

Preventive epidemiological measures; principles of vaccination

MUDr. Marie Kolářová, CSc.
Ústav ochrany a podpory zdraví LF MU
Spring 2018

Epidemiology

is the **study** (scientific, systematic, data-driven)
of the **distribution** (frequency, pattern)
and **determinants** (causes, risk factors)
of **health-related states or events** (not just diseases)
in **specified populations** (patient is community,
individuals viewed collectively),
and the **application** (since epidemiology is a discipline
within public health) of this study to the control of health
problems.

SURVEILLANCE

The systematic

- ❖ collection,
- ❖ analysis,
- ❖ interpretation, and
- ❖ dissemination of health data on an ongoing basis, **to gain knowledge of the pattern of disease occurrence and potential in a community, in order to control and prevent disease in the community.**



WHO - Health statistics and information system

- The **World Health Organization (WHO)** is a specialized agency of the United Nations that is concerned with international public health.
- It was established on 7 April 1948 headquartered in Geneva, Switzerland.
- The WHO is a member of the United Nations Development Group. Its predecessor, the Health Organization, was an agency of the League of Nations.



World health statistic

- The World Health Statistics series is WHO's annual compilation of health statistics for its 194 Member States.
- WHO's annual World Health Statistics reports present the most recent health statistics for the WHO Member States.
- *World Health Statistics 2017* focuses on the health and health-related Sustainable Development Goals (SDGs) and associated targets by bringing together data on a wide range of relevant SDG indicators.
- In some cases, as indicator definitions are being refined and baseline data are being collected, proxy indicators are presented.
- In addition, in the current absence of official goal-level indicators, summary measures of health such as (healthy) life expectancy are used to provide a general assessment of the situation.

WHO - Health statistics and information system

- National Health Interview Survey(<https://www.cdc.gov/nchs/nhis/index.htm>)
- **Selected Data Items:**
- Health status and limitations
- Utilization of health care
- Health insurance
- Access to care
- Selected health conditions
- Poisonings and injuries
- Health behaviors
- Functioning/disability
- Immunizations
-



European Centre for
Disease Prevention and
Control
An agency of the
European Union

 Eurosurveillance

- The European Centre for Disease Prevention and Control (ECDC) was established in 2005.
- It is an EU agency aimed at strengthening Europe's defences against infectious diseases. It is located in Solna, Sweden.
- ECDC core functions cover a wide spectrum of activities: surveillance, epidemic intelligence, response, scientific advice, microbiology, preparedness, public health training, international relations, health communication, and the scientific journal *Eurosurveillance*.
- ECDC disease programmes cover antimicrobial resistance and healthcare-associated infections; emerging and vector-borne diseases; food- and waterborne diseases and zoonoses; HIV, sexually transmitted infections and viral hepatitis; influenza and other respiratory viruses; tuberculosis; and vaccine-preventable diseases. All in all, ECDC monitors 52 communicable diseases.



Work Programmes and long-term strategies



- The Work Programmes includes two parts: the first presents objectives and priorities while the second part provides more detail on the specific objectives and expected outputs.
- **Long-term surveillance strategy 2014–2020**
- ECDC has launched the ‘Strategic Multi-annual Programme 2014–2020: Working together to reduce the burden’.
- This long-term surveillance strategy covers the same period, 2014–2020, and should be seen as a further elaboration of this core activity as detailed in the broader multi-annual programme.
- Public health surveillance has been referred to as ‘the epidemiological foundation for modern public health’.



Work Programmes and long-term strategies

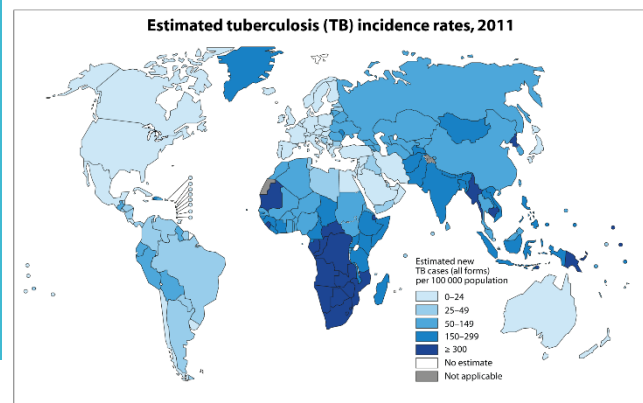
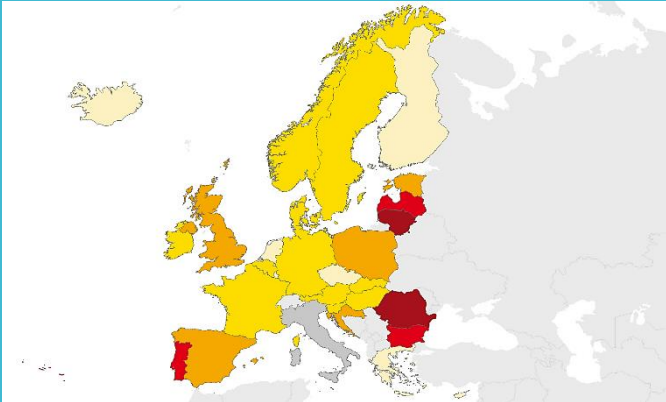


- **Long-term surveillance strategy 2014–2020**
- The final strategy is divided into six priorities:
- **1** Consolidating surveillance, increasing its efficiency and enhancing the outputs and their impact
- **2** Developing standards, improving data quality and sharing best practices in surveillance
- **3** Promoting use of surveillance data
- **4** Strengthening capacity in surveillance
- **5** Controlling expansion
- **6** Monitoring the strategy.

Diseases and special health issues under EU surveillance


- **Diseases preventable by vaccination**
- **Sexually transmitted diseases**
- **Viral hepatitis**
- **Food- and waterborne diseases and diseases of environmental origin**
- **Diseases transmitted by non-conventional agents (prions)**
- **Airborne diseases**
- **Zoonoses (other than those listed above)**
- **Serious imported diseases**
- **Vector-borne diseases**
- **Special health issues (HAI, antibiotic resistance)**

European Tuberculosis Surveillance Network



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.



- The European Tuberculosis Surveillance Network consists of TB surveillance experts from all 53 countries belonging to the World Health Organization's European Region, including 30 EU/EEA Member States.
- Under the joint coordination of ECDC and the World Health Organization's Regional Office for Europe, the network collects, validates, analyses and disseminates European TB surveillance data.
- The purpose of the network is to identify the epidemiological patterns of TB in the Region and monitor progress towards TB elimination, with key surveillance and monitoring findings published in an annual report.
- In addition, the network aims to further strengthen TB surveillance in Europe.

Global Disease Elimination and eradication

- During the 25 years since the certification of smallpox eradication there has been considerable debate among public health practitioners about how existing health technologies can best be used to decrease infectious disease incidence and prevalence.
- Interruption of transmission has often been envisaged as the ultimate goal, and standard public health concepts of disease reduction have been defined or re-defined.
- In 1998, Dowdle proposed a definition of control as a reduction in the **incidence, prevalence, morbidity** or **mortality** of an infectious disease to a locally acceptable level;
- **elimination** as reduction to zero of the incidence of disease or infection in a defined geographical area;
- and **eradication as permanent reduction to zero** of the worldwide incidence of infection

Eradication and Elimination

Eradication is an absolute process, an “all or none” phenomenon, restricted to termination of infection from the whole world.

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

8. May 1980.

- The term **elimination** is sometimes used to describe eradication of a disease from a large geographic region. Disease which are amenable to elimination in the meantime are polio, measles and diphtheria.

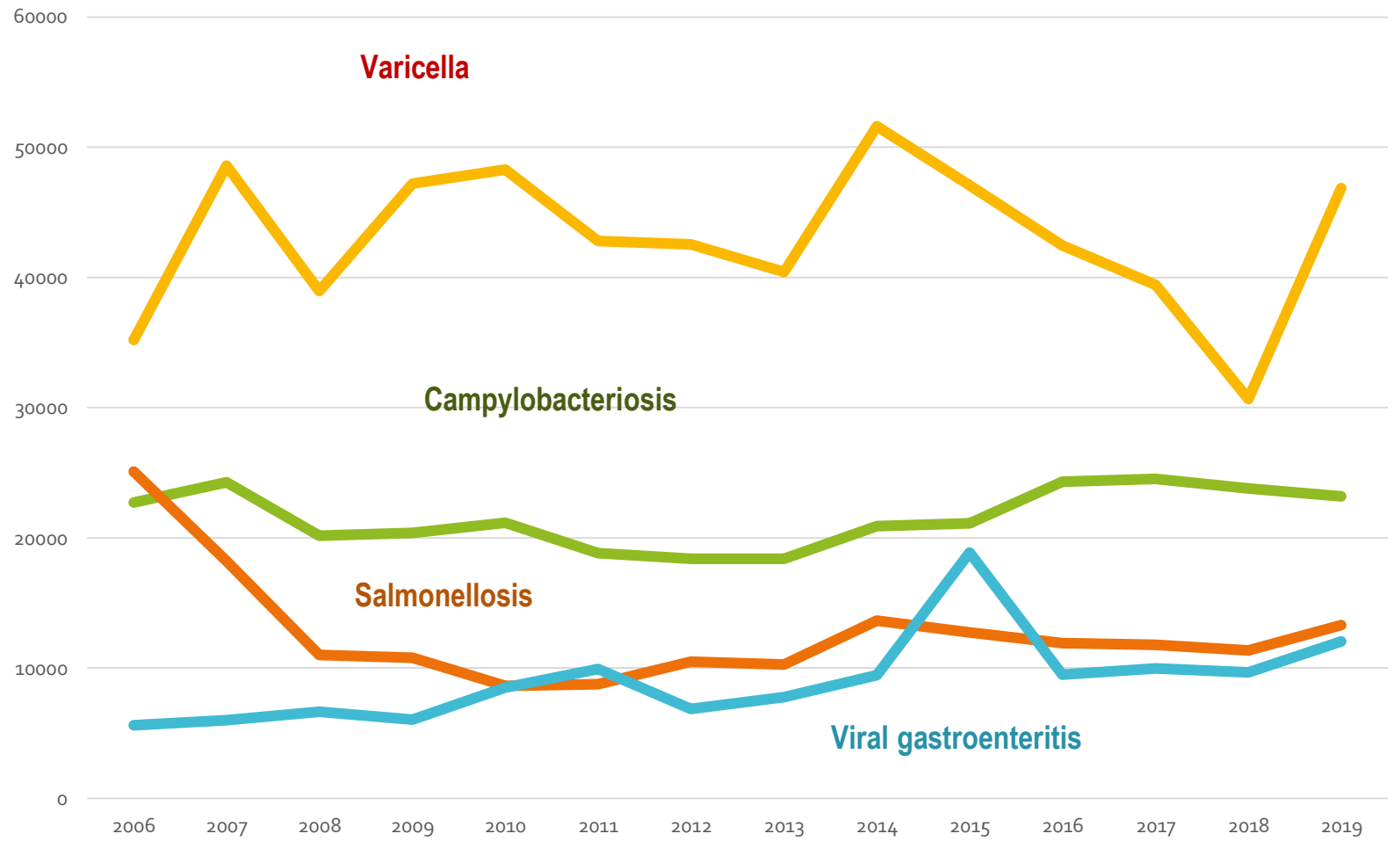
**Health 2020:
the European
policy for health
and well-being**

- **Health 2020** is the new European health policy framework.
- It aims to support action across government and society to:
 - “significantly improve the health and well-being of populations,
 - reduce health inequalities,
 - strengthen public health and ensure people-centred health systems that are universal, equitable, sustainable and of high quality

SURVEILLANCE

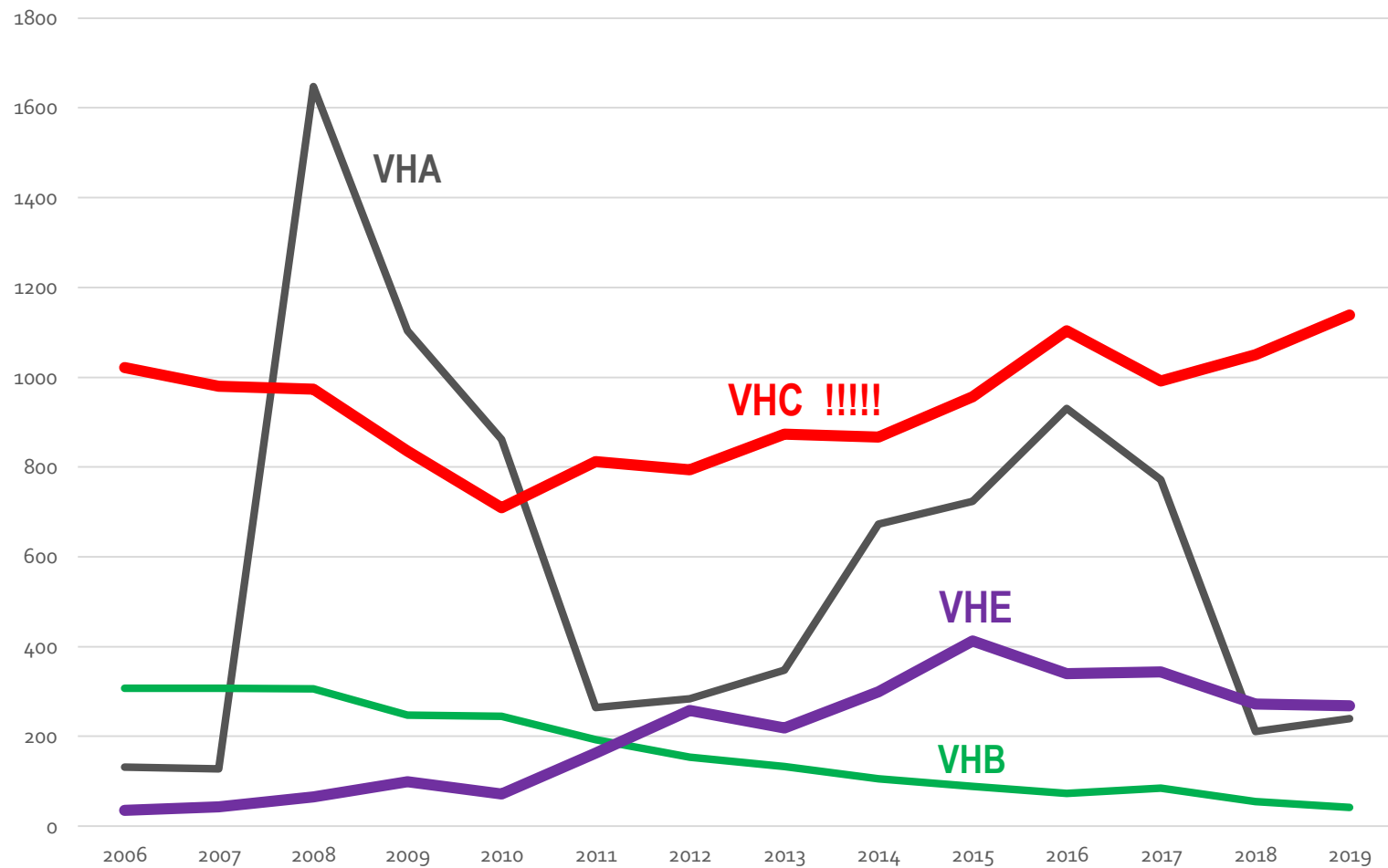
- Surveillance programmes can be carried out on a large scale such as for districts and regions.
- In the Czech Republic, surveillance programmes exist for poliomyelitis, pertussis, diphtheria, measles, viral hepatitis, alimentary infections and influenza.
- Under the general guidelines released by WHO, surveillance of influenza is carried out on an international level.

Current epidemiological situation ČR

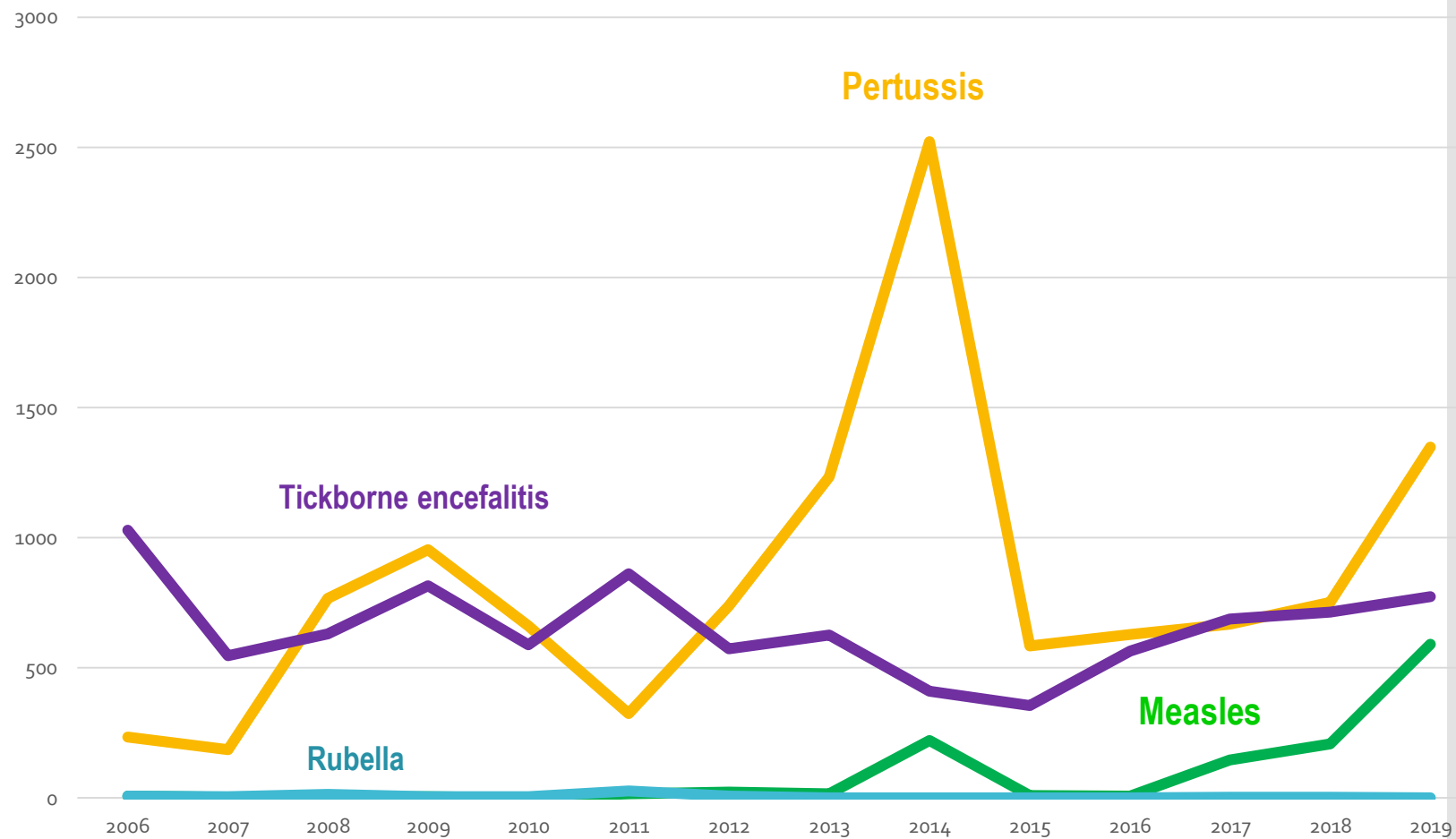


Current epidemiological situation ČR

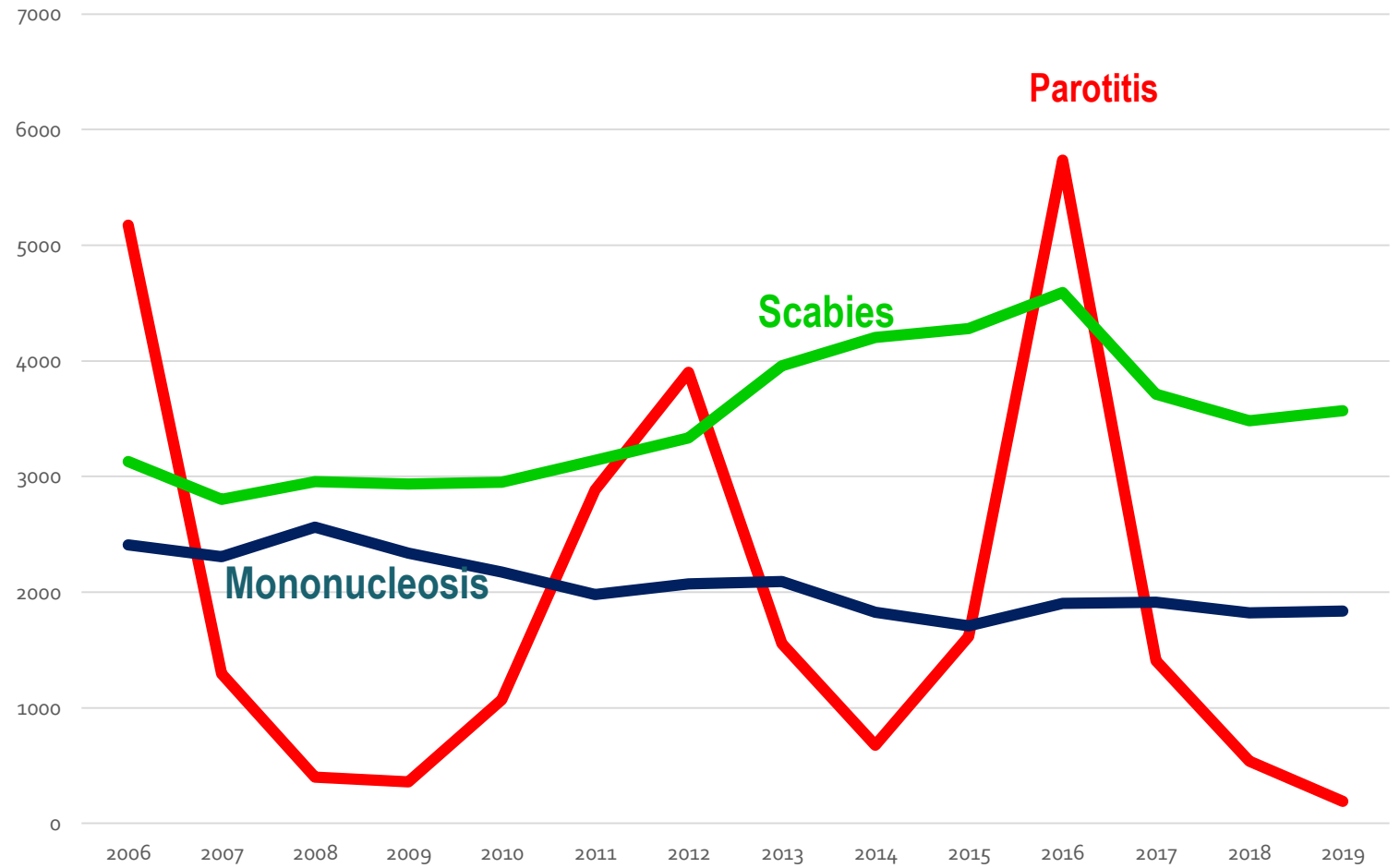
Current epidemiological situation ČR



Current epidemiological situation ČR



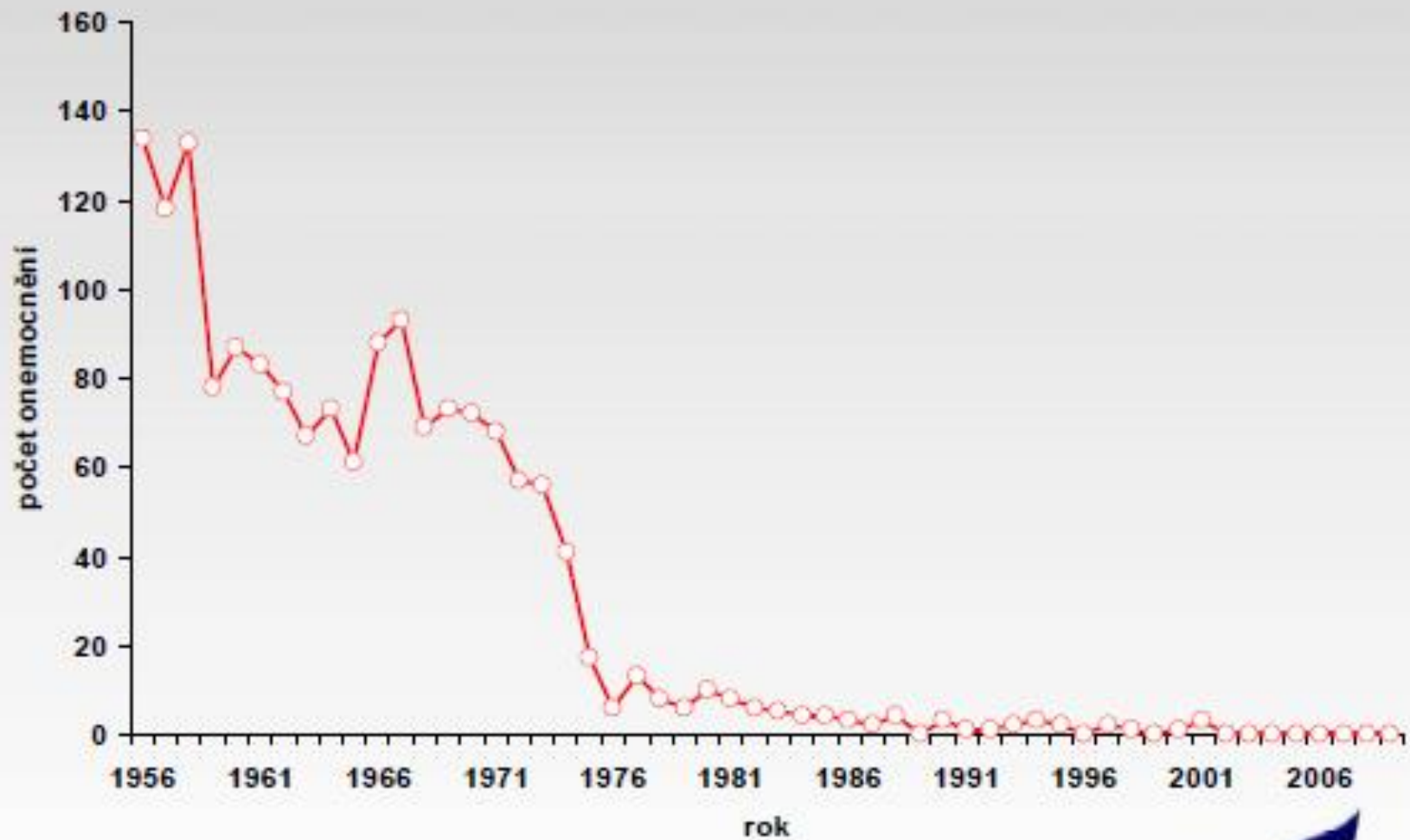
Current epidemiological situation ČR



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



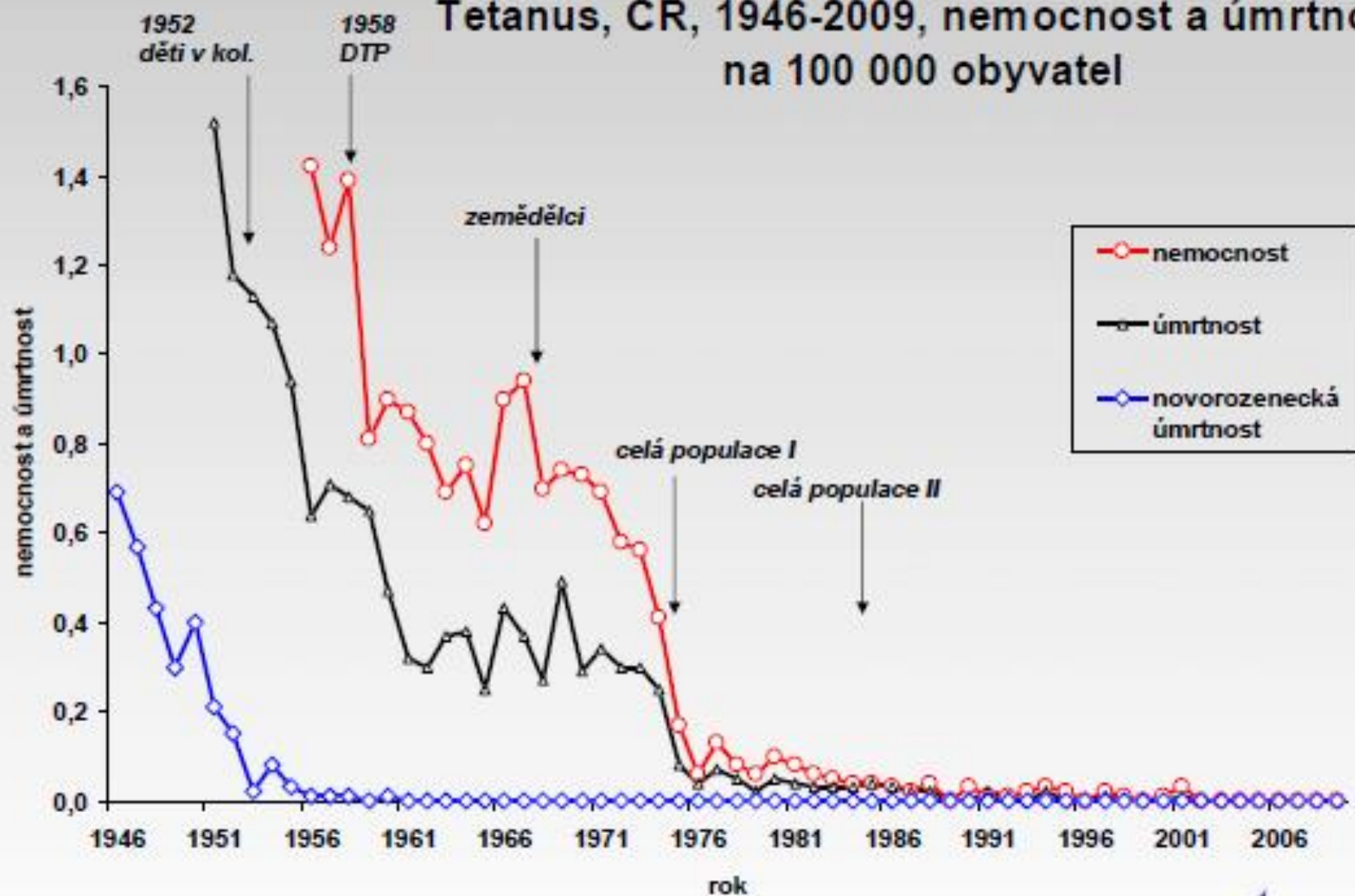
Tetanus, Česká republika, hlášená onemocnění 1956-2009



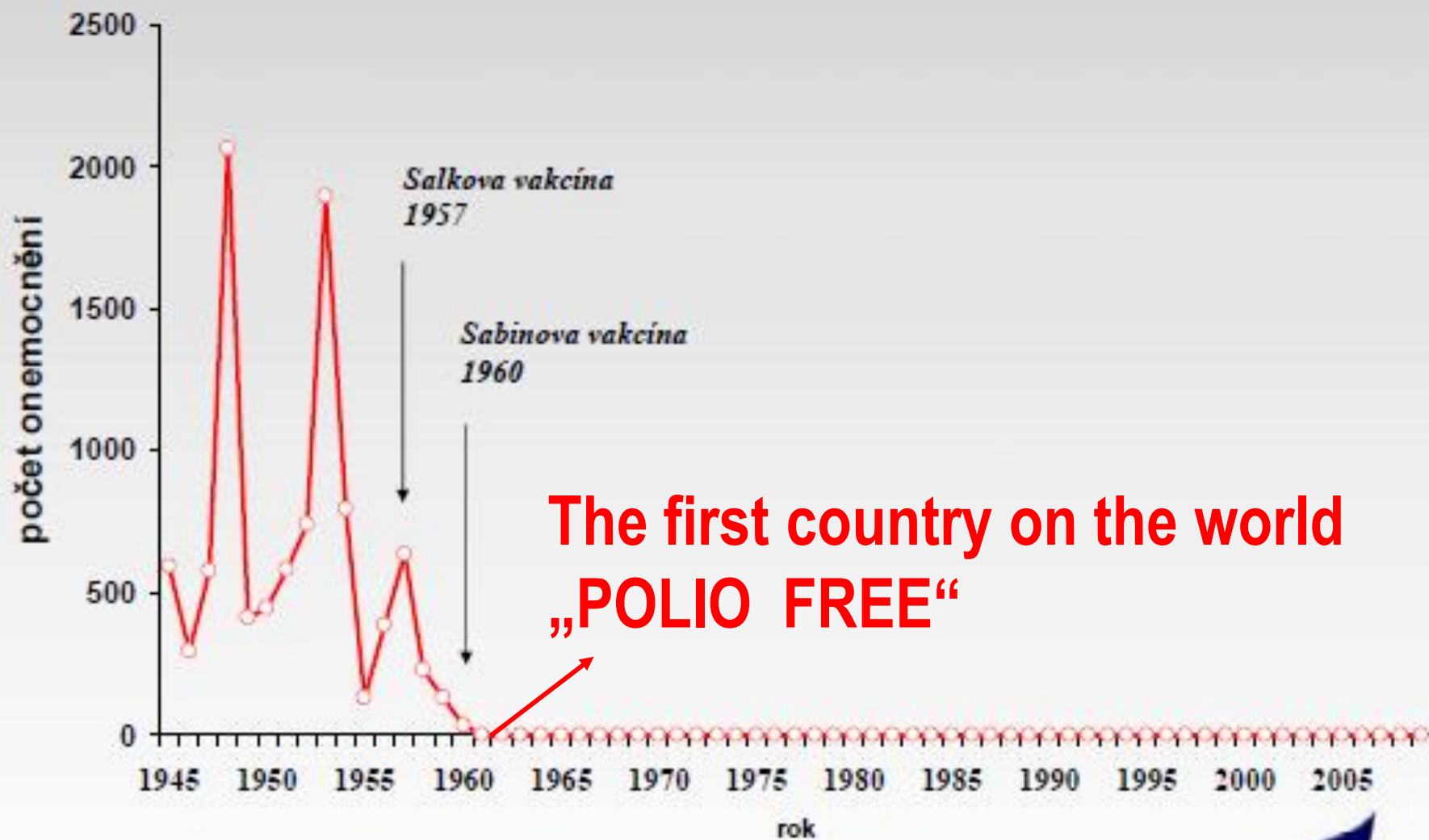
Státní zdravotní ústav



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

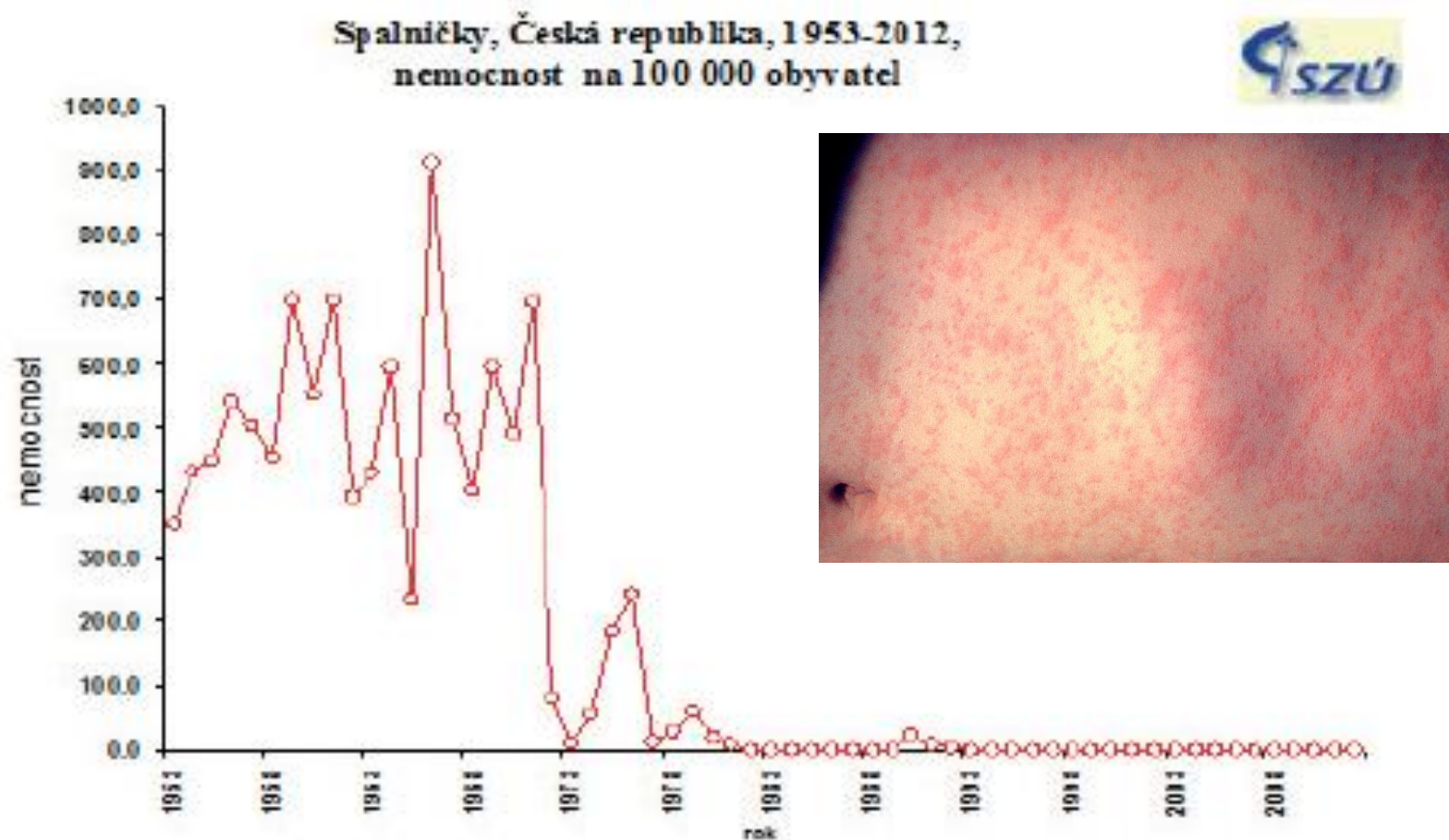


Polio (A80), Česká republika, hlášená onemocnění 1945-2009



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.

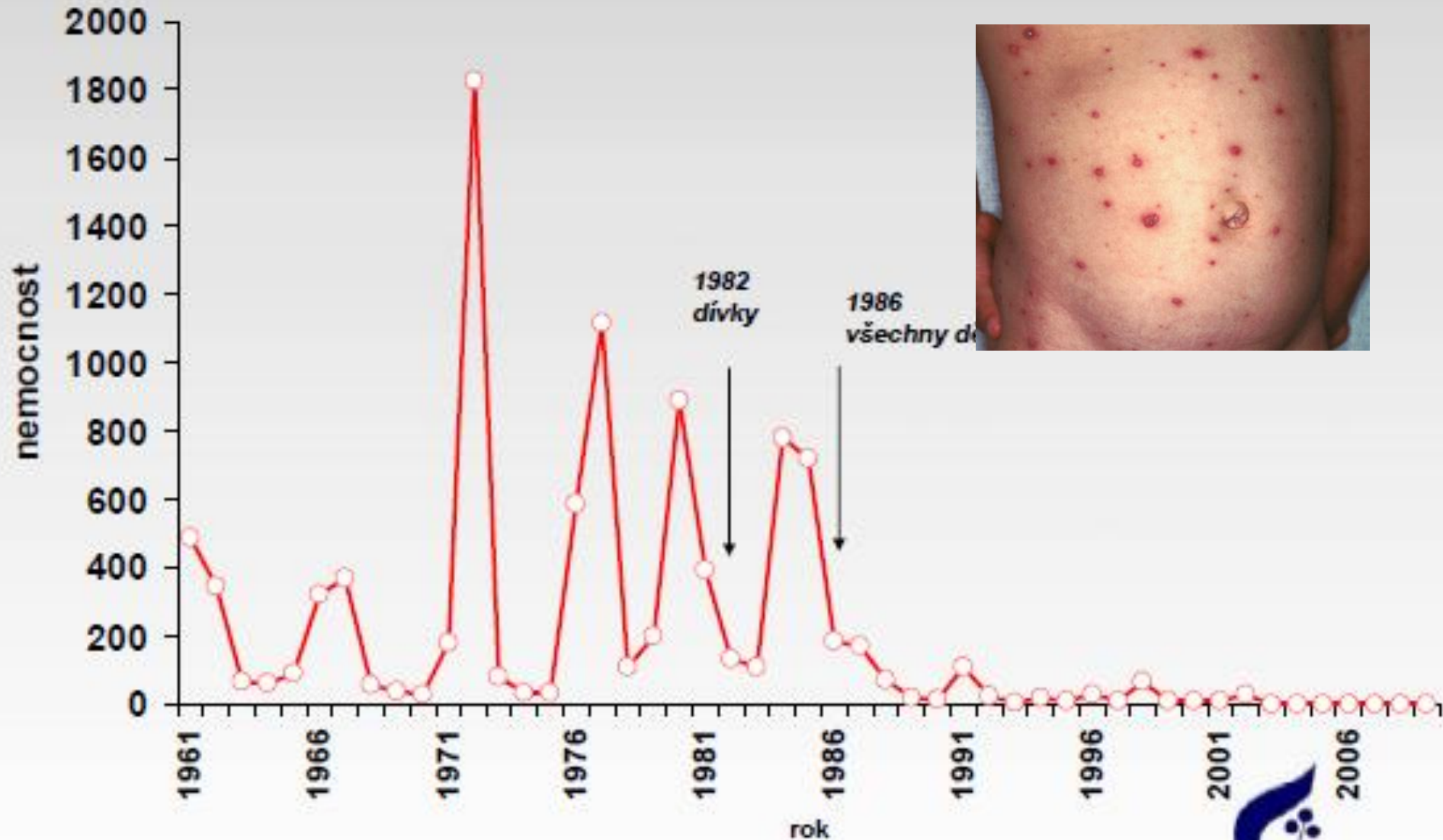


© Ministerstvo zdravotnictví České republiky 2014

Zdroj: SZÚ

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

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



**Solving
health
problem**

Step 1
Data collection

Surveillance; determine
time, place and person

Step 2 Assessment

Inference

Step 3
Hypothesis testing

Determine how and why

Step 4
Action

Intervention

Chain of infections (epidemic process)

THE CAUSATIVE AGENT OF INFECTION (bacteria, viruses, fungi, prions, protozoa)

1. the presence of rezervoir (source) of infection

man, animal

at the end of incubation period
acute stage
carriers

2. the way of transmission A/ direct contact

touching, kissing or sexual intercourse (Staphylococcus spp., Gonococcus spp., HIV ...),
- **vertical transmission** – from mother to fetus (VHB, VHC, HIV, listeria, rubella, cytomegalovirus...)

B/ indirect contact

- inhalation of droplets containing the infectious agents (TBC, measles, influenza...)
- ingestion of food or water that is contaminated (salmonella, Norwalk virus, VHA....)
- **biological transmission** by insects (malaria, borellia....)

3. the susceptibility of the population or its individual members to the organism concerned

Host factors : age, nutrition, genetics
immunity – natural (nonspecific),
- acquired

THE INFECTION

= 1. source of infection

Chain of infections (epidemic process)

If the epidemiology is known, we can interfere with transmission:

„BREAKING THE CHAIN OF INFECTION“

Different infections have different epidemiologies and thus require different methods of control

Preventive anti-epidemic measures

is a set of measures to prevent the infection of susceptible individuals:

- **primary** , when we *prevent impact of external risk factors* , or we will *increase the resistance of the individual* (epidemiology)
- **Secondary** prevention is *early to find* (diagnosis), *treatment and prevention of further development of the disease and complications* (clinical medicine)
- **Tertiary** prevention monitors patients who have overcome the disease

Preventive anti-epidemic measures

- **Include:**

Increasing hygienic standards of the population - the most important is compliance with sanitary regulations relating to *water supply* , *food* , *manufacturing* and *food handling* , *waste water* , *waste* , *faeces* and so forth.

Vaccination - in order to induce maximum collective immunity.

Evidence and vector control (and the people with them living in the same household) - on the *territory concerned health authorities* must *register for* (eg. Portability typphoid, salmonella, bacillary dysentery and diphtheria); must be under *constant medical supervision* , *regular* microbiologically *examined* or *treated* . Must submit certain *restrictive measures* , always report a change of residence *must not endanger their actions of another person* .

Measures to prevent the introduction of infection into collectives - *entrance examinations* (to work, camp, army, morning filters in nurseries and kindergartens), *prevent the entry into the collective* persons that could be a source of infection (important information too).

Preventive anti-epidemic measures

Prophylactic disinfection - aims to *reduce the number of pathogens* in the external environment (public buildings, medical facilities, public transport, drinking water, waste water from hospitals, milk pasteurisation).

Border protection - a *system of measures* protecting the borders of the introduction of diseases from foreign **persons** , **materials** , **goods** , **imported animals** . It is, among other things. Persons who come *from countries with endemic or epidemic occurrence of serious communicable diseases* . Such passengers must show a valid vaccination certificate, if you do not or are not vaccinated, subjected to medical supervision, quarantine or vaccination. Quarantine diseases as plaque, yellow fever and cholera. As for the people, not absolute boundaries conserve data. More important is the **protection of imported commodities** , which must be *accompanied by a certificate of health or veterinary authorities about their health* .

Health education - raising awareness of health and culture of the inclusion of basic hygiene and epidemiology in school and extracurricular educational facilities.

Herd immunity

(also called herd effect, population immunity, or social immunity)

is a form of indirect protection from infectious disease that occurs when a large percentage of a population (85 – 95 %) has become **immune** to an infection, thereby providing a measure of protection for individuals who are not immune.

In a population in which a large number of individuals are immune, chains of infection are likely to be disrupted, which stops or slows the spread of disease.

The greater the proportion of individuals in a community who are immune, the smaller the probability that those who are not immune will come into contact with an infectious individual.

can be gained through recovering from a natural infection or through artificial means such as **vaccination**.

Some individuals cannot become immune due to medical reasons and in this group herd immunity is an important method of protection.

Individual immunity



Herd immunity
(also called **herd effect,**
population immunity,
or **social immunity**)

Once a certain threshold has been reached, herd immunity gradually eliminates a disease from a population.

This elimination, if achieved worldwide, may result in the permanent reduction in the number of infections to zero, called eradication.

This method was used for the eradication of **smallpox** in 1980 and for the regional elimination of other diseases.

Herd immunity does not apply to all diseases, just those that are **contagious** meaning that they can be transmitted from one individual to another. **Tetanus**, for example, is infectious but not contagious, so herd immunity does not apply.