Tuberculosis

Kolářová M., EPI Autumn 2020

Tuberculosis – Case definition

Clinical Criteria

- Any person with the following two:
- — Signs, symptoms and/or radiological findings consistent with active tuberculosis in any site
- AND
- — A clinician's decision to treat the person with a full course of anti-tuberculosis therapy
- OR
- A case discovered post-mortem with pathological findings consistent with active tuberculosis that would have indicated anti-tuberculosis antibiotic treatment had the patient been diagnosed before dying

Laboratory Criteria

- — Laboratory criteria for case confirmation
- At least one of the following two:
- — Isolation of *Mycobacterium tuberculosis* complex (excluding *Mycobacterium bovis*-BCG) from a clinical specimen
- — Detection of *Mycobacterium tuberculosis* complex nucleic acid in a clinical specimen AND positive microscopy for acid-fast bacilli or equivalent fluorescent staining bacilli on light microscopy
- — Laboratory criteria for a probable case
- At least one of the following three:
- — Microscopy for acid-fast bacilli or equivalent fluorescent staining bacilli on light microscopy
- — Detection of *Mycobacterium tuberculosis* complex nucleic acid in a clinical specimen
- — Histological appearance of granulomata

Epidemiological Criteria NA

Case Classification

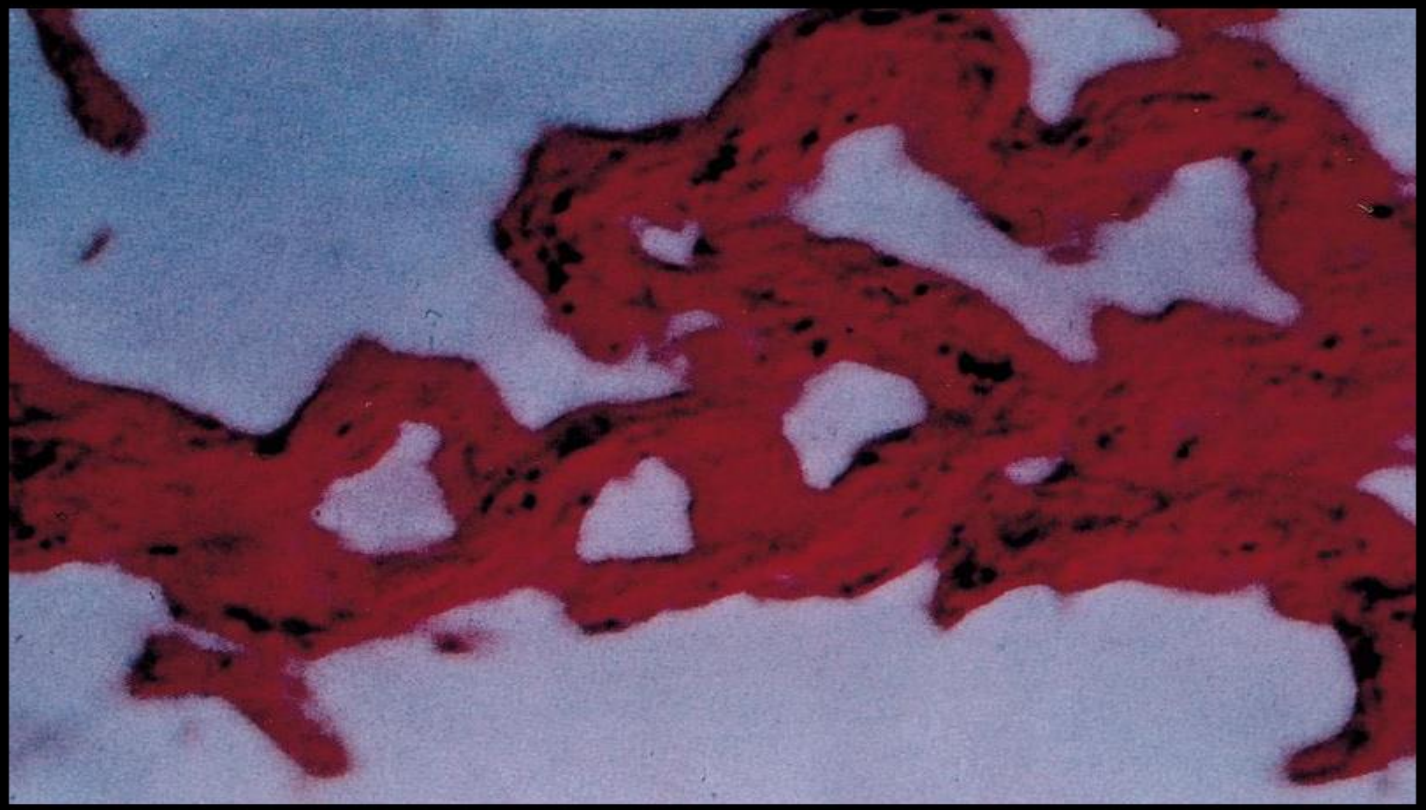
- A. **Possible case**
- Any person meeting the clinical criteria
- B. **Probable case**
- Any person meeting the clinical criteria and the laboratory criteria for a probable case
- C. **Confirmed case**
- Any person meeting the clinical and the laboratory criteria for case confirmation

The most important causative agent of tuberculosis is Mycobacterium tuberculosis.

M. tuberculosis, together with M. bovis, M. africanum and M. microti, form the ‘M. tuberculosis complex’, which is a group within the genus Mycobacterium.

This genus also includes many different nontuberculous mycobacteria of which M. leprae and M. avium are best known.

Ziehl-Neelsen stain of 'cords' of *Mycobacterium tuberculosis* isolated from a broth culture. Tubercle bacilli aggregate end to end and side to side to form serpentine cords, especially in broth cultures.



Clinical features and sequelae

Infection with M. tuberculosis is asymptomatic = unrecognised source of TBC. The symptoms that occur when TB disease develops are usually not very specific. Often there are complaints of tiredness, listlessness, loss of weight, sub-febrile body temperature and night sweating.

In the case of pulmonary TB, usually a cough has been present for weeks or even months, possibly accompanied by haemoptysis. Localisation in the vertebral column (spondylitis tuberculosa) can, apart from back pain, also present itself as an abscess with vertebral collapse. Lymphadenitis tuberculosa usually presents itself by painless lymph node enlargement in the neck. Blood in the urine (haematuria) can present as the only symptom of TB of the kidney.

In cases of co-infection with HIV, the clinical presentation can be less typical. This atypical presentation is usually seen in a more advanced stage of the HIV infection and is the result of impaired cellular immunity. HIV-infected patients show disseminated forms of TB relatively often.

In the pre-chemotherapy era, case-fatality from tuberculous meningitis approached 100 per cent. Pulmonary TB accounted for the majority of deaths. Sputum smear-positive TB has a much higher fatality than sputum smear-negative TB. Untreated sputum smear-positive TB leads to death in about 30–40 per cent of cases within one year and cumulatively kills about 50–70 per cent of cases within 5 to 7 years5.

- Humans are the main reservoir for M. tuberculosis and M. africanum.

- For M. bovis, cattle are the most important host.
- Cases of TB can occur sporadically in monkeys and some other mammals.
- In general, in patients with a positive Ziehl-Neelson slide and/or positive culture of their sputum, the start of coughing complaints is considered to be the start of the period of infectiousness.

- Patients with a negative culture of sputum ('closed' TB) and cases of extrapulmonary TB are not considered to be contagious.

Transmission

- Transmission of TB is aerogenic. After coughing, sneezing, speaking or singing, infected sputum droplets can dry and form into droplet nuclei of approximately 6–18 μm.

These droplet nuclei can float in the air for a longer period and penetrate into the alveoli of the host after inhalation. In moist warm air, the droplet nuclei can survive for hours.

- The lifetime risk of developing TB for people outside of the risk groups is approximately ten percent.

For HIV-infected persons this risk is much higher, amounting to 8–10 per cent per year.

The risk of transmission in cases of active TB is determined:

a) by patient factors and b) the type of contact made with their surroundings.

a) the level of contagiousness of TB patients depends:

- on the concentration of bacteria in the sputum,
- the severity of the cough and
- the coughing hygiene practiced by the patient.

b) the closer and/or more frequent the contact, the higher the chance of transmission

- characteristics of the place of contact may also play an important role (e.g. size of the room, ventilation).

Usually, intimate contacts (household) are at the highest risk of being infected.

Transmission II

The incubation period (between infection and the first signs of illness) varies between eight weeks to a lifetime.

The greatest chance of progressing to disease is within the first two years after infection, with half of all cases of disease occurring within five years of the original infection.
However, a lifelong risk of progression to disease remains for all those people with ‘dormant’ organisms.
People in whom infection progresses to disease are only a minority of all infected persons.

People with latent TB infection are never infectious.

.

Prevention

The vaccine currently available is the BCG-vaccine (Bacille Calmette Guérin). This is a live, weakened strain of M. bovis.

It mainly gives protection against severe forms of the disease, like meningitis TB and miliary TB, in children under five years of age.

The World Health Organization (WHO) advises BCG-vaccination for all newborns in countries with a high incidence of TB within the framework of the Expanded Program of Immunization (EPI).

Within the EU, the policy on BCG-vaccination varies between countries.

Low incidence countries commonly vaccinate only persons with an increased risk of TB; for example, children whose parents come from high incidence countries and who travel regularly to their home country.

BCG-vaccination should not be given to the immunosuppressed (e.g. HIV, leukaemia, chemotherapy) due to the increased risk for complications.

Also, BCG-vaccination during pregnancy should be avoided, even though no harmful effects on the foetus have been observed.

Prevention II

- Practising cough hygiene will decrease the spread of all types of infections that are spread through the air.

Preventing the transmission of the disease is the foundation for effective **TB control programmes.**

Preventive measures focusing on:

* the early diagnosis and
* immediate effective treatment of people with contagious TB

is therefore essential.

Many factors have been shown to be associated with a delay in diagnosis including old age, low education/awareness, poverty, negative sputum smear, extrapulmonary TB, female sex and a history of immigration.

Passive case finding is defined as the detection of TB cases among patients attending healthcare facilities because they have symptoms.

Active case finding focuses on the screening of high-risk groups (immigrants, drug addicts, homeless people and prisoners) for TB.

It aims to identify and treat TB cases at an early stage and to provide preventive treatment to those at the highest risk for developing active TB.

Management and treatment

Notification of TB cases is compulsory in most EU countries.

- Cases of respiratory TB require infection control precautions until infectivity has been eliminated by effective chemotherapy; this often requires two weeks treatment with drugs to which the infecting strain is sensitive.

✓ Contact investigation can be performed as soon as a contagious patient with TB has been diagnosed.

The aim of this activity is to identify secondary cases of TB and/or newly infected persons. If a secondary case is identified through the contact investigation, this patient can be diagnosed early which then reduces the chance of further transmission.

✓ Newly infected persons can be offered prophylactic treatment in order to reduce their chance of progression from latent to active disease.

The treatment of active TB has two phases:

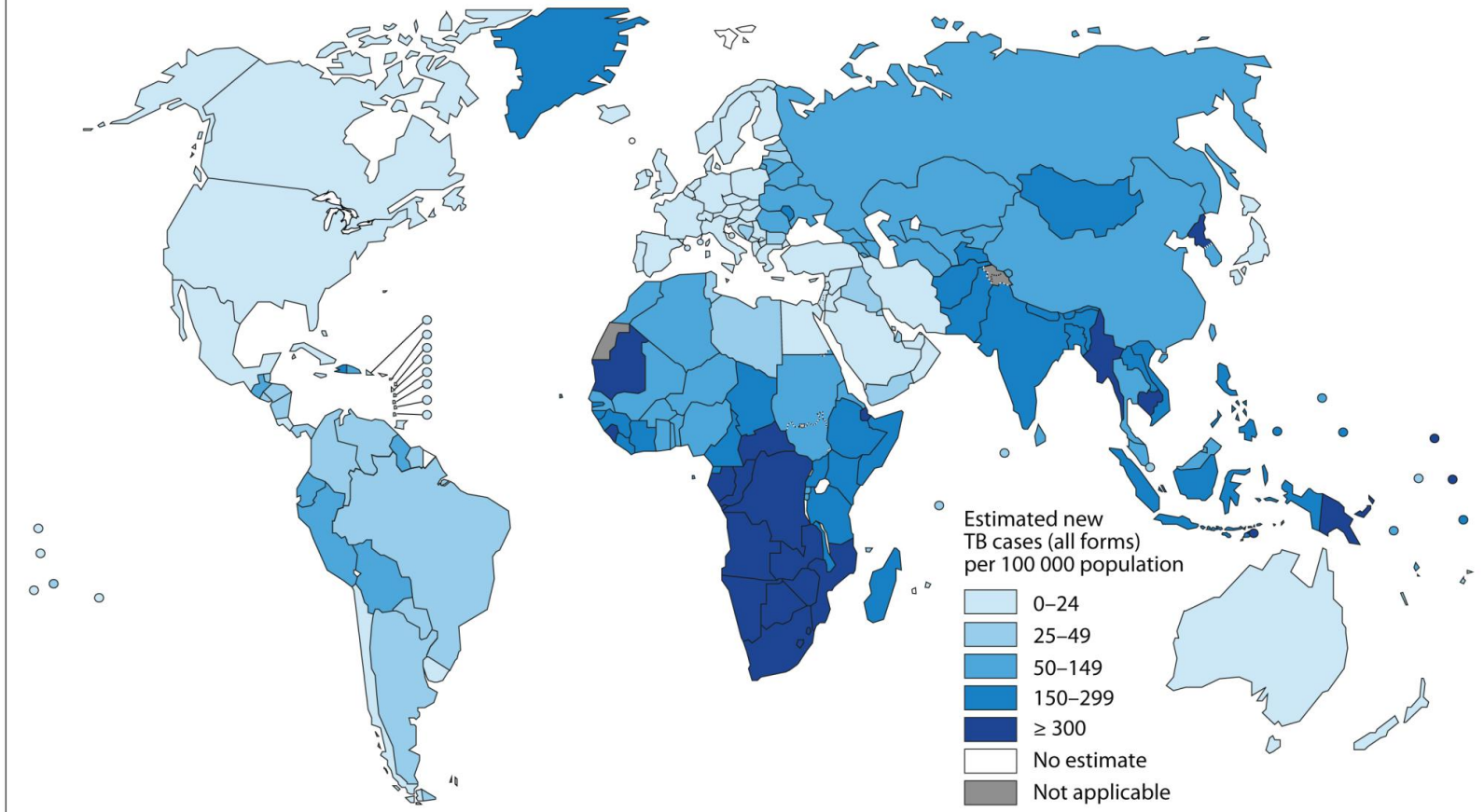
- an initial intensive phase and
- a continuation phase

The recommended standard regimen by the WHO for all new cases is an intensive phase of two months with isoniazid, rifampicin, pyrazinamide and ethambutol and in continuation phase of four months with isoniazid and rifampicin.

- Drug resistance is increasing in many countries, and treatment failure and relapse are strongly associated with initial drug resistance. Individual risk factors include history of previous treatment for TB, recent contact with drug-resistant case and HIV infection24.

Persons at a high risk for developing TB (cases with recent M. tuberculosis infection and those with clinical conditions associated with progression to active TB like HIV, for example) will be given prophylactic treatment.

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

Tuberculosis surveillance and monitoring in Europe 2020

TB ranks among the top 10 causes of death on a global scale.

Although TB typically affects the lungs (pulmonary TB), it can cause disease in any organ (extrapulmonary TB).

TB is transmitted from person to person, for example, when an individual with pulmonary TB expels bacteria into the air by coughing. Approximately 25% of the world's population is infected with M. tuberculosis, but only a small proportion of people (≈10%) will develop TB disease during their lifetime; the risk is much higher among immunocompromised individuals (such as people infected with HIV).

Sputum-smear microscopy has been the most common initial TB diagnostic method worldwide, but culture remains the gold standard, while the use of rapid molecular testing is increasing.

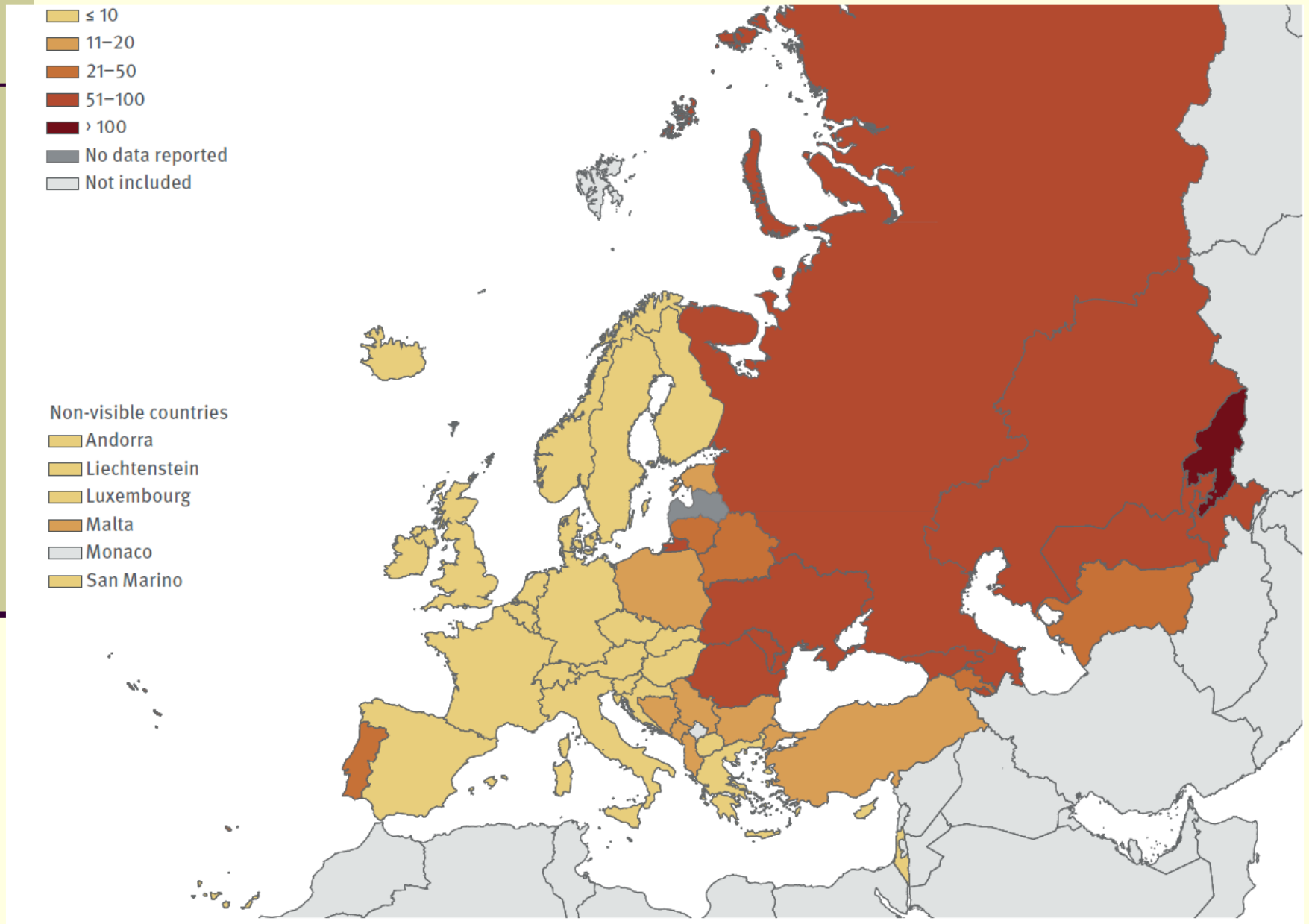
WHO estimated that 10 million people fell ill with TB in 2018.

Most cases were thought to occur in the WHO SouthEast Asia Region (44%), the WHO African Region (24%) and the WHO Western Pacific Region (18%). Smaller proportions of cases were estimated for the WHO Eastern Mediterranean Region (8%) and the WHO Region of the Americas (3%). The WHO European Region accounted for 3% of all cases.

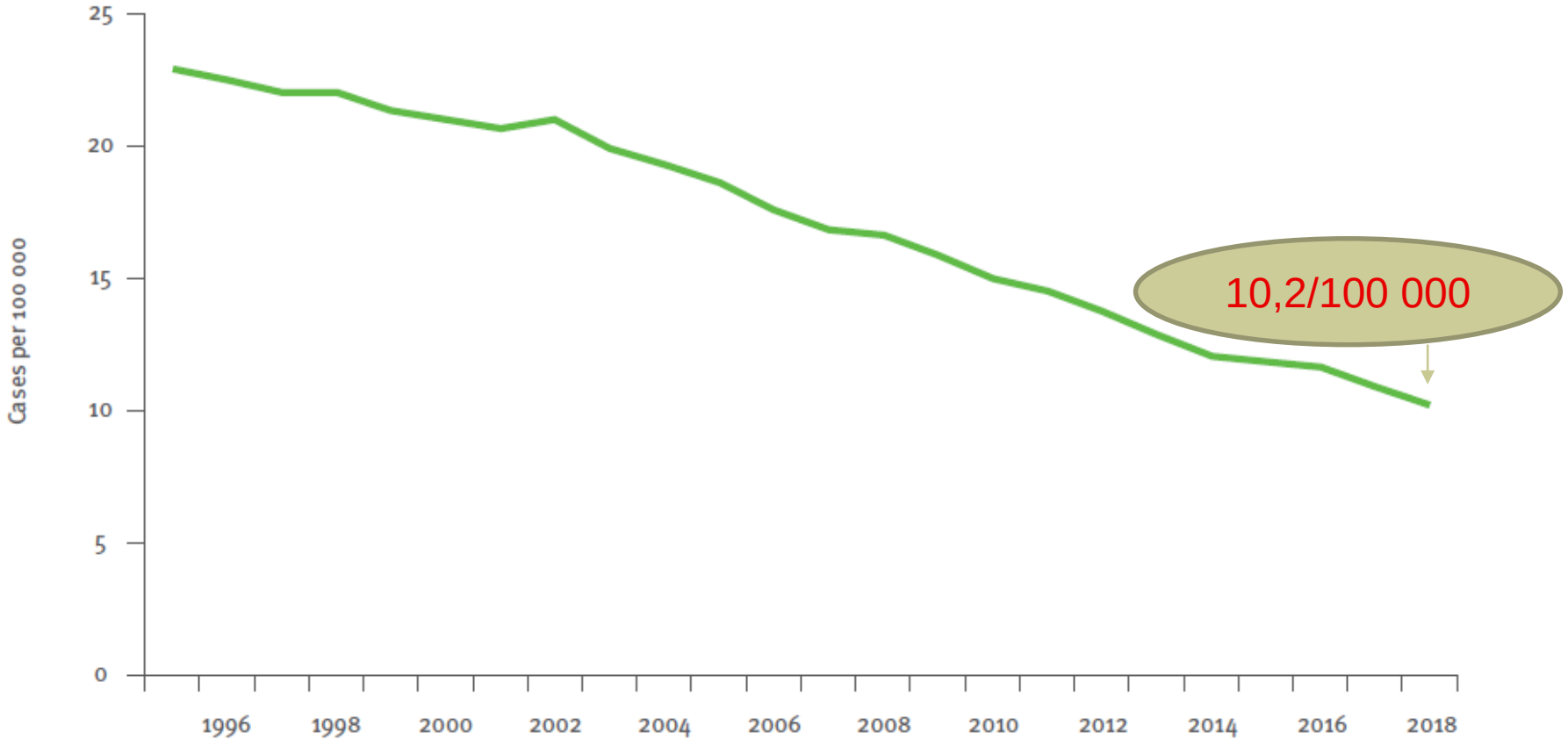
Overall, this report shows that in the EU/EEA, TB remains a public health issue. Most EU/EEA countries, however, are low-incidence countries (with a notification rate below 10 per 100 000) in which TB predominantly affects vulnerable populations, such as migrants, prison inmates or people coinfected with HIV.

The overall aim of TB surveillance is to help inform public health action. The annual TB surveillance and monitoring report presents key figures and trends and provides an overview of the TB situation in the EU/EEA and the WHO European Region.

TB notification rates of new TB cases and relapses per 100 000 population, European Region, 2018



TB notification rate per 100 000 population by year of reporting, EU/EEA, 1995 -2018



Data source: ECDC Surveillance Atlas of Infectious Diseases. http://www.ecdc.europa.eu/en/data-tools/atlas/Pages/atlas.aspx

Czech Republic

Total population at 10 May 2019 by EUROSTAT: 10 610 055

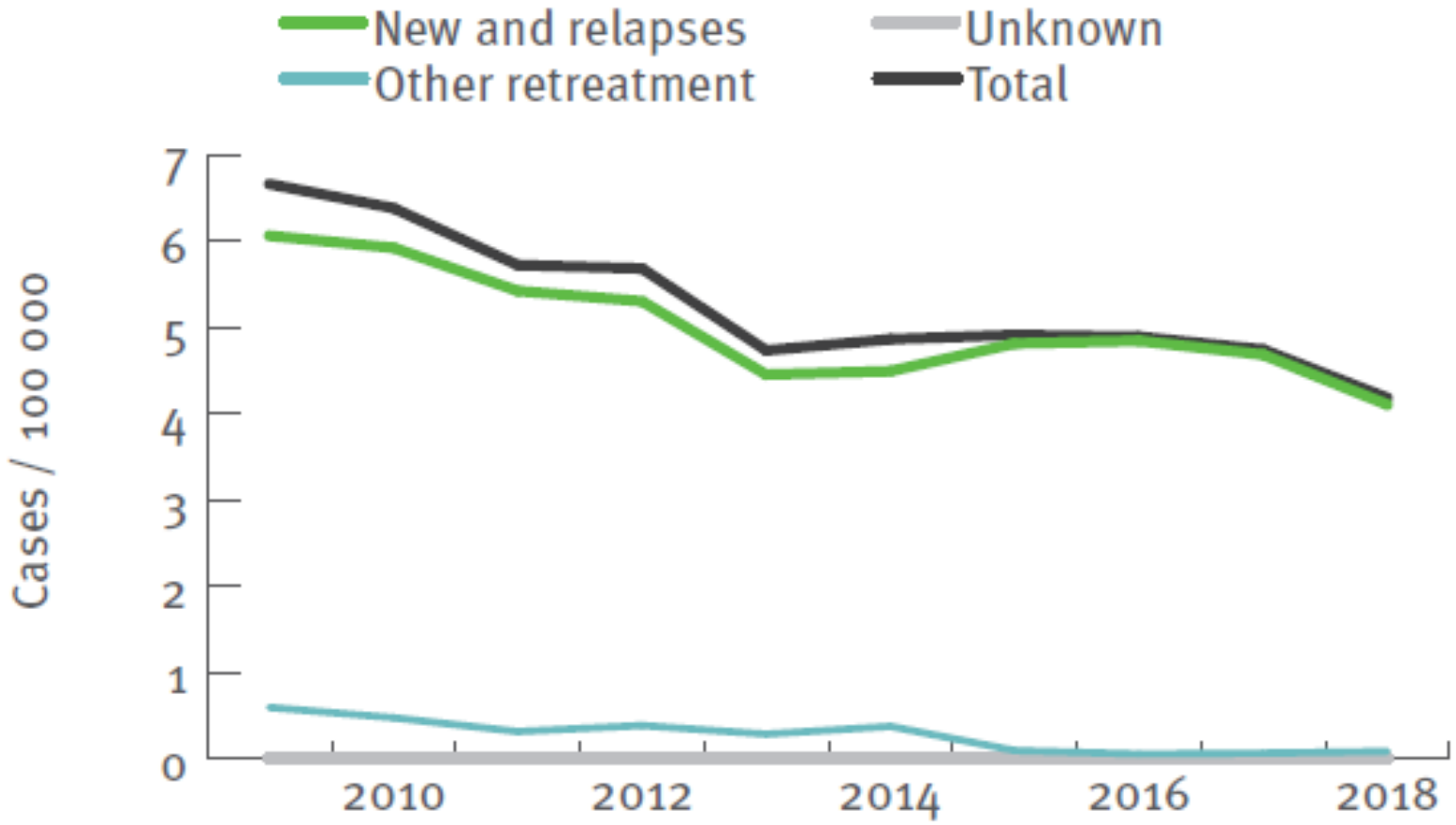
TB case notifications, 2018

Total number of cases	444	
Notification rate per 100 000	4.2	
Pulmonary	397	(89.4%)
of which microscopy-positive	165	(41.6%)
of which laboratory-confirmed	325	(81.9%)
Laboratory-confirmed TB cases	361	(81.3%)
Mean age of new native TB cases	55.5 years	
Mean age of new foreign TB cases	39.1 years	
Foreign origin of all TB cases	147	(33.1%)
New (not previously treated)	413	(93.0%)

Czech Republic

Total population at 10 May 2019 by EUROSTAT: 10 610 055

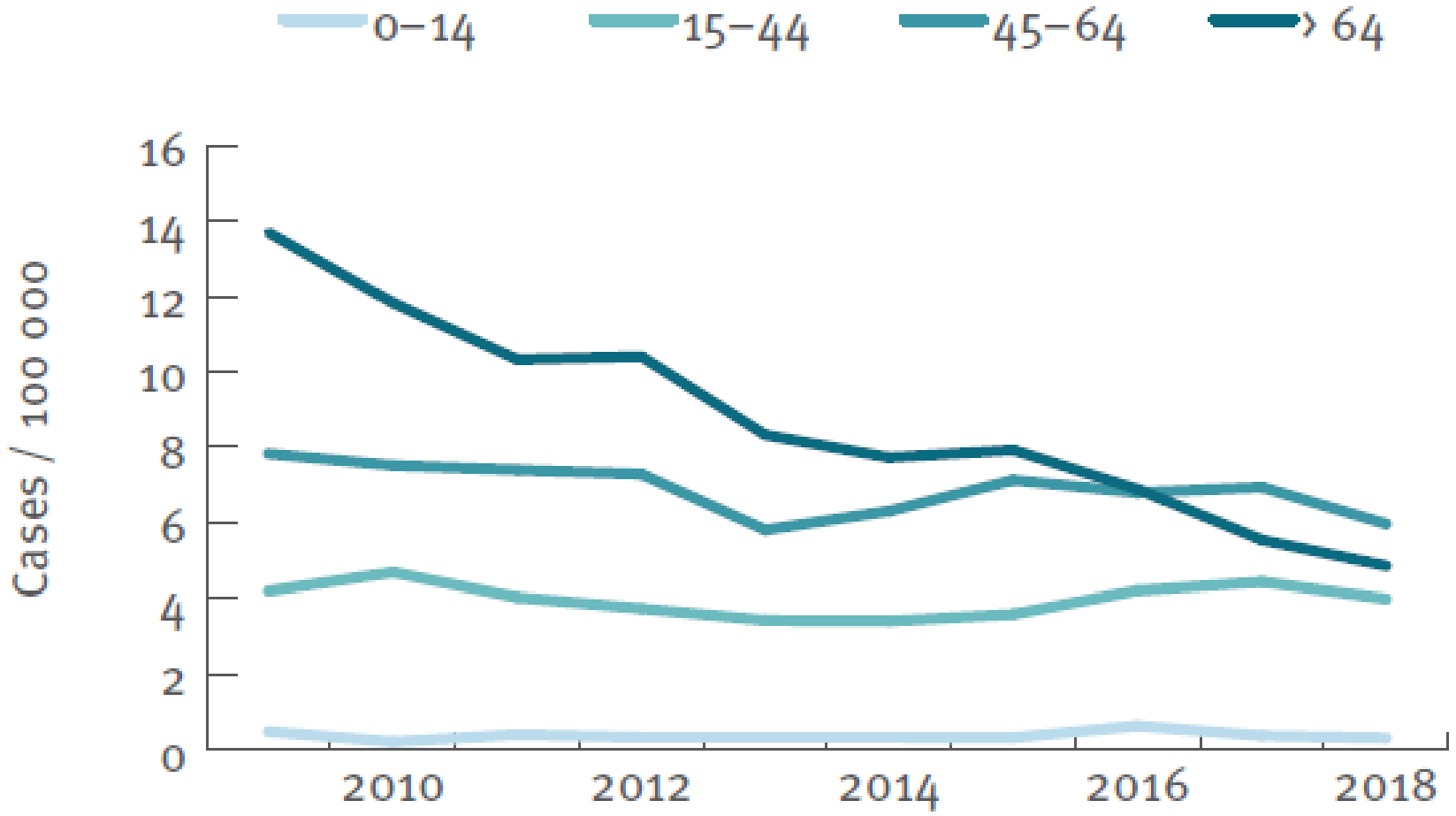
TB notification rates by treatment history, 2009–2018



Czech Republic

Total population at 10 May 2019 by EUROSTAT: 10 610 055

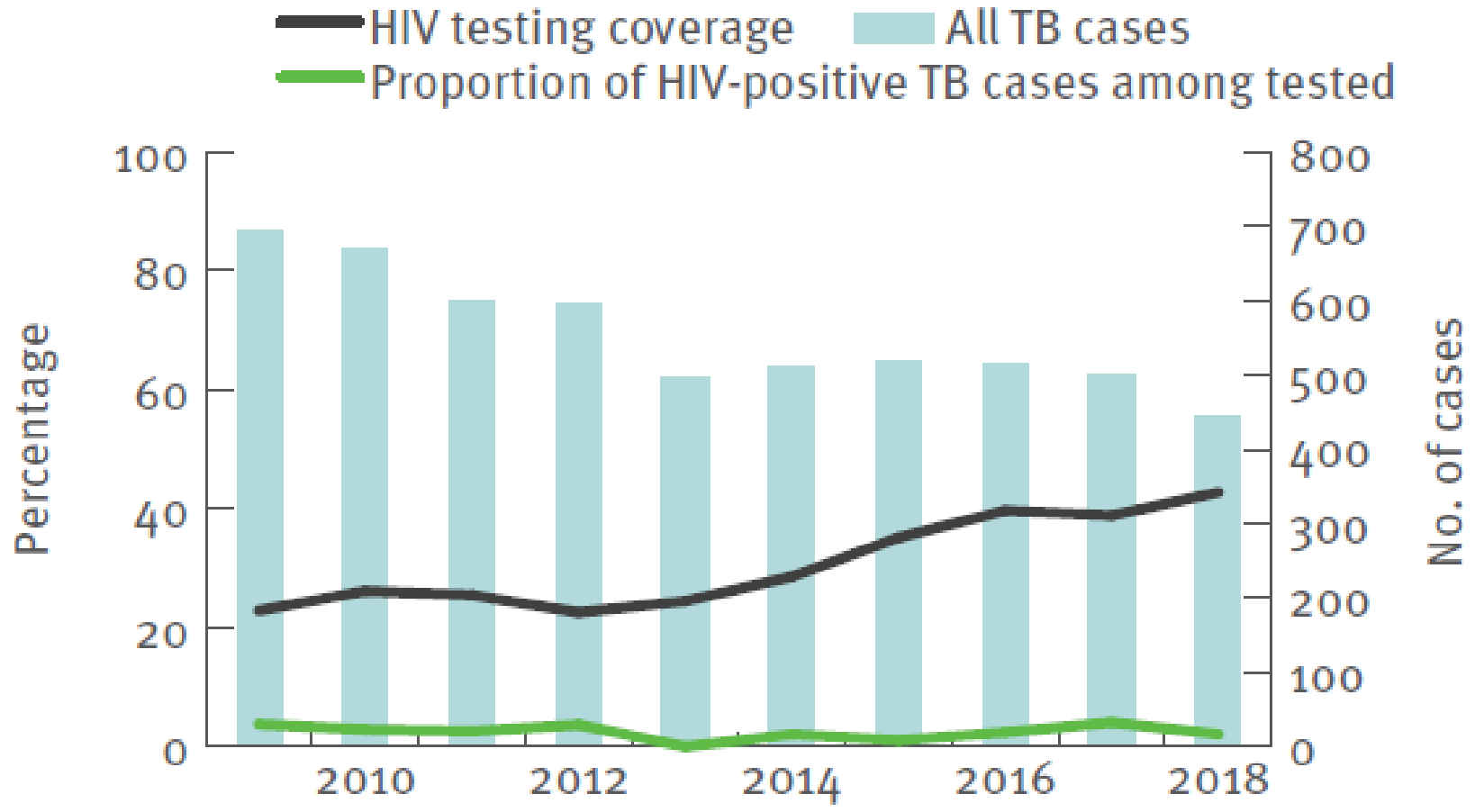
New and relapsed TB cases – notification rates by age group, 2009–2018



Czech Republic

Total population at 10 May 2019 by EUROSTAT: 10 610 055

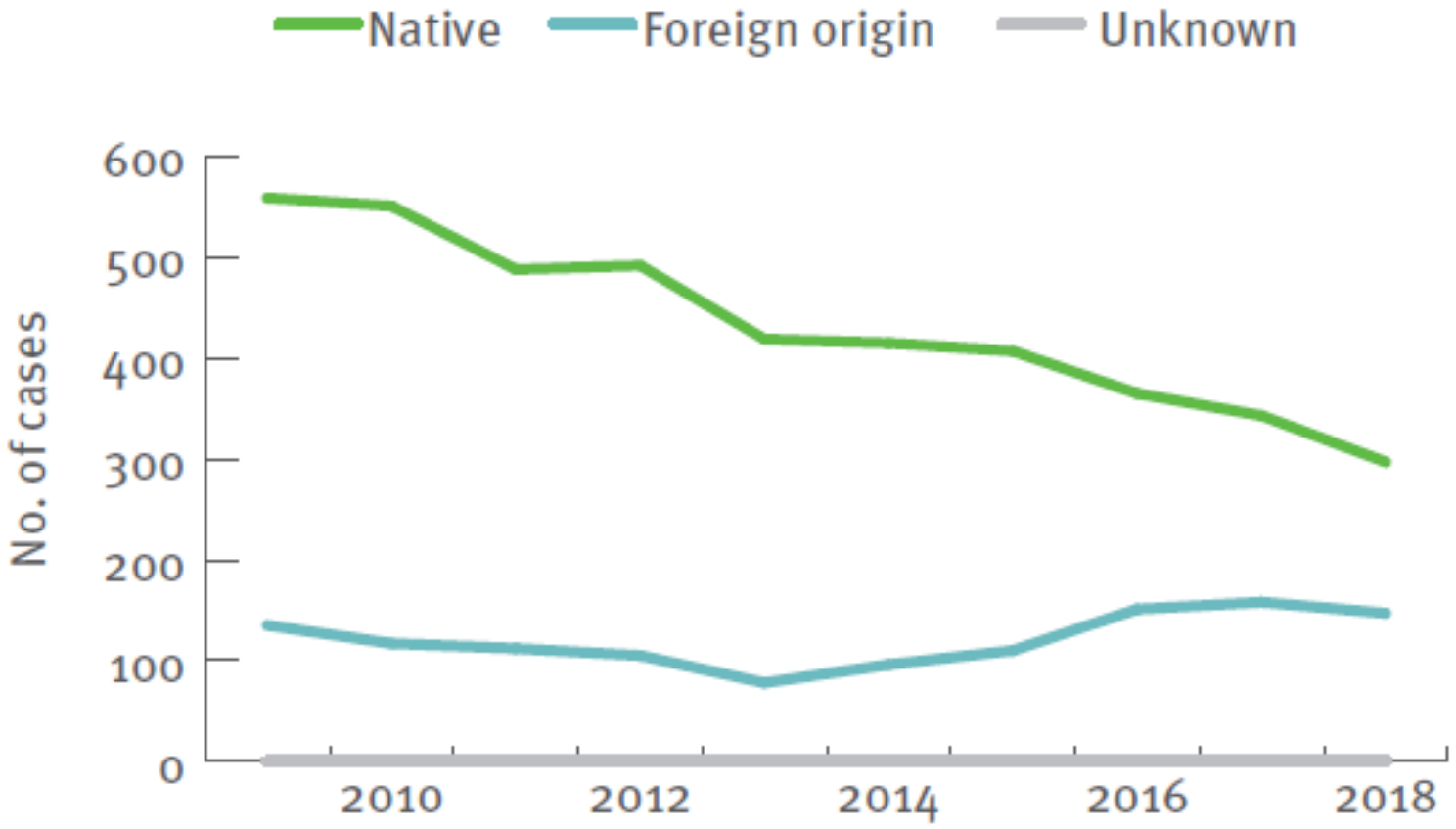
TB/HIV coinfection, 2009–2018



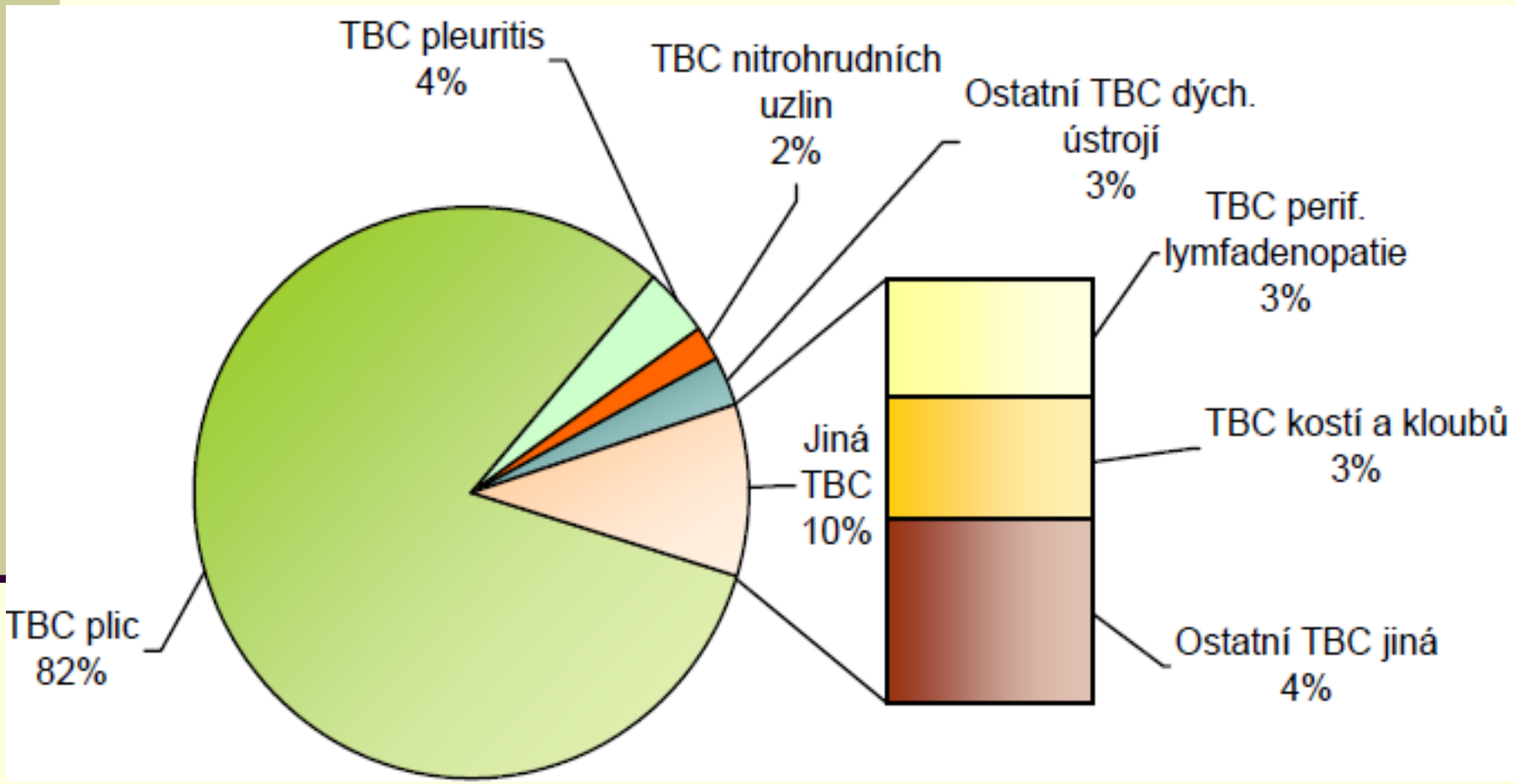
Czech Republic

Total population at 10 May 2019 by EUROSTAT: 10 610 055

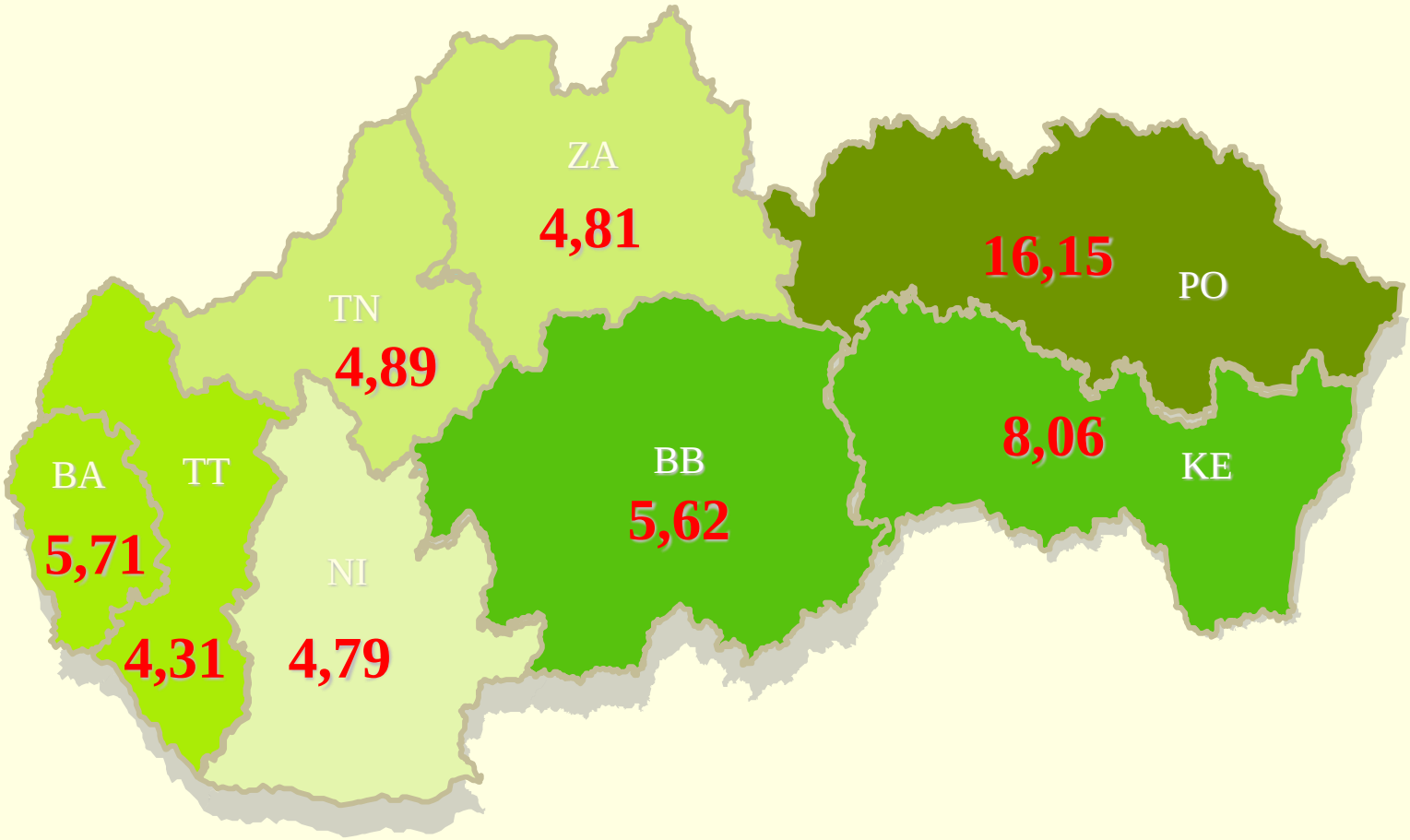
TB cases by geographical origin, 2009–2018



Struktura hlášené TBC podle dg., rok 2012



TBC – in Slovakia - 2013
number of cases/100 000 residents



Source: Doc. MUDr. Ivan Solovič, CSc.