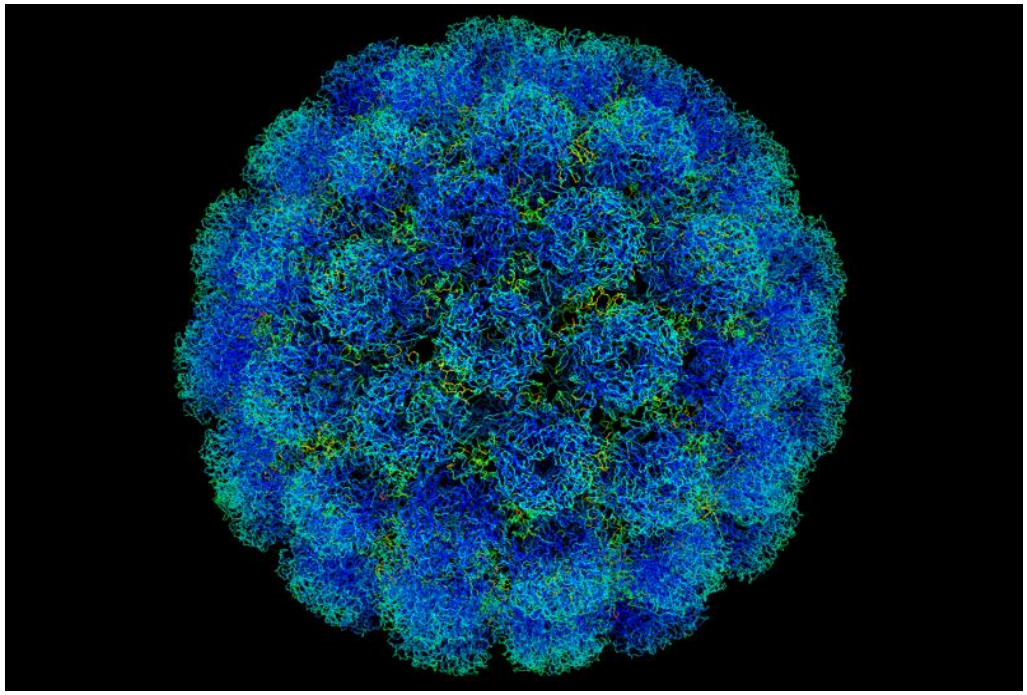
POLIOMYELITIS



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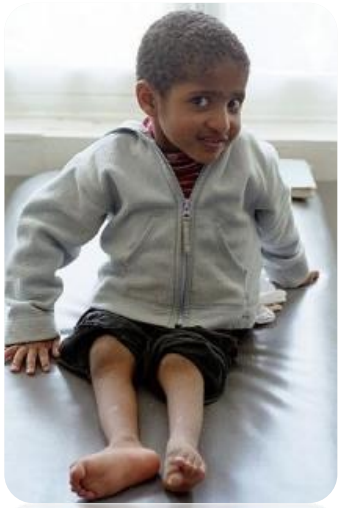
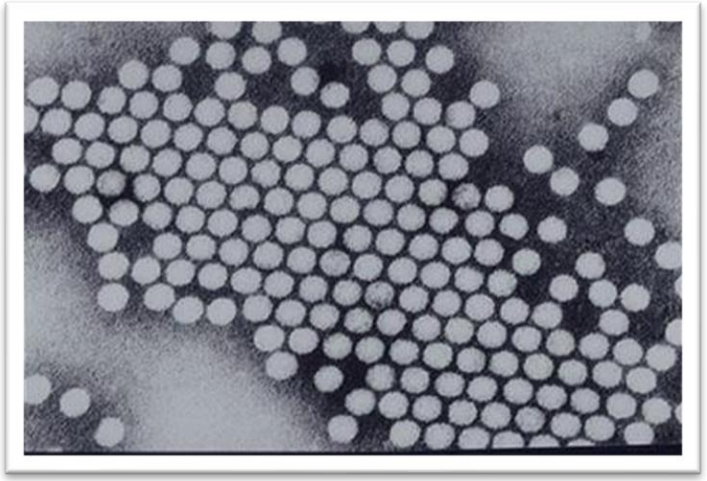
What is polio disease?

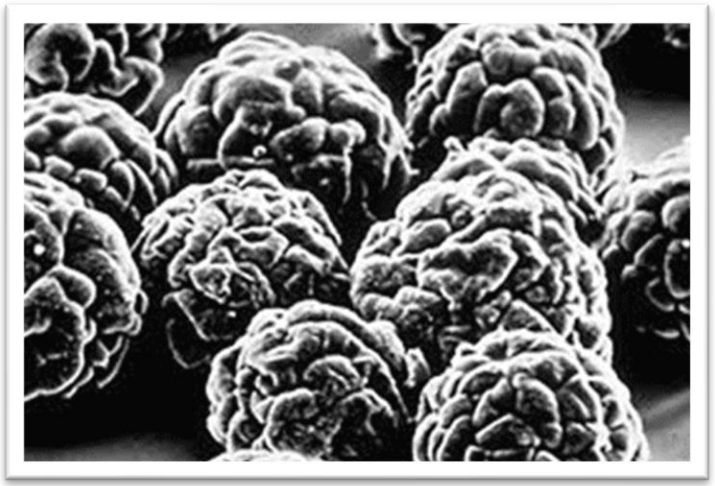


- Polio (also called Poliomyelitis) is a highly infectious disease caused by a virus.
- The virus invades the nervous system and can cause *permanent paralysis*
- Polio is spread through *person-to-person contact* and can spread rapidly through a community.
- Most infected people (90%) have **no symptoms or very mild symptoms**
- **However,** one in 200 infections leads to permanent paralysis (can't move parts of the body) and even death.

VIRUS

- Family: PICORNAVIRUS
- Type: ENTEROVIRUS
- Three serotypes (1, 2 , 3)
- Symmetry icosahedreal
- Diameter 20-30 nm
- No envelope
- Single RNA





How does Poliovirus spread?

- Poliovirus infection is ***highly contagious***
- Poliovirus is spread mostly by the ***fecal-oral route***
  - Primary mode of transmission – passage of the virus in stool to the mouth of another child
  - Can also be spread through saliva or droplets from a sneeze or cough

Child excretes virus in stool

Virus transferred to objects from hands

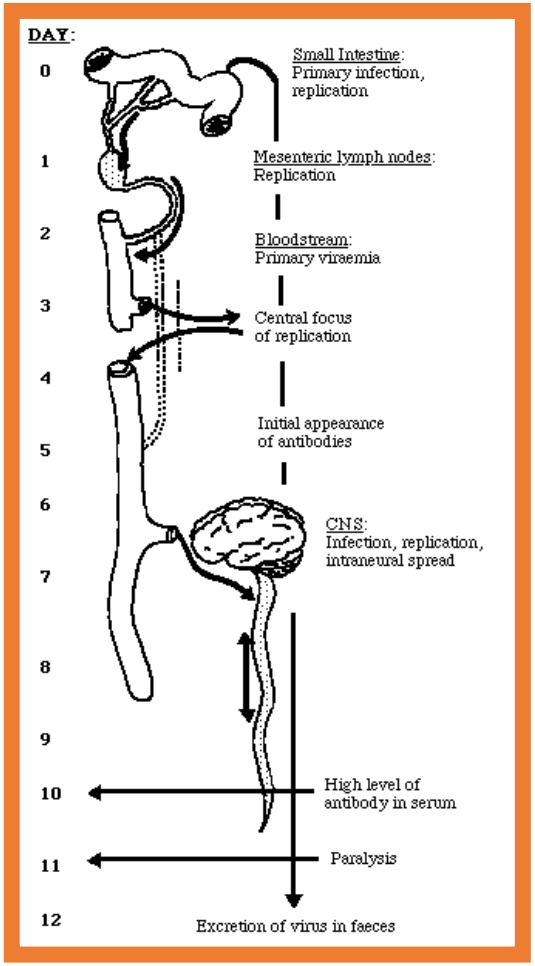
Virus transferred to another child's hands

Virus transferred ingested

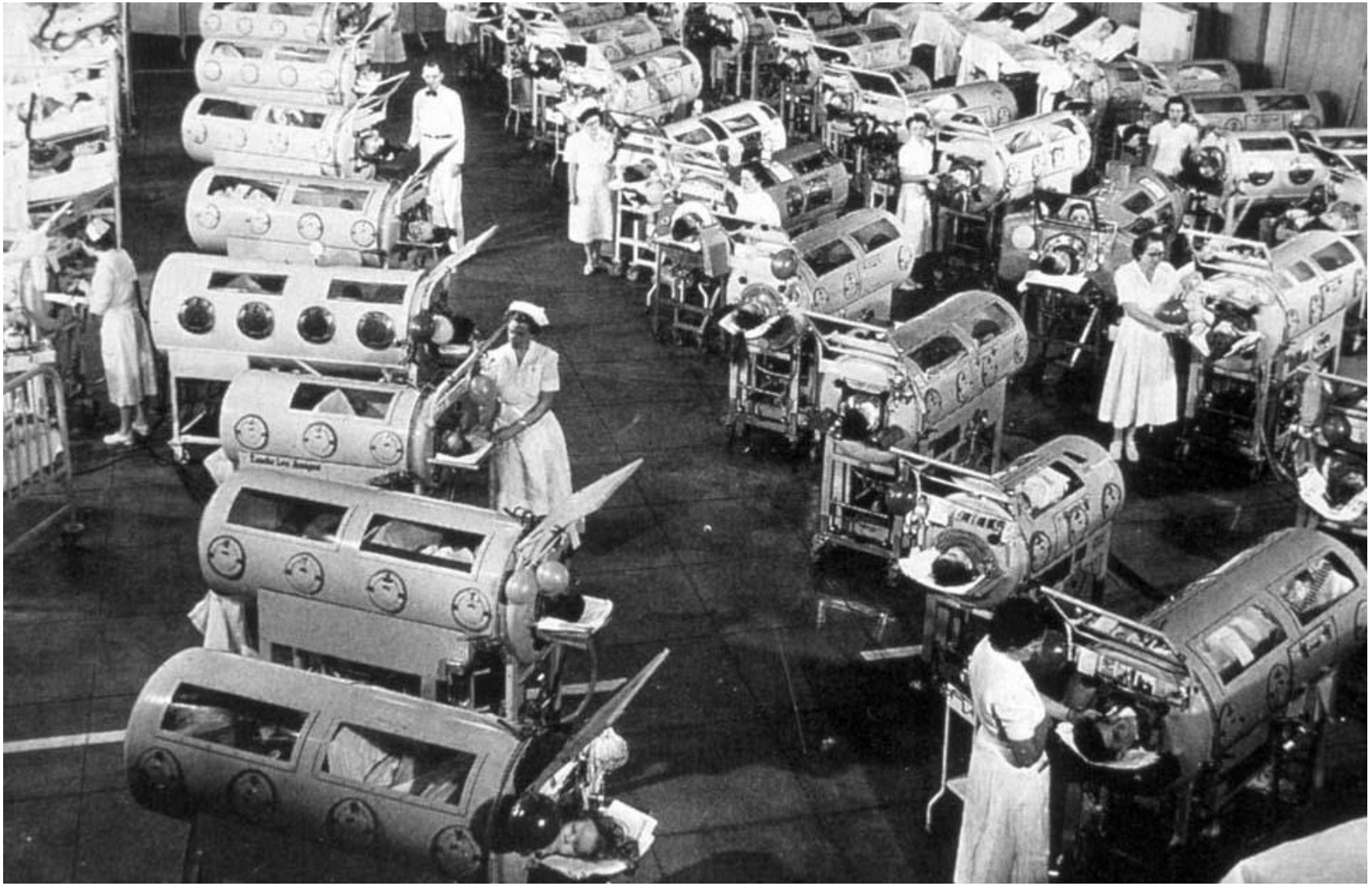
Next cycle of infection

INFECTION

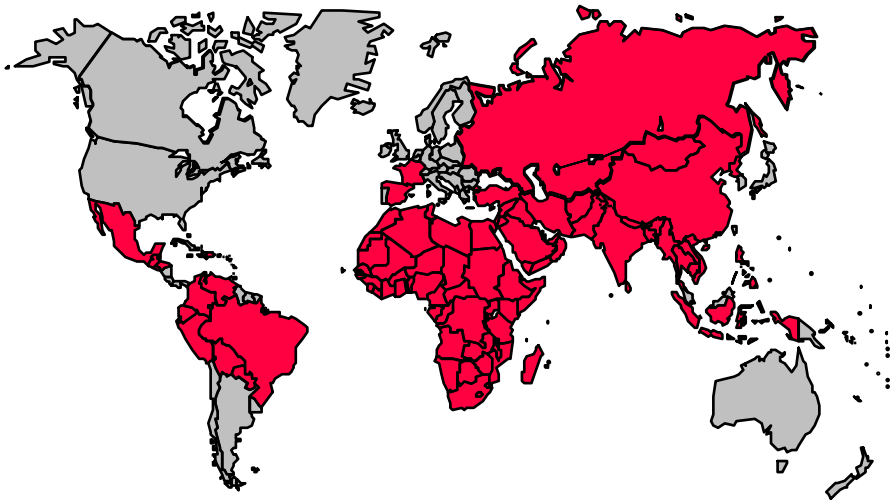
- Introduction by oral way
- The new viruses go:
  - Intestine (feces)
  - Blood circulation and route lymphatic
- The viruses arrive to CNS
- Distrubution to neuron of the legs



STEEL LUNG



How many polio cases are there?



1988

- 350,000 cases
- 125 endemic countries
- World Health Assembly resolved to eradicate polio

2013

- 416 cases reported (as of 14 May 2014)
- 3 endemic countries
- 7 countries with re-established transmission

Types of polioviruses

- 3 Types of polioviruses
  - Wild poliovirus (WPV) – 3 serotypes
    - **Type 1 – 416 cases in 2013** (this is the only type of WPV in circulation today)
    - Type 2 – eliminated in 1999
    - Type 3 – last case reported in 2012 (more time is needed to certify eradication)

Types of Oral Polio Vaccines

- 3 Types of Oral Polio vaccine
  - **Tri**valent OPV (tOPV): types 1, 2 *and* 3
    - most commonly used OPV in routine immunization globally
  - **Bi**valent OPV (bOPV): types 1 *and* 3
    - commonly used in supplementary immunization activities (SIAs)
  - **Mono**valent OPV (mOPV): type 1, 2 *or* 3
    - primarily used for SIAs in areas where only type 1 or type 3 is circulating

OPV is still the primary vaccine for eradication

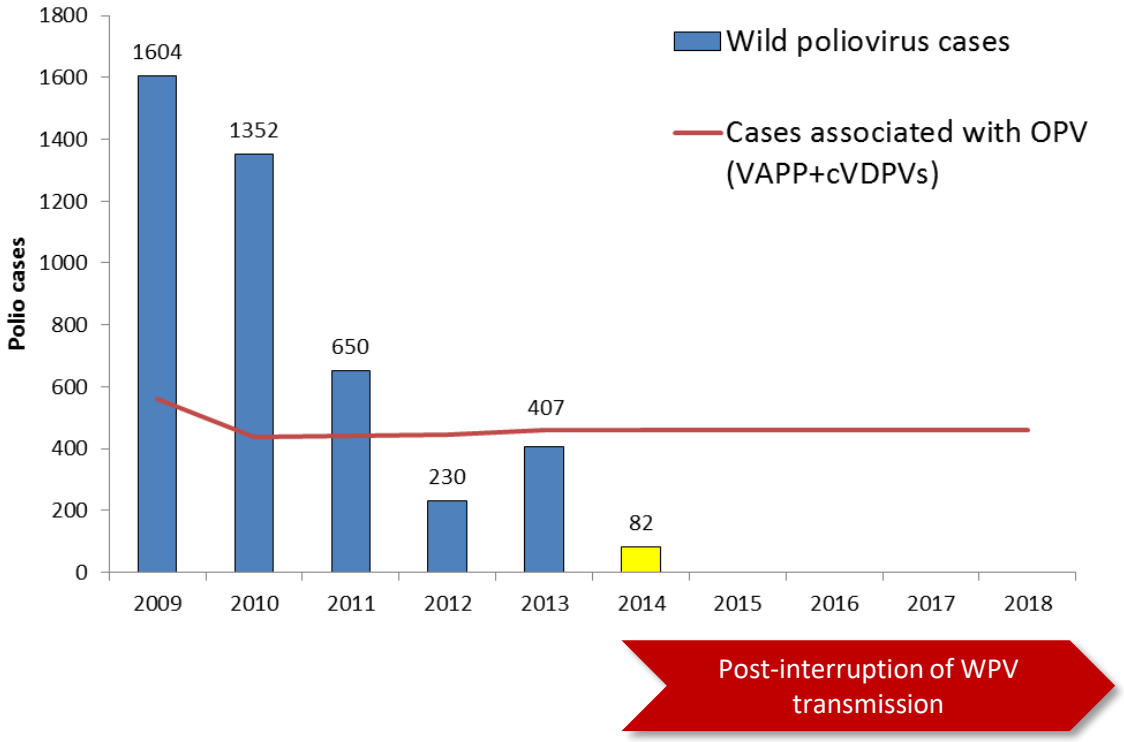
Paralysis associated with OPV

- OPV offers effective protection against polio, but…
- In very rare cases it can lead to paralysis
  - **Vaccine Associated Paralytic Polio (VAPP)**
    - Vaccine virus spontaneously changes and becomes capable of causing disease to the nervous system
    - 1 case per 2.4 million vaccine doses administered
    - 250-500 cases/year
    - 40% of VAPP are from type 2 OPV
  - **Circulating Vaccine Derived Poliovirus (cVDPV)**
    - Rare outbreaks caused by person-to-person spread of vaccine strain, which mutates/changes to a highly transmissible form capable of causing disease to the nervous system, in areas/countries with low immunity against polio
    - 97% of cVDPVs are from type 2 OPV
    - Low coverage is one of the main factors for the occurrence of cVDPVs

WPV and vaccine-related polio cases 2009-2014*

Through the use of OPV, polio cases related to the wild poliovirus have decreased.

Today the number of polio cases due to OPV is greater than those related to the wild virus.



* as of 21 May 2014

Polio eradication plan

- In May 2012 the World Health Assembly of WHO declared poliovirus eradication to be a global public health emergency
- Under this plan to achieve a polio-free world, they recommend that the **use of OPV must eventually be stopped worldwide**
- Type 2 OPV has the two risks: VAPP and cVDPV – and is no longer needed for eradication – hence the type 2 containing OPV will be eventually withdrawn from use
- OPV will be withdrawn in 2 phases beginning with type 2 OPV

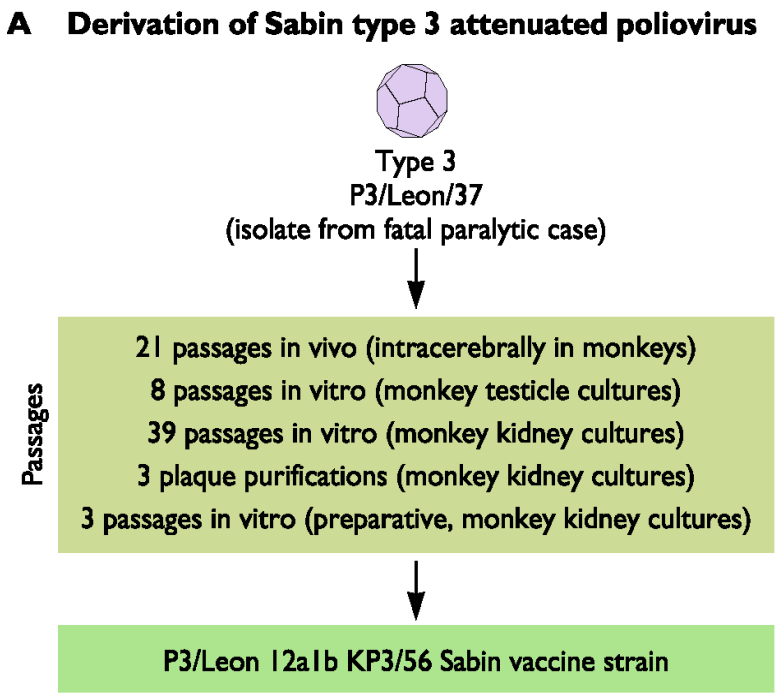
Polio eradication plan (continued)

- WHO's Strategic Advisory Group of Experts (SAGE) recommends that all countries introduce **at least one dose of IPV** into their routine immunization schedule by the end of 2015, before type 2 OPV is withdrawn

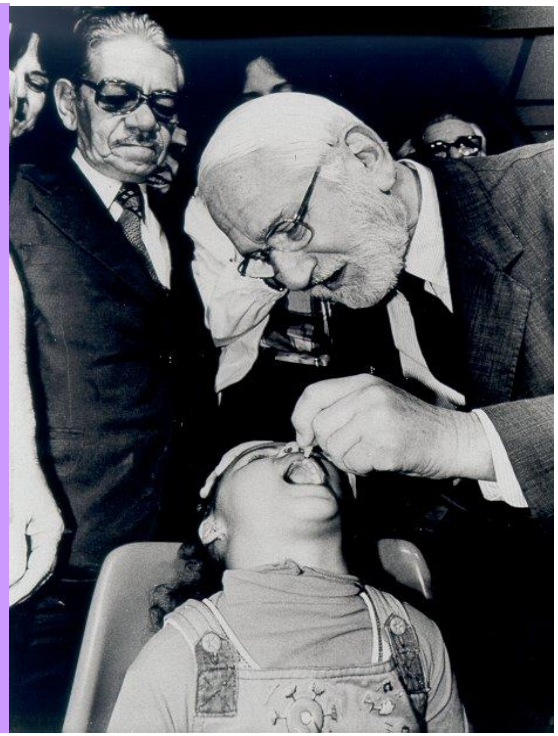
- Rationale for this includes:
- To **reduce risks** of an outbreak after type 2 OPV vaccine withdrawal
- To **help stop outbreaks quickly** if type 2 virus is reintroduced
- To **boost immunity** against polio types 1 & 3 to protect populations and hasten eradication

Attenuated poliovirus vaccines

Sabin (live attenuated, or OPV) poliovirus vaccine consists of 3 serotypes of the virus, developed in 1961



..... by modern methods of manufacture, it is extremely safe, and the chances of causing paralysis are less than one in a million.



Comparison of OPV and IPV?

Oral polio vaccine (OPV)

- Live, attenuated (weakened) virus
- Administered by **drops**

- Highly successful in reducing transmission in developing countries as part of eradication strategy
- Inexpensive
- Easy to administer
- Provides mucosal/gut immunity
- Protects close contacts who are unvaccinated

Inactivated polio vaccine (IPV)

- Killed virus
- Administered by **injection**

- Highly effective
- Used commonly in developed countries

- More expensive than OPV
- Requires trained health workers
- Provides immunity through blood
- Carries no risk of VAPP or VDPV

Both vaccines are needed to fully eradicate polio!

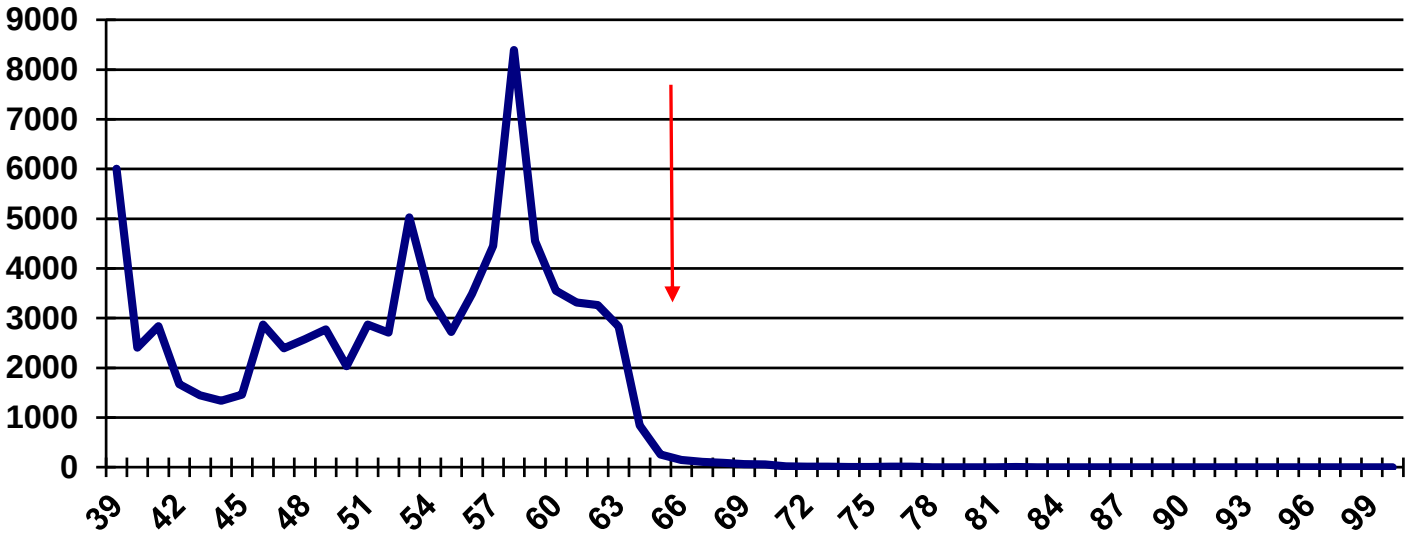
Why IPV?

- IPV does not cause any paralysis and is a very safe vaccine
- IPV introduction sets the stage for ending OPV use entirely after WPV eradication has been achieved
- When use of OPV is eventually stopped, IPV will continue to provide full protection
- Introducing IPV to our community also helps us remind caretakers about the importance of vaccinations overall, inform them about missed and upcoming vaccinations.

Key Messages

- Polio is a highly contagious viral disease that can spread rapidly through person-to-person contact causing permanent paralysis
- There are 3 types of wild poliovirus but only type 1 remains in circulation today
- OPV is inexpensive and effective at reducing polio transmission in developing countries, but carries a risk of VAPP and VDPV
- All use of OPV must stop for the world to be completely polio-free
- IPV is being introduced to provide protection against all 3 serotypes, while OPV is being phased out, to help us make the world polio free

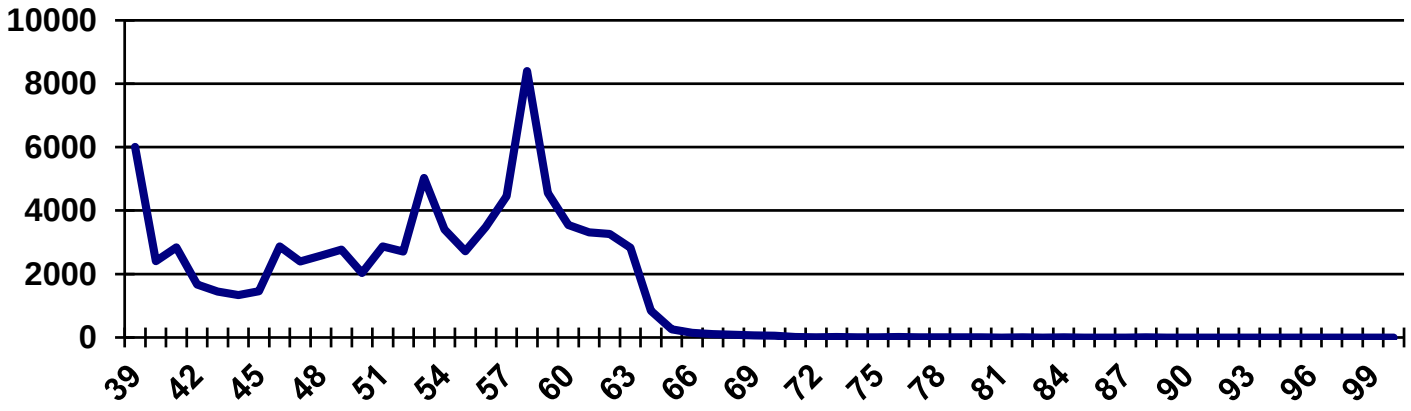
Poliomyelitis in Italy; 1939-2000



In Italy, the last polio native case was in Naples in 1982 (little epidemic) and last of imported polio case in 1988.

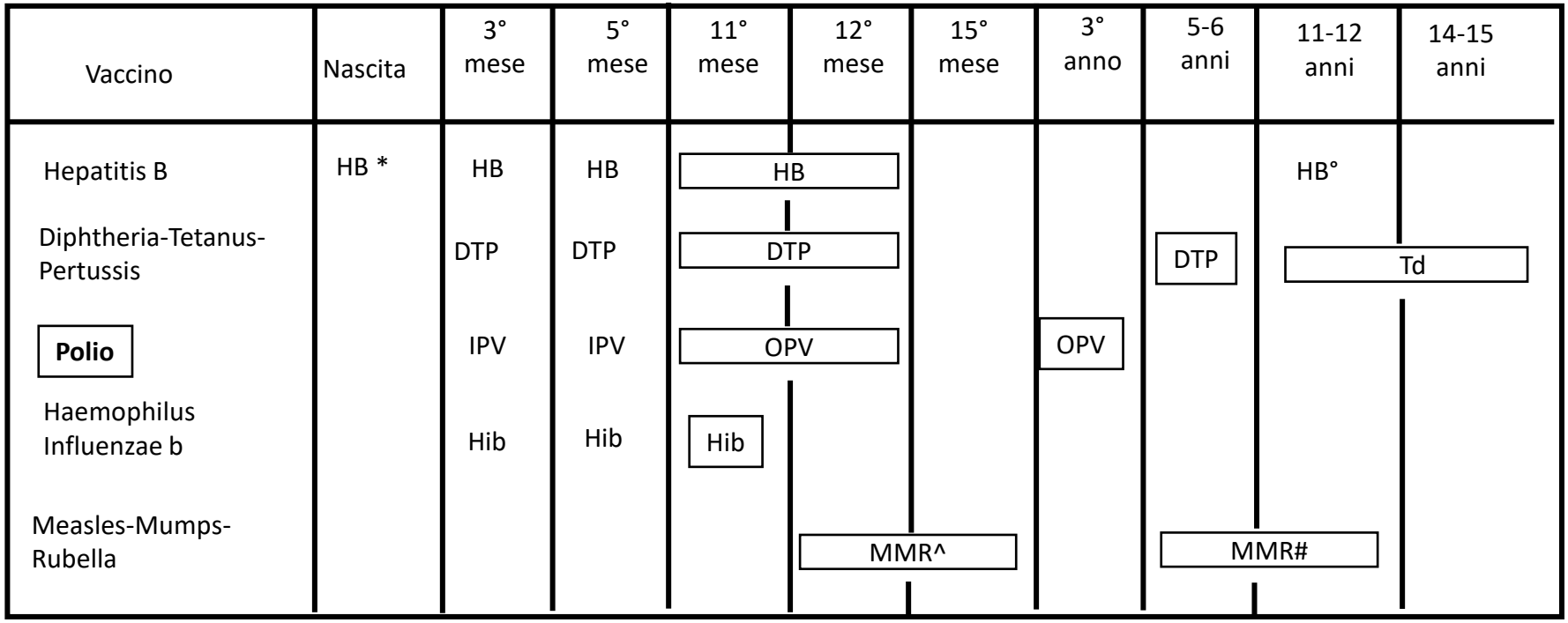
Polio Vaccine in Italy

In Italy the Salk vaccine (IPV) was adopted in 1957. In the two-year period 1959-1960 vaccination is recommended for people aged 0 to 20 when the incidence of poliomyelitis reaches its peak in Italy, with over 8000 cases declared. The Sabin vaccine (OPV) replaced IPV in the spring of 1964, when a mass vaccination campaign for the population aged 0 to 20 began. In 1964 the declared cases of poliomyelitis in Italy were about 3000. In 1965 the declared incidence was limited to 500 cases. In 1966, polio vaccination becomes mandatory. The last indigenous case was reported in 1982, followed by two cases in 1984 and 1988 imported from Iran and India respectively. In the period between 1995 and 2002, nine cases of vaccination-associated poliomyelitis occurred, which is why in 2002 it was decided - basically following the example of the rest of the developed world - to return to the IPV vaccine.



MANDATORY VACCINES SCHEDULE IN ITALY FROM 1991.

Vaccine	3° month	5° month	11° month	3° year	5°-6° year	12°
Polio	OPV	OPV *	OPV **	OPV		
Diphtheria -Tetanus	DT	DT *	DT **		DT	
HBV	HB	HB *	HB **		HB ***	


Vaccino
Nascita
3° mese
5° mese
11° mese
12° mese
15° mese
3° anno
5-6 anni
11-12 anni
14-15 anni
Hepatitis B
HB *
HB
HB
HB
HB°
Diphtheria-Tetanus-Pertussis
DTP
DTP
DTP
DTP
Td
Polio
IPV
IPV
OPV
OPV
Haemophilus Influenzae b
Hib
Hib
Hib
Measles-Mumps-Rubella
MMR^
MMR#

Polio Vaccine in Italy

Due to the different adhesion to the vaccination campaign that took place in the South compared to the North of the country, with an incidence of polio infections three times higher in the South than in the North in the three-year period 1966-68, with the law of 4 February 1967 and 25 May 1967, the Minister of Health made vaccination in the first year of life and revaccination in the third year compulsory in the vaccination calendar. In 1982 the last two autochthonous cases (two unvaccinated Italian children) were recorded in Italy, while in the following years only occasional cases of children of foreign origins occurred. In Italy, after noting that nine of the ten cases of paralysis following the administration of oral polio vaccine (OPV) in the 1990s had occurred after the first administration, the vaccination schedule was modified by introducing the intramuscular virus vaccine for the first two doses. Salk-type killed poliomyelitis (IPV), maintaining the OPV for the last two doses. But already in 2002 Italy, declared "Polio-Free" by the WHO, together with the rest of Western Europe, completely abandoned the OPV vaccine to adopt basic immunization with four administrations of IPV. Only in the event of an outbreak of an epidemic, where the IPV vaccine is now being used, would the use of the OPV be required again, of which a supply is still kept for emergencies.

Four countries in the world were polio-endemic at the beginning of 2006:

Nigeria,
India,
Pakistan,
Afghanistan

Polio cases from 22 February 2005 to 21 February 2006

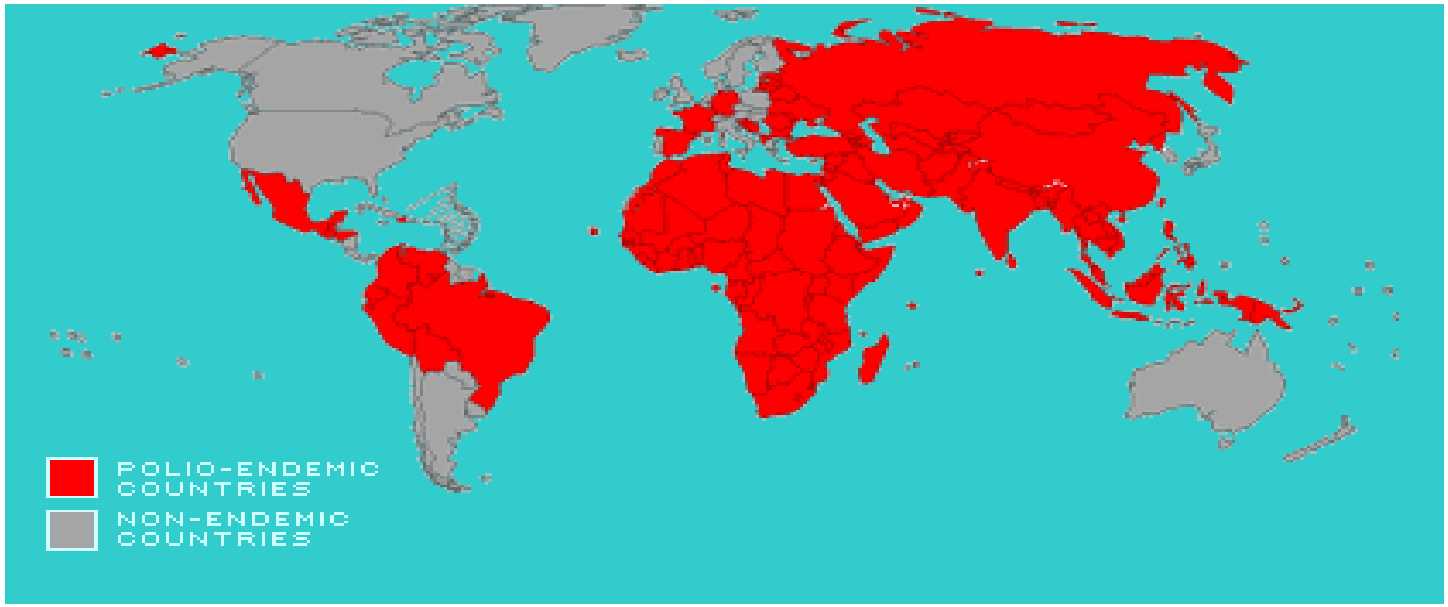
Total cases of poliovirus worldwide: 1932

Nigeria (endemic)	788
Yemen (importation)	478
Indonesia (importation)	302
Somalia (importation)	184
India (endemic)	66
Pakistan (endemic)	27
Sudan (importation)	27
Ethiopia (importation)	22
Angola (importation)	10
Niger (importation)	10
Afghanistan (endemic)	7
Nepal (importation)	4
Mali (importation)	3
Chad (importation)	2
Eritrea (importation)	1
Cameroon (importation)	1

Eight countries had circulation of imported wild poliovirus in the past 6 months:

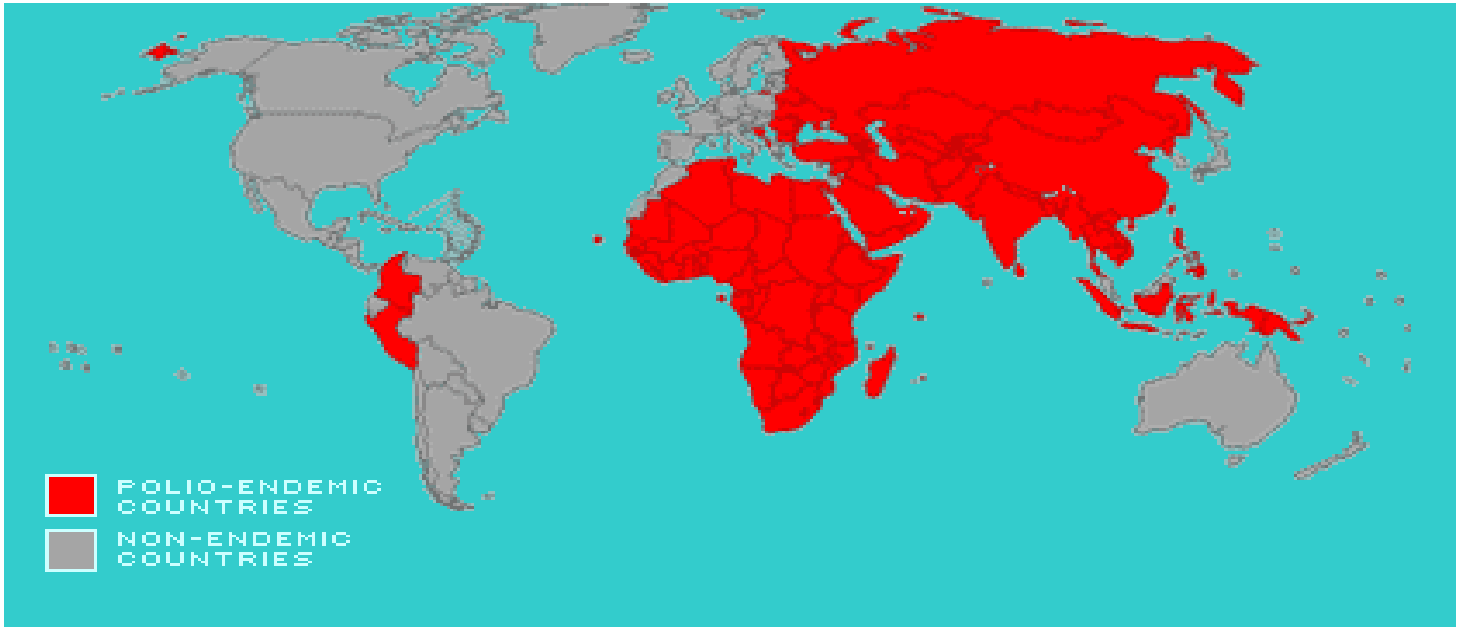
Somalia,
Indonesia,
Niger,
Chad,
Ethiopia,
Yemen,
Angola,
Nepal.

Poliomyelitis: story of eradication



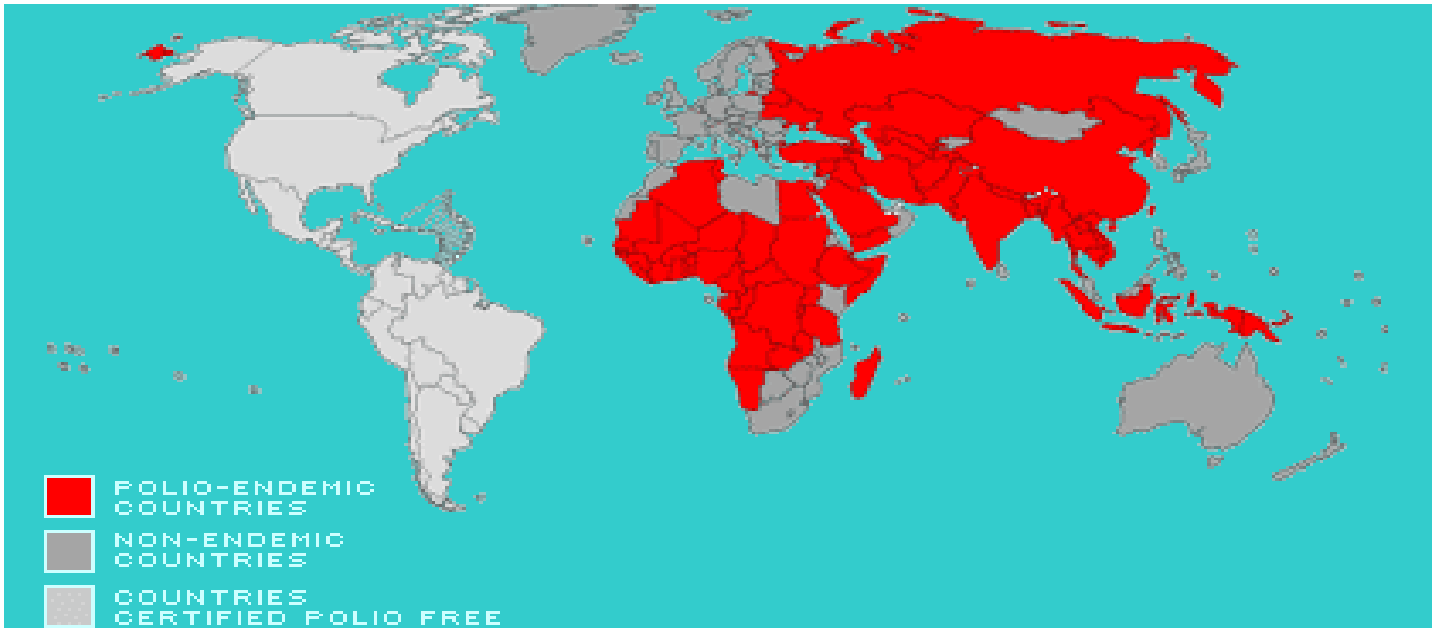
1988 1991 1994 1997 1998 2000 2002 2003

Poliomyelitis: story of eradication



Ultimo caso di poliomielite nella Regione WHO "Americhe"

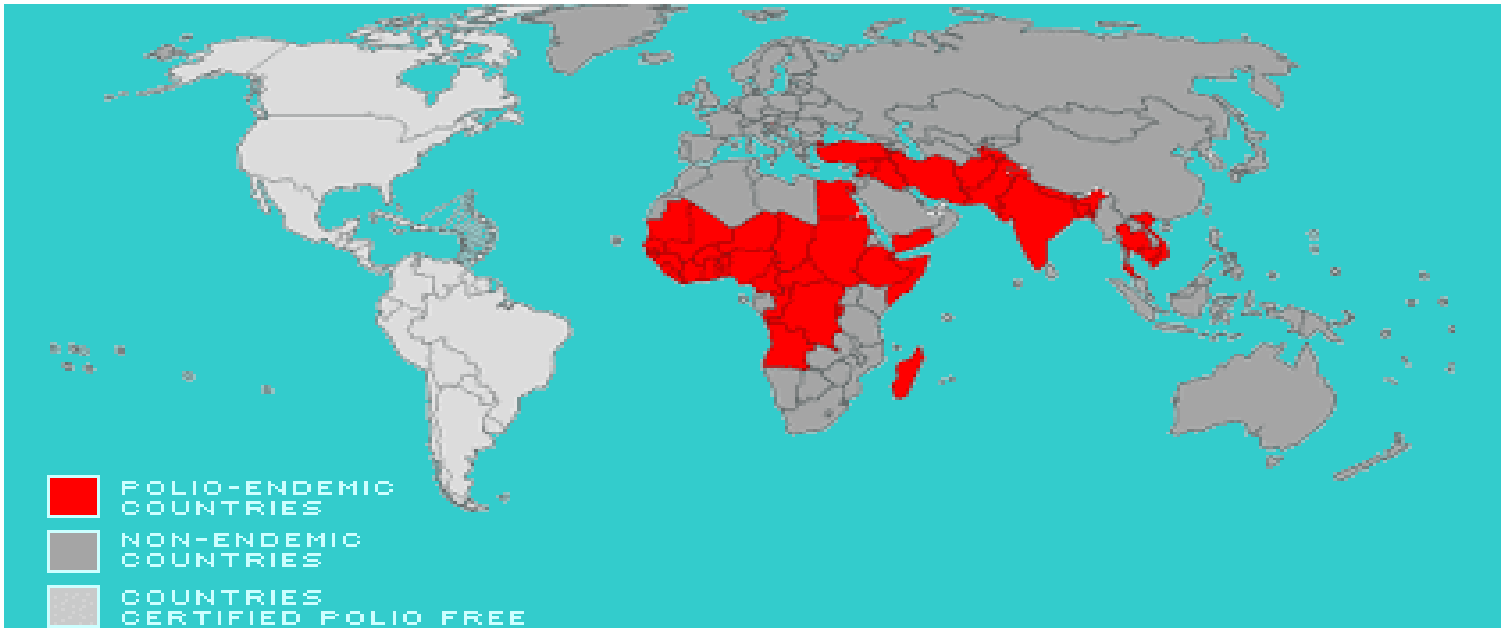
Poliomyelitis: story of eradication



1988 1991 **1994** 1997 1998 2000 2002 2003

La Regione WHO "Americhe" viene certificata polio-free

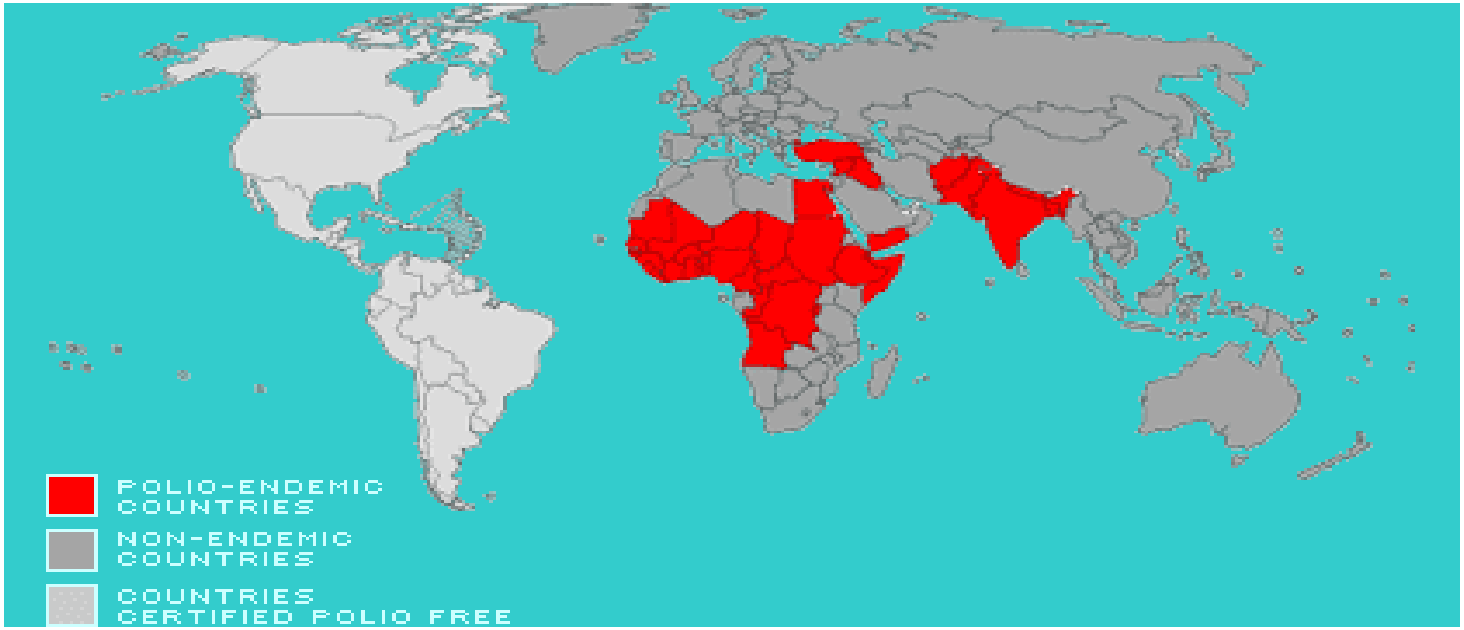
Poliomyelitis: story of eradication



1988 1991 1994 **1997** 1998 2000 2002 2003

Ultimo caso di poliovirus selvaggio
nella Regione WHO "Pacifico Occidentale"

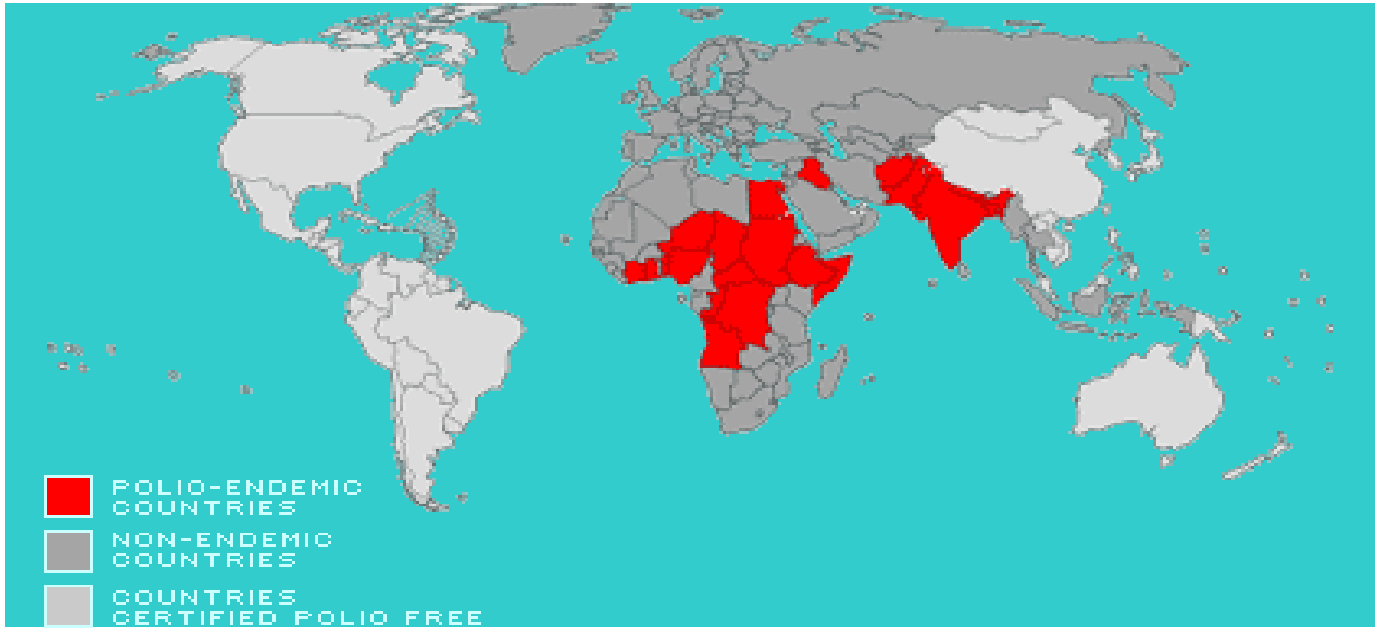
Poliomyelitis: story of eradication



1988 1991 1994 1997 **1998** 2000 2002 2003

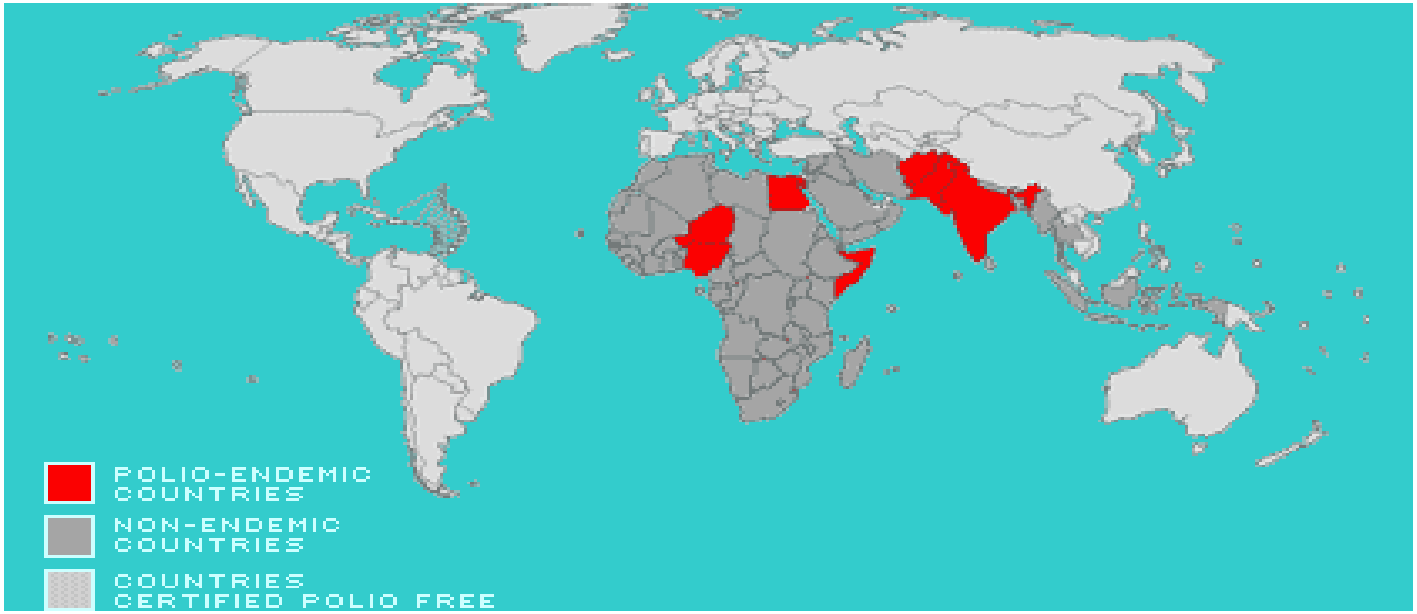
Ultimo caso di poliovirus selvaggio nella Regione WHO "Europea"

Poliomyelitis: story of eradication



La Regione WHO "Pacifico Occidentale" certificata polio-free

Poliomyelitis: story of eradication



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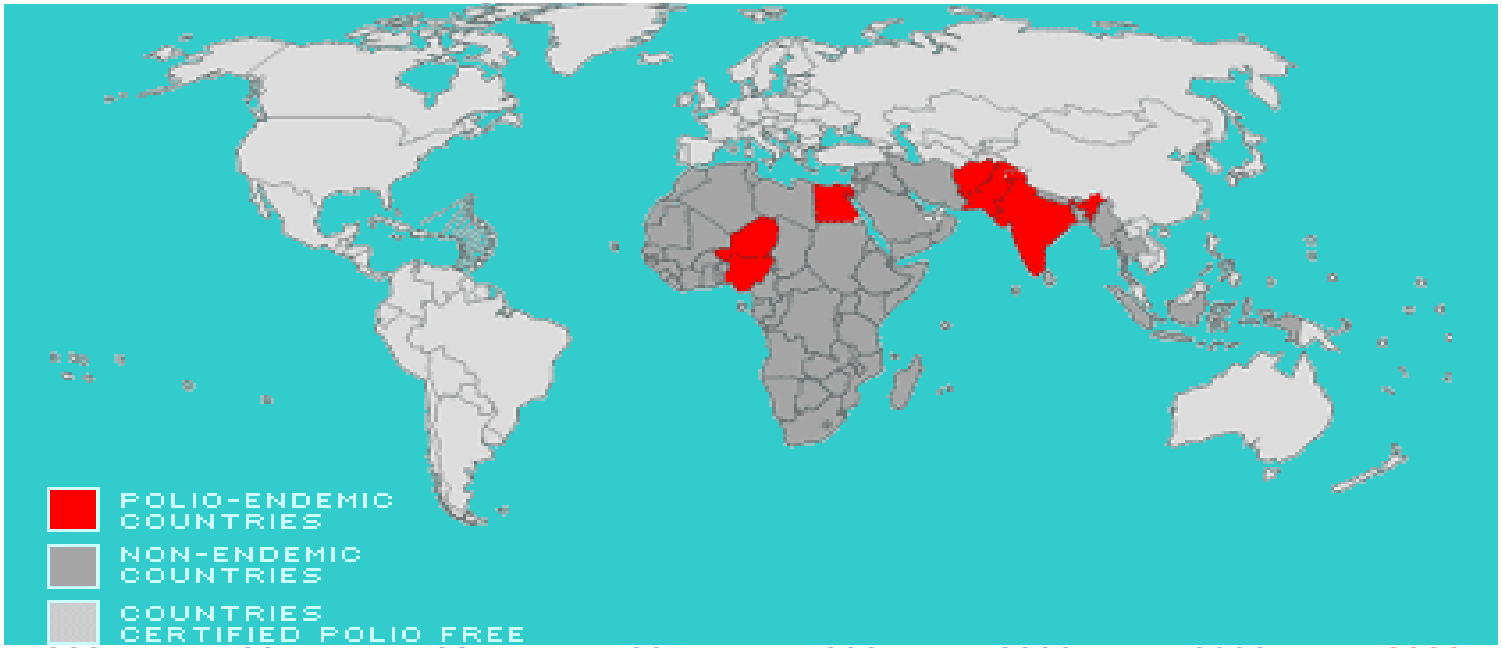
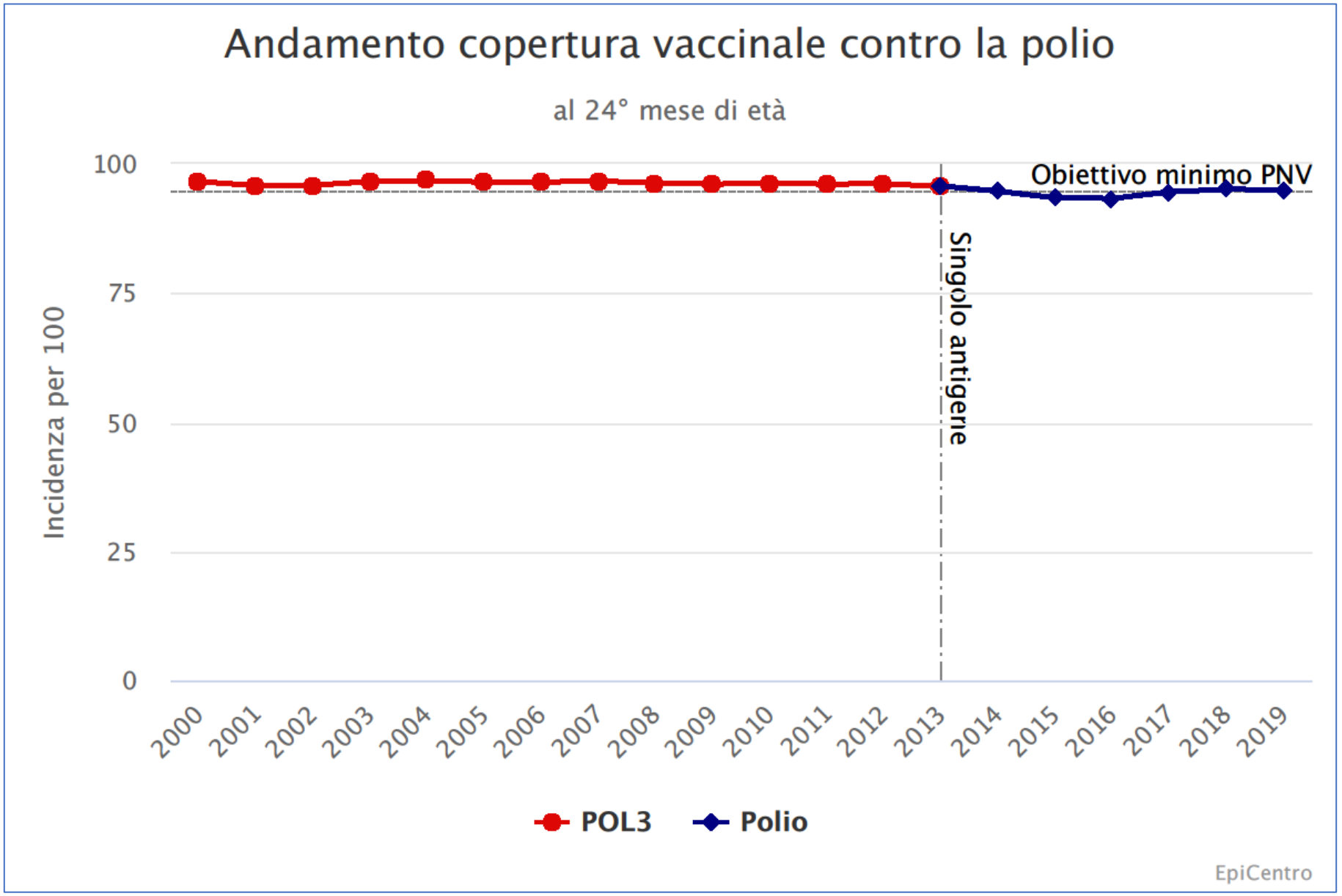
La Regione WHO "Europea" certificata polio-free

Poliomyelitis: story of eradication



Sei nazioni ancora endemiche
(Nigeria, India, Pakistan, Niger, Afghanistan)


Andamento copertura vaccinale contro la polio
al 24° mese di età
Incidenza per 100
100
75
50
25
0
Obiettivo minimo PNV
Singolo antigene
2000
2001
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2004
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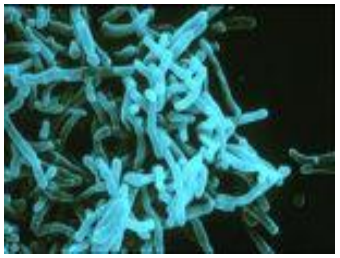
2016
2017
2018
2019
POL3
Polio
EpiCentro

DIPHTHERIA

www.osmosis.org/learn/Corynebacterium_diphtheriae_(Diphtheria)

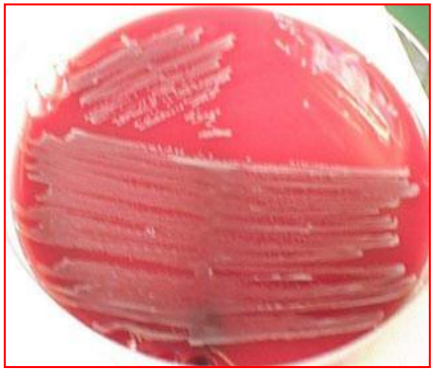
Corynebacterium diphteriae

- Gram positive aerobic bacterium



- The ability to produce the toxin is mediated by the presence of bacteriophage which carries the information necessary for its production.

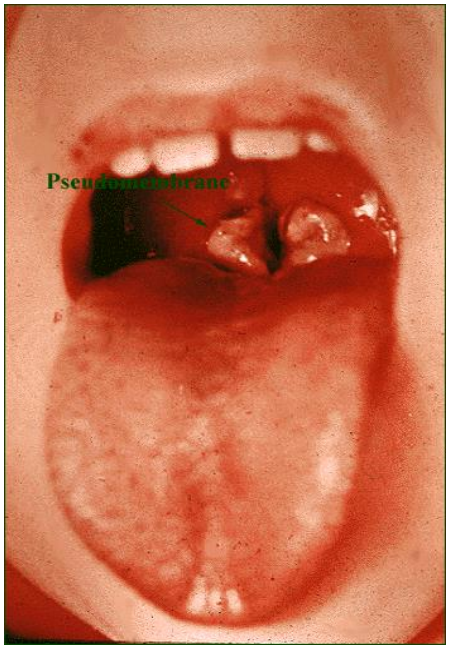
- There are four biotypes:
  - Mitis
  - Gravis
  - Intermedius
  - Belfanti



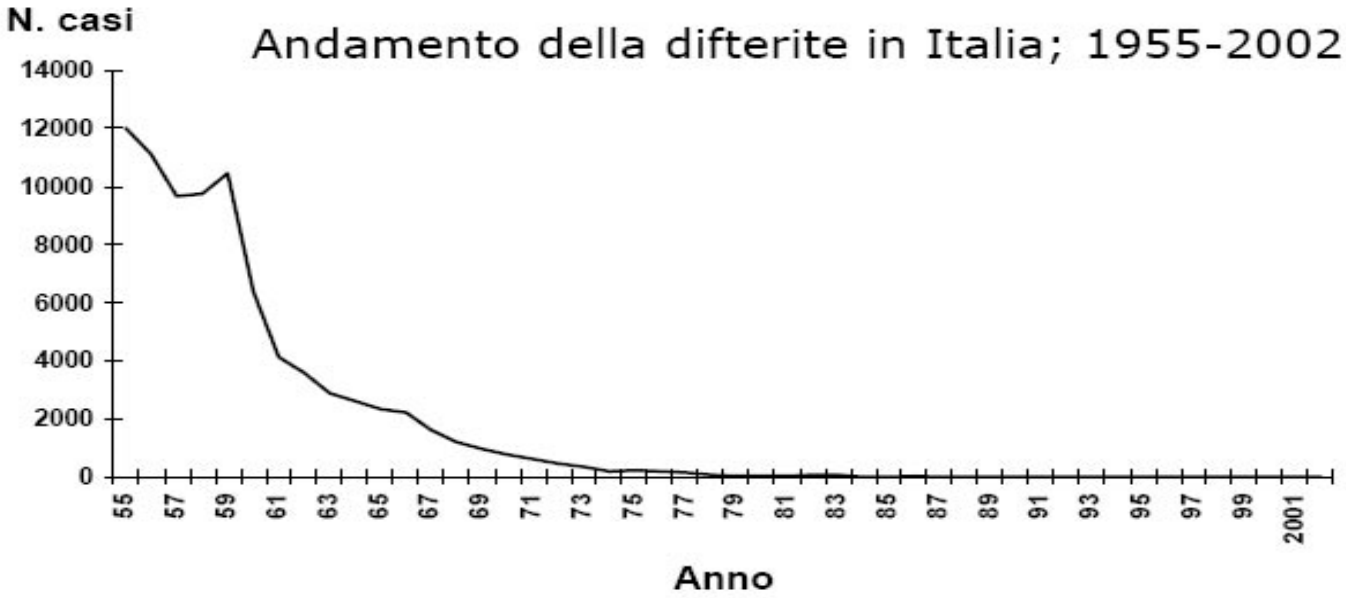
PATHOGENESIS

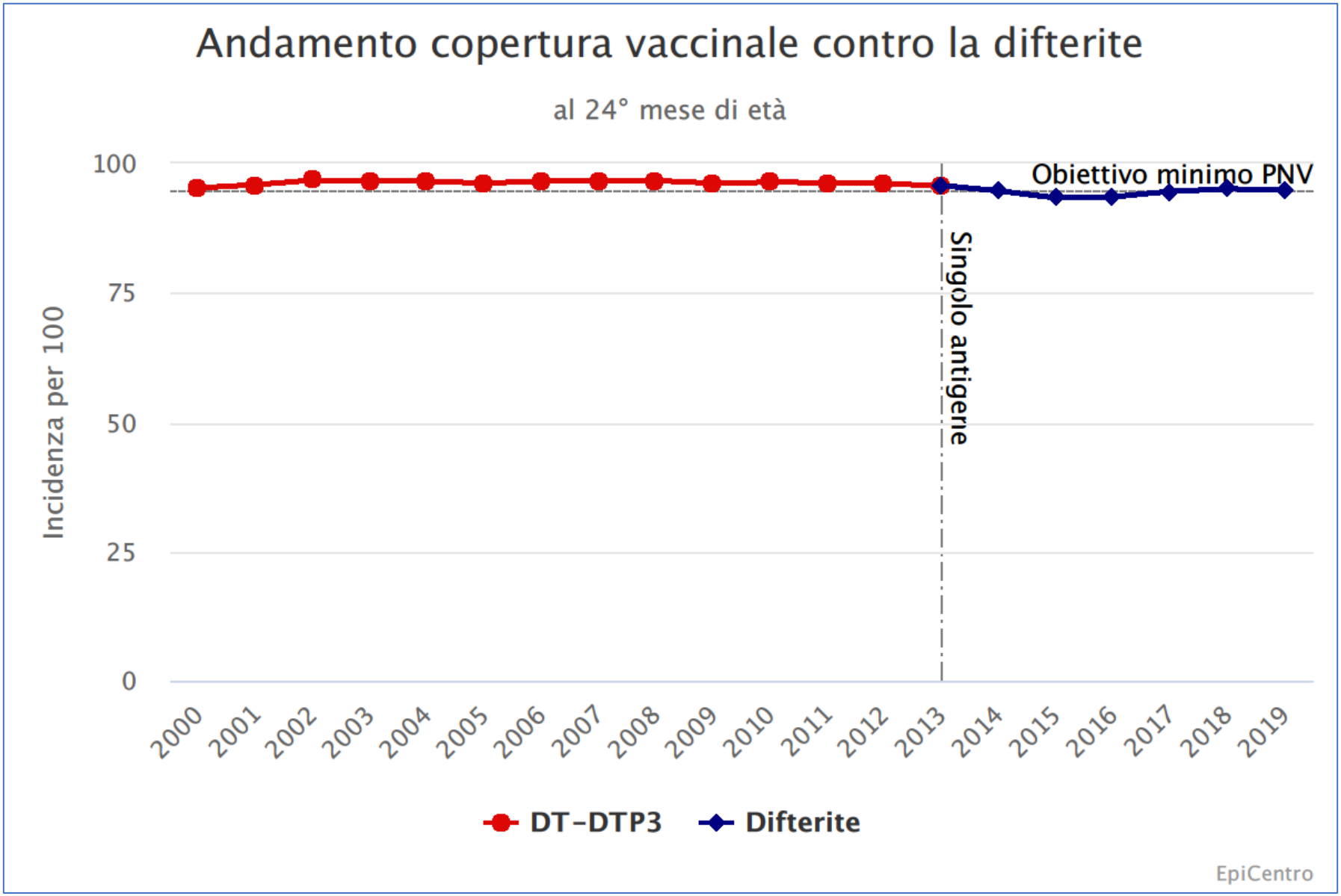
- **Source of infection (nasal pharyngeal secretions)**
- **Incubation 2-5 days**

- **Classified according to the site of infection**
  - **Nasal**
  - **Tonsillar and pharyngeal**
  - **Laryngeal**
  - **Cutaneous**
  - **Eye**
  - **Genital**



DIPHTHERIA IN ITALY




Andamento copertura vaccinale contro la difterite
al 24° mese di età
Incidenza per 100
100
75
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Obiettivo minimo PNV
Singolo antigene
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DT-DTP3
Difterite
EpiCentro

TETANUS

https://www.osmosis.org/learn/Clostridium_tetani_(Tetanus)

TETANUS

- Tetanus is an acute infectious disease caused by toxigenic strains of the bacterium *Clostridium tetani* (*C. tetani*).

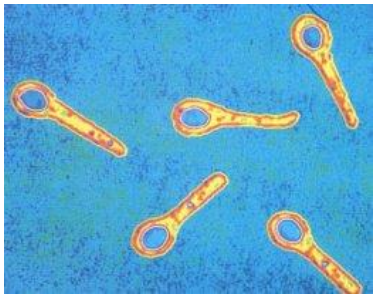
- The spores of *C. tetani* are present in the environment irrespective of geographical location; they enter the body through contaminated skin wounds or tissue injuries including puncture wounds.

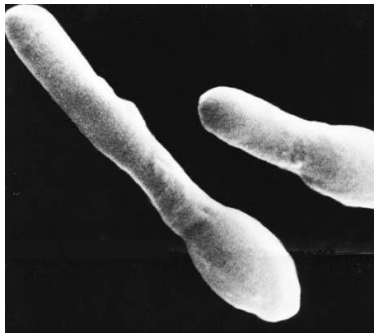
- The majority of reported tetanus cases are birth-associated, occurring in low-income countries among insufficiently vaccinated mothers and their newborn infants, following unhygienic deliveries and abortions and poor postnatal hygiene and cord care practices.

- The disease remains an important public health problem in many parts of the world where immunization programmes are suboptimal, particularly in the least developed districts of low-income countries

Clostridium tetani

- Obligate anaerobic bacterium, gram positive, sporogenous, sporigenous.
- Sensitive to heat and cannot survive in the presence of oxygen.
- The spores, on the other hand, are resistant to heat and normal disinfectants.
- They are found in the soil and in the feces of horses, sheep, cattle, dogs, cats etc.
- The toxin is produced as bacterium grows
- The letal dose in human is estimated at in 150 ng





Disease and Diagnosis

- Incubation period:
  - In non-neonatal tetanus varies between 3 and 21 days after infection.
  - In neonatal tetanus, symptoms usually present 3 to 14 days, averaging 7 days, after birth in 90% of cases.

- Characteristic features of the disease are muscular spasms.

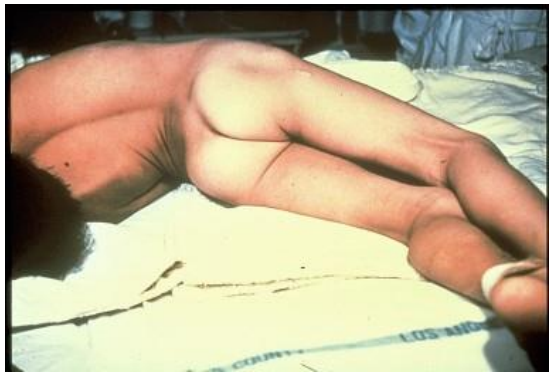
- Case-fatality rates vary from 10% to 70% depending on treatment, age and general health of the patient. Among patients in the youngest and oldest age groups without intensive care, case-fatality rates approach 100%.

- The diagnosis of tetanus is primarily based on clinical features and does not depend on laboratory confirmation.

CLINICAL FORMS

- Local (rare in the lesion site)
- Cephalic (with otitis media and involvement of the neck muscles)
- Generalized (the most common)
- Neonatal tetanus: transmitted through cutting with contaminated instruments of the umbilical cord.

- Generalized
  - First sign is the trismus (risus sardonicus)
  - Nuchal stiffness
  - Difficolty swallowing
  - Stiff abdominal muscles
  - Muscle spams

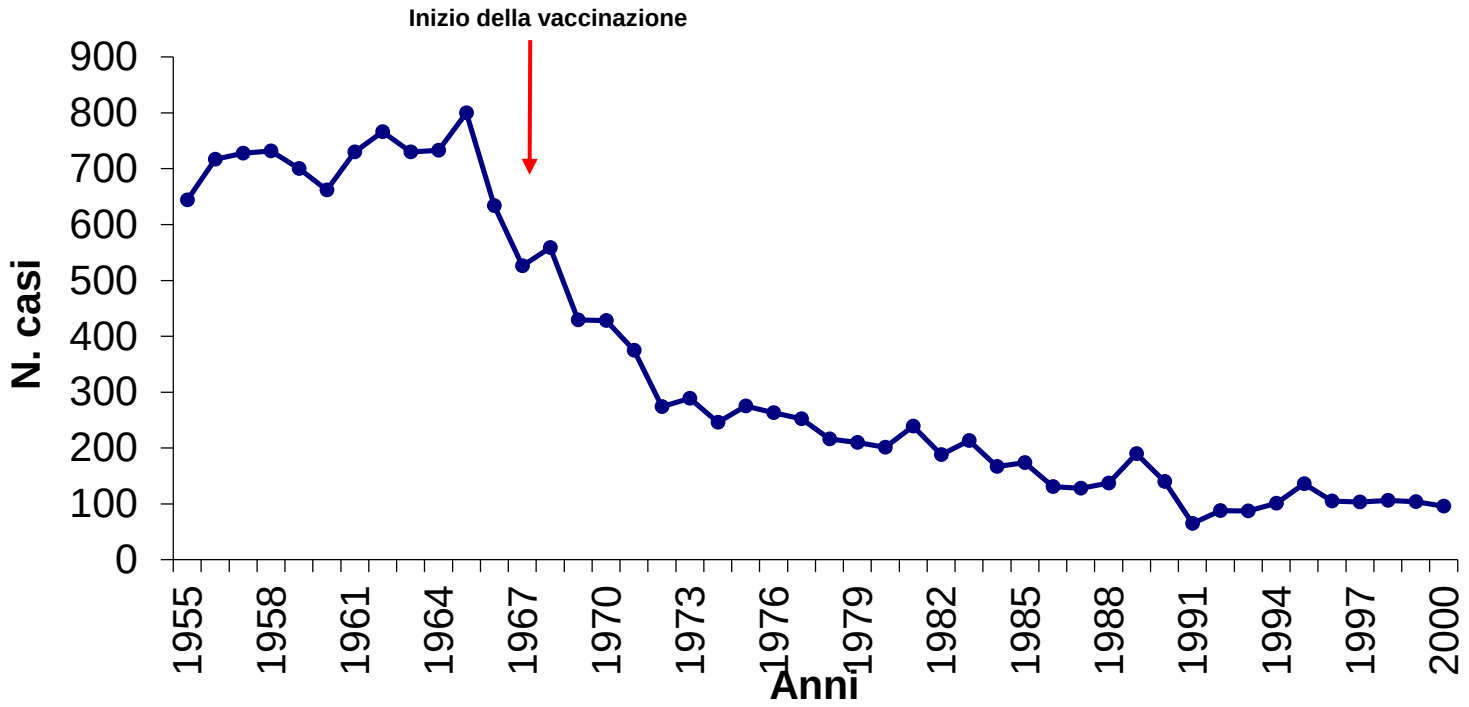


TETANUS VACCINE

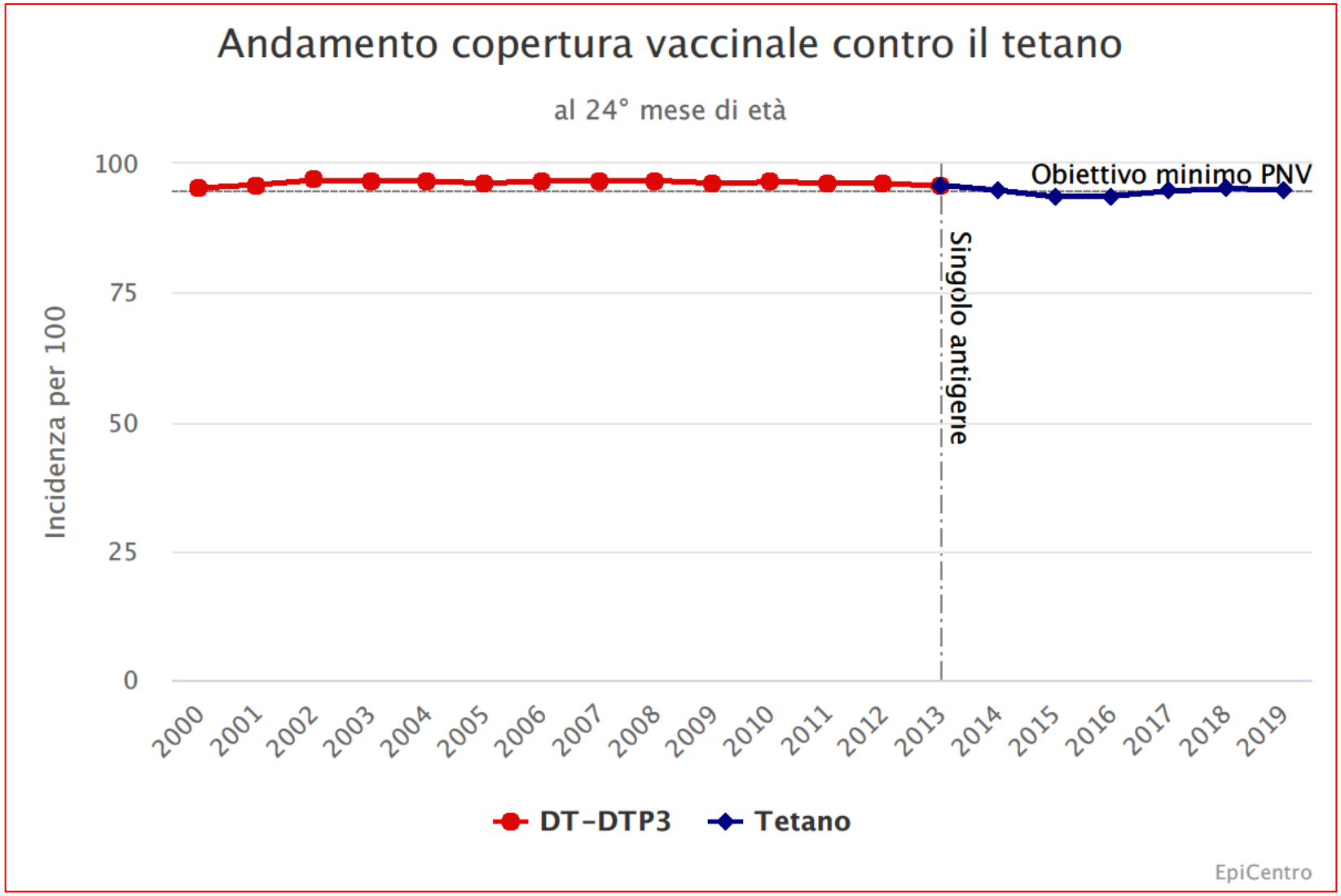
TT vaccine was first produced in 1924 and used extensively for the first time among soldiers during World War II. Since then, immunization programmes using TTCVs have been highly successful in preventing maternal and neonatal tetanus (MNT) as well as injury-associated tetanus.

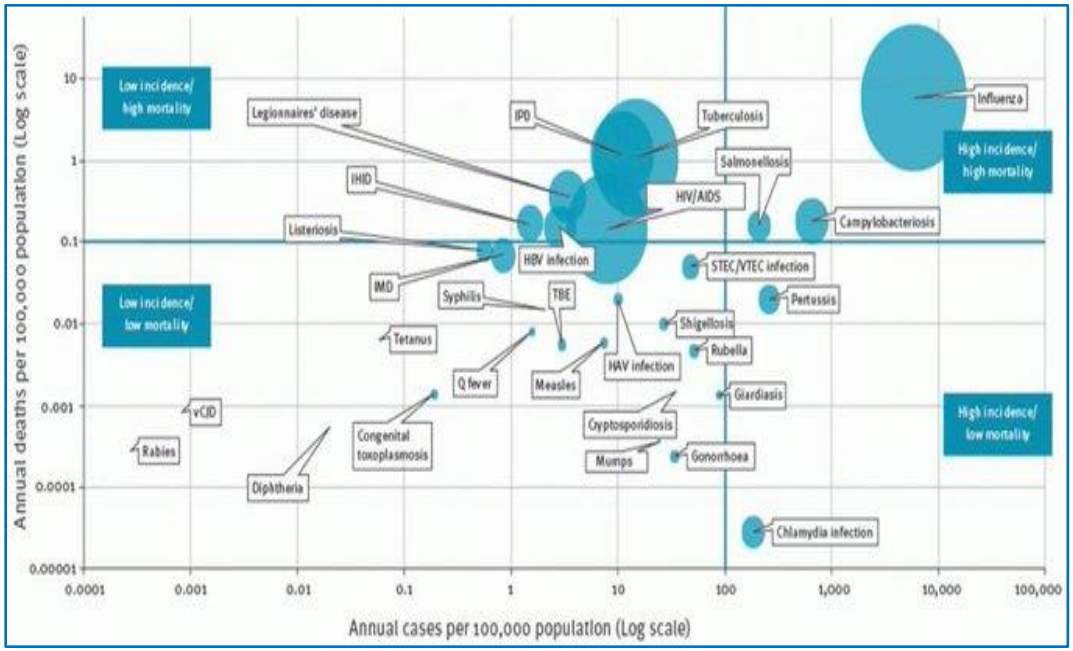
- In Italy, Tetanus vaccination has been made compulsory since 1938 for the soldiers, since 1963 for children in the second year of life and for some professional categories more exposed to risk of infection (farmers).
- 1968, vaccination since first year of life, the schedule provides three doses at third, fifith and twelfth month of age. A booster dose is performed in the sisth year and another at 14 years (Tetanus and Diphtheria with reduced content of anatoxins,Td)

TETANUS IN ITALY



1968: Tetanus vaccine became mandatory


Andamento copertura vaccinale contro il tetano
al 24° mese di età
Incidenza per 100
100
75
50
25
0
Obiettivo minimo PNV
Singolo antigene
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
DT-DTP3
Tetano
EpiCentro


Low incidence/ high mortality
High incidence/ high mortality
Low incidence/ low mortality
High incidence/ low mortality
Legionnaires' disease
IPD
Tuberculosis
Influenza
Salmonellosis
IHD
HIV/AIDS
Campylobacteriosis
Listeriosis
HBV infection
STEC/VTEC infection
IMD
Syphilis
TBE
Pertussis
Shigellosis
Tetanus
Rubella
Q fever
Measles
HAV infection
Giardiasis
vCJD
Cryptosporidiosis
Rabies
Congenital toxoplasmosis
Mumps
Gonorrhoea
Diphtheria
Chlamydia infection
Annual deaths per 100,000 population (Log scale)
10
1
0.1
0.01
0.001
0.0001
0.00001
0.0001
0.001
0.01
0.1
1
10
100
1,000
10,000
100,000
Annual cases per 100,000 population (Log scale)