

# Group discussion exercise

- Divide in to groups
- You are a scientist working in West Africa
- Since 2011 a vaccine against pneumococcal infection (covering 13 serotypes) has been recommended for use in this country for all children under 5 years of age
- You are travelling through a rural area and you find when discussing with local health workers that many children under 5 are still dying of pneumococcal infection
- Discuss in your groups possible reasons for this disparity between WHO recommendations and what is happening in reality

# Vaccine preventable diseases II

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For BSc Global Health 2012

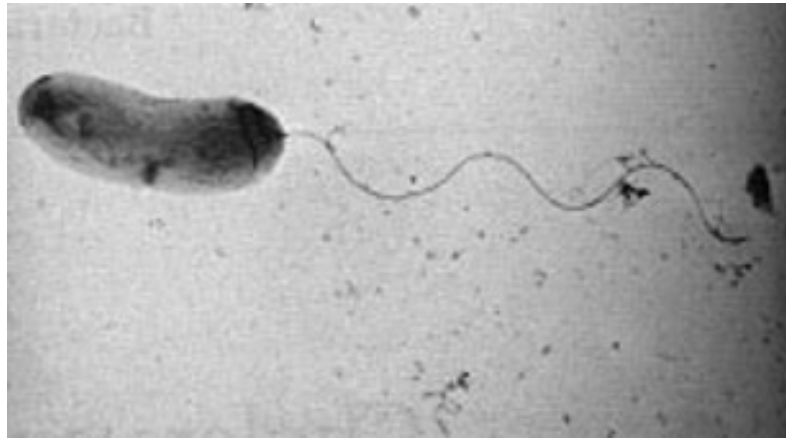
# Aim

- To place information in previous lecture in a global context

# Objectives

- A few more vaccines... (sorry)
- EPI
- Other global vaccination strategies
- Success stories
- Global burden of vaccine preventable disease
- Potential success stories
- Barriers to immunisation in resource limited setting
- The future...

# Cholera – the organism

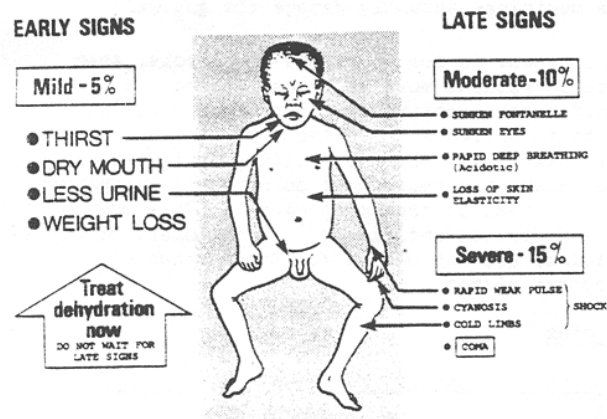


*Vibrio cholerae*

# Cholera – the disease



Rx: Rehydration  
+/- antibiotics



# Cholera – the vaccine



- Oral, killed
- Mucosal immunity
- Not used in cholera control programmes outside Vietnam
- 2-3 doses
- Possible herd immunity
- Epidemic vs endemic strategies...



# Typhoid – the organism



Salmonella typhi

# Typhoid – the disease

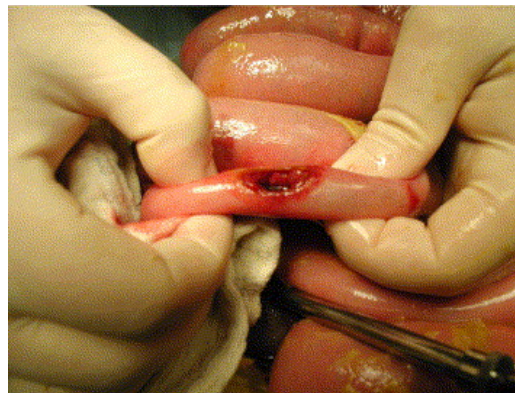


Rose spots



Fever with relative bradycardia

Rx : antibiotics



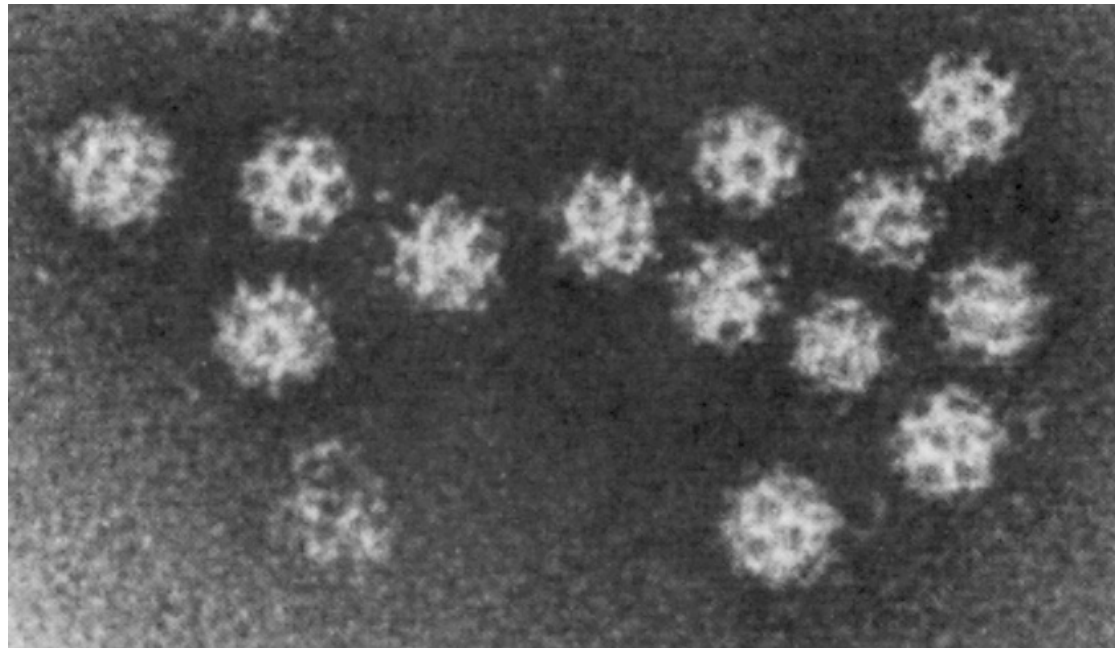
Intestinal perforation

# Typhoid – the vaccine



- Polysaccharide
- Live attenuated
- Included in a few countries national schedules
- Travel vaccine
- Conjugate vaccines in the pipeline

# Yellow Fever – the organism



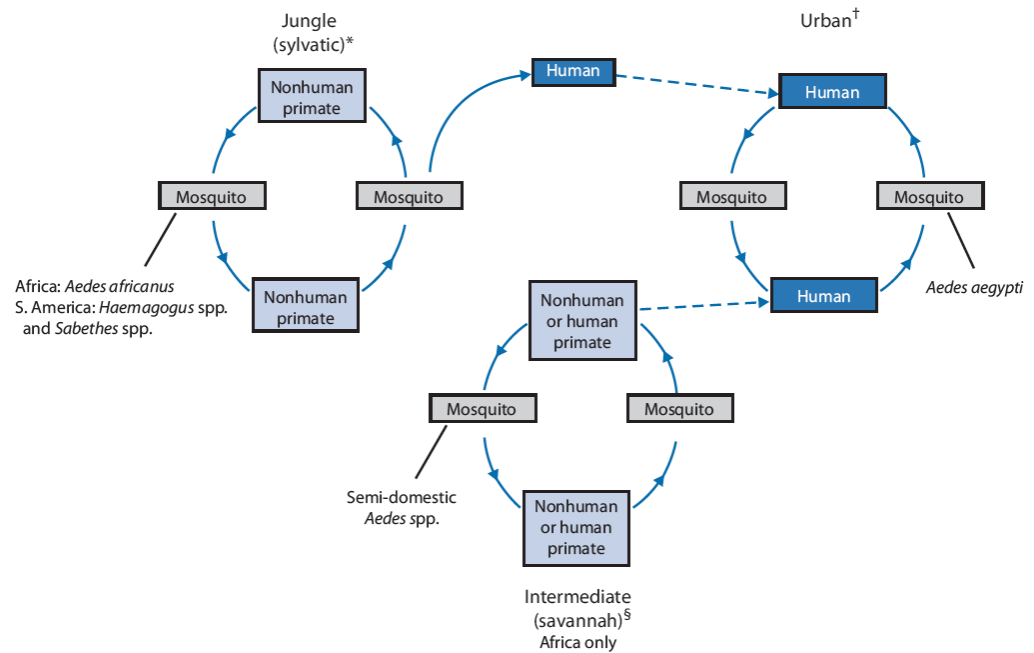
Flavivirus - RNA

# Yellow Fever – the disease

Aedes mosquito



Context dependent transmission



Proportion  
have severe  
disease

# Yellow fever – the vaccine



- Live attenuated vaccine
- Certificate of vaccination
- Potential severe adverse reaction

**INTERNATIONAL CERTIFICATE OF VACCINATION**  
AS APPROVED BY  
THE WORLD HEALTH ORGANIZATION

**CERTIFICAT INTERNATIONAL DE VACCINATION**  
APPROUVÉ PAR  
L'ORGANISATION MONDIALE DE LA SANTÉ

TRAVELER'S NAME—NOM DU VOYAGEUR

ADDRESS—ADRESSE (Number—Numéro) (Street—Rue)

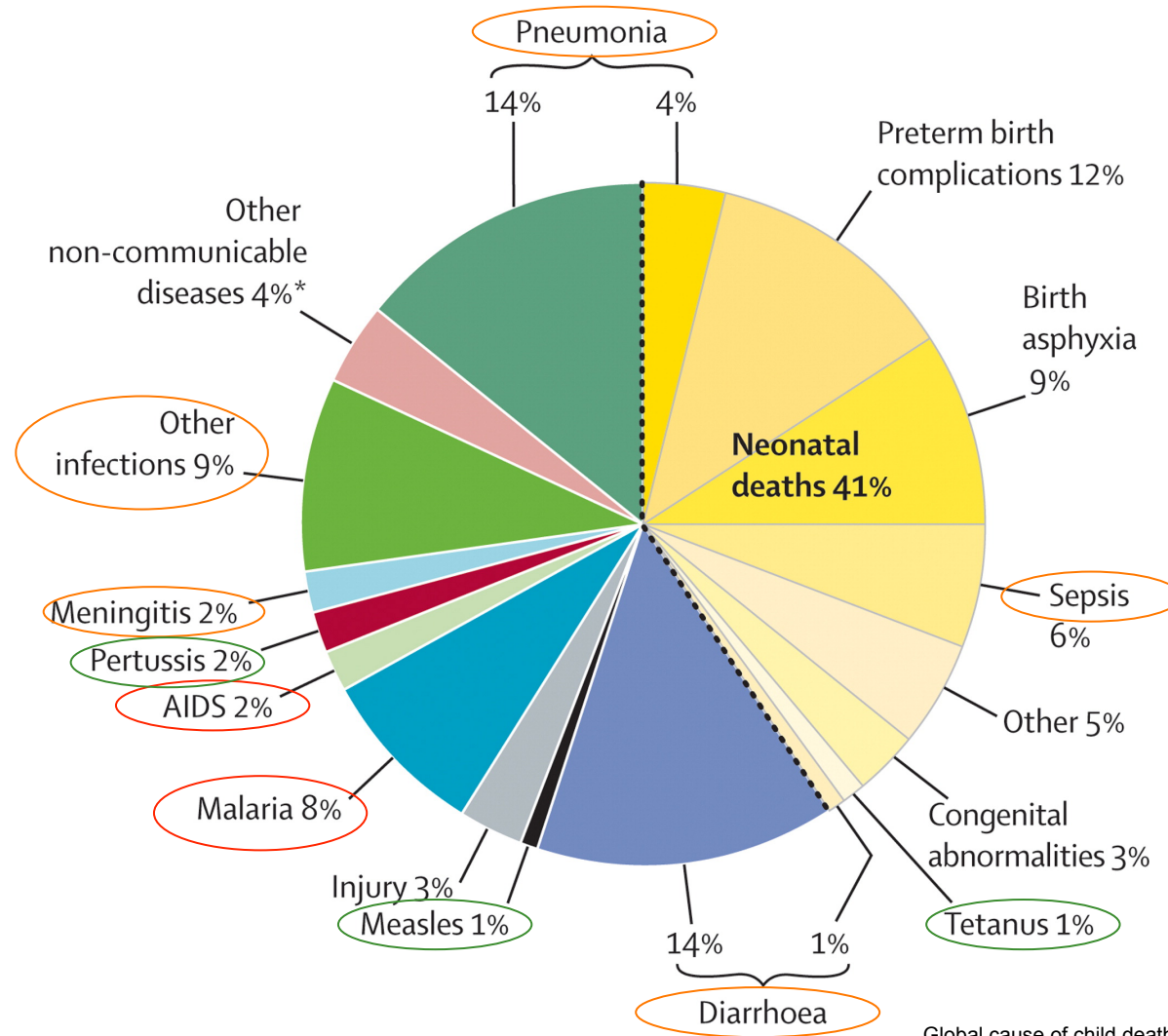
(City—Ville)

(County—Département) (State—État)

 U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
PUBLIC HEALTH SERVICE

PHS-731 (REV.11-91)

# Which diseases are important?



Global cause of child death  
From Black et al Lancet 2010;375:1969-87

# Expanded Programme on Immunization (EPI)

- Launched by WHO in 1974
- Aim: to provide a system whereby underutilized vaccines could be provided in low and middle income (LMI) countries
  - BCG
  - Tetanus (mother and infant)
  - Pertussis
  - Polio
  - Diphtheria
  - Measles
- Focus only on provision of these vaccines
- Outcome measure – percentage coverage
- Additional vaccines now included in some countries



- Building on the success of the Expanded Programme on Immunization: Enhancing the focus on disease prevention and control.

John TJ, Plotkin SA, Orenstein WA. Vaccine 29 (2011) 8835–8837

**ACRONYM ALERT**

# Beyond EPI

- 1974 EPI
- 1978 Alma-Ata declaration
- 1982 GOBI
- 1990 World Summit for Children
- 2000 MDG, GAVI
- 2002 ADIP (PneumoADIP, Hib initiative, Rotavirus vaccine programme)
- 2003 Bellagio, Lancet child survival series
- 2005 GIVS, Countdown to 2015
- 2010 G8 Muskoka initiative
- 2012 Decade of vaccines: GVAP

Saving  
children's  
lives

GAVI Alliance  
Pledging  
conference for  
immunisation

LONDON  
13 JUNE 2011



DECADE *of* VACCINES  
COLLABORATION

# Goals for Decade of Vaccines (2011-2020)

- Achieve a world free of poliomyelitis
- Meet global and regional elimination targets
- Meet vaccination coverage targets in every, region, country and community
- Develop and introduce new and improved vaccines and technologies
- Exceed MDG4 target for reducing child mortality

# Success stories

# Smallpox

- Variola virus
- Devastating disease
- Contagious
- Common in childhood
- Earliest vaccination



TABLE 2. CASE-FATALITY RATES IN SELECTED AREAS

Country	Year	Age (years)	Cases	Deaths	Case-fatality rate (%)
Afghanistan	1970	<1	49	12	24.5
		1-4	361	67	18.6
		5-14	385	45	11.7
		15+	109	20	18.4
		All ages	916 <sup>a</sup>	156 <sup>a</sup>	17.0
Brazil	1969	<1	247	12	4.9
		1-4	1 578	10	0.6
		5-14	3 177	5	0.2
		15+	1 750	10	0.6
		All ages	6 795 <sup>b</sup>	37	0.5
Ethiopia	1971	<1	262	38	14.5
		1-4	2 178	70	3.2
		5-14	4 809	45	0.9
		15+	2 806	55	2.0
		All ages	10 357 <sup>c</sup>	211 <sup>c</sup>	2.0
Indonesia (Djakarta)	1970	<1	37	12	32.5
		1-4	159	26	16.4
		5-14	127	14	11.0
		15+	18	0	0
		All ages	371 <sup>d</sup>	57 <sup>d</sup>	15.4
Pakistan (Punjab)	1971	<1	105	28	26.7
		1-4	665	110	16.5
		5-14	677	77	11.4
		15+	227	34	15.0
		All ages	1 674	249	14.9
Sierra Leone	1968-69	<1	35	7	20.0
		1-4	163	14	8.6
		5-14	270	10	3.7
		15+	627	84	13.4
		All ages	1 180 <sup>e</sup>	131 <sup>e</sup>	11.1

<sup>a</sup> Includes 12 cases and 12 deaths (age unknown)

WHO Technical Report  
Series 493 (1972) WHO  
Expert committee on  
smallpox eradication:  
Second report

### Smallpox cases in India and the world, 1950-1977

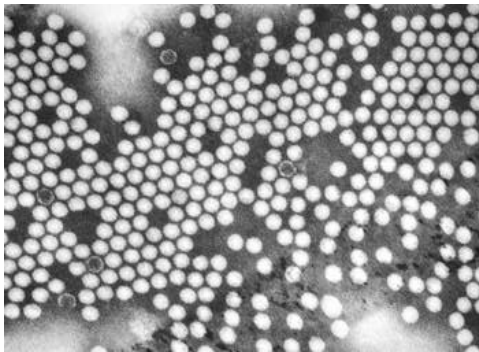
Year	India	World	India/World Percentage
1950	157,487	332,224	47.4
1951	253,332	485,942	52.1
1952	74,836	155,609	48.1
1953	37,311	90,768	41.1
1954	46,619	97,731	47.7
1955	41,887	87,743	47.7
1956	45,109	92,164	48.9
1957	78,666	156,404	50.3
1958	168,216	278,922	60.3
1959	47,109	94,603	50.4
1960	31,091	65,737	47.3
1961	45,380	88,730	51.3
1962	55,595	98,700	56.3
1963	83,423	133,003	62.7
1964	41,160	75,910	54.2
1965	33,402	112,703	29.8
1966	32,616	92,620	35.2
1967	83,943	131,418	63.9
1968	30,925	80,213	37.8
1969	19,139	52,204	35.3
1970	12,341	33,663	36.7
1971	16,166	52,794	30.6
1972	20,407	65,153	31.3
1973	88,109	135,851	64.9
1974	188,003	218,364	86.1
1975	1,436	19,278	7.5
1976	Zero	953	--
1977	Zero	3,234	--

Source: R.N. Basu, Z. Jezek and N.A. Ward, *The Eradication of Smallpox from India* (WHO/SEARO: New Delhi, 1979), 36.



# Poliomyelitis

- Poliovirus
- 3 serotypes
- Spectrum of symptoms and signs
- 1988 - Global Polio Eradication Initiative
- Vaccination available since 1950s





- Polio endemic country
- Country in polio endemic region
- No data

Data is projected to 2008 WHO legal template.



- Polio endemic country
- Country in polio endemic region
- No data

Data is projected to 2008 WHO legal template.

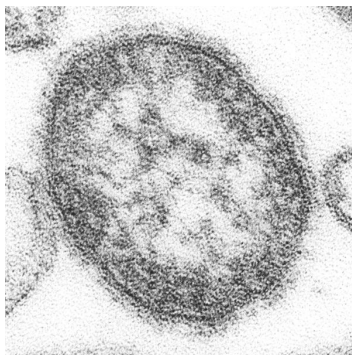
**POLIO** GLOBAL  
ERADICATION  
INITIATIVE

Strategic Plan  
2010-2012

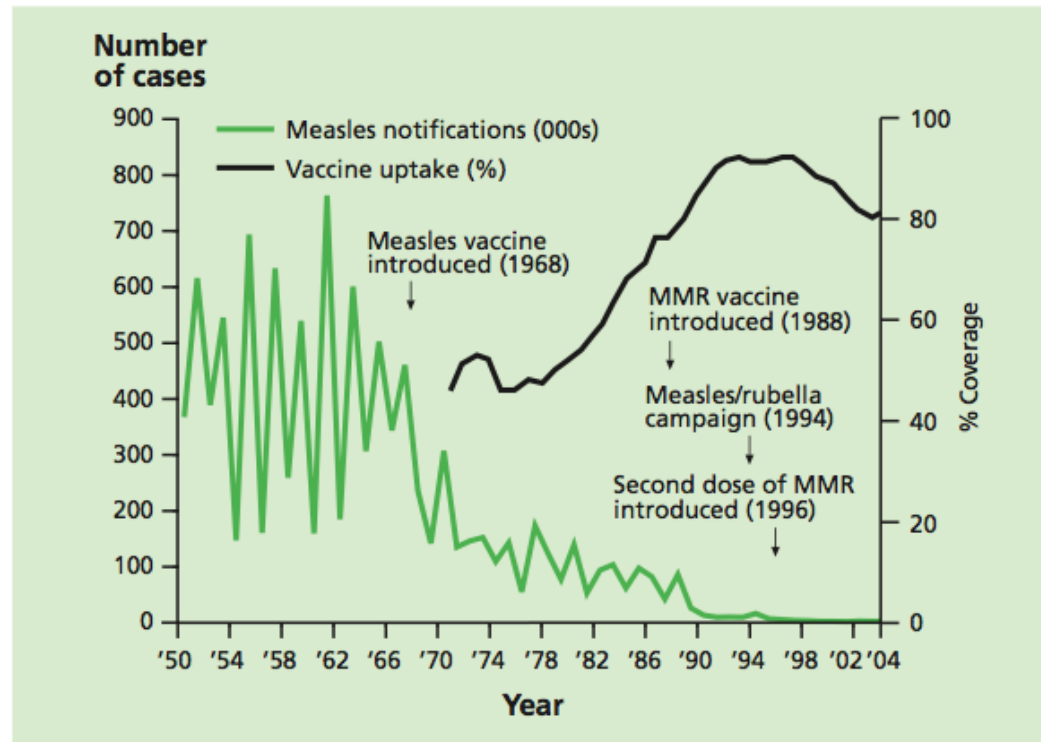


# Measles

- Measles virus
- Characteristic rash
- Severe/fatal complications
- Malnutrition interaction
- Vaccine available since 1960s

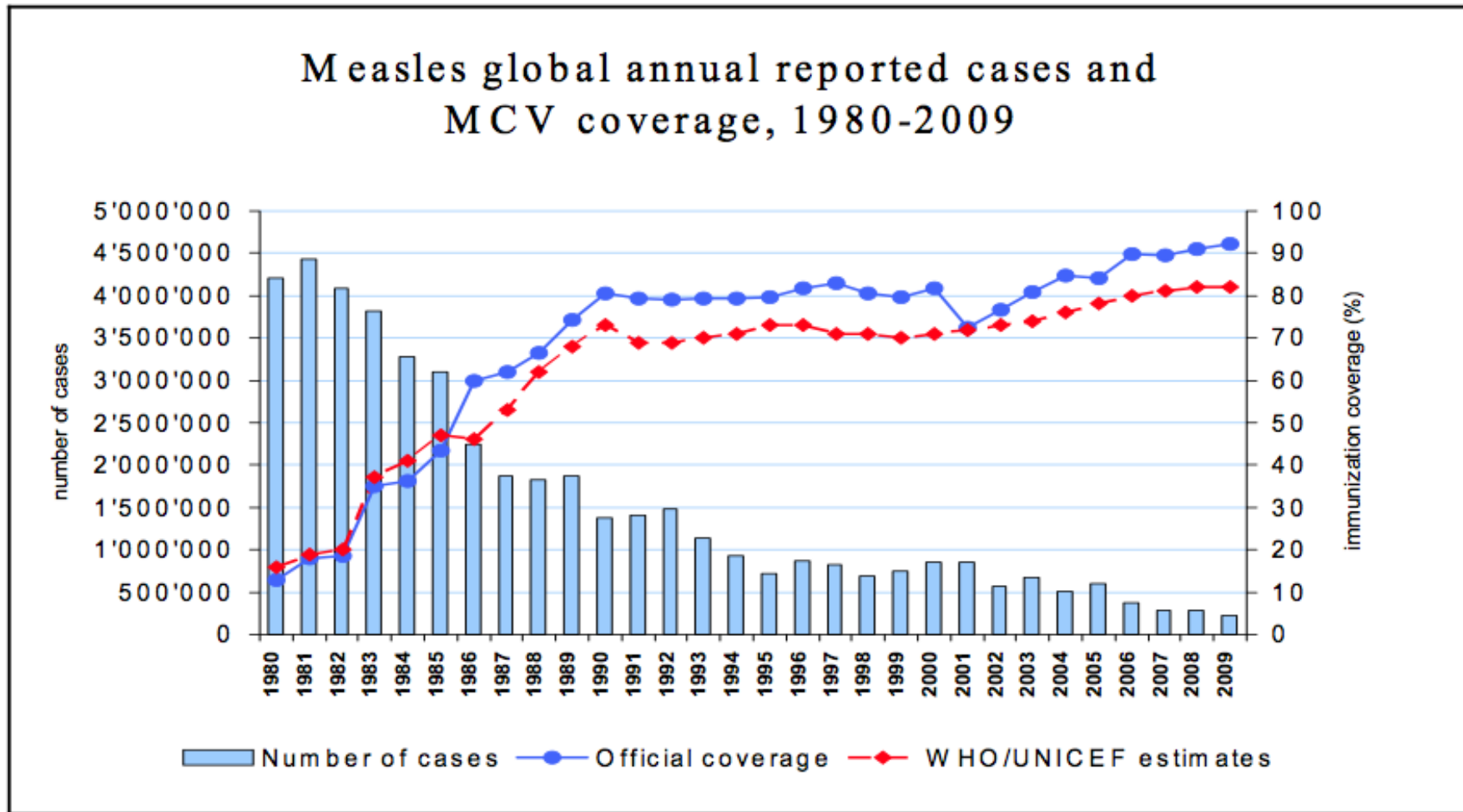


# Measles – then and now



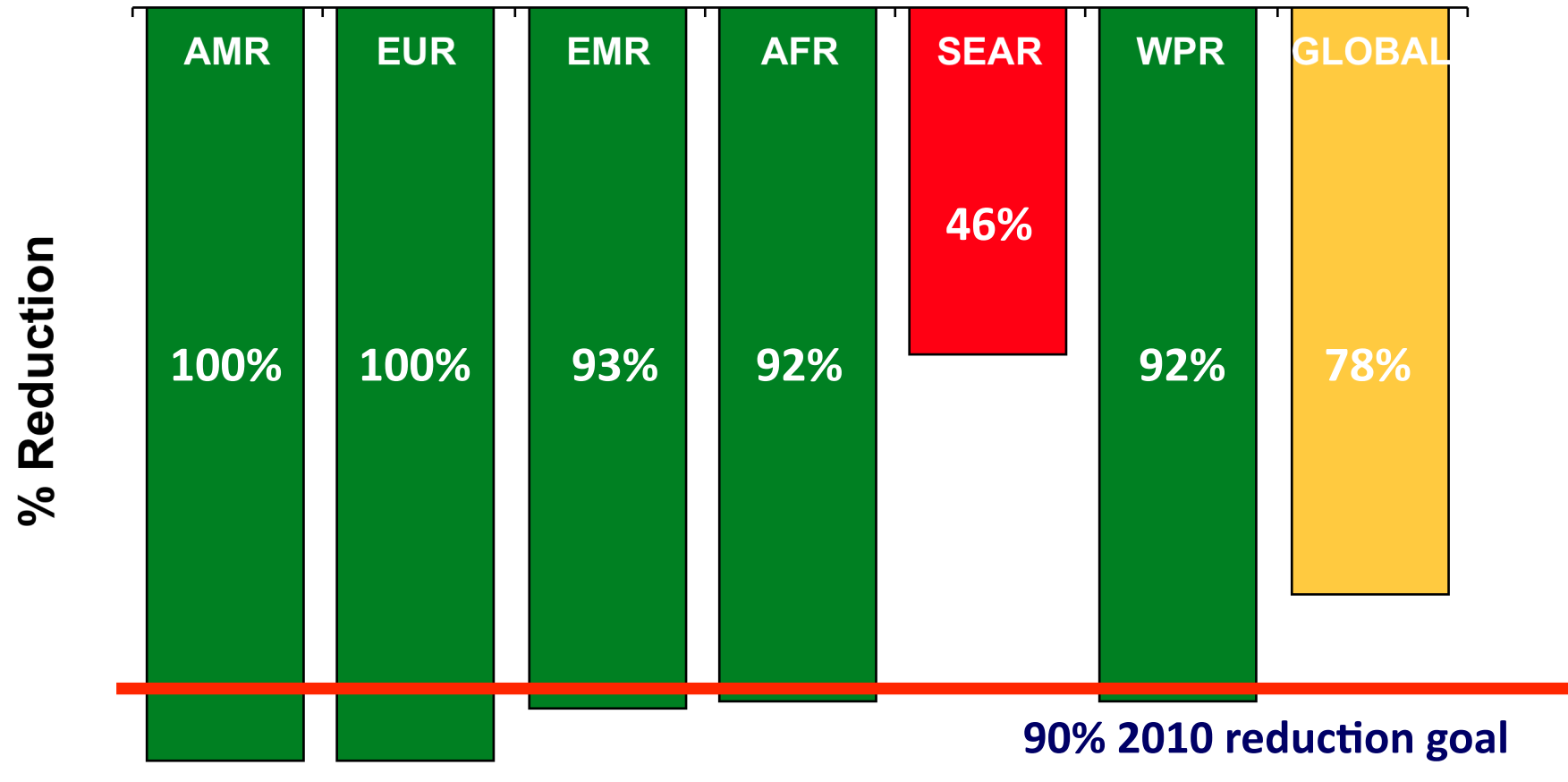
Immunisation against infectious disease "Green Book" DoH 2006

## Measles



WHO vaccine-preventable diseases monitoring system, 2010 global summary

# Reduction in Estimated Measles Deaths by WHO Region 2000 to 2008

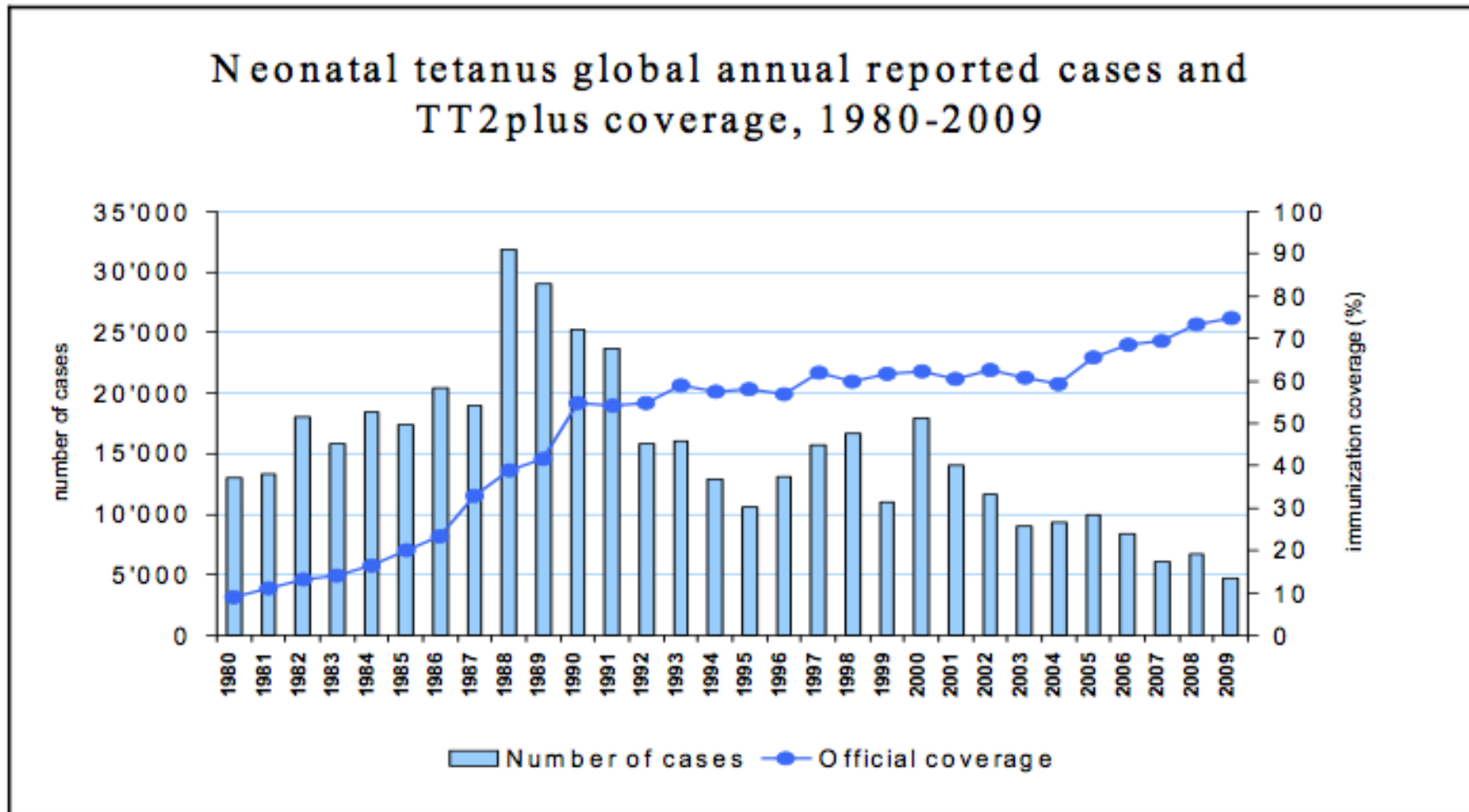


Slide from presentation at Global Measles Management Meeting  
Geneva, Switzerland, 4 February 2010  
Peter Strebel and Alya Dabbagh  
Data from WHO/IVB November 2009



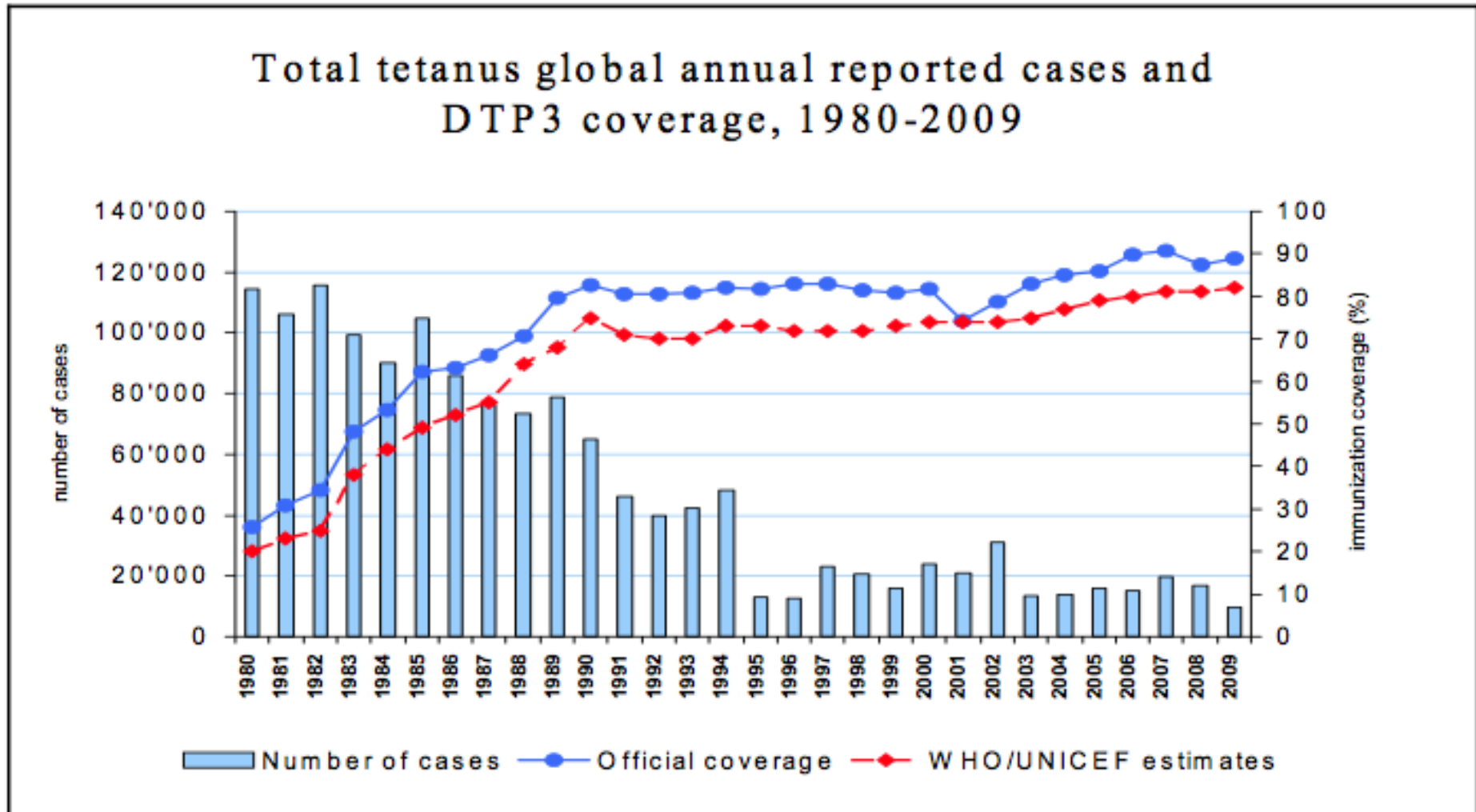
# Tetanus – then and now

## Neonatal tetanus

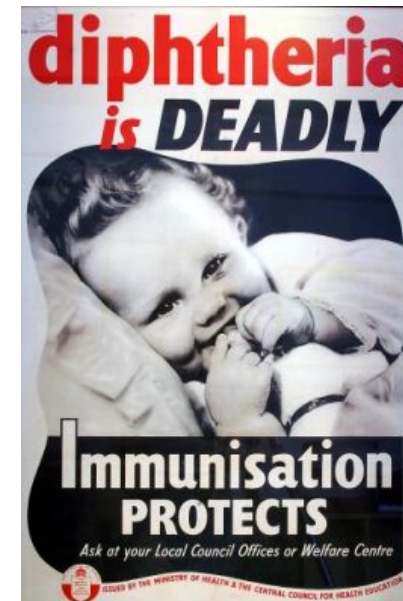
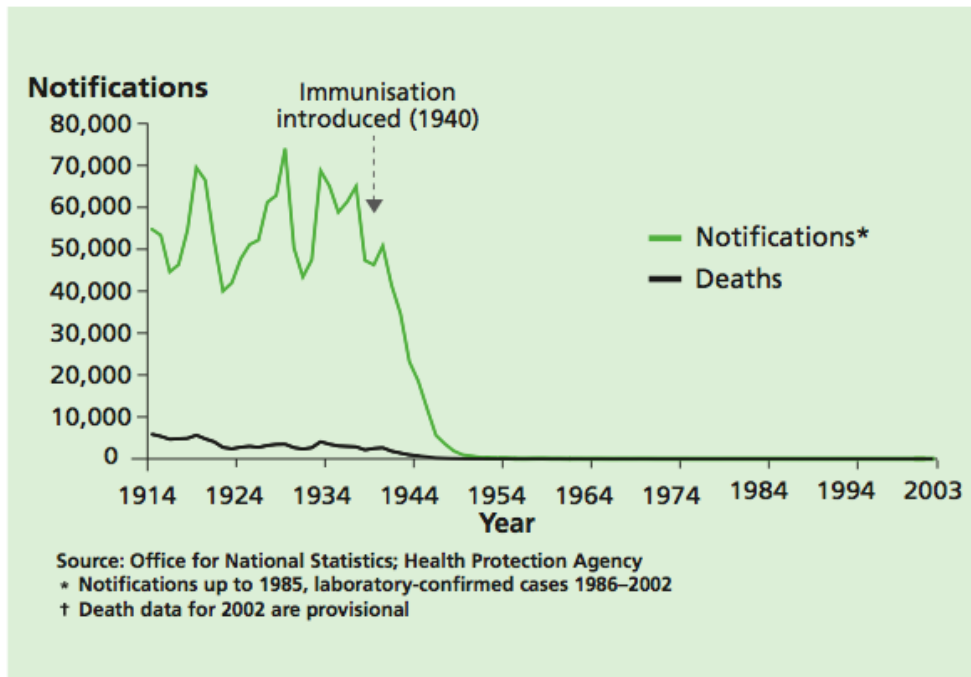


# Tetanus – then and now

## Total tetanus



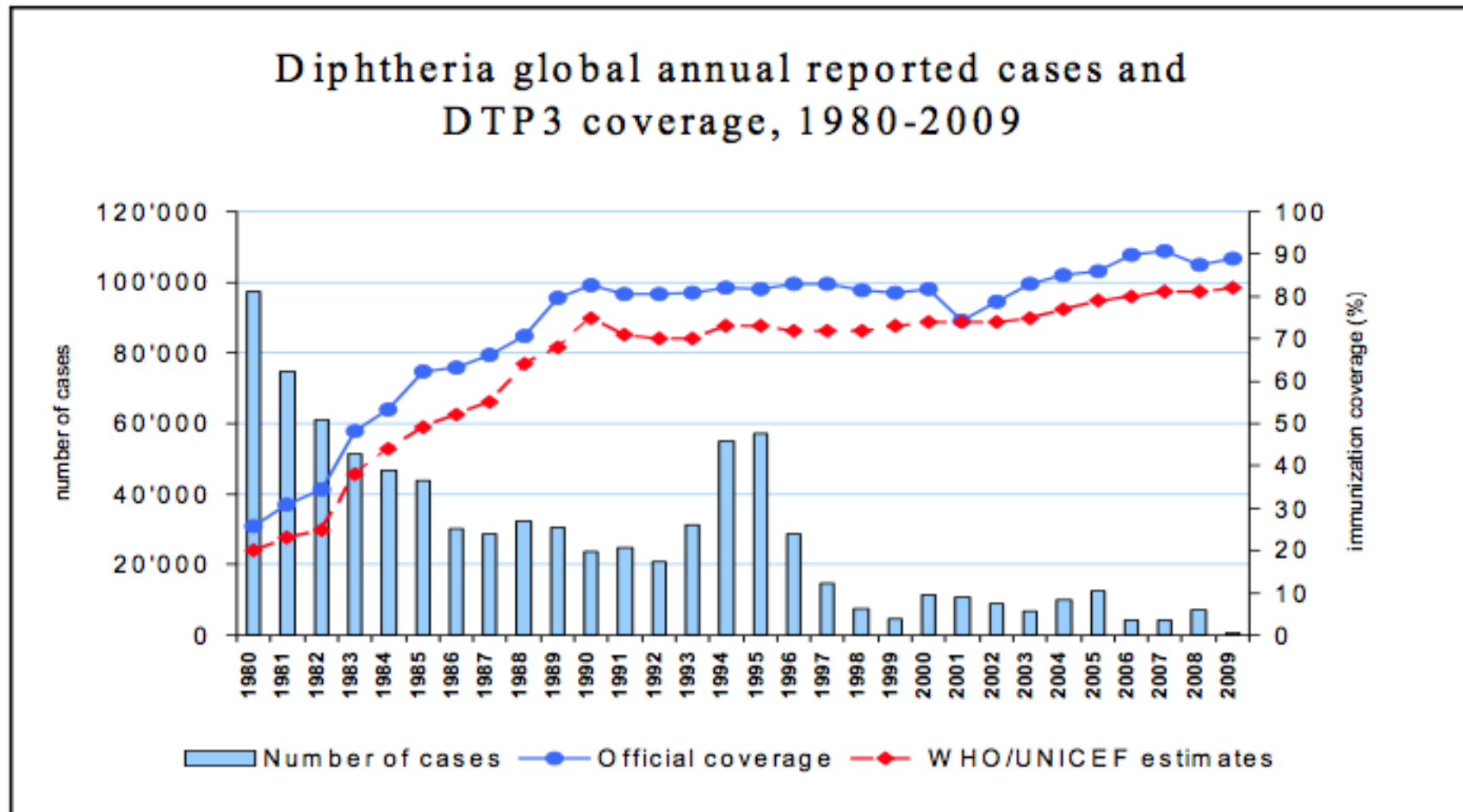
# Diphtheria – then and now



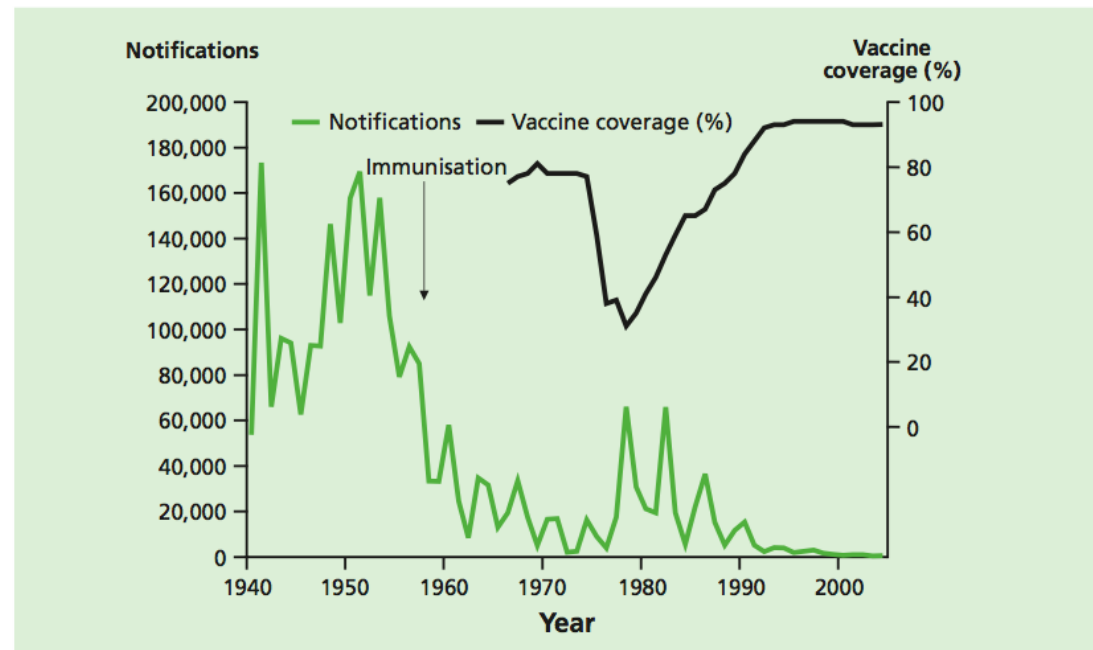
Immunisation against infectious disease “Green Book” DoH 2006

# Diphtheria – then and now

## Diphtheria



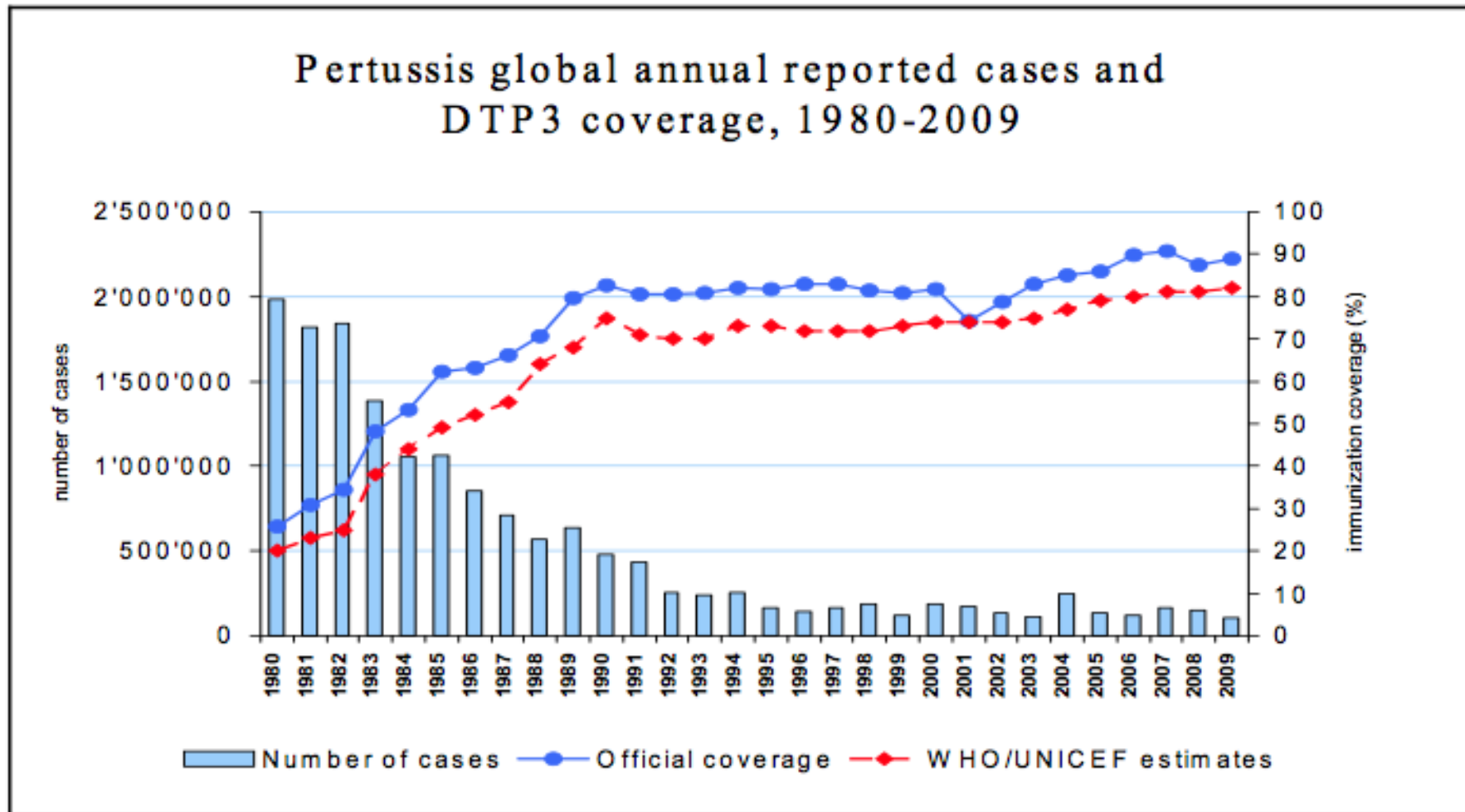
# Pertussis – then and now



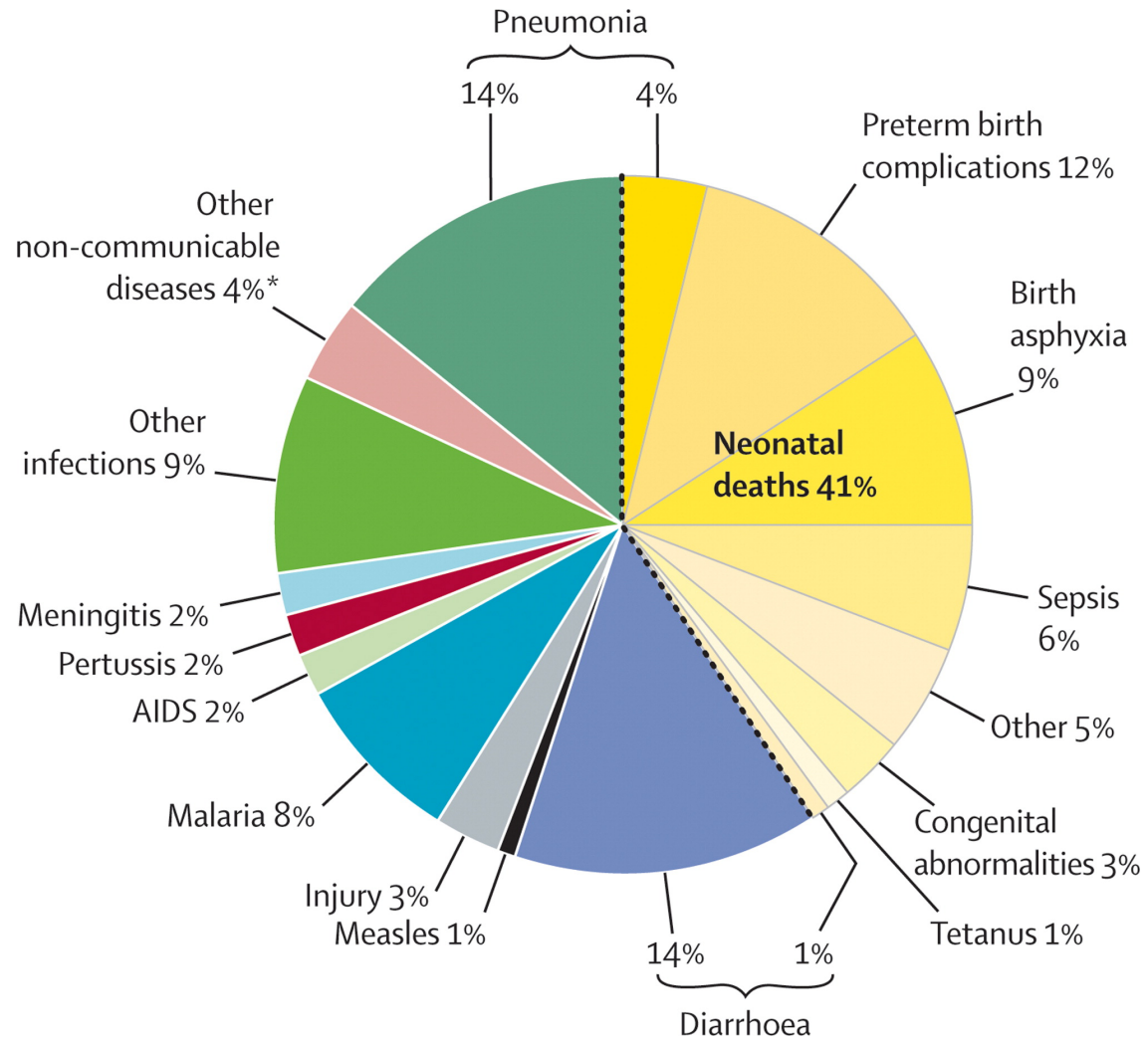
Immunisation against infectious disease "Green Book" DoH 2006

# Pertussis – then and now

## Pertussis



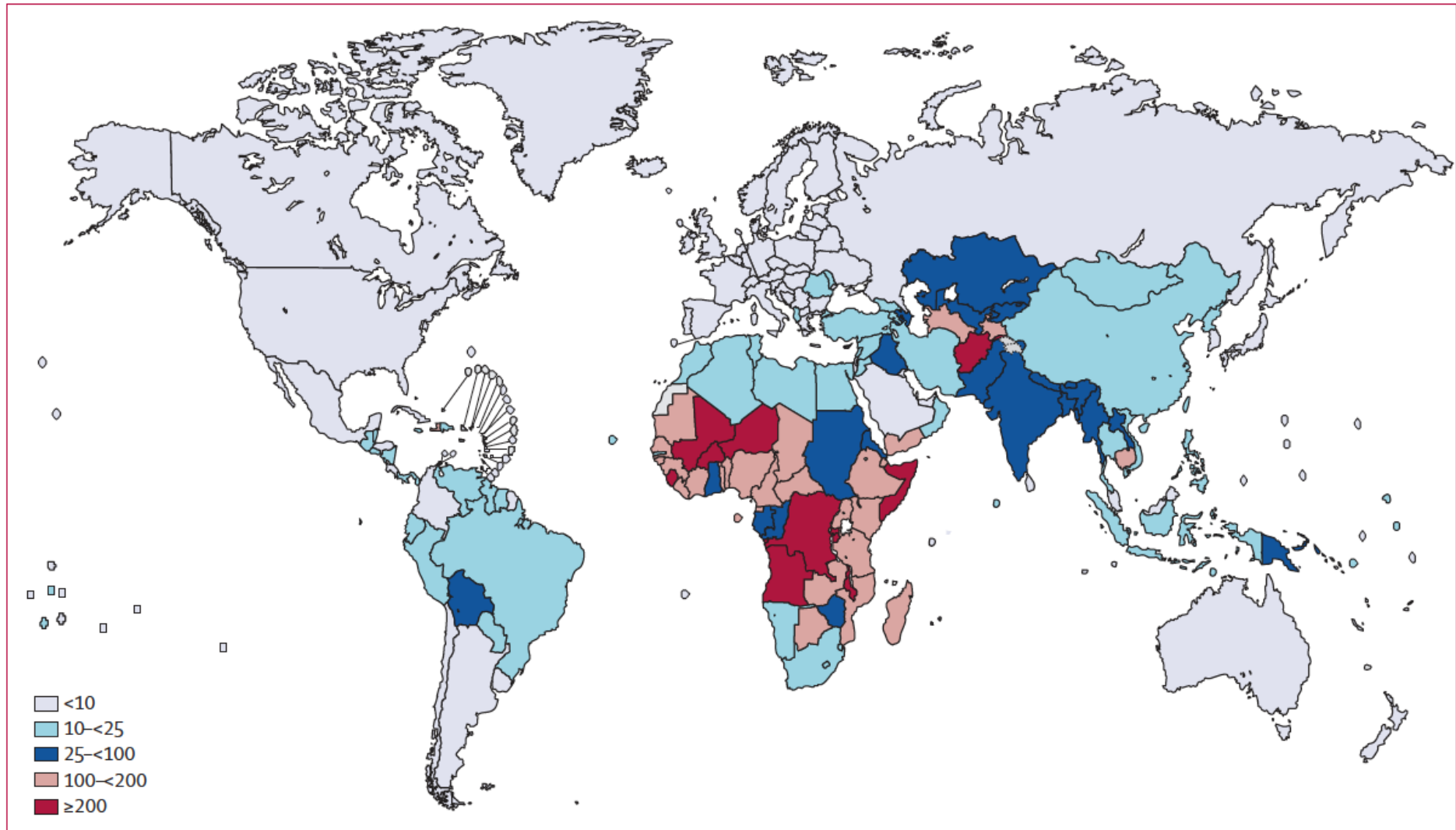
Potential success stories



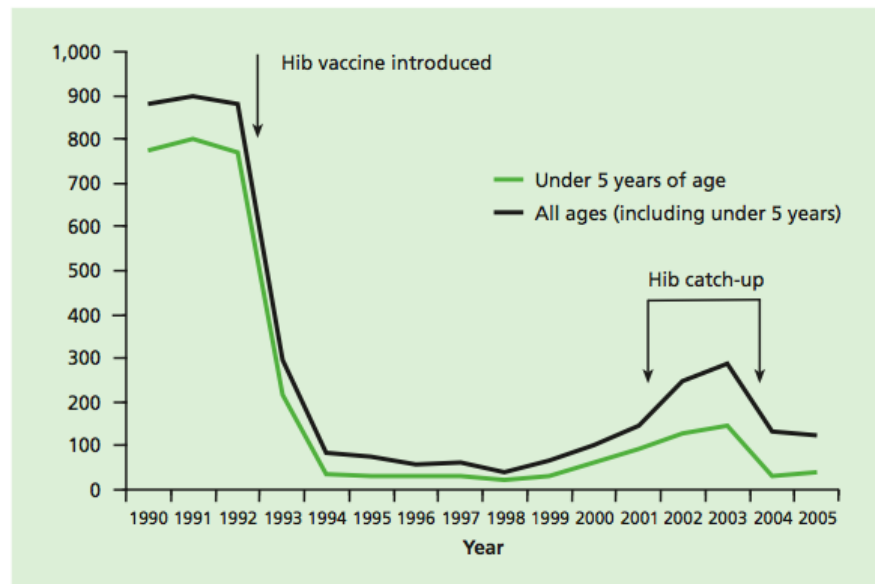
Global cause of child death  
 From Black et al Lancet 2010;375:1969-87



# Hib mortality rates



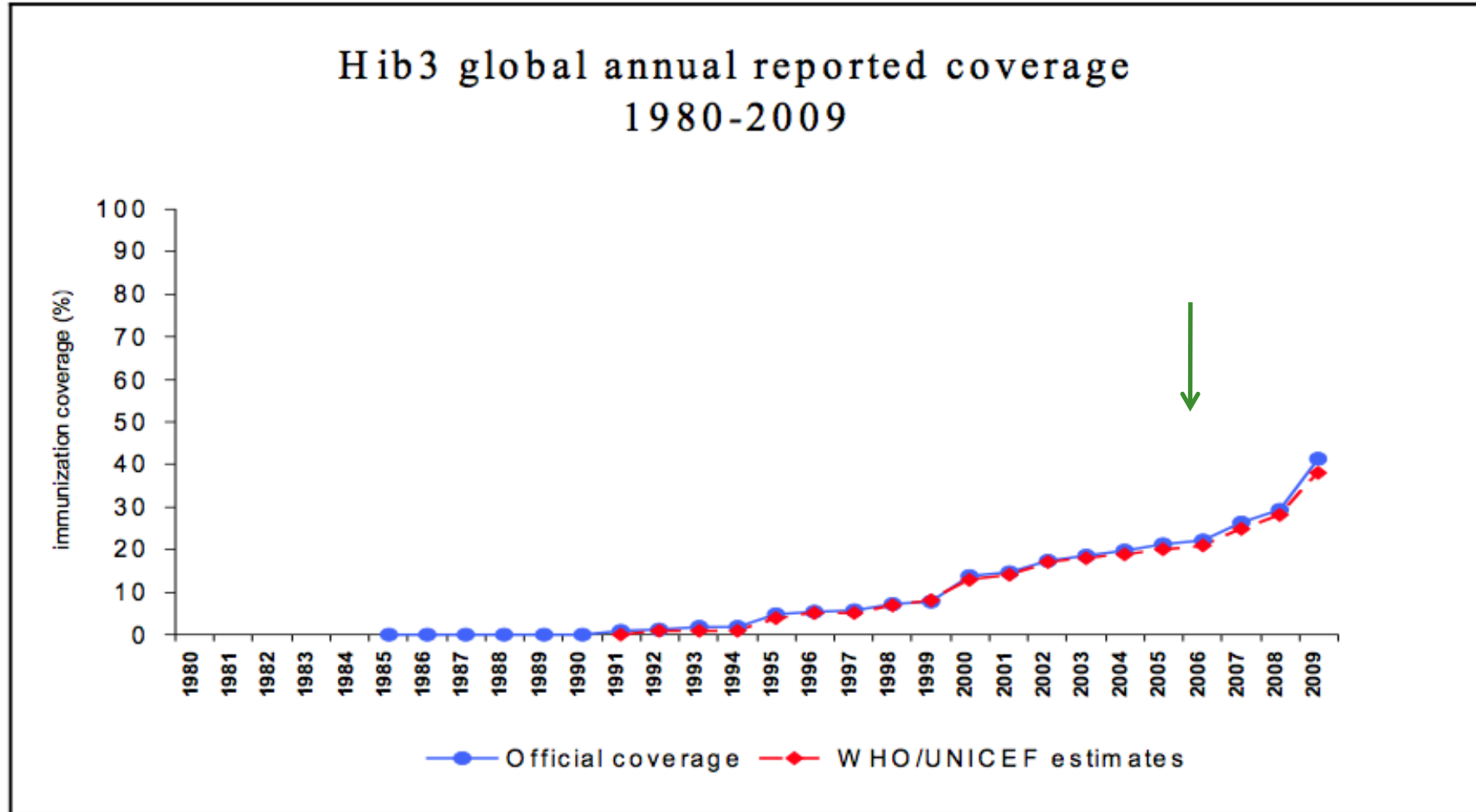
# Hib – then and now



Immunisation against infectious disease "Green Book" DoH 2006

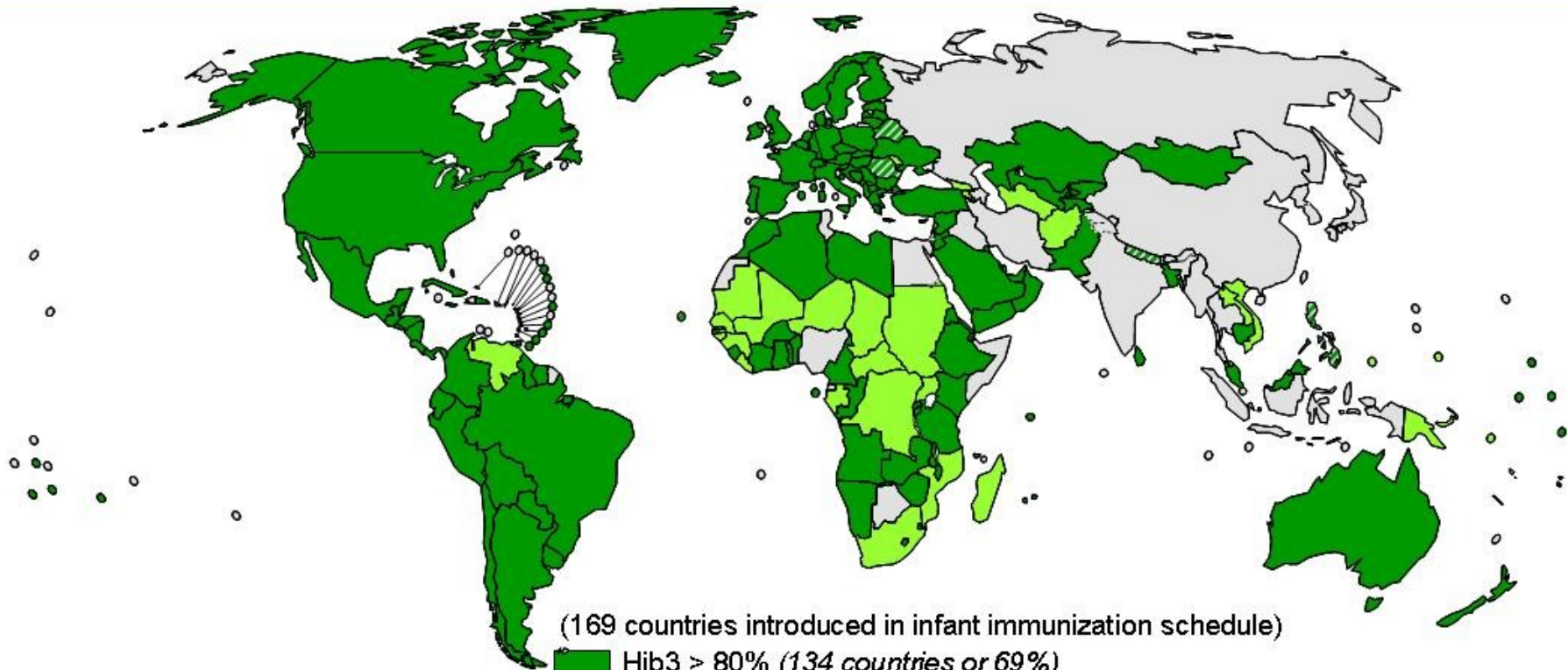
## Haemophilus Influenza type b

Hib3 global annual reported coverage  
1980-2009

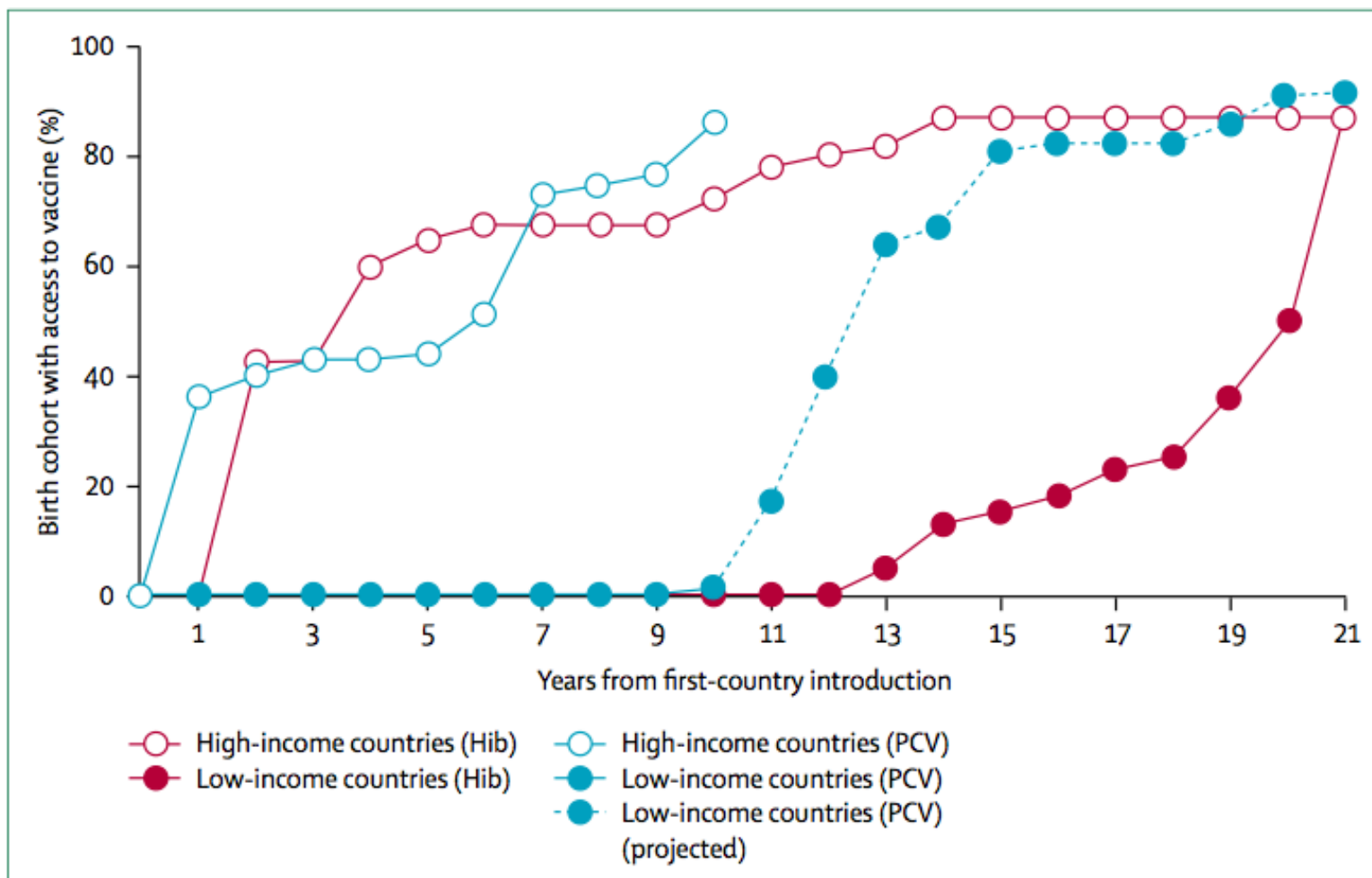


WHO vaccine-preventable diseases monitoring system, 2010 global summary

# Countries having introduced Hib vaccine and infant Hib coverage, 2010

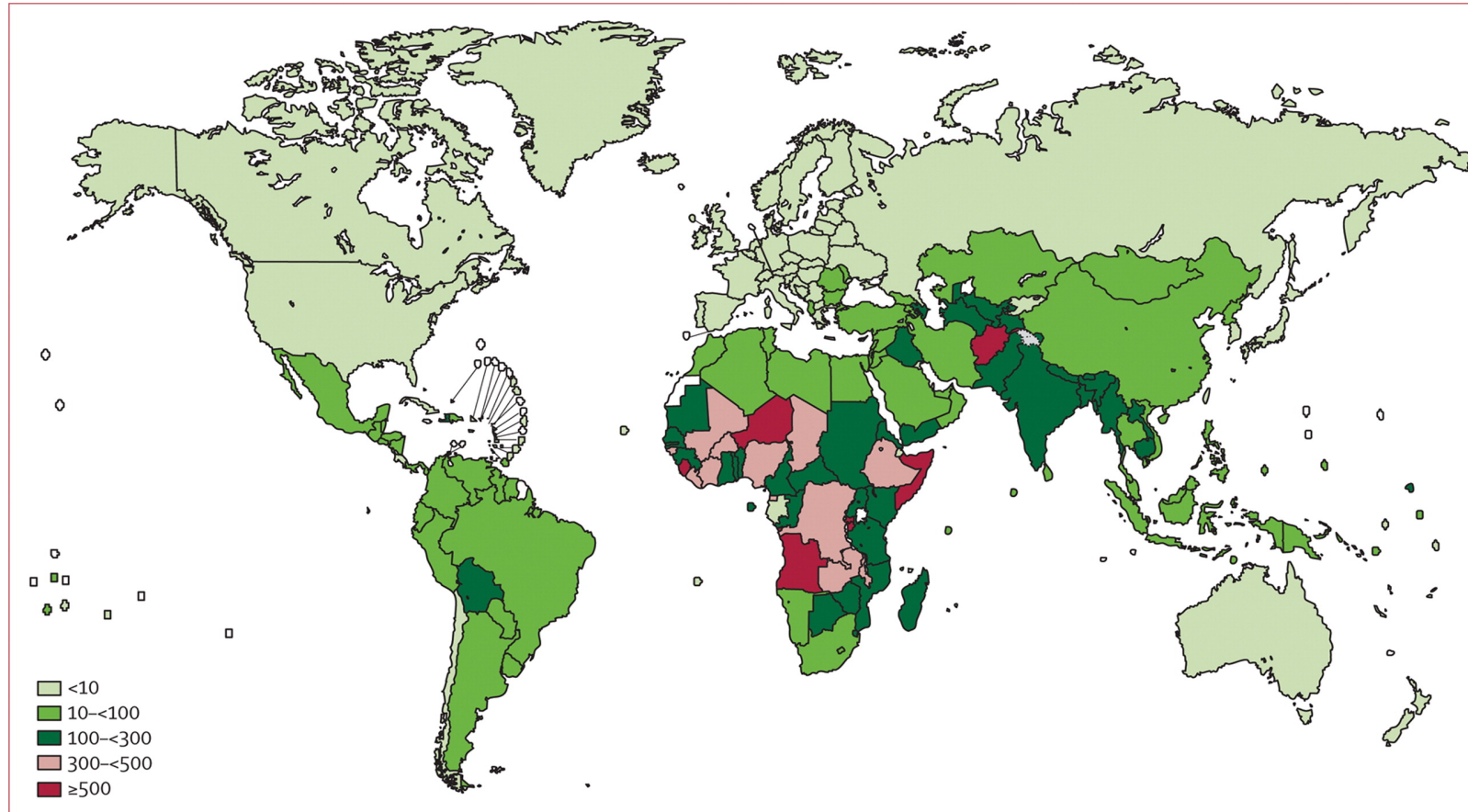


The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.  
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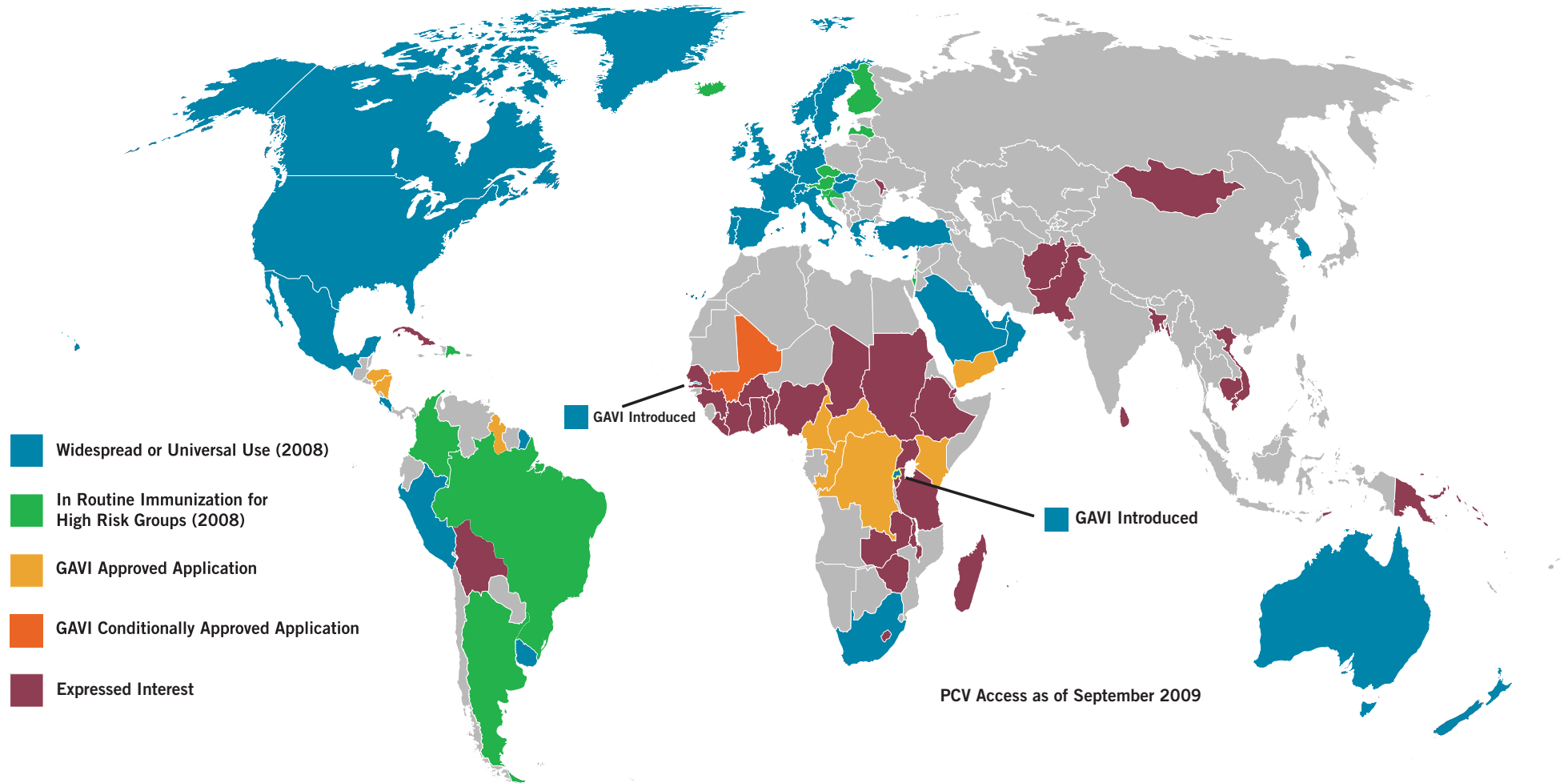
**Figure 3: Uptake of Hib and pneumococcal vaccines in high-income versus low-income countries**  
 Hib=*Haemophilus influenzae* type b. PCV=pneumococcal vaccine. Dashed line=projected uptake. Solid line=actual uptake.

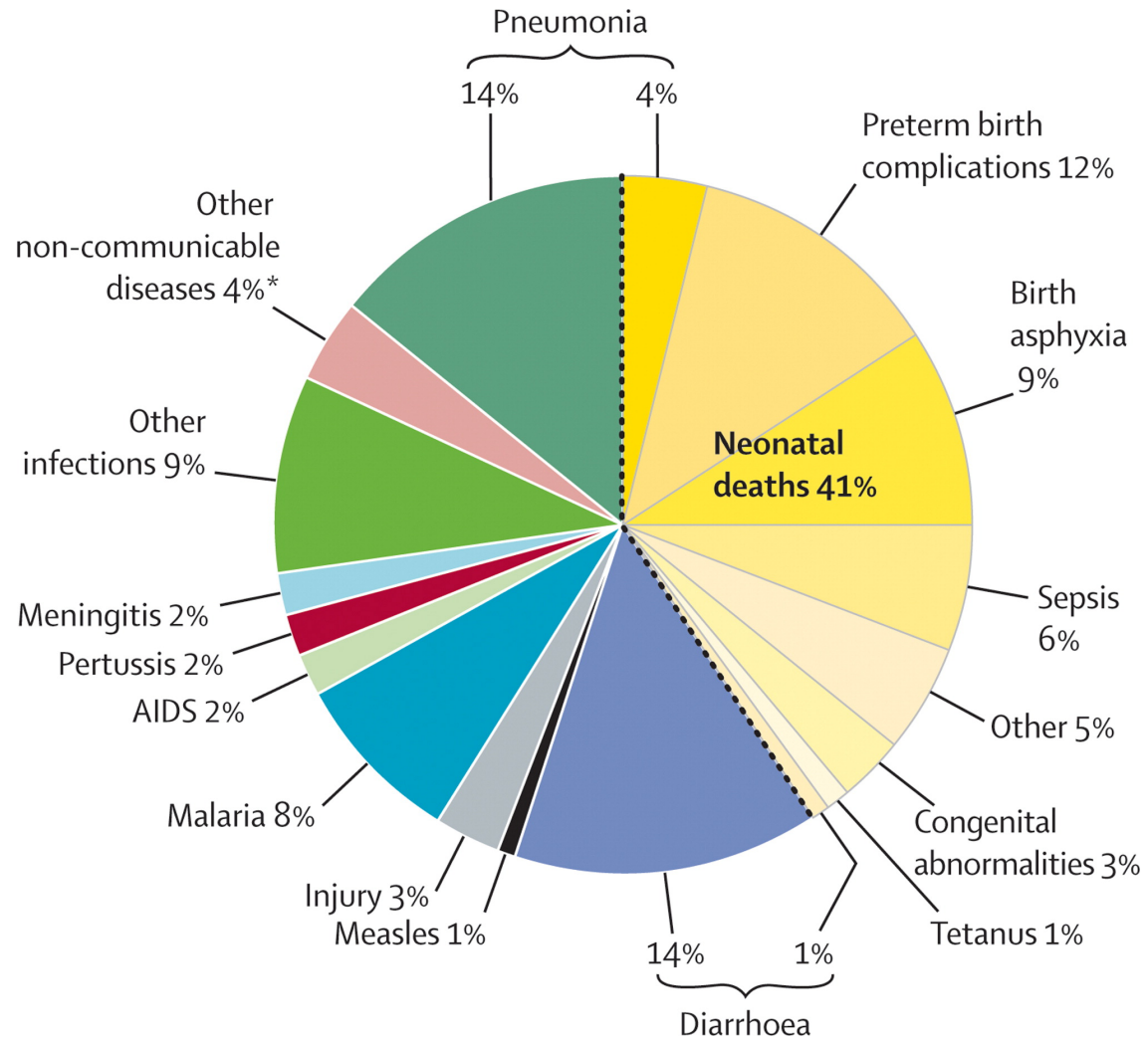
# Deaths from invasive pneumococcal disease (IPD): children <5 years





# Status of Global Pneumococcal Conjugate Introduction



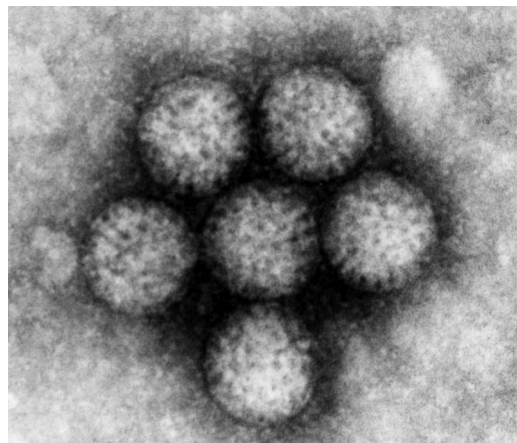


Global cause of child death  
 From Black et al Lancet 2010;375:1969-87



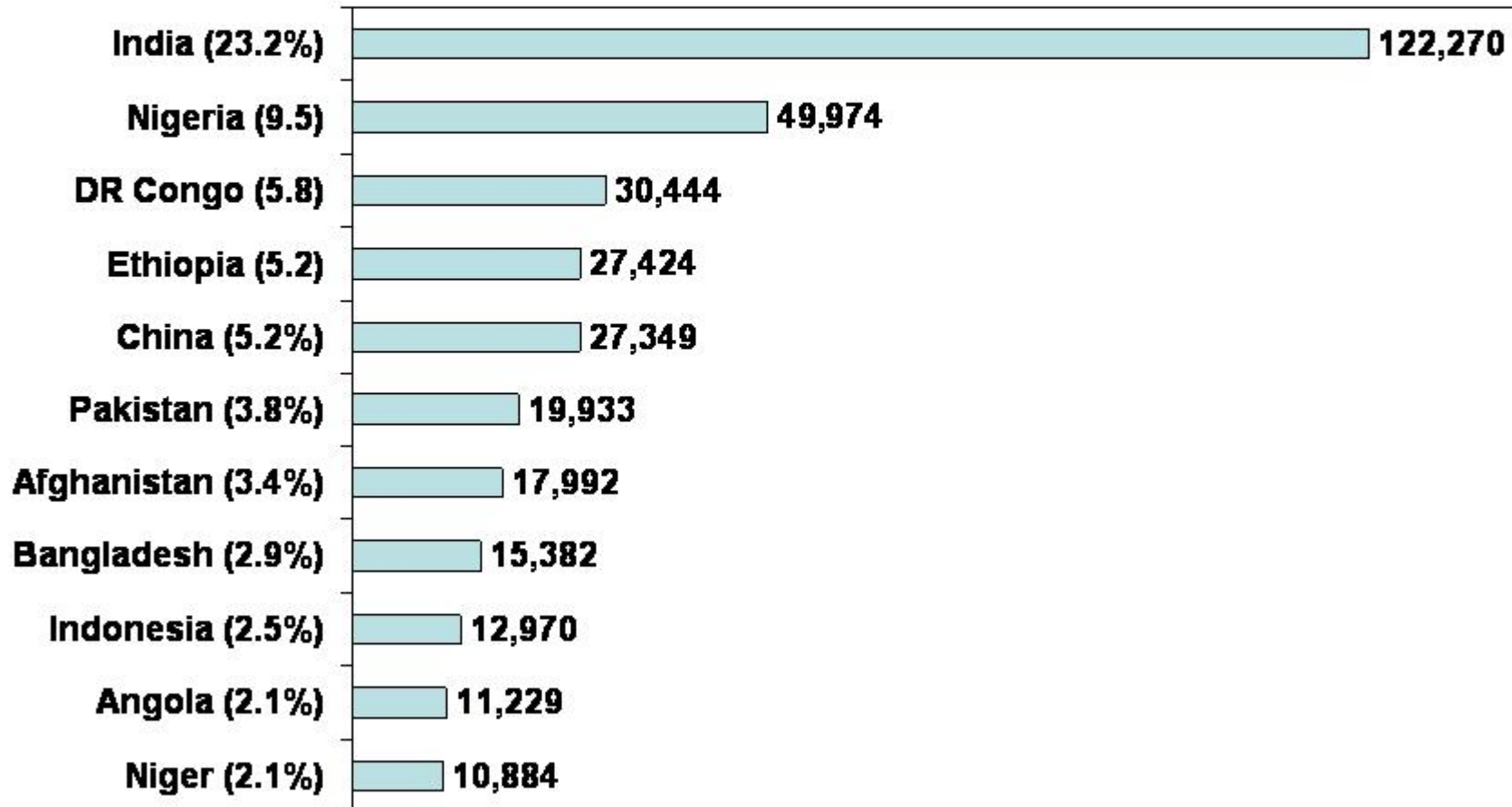
# Rotavirus

- Viral cause of diarrhoeal disease
- Very common throughout the world
- Variable impact on mortality
- 2 vaccines currently licensed



Number (and percent of global total) child rotavirus deaths by country:  
global total = 527 000

11 countries account for 65% of all child rotavirus deaths

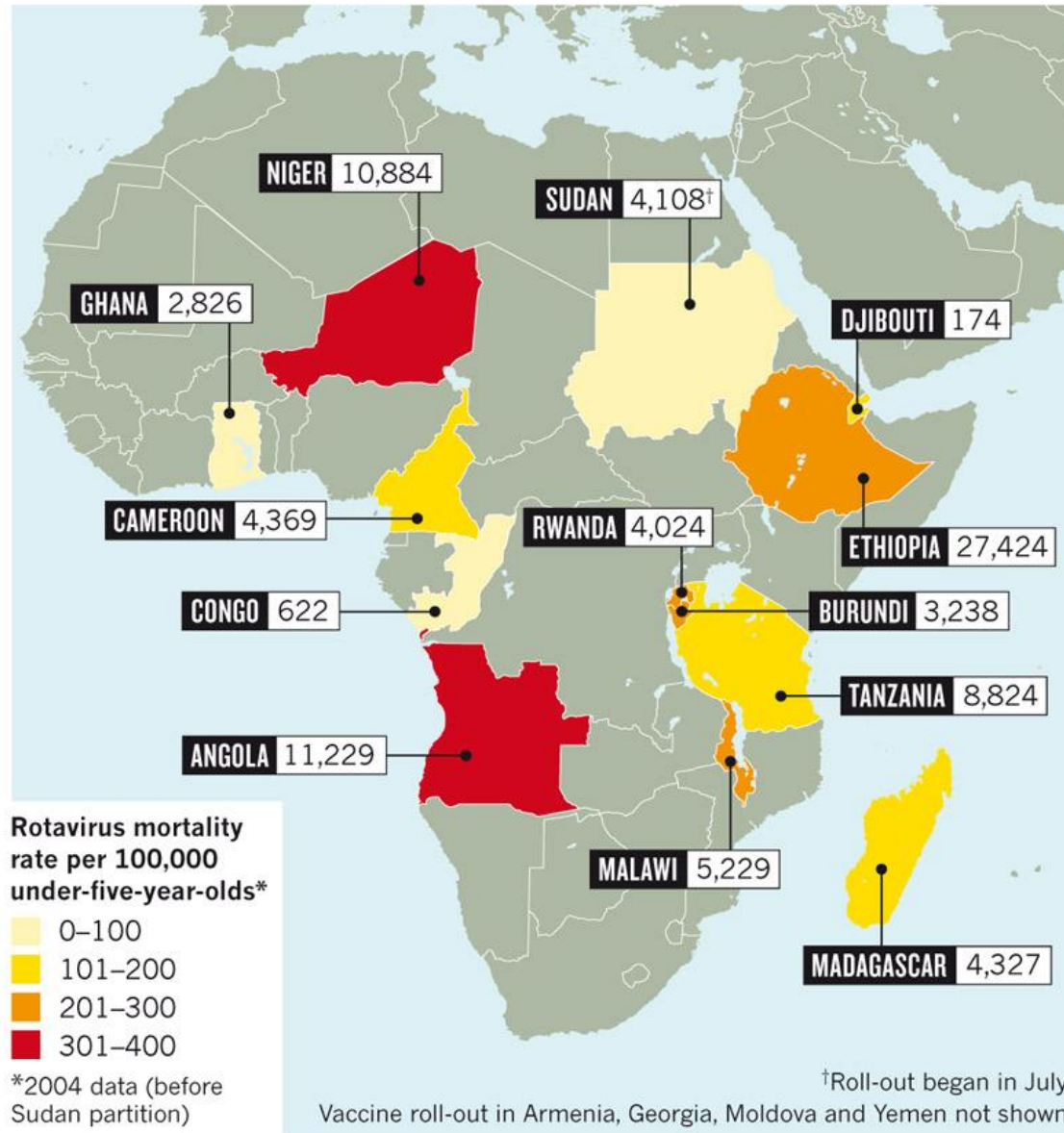


Source: Department of Immunization, Vaccines & Biologicals (IVB)

## ROTAVIRUS ROLL-OUT

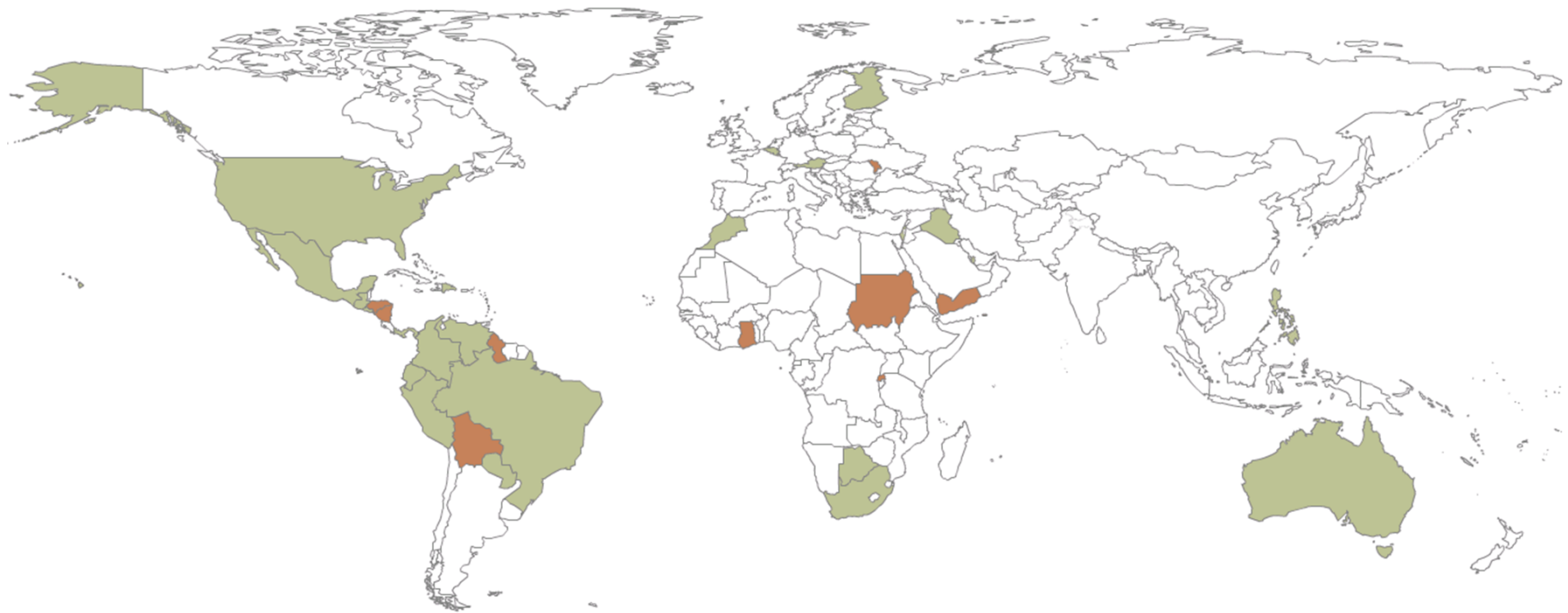
The vaccine will be given to children in 13 African countries, where rotavirus is responsible for high child mortality rates.

**COUNTRY** Annual deaths from rotavirus of children under five



*Nature 477, 519 (2011)*

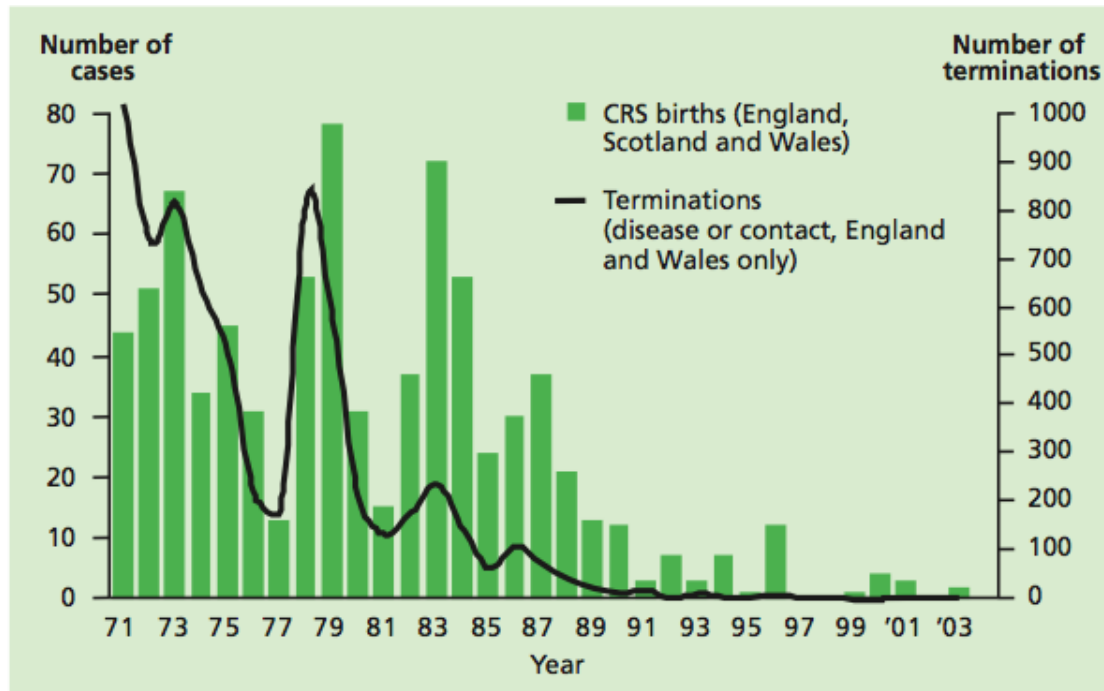
# 38 countries have introduced RV nationally\*



\*National introductions as of 1 Sept 2012

■ Not GAVI-eligible ■ *GAVI-eligible*

# Rubella – then and now



Immunisation against infectious disease "Green Book" DoH 2006

# Countries Using Rubella Vaccine in National Immunization Schedule, 2009



No (63 countries or 33%)

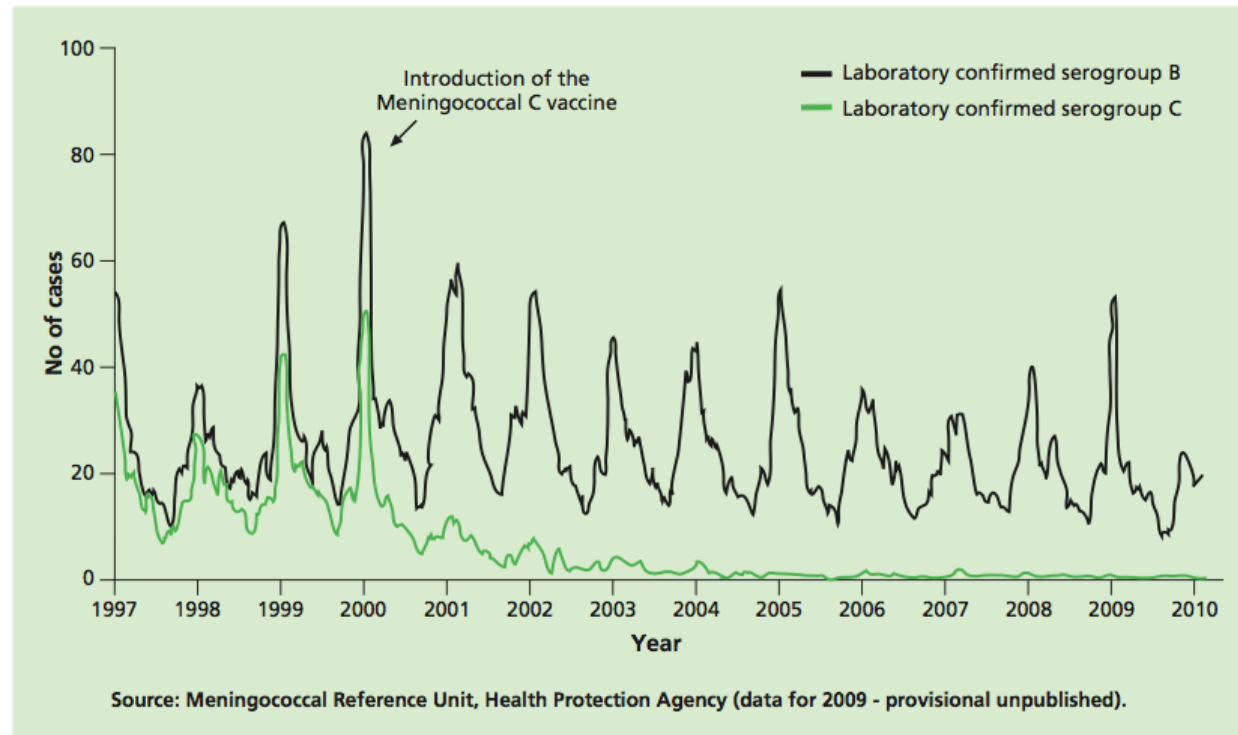
Yes (130 countries or 67%)

Source: WHO/IVB database, 193 WHO Member States. Data as of July 2010

Date of slide: 19 August 2010

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# Neisseria meningitidis - then and now



Immunisation against infectious disease "Green Book" DoH 2006

# Current challenges

- Poverty and inequity
- Conflict
- Logistics
- Geography
- Communication
- Attitudes and beliefs
- Research, monitoring, evidence, safety
- HIV



# Future challenges

- HIV
- TB
- Malaria
- Neglected tropical diseases
- Neonatal morbidity/ mortality
- Funding
- Equity

# Summary

# Questions

# Suggested further reading

## Reference only:

- Immunisation against infectious disease – ‘The Green Book’ Department of Health 2006 (available online [http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH\\_079917](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_079917)) - useful quick reference for info on vaccination and vaccine preventable disease (UK)
- Textbook of Pediatric Infectious Diseases 5<sup>th</sup> Edition. Feigin J, Cherry J, Demmier-Harrison, G, Sheldon K – good general paediatric ID textbook for background on specific vaccine preventable childhood diseases
- Vaccines: Expert Consult. 5th ed. Plotkin SA, Orenstein WA, Offit PA, editors – excellent textbook only really for those extra interested in vaccines!

## Putting vaccine preventable disease in a global health context:

- The Lancet Series on child survival 2003
- Alma-Ata 30 years on: revolutionary, relevant, and time to revitalise. Lawn et al. Lancet 2008;372:917-927
- Global regional and national causes of child mortality in 2008: a systematic analysis. Black et al. Lancet 2010;375:1969-1987
- WHO vaccine-preventable diseases monitoring system, 2010 global summary (available online [http://whqlibdoc.who.int/hq/2010/WHO\\_IVB\\_2010\\_eng.pdf](http://whqlibdoc.who.int/hq/2010/WHO_IVB_2010_eng.pdf))
- The Lancet: New Decade of Vaccines · June, 2011 (<http://www.thelancet.com/series/new-decade-of-vaccines>)