dose of Dtap Vaccine, California 2010

Months Since 5th Dose	Cases No.	Controls No.	Vaccine Effectiveness [95% CI]
0 doses (reference)	53	19	1 (reference)
<12	19	354	98.1% [96.1, 99.1]
12-23	51	391	95.3 % [91.2, 97.5]
24-35	79	366	92.3 % [86.6, 95.5]
36-47	108	304	87.3 % [76.2, 93.2]
48-59	141	294	82.8 % [68.7, 90.6]
≥ 60	231	288	71.2 % [45.8, 84.8]

Misegades LK et al JAMA 2012;308:2126-2132

Immunization of Adults with Tetanus-diphtheria-acellular pertussis vaccine (TdaP)

ACIP Recommendation

- All adults should receive a single dose of TdaP, followed by doses of Td every 7 to 10 years

MMWR 2013

Immunization of Pregnant Women with Tetanus-diphtheria-acellular pertussis vaccine (TdaP)

2011 ACIP Recommendations

- Reviewed safety data from manufacturers' pregnancy registries and the VAERS data: no evidence for safety problems when TdaP was given to pregnant women
- Reviewed evidence for the effect of maternal TdaP on infant immune responses to routine (2,4,6 month) DTaP vaccine: infants born to mothers who had received TdaP during pregnancy did develop immune responses to active immunization, but the responses were quantitatively lower – these differences were not judged to be important

MMWR 2011 60:1424-1426

Immunization of Pregnant Women with Tetanus-diphtheria-acellular pertussis vaccine (TdaP)

2011 ACIP Recommendation

- Immunize pregnant women who have not previously received a dose of TdaP after 20 weeks gestation

Benefits:

- Mothers will be protected from pertussis and are thus less likely to infect their infants
- Infants will receive anti-pertussis IgG antibodies from their from mothers during the 3rd trimester and will likely have protection from pertussis for several months

MMWR 2011 60:1424-1426

Immunization of Pregnant Women with Tetanus-diphtheria-acellular pertussis vaccine (TdaP)

2013 ACIP Recommendation

- Immunize women with TdaP during each pregnancy
- Optimal timing for Tdap administration is between 27 and 36 weeks gestation although Tdap may be given at any time during pregnancy
- “Cocooning” still recommended: adolescents and adults (e.g., parents, siblings, grandparents, child-care providers, and health-care personnel) who anticipate having close contact with an infant aged <12 months should receive a single dose of Tdap if they have not received Tdap previously.

MMWR 2011 60:1424-1426

TdaP Immunization Rates, US, 2010

	Sample size	%	(95% CI)	Difference from 2009
Total	**14,824**	**8.2**	**(7.6–8.8)**	**1.6**
White	7,830	9.1	(8.3–9.9)	1.7
Black	2,441	7.4	(6.1–8.8)	1.6
Hispanic or Latino	3,183	4.8	(3.9–5.9)	0.1
Asian	1,058	9.2	(6.9–12.1)	4.8
Living with an infant aged <1 yr	624	10.6	(7.9–14.2)	0.3
Not living with an infant aged <1 yr	14,200	8.1	(7.5–8.7)	1.7

MMWR February 3, 2012 / 61(04);66-72