

Vaccine Preventable Diseases

Immunisation Study Day
30th August 2012

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What is most cost effective health care intervention?

Antibiotics?

Anti – hypertensive medications?

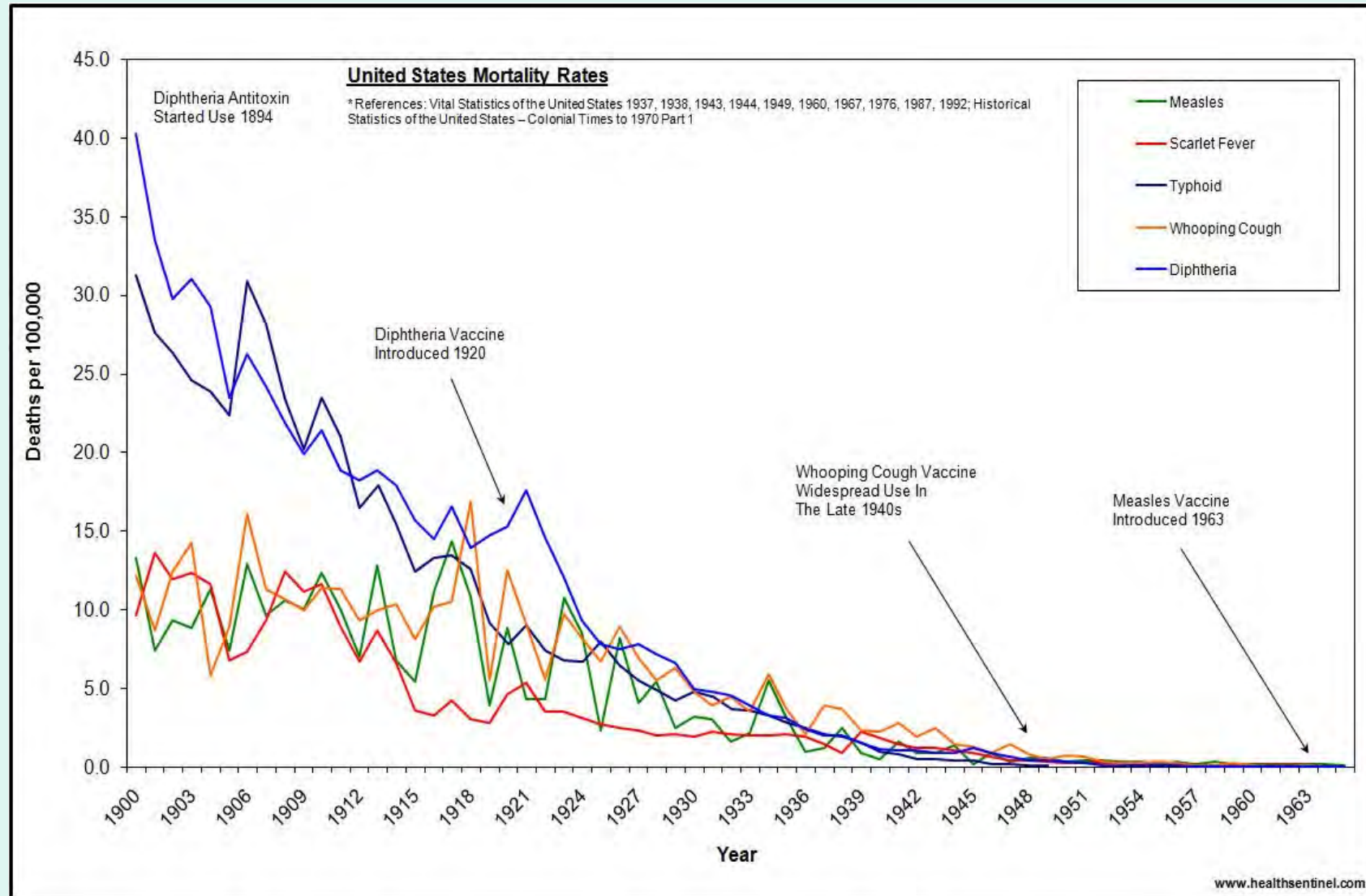
Breast Cancer screening?

Intensive Care Units?

– Clean water (except this is not health care)

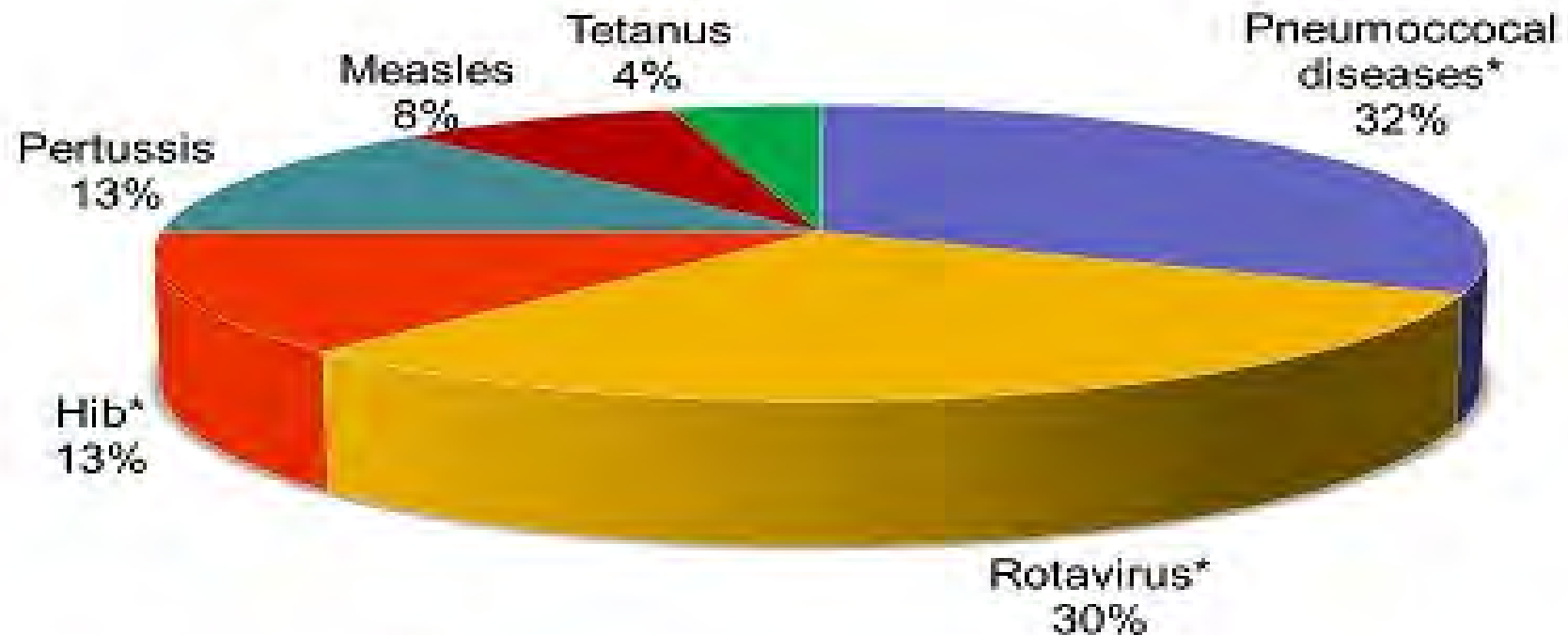
– **Childhood Immunisation**

Effects of vaccination?



Vaccine Preventable Diseases - 17% of global total mortality of children < 5 years age

Distribution of the estimated deaths among children < 5 years, from diseases that are preventable by vaccination in 2008



Source: Black RE, et al. Global, regional, and national causes of child mortality in 2008: a systematic analysis. *Lancet*. 2010 Jun 5;375(9730):1968-87. [Epub 2010 May 11].

* WHO/IVE estimates.

Primary childhood immunisation programme

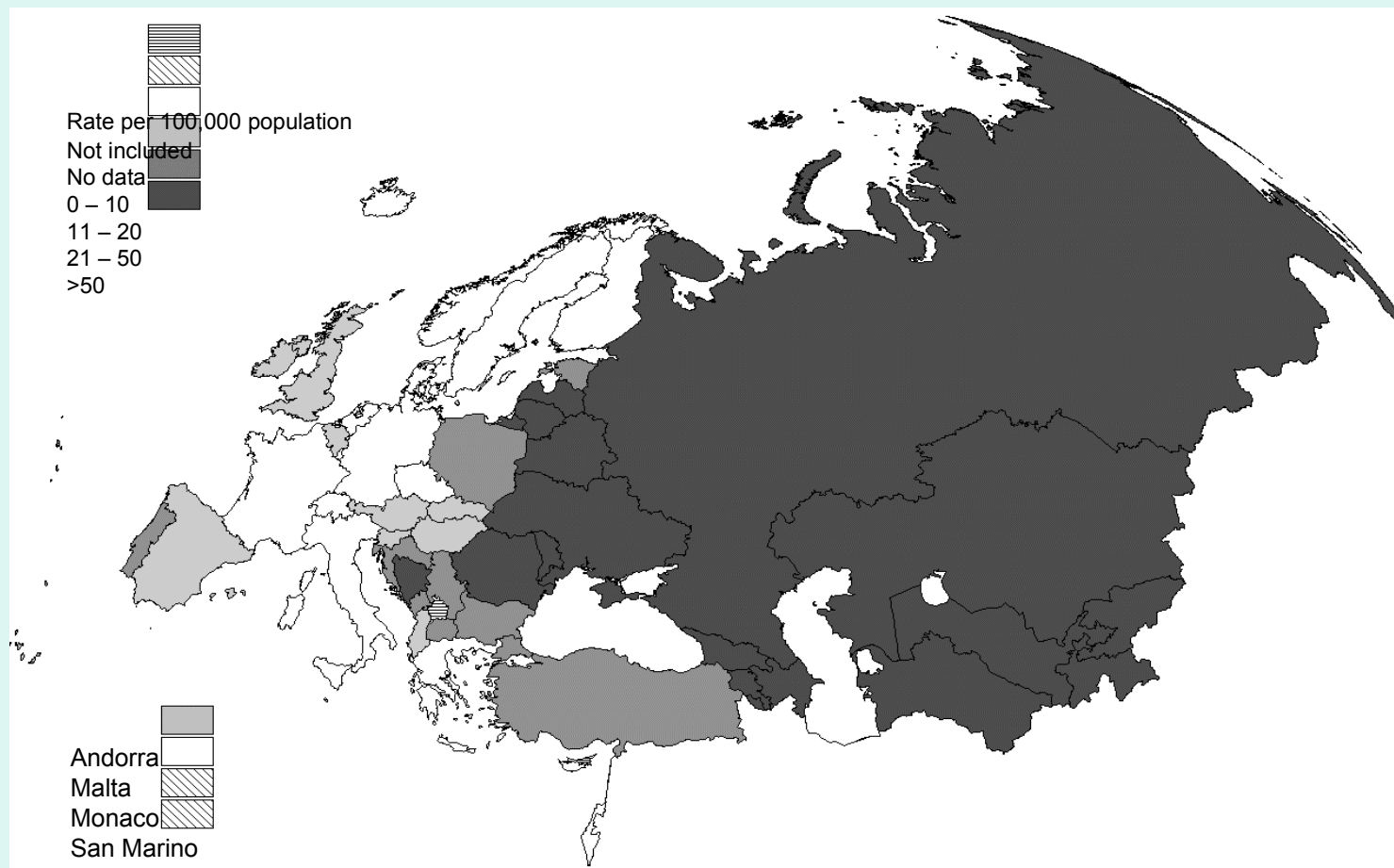
	Schedule	No of injections
Birth	BCG	1 injection
2 months	6 in 1 + PCV	2 injections
4 months	6 in 1 + Men C	2 injections
6 months	6 in 1 + Men C + MenC	3 injections
12 months	MMR + PCV	2 injections
13 months	MenC + Hib	2 injections
Early school booster (3-5 years)	DTaP/IPV +MMR	2 injections
11- 14 years	Tdap	1 injection
12-14 years/1st year second level (girls only)	HPV	3 doses over 6 months

6 in 1 = diphtheria, tetanus, acellular pertussis, inactivated polio, hib + hepatitis B

Tuberculosis

- Human TB is caused by infection with bacteria of the *Mycobacterium tuberculosis complex*
- Most commonly due to *M tuberculosis* (rarely *M bovis*)
- Initial infection may be eliminated, may lead to latent infection or to active TB
- Mostly involve the respiratory system (70%)
- Symptoms (respiratory TB): persistent cough, fever, weight loss, night sweats, may have blood stained sputum
- Those with smear positive sputum are most infectious
- Most at risk: Coming from high incidence country; poor nutrition/housing; immune deficiency/chemotherapy/steroids/antiTNFs/old age (latent TB)

Tuberculosis notification rates per 100,000 population, WHO European region, 2005



Source: WHO

BCG



Calmette

- **B**acille **C**almette-**G**uerin (BCG) vaccine
 - Live attenuated vaccine
- Importance in children
 - Preventing tuberculous meningitis and miliary TB
 - BCG in infants -no need to delay primary immunisations
- Side-effects
 - May get local lymphadenopathy, other reactions rare

Crude incidence rate per 100,000 for notified cases of TB by LHO HSE South (SE) from 2005 to 2011*

Year	2005	2006	2007	2008	2009	2010	2011*	Average Cumulative incidence 2005-2011
Carlow/ Kilkenny	6.6	7.5	5.8	5.0	4.1	5.8	5.8	5.8
Tipperary South	13.6	20.3	9.0	6.8	10.2	7.9	7.9	10.5
Waterford	9.2	13.3	8.3	9.2	15.8	8.3	9.2	10.5
Wexford	4.6	6.0	3.0	5.3	3.0	2.3	5.3	4.2
South East	8.0	11.1	6.3	6.5	8.0	5.8	6.5	7.5

* Data for 2011 provisional.

Incidence rates base on 2006 census. LHO Population data from 2011 census is not yet available

Human Diphtheria

- **Clinical presentation (IP 1-5 days)**
 - low-grade fever precedes → pharyngeal pseudomembrane & lymphadenopathy
 - Nasal diphtheria (sero-sanguinous discharge)
 - Skin/wound ulceration

Systemic effects of toxigenic diphtheria

- Myocarditis, polyneuritis

- **Early diagnosis essential**

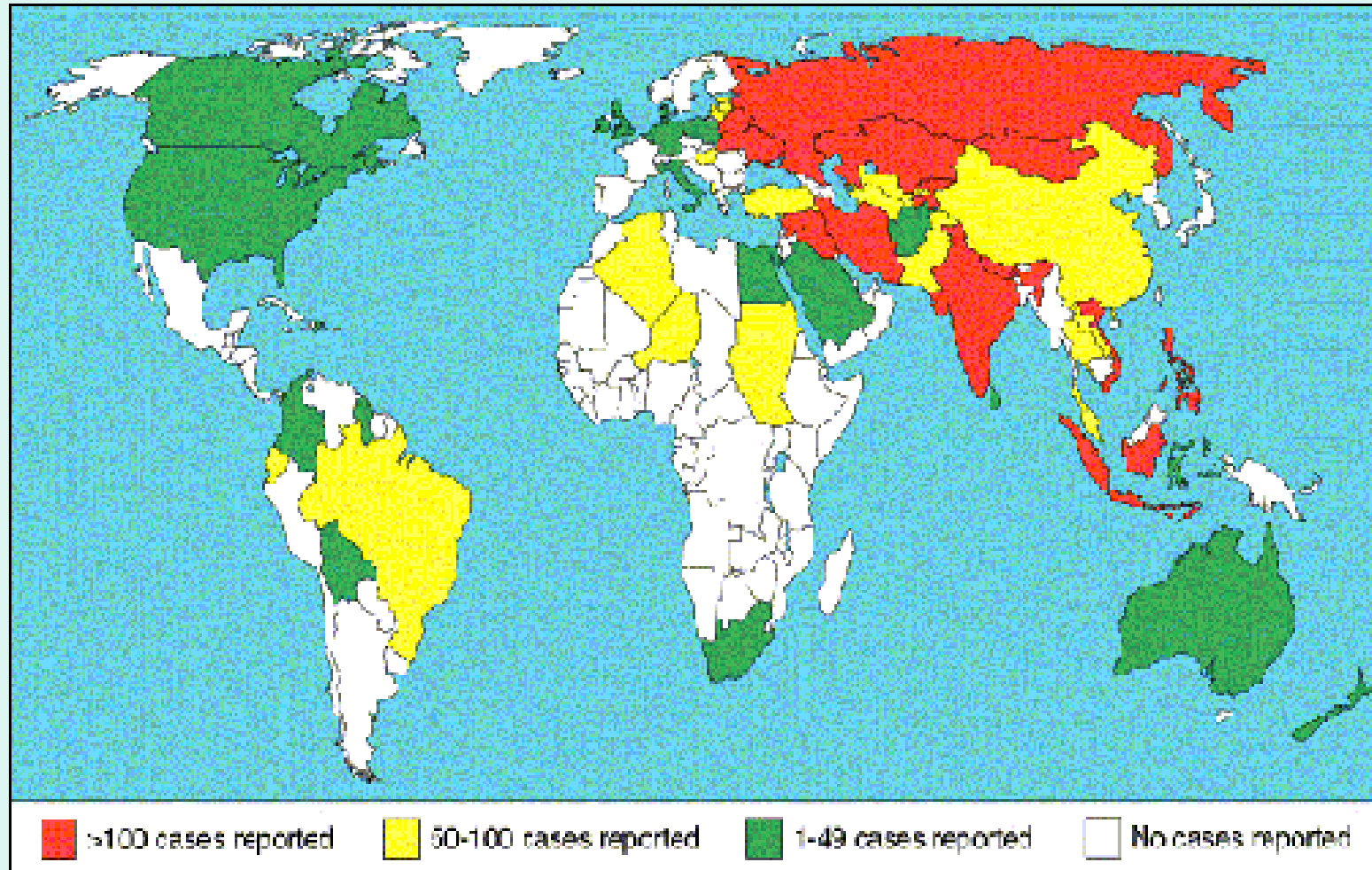
- Early treatment– diphtheria anti-toxin and antibiotics
- Rapid investigation and control measures

- **Prevention**

- High diphtheria vaccination coverage must be maintained
- Now 5 doses in routine schedule
- If 10 yrs or older, low dose vaccine indicated
- Additional doses can be given every 10 yrs – esp for those travelling to endemic areas



Diphtheria Hotspots 1997 - present cases reported to the WHO



Source WHO

Tetanus

- Acute neurological condition – muscle rigidity and contractions
- Caused by toxin produced by *C tetani*
- Spores present in soil and gut/faeces of cows, sheep, horses, chicken, heroin
- Anaerobic –puncture wounds,foreign body
- Incubation period: 4-21days
- 5 doses of vaccine (primary X 3 doses and 2 X booster doses) give satisfactory long term protection, except travel to area without adequate medical facilities

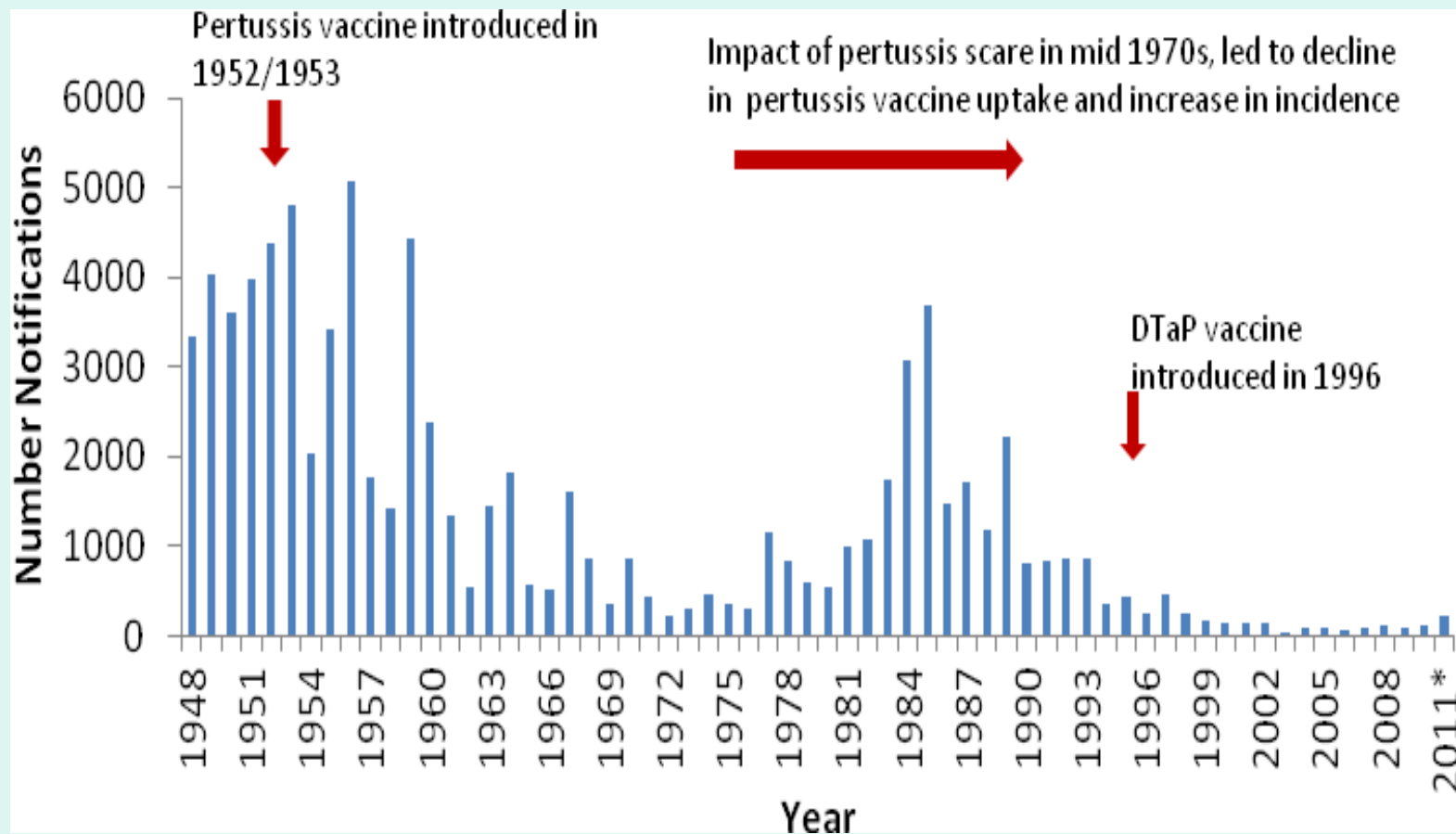
Tetanus in neonate



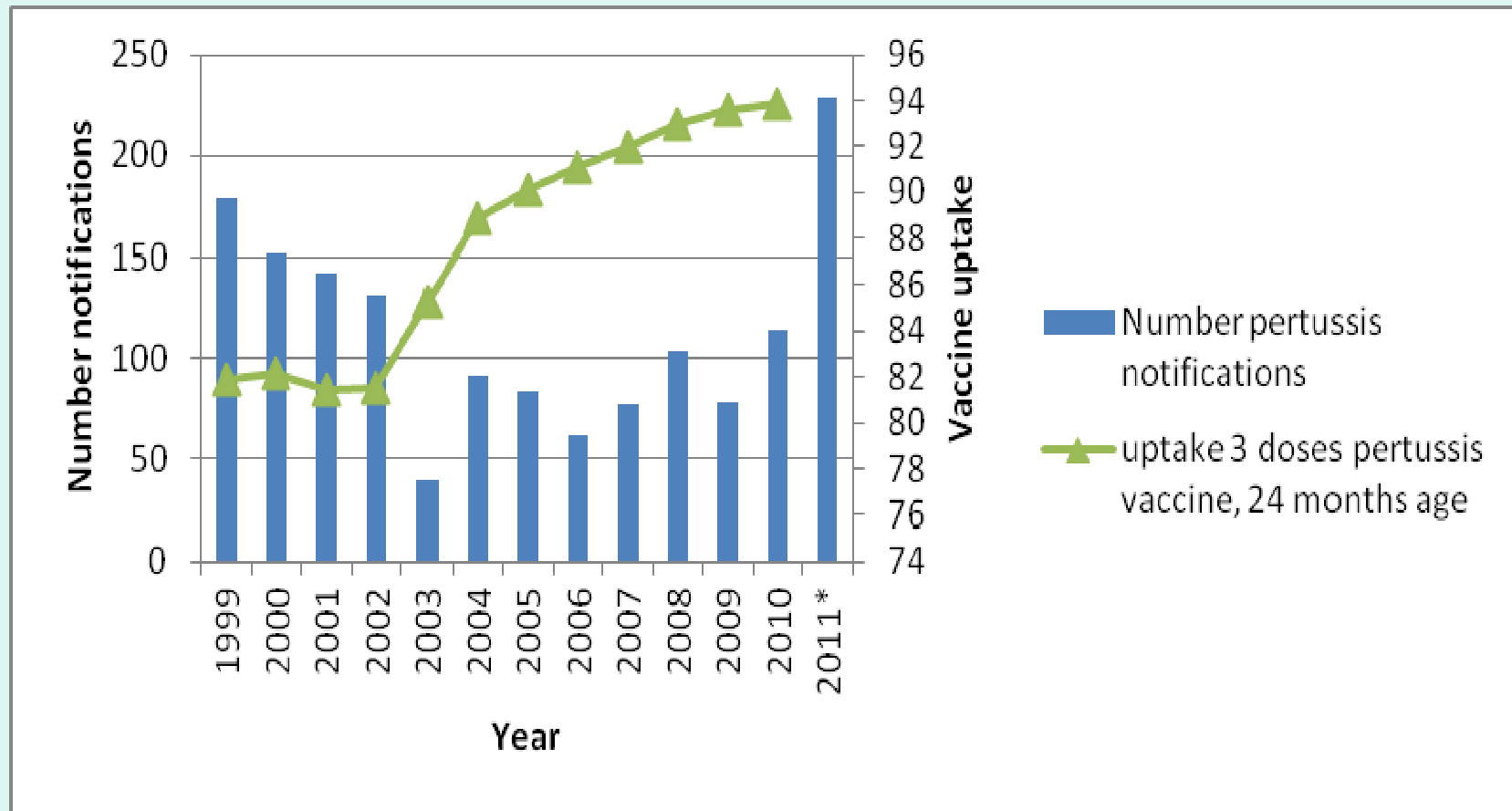
Pertussis (Whooping cough)

- *Bordetella pertussis*, toxins paralyse respiratory cilia, inflammation
- Initial rhinorrhoea, then irritating cough, then cough spasms +/- vomiting, whoop. IP: 4-21 days
- Easily spread by droplets (coughing/sneezing), often from older adults and older children
- Young infants most severely affected – apnoea/cyanosis
- Teenager/adult – persistent cough
- Worldwide recent increase in notifications, incl Ireland, despite good vaccine coverage
- Immunity wanes over time, with disease or vaccine
- Early notification (on clinical suspicion) essential for protection of vulnerable contacts
- Antibiotics v early can reduce length of disease/transmission or reduce severity in contacts

Pertussis notifications and vaccine history, Ireland, 1948-2011



Pertussis notifications and vaccine uptake at 24 months, 1999-2011



* 2011 provisional data

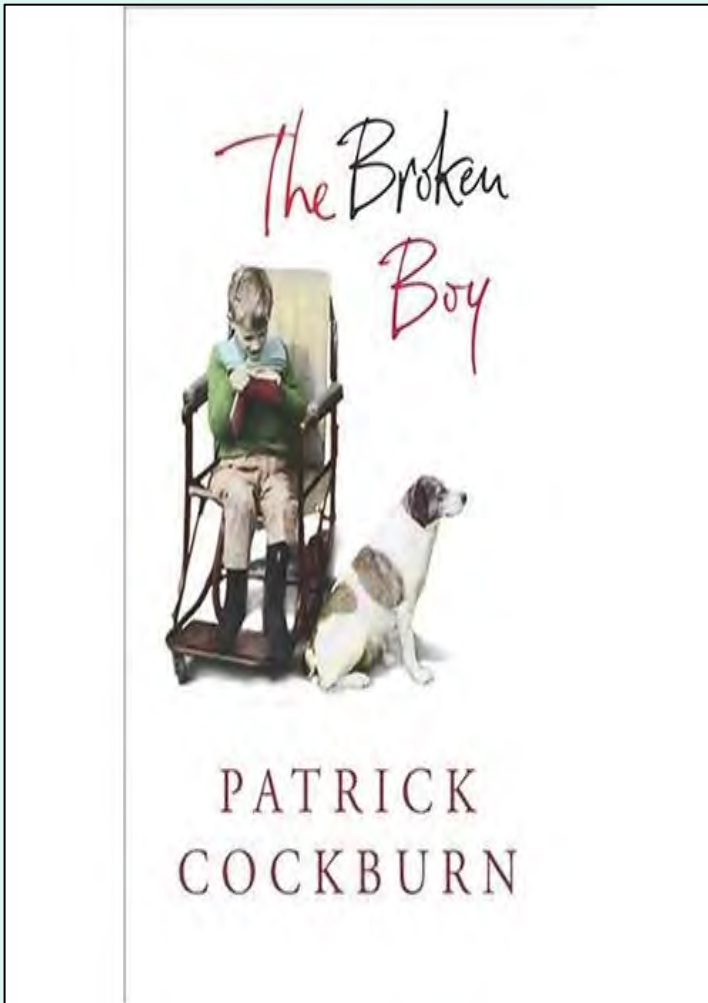
Pertussis vaccine

- Primary course as part of 6 in 1 – 3 doses
- Booster at 4/5 years as part of 4 in 1
- Booster at 11/13 years as part of Tdap
- HCWs in contact with infants, pregnant women and immunocompromised – booster dose every 10 years
- Pregnant women who had not received pertussis vaccine in previous 10 yrs – after 20 weeks gestation
- Other adults
- Cocooning?



Polio

- highly infectious viral disease
- 95% of infected no symptoms
- primarily affects children < three years of age
- can cause paralysis within hours.
- Before 1985 (WHO eradication)
 - polio paralysed > 1,000 children a day
 - ~ 350,000 children annually.
- 2001 Europe certified polio free
- **2010 Polio re-emerged in a number of former Russian states**
- Inactivated Polio vaccine now used



1956 polio outbreak

August 12 - All-Ireland Hurling and Football Finals postponed

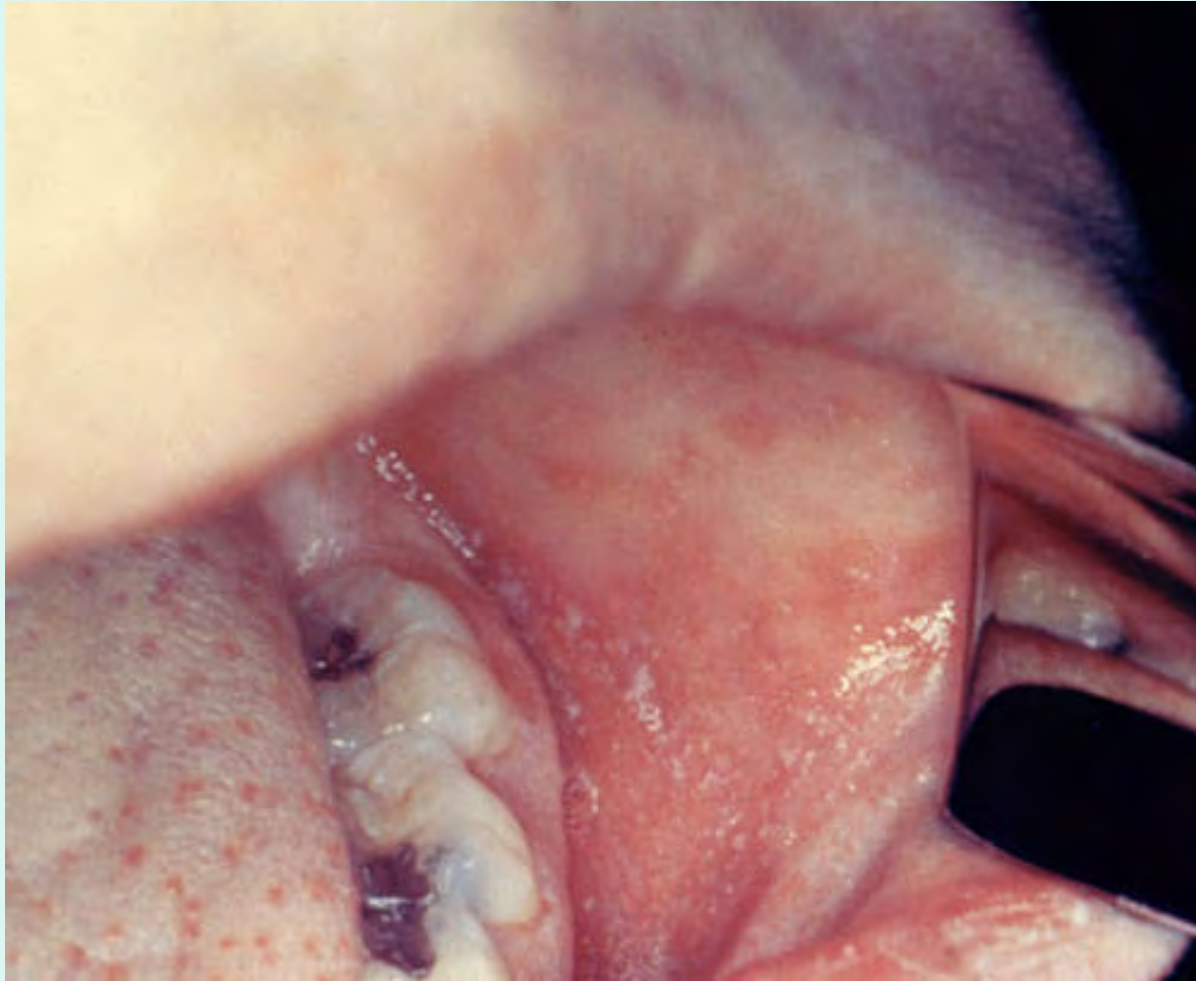
Cork

~ 550 patients, mainly children admitted to St Finbarr's hospital, polio reception centre

Measles

- Highly infectious, spread by droplets
- IP: 7-18 days
- Infectious from 4-5 days before rash to 4 days after rash appears
- Prodromal: fever, unwell, rhinorrhoea, conjunctivitis, cough; Kopliks spots
- Rash – red, maculopapular, starts behind ears face, trunk and limbs; lasts at least 3-4 days; may leave brown colour
- Aprox 30% cases have complications – pneumonia, otitis media, diarrhoea, convulsions, encephalitis (0.1%), death (0.5-0.1%)

Koplik's Spots



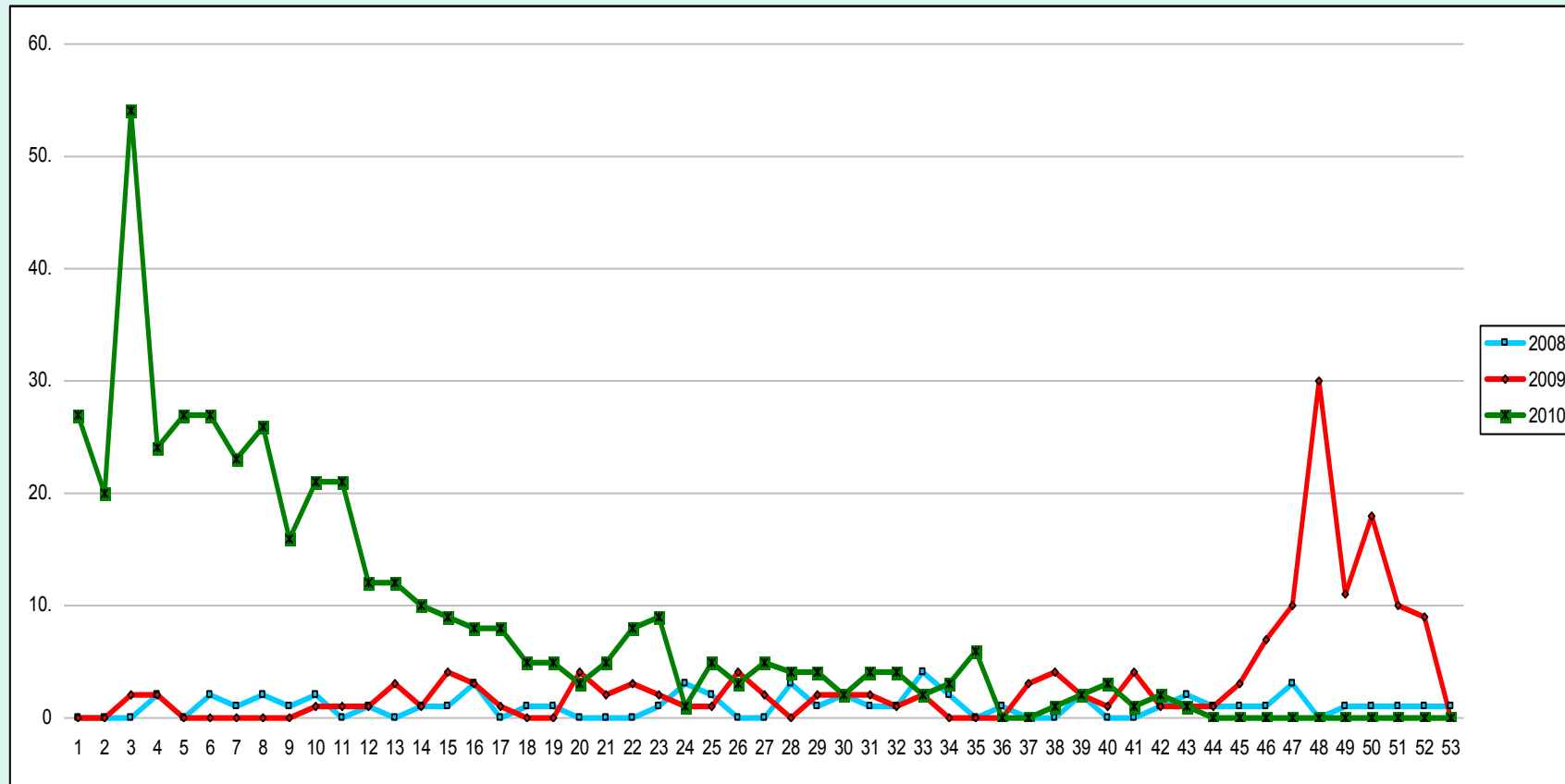
Measles rash



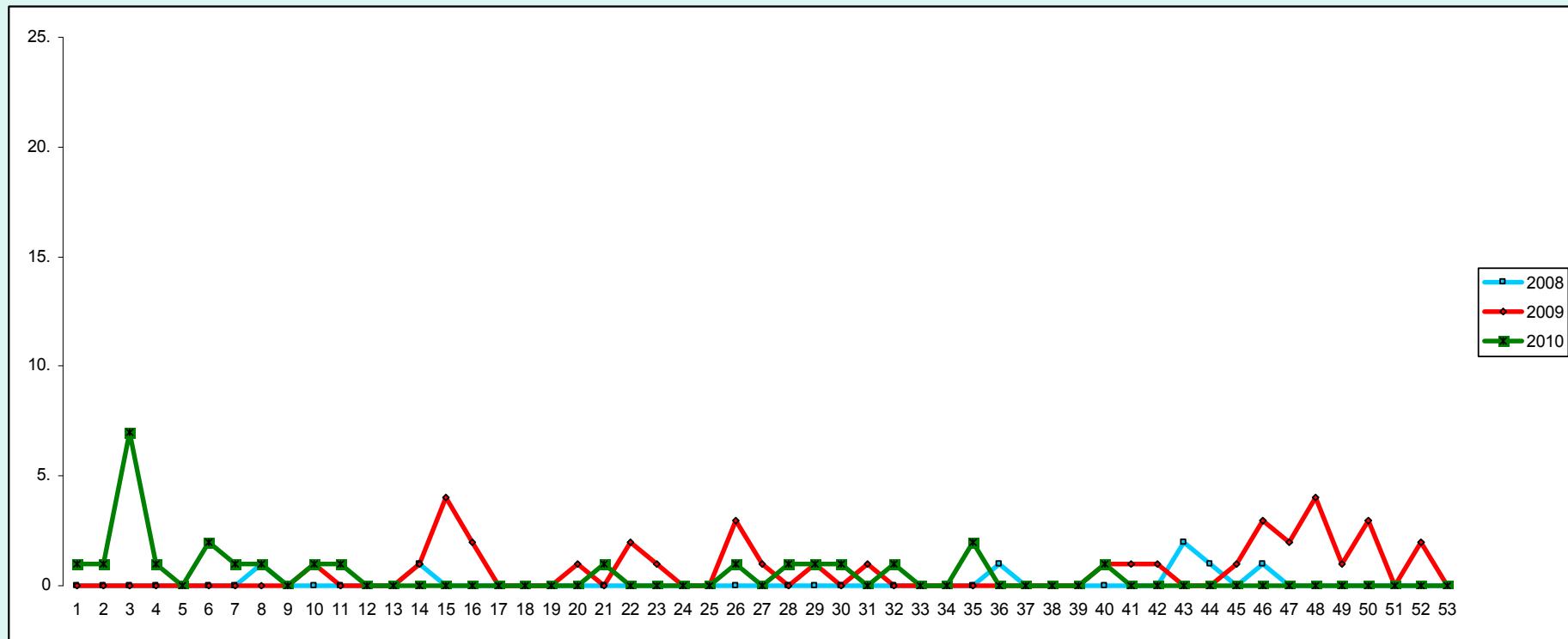
Measles Outbreak

- Early identification /notification of cases
- Vaccine given within 72 h of contact may prevent or attenuate illness in susceptible contacts
- MMR to 6 –12m olds may be indicated
- Infection control issues in HC settings
- Vaccination of HCWs important
- Third dose of MMR if vaccine history unknown
- HNIG may be indicated eg non-immune pregnant women in contact with rash illness
- Measles elimination campaign – MMR catch-up campaign 2012/13?

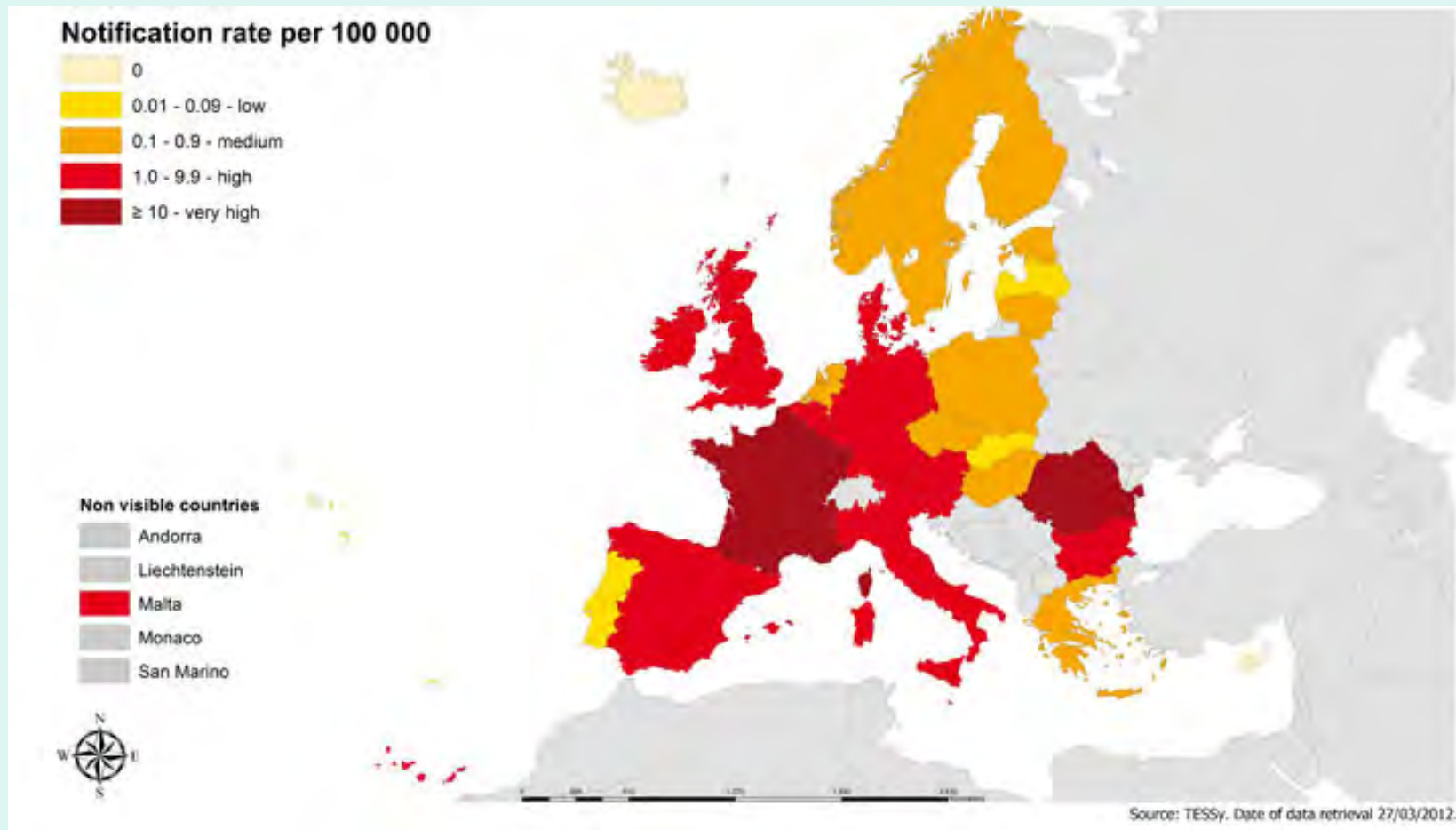
Measles outbreak 2009/2010 – national figures



Measles outbreak – 2009/2010 – South East



Notified Measles cases in EU and EEA countries, 2011

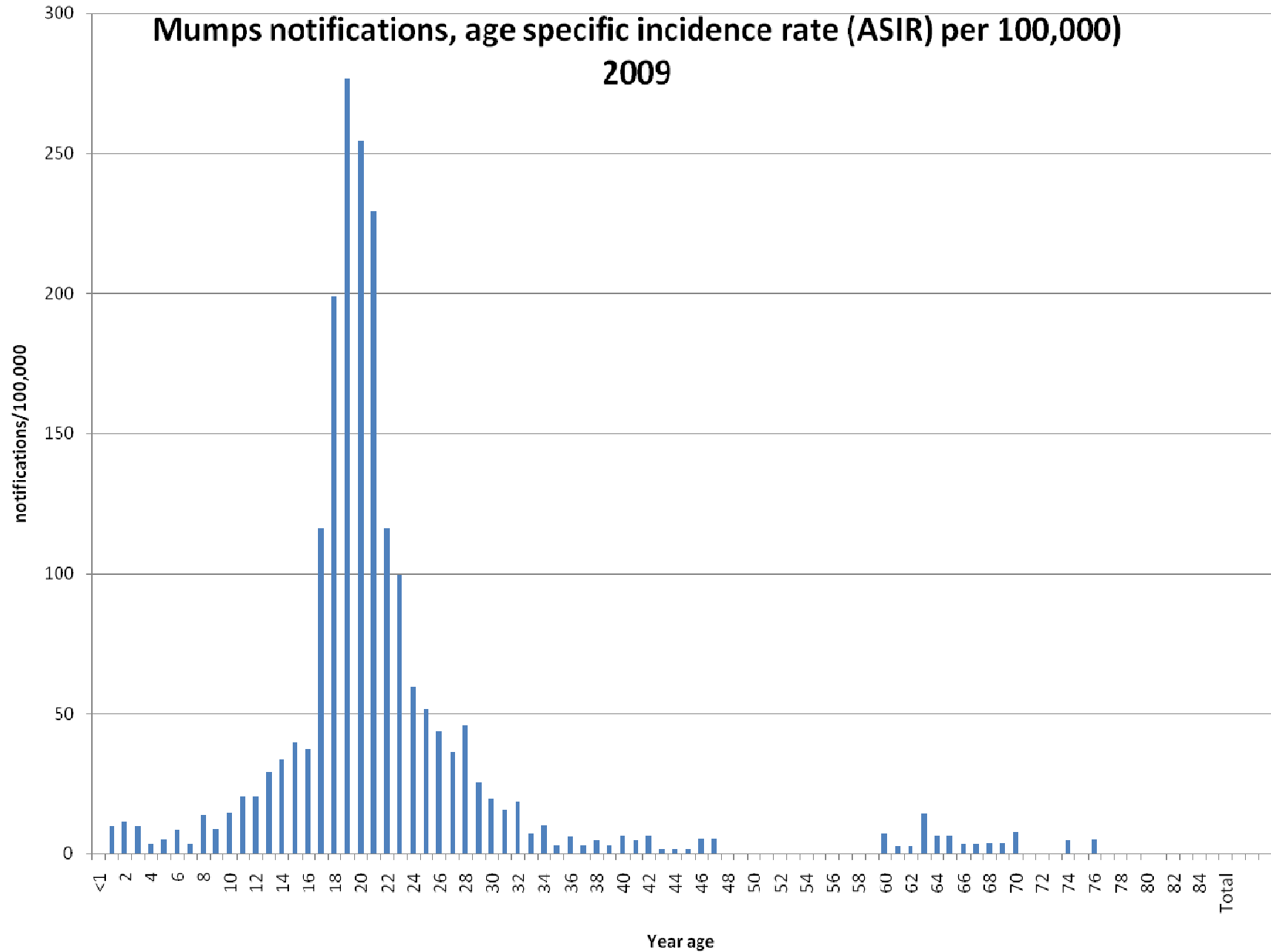


Mumps – an acute viral infection

- Frequent cause of outbreaks in pre vaccine era
- Incubation 14-18 days
- Up to 20% asymptomatic
- Complications:
 - Parotitis: 30-40% cases
 - Orchitis 20-50% post pubertal males
 - CNS involvement 15%
 - Pancreatitis 2-5%
 - 1/20,000 deafness



Mumps notifications, age specific incidence rate (ASIR) per 100,000 2009

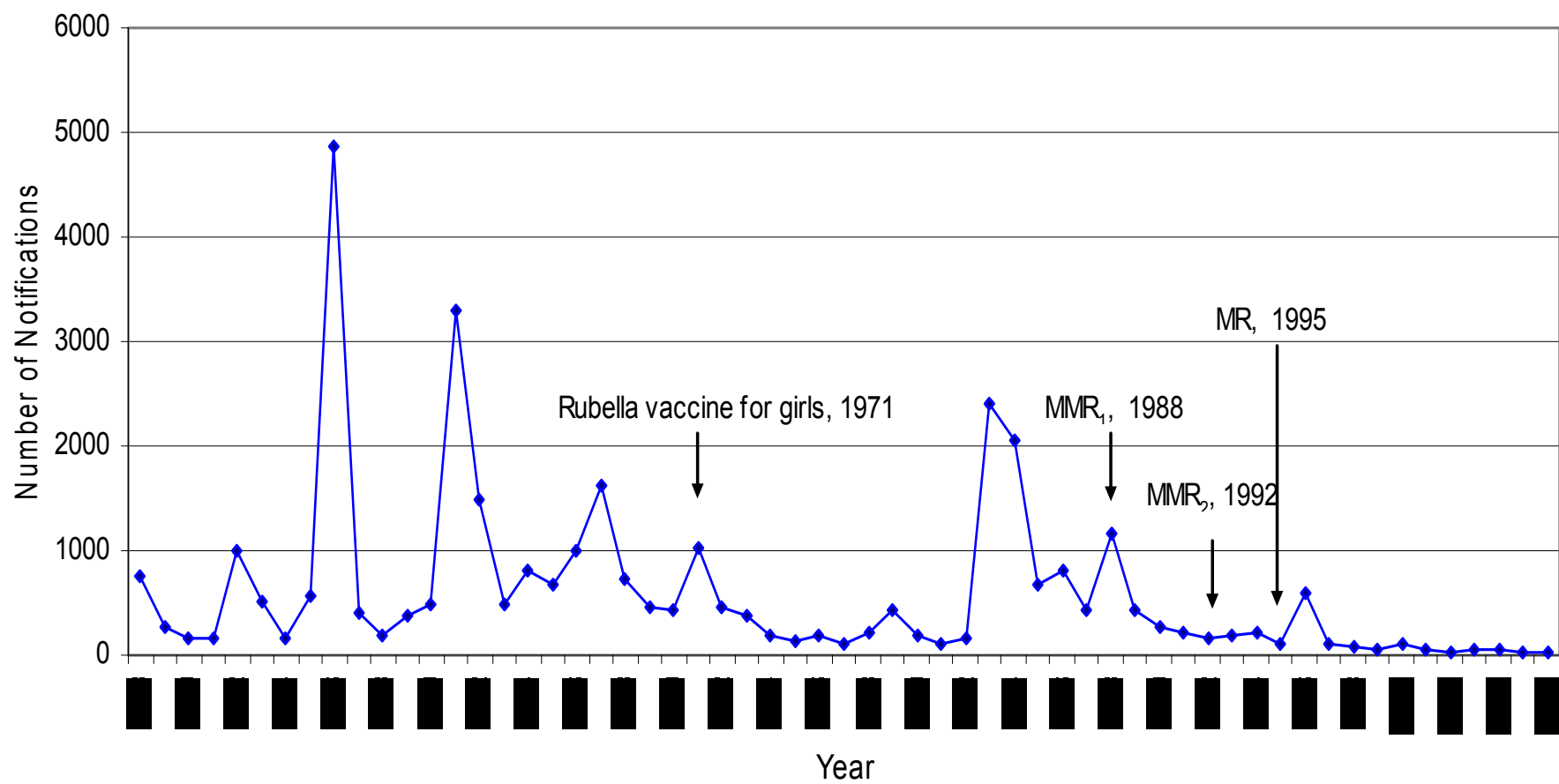


Rubella

- Transmission by droplet or direct
- Infectious: 7 days before to 7 days after rash
- Prodromal symptoms rare in children
- IP: 14-21 days
- Lymphadenopathy neck may precede rash
- Rash starts on face and neck
- Rash short lived



Rubella notifications nationally 1949-2006



Congenital Rubella Syndrome (CRS)

CRS may include all or some of the following:

- Deafness
- Cataracts
- Heart defects
- Microcephaly
- Mental retardation
- Bone alterations
- Liver and spleen damage



MMR

- No evidence for use of single vaccines against measles, mumps and rubella
- Scientific evidence shows no association with autism or inflammatory bowel disease
- Egg allergy not a contraindication to MMR

Meningitis

- Meningitis can be viral or bacterial
- Bacterial organisms include *N. meningitidis*, Group B *Streptococci*, *E coli*, Hib, *S. pneumoniae*
- Signs/s of bac. meningitis similar for all organisms (except rash in *N meningitidis* - 40% cases)
- Abrupt/fulminant or insidious (RTI prodrome)
- Symptoms can be non-specific initially
- Infants: Fever, drowsy, irritable, off feeds
- Older: Headache, neck stiffness, fever, photophobia, confusion
- Complications: Death, deafness, epilepsy, cognitive impairment, hydrocephalus, digit +/- limb amputation (*N meningitidis*)

Meningococcal Disease

Rash - spots change into purple bruises which don't blanch (lose their color) when pressed by glass



Gangrene

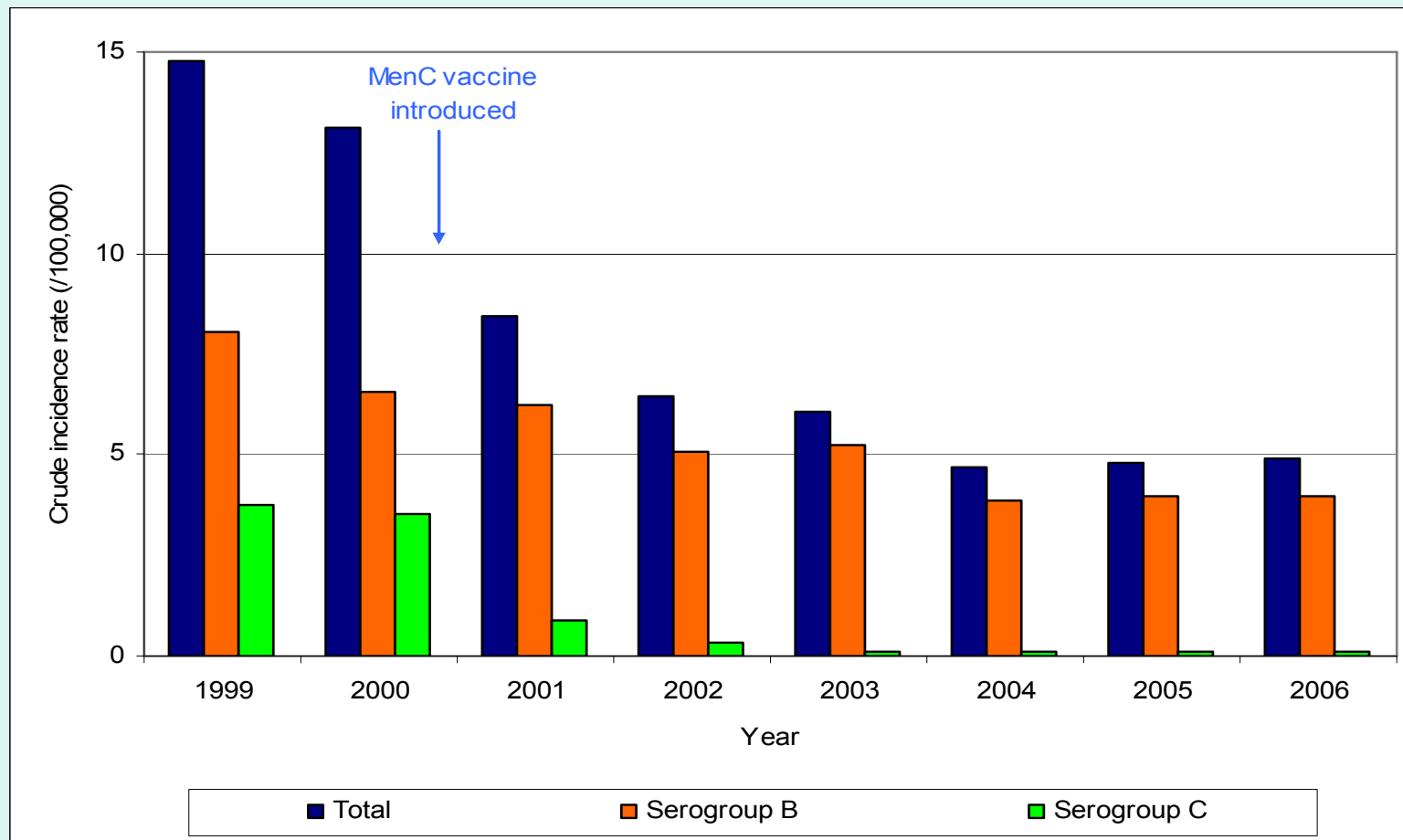


Source: courtesy of www.meningitis-trust.org

Invasive Meningococcal Disease

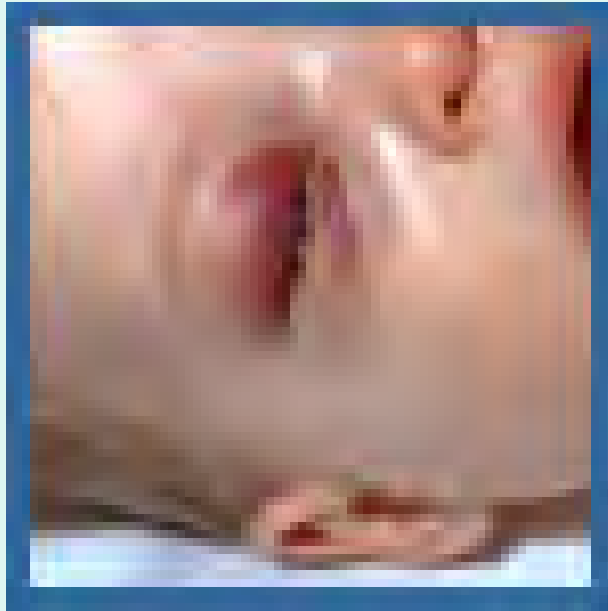
- *N mening.* serogroups A, B, C, Y, W, etc
- Invasive *N. meningitidis* causes meningitis and/or septicaemia
- 10% of pop. carry *N men* in nasopharynx – peak in 15-19 age group – carriage results in antibodies
- Why invasive for some? RTI (influenza); smoking; living in closed or semi-closed communities
- Most common infancy and early childhood
- Second small peak adolescents
- Winter and early spring in Ireland

Invasive meningococcal disease Ireland 1999-2006, by serogroup



Invasive Hib disease

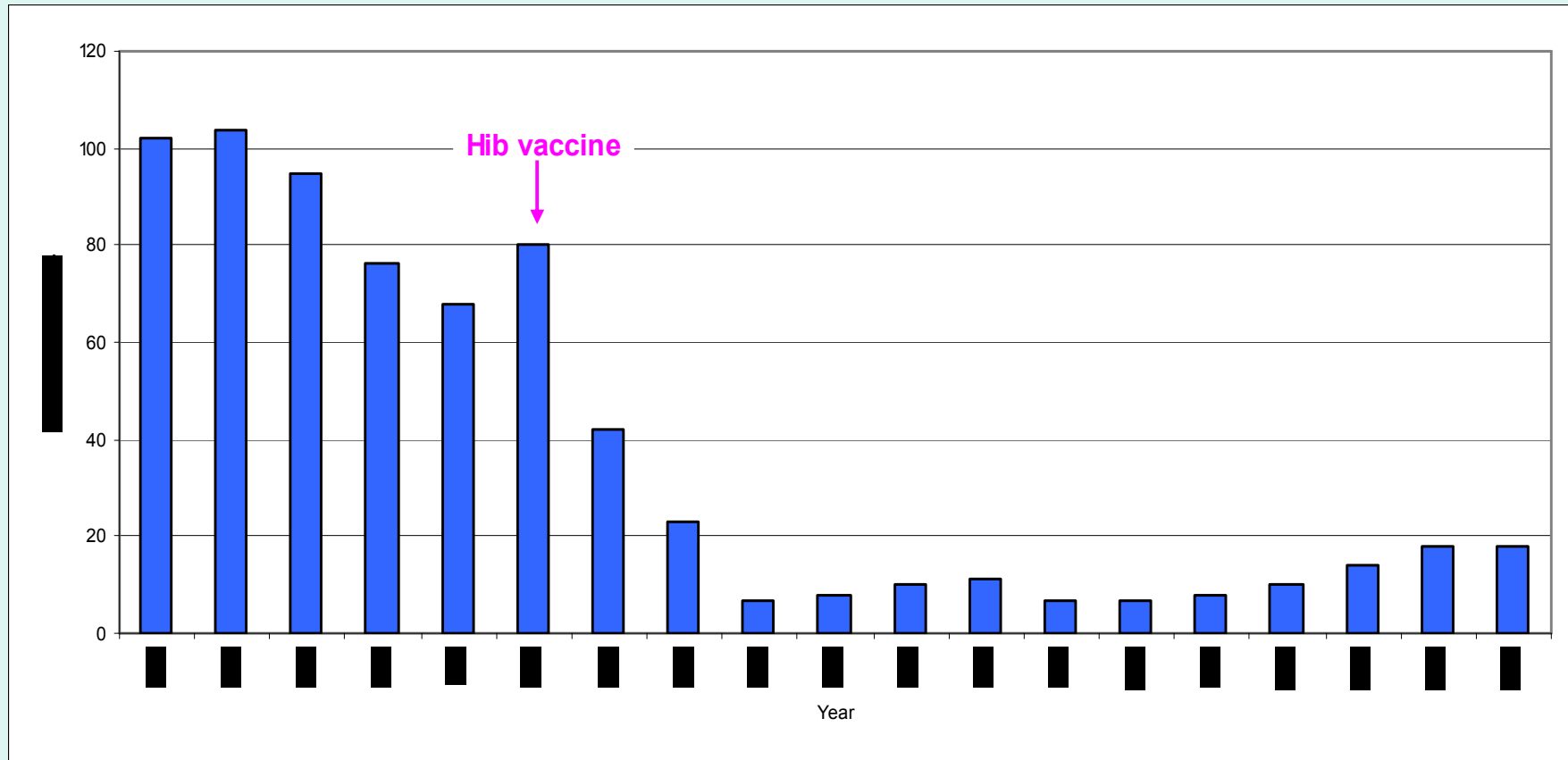
(Haemophilus influenzae type B)



- Most invasive H.i. infections type B
- Was a common cause of meningitis (50-65% cases)
 - Mortality ratio 2-5%
 - Permanent neurological sequelae 15%-30
- Epiglottitis 17%
- Other sites infection
 - joint (8%), skin (6%), pneumonia (15%), and bone (2%).
- In 2005, after introduction of 3-dose vaccine in 1992, noted an increase in iHib in fully-vaccinated children = booster Hib vaccine added at 12/13 months



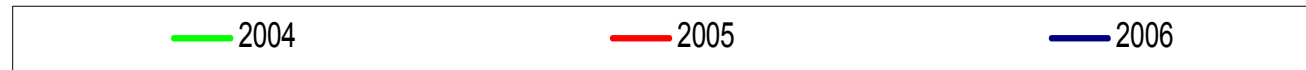
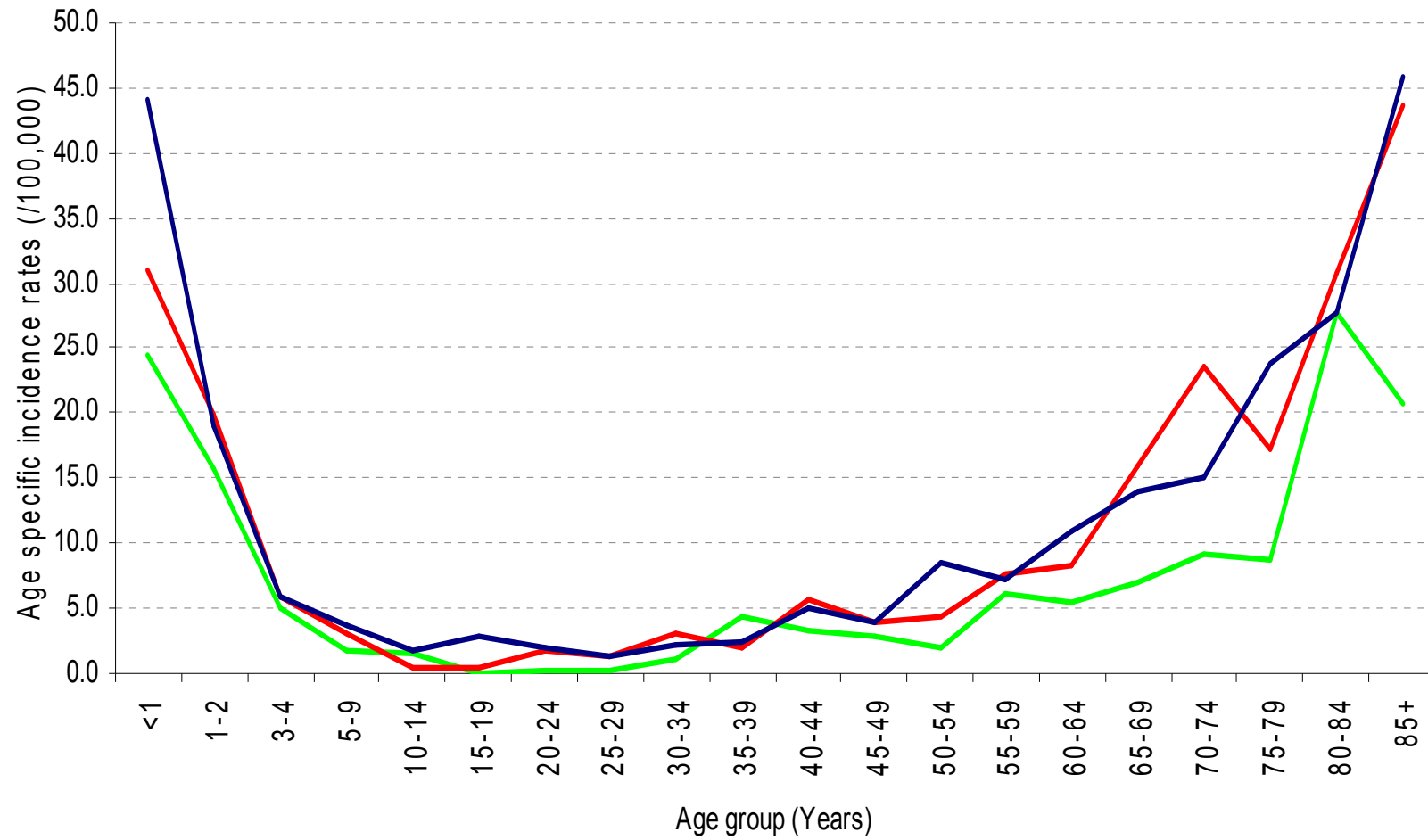
H.Influenzae type b, 1987-2007



Invasive Pneumococcal Disease (IPD)

- *Streptococcus pneumoniae* can cause both invasive and non-invasive disease
- IPD - disease of early childhood and of older adults; also asplenia; immune compromised; chronic disease
- 90 serotypes of *S. pneumoniae* have been described
- Causes: sepsis, meningitis, pneumonia, endocarditis; as well as sinusitis, acute otitis media, cellulitis.

Age-specific incidence Invasive Pneumococcal Disease (IPD), 2004-2006, by age group

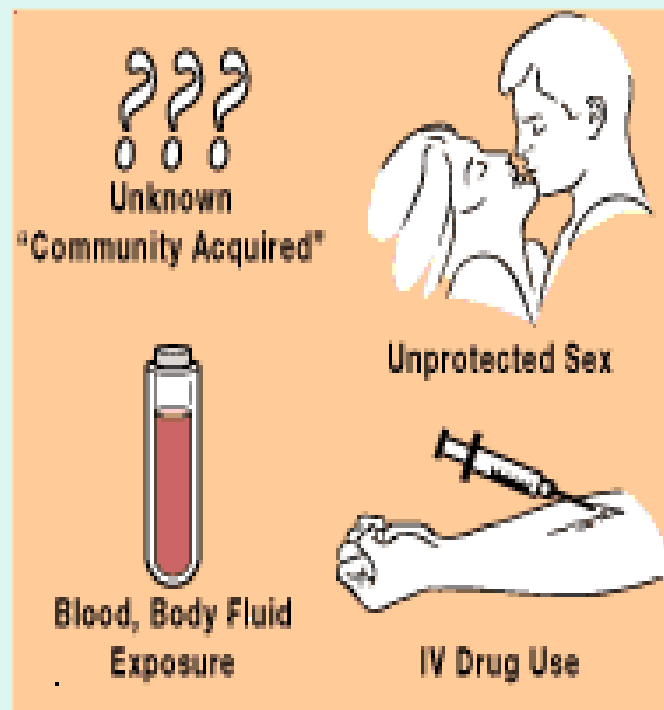


PCV13 and PPV23 vaccines

- PCV13
 - All children – 3 doses at 2, 6, 12 months
 - One dose only if 12 months or older
 - No dose if > 24 months, unless in risk group when can give up to 5 yrs (or 18 v occas)
- PPV23
 - All adults > 64 yrs
 - At risk group if age 2 - 64 yrs
 - This includes all smokers and alcoholics

Hepatitis B virus

- BBV; 50-100 times more infectious than HIV
 - lasts up to 7 days on surface
 - 90% of infected infants and 1-10% of adults - chronic HBV infection
 - Chronic infection can lead to chronic liver disease, cirrhosis and/or hepatocellular cancer
 - Death from chronic liver disease occurs in 15-25% of chronically infected people
 - Acute infection: Irish; 20-40y olds; symptomatic; usually resolves
 - Chronic: Non-Irish born (SE Asia; Africa; East Europe); not symptomatic
- >350 million people chronically infected worldwide
 - Vaccine preventable



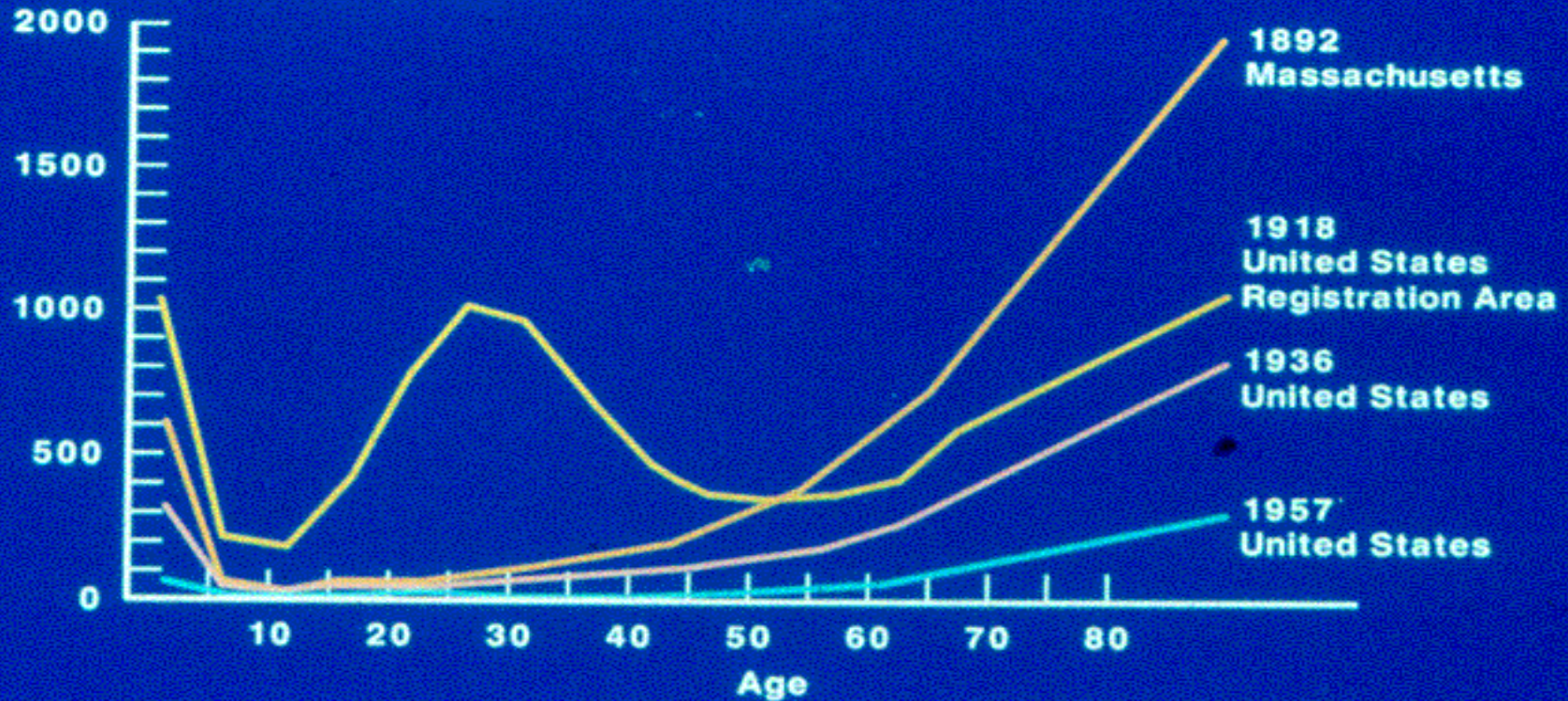
Influenza

- Acute viral infection caused by Inf A /B /C
- Sudden onset of fever, chills, headache, fatigue, dry cough, sore throat, stuffy nose
- Antigens change - vaccine changes yearly
- Indicated yearly for
 - those > 64 yrs and
 - those age >6 months in 'at risk' category
 - HCWs and those likely to transmit to 'at risk'
 - Pregnant women
 - People with regular contact with pigs, poultry or water fowl

Pandemic deaths US, 1918-1957

20th Century Influenza Pandemics

Deaths per 100,000 Population

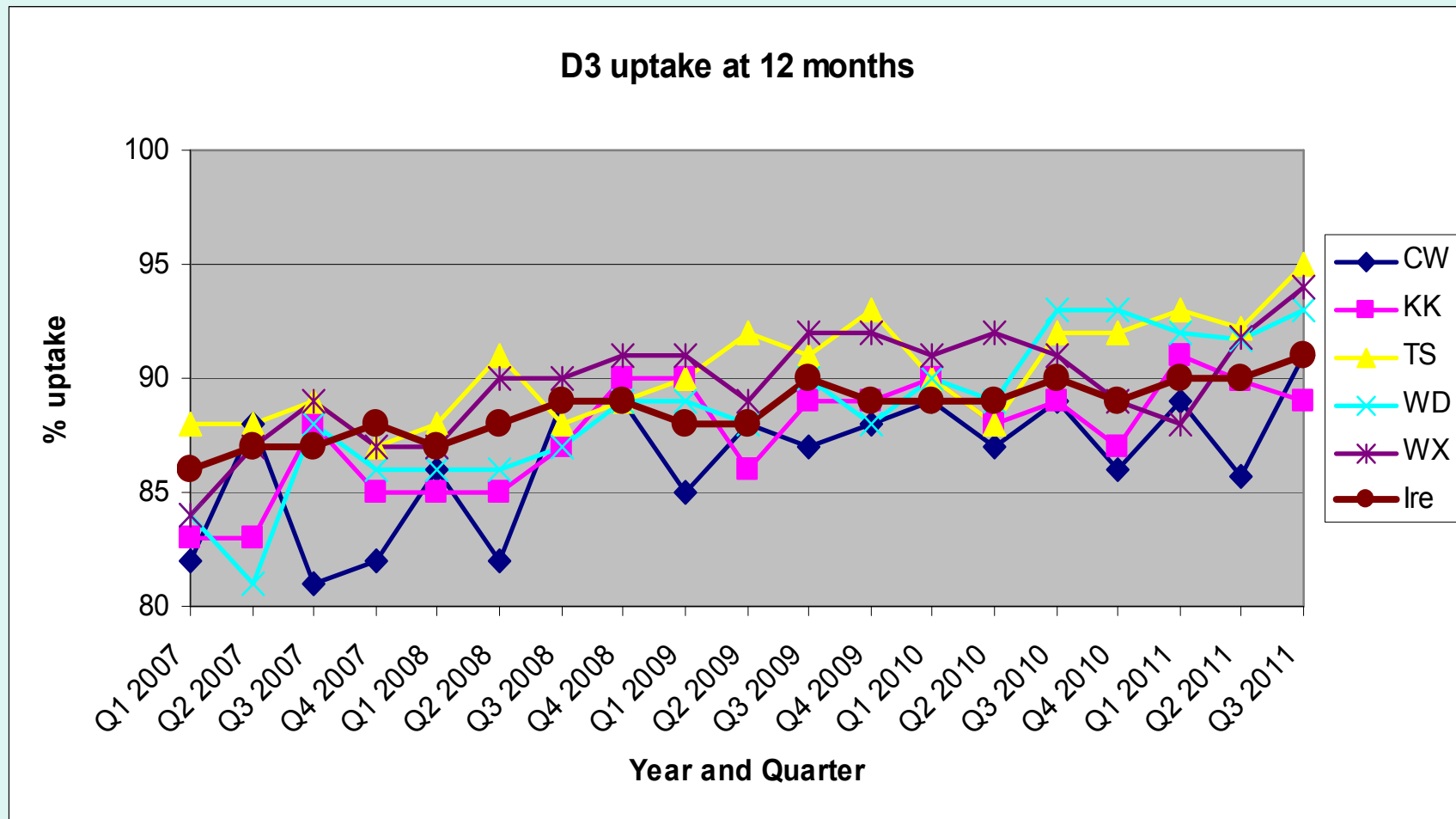


Dauer & Serfling, Am Rev Resp Dis 1961; 83:25

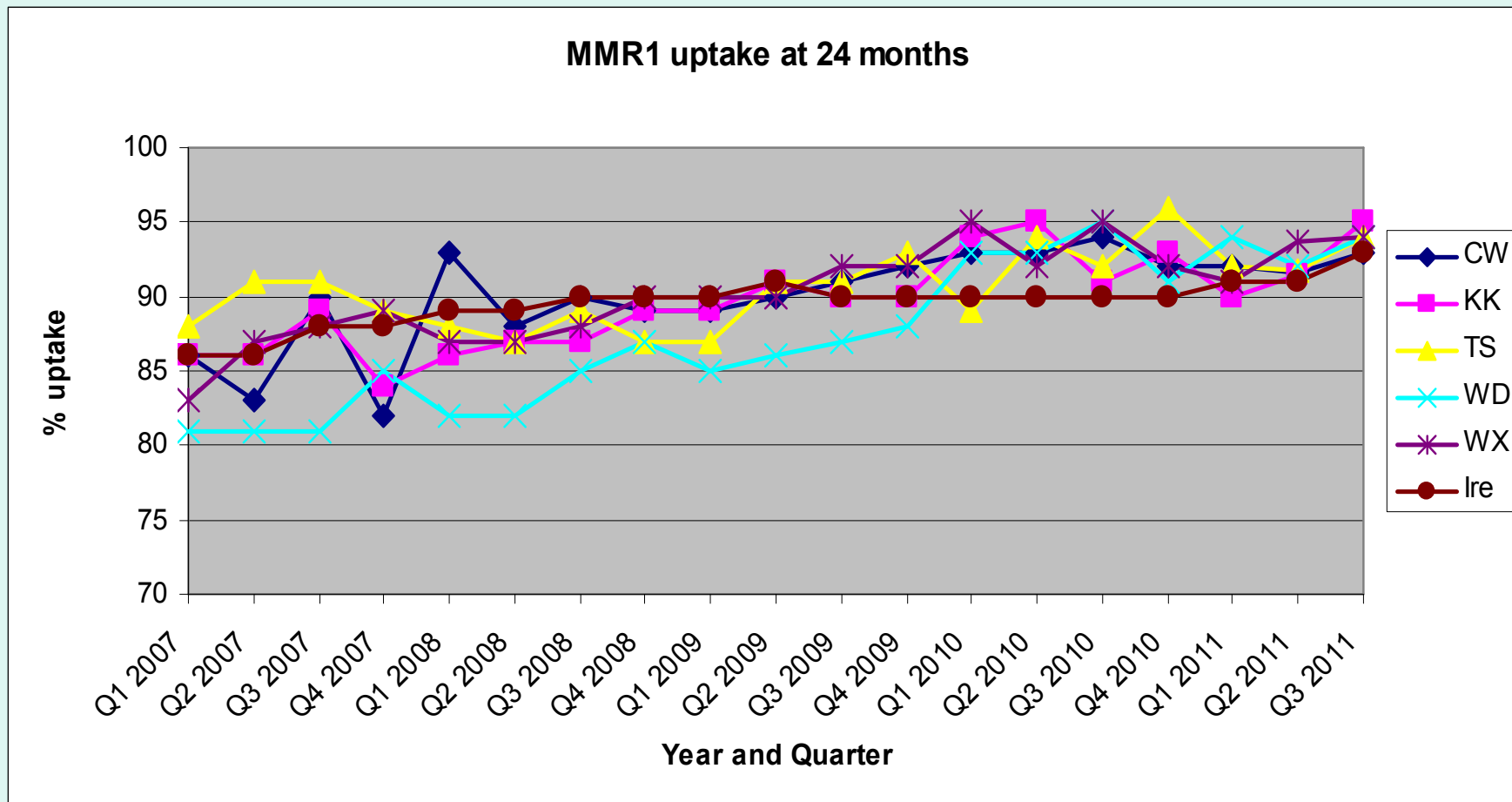
What are new vaccines that may be relevant to Irish population?

- ETEC (Verotoxigenic E coli)
- Group A Streptococcus
- H pylori
- Hepatitis C
- HIV/AIDS
- Measles (aerosol)
- Meningococcus Group B
- RSV
- Shigellosis

Vaccine Uptake for 3rd Vaccine visit, SE, 2007-Q3, 2011

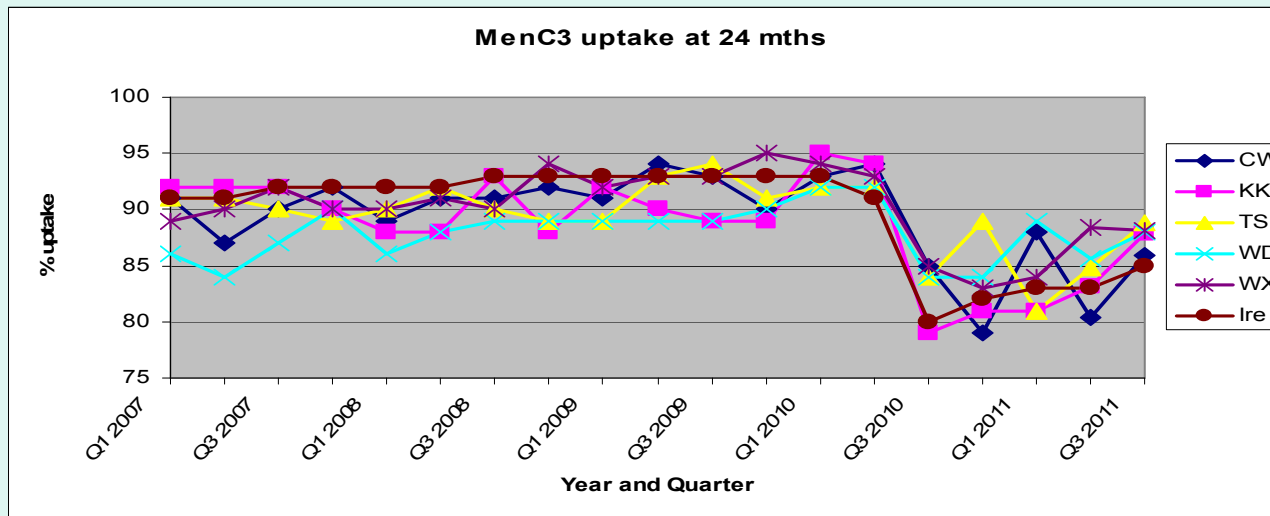


Vaccine Uptake for MMR, SE, 2007-Q3, 2011



Need to keep vigilant?

- MMR - scare
- MenC – change in schedule



- Hib – waning herd immunity/vaccine
- Pertussis – waning immunity/?vaccine