

Surveillance of infections; pandemic plans

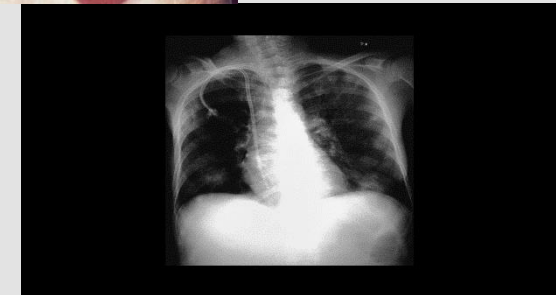
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Chicken Pox



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.*

**Solving
health
problem**

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graph LR; A((Solving health problem)) --> B[Step 1  
Data collection]; A --> C[Step 2  
Assessment]; A --> D[Step 3  
Hypothesis testing]; A --> E[Step 4  
Action]; B --> F[Surveillance; determine  
time, place and person]; C --> G[Inference]; D --> H[Determine how and why]; E --> I[Intervention];
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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

Solving health problem

Epidemiologists arrange their data in various ways, depending on what aspect of the information they want to emphasize.

One of the most powerful tools an epidemiologist can use is case reporting:

reporting specific diseases to

- * **local**,
 - * **state** and
 - * **national health authorities**,
- who accumulate the data

How safe is your food?



Source and number of outbreaks* in the European Union in 2016



The most common food-borne diseases in the European Union

Campylobacteriosis

2015 232 134 reported cases
2016 246 307 reported cases

Outbreaks

2015	2016
25	24

Salmonellosis

2015 94 597 reported cases
2016 94 530 reported cases

Outbreaks

2015	2016
184	215

Listeriosis

2015 2 206 reported cases
2016 2 536 reported cases

Outbreaks

2015	2016
5	2

* Outbreaks refer to strong-evidence food-borne outbreaks (excluding waterborne outbreaks).

Source: European Union summary report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2016, published by EFSA and ECDC in 2017. Data on case numbers come from the European Surveillance System (TESSy), data on outbreaks come from EFSA zoonoses database.

Solving health problem

Epidemiologic investigations

Epidemiologic investigations are largely mathematical descriptions of persons in groups, rather than individuals.

The basic quantitative measurement in epidemiology is a count of the number of persons in the group being studied who have a particular disease.

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.**

SURVEILLANCE

- **Surveillance** represents a number of long-term and complex programmes, in which experts of various medical fields participate together, for example epidemiologists, microbiologists, hygienists, clinicians etc. Other non-medical personnel, such as statisticians, vets and ecologists, may also participate alongside medical personnel.
- The epidemiologist is usually the initiator and organiser of the program.
- Surveillance was initially started in the field of infectious diseases.

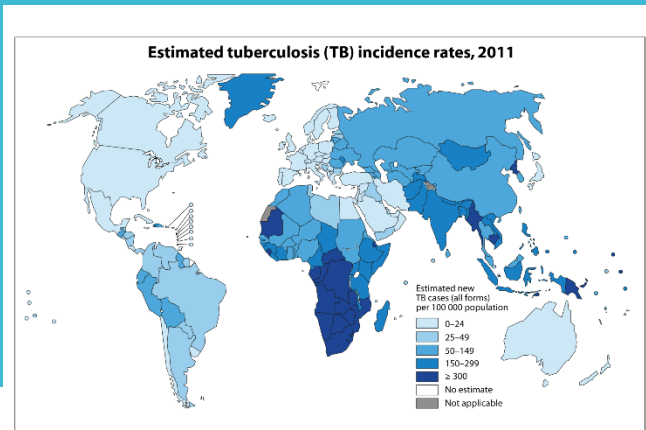
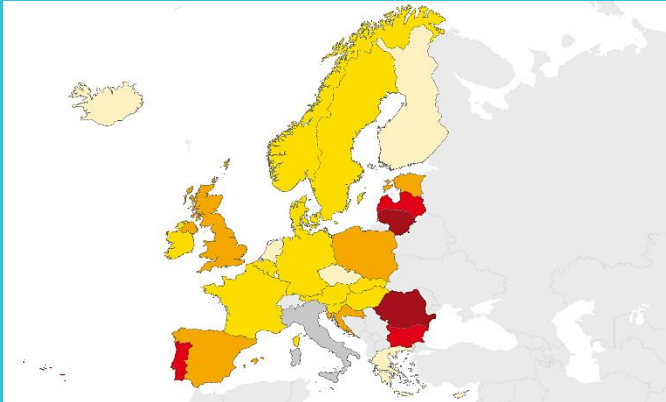
SURVEILLANCE

- **Surveillance is put into effect in three successive stages:**
- Obtaining the necessary data such as the number of sick, the number of dead, data from microbiological laboratories on circulation and qualities of etiological agent, clinical information on symptomatology of individual diseases, monitoring of vaccination and collective immunity of population, monitoring of infections with animals, and data of natural sciences on vectors.
- Analysis of collected data, including evaluation of information and suggestion of measures. Long-term surveillance gives the possibility of making a prognosis of the occurrence of a given disease for the future.
- Guaranteeing qualified information to all concerned people who can further use it for improvement of their own measures and theories.

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.

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.

Terminology and Definitions

- Chain of infection
 - Host (source)
 - Reservoir
 - Transmission
 - Direct
 - Indirect
 - Biologic
 - Vertical
 - Susceptible host
 - Incidence and prevalence
 - Case definition
- Sporadic disease
 - Endemic disease
 - Epidemic(outbreak)
 - Pandemic disease
 - Zoonosis, epizootic and enzootic
 - Eradication
 - Elimination
 - Nosocomial infection
 - Attack rate
 - Opportunistic infection
- Immunity passive active
 - Individual immunity
 - Herd immunity
 - Virulence
 - Incubation period
 - Infectivity period
 - Latent period
 - Probability ratio

Chain of infections (epidemic proces)

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, giardia, 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

Disease trends

- **Incidence** - measures the number of new cases over time.

This number measures an individual chances of developing or contracting the disease.

$$\frac{\text{Number of new cases within a specified time period}}{\text{Total number of people in the population}}$$

- **Prevalence** – measures the total number of cases of disease in a population.

$$\frac{\text{Total number of diseases individuals}}{\text{Total number of people in the population at a given time}}$$

Occurrence of Diseases

- **Sporadic** Disease that occurs occasionally in a population.
- **Endemic** Disease constantly present in a population at all times – malaria is present in Africa at all time because of the presence infected mosquitos.
- **Epidemic or outbreak** Disease occurrence among a population that is in excess of what is expected in a given area in a short time – the Ebola virus in parts of Africa is in excess of what is expectes for this region.
- **Pandemic** Disease or condition that spread across world - – HIV/AIDS is one of the worst global diseases in history.

Terminology and definitions

- **Case definition:** a set of standard criteria for deciding whether a person has a particular disease or health-related condition, by specifying clinical, laboratory and epidemiological criteria and limitations on time, place and person.
- **Attack rate:** proportion of non-immune exposed individuals who become clinically ill.
- **Zoonosis** is an infection that is transmissible under natural conditions from vertebrate animals to man, e.g. rabies, plague, bovine tuberculosis.....
- **An epizotic** is an outbreak (epidemic) of disease in an animal population, e.g. rift valley fever.
- **An enzotic** is an endemic occurring in animals, e.g. bovine TB.
- **Nosocomial (hospital acquired) infection** is an infection originating in a patient while in a hospital or another health care facility. It has to be a new disorder unrelated to the patient's primary condition.

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.

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 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.

Individual immunity



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.

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.

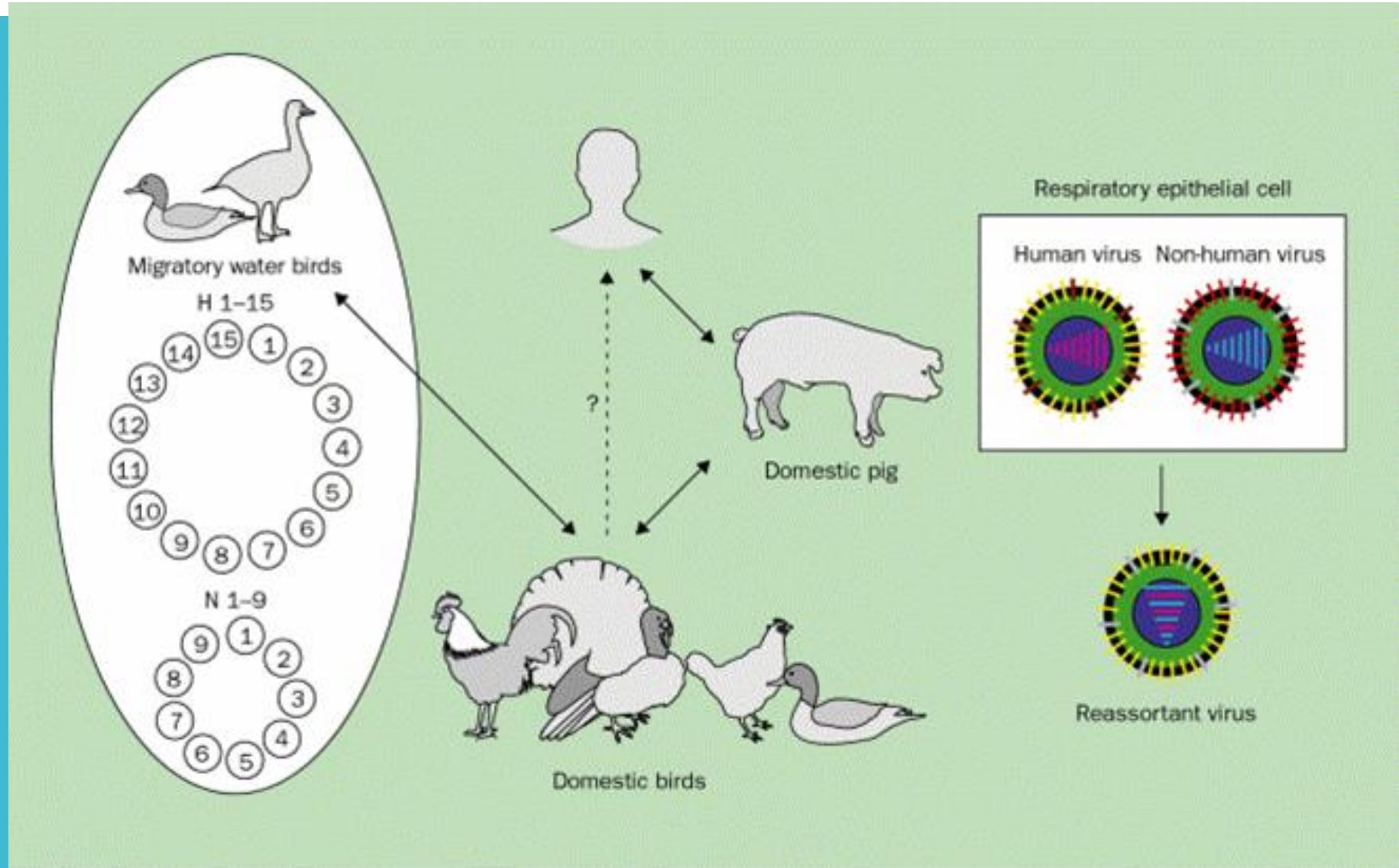
This elimination, if achieved worldwide, may result in the permanent reduction in the number of infections to zero, called eradication.

This method was used for the eradication of **smallpox** in 1977 and for the regional elimination of other diseases¹ Herd immunity does not apply to all diseases, just those that are **contagious** meaning that they can be transmitted from one individual to another.¹ **Tetanus**, for example, is infectious but not contagious, so herd immunity does not apply¹.

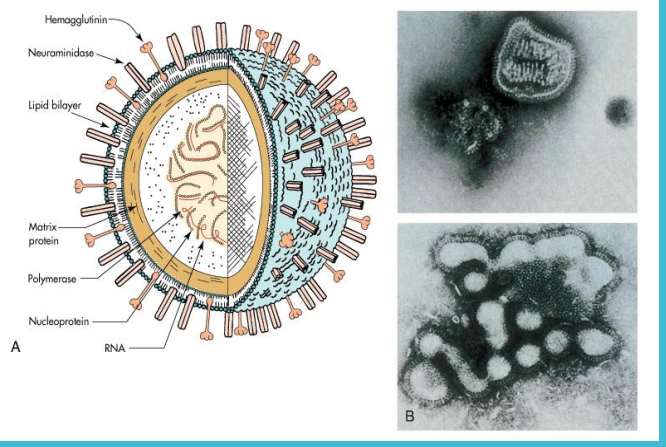
Definition of a pandemic

- A pandemic is an epidemic extending over a wide geographic area, affecting whole continents.
- It involves the high incidence of a disease over a large territory (continent) over a specific period of time.
- According to the WHO definition, an influenza pandemic is characterized by the spread of a pandemic virus within communities in at least 2 countries of a single WHO region and at least one other country in another WHO region.

The rise of the pandemic strain



The rise of the pandemic strain



Pandemic preparedness

- Pandemic preparedness is most effective if it is built on general principles that guide preparedness planning for any acute threat to public health. This includes the following:
- Pandemic preparedness, response and evaluation should be built on generic preparedness platforms, structures, mechanisms and plans for crisis and emergency management.
- To the extent possible, pandemic preparedness should aim to strengthen existing systems rather than developing new ones, in particular components of national seasonal influenza prevention and control programmes.
- New systems that will be implemented during a pandemic should be tested during the inter-pandemic period.
- Adequate resources must be allocated for all aspects of pandemic preparedness and response.

Pandemic preparedness

- The planning process, implementing what is planned, testing and revising the plan in order for key stakeholders to familiarise themselves with the issues at hand, may be even more important than the pandemic plan itself.
- Pandemic response requires that business continuity plans and surge capacity plans be developed for the health sector and all other sectors that could be affected by a pandemic to ensure sustained capacity during a pandemic.
- The response to a pandemic must be evidence-based where this is available and commensurate with the threat, in accordance with the IHR. Planning should be based on pandemics of differing severity while the response is based on the actual situation determined by national and global risk assessments.
- Not all countries will be in a position to contribute to global risk assessment, nor conduct evaluations such as pandemic vaccine effectiveness. They must all have the capacity to access and interpret data for risk assessment provided by WHO, ECDC, and from other countries or sources.

Pandemic preparedness

- Preparing for an **influenza pandemic** is a continuous process of planning, exercising, revising and translating into action national and subnational pandemic preparedness and response plans.
- A pandemic plan is thus a living document which is reviewed at intervals and revised if there is a change in global guidance or evidence-base; lessons learned from a pandemic, an exercise, or other relevant outbreak; or changes to national or international legislation related to communicable disease prevention and control :

Pandemic preparedness

Figure 1. Key elements of the pandemic preparedness planning cycle

