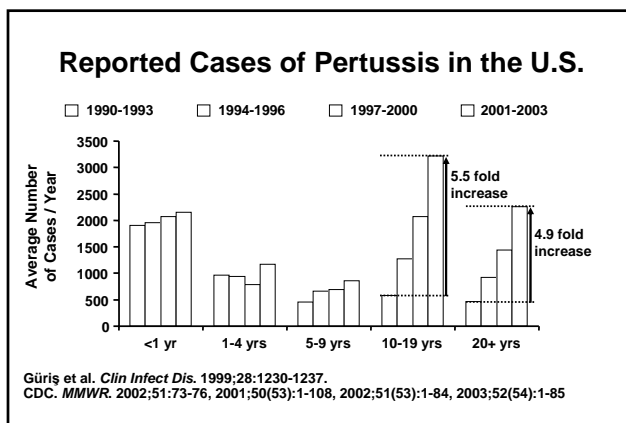
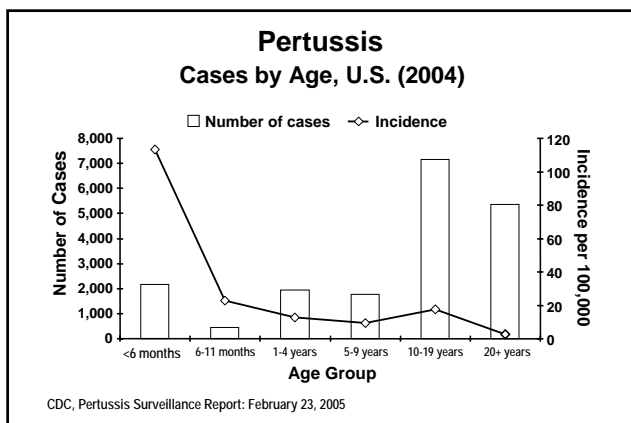


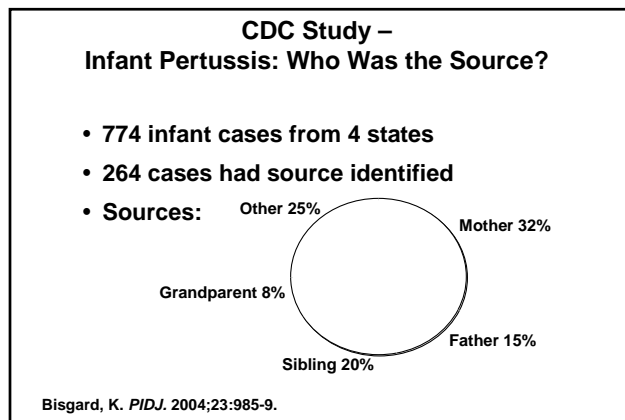
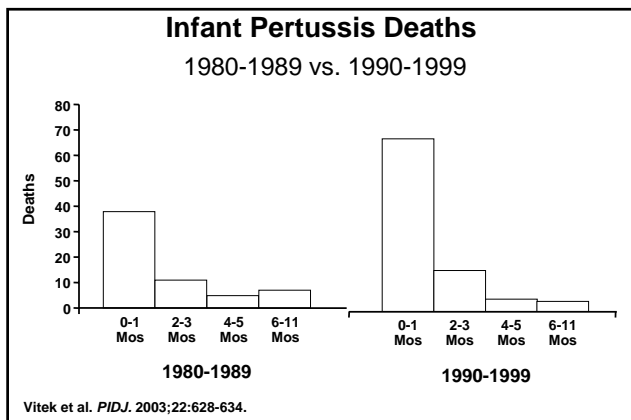
### Pertussis in the U.S., 2004

- Provisional total of 18,957 cases
- 12% in children <6 months of age (i.e., too young to be fully vaccinated)
- 38% in persons 10-19 years of age

CDC, Pertussis Surveillance Report: February 23, 2005

### Details of Pertussis Epidemiology





- ### Healthcare Professionals Involved in Transmission of Pertussis
- Physicians 1912 Schwenkenbecher
  - Nurses 1972 Kurt et al
  - Physicians 1992 Etkind et al
  - Nurses 1995 Christie et al
  - Nurses 1997 Matlow et al
  - Nurses and Physicians 2005 CDC
- Schwenkenbecher, 1912;  
Kurt et al. *JAMA.* 1972;221(3):264-7;  
Etkind et al. *Am J Dis Child.* 1992;146:173-6;  
Christie et al. *Infect Control Hosp Epidemiol.* 1995;16:556-63;  
Matlow et al. *Infect Control Hosp Epidemiol.* 1997;18:715-16;  
CDC. *MMWR.* 2004;54(03):67-71.

- ### Why has pertussis incidence increased?
- Increased recognition?
  - Incomplete vaccination?
  - Ineffective vaccines?
  - Waning immunity in older children and adults?

### Estimated Duration of Immunity After Infection or Vaccination

Source of Immunity	Duration	Reference
Natural infection	15 years	Wirsing von König et al, 1995
Whole-cell vaccine		
UK	6 years	Jenkinson, 1988
Finland	6 years	He et al, 1994
Germany	>6 years	Lugauer et al, 2002
Acellular vaccine		
Italy	6 years	Salmaso et al, 2001
Germany	>6 years	Lugauer et al, 2002

Wirsing von König CH, et al. *Lancet Infect Dis* 2002; 2: 744–50

- ### Pertussis in Massachusetts (1989-1998)
- Department of Public Health engages in active surveillance for pertussis
  - By 1998, 92% of cases involved adolescents and adults
  - Incidence of pertussis was
    - 71/100,000 in adolescents and
    - 5/100,00 in adults
    - (national averages: 5 and 0.8/100,000)
- Yih WK et al. (2002), *J Infect Dis* 182(5):1409-1416

### Reported Pertussis in the U.S. vs. Massachusetts

Age Group	Per 100,000			
	2001		2002	
	U.S.	Mass.	U.S.	Mass.
Infants (<1)	49.8	16.7	52.5	23.1
Children (1-9)	5.0	1.5	5.8	2.9
Adolescents (10-19)	5.8	43.8	5.7	49.8
Age ≥20	0.8	3.9	1.0	4.0

Marchant CD (2005)

### Pertussis in Wisconsin (2004)

- Aggressive case-finding and testing
  - PCR available
- 5,020 cases overall
  - 111 hospitalizations (57 in infants <6 months)
- 2,028 cases (40%) within the ages 10-19
  - Rate: 251/100,000

Cortese MM (2005), Presented at the Annual Meeting of the ACIP. Atlanta; February 11; Data from Wisconsin Department of Public Health, provisional

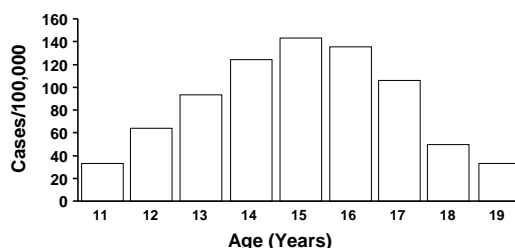
### Pertussis Incidence in the U.S. vs. Wisconsin (2004)

Age Group	Reported Incidence per (100,000)	
	U.S.	Wisconsin
1-4	12.76	149.4 (1-2 years) 197.0 (2-4 years)
5-9	9.17	173.6
10-19	17.43	310.1 (10-14 years) 203.7 (15-19 years)
20+	2.64	43.0 (>19 years)

Excluding infants <1 yr: CDC, Pertussis Surveillance Report: 2/23/05; Davis JP (2005), Wisconsin Department of Health

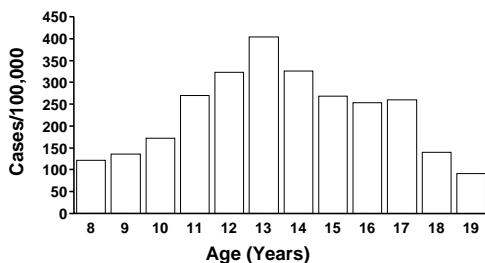
### Pertussis

#### Incidence in Adolescents in Mass., (1996-2003)



Cortese MM (2005), Presented at the Annual Meeting of the ACIP. Atlanta; February 11; Data from Wisconsin Department of Public Health, provisional

### Pertussis Incidence in Adolescents in Wisconsin, (2004)



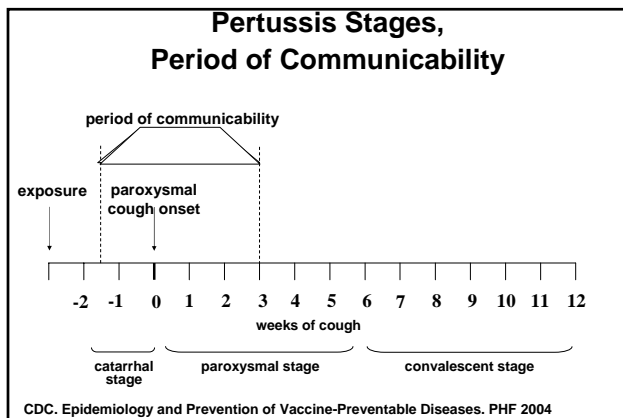
Excluding infants <1 year: CDC, Pertussis Surveillance Report: 2/23/05; Davis JP (2005), Wisconsin Department of Health

### Have you diagnosed pertussis?

Have you diagnosed pertussis?

- Ever?
- In the last year?
- In an adolescent?

## Mortality & Morbidity



## Complications of Pertussis

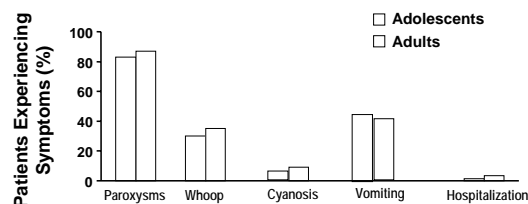
### Children ≤4 Years Old in the U.S. (1997-2000)

Age	Number With Pertussis	Pneumonia	Seizures	Encephalopathy	Death	Hospitalized
<6 Months	7203	847	103	15	56	4543
6-11 Months	1073	92	7	1	1	301
1-4 Years	3137	168	36	3	1	324

CDC (2002), Pertussis—United States, 1997-2000. MMWR 51(4):73-76

## Pertussis Morbidity

### Adolescents and Adults in Massachusetts (1989-1998)



Yih WK et al. (2002), J Infect Dis 182(5):1409-1416

## Significant Morbidity in Adolescents

- **Persistent cough (may last 100 days or more)**
  - 38% still coughing at 106 days
- **83% miss school**
  - Mean # of missed days: 5.5
  - Range: 0.4 to 32 days

Lee GM et al. (2004), Clin Infect Dis 39(11):1572-1580

## Pertussis as a Cause of Prolonged Cough Illness in Adolescents and Adults

Source	Locale	Years	% of Cough Illness
Nennig et al.	San Francisco	1994-1995	12
Strebel et al.	Minn.—St. Paul	1995-1996	13
Jackson et al.	Seattle	1983-1987	15
Jansen et al.	San Diego	1993-1994	17
Wright et al.	Nashville	1992-1994	21
Mink et al.	Los Angeles	1986-1989	26
Rosenthal et al.	Chicago	1993-1994	26

Senzilet LD et al. (2001), Clin Infect Dis 32(12):1691-1697

## Strategies

### Notes on Getting in DTaP #4

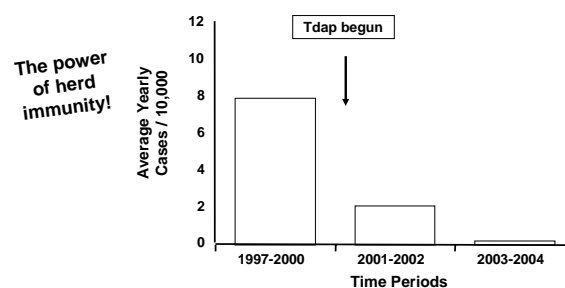
- Get the first 3 doses in by 6 months so the 4<sup>th</sup> dose can be given *at 1<sup>st</sup> birthday visit*
- Send them home with an appointment
- Check the chart for shot record every visit
- Simultaneous vaccination
- Recall

### Tdap Experience in Canada

- ADACEL™ licensed in Canada – May 1999
- NACI issued a supportive statement, but at that time did not give a recommendation for universal routine use
- 3 provinces or territories launched Tdap vaccination programs

Health Canada. CDDR. 2000;26(ACS-1):1-8.

### Pertussis Incidence and Vaccine Use, 1993–2004 Canada's Northwest Territories



Kandola, K. Abstract in *Can J Infect Dis Med Microbiol.* 2004;15:351. Manuscript in preparation.

### DTaP (and Tdap) Vaccines

Indicated Age Group	Tripedia	Infanrix	Daptacel	Boostrix*	Adacel†
	Infants/ Children‡	Infants/ Children‡	Infants/ Children‡	Adults/ Adolescents	Adults/ Adolescents
Antigenic Components					
PT (µg)	23.4	25	10	8	2.5
FHA (µg)	23.4	25	5	8	5
PRN (µg)	—	8	3	2.5	3
FIM 2 + 3 (µg)	—	—	5	—	5
D (Lf)	6.7	25	15	2.5	2
T (Lf)	5	10	5	5	5

ADACEL - licensed for people 11-64 years of age

BOOSTRIX - licensed for people 10-18 years of age

### New recommendations

[http://www.cdc.gov/nip/vaccine/tdap/tdap\\_acip\\_recgs.pdf](http://www.cdc.gov/nip/vaccine/tdap/tdap_acip_recgs.pdf)

### New Recommendations for Tdap

- Replace Td with Tdap for everyone 11-64 yrs of age who has not had Tdap already
- Also, give to adults who have or anticipate close contact with infant <12 months of age ideally 1 month before contact begins (include immediate post-partum, might become pregnant)
- For adolescents preferred age is 11-12
- With other vaccines, including meningococcal
- Minimum 2 yr interval between Td/DTaP & Tdap

### Special Situations

- If *not* given with other vaccines, no special interval between inactivated vaccines
- If Tdap is not available, use Td if that last DTP/DTaP/DT/Td was > 10 years ago
- Pertussis outbreaks - routine Tdap plus post-exposure chemoprophylaxis
- Wound management - Tdap should replace Td for adolescents who haven't had a Tdap (if available); others should get Td

### Special Situations (continued)

- Adolescents with a PMHx of pertussis "generally should receive Tdap" per routine
- No hx of DTP/DTaP/Td/Tdap -- should receive 2 doses Td & 1 dose Tdap (0, 1, 6 month schedule; prefer 1st as Tdap)
- Received DT series, but no hx of pertussis immz - should get 1 dose Tdap per routine if no contraindication
- "If otherwise indicated, administering Tdap to adolescents who are in the 2nd or 3rd trimester of pregnancy should be considered."

### Two Contraindications

- Immediate anaphylactic reaction to any component
- Encephalopathy w/in 7 days of pertussis vaccine not attributable to other cause

[http://www.cdc.gov/nip/vfc/acip\\_resolutions/605dtap.pdf](http://www.cdc.gov/nip/vfc/acip_resolutions/605dtap.pdf)

### Precautions

- Arthus type hypersensitivity reaction to previous tetanus toxoid
- Progressive neurologic disorder
- Latex allergy
- GBS w/in 6 weeks of previous tetanus toxoid
- Acute moderate to severe illness

[http://www.cdc.gov/nip/vfc/acip\\_resolutions/605dtap.pdf](http://www.cdc.gov/nip/vfc/acip_resolutions/605dtap.pdf)

### Summing up

- 1) Possible reasons for the increase in reported cases of pertussis disease
- 2) Complications of pertussis in children < 5 years of age and older individuals
- 3) Rationales for the routine use of Tdap
- 4) New recommendations

The vaccine we really need  
for adolescents....

