Principles of Vaccination

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The word “vaccine” comes from the Latin word *vaccinus*, which means “pertaining to cows.” What do cows have to do with vaccines? The first vaccine was based on the relatively mild cowpox virus, which infected cows as well as people.

This vaccine protected people against the related, but much more dangerous, smallpox virus.

More than 200 years ago (in 1789), Edward Jenner, a country physician practicing in England, noticed that milkmaids rarely suffered from smallpox.

1777 – George Washington orders the inoculation of Continental Army = a ten time reduction in risk

The milkmaids often did get cowpox, a related but far less serious disease, and those who did never became ill with smallpox.

In an experiment that laid the foundation for modern vaccines, Jenner took a few drops of fluid from a skin sore of a woman who had cowpox and injected the fluid into the arm of a healthy young boy who had never had cowpox or smallpox.

Six weeks later, Jenner injected the boy with fluid from a smallpox sore, but the boy remained free of smallpox.

Dr. Edward Jenner

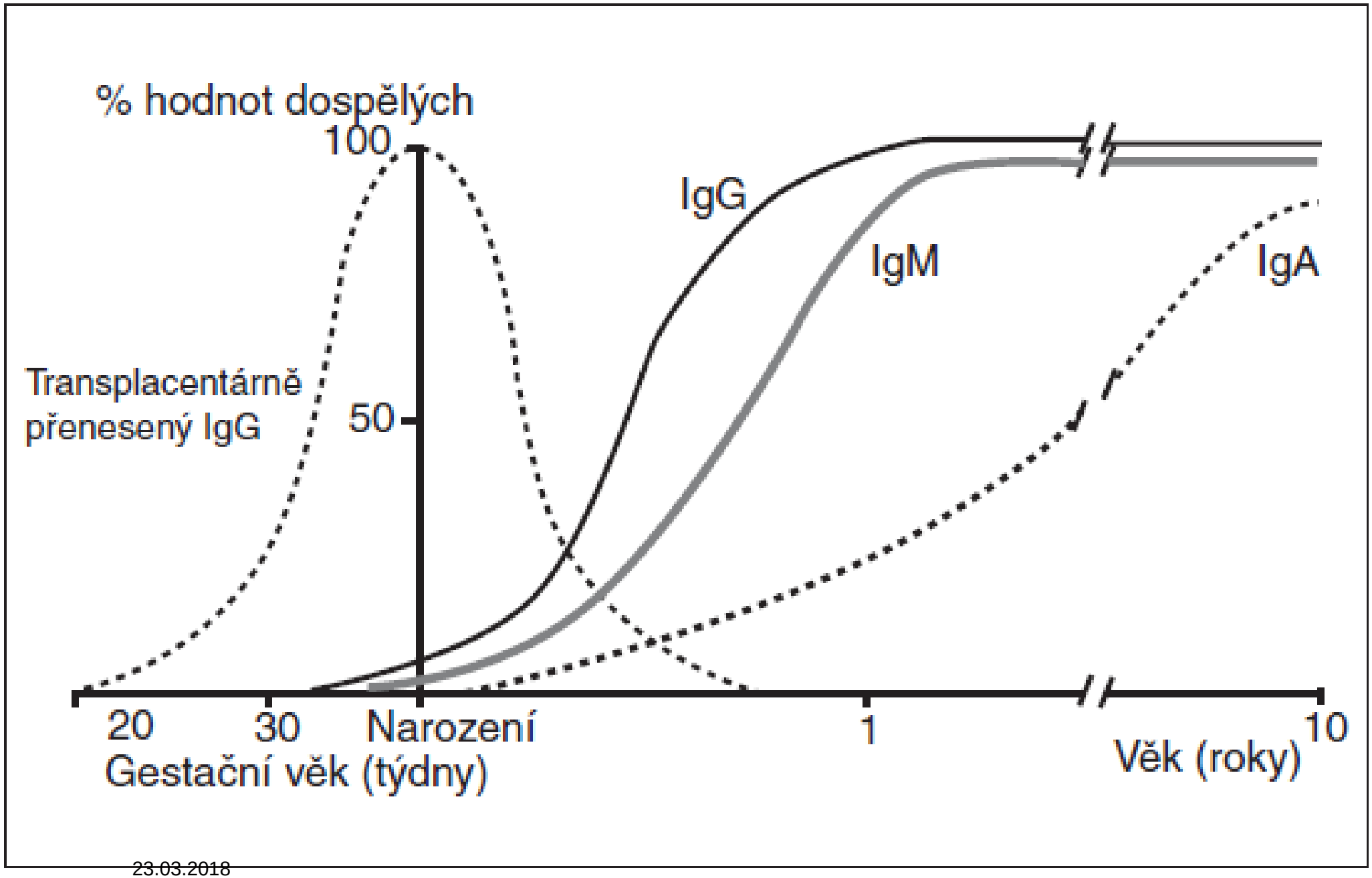
Dr. Jenner had discovered one of the fundamental principles of immunization.

He had used a relatively harmless foreign substance to evoke an immune response that protected someone from an infectious disease.

His discovery would ease the suffering of people around the world and eventually lead to the elimination of smallpox, a disease that killed a million people, mostly children, each year in Europe.

By the beginning of the 20th century, vaccines were in use for diseases that had nothing to do with cows—rabies, diphtheria, typhoid fever, and plague—but the name stuck.

Graf 1. Development of immunoglobulin levels



Šedivá A. Čes.-slov. Pediat., 2005, roč.60, č.11, s. 617-624

Remembering an Old Disease

Smallpox

Face lesions on boy with smallpox.

Public Health Images Library (PHIL) ID # 3.
Source: CDC/Cheryl Tyron

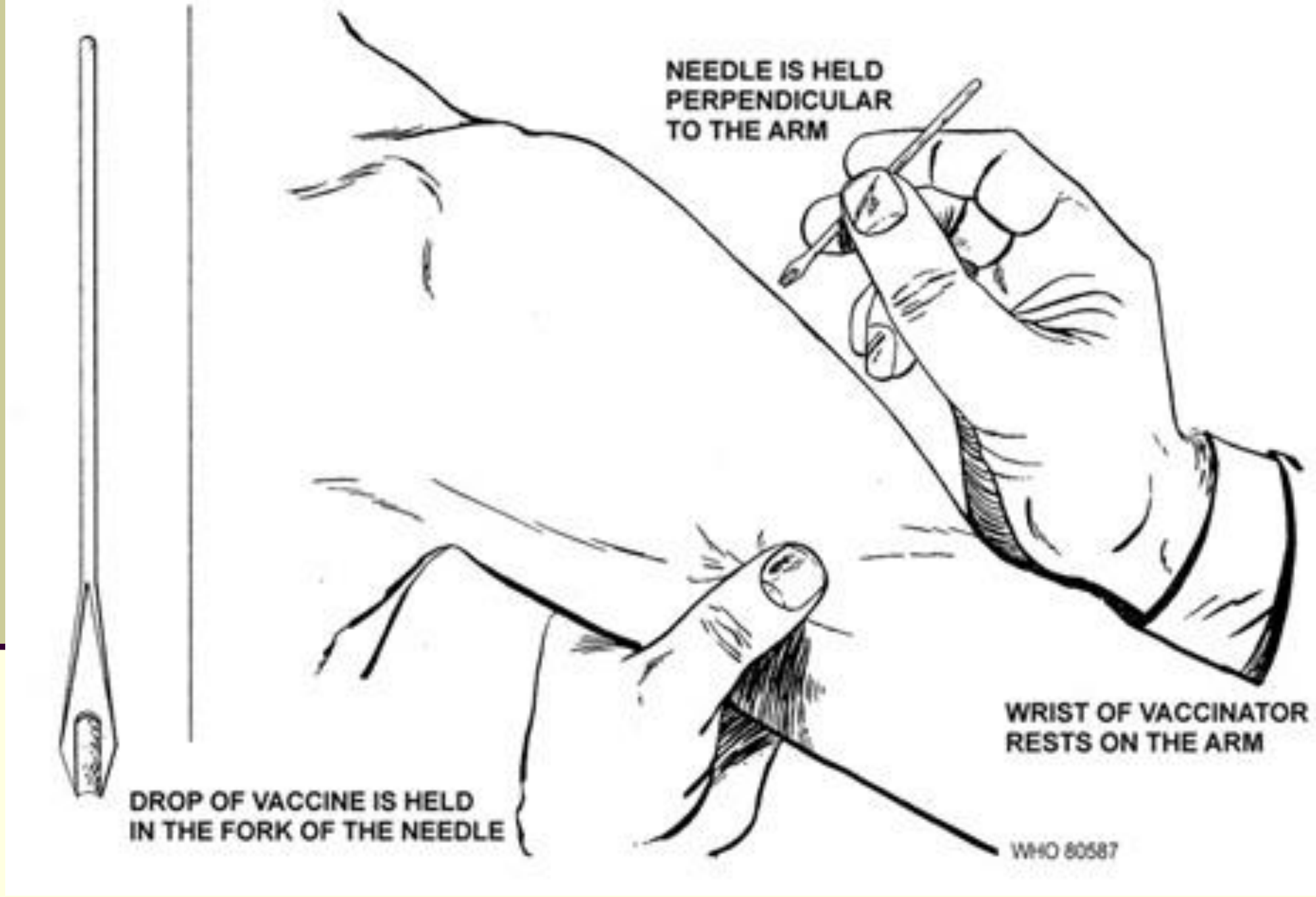
Smallpox recognition card, c.1973, courtesy Dr. Damodar Bhonsule, Panjim, Goa, India.

Smallpox lesions on skin of trunk.

Picture taken in Bangladesh, 1973.

Public Health Images Library (PHIL) ID # 284. Source: CDC/James Hicks

MULTIPUNCTURE VACCINATION BY BIFURCATED NEEDLE



Variola virus, which causes smallpox, was once the scourge of the world.

This virus passes from person to person through the air.

A smallpox infection results in fever, severe aches and pains, scarring sores that cover the body, blindness in many cases, and, often, death. There is no effective treatment.

Although vaccination and outbreak control eliminated smallpox in the United States by 1949, the disease still struck an estimated 50 million people worldwide each year during the 1950s.

In 1967, the World Health Organization (WHO) launched a massive vaccination campaign to rid the world of smallpox — and succeeded.

Rural vaccinator in United Provinces, British India,

c.1930, private collection of Dr. Sanjoy Bhattacharya

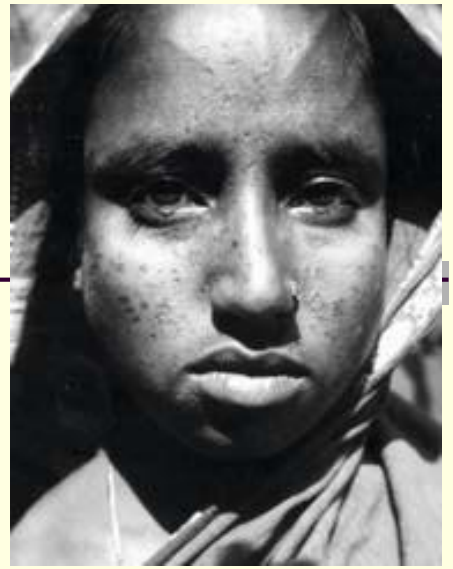
Eradication of smallpox - Czech experts

A key figure in the global eradication program smallpox was prof. MUDr. Karel Raska, MD., who drove in the sixties division Communicative Diseases of the WHO Secretariat in Geneva.

He promoted the establishment of a new, independent units "Eradication of smallpox"and ensure its initial financial and material support, not only in Geneva, but also in regional offices of WHO.

With its support of the program also attended the 20 Czechoslovak health professionals (14 Czechs and Slovaks 6), mainly epidemiologists.

The last natural case of smallpox occurred in Somalia in 1977.



Ali Maow Maalin, cook twenty-three

of the hospitals in the Somali Merce.

He contracted when he showed the path of the ambulance chauffeur who drove two sick children to camp insulation.

Mr. John Wickett, of the World Health Organization, with **the last person** to have contracted – **and survived** – naturally occurring smallpox in Somalia. (1977); courtesy Mr. John Wickett.

In 1978 was ill photographer Medical School in Birmingham, England. She was killed by a virus that escaped from a neighboring laboratory.

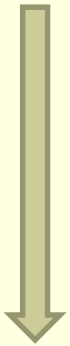
This unfortunate event has led to another strong request by the WHO to destroy the virus or transmit it to WHO Collaborating Centers equipped with the highest level of biological protection.

At present, viruses of smallpox are deposited into laboratories:

in Russia (Moscow)

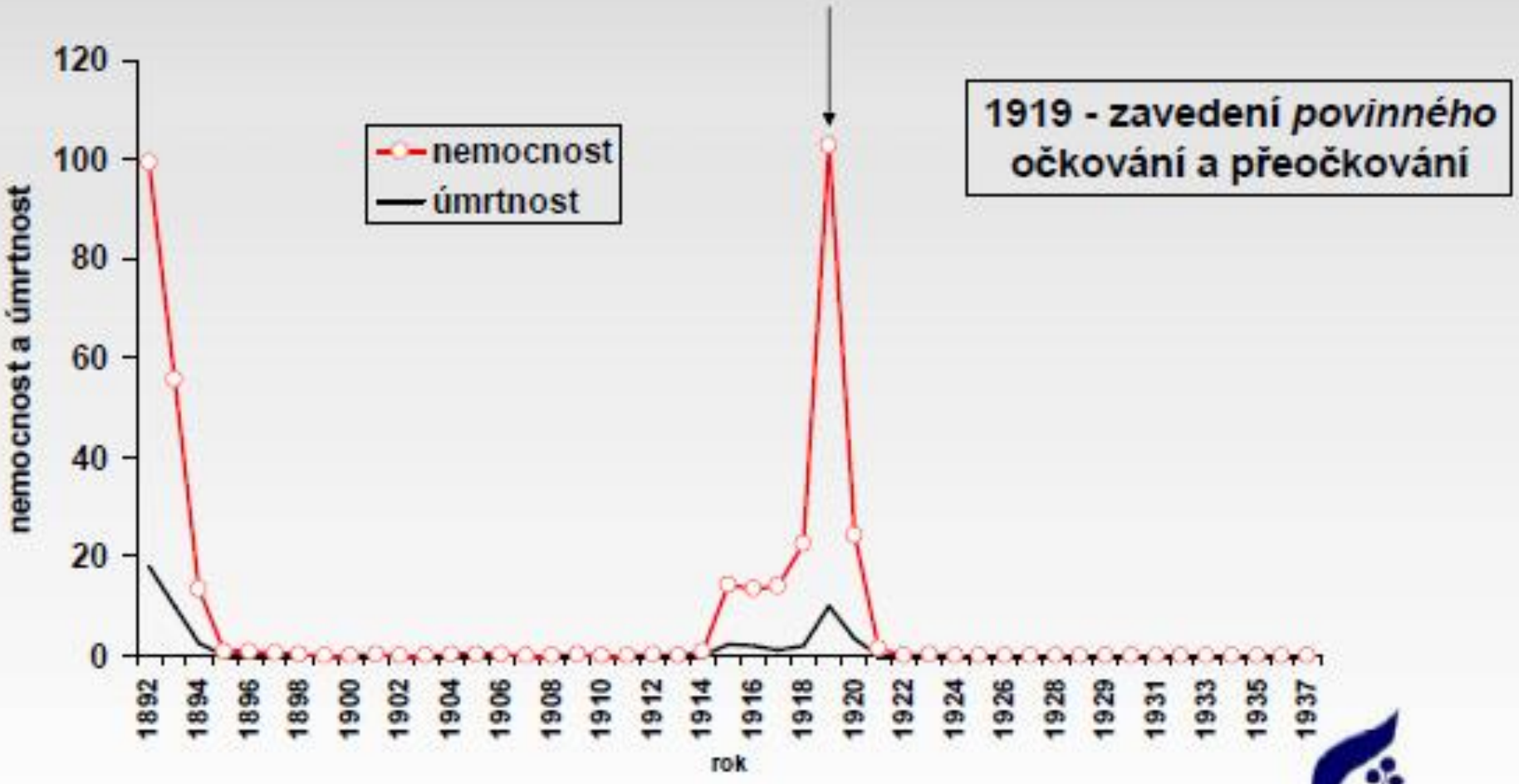
in USA (Atlanta)

In the Czech republic began to vaccinate against smallpox in 1821 on the basis of the issue of an imperial document.



Vaccination was terminated in 1980 with eradication of smallpox around the world.

Variola, České země, 1892-1937, nemocnost a úmrtnost na 100 000 obyvatel



Státní zdravotní ústav

SZÚ

Smallpox eradication was officially announced at the 33rd General Assembly WHO

8. May 1980.

Milestones in the eradication of smallpox

1789 Edward Jenner invents a smallpox vaccine.

1966 The World Health Organization (WHO) launches a massive global campaign to eradicate smallpox.

1972 Smallpox vaccinations are discontinued in the United States.

1975 and 1977 The last cases of the two known variants of smallpox occur in the world, in Bangladesh and Somalia.

1978 Two people are sickened in a lab accident in England; one dies.

1980 The WHO declares smallpox eradicated.

1991 Smallpox virus DNA is mapped.

1999 The WHO sets this deadline, by which remaining lab stocks of the virus are to be destroyed. The deadline will be postponed again and again.

2003 Millions of doses of vaccine are produced to hedge against a biological attack.

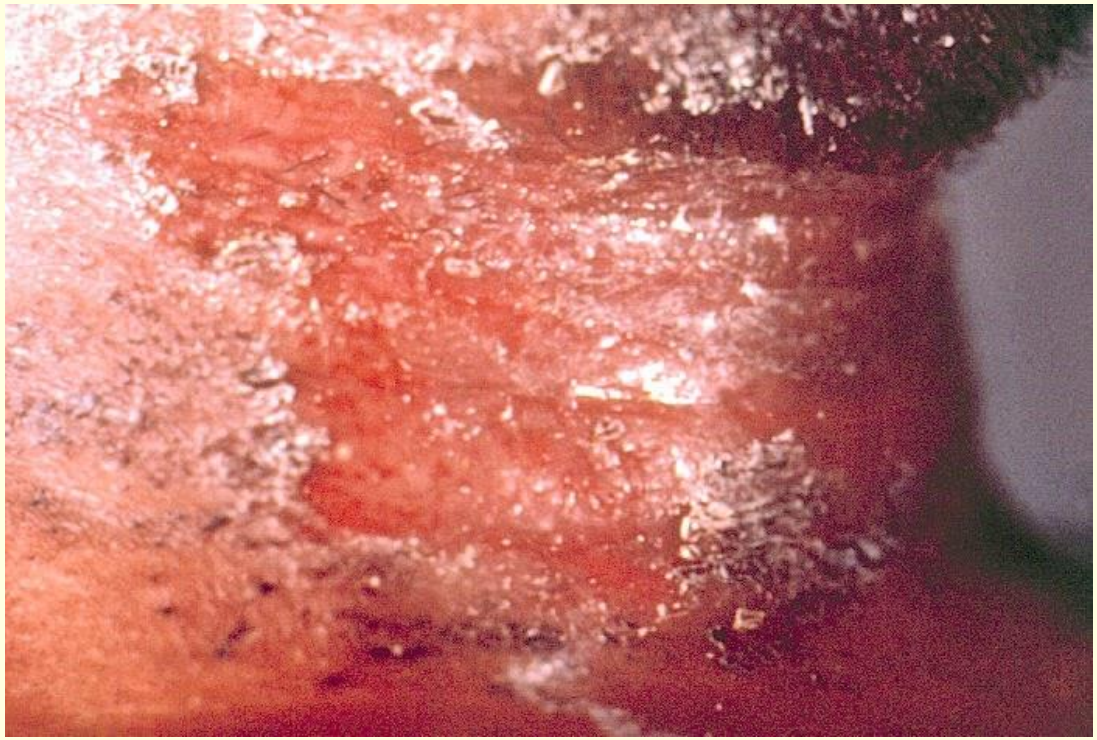
2011 WHO's decision-making body will meet in May to again vote on whether to kill the remaining live viruses.

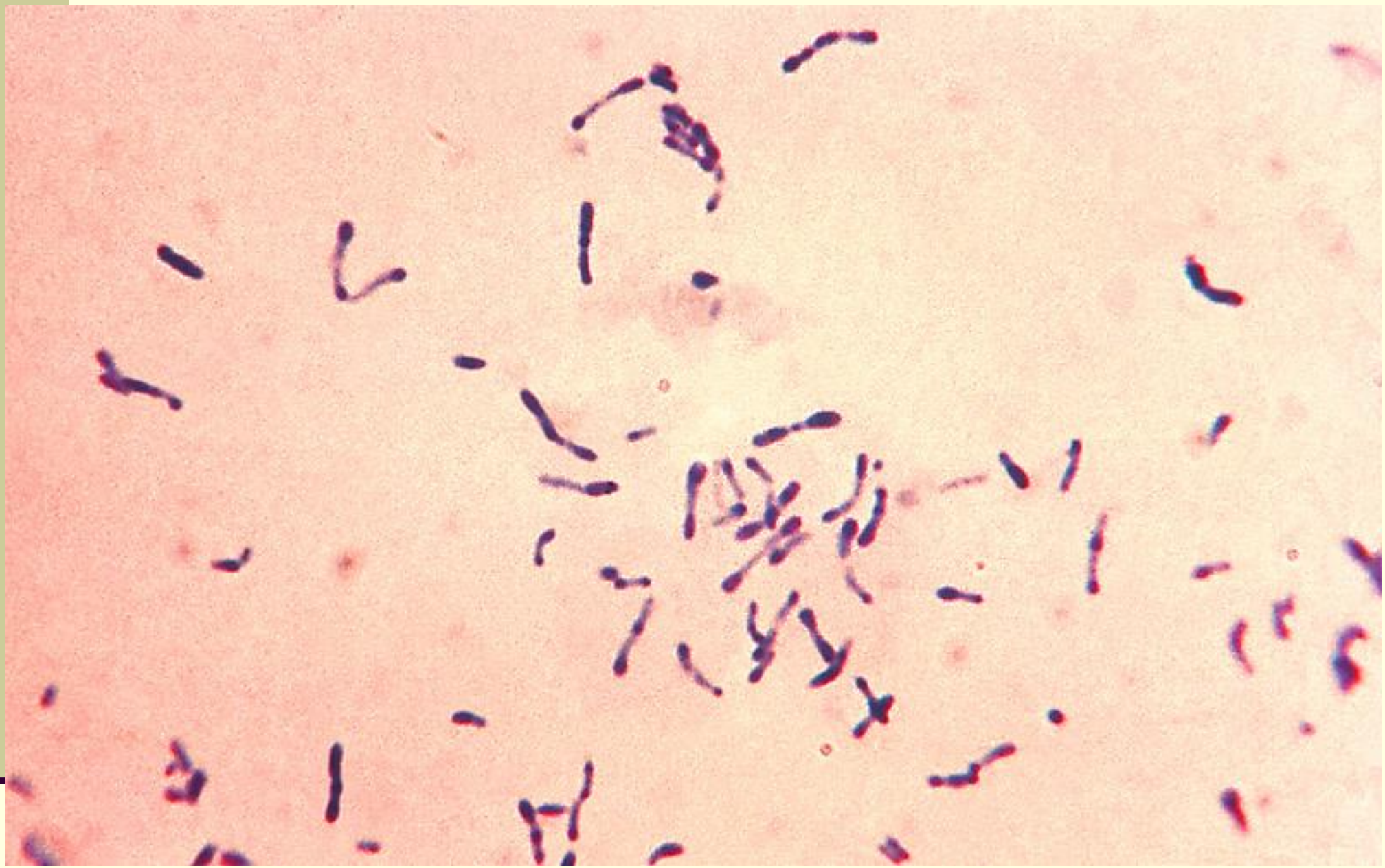
There is a risk of variola virus abuse as a possible biological weapon

For this reason, a certain supply of vaccines is constantly kept on a global scale, because it is impossible to completely exclude the possibility that somewhere in the world is stored this virus, which is potentionally abusive for terrorist purposes.

At present, however, it is clear that the cognition of this virus has reached such a level that it will also be possible to consider its destruction.

Remembering an Old Disease Diphtheria:





PHIL Photo ID#7323

Causes and Transmission

Diphtheria is an infection caused by the toxic *Corynebacterium diphtheriae* bacterium.

Diphtheria is spread (transmitted)

from person to person,

usually through respiratory droplets, like from coughing or sneezing.

Rarely, people can get sick from touching open sores (skin lesions) or clothes that touched open sores of someone sick with diphtheria.

A person also can get diphtheria by coming in contact with an object, like a toy, that has the bacteria that cause diphtheria on it.

The incubation period of diphtheria is 2–5 days (range: 1–10 days).

After:

- ✓ **the provisional clinical diagnosis is made**
- ✓ **and appropriate cultures are obtained,**

persons with suspected diphtheria should be given:

1. **- antitoxin and**
2. **- antibiotics in adequate dosage and**
3. **- placed in isolation.**

Respiratory support and airway maintenance should also be administered as needed.

Symptoms

When the bacteria get into and attach to the lining of the respiratory system, they produce a poison (toxin) that can cause:

- Weakness
- Sore throat
- Fever
- Swollen glands in the neck (sometimes referred to as „bull neck“)

PHIL Photo ID#5325

The poison destroys healthy tissues in the respiratory system.

Within two to three days, the dead tissue forms a thick, gray coating that can build up in the throat or nose. This thick gray coating is called a "**pseudomembrane**."

It can cover tissues in the nose, tonsils, voice box, and throat, making it very hard to breathe and swallow.

The poison may also get into the blood stream and cause damage to the heart, kidneys, and nerves.

EU case definition of diphteria

2.11. DIPHTHERIA (*Corynebacterium diphtheriae, Corynebacterium ulcerans* and *Corynebacterium pseudotuberculosis)*

Clinical Criteria

- Any person with at least one of the following clinical forms:

Classic Respiratory Diphtheria:

- An upper respiratory tract illness with laryngitis or nasopharyngitis or tonsillitis
- AND
- an adherent membrane/pseudomembrane

Mild Respiratory Diphtheria:

- An upper respiratory tract illness with laryngitis or nasopharyngitis or tonsillitis
- WITHOUT
- an adherent membrane/pseudomembrane.

Cutaneous Diphtheria:

- Skin lesion

Diphtheria of other sites:

- Lesion of conjunctiva or mucous membranes

Laboratory Criteria

- Isolation of toxin-producing *Corynebacterium diphtheriae, Corynebacterium ulcerans* or *Corynebacterium pseudotuberculosis* from a clinical specimen.

Epidemiological Criteria

- At least one of the following epidemiological links:
- — Human to human transmission
- — Animal to human transmission

Case Classification

- A. **Possible case**
- Any person meeting the clinical criteria for classical respiratory diphtheria
- B. **Probable case**
- Any person meeting the clinical criteria for diphtheria (Classic Respiratory Diphtheria, Mild Respiratory Diphtheria, Cutaneous Diphtheria, Diphtheria of other sites) with an epidemiological link to a human confirmed case or with an epidemiological link to animal to human transmission
- C. **Confirmed case**
- Any person meeting the laboratory criteria AND at least one of the clinical forms

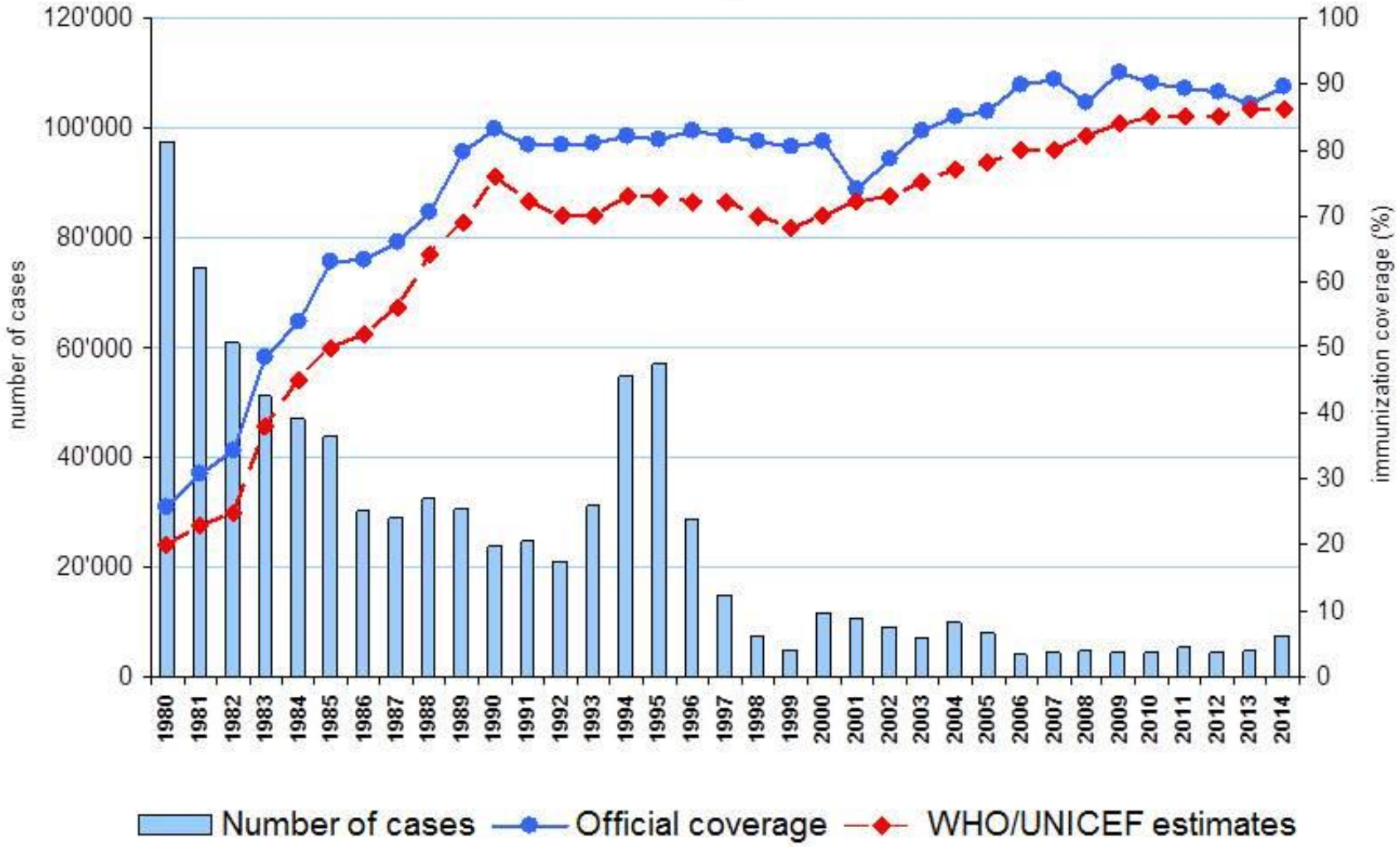
In the United States is diphtheria now reported only infrequently. In the prevaccine era, the disease was one of the most common causes of illness and death among children.

Since the introduction and widespread use of vaccines containing diphtheria toxoid (formalin-inactivated diphtheria toxin) beginning in the 1920s and 1930s and universal childhood immunization in the late 1940s, diphtheria has been well controlled in the United States.

- In the 1970s, diphtheria was endemic in the Southwest, the Northern Plains, and the Pacific Northwest. The last major outbreak was in Seattle, Washington, in the 1970s.

In recent years, some cases in the United States have been related to importation. From 1980 to 2010, 55 cases of diphtheria were reported to CDC's National Notifiable Diseases Surveillance Systém.

Diphtheria global annual reported cases and DTP3 coverage, 1980-2014



Source: WHO/IVB database, 2015
194 WHO Member States.
Data as of July 2015

Date of slide: 14 July 2015

WHO

- Diphtheria remains endemic in many parts of the developing world, including some countries of the Caribbean and Latin America, Eastern Europe, Southeast Asia, and Africa.

In the 1990s, a large epidemic of diphtheria occurred in the former Soviet Union where diphtheria had previously been well controlled and this renewed interest in the factors associated with persistent circulation of toxigenic *C. diphtheria.*

In the EU/EEA.

The reported number of cases of diphtheria remains low.

During 2009–2013, 102 cases of diphtheria were reported in the EU/EEA with 55 cases of C. diphtheriae. There has been an increase in the number of C. diphtheriae cases reported at EU level since 2011.

Latvia is the only EU Member State that reports indigenous transmission.

In a recent European study, ten European countries each screened between 968 and 8551 throat swabs from patients with upper respiratory tract infections for C. diphtheriae during 2007–2008.

Six toxigenic strains of C. diphtheriae were identified: two from symptomatic patients in Latvia and four from Lithuania (two cases, two carriers).

Among the toxigenic isolates, the Sankt Petersburg epidemic clone that caused large diphtheria outbreaks in Russia countries in the 1990s was still in circulation .

Carriage rates among household contacts of a laboratory-confirmed case may be as high as 25% .

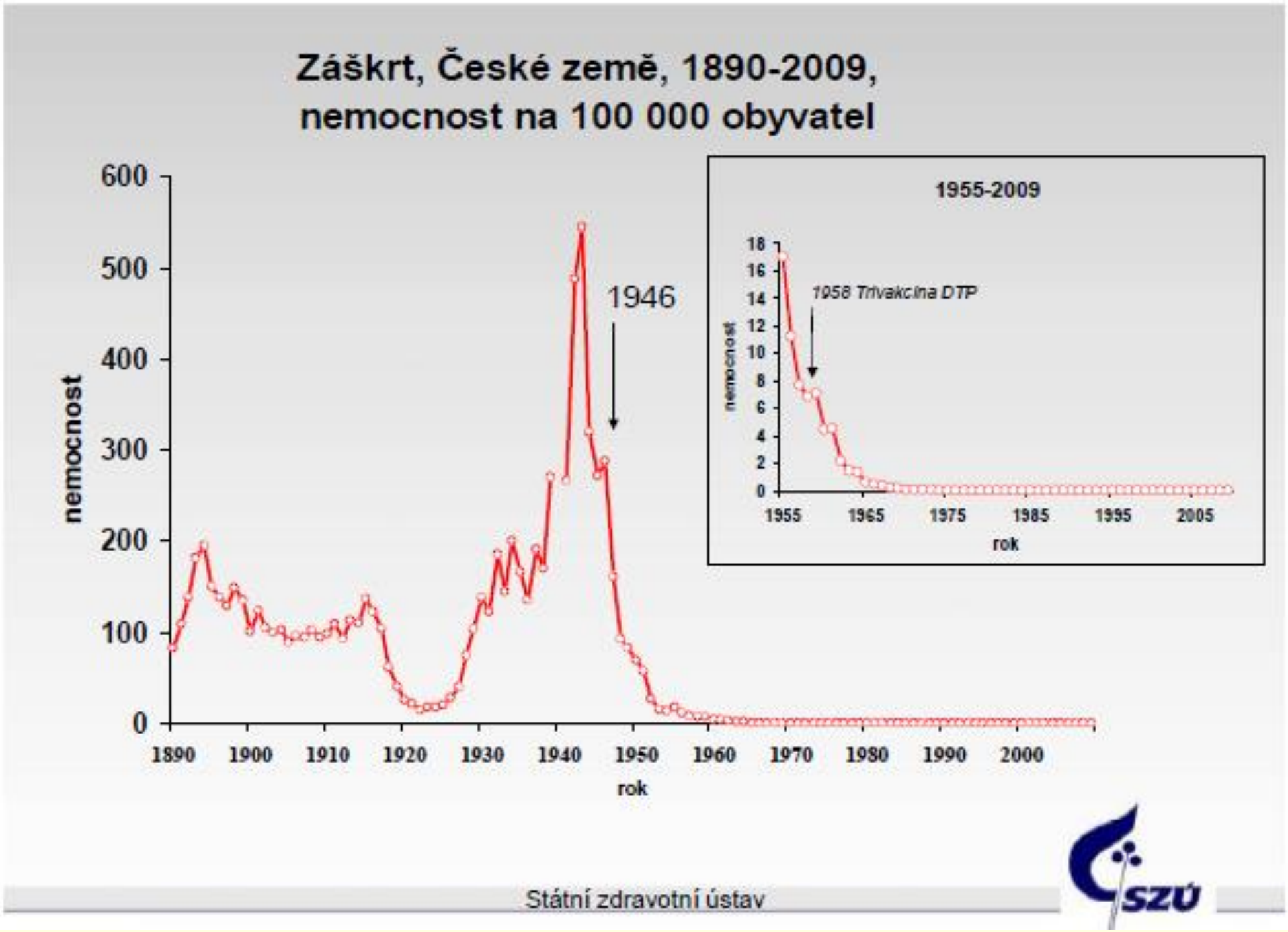
In 2014 --- 7 321 cases of diphtheria were reported worldwide to the World Health Organization, but many more cases likely go unreported.

The case-fatality rate for diphtheria has changed very little during the last 50 years.

The overall case-fatality rate for diphtheria is 5%–10%,

with higher death rates (up to 20%) among persons younger than 5 years and older than 40 years of age.

Before there was treatment for diphtheria, the disease was fatal in up to half of cases.


Záškrt, České země, 1890-2009,
nemocnost na 100 000 obyvatel
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Státní zdravotní ústav
SZÚ

A case of diphtheria in Spain

15 June 2015

The detection, management and public health response to the first case of diphtheria in Spain in nearly 30 years has highlighted challenges for preparedness against diphtheria in the European Union.

The case is a 6-year-old unvaccinated child. A case of diphtheria in an unvaccinated individual within a highly protected population is not unexpected, because vaccinated people can be asymptomatic carriers of toxigenic C. diphtheriae.

The challenges for diphtheria case management, preparedness and public health response experienced in Spain are shared by many EU Member States. The most urgent critical issue is the shortage of diphtheria antitoxin (DAT) for immediate use when clinicians suspect diphtheria.

DAT must be given as early as possible to be effective, often on the suspicion of diphtheria before a laboratory confirmation.

EU Member States have for a number of years reported difficulties with sourcing and maintaining adequate stockpiles of DAT for emergency use, a problem they share with many countries around the world. EU Member States have on occasion been forced to arrange emergency deliveries of DAT for patients with diphtheria.

A fatal case of diphtheria in Belgium, March 2016

On 17 March, Belgian authorities reported a case of toxigenic respiratory diphtheria. The case had been confirmed on 15 March in Antwerp in a 3-year-old unvaccinated child of Chechnyan origin, born in Belgium.

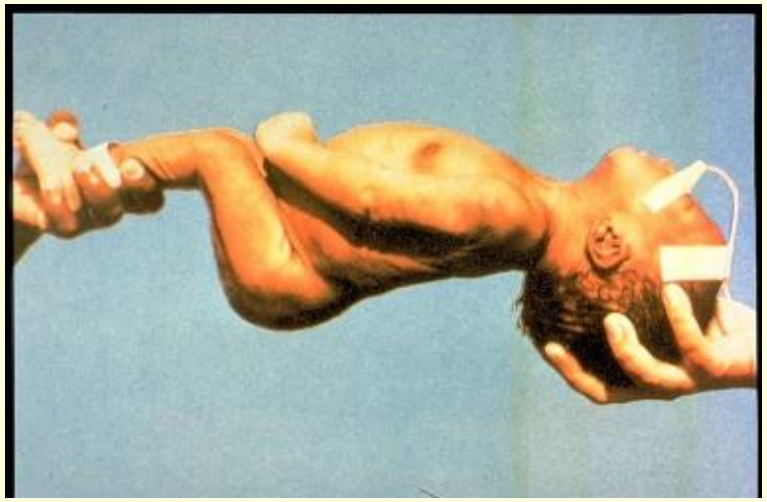
The case had onset of symptoms on 6 March. On 10 March, the child was transferred to the University Hospital in Antwerp and admitted to a special intensive care unit with **severe tonsillitis**. Diphtheria was included in the differential diagnosis and a search for DAT was started the same day. Since no DAT was readily available in Belgium, the search was extended but not expedited as the girl's clinical condition improved. At this point, no formal microbiological diagnosis had been made. On 11 March, the girl was transferred to the ward in an isolator. Later on, she developed an AV block and myocarditis. An external pacemaker was used.

Despite administration of DAT, the child died on 17 March.

Upon confirmation of the case, Belgian regional authorities implemented prevention and control measures according to regional regulations (The family of the child received prophylactic antibiotic treatment and were swabbed to determine the presence of the bacterium. The medical personnel and caregivers – who could have been exposed to droplets during the admission process in the first hospital – were swabbed and received antibiotics. The doctor at the day-care centre verified the vaccination status of all children in the child's group and another two groups in adjacent rooms. One child needed a supplementary vaccination).

Remembering an Old Disease

Tetanus:



Tetanus is an acute, potentially fatal disease that is characterized by generalized increased rigidity and convulsive spasms of skeletal muscles.

Tetanus is caused by the spore-forming bacterium *Clostridium tetani*. *C. tetani* spores (the dormant form of the organism) are found in soil and in animal and human feces.

The spores enter the body through breaks in the skin, and germinate under low-oxygen conditions. Puncture wounds and wounds with a significant amount of tissue injury are more likely to promote germination. The organisms produce a potent toxin tetanospasmin which is absorbed into the bloodstream. The toxin then reaches the nervous system, causing painful and often violent muscular contractions. The muscle stiffness usually first involves the jaw (lockjaw) and neck, and later becomes generalized.

Tetanus is a noncommunicable disease — it is not transmitted from one person to another.

The spores can get into the body through broken skin, usually through injuries from contaminated objects. Certain breaks in the skin are more likely to get infected with tetanus bacteria. **These include**:

- Wounds contaminated with dirt, poop (feces), or spit (saliva)
- Wounds caused by an object puncturing the skin (puncture wounds), like a nail or needle
- Burns
- Crush injuries
- Injuries with dead tissue

Rarely, tetanus has also been linked to breaks in the skin caused by:

- Clean superficial wounds (when only the topmost layer of skin is scraped off)
- Surgical procedures
- Dental infections
- Compound fractures (a break in the bone where it is exposed)
- Chronic sores and infections
- Intravenous (IV) drug use
- Intramuscular injections (shots given in a muscle)

Time from Exposure to Illness

- The incubation period is usually between 3 and 21 days (average 10 days), although it may range from one day to several months, depending on the kind of wound. Most cases occur within 14 days.
- In general, shorter incubation periods are seen with more heavily contaminated wounds, more serious disease, and a worse outcome (prognosis).

Tetanus is often called “lockjaw” because one of the most common signs of this infection is tightening of the jaw muscles. Tetanus infection can lead to serious health problems, including being unable to open the mouth and having trouble swallowing and breathing.

Symptoms of tetanus include:

- Jaw cramping
- Sudden, involuntary muscle tightening (muscle spasms) — often in the stomach
- Painful muscle stiffness all over the body
- Trouble swallowing
- Headache
- Fever and sweating
- Changes in blood pressure and a fast heart rate

EU case definitions - Tetanus

2.43. TETANUS (*Clostridium tetani*)

- **Clinical Criteria**
- Any person with at least two of the following three:
- — Painful muscular contractions primarily of the masseter and neck muscles leading to facial spasms known as trismus and 'risus sardonicus'
- — Painful muscular contractions of trunk muscles
- — Generalised spasms, frequently position of opisthotonus
- **Laboratory Criteria**
- At least one of the following two:
- — Isolation of *Clostridium tetani* from an infection site
- — Detection of tetanus toxin in a serum sample

- **Epidemiological Criteria** NA
- **Case Classification**
- A. **Possible case** NA
- B. **Probable case**
- Any person meeting the clinical criteria
- C. **Confirmed case**
- Any person meeting the clinical and the laboratory criteria

TETANUS DISEASE

- **TETANUS VACCINE:** The most common reactions reported to occur following DT vaccine include swelling and pain at the injection site; sleepiness; irritability; vomiting; loss of appetite; persistent crying; and fever.
- Paleness, cold skin, collapse, rash, and joint pain have also been reported.
- In 1994 the Institute of Medicine concluded that there is compelling scientific evidence to conclude that tetanus, DT and Td vaccines can cause Guillain-Barre syndrome including death; brachial neuritis; and death from anaphylaxis (shock).

Vaccination against rabies or tetanus in the case of injuries, injuries, non-healing wounds and some cures

Tetanus prophylaxis is performed:

when injuries,

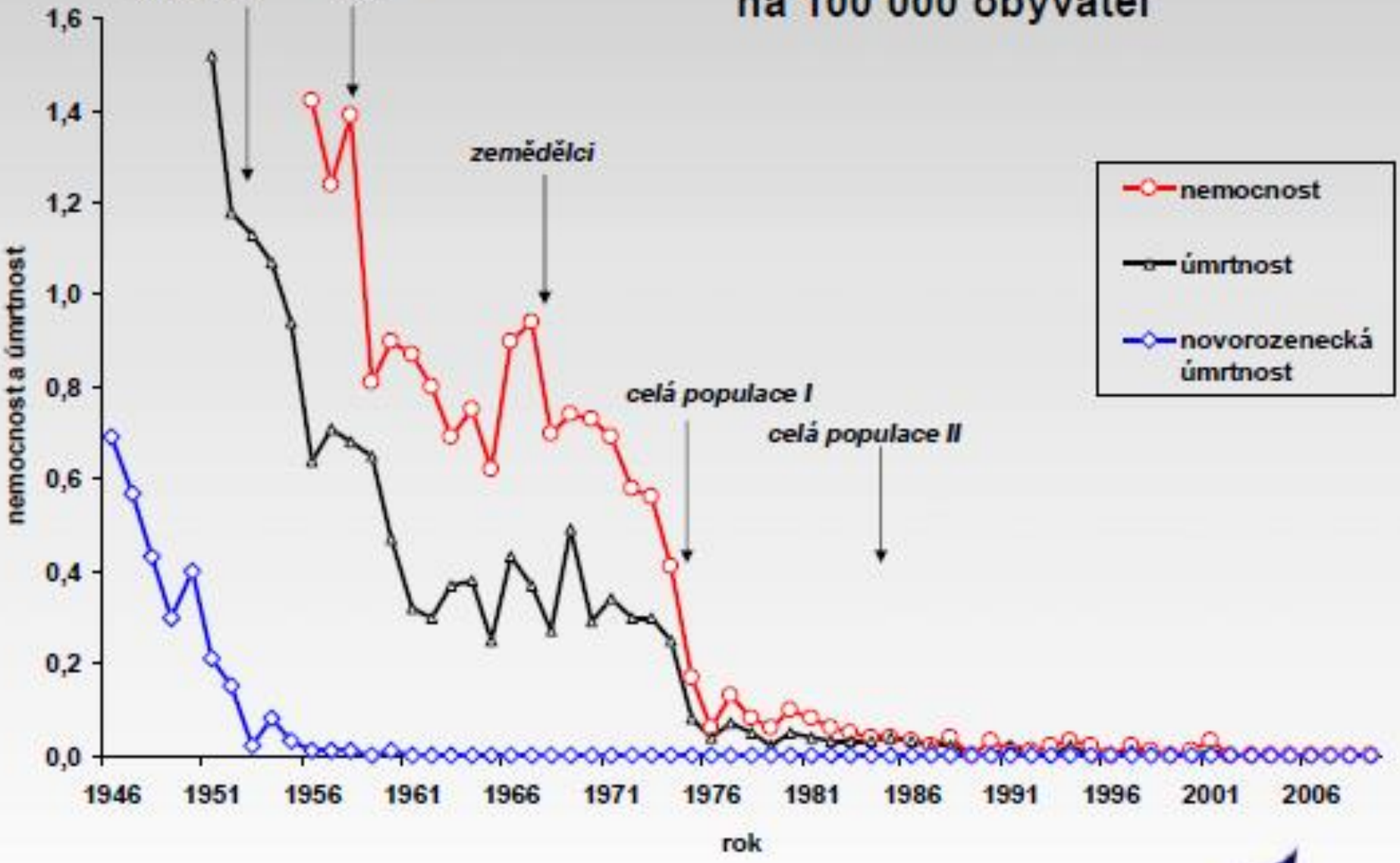
injuries

non-healing wounds,

in indicated cases in pre-operative preparation, especially before surgery on the rectum or colon.

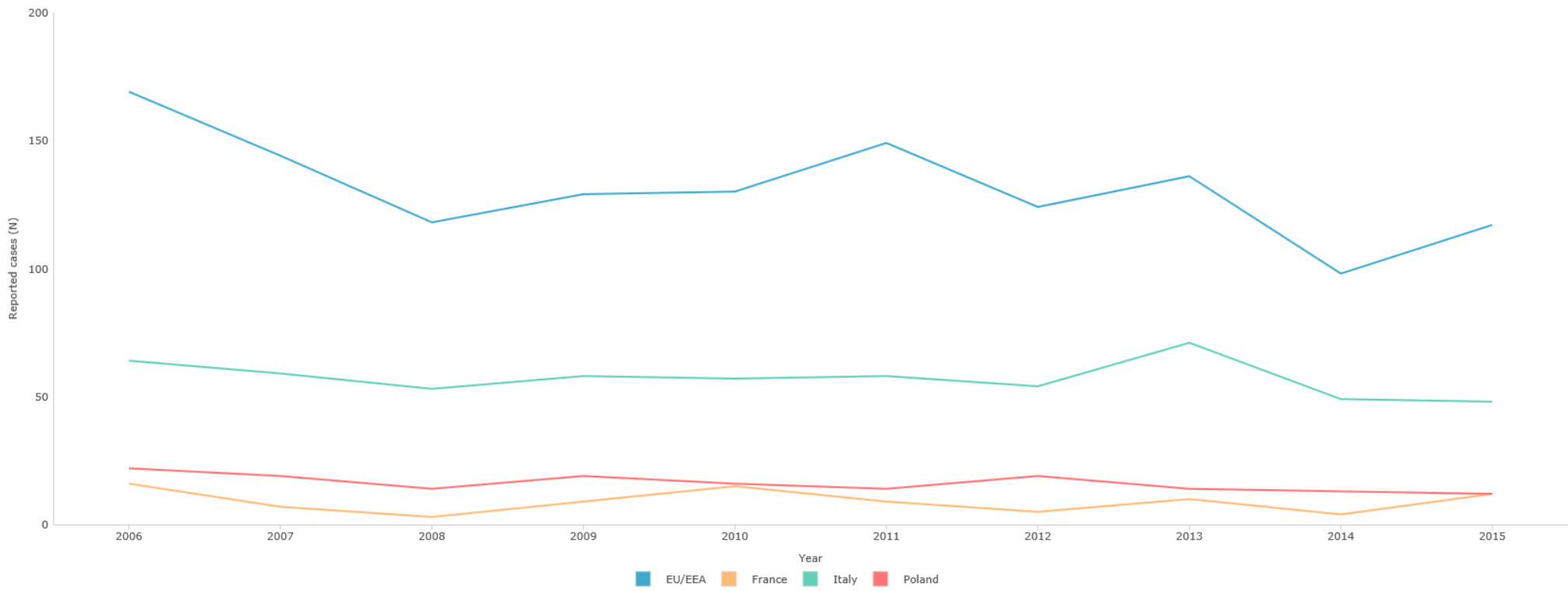
Vaccination is performed

Tetanus, ČR, 1946-2009, nemocnost a úmrtnost na 100 000 obyvatel

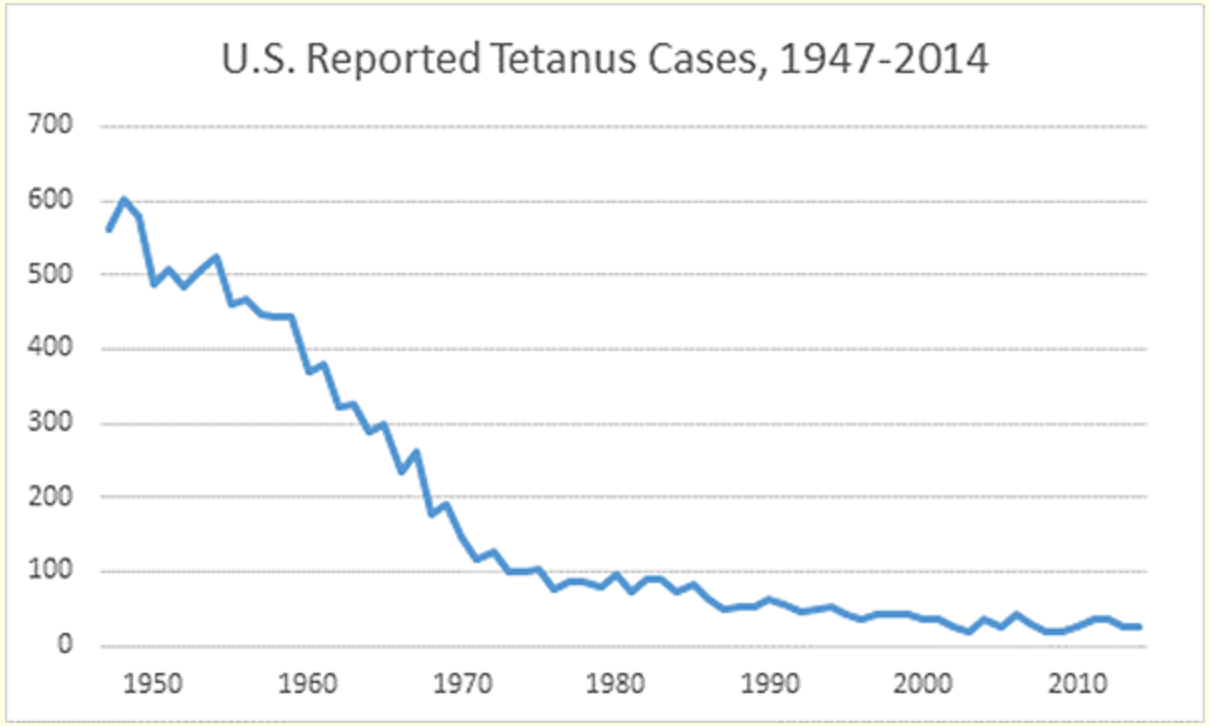


Surveillance Atlas of Infectious Diseases

Tetanus | All cases | Reported cases | 2015



Tetanus – United States 1947 2014



Remembering an Old Disease

Poliomyelitis:

The highly infectious poliovirus, the cause of polio, once crippled 13,000 to 20,000 people every year in the United States. In 1 out of 200 cases, this virus attacks the spinal cord, paralyzing limbs or leaving victims unable to breathe on their own. In 1954, the year before the first polio vaccine was introduced, doctors reported more than 18,000 cases of paralyzing polio in the United States. Just 3 years later, vaccination brought that figure down to about 2,500. Today, the disease has been eliminated from the Western Hemisphere, and public health officials hope to soon eradicate it from the globe. In 2001, only 537 cases of polio were reported worldwide, according to WHO.

EU case definition of poliomyelitis

2.31. POLIOMYELITIS (Polio virus)

Clinical Criteria

Any person < 15 years of age with Acute flaccid paralysis (AFP)

OR

Any person in whom polio is suspected by a physician

Laboratory Criteria

At least one of the following three:

— Isolation of a polio virus and intratypic differentiation — Wild polio virus (WPV)

— Vaccine derived poliovirus (VDPV) (for the VDPV at least 85 % similarity with vaccine virus in the nucleotide sequences in the VP1 section)

— Sabin-like poliovirus: intratypic differentiation performed by a WHO-accredited polio laboratory (for the VDPV a > 1 % up to 15 % VP1 sequence difference compared with vaccine virus of the same serotype)

Epidemiological Criteria

At least one of the following two epidemiological links:

— Human to human transmission

— An history of travel to a polio-endemic area or an area with suspected or confirmed circulation of poliovirus

Case Classification

- A. **Possible case**
- Any person meeting the clinical criteria
- B. **Probable case**
- Any person meeting the clinical criteria and with an epidemiological link
- C. **Confirmed case**
- Any person meeting the clinical and the laboratory criteria

Poliomyelitis

Morbid changes occur
mainly in the gray matter of the spinal cord.

The infectious agent:
There are three types of polioviruses
-1, 2 and 3.

Virus excretion: 1 week from the nasopharynx,
6 weeks of stool.

80% of cases are asymptomatic.

- Polio Viruses, which are endemic or epidemic areas
- spreading in a population,we are known as **wild polioviruses**.

- Among them were for the purpose of preparing
live vaccines repeated passaging the virus in cell cultures
resulting strain called **vaccinal.**

Polio eradication

In 1988, the forty-first World Health Assembly adopted a resolution for the worldwide eradication of polio, the Global Polio Eradication Initiative (GPEI). Since then, the number of cases has fallen by over 99% from an estimated 350 000 to 416 reported cases in 2013.

In 2014, only three countries in the world remained polio-endemic: Nigeria, Pakistan and Afghanistan.

In 2015 to date, two countries have together reported 37 cases: Pakistan (29 cases) and Afghanistan (eight cases), all due to wild poliovirus type 1.

The last natural circulation of WPV2 was in India in 1999 and the last WPV3 case was detected in Nigeria in November 2012.

- Since then, WPV1 has been the only circulating wild type virus.

The last case of endemic paralytic polio in the WHO European Region (i.e. with the source of the infection originating in the Region) was reported in Turkey in November 1998,

and the Region was declared polio-free in June 2002.

The most recent outbreaks linked to importations into the WHO European Region occurred in 2010 in Tajikistan and in 2013–2014 in Israel where WPV1 was circulating in the environment without causing clinical cases .

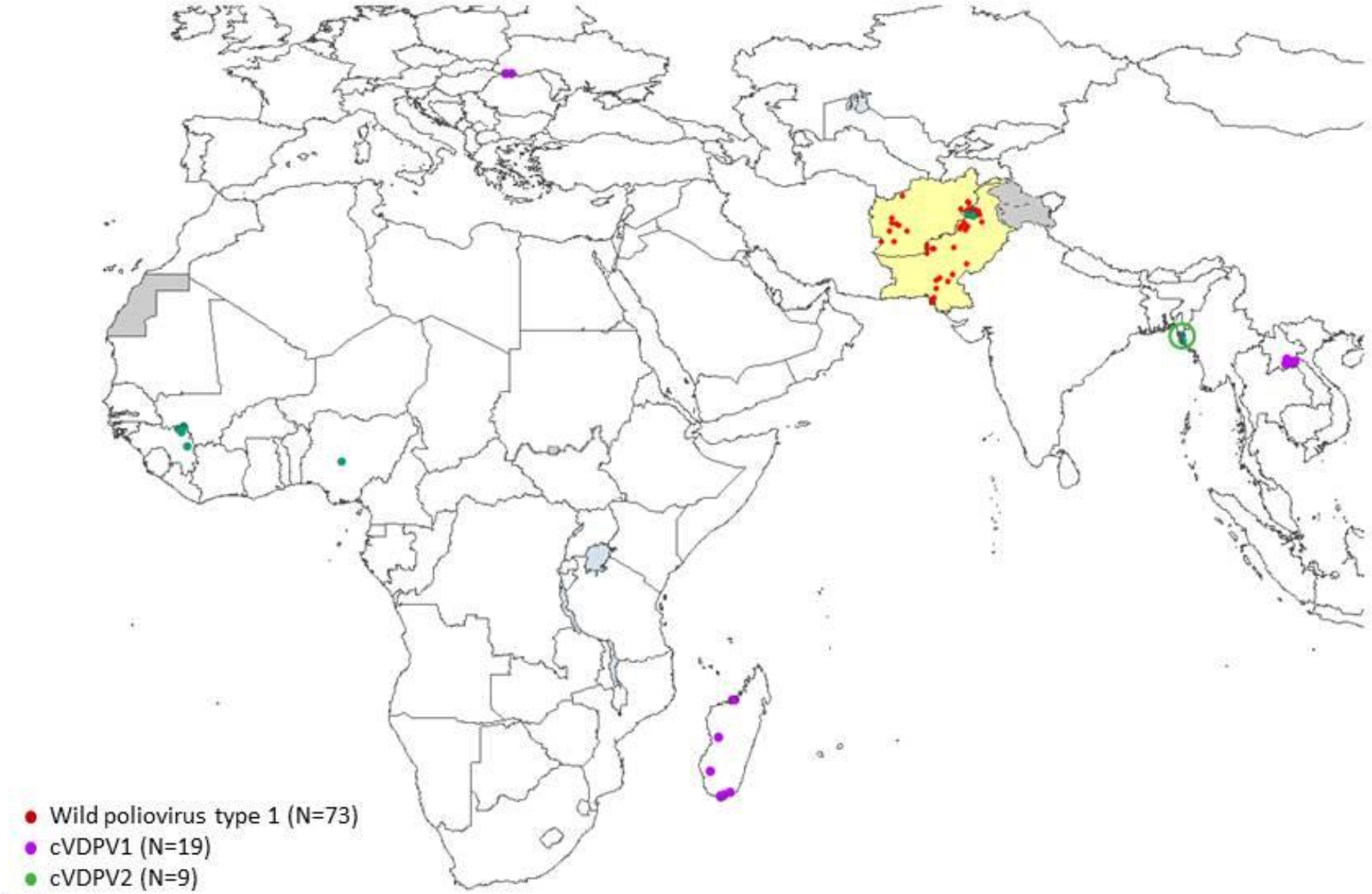
The most recent polio outbreaks in what today constitutes EU/EEA were in the Netherlands in 1992, in a religious community opposed to vaccination,

and in 2001, when three polio cases were reported among Roma children in Bulgaria .

On 5 May 2014, WHO declared the international spread of wild poliovirus in 2014 a Public Health Emergency of International Concern (PHEIC) following the confirmed circulation of wild poliovirus in several countries and the documented exportation of wild poliovirus to other countries.

The Polio Eradication and Endgame Strategic Plan 2013–2018 sets out the actions required for a polio-free world by 2018 and beyond.

Wild Poliovirus & cVDPV Cases[1], 2015
01 January – 31 December



[1]Excludes viruses detected from environmental surveillance.

Data in WHO HQ as of 02 February 2016

Outbreak of circulating vaccine-derived poliovirus type 1 (cVDPV1) in Ukraine

2 September 2015

Two cases of paralytic poliomyelitis caused by circulating vaccine-derived poliovirus type 1 (cVDPV1) were confirmed in Ukraine on 28 August 2015.

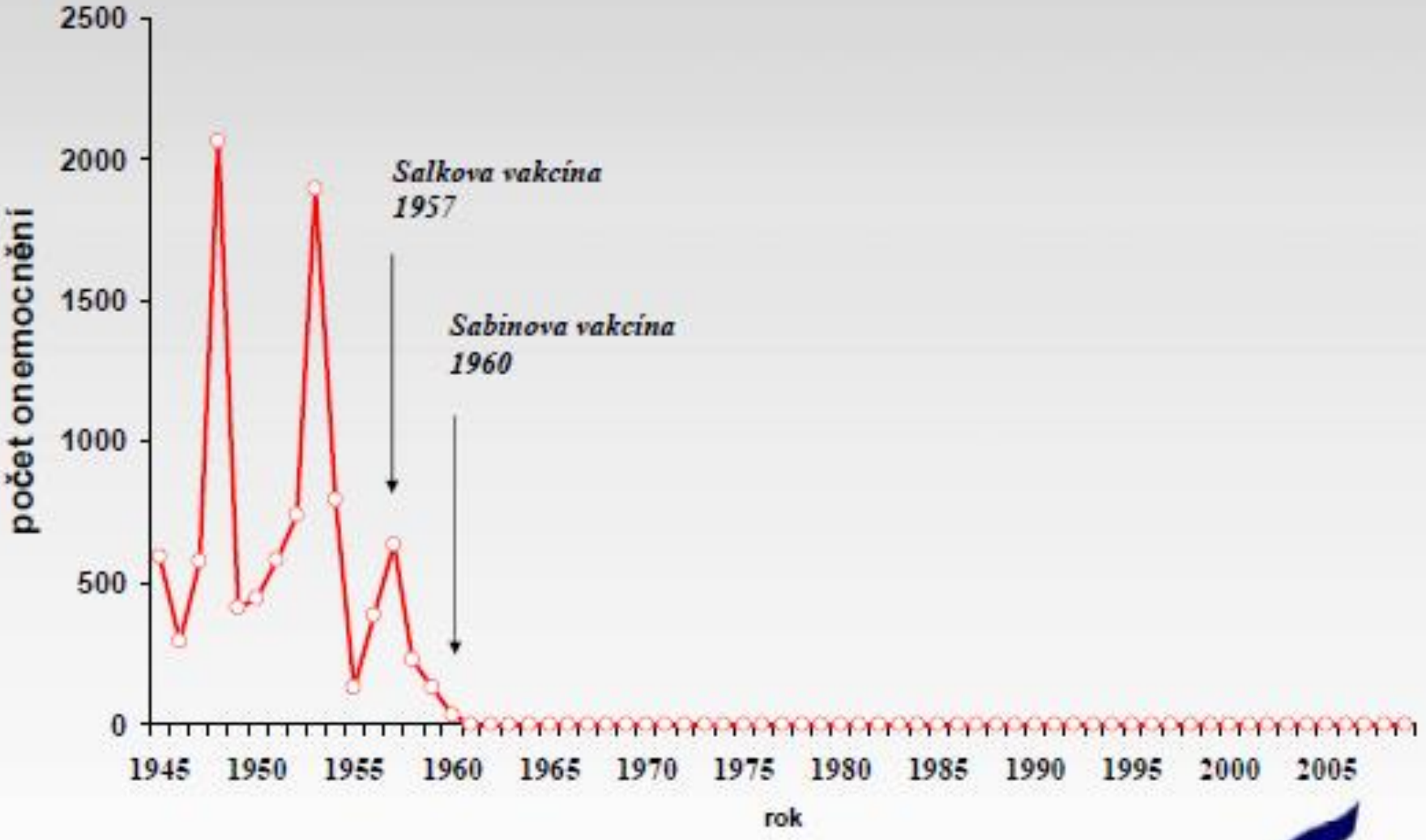
The cases, a 4-year-old child and a 10-month-old infant, had onset of paralysis on 30 June and 7 July respectively and the positive stool samples were collected from 5–10 July 2015.

The genetic similarity between the isolates indicates active transmission of cVDPV1.

Both children are from the Zakarpatskaya oblast [region], in south-western Ukraine, bordering Romania, Hungary, Slovakia and Poland.

Ukraine has been at high risk of vaccine-preventable diseases outbreaks for several years due to persistent low routine vaccination coverage.

Polio (A80), Česká republika, hlášená onemocnění 1945-2009



Monitoring the circulation of polioviruses and other enteroviruses in sewage waters in the Czech Republic in 2016

Petra Rainetová,

Zprávy CEM (SZÚ, Praha) 2017, (3).

The National Laboratory for Enteroviry investigates environmental surveillance waste water from treatment plants of 9 selected cities

- Prague, Rakovník, Plzeň, České Budějovice, Ústí nad Labem, Hradec Králové, Brno, Ostrava)
- and 3 refugee camps (Zastávka at Brno, Jezová, Kostelec nad Orlicí).

Within environmental surveillance, the National Reference Laboratory for Enteroviruses screens wastewater from sewage treatment plants in nine cities and five refugee camps in the Czech Republic. In 2016, 191 sewage samples were analyzed, and in eight of them, non-polio-enteroviruses (NPEV) were detected.

In the US, the last case of uncontrolled polio occurred in 1979 and in September 1991 South America recorded the last case across the American continent.

Similar success was achieved in 2000 in the Western Pacific region, which includes 37 countries, including China's most populous country.

Both WHO and ECDC draw attention to the risk of spreading wild type 1 poliomyelitis (WPV1) from Israel.

From February to early August 2013, WPV1 was detected in 85 waste water samples from 27 sampling points in the southern and central parts of the country.

The virus was isolated from stalk samples of 42 people in these areas, allegedly vaccinated by IPV in accordance with Israeli national recommendations.

There was no case of paralytic poliomyelitis.

Retrospectively, positive findings were also found in waste water samples in the West of the country, in the Gaza Strip.

Indigenous transfer of wild poliovirus has not been recorded in Israel since 1988. The strain is related to strains circulating in Pakistan and strain detected in December 2012 from wastewater in Cairo, Egypt.

The aggravation of poliomyelitis has been demonstrated in the 1980s when people with persistent consequences of poliomyelitis have been deformed after many years of stability

new nervous signs have begun to appear:

pain in muscles and joints,

reducing the strength of the affected and untreated muscles,

fasciculation and muscle cramps,

new paralysis and atrophy, and

overall impairment of movement abilities.

Patients complain of fatigue, sleep disturbances, breathing difficulties and cold sensitivity.

These late consequences of poliomyelitis are referred to as post-poliomyelitis syndrome.

It occurs in 40-70% of people in 25-35 years after the disease with poliomyelitis. Excessively stressed muscles, which compensate for the function of the denerved muscle groups, are particularly affected.

The essence of the syndrome is premature termination of long-overloaded motor units.

WHO estimates that there are over 20 million people in the world suffering from polio, and there are about 15,000 people in the Czech Republic endangered by post-poliomyelitis syndrome.

These patients require permanent dispensarisation, longer convalescence after injuries or surgery, and regular rehabilitation care.

Pertussis

Pertussis is an acute bacterial infection of the respiratory tract, caused by the bacterium *Bordetella pertussis*. The disease is characterised by a severe cough, which can last two months or even longer.

Humans are the only reservoir. Infected adults usually have only mild symptoms, but can shed bacteria for weeks. Following infection (by inhalation of droplets), susceptible individuals develop symptoms after an incubation period of about 10 days. The typical paroxysmal cough is usually seen in young children. Babies less than six months old may not cough, but they manifest dyspnea and paroxysmal asphyxia and are the most likely to die of the disease unless they receive suitable treatment.

Affected children are also exposed to complications such as pneumonia, atelectasia, weight loss, hernia, seizures, encephalopathy (probably due to hypoxia). Antibiotics may reduce the duration of the disease, especially if administered in its early stages.

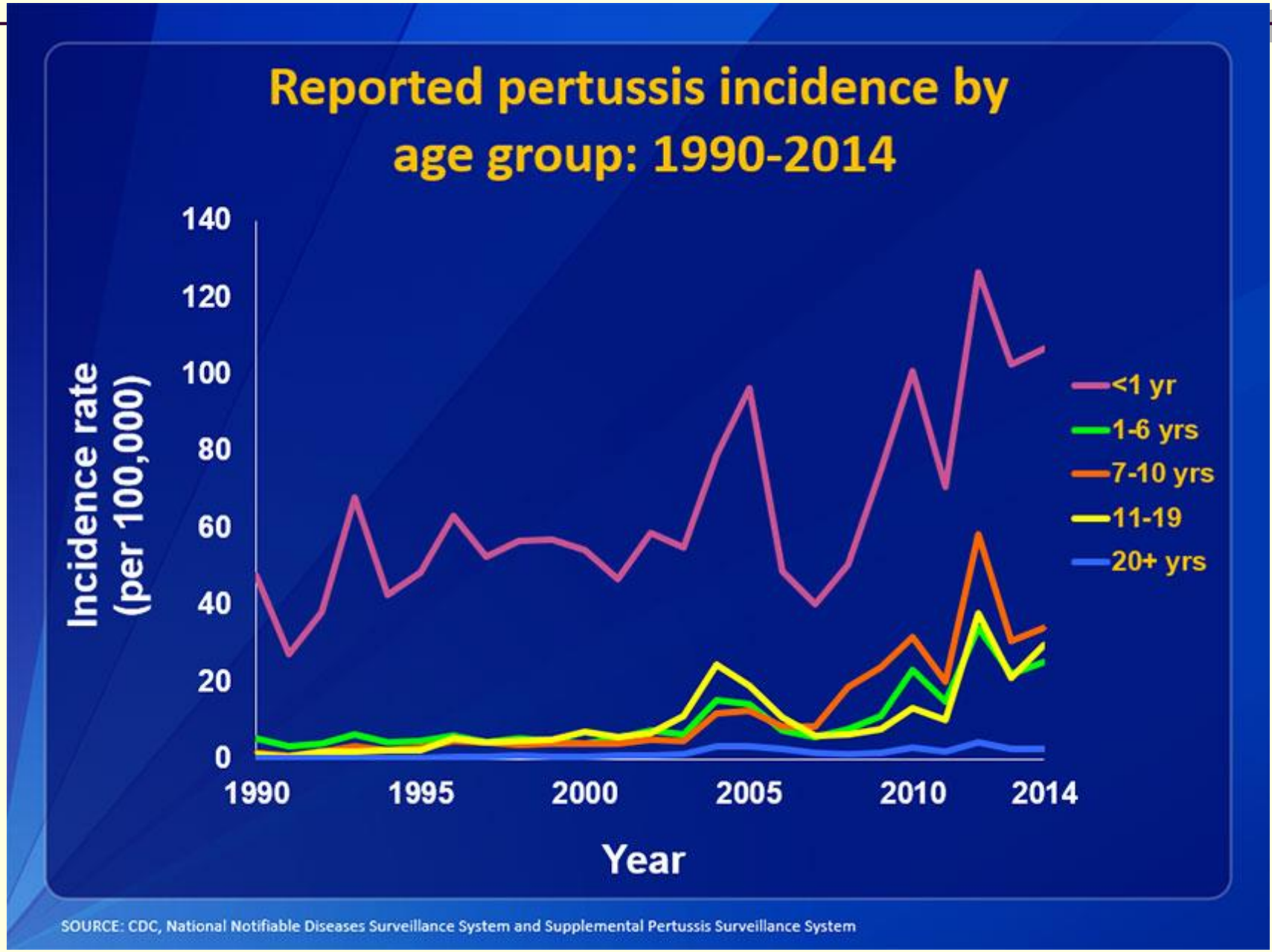
Bordetella pertussis

Sequencing of genomic areas ptxP, ptxA, prnA and fim3 in B. pertussis strains isolated in the Czech Republic in the period 1967-2010 changes in allelic variants were confirmed these areas.

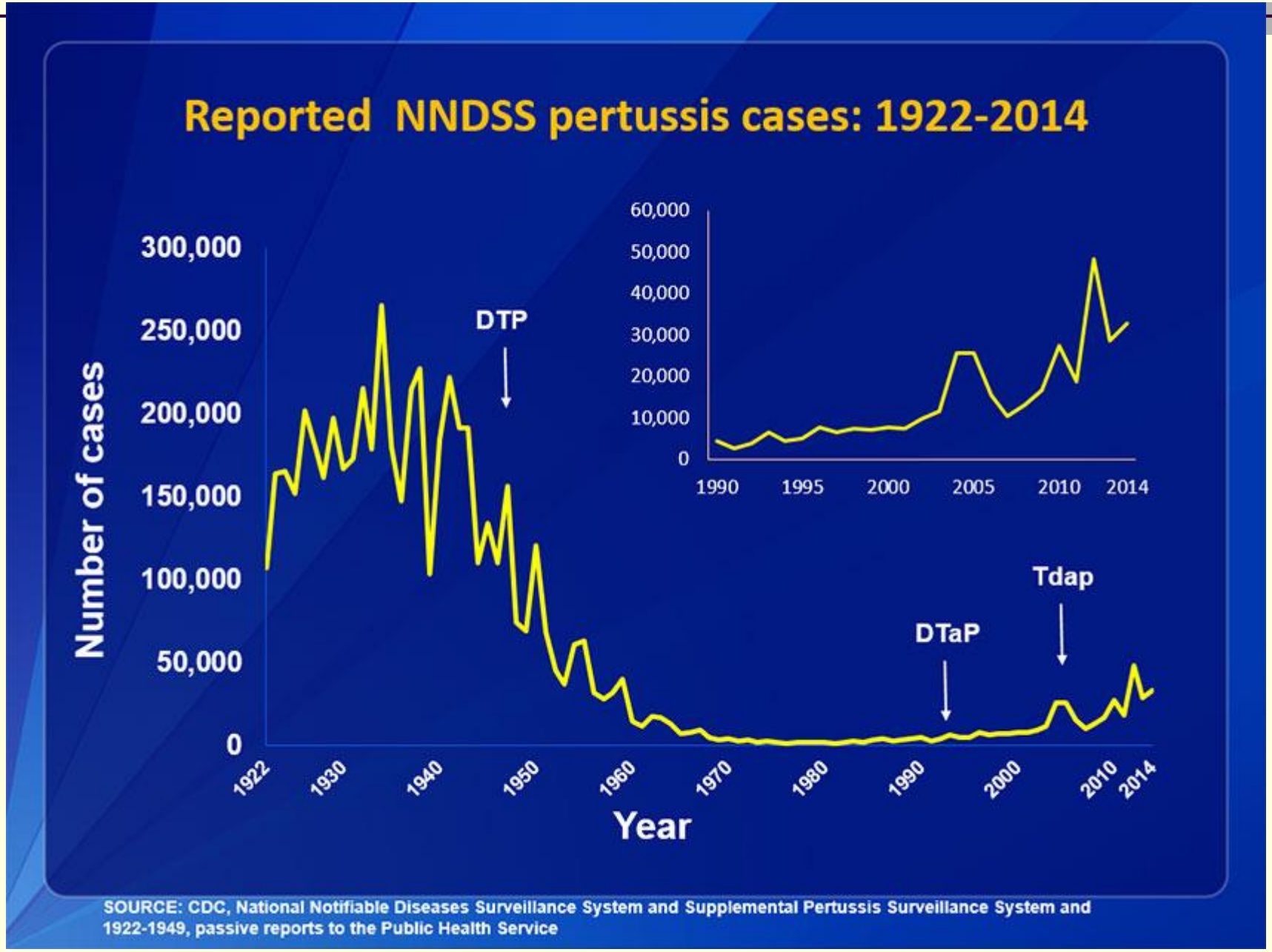
The occurrence of strains carrying new allelic variants has increased since 1995 at the expense of the strains carrying the original variants.

The results of the study can be interpreted as partial genetic leakage of pathogenic B. pertussis strains outside effectiveness of pertussis vaccines.

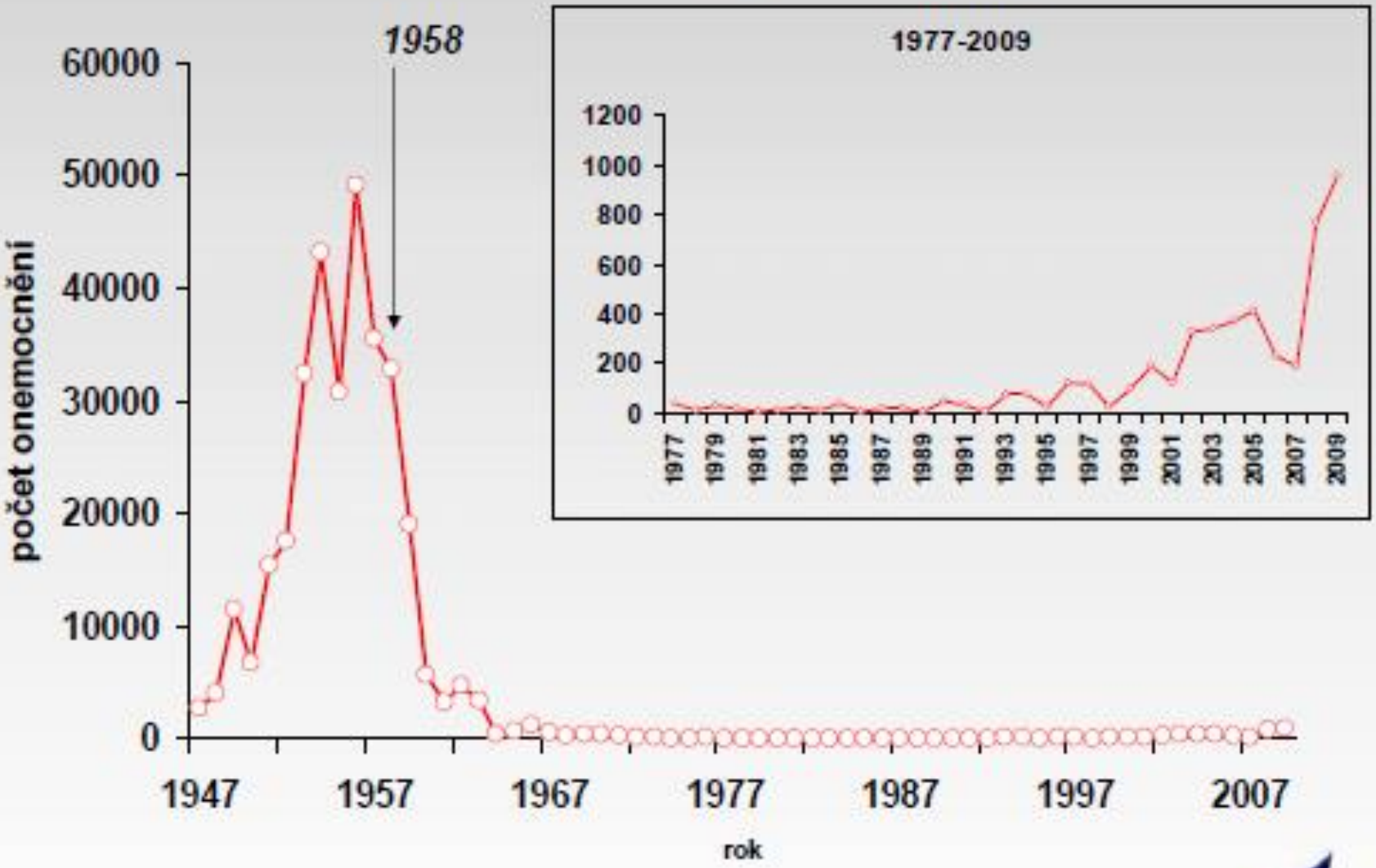
This graph shows reported pertussis incidence (per 100,000 persons) by age group in the United States from 1990–2014. Infants aged <1 year, who are at greatest risk for serious disease and death, continue to have the highest reported rate of pertussis. School-aged children 7 to 10 years continue to contribute a significant proportion of reported pertussis cases.



This graph illustrates the number of pertussis cases reported to CDC from 1922 to 2014. Following the introduction of pertussis vaccines in the 1940s when case counts frequently exceeded 100,000 cases per year, reports declined dramatically to fewer than 10,000 by 1965. During the 1980s pertussis reports began increasing gradually, and by 2014 more than 32,000 cases were reported nationwide.

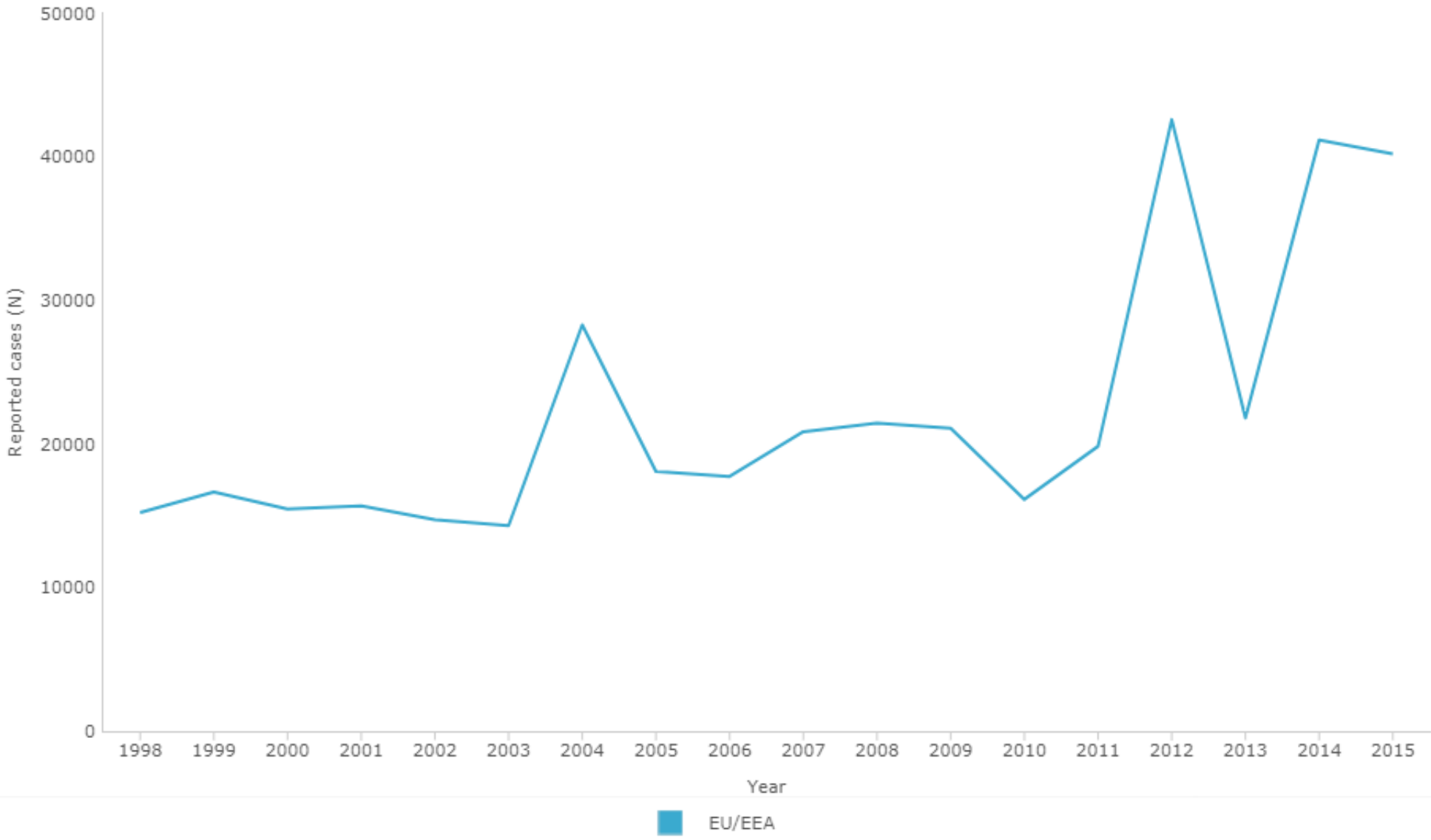


Dávivý kašel - pertuse (A37.0), Česká republika, 1947-2009

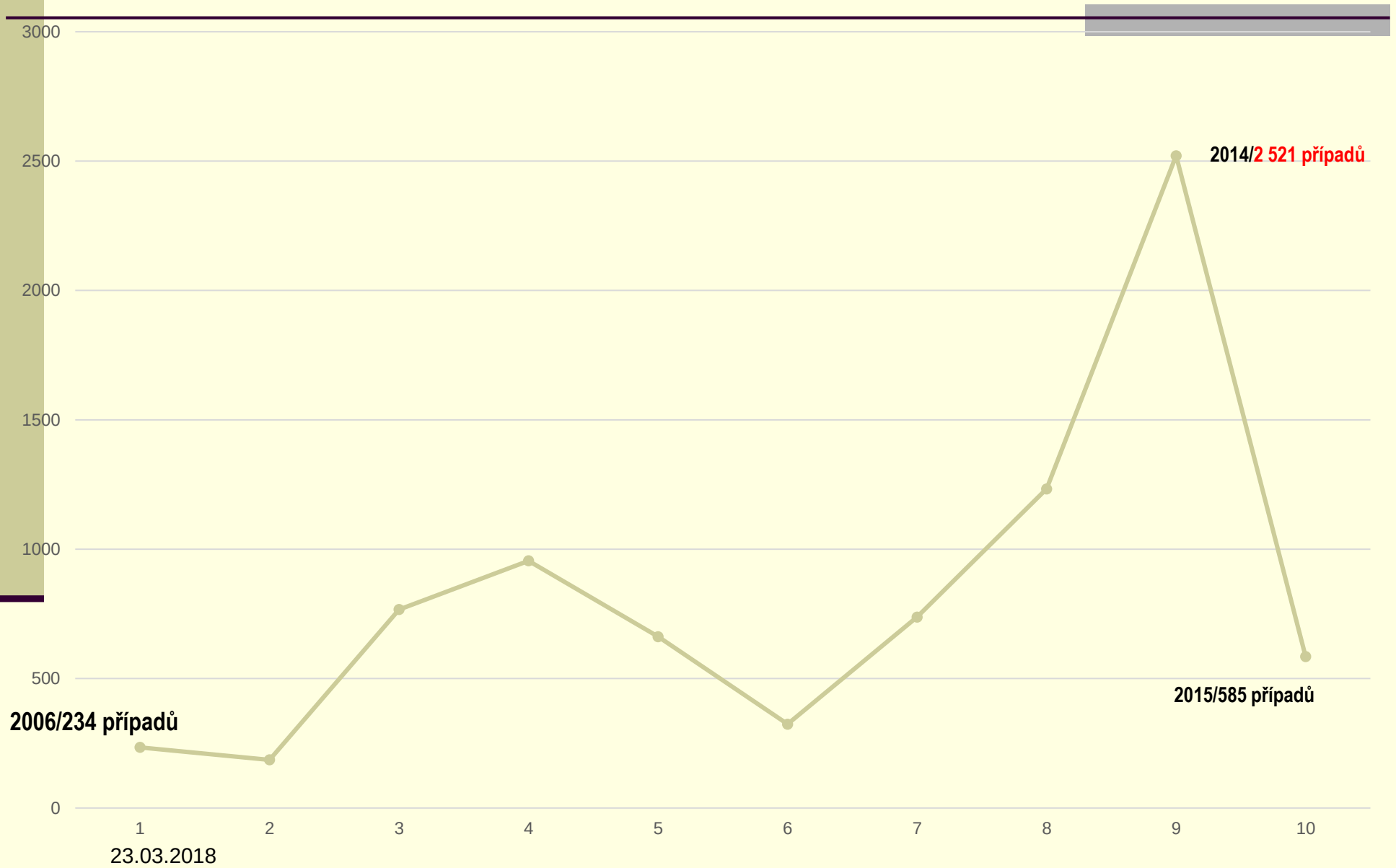


Surveillance Atlas of Infectious Diseases

Pertussis | All cases | Reported cases | 2015



ČR Pertusse


3000
2500
2000
1500
1000
500
0
2014/2 521 případů
2015/585 případů
2006/234 případů
1
2
3
4
5
6
7
8
9
10
23.03.2018

- **Recommendations for the vaccination of pregnant women against pertussis.**

Measles

During the 12-month period from July 2014 to June 2015, a total of 4 224 cases was reported by 30 EU/EEA countries. Twenty-three countries reported consistently throughout this period.

- Germany accounted for 58.2% of the cases reported during this period.

In 10 of the countries reporting consistently, the measles notification rate was less than one case per million population, including six countries which reported zero cases during the 12-month period.

The diagnosis of measles was confirmed by positive laboratory results (serology, virus detection or isolation) in 63.4% of all cases.

Of all cases, 89.2% had a known vaccination status and of these, 83.8% were unvaccinated.

In the target group for routine childhood MMR vaccination (1–4-year-old children), 76.9% of the cases were unvaccinated.

One measles-related death was reported during the period July 2014–June 2015, and eight cases were complicated by acute measles encephalitis.

Since the previous report, outbreaks of measles have been detected in several countries in the WHO European Region: Austria, Belarus, Lithuania, Denmark, Norway, the United Kingdom, France, Sweden and Belgium.

Outside of Europe, measles outbreaks are reported from the Democratic Republic of Congo, Guinea, Sudan, South Sudan, Brazil, Australia, Mali, Algeria, Chile, Peru, Cameroon, Taiwan, Iraq and Malaysia.

Measles

High incidence in developing countries and in Europe (2015: 15 months of death in Berlin)

In the Czech Republic, measles are virtually absent, in the case of isolated diseases, they are mostly imported diseases.

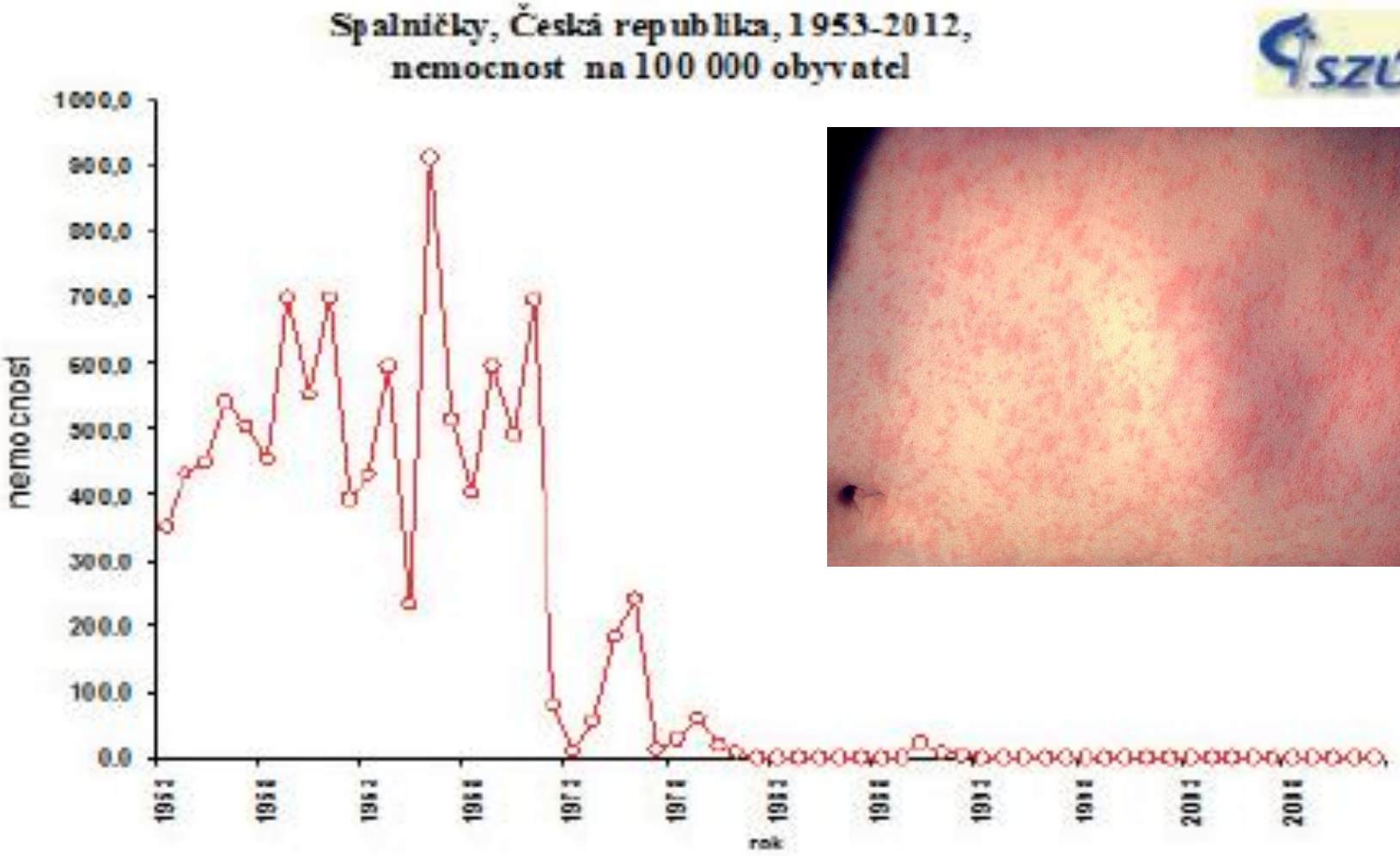
CR - there are no conditions for epidemics

But 20% of people aged 35-44 do not have antibodies

Threats: health professionals, young adults, children of non-immature mothers, rarely even immunized children

Graf č. 5 Zvládnutí spalniček očkováním

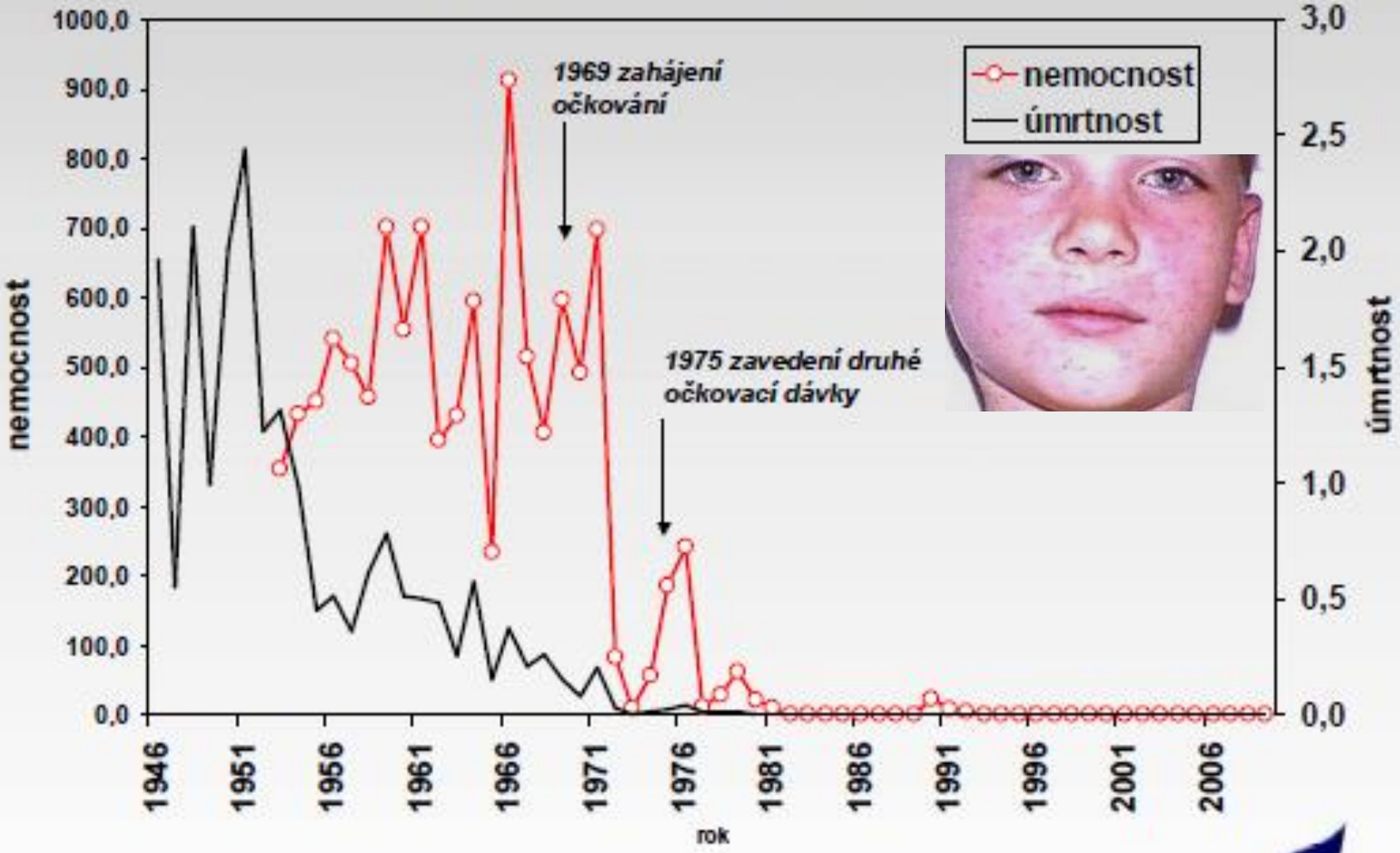
Dokud bylo očkování nepovinné, patřily spalničky mezi nejčastější příčiny smrti u dětí do 5 let. Jednalo se hlavně o navazující zápaly plic, průdušnice, mozku nebo srdečního svalu.Jedna dávka očkovací látky se ukázala jako nedostatečná, proto bylo zavedeno očkování druhou dávkou.

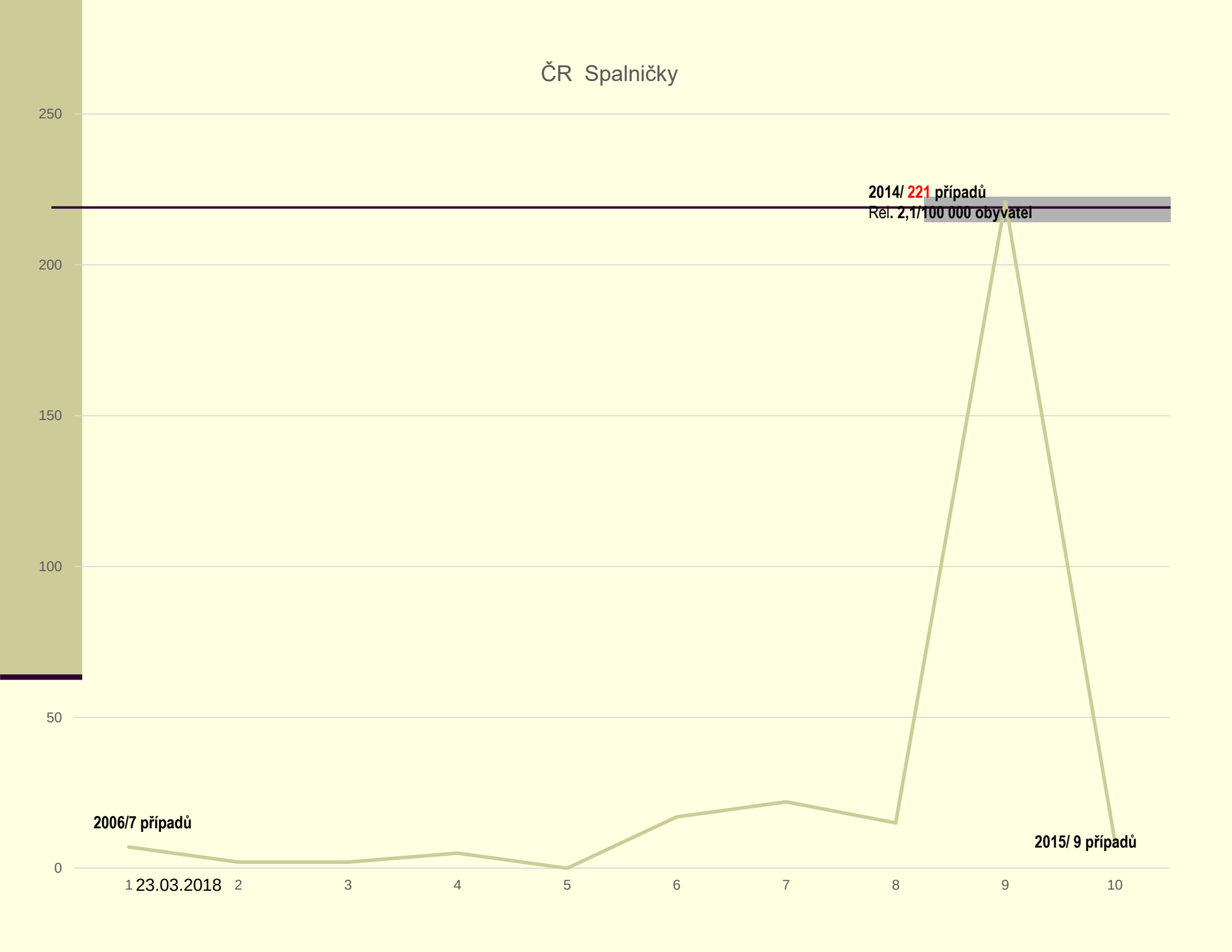


Zdroj: SZÚ

Zdraví 2020 – Národní strategie ochrany a podpory zdraví a prevence nemocí

Spalničky, nemocnost a úmrtnost, ČR, 1953-2009 nemocnost a 1946-2009 úmrtnost na 100 000 obyvatel




ČR Spalničky
250
200
150
100
50
0
2014/ 221 případů
Rel. 2,1/100 000 obyvatel
2006/7 případů
2015/ 9 případů
1 23.03.2018
2
3
4
5
6
7
8
9
10

Rubella

• Twenty-eight EU/EEA countries reported a total of 2 808 rubella cases during the period July 2014 to June 2015.

• In 18 of the countries reporting consistently, the rubella notification rate was less than one case per million population, including 11 countries reporting zero cases during the 12-month period.

• Poland accounted for 93.9% of all reported rubella cases in the 12-month period.

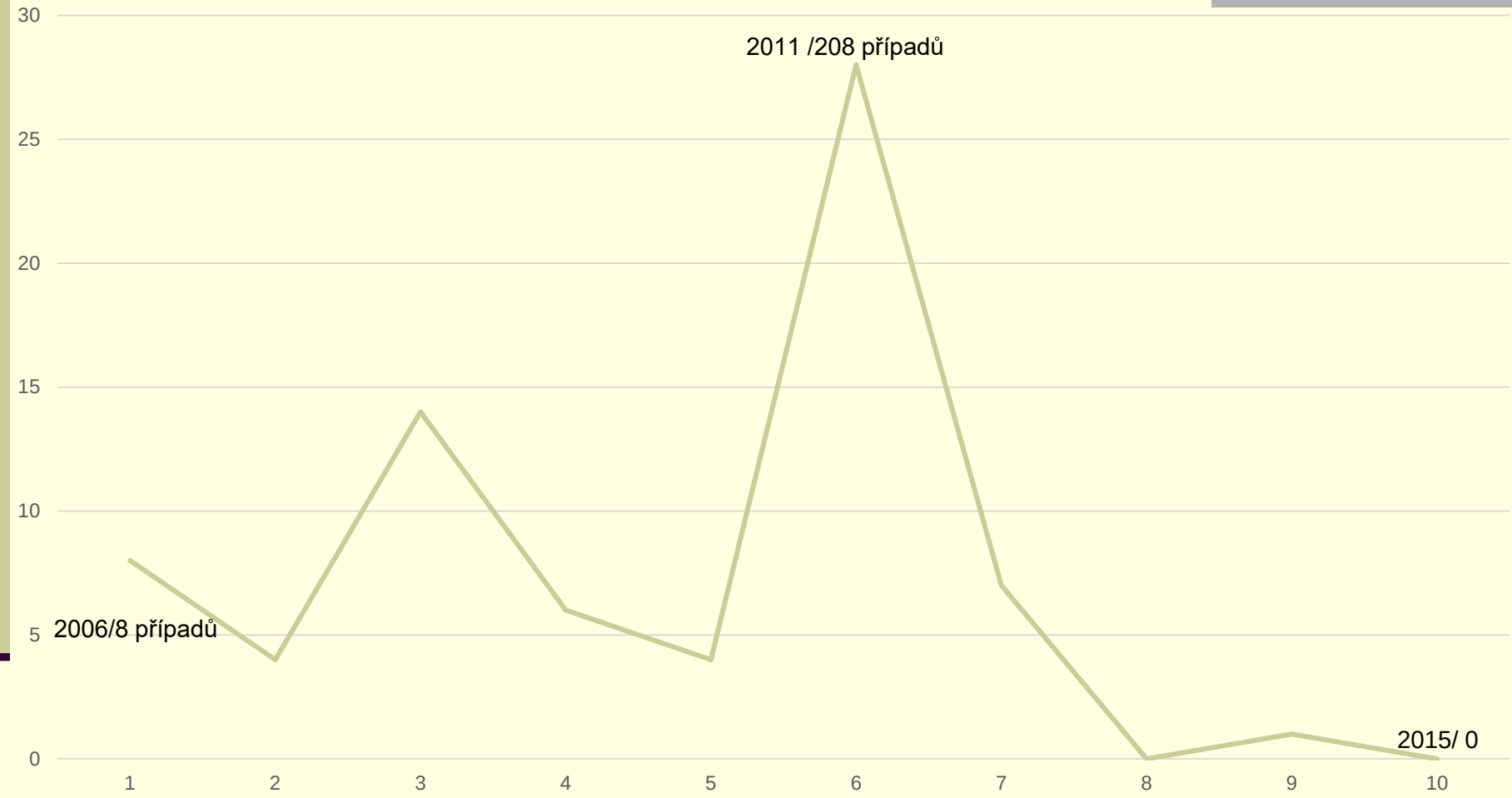
The highest number of cases was observed in 5–9- and 1–4-year-olds. 28.5% of the cases were unvaccinated.

However, this figure needs to be interpreted with caution as only 37 cases were confirmed through laboratory testing.

• No outbreaks of rubella have been detected by epidemic intelligence since the last report.

Zarděnky, Česká republika, 1961-2009, nemocnost na 100 000 obyvatel

ČR Zarděnky



23.03.2018

MUMPS

Mumps is an acute illness caused by the mumps virus. It is characterised by fever and swelling of one or more salivary glands (mumps is the only cause of epidemic infectious parotitis).

Humans are the only reservoirs of the virus, which is transmitted from person to person via droplets and/or saliva. Following infection, the incubation period lasts on average 16–18 days. Salivary glands apart, other organs may be involved and symptoms might include infection in the testicles (in post-pubertal males), prostate gland, thyroid gland, and pancreas. Brain involvement is frequent, but mostly without symptoms. Brain infection is believed to occur in only one in 10 000 cases, but it often leads to death.

Mumps is preventable by a vaccine, which is most often administered in association with anti-rubella and anti-measles vaccines (MMR).

MUMPS - NORWAY: INCREASED INCIDENCE

Date: Fri 6 Nov 2015

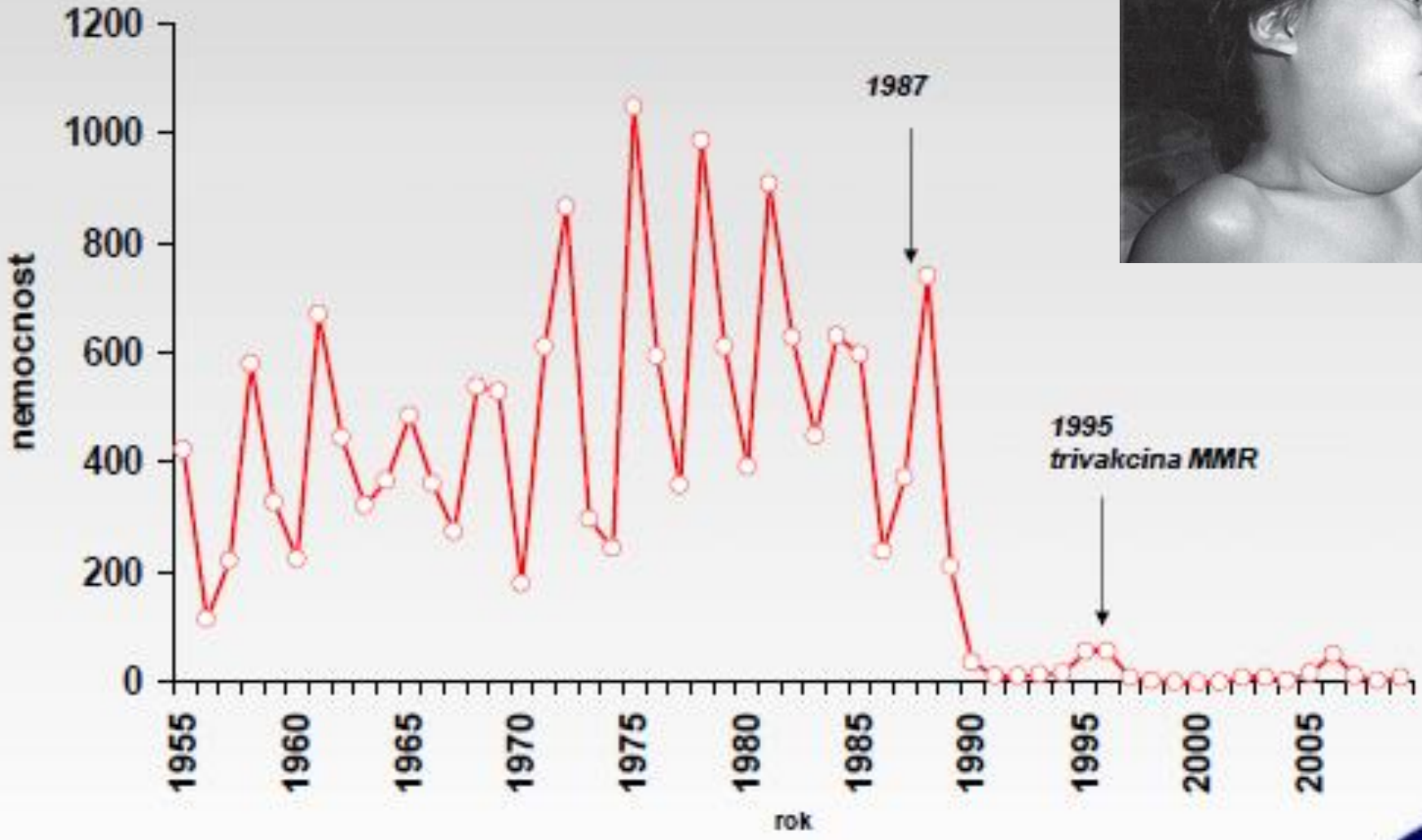
Around 80 cases of the mumps (called kusma in Norwegian) have been recorded in Norway recently, mostly among college students. The outbreak began in Trondheim, but residents of Oslo, Bergen and elsewhere along the west coast have also fallen ill.

Doctors in Trondheim alerted state officials at the Institute for Public Health (Folkehelseinstituttet) late last week. By then, cases were spreading beyond Trondheim. All students suffering symptoms that can be confused with flu were urged to undergo testing. Dr Karin Ronning of the health institute said the outbreak is believed to have been brought in by foreign students.

"Since 1969, all children in Norway have been offered vaccination against measles via the Childhood Immunisation Programme. The measles vaccine is given in the form of 2 doses of MMR vaccine at 15 months and at 11 years (Grade 6). If there is an increased risk of infection, the vaccine may be given as early as 9 months, but a booster dose at

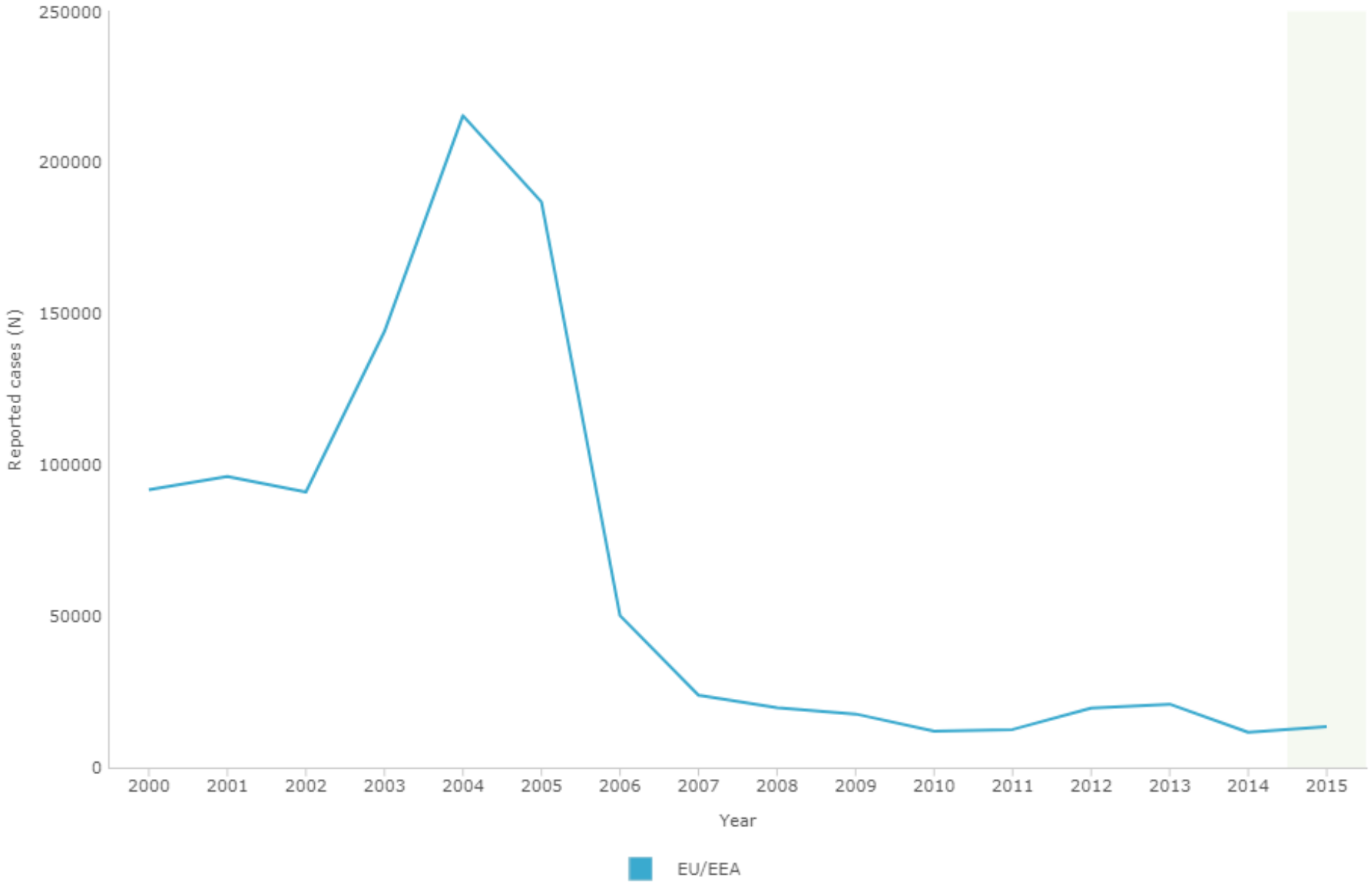
- 15 months of age is recommended.„

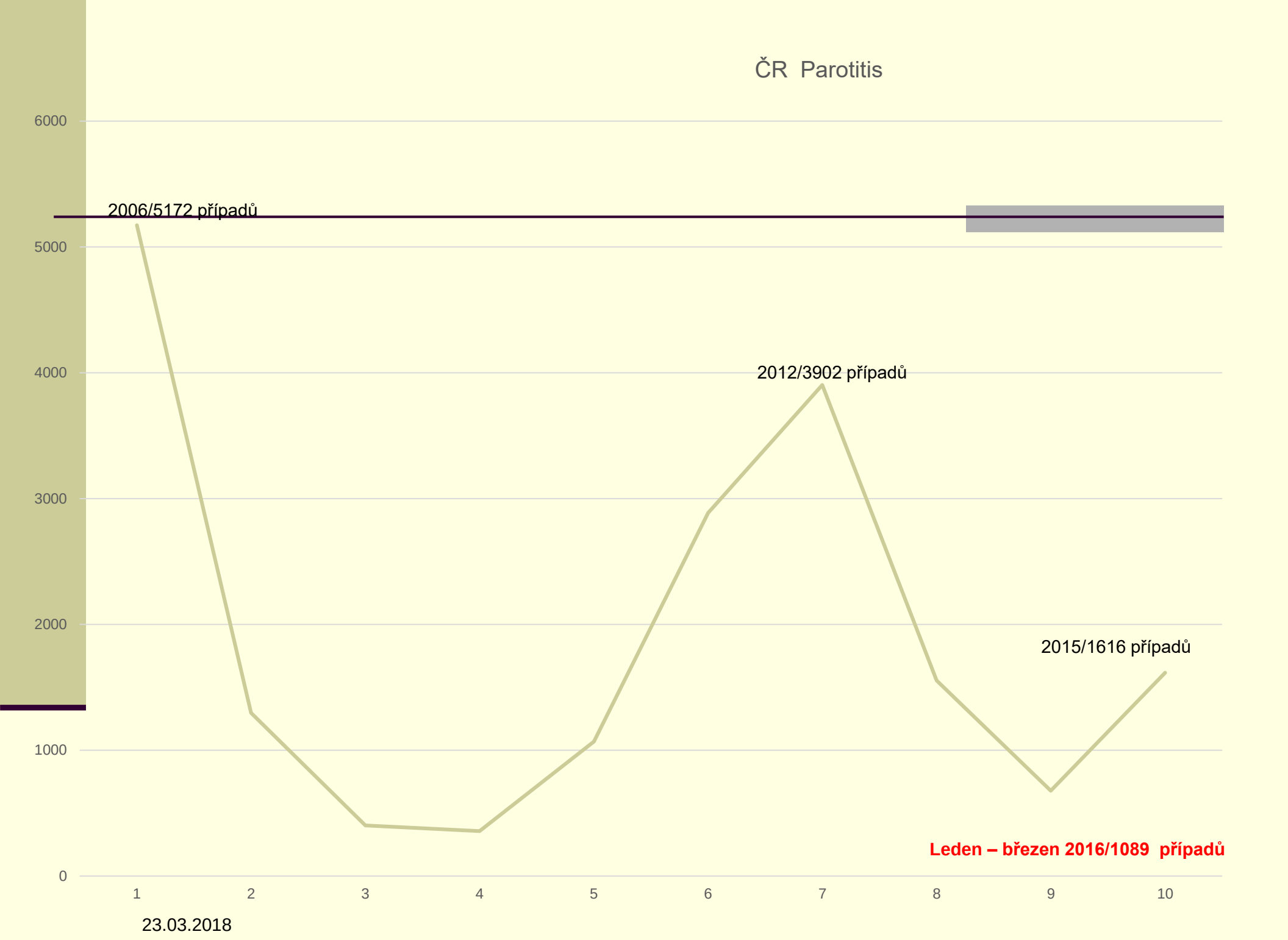
Příušnice, ČR, 1955-2009, nemocnost na 100 000 obyvatel



Surveillance Atlas of Infectious Diseases

Mumps | All cases | Reported cases | 2015




ČR Parotitis
6000
5000
4000
3000
2000
1000
0
2006/5172 případů
2012/3902 případů
2015/1616 případů
Leden – březen 2016/1089 případů
1
2
3
4
5
6
7
8
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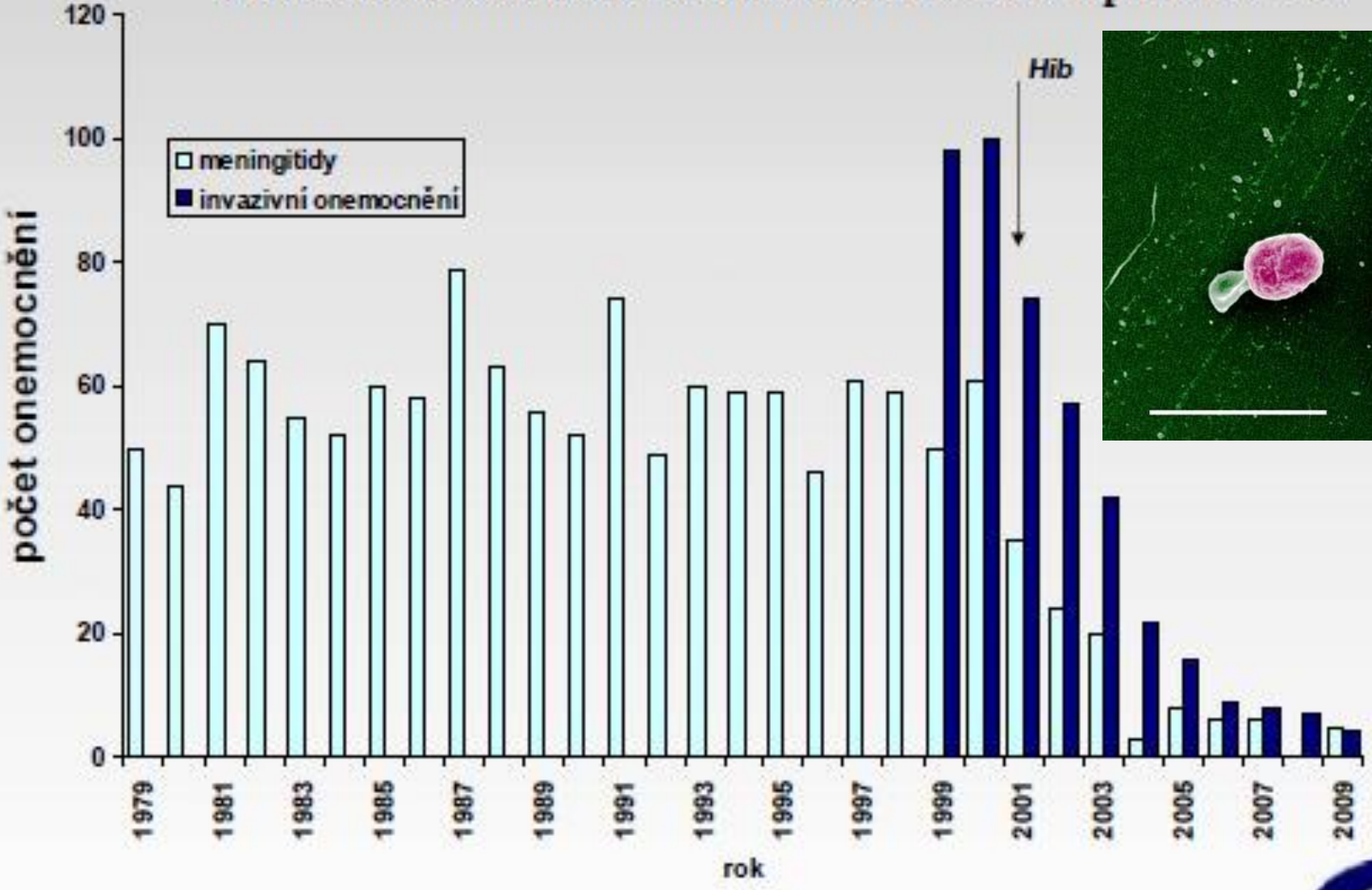
10
23.03.2018

***Haemophilus influenzae* type b (Hib).**

Other familiar diseases that vaccines protect against include chickenpox, hepatitis A and B, and ***Haemophilus influenzae* type b (Hib)**. Hib causes meningitis, an inflammation of the fluid-filled membranes that surround the brain and spinal cord. Meningitis can be fatal, or it can cause severe disabilities such as deafness or mental retardation. This disease has nearly disappeared among babies and children in the United States since the Hib vaccine became widely used in 1989.

Hemofilové bakteriální meningitidy (do roku 1998) a invazivní hemofilová onemocnění B96.3 v Epidatu v ČR



Invasive Haemophilus influenzae disease

Invasive Haemophilus influenzae disease has become rare; the notification rate in Europe was 0.49 per

100 000 population, with a slightly ascending trend which may be attributed to improved surveillance in most countries.

 Country-specific rates were highest in northern Europe and in the United Kingdom;

age-specific rates were highest in children under one year and adults aged 65 years or over.

 The national immunisation schedules of all EU/EEA countries include the Hib vaccine, which has led to a

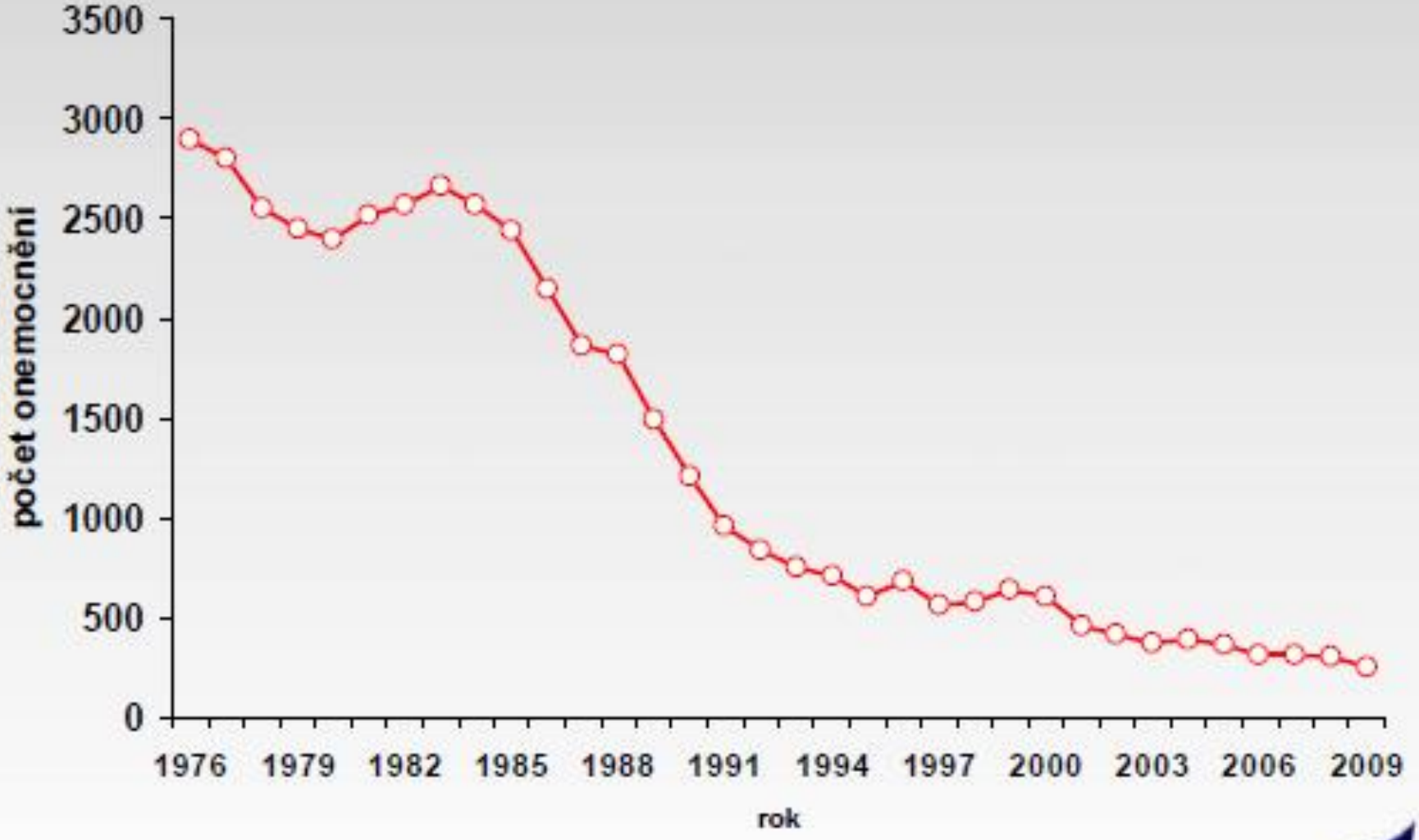
- progressive reduction of type b serotype infections.

 Even though there appears to be a trend towards an increase in disease due to non-capsulated (nontypeable) strains, European data is too scarce to draw conclusions on serotype replacement.

 Continued monitoring of strains, together with their associated clinical syndromes, is essential for assessing the effect of interventions.

In 2012, 2 545 confirmed cases of invasive Haemophilus influenzae disease (all serotypes) were reported by 27 countries, 24 of which have surveillance systems with national coverage. Belgium, France and Spain reported data from sentinel surveillance and therefore had to be excluded from the notification rates analysis, while no confirmed cases were reported from Malta for 2012.

Akutní hepatitida B (B16), Česká republika, 1976-2009, počet hlášených nových onemocnění



Tuberculosis (TB) remains a common infection in EU/EEA countries.

In 2014, 58 008 cases of TB were reported in 29 EU/EEA countries (excluding Italy and Liechtenstein).

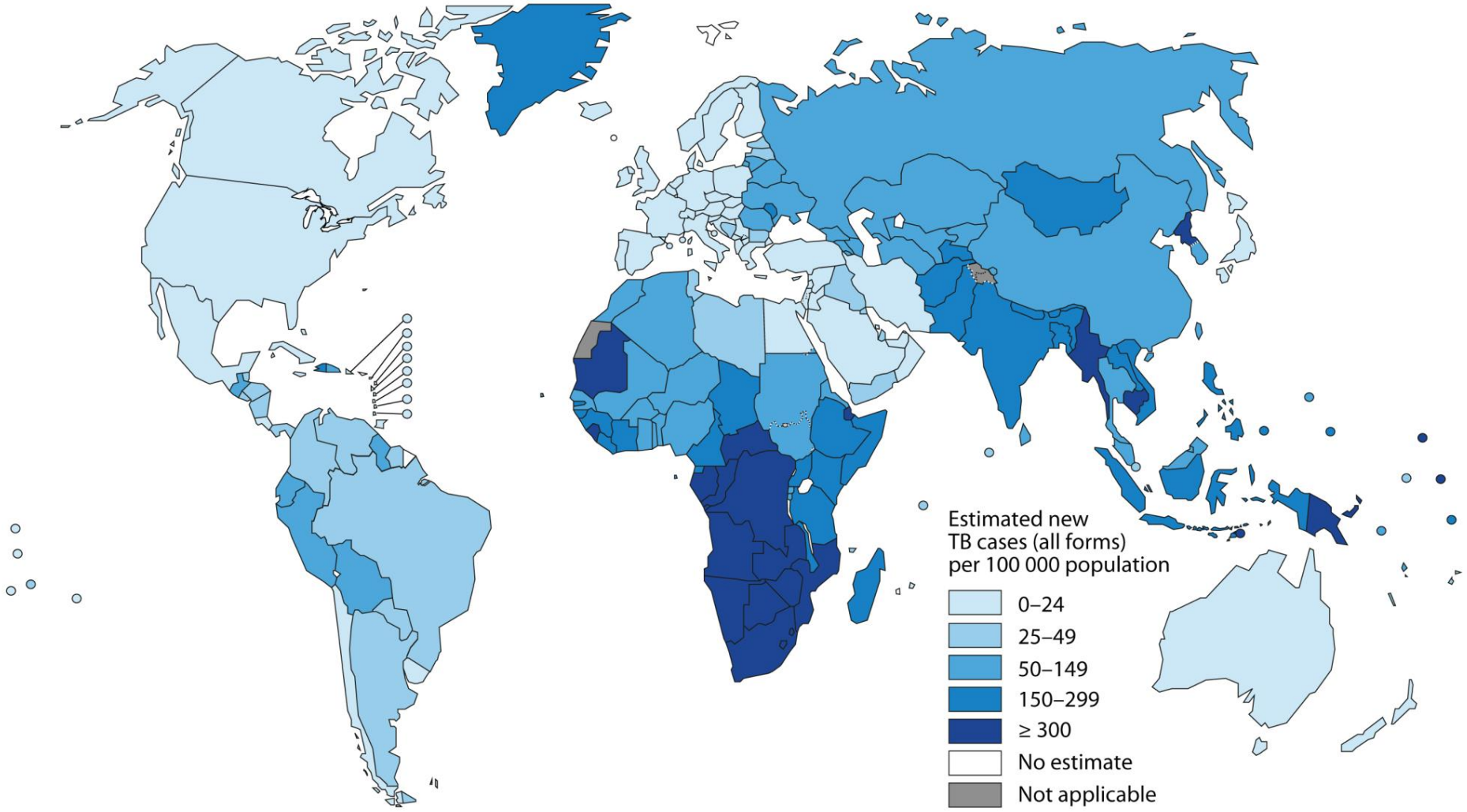
The EU/EEA notification rate in 2014 was **12.8 per 100 000 population.**

Twenty-seven per cent of TB cases were in people of foreign origin, most of them residing in low-incidence countries.

Multidrug-resistant TB (MDR TB) was reported for 4.0% of 36 380 cases with drug susceptibility testing results and continues to be most prevalent in the three Baltic countries.

Of all TB cases with a known HIV status, 4.9% were co-infected with the virus.

Estimated tuberculosis (TB) incidence rates, 2011



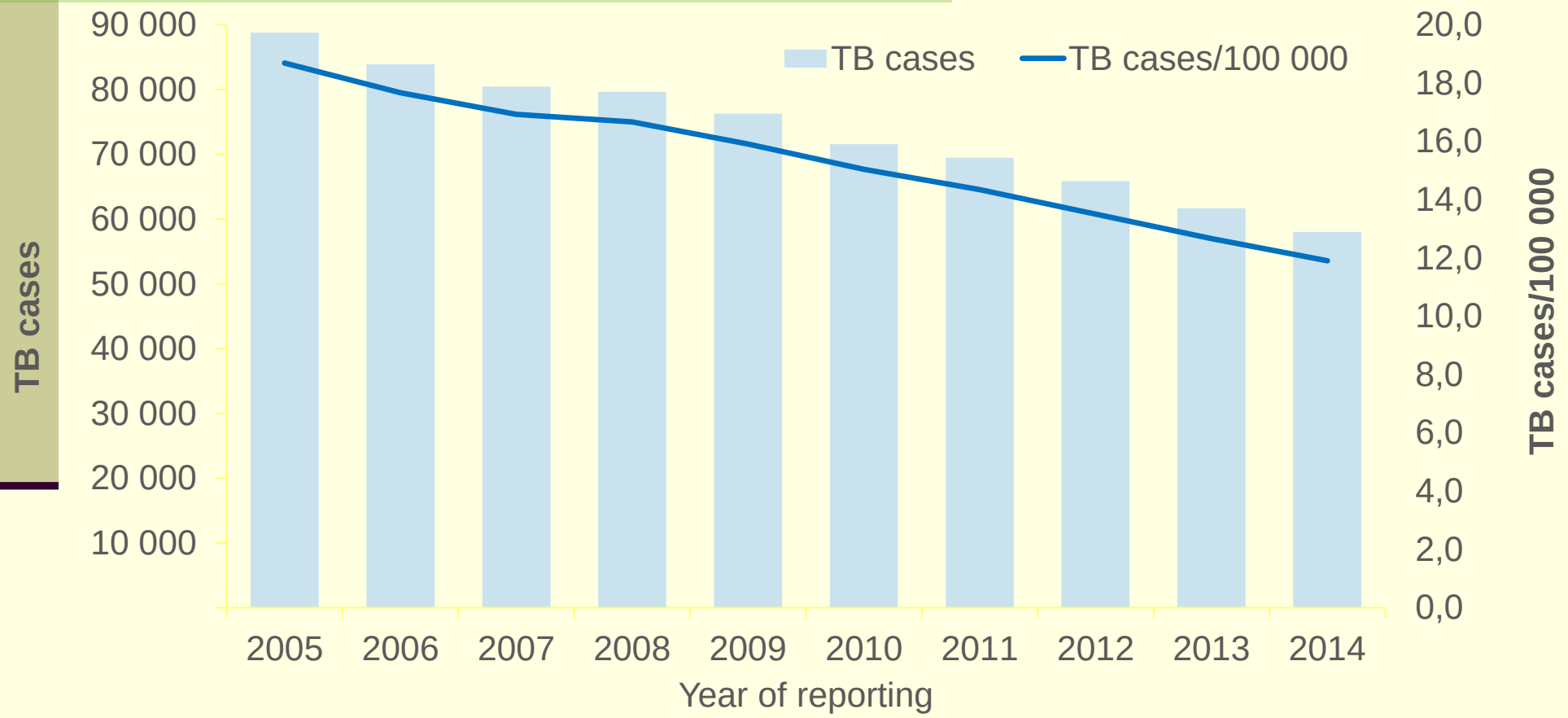
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Source: *Global Tuberculosis Report 2012*. WHO, 2012.

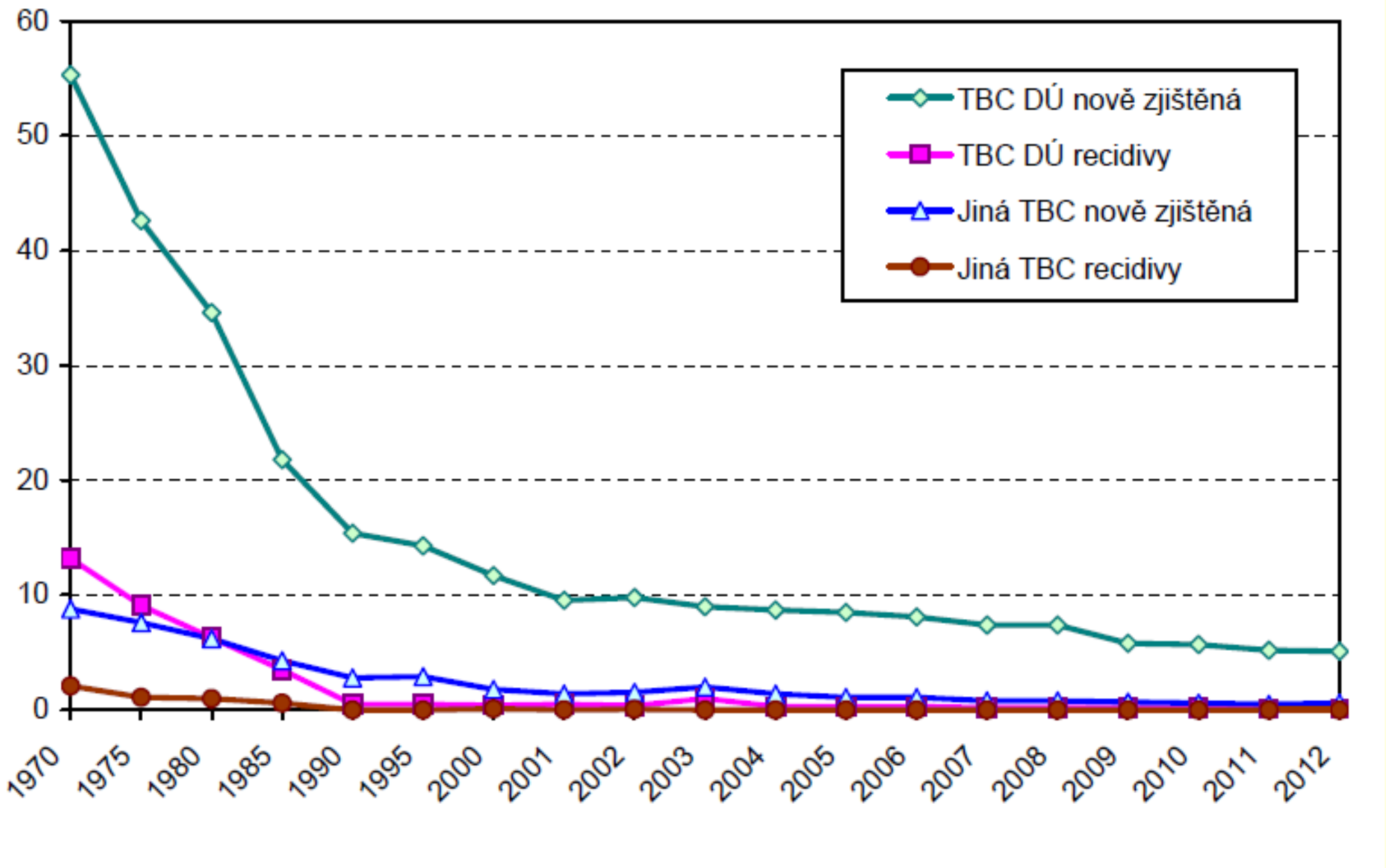
World Health Organization

Reported TB cases, EU/EEA, 2005 – 2014

- Steady decline between 2005 and 2014:
  - number of TB cases decreased by **35%**
  - notification rate decreased by **36%**



Vývoj počtu hlášených TBC/100 tis.obyvatel,ČR



Immunity

- Individual vs. herd immunity
- Protection from infectious disease
- Usually indicated by the presence of antibody
- Very specific to a single organism

Principles of Vaccination

- **Active immunisation**
- Protection produced by the person's own immune system
- Usually permanent

- **Passive immunization**
- Protection transferred from another person (from mother to the foetus) or animal
- Temporary protection that wanes with time

Active Immunisation

- A live or inactivated substance (e.g., protein, polysaccharide) capable of producing an immune response
- Protein molecules (immunoglobulin) produced by B lymphocytes to help eliminate an antigen

Types of vaccines

monovalent - against one agent

polyvalent - against several types of origin of the same species

examples: divalent - meningococcal A + C

trivalent - 3 types of polio virus -OPV, IPV

polyvalent - 23 polysaccharide antigens

Pneumo 23

combined - 2 or more antigens of different agents

examples: VH A + VH B div

tetravachin D + T + Per + Hib

hexavacine D + T + Per + Hib + IPV + VH B

Composition of vaccines

- **antigens** (the immune response inducing component)
- **adjuvants** (depot effect, immunomodulators)
- **antibiotics** (suppressing the growth of contaminants
- microorganisms - for example neomycin, kanamycin)
- **preservatives** (secondary prevention
- contamination - multivariate packaging - eg thiomersal)
- **stabilizers** (support for the stability of vaccines - at different vaccines - magnesium sulphate, sucrose, albumin

General contraindications to vaccination

Temporary contraindications - (absolute, relative) nursing doctor evaluates for each exercise

- the child is acutely ill or has a temperature, more attention should be paid to the current state of health of the child when vaccinated with "live" vaccines (eg measles)
- the child was in contact with the patient and is in the so-called incubation period (which usually lasts 1-3 weeks depending on the type of illness);
- the child is weakened after illness (it is in convalescence), for common childhood illnesses it is usually 1 - 2 weeks,
- the child has a serious long-term illness (most often neurological or oncological)
- the child uses corticosteroids or immunosuppressive drugs.
- Other reasons to prevent vaccination (mostly persistent) may be severe post-vaccination or severe chronic disease (most commonly neurological or immune defects).

permanent contraindications - specialist (record of the opinion of the specialist is obligatorily stored in the documentation)

Contraindications

- Specific
  - Depends on the types of vaccine (exampl.- alergic reaction on the some substances

Apliccation

- Under aseptic conditions !
- i.m.
- s.c.
- intradermal (epidermis)
- p.o.
- scarification
- …..

After aplication - 30 min - under oversight !

Reaction after apliccation

- Fysiolocal reaction
  - Local
    - erythema, swelling, soreness …
  - Generally
    - higher temperature, fever, tiredness, hedeache,
    - pain of the muscles, joints,
    - Indigestion
- Alergic reaction

Vaccination

- Active immunity produced by vaccine
- Immunity and immunologic memory similar to natural infection but without risk of disease

Division of vaccines according to mechanism of action

Live vaccines contain their own infectious agents in attenuated form. It's for example vaccines against certain viral diseases (measles, mumps, rubella).

Inactivated vaccines also contain their own infectious agents, but this time in the killed form. These include, for example, vaccines against certain viruses (influenza, tick encephalitis or rabies).

Subunit vaccines contain only certain components of the pathogen against which they are newly exposed

The emerging immunity of the organism to focus. They are used, for example, against encapsulated bacteria such as are H. influenzae or meningococci; the individual components of their polysaccharide capsule are used in the vaccines.

Recombinant vaccines for the production of vaccines are involved in genetic engineering methods. Specific protein antigens of a particular pathogen (typically, for example, hepatitis B virus) are artificially synthesized, for example, in yeast, and subsequently forms an essential part of the recombinant vaccine.

Toxoids (anatoxins) are a specific type of vaccine where the main objective of the immune response is inactivated pathogenic toxin. Typically, these vaccines are used to prevent tetanus or diphtheria.

DNA vaccines: Although they have not been used in practice for a long time, DNA vaccines are promising promise for the future. Their principle is to some extent similar to that of recombinant vaccines, but vector with the appropriate DNA sequence is administered directly to the vaccinated individual, which is subsequently made immunogenic antigens in your body itself. In addition, persistent stimulation can provide real long-term immunity.

Live Attenuated Vaccines

- Attenuated (weakened) form of the "wild" virus or bacterium
- Must replicate to be effective
- Immune response similar to natural infection
- Usually effective with one dose*

Live Attenuated Vaccines

- Severe reactions possible
- Interference from circulating antibody
- Fragile – must be stored and handled carefully

Live Attenuated Vaccines

- Viral — measles, mumps, rubella, vaccinia, varicella, yellow fever, intranasal influenza, (oral polio) (rotavirus)
- Bacterial — BCG, oral typhoid

Inactivated Vaccines

- Cannot replicate
- Less interference from circulating antibody than live vaccines
- Generally require 3-5 doses
- Immune response mostly humoral
- Antibody titer diminishes with time

Inactivated Vaccines

- Viral — polio, hepatitis A, rabies (influenza)
- Bacterial — (pertussis) (typhoid) (cholera) (plague)

Inactivated Vaccines

- Subunit — hepatitis B, influenza, acellular pertussis, (Lyme) (HPV)
- Toxoid — diphtheria, tetanus

Polysaccharide Vaccines

- pneumococcal
- meningococcal
- *Salmonella* Typhi (Vi)

- *Haemophilus influenzae* type b
- pneumococcal
- meningococcal

Pure Polysaccharide Vaccines

- Not consistently immunogenic in children <2 years of age
- No booster response
- Antibody with less functional activity
- Immunogenicity improved by conjugation

Passive Immunisation

- Transfer of antibody produced by one human or other animal to another
- Temporary protection
- Transplacental most important source in infancy

Sources of Passive Immunity

- Almost all blood or blood products
- Homologous pooled human antibody (immune globulin)
- Homologous human hyperimmune globulin
- Heterologous hyperimmune serum (antitoxin)

Passive immunization

P (1) Human hyperimmune antitetanic globulin is administered:
to unvaccinated people at all after the prescribed interval for re-vaccination (persons over 60 years of age after 10 years)
without proof of vaccination against tetanus

(2) hyperimmune anti-rabies globulin:
in the case of bite or injury by an animal suspected of rape infection.

(3) hyperimmune globulin against viral hepatitis B:
newborn mothers of HBsAg positive mothers

Botulism immune globulin (BIG)
Antidifteric serum.

Passive immunization

botulism immune globulin (BIG) is indicated in infants with clinically diagnosed infant botulism, before diagnostic confirmation. The prompt use of this specific immunoglobulin leads to a significant decrease in both ICU and total hospital stay.

Immunisation in Czech Republic

Regulary vaccination – (refunding the state)

- (TBC) form 2010 only by indicated group
- Diphteria, Tetanus, Pertussis, Hemophillus influenzae B, Poliomyelitis, Viral hepatitis B (VHB),
- Morbilli, Rubeola, Parotitis epidemica

- Inluenza, Pneumoccus (for specific groups – by low)
- VHB (healths workers)

TBC	only - indication
Di,Te,P(a), Hib, VHB,IPV	from 13th week 3 times in 1 year (each after 1 months) 4th dosis 6th months after 3th dosis
MMR	1st dosis from 15th months 2nd dosis from 6th to 10th months after 1st dosis
Di,Te,P(a)	5 years
Di,Te,P(a),IPV	10 years
VHB	12 years
Te	25 years, revaccination each after 10 - 15 years

Poznámka: TBC , Di (Diphteria), Tetanus (Te), P (Pertussis), Hib (Haemophilus influenzae b), HB (VHB), IPV (poliomyelitis), MMR (measles, mumps, Rubella).

Vaccination before going abroad. Obligatory vaccination against:

- **yellow fever** when traveling to countries of Africa and Central and South America and
- **meningococcal meningitis (A, C, Y, W - 135)** when traveling to Saudi Arabia.

Typhus abdominalis

TYPHIM Vi is a vaccine prepared from the purified Vi capsular polysaccharide obtained by extraction from Salmonella typhi.

Preventing typhoid fever in adults and children over 2 years of age, especially people traveling to endemic areas, migrants, health workers and soldiers.

Protection is provided by one dose of the vaccine.

The vaccination is done every three years if the risk of infection with the typhoid persists.

New HPV vaccine - Gardasil 9,

Clostridium difficile vaccine

Vaccine against Autism?

Philippines - Sanofi's Dengvaxia vaccine is the first ever authorized dengue fever vaccine.

Last week, however, the company admitted that long-term studies have shown that the vaccine is effective for people who have been infected in the past but are at risk for those who become infected for the first time. The illness may be more severe in them.

Anthrax

Cervical Cancer

Diphtheria

Hepatitis A

Hepatitis B

Haemophilus influenzae type b

Human Papillomavirus (HPV)

H1N1 Flu (Swine Flu)

Influenza (Seasonal Flu)

Japanese Encephalitis (JE)

Measles

Meningococcal

Mumps

Pertussis (Whooping Cough)

Pneumococcal

Poliomyelitis (Polio)

Rabies

Rotavirus

Rubella (German Measles)

Shingles (Herpes Zoster)

Smallpox

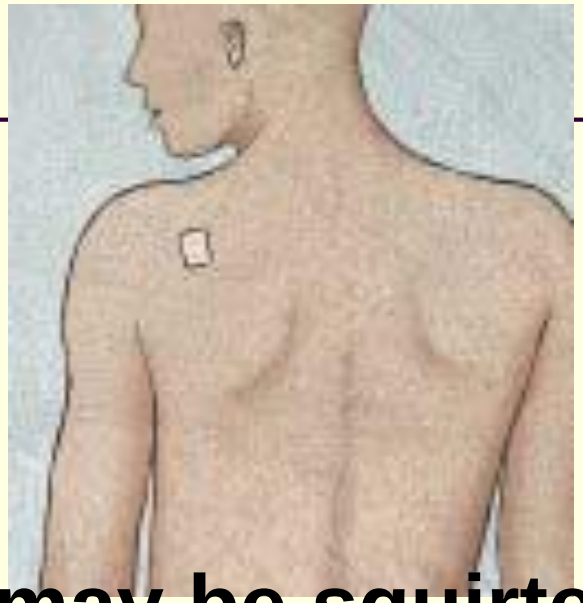
Tetanus

Tuberculosis

Typhoid Fever

Varicella (Chickenpox)

Yellow Fever



Future vaccines may be squirted up the nose, worn as a patch, or eaten at the dinner table.