



Univ.Klinik für Kinder-
und Jugendheilkunde Wien



Pertussis Impfung und Diagnostik

32. Jahrestagung ÖGKJ Sektion Süd-Ost

24.11.07

Wolfgang Maurer

wolfgang.maurer@meduniwien.ac.at

Efficacy & Effectiveness

- Efficacy
 - Does the vaccine work?
 - Randomised double-blind, placebo controlled studies
- Effectiveness
 - Does vaccination help people?
 - Efficacious vaccine in routine setting
 - Case control, sekundary attack rate, cohort
 - Efficacy + herd effects

Efficacy & Effectiveness

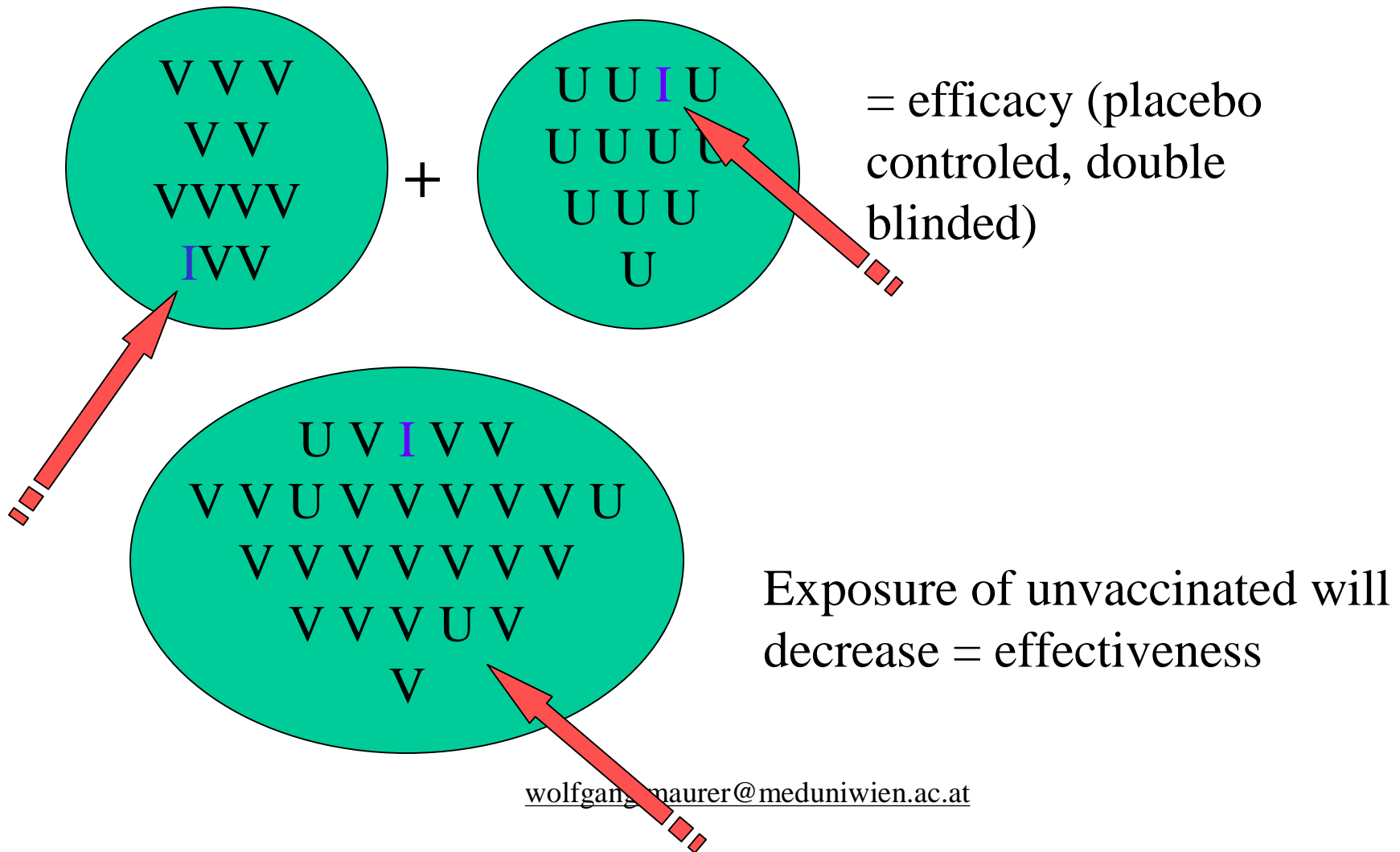
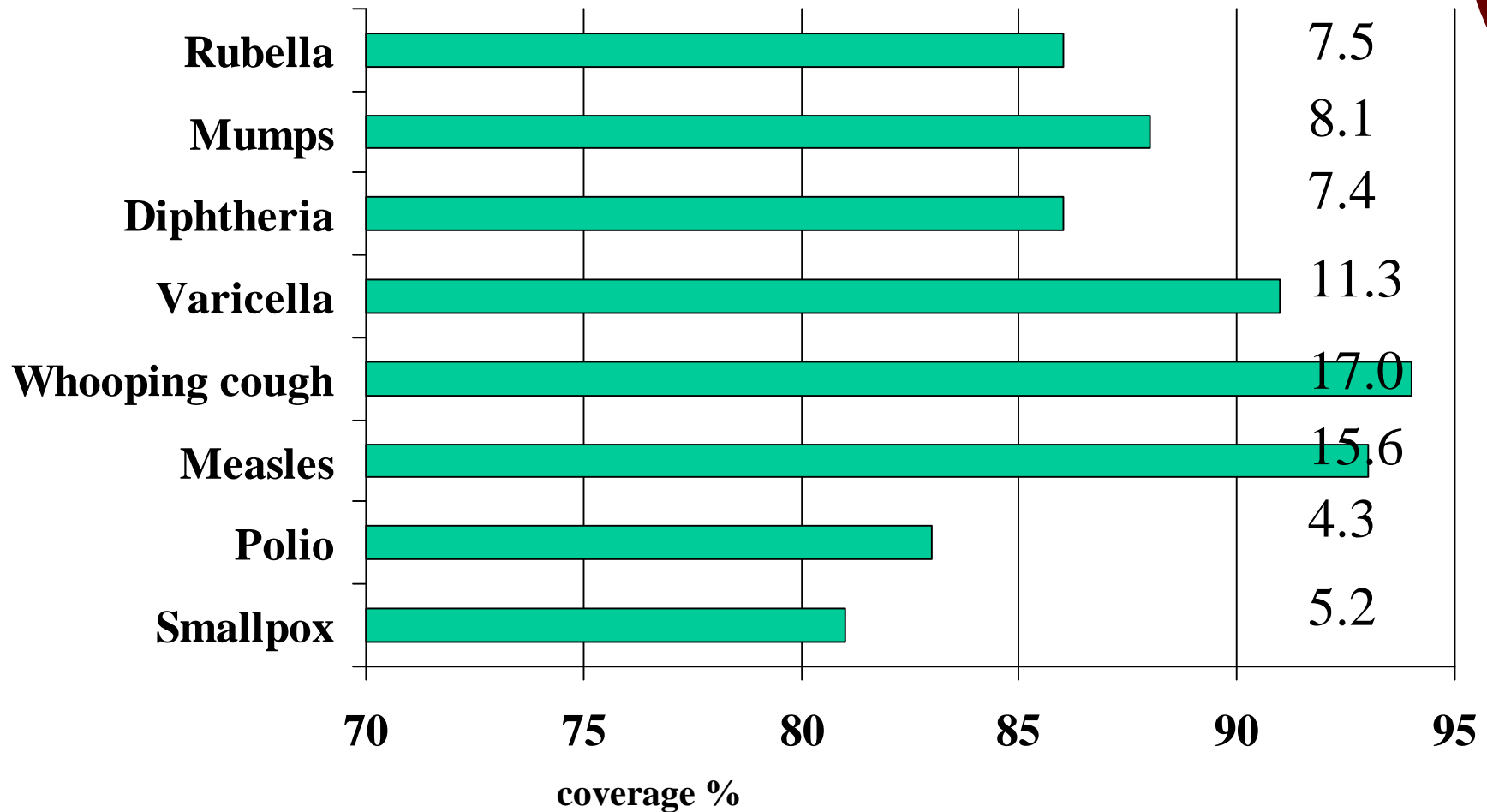


Table 2. Estimates of contact numbers and herd immunity fractions from data (Anderson, 1982) on average ages of attack and average lifetimes

Disease	Location	A	L	$\sigma = 1 + A/L$	Minimum R for herd immunity
Measles	England and Wales, 1956–1959	4.8	70	15.6	0.94
	USA, 1912–1928	5.3	60	12.3	0.92
	Nigeria 1960–1968	2.5	40	17.0	0.94
Whooping cough	Maryland, USA, 1943	4.3	70	17.3	0.94
	England and Wales, 1944–1978	4.5	70	16.5	0.94
Chickenpox	Maryland, USA, 1943	6.8	70	11.3	0.91
Diphtheria	Virginia and New York, USA 1934–1947	11.0	70	7.4	0.86
Scarlet fever	Maryland, USA, 1908–1917	8.0	60	8.5	0.88
Mumps	Maryland, USA, 1943	9.9	70	8.1	0.88
Rubella	England and Wales, 1979	11.6	70	7.0	0.86
	West Germany, 1972	10.5	70	7.7	0.87
Poliomyelitis	USA, 1955	17.9	70	4.9	0.80
	Netherlands, 1960	11.2	70	4.3	0.86
Smallpox	India	12	50	5.2	0.81

A = average attack age, L = life expectancy, σ = contact #

HERD IMMUNITY



No Herd Immunity

- Tetanus (various combined Vaccines)
 - avoid monovalent Tetanus Vaccination
- TBE (Encepur[®], FSME immun[®])
 - Human to human transmission rare
 - Breastfeeding mother with TBE-infection
- Rabies (Rabipur[®])
 - Human to human transmission rare
 - Organtransplantation, Corneatransplantation
- Influenza (various inactivated vaccines, subunit, split)
 - No herd immunity but herd effects

**Maximum and current reported cases of vaccine preventable diseases and adverse events ,USA;
updated 04-2000 and 05-2003 and 2004/7**

Disease	Prevaccine era*	year	1992	1998	2001	2002	2006	% change
Diphtheria	206.939	1921	4	1	2	1	0	-99.99
Measles	894.134	1941	2.200	89	116	37	55	-99.98
Mumps	152.209	1968	2.500	606	266	238	6.584	-95.70
Pertussis	265.269	1934	4.000	6.279	7.580	8.296	11.410	-95,7
Polio (wild)	21.269	1952	--	0	0	0	0	-100.00
Rubella	57.686	1969	160	345	23	14	11	-99.30
Tetanus	1.560	1948	--	34	37	23	41	-97.40
Invasive Hib	20.000	1984	--	54		282	29	- 99.70

Total (as of 1997)	1.639.066	--	--	--	6644			-99.59
Vaccine adv.events	0				11.365	7.773		+++

* Maximum cases reported in prevaccine era and year

Compilation from Nature Medicine **4**:1; Jan 1998 and The Lancet **351**: 611; 28.2.1998 and MMWR **48**:243-8;1999 MMWR 50(53)2001 published 2.Mai 2003

Effects of Herd Immunity

indirect protection

- No successful vaccination
 - „primary vaccine failure“
 - Non-seroconverter (Hep B !)
 - „secondary vaccine failure“
 - St. post Chemotherapy, Transplant Patients, waning immunity
- Unvaccinated children
 - If measles virus does no longer circulate
 - Pre vaccine era 6% Measles cases, but 33% fatalities in the 1 yr
- Children of parents who forgot vaccination/or who are not informed
- Children of parents who are opponents of vaccination

Pertussis (Whooping Cough)

- *Bordetella pertussis* global
 - The disease is most dangerous in infants.
 - In 2000, an estimated
 - 39 million cases and
 - 297 000 deaths occurred worldwide.
 - WHO estimate : <http://www.who.int/immunization/topics/pertussis/en/index1.html>
- Outbreaks first described in 16th century
- *Bordetella pertussis* isolated in 1906

Pertussis

- **Bordetella pertussis** ICD-10 A37.0
 - Gram negative, pleomorph
- **Other infectious agents with similar cough illness**
 - Bordetella parapertussis (no PT) ICD-10 A37.8 *
 - (B. bronchiseptica* animal pathogen, humanpathogen?)*
 - Pseudomonas pertucinogena (?) - ATCC
 - Mycoplasma pneumoniae
 - Chlamydia trachomatis,
 - Chlamydia pneumoniae
 - Bordetella bronchiseptica
 - Bordetella holmesii **
 - Certain adenoviruses
 - RS Virus

* subspecies of the same bacterium? Adaptation of an animal organism to humans 5 centuries ago?

** MMWR 24.Aug 2007:56(33):837-42

Bordetella pertussis

- Fastidious gram-negative bacteria
- Antigenic and biologically active components:
 - pertussis toxin (PT, 120 kD) , toxin and adhesion factor
 - filamentous hemagglutinin (FHA, 220 kD), adhesion factor
 - Fimbriae 2,3, adhesion factor
 - adenylate cyclase, toxin, inhibits phagocytosis
 - pertactin (PRN, 69kD), adhesion factor
 - tracheal cytotoxin, toxin, paralysis mucociliary clearance system

Pertussis Pathogenesis

- Primarily a toxin-mediated disease
- Bacteria attach to cilia of respiratory epithelial cells
- Inflammation occurs which interferes with clearance of pulmonary secretions
- What factors contribute to the clinical course is unknown

Pertussis Clinical Features

- Incubation period 5-10 days (range 4-21 days)
- Insidious onset, similar to minor upper respiratory infection with nonspecific cough
- Fever usually minimal throughout course of illness

Pertussis Clinical Features

- Catarrhal stage 1-2 weeks
- Paroxysmal
cough stage 1-6 weeks
- Convalescence Weeks to
 months

school report WM

1.Term

Ev. Volksschule 63, Krefeld-Merdingen

Zeugnis

für Wolfgang Mauser
 Schulfahr 1957/58 Klasse 2.2 1. Halbjahr

I. Führung: sehr gut
 II. Beteiligung am Unterricht: gut
 III. Häuslicher Fleiß: gut
 IV. Schulbesuch: regelmäßig

V. Beurteilung

Religion: a) Katechismus	Naturkunde:
b) Bibl. Geschichte <u>gut</u>	Naturlehre:
Deutsch: a) mündl. Ausdruck <u>gut</u>	Rechnen: <u>gut</u>
b) Lesen <u>gut</u>	Raumlehre:
c) schriftl. Ausdruck	Musik: <u>ausreichend</u>
d) Rechtschreiben <u>gut</u>	Zeichnen und Werken: <u>gut</u>
e) Schrift <u>gut</u>	Weibl. Handarbeiten:
Englisch:	Leibesübungen: <u>gut</u>
Geschichte:	Schwimmen:
Erdkunde:	

VI. Schulversumisse: 27 Schultage mit Entschuldigung
 - Schultage ohne Entschuldigung

VII. Bemerkungen:

Merdingen 21. Oktober 19 58
 Der Schulleiter: Müller Der Lehrer: Ludt
 Kennzeichen: Mauser
 Unterschrift d. Entschuldigungsberechtigten

2.Term

Ev. Volksschule 63, Krefeld-Merdingen

Zeugnis

für Wolfgang Mauser
 Schulfahr 1957/58 Klasse 2.2 2. Halbjahr

I. Führung: sehr gut
 II. Beteiligung am Unterricht: gut
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e) Schrift <u>gut</u>	Weibl. Handarbeiten:
Englisch:	Leibesübungen: <u>gut</u>
Geschichte:	Schwimmen:
Erdkunde:	

VI. Schulversumisse: 45 Schultage mit Entschuldigung
 - Schultage ohne Entschuldigung

VII. Bemerkungen: Pertussis!

Merdingen 23. März 19 58
 Der Schulleiter: Müller Der Lehrer: Simon
 Kennzeichen: Mauser
 Unterschrift d. Entschuldigungsberechtigten

Measles 27 days of sickness,

Pertussis 45 days of sickness

Σ 72 days of sickness

Pertussis Among Adolescents and Adults

- Disease often milder than in infants and children
- Infection may be asymptomatic, or may present as classic pertussis
- Persons with mild disease may transmit the infection
- Older persons often source of infection for children (parents!)

Pertussis Complications*

<u>Condition</u>	<u>Percent reported</u>
Pneumonia	4.9
Seizures	0.7
Encephalopathy	0.1
Hospitalization	16
Death	0.2

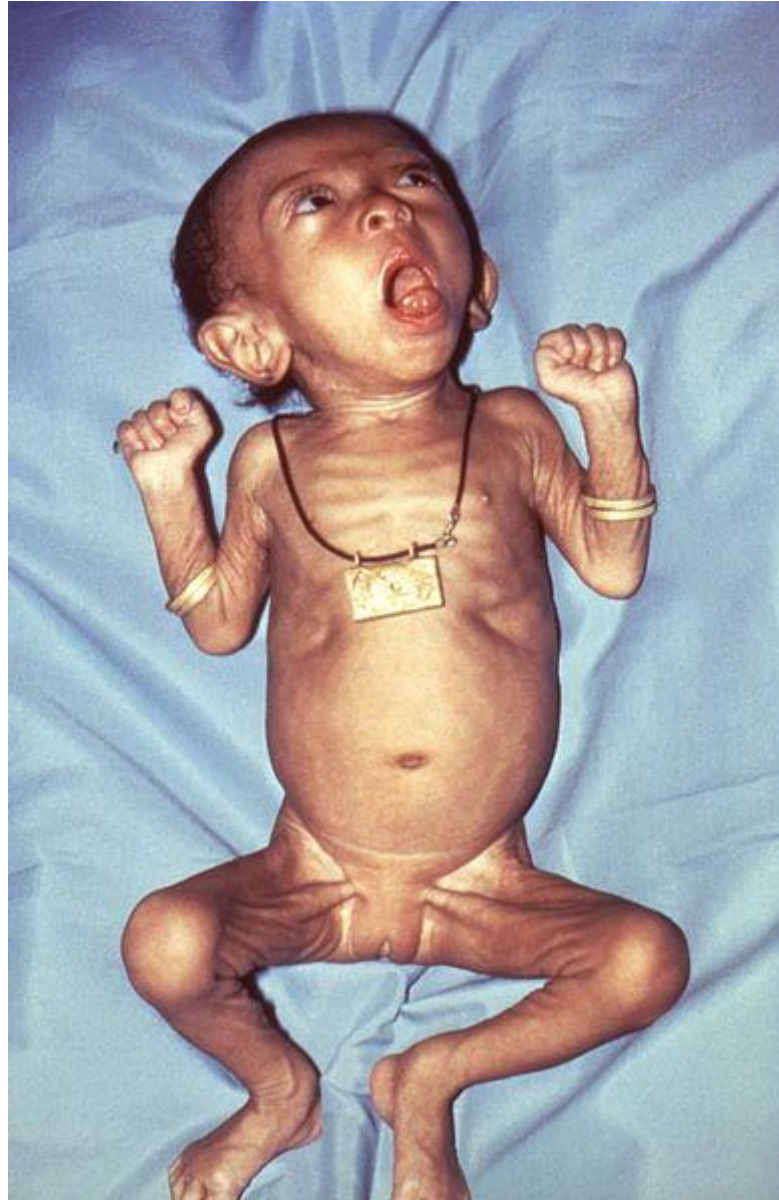
*Cases reported to CDC 2001-2003 (N=28,998)

Pertussis Deaths in the United States, 2004-2005

	<u><3 mos</u>	<u>>3 mos</u>	<u>Total</u>
2004	24	3	27
2005	32	7	39
Total	56	10	66
	(85%)	(15%)	

CDC, unpublished data, 2006

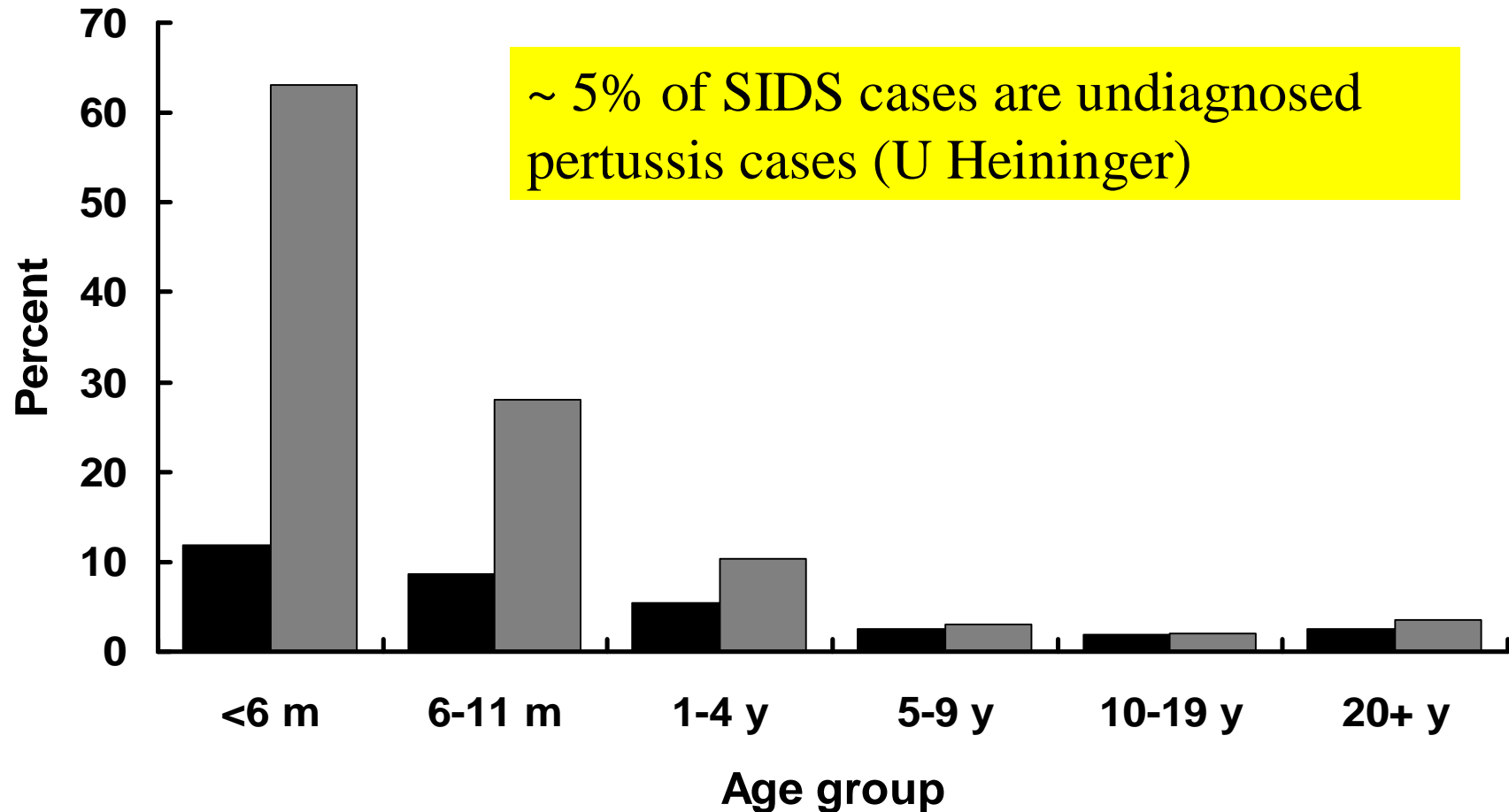
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Pertussis Complications by Age *

■ Pneumonia ■ Hospitalization



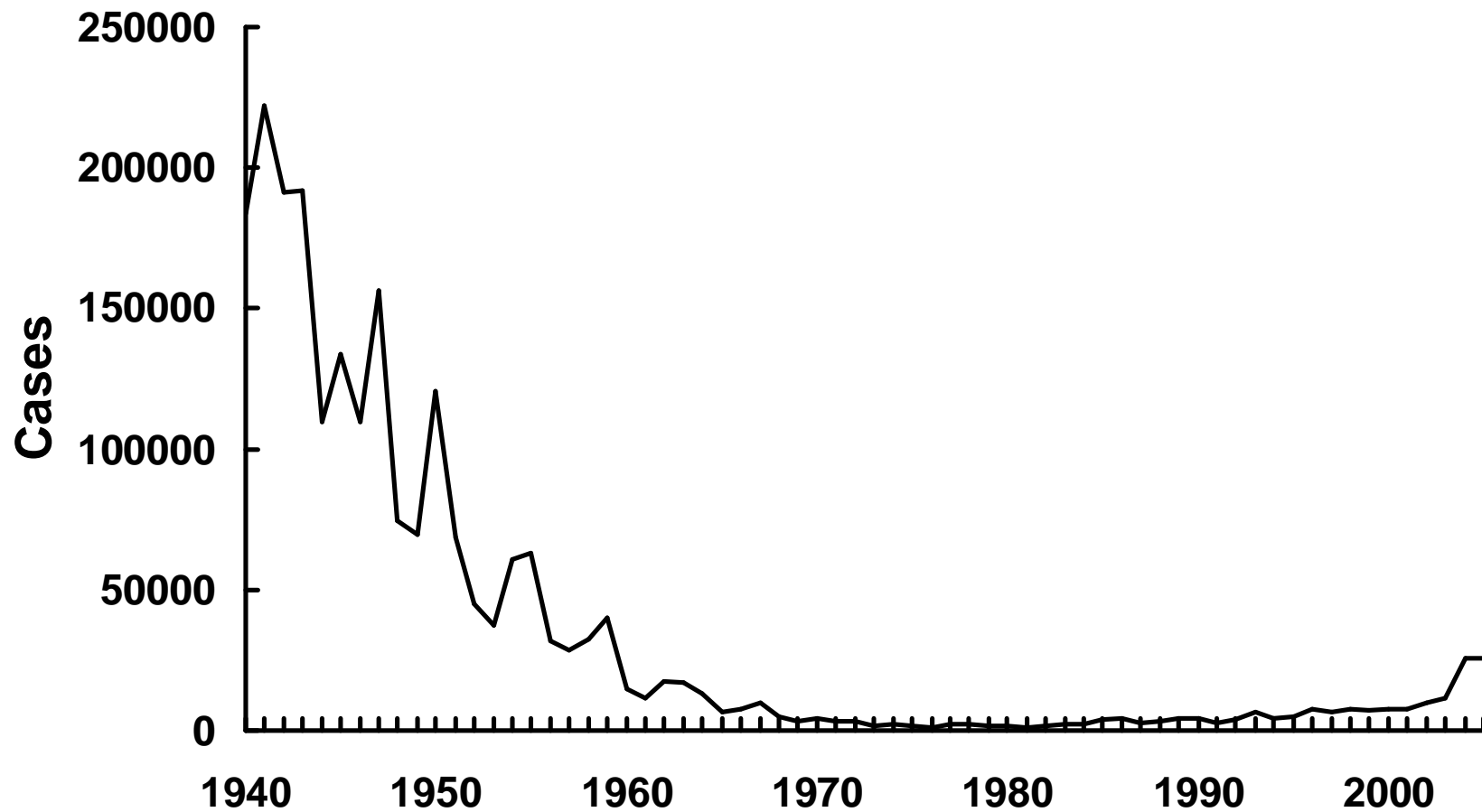
*Cases reported to CDC 1997-2000 (N=28,187)

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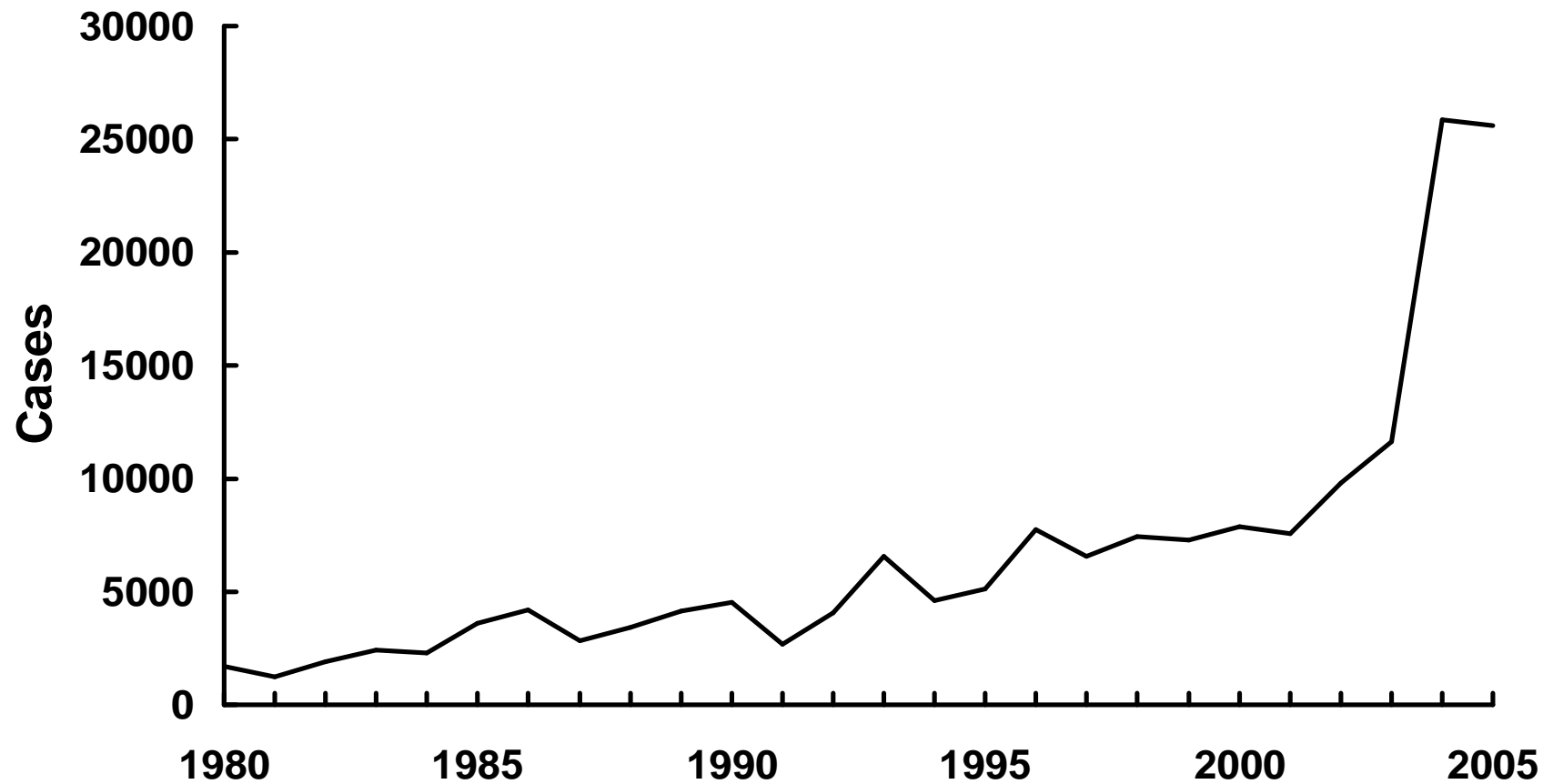
Pertussis Epidemiology

- Reservoir Human
 Adolescents and adults
- Transmission Respiratory droplets
- Communicability Maximum in catarrhal stage
 Secondary attack rate
 up to 80%

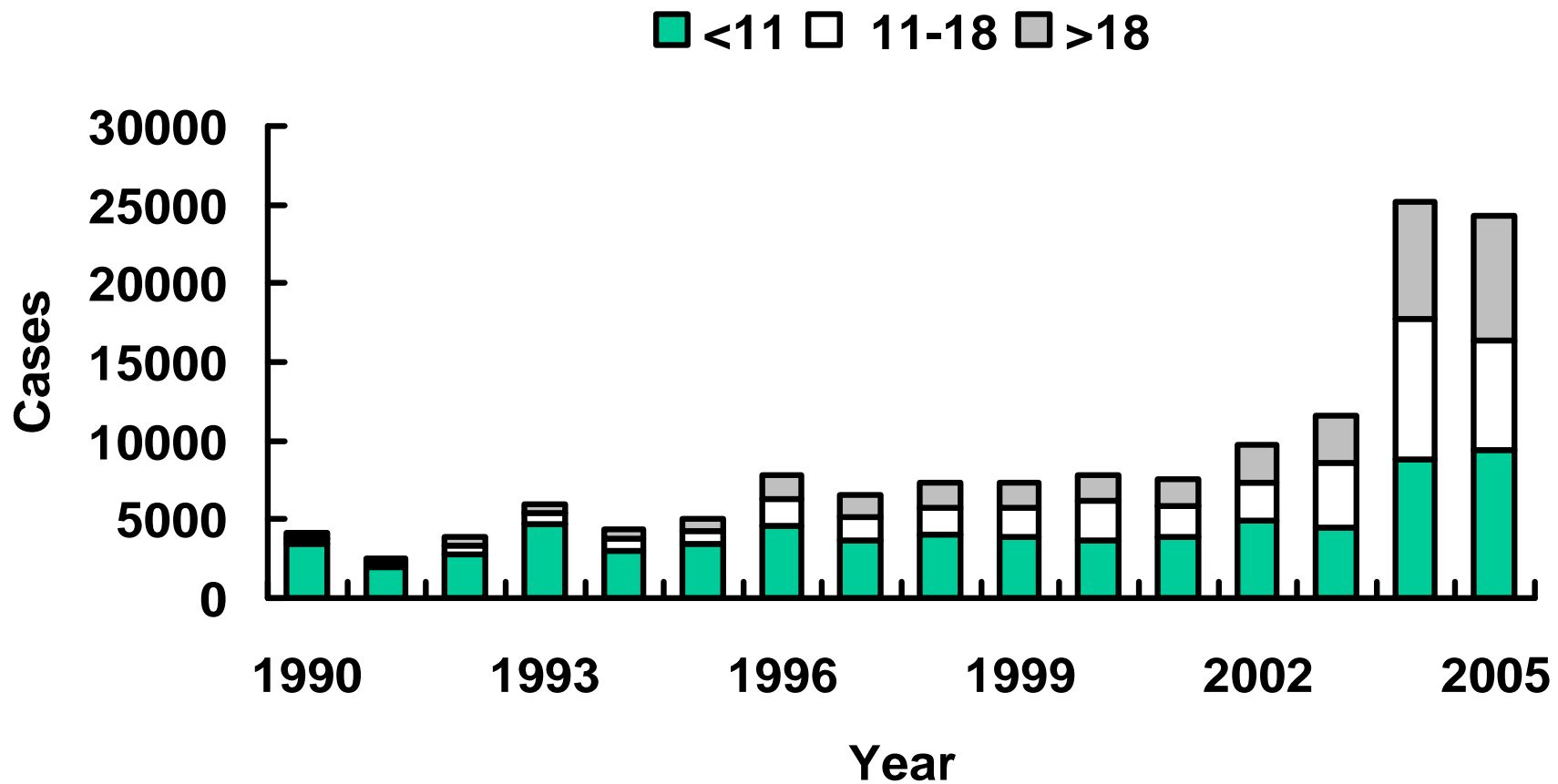
Pertussis—United States, 1940-2005



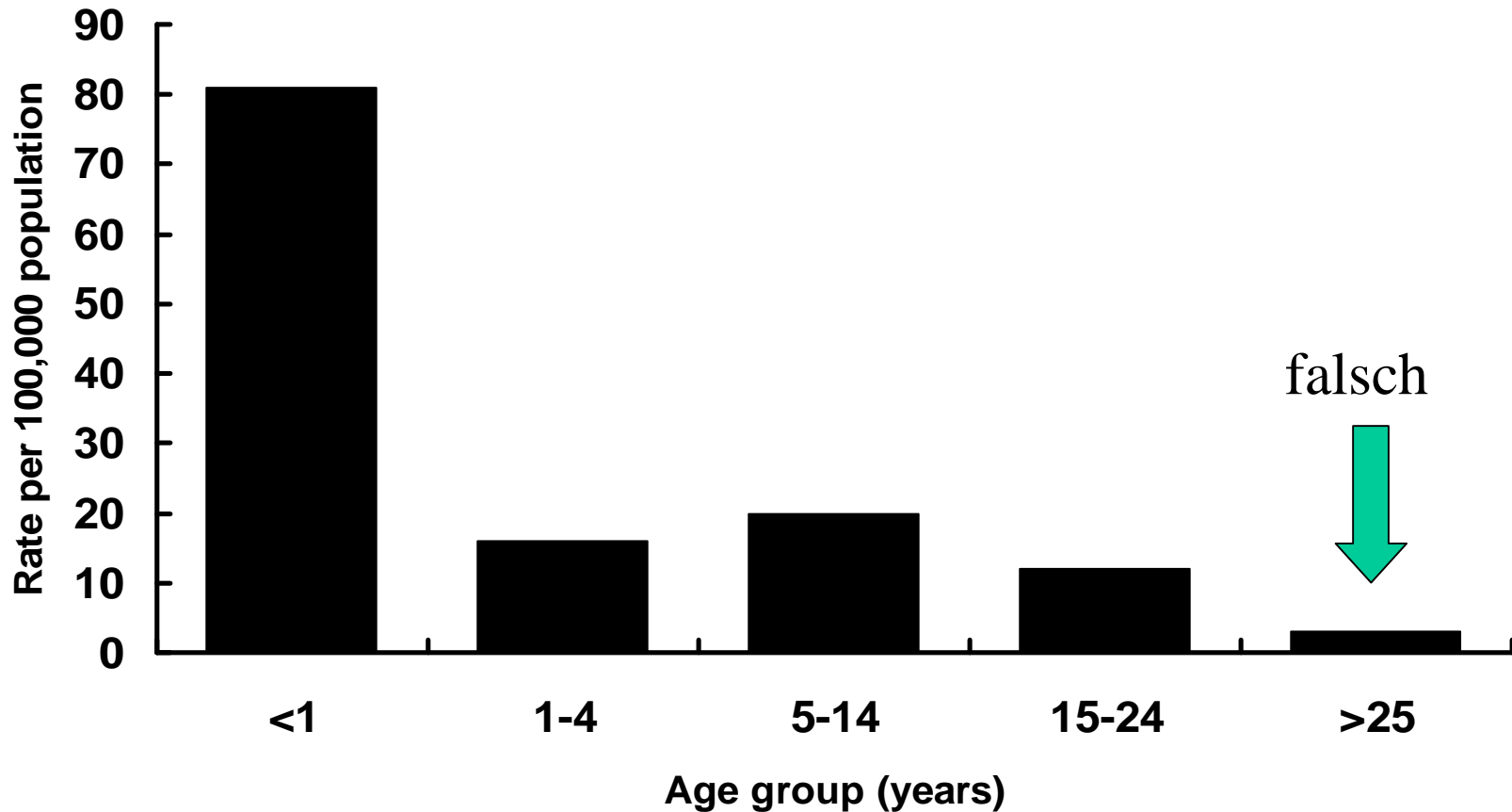
Pertussis—United States, 1980-2005



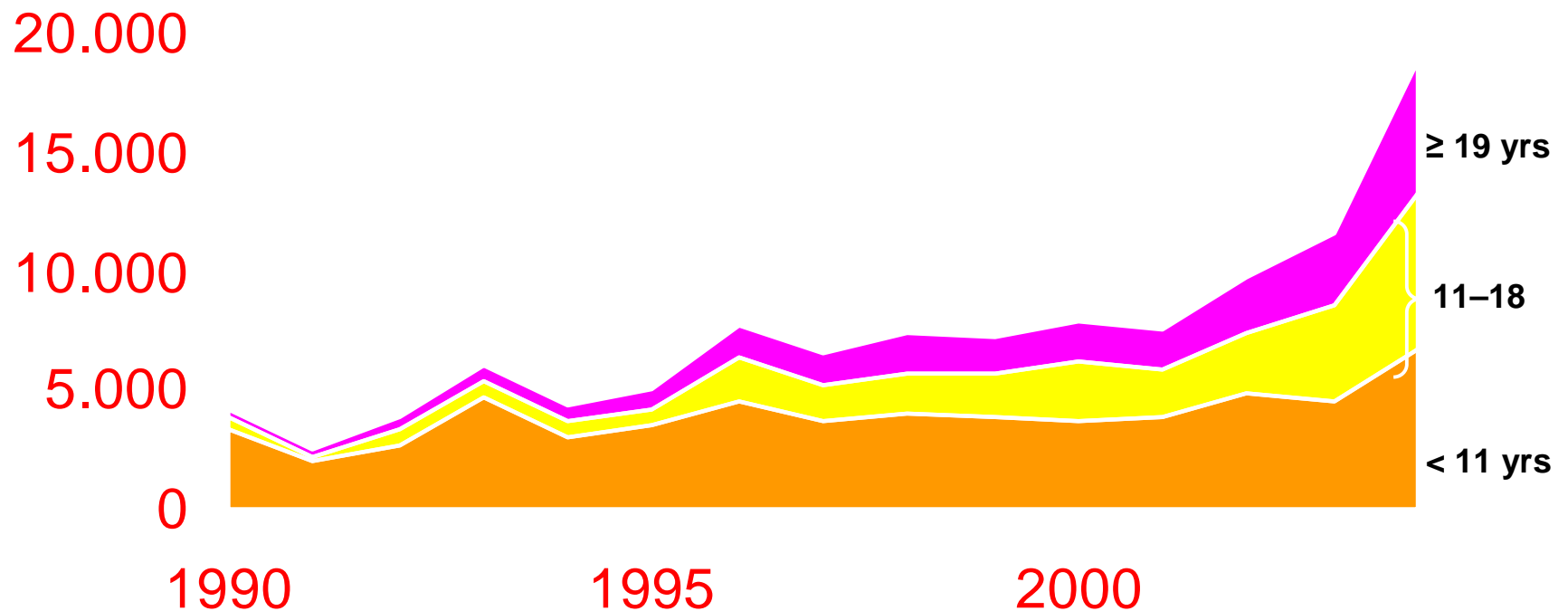
Reported Pertussis by Age Group, 1990-2005



Pertussis Incidence, 2004



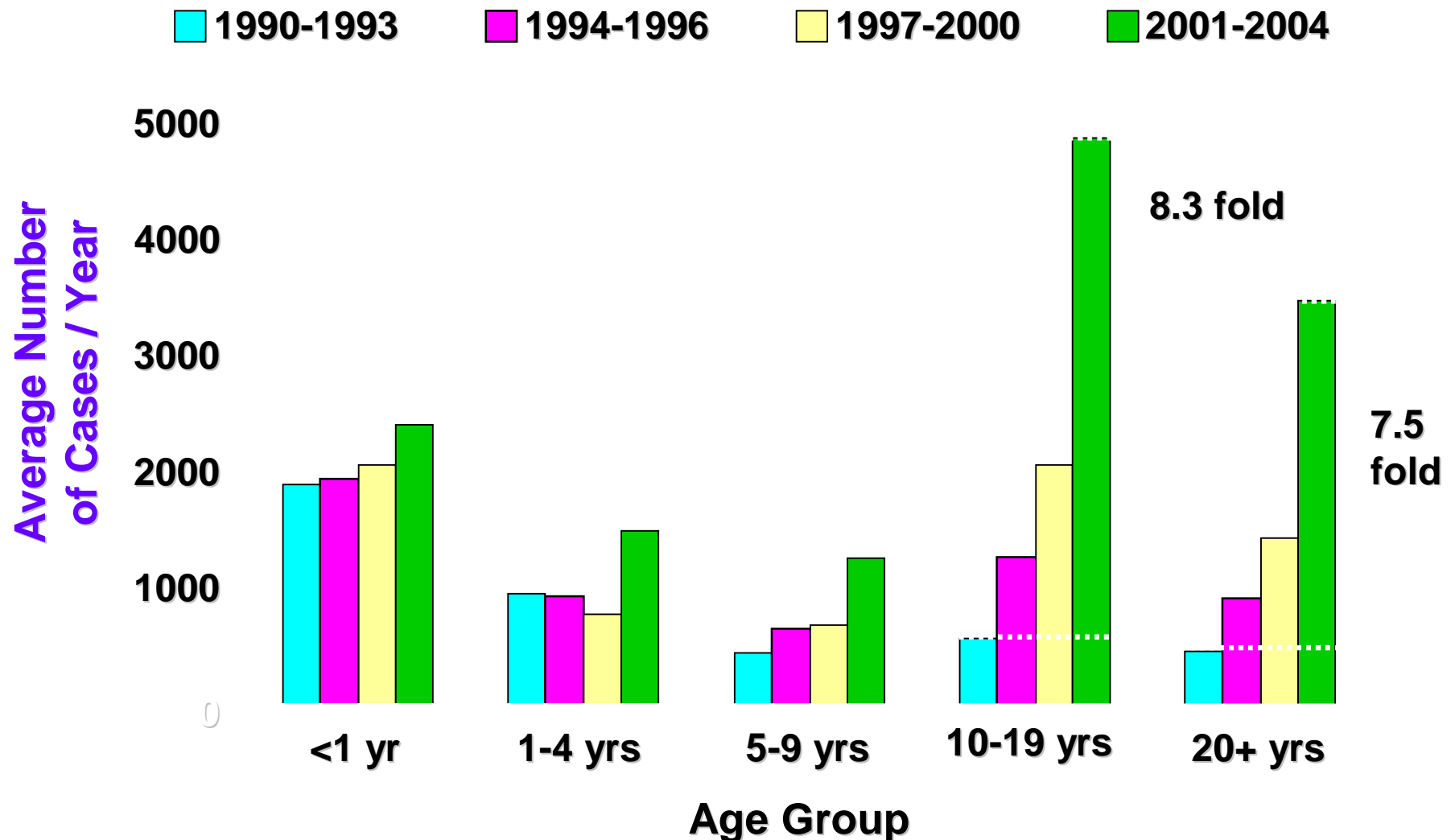
Reported cases of pertussis USA, 1990–2004



Trudy V. Murphy, MD, National Immunization Program, CDC
Current Issues in Immunization NetConference, July 14, 2005



Reported cases of pertussis, USA



Güriş et al. *Clin Infect Dis.* 1999;28:1230-1237.

CDC. *MMWR.* 2002;51:73-76, 2001;50(53):1-108, 2002;51(53):1-84, 2003;52(54):1-85

Bacterial Vaccine Preventable Disease Branch, National Immunization Program, 2005.

wolfgang.maurer@meduniwien.ac.at

Prolonged cough in adolescents and adults due to *B. pertussis*

<i>Authors</i>	<i>Place</i>	<i>Year(s)</i>	% of cough illness
Nennig et al	San Francisco	1994-95	12
Strebel et al	Minn-St Paul	1995-96	13
Jackson et al	Seattle	1983-87	15
Jansen et al	San Diego	1993-94	17
Birbeback et al	Denmark	1995-97	17
Wright et al	Nashville	1992-94	21
Robertson et al	New S Wales	1985-86	26
Mink et al	Los Angeles	1986-89	26
Rosenthal et al	Chicago	1993-94	26
Wirsing v Köenig et al	Germany	1992-94	31
Schmitt-Grohé et al	Germany	1992-94	32
Vicent et al	Korea	1997-98	50
Gilberg et al	Paris	1999	52

“The disease is most common in childhood but is not confined to that period of life. The phenomenon of an old person suffering from whooping cough is far from uncommon.”

Source: Physicians and Surgeons of the Principle London Hospital
The Family Physician. Manual of Domestic Medicine. Volume I, 1884.

Pertussis among Elderly

- 75 not vaccinated residents
- 19/24 not vaccinated nonresidential personnel
- Overall attack rate (> 2 Wks) 49%
 - 42% (41/98) lab confirmed pertussis attack rate
 - Mean cough duration 69 days (7-268)
 - 5% fatal (4/75) brain bleeding with symptoms of pertussis (3 > 75-94 a)

Lit Mertens PLJM Eur J Clin Micro Infe Dis (1999) 18:242-247

Infants to young for completion of the primary series- pertussis

- Prospective international study
- Laboratory confirmed
 - Index cases 91
 - Primary case identified 44 (48,4%)
 - Parent 27 (54,1%)
 - Sibling 8 (16,3%)
 - Aunt/uncle 5 (10,2%)
 - Household members responsible for 76%-83% of transmissions

Wendelboe AM PIDJ (2007) 26:293-299

Maternal Vaccination ?

- >50% of infants < 6 mo require hospitalisation
- Passive immunisation with high titer Ig
 - Partial protection
- Human studies between 1930-1950 with wcP
 - Cave wcP contained endotoxins !
- Acell Pertussis Vaccination is not contraindicated in pregnancy
 - <http://aapredbook.aappublications.org/cgi/content/extract/2006/1/1.7.2>
- High titer AB risk for adverse event?
 - Mooi FR The case of maternal vaccination against pertussis Lancet Inf Dis Sept 2007;7:614-624



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Section 1. Active and Pa

IMMUNIZATION IN SPECIAL

Pregnancy ¹

Immunization during pregnancy poses the

pregnant women should receive a vaccine only when the vaccine is unlikely to cause harm, the risk for disease exposure is high, and the infection would pose a significant risk to the mother or fetus. When a vaccine is to be given during pregnancy, delaying administration until the second or third trimester, when possible, is a reasonable precaution to minimize concern about possible teratogenicity.

The only vaccines recommended for routine administration during pregnancy in the United States, provided they are indicated (either for primary or booster immunization), are adult-type tetanus and diphtheria toxoids (Td); tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap); and inactivated influenza vaccines. Pregnant women who have not received a Td-containing booster during the previous 10 years should be given Tdap, and women who are unimmunized or only partially immunized should complete the primary series. For complete recommendations regarding Td and Tdap use in pregnancy, see Pertussis, p 498. In developing countries with a high incidence of neonatal tetanus, Td routinely is administered during pregnancy without evidence of adverse effects and with striking . . . [\[Go to Full Text\]](#)

Schwangerschaft: Impfstoffe
routinemäßig empfohlen DIP-TET und
INF. Schwangere ohne DIP-TET
Impfung in den letzten 10 Jhr sollen DIP-
TET-PEA erhalten. Un/Teilgeimpfte
sollen Grundimmunisierung erhalten

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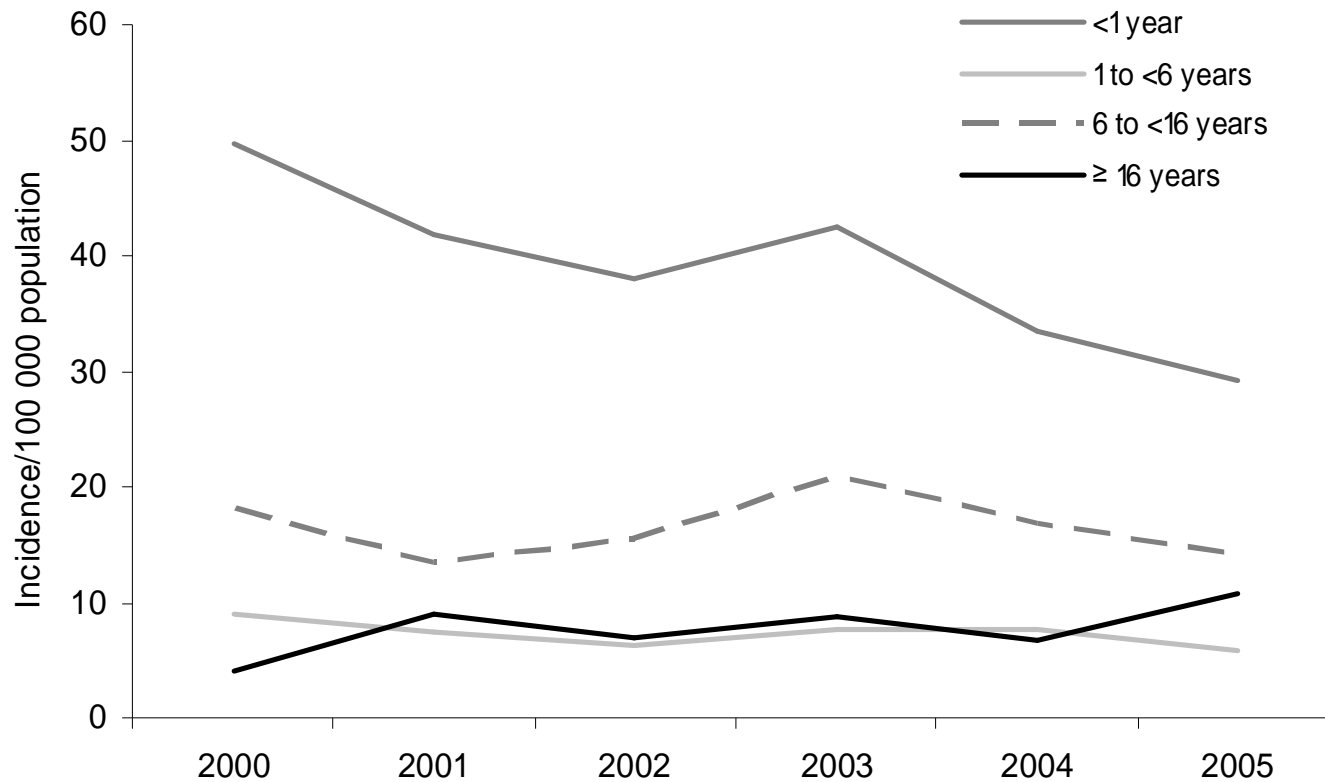
Poliovirus Infections

Red Book 2006: 542-547. [\[Extract\]](#) [\[Full Version\]](#)

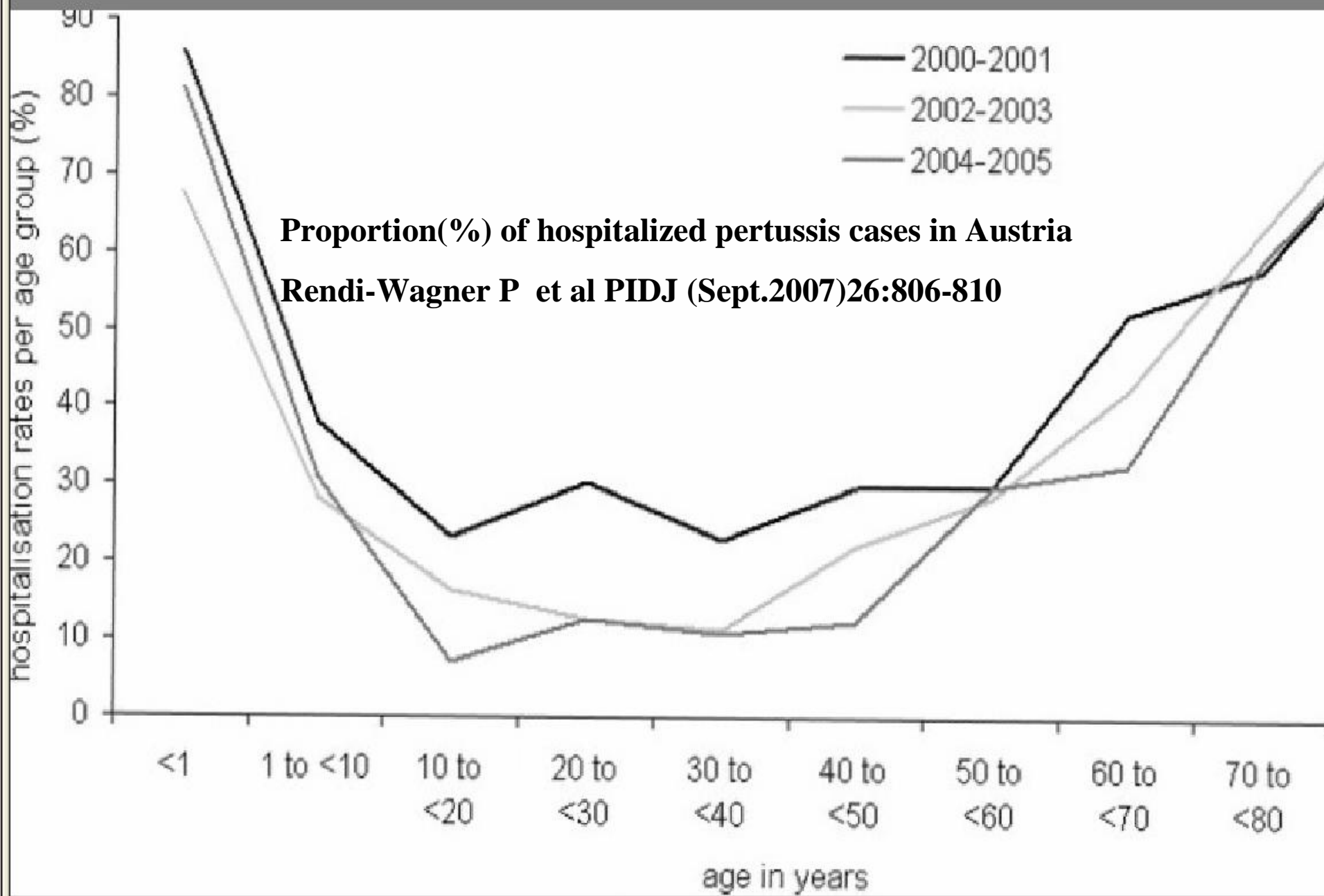
Fertig

Pertussis incidence in Austria 2000-2005

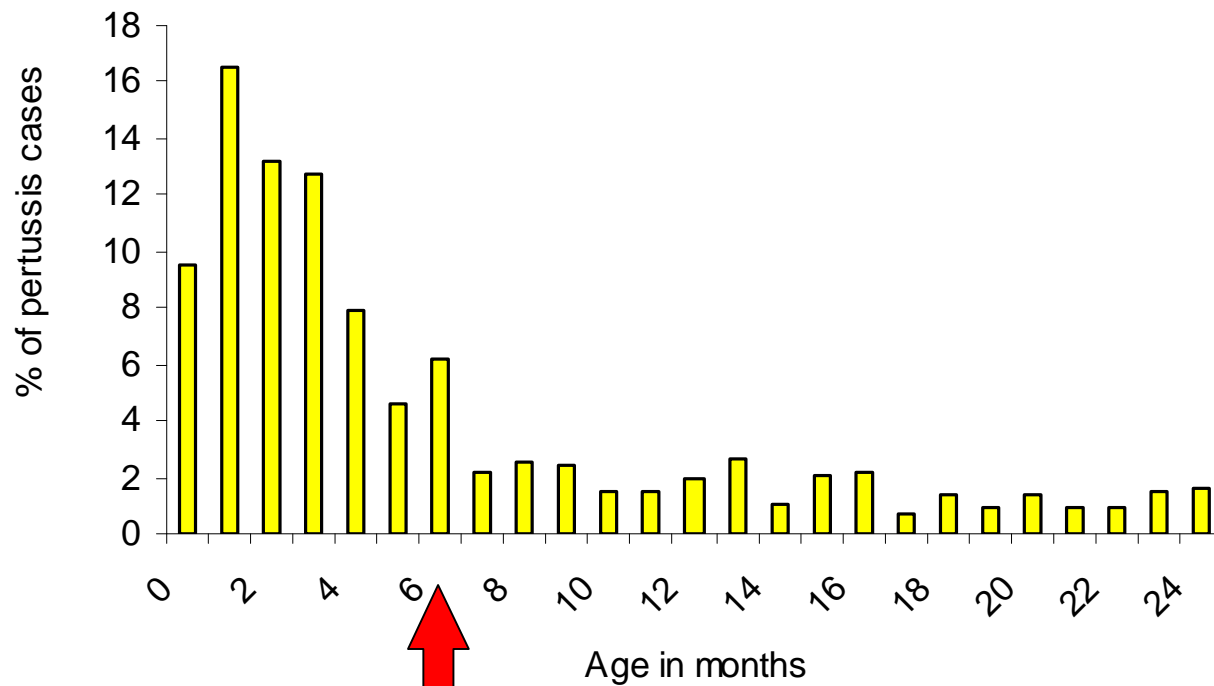
Laboratory surveillance



Rendi-Wagner PIDJ Sept 2007;26(9):806-810

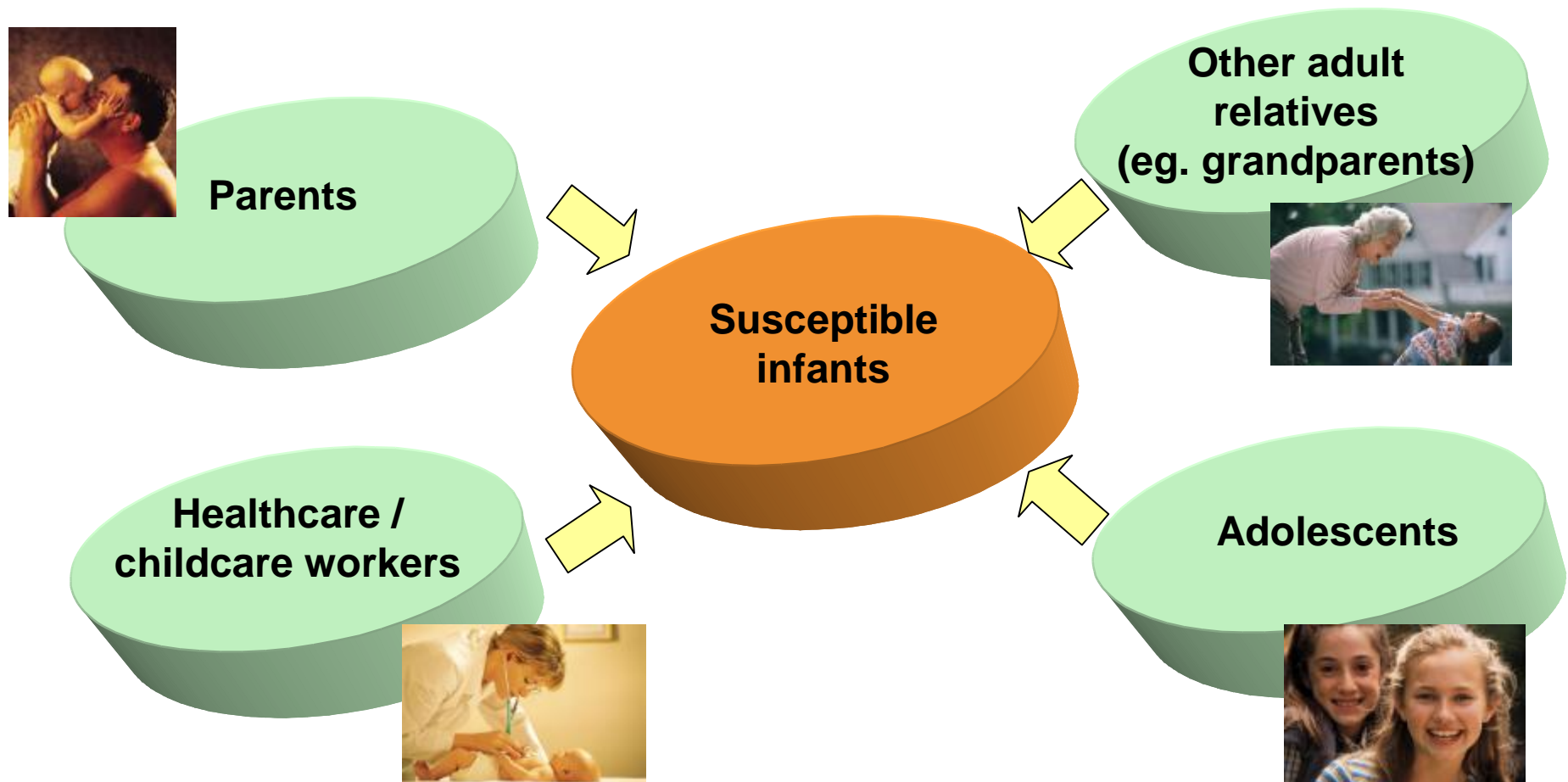


Pertussis cases in children ≤24 months Austria, 1996-2005



Data from H. Kollaritsch, P. Rendi-Wagner
Dep. of Specific Prophylaxis & Trop. Med.
Med. University Vienna

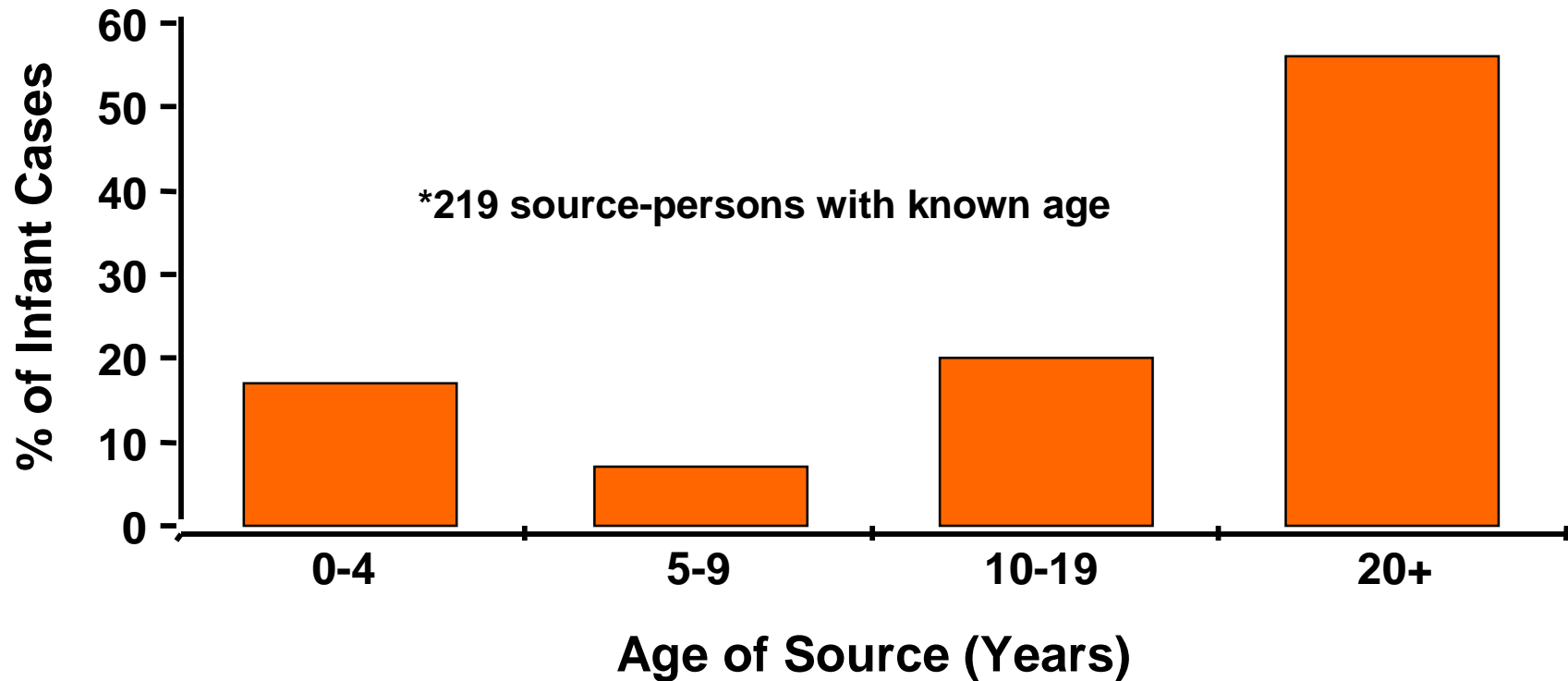
Adolescents/adults a major source of pertussis infection for infants



Baron et al. *Pediatric Infect Dis J* 1998;17:412-18
Cattaneo et al. *J Infect Dis* 1996;173:1256-9
Deen et al. *Clin Infect Dis* 1995;2:1211-9

Izurieta et al. *Clin Infect Dis* 1996;22:503-7
Gehanno et al. *Arch Pediatr* 1998;5:92-3
Wirsing von König et al. *Eur J Pediatr* 1998;157:391-4

Age of Pertussis Source for Infants



Vaccination policies in Europe* and North America*

*27 EU countries
+ Switzerland
Iceland, Norway*

USA, Canada

Children 4-7 years

- No wcP
- 21 of 32 countries (66%) use acP
 - In combination with diphtheria and tetanus
 - 14 of 21 countries use a combination with IPV

Vaccination policies in Europe* and North America*

*27 EU countries
+ Switzerland
Iceland, Norway*

USA, Canada

Adolescents 9-16 years

- All 32 countries give a booster with d and T between 9 and 16 years
- 12 of 32 countries (37%) use acP between 9 and 14 years
 - dT-acP-IPV: 3 countries
 - dT-acP: 9 countries

wolfgang.maurer@meduniwien.ac.at

Vaccination policies in Europe* and North America*

*27 EU countries
+ Switzerland
Iceland, Norway*

USA, Canada

Adult boosters

- Most countries recommend dT every 10 years
- dT-acP-IPV every 10 years:
Austria and Luxembourg, USA since 2007
- dT-IPV every 10 years: France

wolfgang.maurer@meduniwien.ac.at

Outbreaks of respiratory Illness Mistakenly Attributed to Pertussis

MMWR 24.Aug 2007:56(33);837-42

- HCW (laboratory) 396 bed hospital
 - 3 week history of paroxysmal cough and posttussive vomiting
 - Pos with single target PCR for pertussis (IS481)
 - Azithromycin, sent off work for 5 days
- 15 more lab workers with resp.illness and pos or +/- PCR
- PEP and vaccination with TET-DIP-PEA
- But 18 more HCW (clinic) identified

Outbreaks of respiratory Illness Mistakenly Attributed to pertussis

MMWR 24.Aug 2007:56(33);837-42

- Screening of HCW for sign and symptoms of upper resp tract infections
 - 134 suspected cases
 - 98 (73%) pos/equivocal PCR
 - 36 (27%) clinical symptoms alone
 - But 32 (34%) reported myalgia not typ f pertussis
 - Extended two target PCR testing (IS481 and ptxS1)
 - 1/111 pos for both targets = B pertussis
 - Further testing 2/39 Bordetella holmesii
 - 4524/6289 were vaccinated,
 - 978 (16%) ill HCW were PCR tested and put on leave

Outbreaks of respiratory Illness Mistakenly Attributed to pertussis

MMWR 24.Aug 2007:56(33);837-42

- Confirmation of pertussis etiology is important
- Culture is ref standard 100% specific
 - But 56% sensitive decreasing with time
 - Can last 7-14 days
- Serology paired specimen, 4 wks apart, not useful for immediate diagnosis, tests not clinically validated

Pertussis vaccine evolutionary pressure for B pertussis-?

- B pertussis resurgence- factors
 - Improved surveillance
 - Waning immunity
 - Bacterial evolution
 - Netherlands
 - Subpotent vaccines
 - Canada, Netherlands

Mooi FR et al Emerging Infectious Diseases 2001;7:526-28

wPertussis and WHO

The Pertussis Vaccine is safe and effective....

.... Claims that the vaccine is also the cause of severe neurological damage have recently found to have been unsubstantiated.....

WHO-Weekly Epidem.Record 30.11.1990

Impact of anti-vaccine movements on pertussis control – the untold story

- No impact
 - Hungary: incidence prae vacc >100; post < 1
 - Former DDR: coverage 95%
 - 1980-1990 incidence 1-2
- Anti-vaccine movement- impact
 - Germany: coverage 11% incidence 180
 - Japan coverage
 - 1974: 80% 1976:10% ;
 - 1979 Pertussis outbreak 13000 cases 41 fatalities,
 - acell. Vaccine since 1981

* Incidence cases per 100.000

E.J.Gangarose et al. Impact of anti-vaccine movements on pertussis control: the untold story Lancet 1998; 351: 356-361

wongang.maurer@meduniwien.ac.at



Vereinte Nationen Sondertagung über Kinder



8. - 10. Mai 2002, New York



Impfungen und Impfstoffe

Jedes Jahr sterben drei Millionen Kinder an Krankheiten, die mit einer bis drei Einheiten einfach erhältlicher Impfstoffe leicht hätten verhindert werden können, vor allem in Entwicklungsländern. Millionen weiterer Kinder werden durch diese Krankheiten geschwächt oder schwerbehindert.

Jedes Kind hat ein Recht auf Impfung
Kindern ist notwendig

Immunisierung ist ein Schlüsselschritt
wie Vitamin A und Jod zur
Armutsbekämpfung.
viele Millionen Dollar
Arbeitsproduktivität an
einmal frei von Kinder
Finanzierung anderer

**Eine bessere Versorgung
eines Landes.** Ein Land
entscheidend zur Stärkung
des medizinischen Personal
ermöglicht die Erkennung

Each child has a right to vaccination against preventable diseases. Routine vaccination of children is necessary, to warrant the children's right to health

Jedes Kind hat ein Recht auf Impfung gegen verhütbare Krankheiten. Die Routineimpfung von Kindern ist notwendig, um das Recht der Kinder auf Gesundheit zu gewährleisten

Vaccination Schedule Austria

- State of the art
 - Yearly update
 - Formally its a decree of the Ministry of Health
 - Binding for HCW
- Physicians as opponents of vaccination
 - Violation of evidence based medicine
 - Sign of professional incompetence
 - Medical malpractice

Allgemeiner Impfkalender für Säuglinge und Kleinkinder 2007

	Ab 7.Woche	3. Monat	4. Monat	5. Monat	6. Monat	7. Monat	2. Lebensja hr
Rotavirus	2 bzw. 3 x RTV-Impfstoff (Schluckimpfung)						
Diphtherie (DIP) Tetanus (TET) Pertussis (PEA) Poliomyelitis (IPV) Haemophilus infl. B (HIB) Hepatitis B (HBV)		1. 6-fach Impfung		2. 6-fach Impfung		3. 6-fach Impfung	4. 6-fach Impfung
Konjugierte Mehrfachimpfung gegen Pneumokokken (PNC)		1. PNC- Impfung		2. PNC- Impfung		3. PNC- Impfung	4. PNC- Impfung
Masern Mumps (MMR) Röteln	Download www.bmgfj.gv.at						2x MMR Impfung

Allgemeiner Impfkalender für Schulkinder 2007

		7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	
		Lebensjahr											
Diphtherie(dip) Tetanus (TET) Polio (IPV)		Auffrischungs- Impfung dip-Tet-IPV											
Hepatitis B (HBV)		Auffrischungs-Impfung HBV bzw. Nachholen der HBV Grundimmunisierung (spätestens bis zum 13.Lj)											
Diphtherie(dip) Tetanus (TET) Pertussis (PEA)								Auffrischungsimpfung dip-TET-PEA					
Windpocken= Varizellen VZV		2x VZV											
Masern Mumps MMR Röteln	With/wo PEA	Ev. Nachholen MMR											
Humane Papilloma- viren (HPV)		3x HPV (siehe Fachinformation)											

Allgemeiner Impfkalender für Erwachsene
Sofern abgeschlossenen Grundimmunisierung vorliegt:

25 Jahre	35 Jahre	45 Jahre	55 Jahre	60 Jahre	65 Jahre	70 Jahre	75 Jahre u.S.w.
dip TET PEA IPV	dip TET PEA IPV	dip TET PEA IPV	dip TET PEA IPV	dip TET PEA	dip TET PEA IPV	dip TET PEA	dip TET PEA IPV
				PNE	PNE *	PNE *	PNE *

Influenza immer ab 60 Jhr

How Soon After a Prior TET-DIP Vaccination Can One Give Adult TET-dip-PEA Vaccine ?

Interval (yr) since TD/Td		2a	10a
Erythema	any	35.6 (31-40.4)	32.3 (28.8-36.0)
	≥ 10 mm	5.8 (3.8-8.5)	5.5 (3.9-7.5)
	≥ 50 mm	1.2 (0.4-2.8)	0.7 (0.2-1.7)
Swelling	any	20.8 (17.0-25.1)	17.4(14.6-20.4)
	≥ 10 mm	4.8 (3.0-7.4)	6.7 (4.9-8.8)
	≥ 50 mm	1.7 (0.7-3.5)	1.5 (0.7-2.7)

Halperin SA PIDJ 25:195-200; 20.March 2006 n=7156 age 8-17 yrs

How Soon After a Prior TET-DIP Vaccination Can One Give Adult TET-dip-PEA Vaccine ?

Interval (yr) since TD/Td		2a	10a
Pain	any	82.0 (77.9-85.6)	81.7 (78.6-84.6)
	≥moderate	27.2 (22.9-31.7)	26.5 (23.3-30.0)
	severe	2.6 (1.3-4.7)	1.3 (0.6-2.5)
Fever	>38	6.4 (4.3-10.0)	5.7 (4.0-7.7)
	>39	2.6 (1.2-5.0)	1.2 (0.5-2.4)
	>40	0.3 (0.0-1.6)	0.5 (0.1-1.3)

Combined Booster Pertussis Vaccines

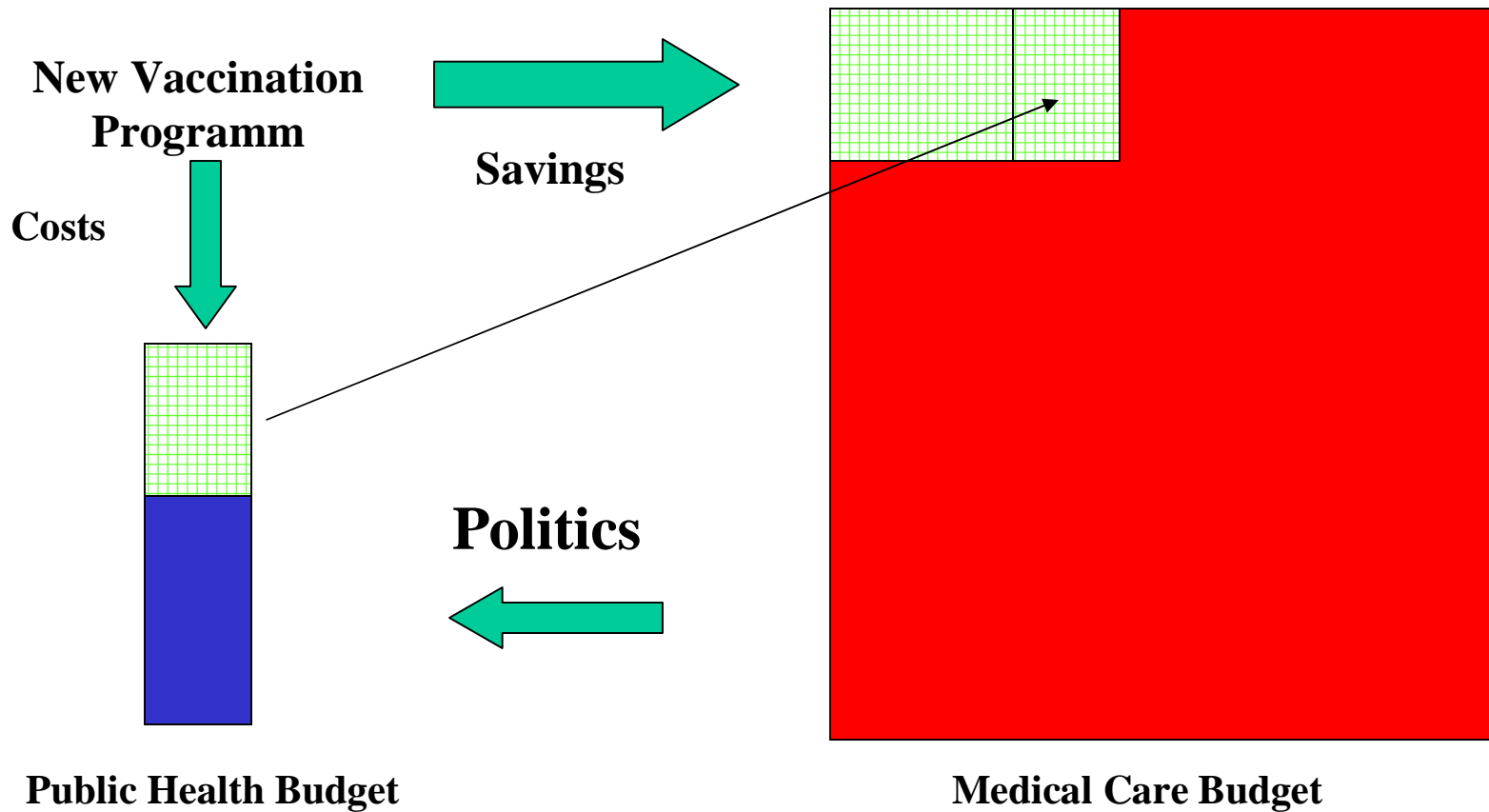
dip-TET-PEA and dip-TET-PEA-IPV

- Covaxis[®] (0,5 ml),
 - Al PO₄ 1,5 mg (\triangleq 0,33mg Al³⁺),
 - TET > 20 IE, dip > 2IE
 - PT 2,5 μ g, FHA 5 μ g, FIM(2,3) 5 μ g, PRN 3 μ g
 - Preservative Phenoxyethanol,
 - Residues of production Form-, Glutaraldehyd
- + IPV = Repevax[®]
- Boostrix[®] (0,5 ml)
 - Al PO₄ / Al (OH)₃ (\triangleq 0,5 mg Al³⁺)
 - TET > 20 IE, dip > 2IE
 - PT 8 μ g, FHA 8 μ g, PRN 2,5 μ g
 - Preservative Phenoxyethanol,
 - Residues of production Formdehyd, Polysorbate 80
- +IPV = Boostrix-Polio[®]

Vaccination Programms:

The Financial and Political Context

Adapted from D.Fedson Adv.Vaccinology Course Anney May 2000



Pertussis vaccination strategies proposed by the Global Pertussis Initiative



- Reinforcement / improvement of the current infant and toddler immunization strategy
- Preschool booster at 4-6 years of age
- Universal adolescent immunization
- Universal adult immunization
- Selective immunization of new mothers and close contacts of newborns
- Selective immunization of health care and child care workers