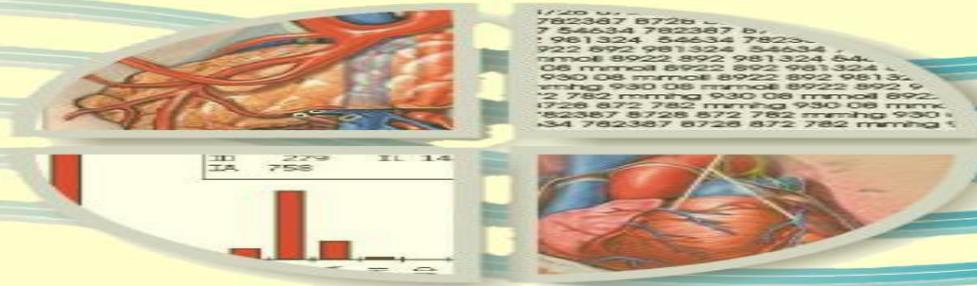


## Course 3



*Transmission through food, objects, vectors, the receiving population, favouring factors, and the manifestation forms of the epidemiological process*

*Emilian Damian Popovici, M.D., PhD*

# *Foods of animal origin*



■ The contamination can be:

**PRIMARY** – coming from sick animals or animals carrying germs, with the following being contaminated in the animal organism itself:

**Meat** – trichinosis, salmonellosis, anthrax, TB

**Milk** – brucellosis, typhoid fever, TB, staphylococcal/streptococcal infections

**SECONDARY** – the most frequent, arising in the following ways:

1. Food products can be contaminated **through the urine and feces** of sick or carrying animals
2. Contamination **through other factors of complex indirect routes**, including through sick or carrying humans (from slaughtering the animal to marketing it)

# *Foods of vegetable origin*



## ■ Contamination:

- through the irrigation of vegetable fields with residual water;
- Using animal faeces as manure;
- From sick or carrying humans – from harvesting the crop to marketing it

### **Examples of diseases:**

- ✓ typhoid fever, paratyphoids,
- ✓ cholera, viral hepatitis A,
- ✓ botulism, toxinfections with *Salmonella* sp.

# *Mixed food*



- These are good culture medium and a good transmission route.
- Most germs mentioned above can be transmitted through:

- ✓ Creams;
- ✓ Salads;
- ✓ Mayonnaises;
- ✓ Beer;

# Objects



- Contamination can occur through direct contact with secretions or excretions of sick or carrying people, through blood or other factors of the complex indirect transmission route;
- Any object can be contaminated;
- The following can be carried:

1. **Bacteria** – *Staphylococcus* sp., *Streptococcus* sp., *Salmonella* sp., *Pseudomonas aeruginosa*, *E.coli*, *Mycobacterium tuberculosis*; rickettsia rickettsii as well as sporulated anaerobic bacteria – gas gangrene germs and *Clostridium tetanii*
2. **Viruses** – adeno- and enteroviruses;

# *Dirty hands*



## ■ Possible scenarios:

- Self-contaminations with the body's own germs through secretions/excretions;
- Contamination from a sick person or germ carrier, which can be:

**DIRECT** – direct contact with the infection source

**INDIRECT** – contact with its pathological products

- Dirty hands can also be contaminated by other factors of the complex indirect transmission route;

# *Dirty hands*



- ❑ Pathogens can be transmitted through dirty hands either directly or through the contamination of other factors of the complex indirect transmission route;

## **Examples of diseases that can be transmitted through dirty hands:**

- ✓ typhoid fever, paratyphoid fever,
- ✓ dysentery,
- ✓ food poisoning,
- ✓ viral hepatitis A,
- ✓ zoonoses,
- ✓ Staphylococcal/streptococcal infections

- ❑ Disease transmission through dirty hands can be done through measures of individual hygiene.

# Effective hand disinfection technique (repeat at least 5 times)

Palm to palm

1



2

Right palm over left dorsum  
and left palm over right dorsum



3

Palm to palm with  
fingers interlaced



4

Backs of fingers to opposing  
palms with fingers interlocked



5

Rotational rubbing of right  
thumb clasped in left palm and  
vice versa



6

Rotational rubbing,  
backwards and forwards  
with clasped fingers of right  
hand in left palm  
and vice versa



*Remove all jewellery and watches  
and keep your nails short*

# Vectors



- According to the method of transmission, they can be:

**PASSIVE (MECHANICAL) – flies, roaches;**  
**ACTIVE (HEMATOPHAGOUS SPECIES) – lice,**  
**flees, mosquitoes, ticks.**

- According to the specificity of transmission:

**MONOVALENT (SPECIFIC) – the tsetse fly**  
**POLYVALENT – the louse**  
**UNIVERSAL - housefly**

# *The receiving population*

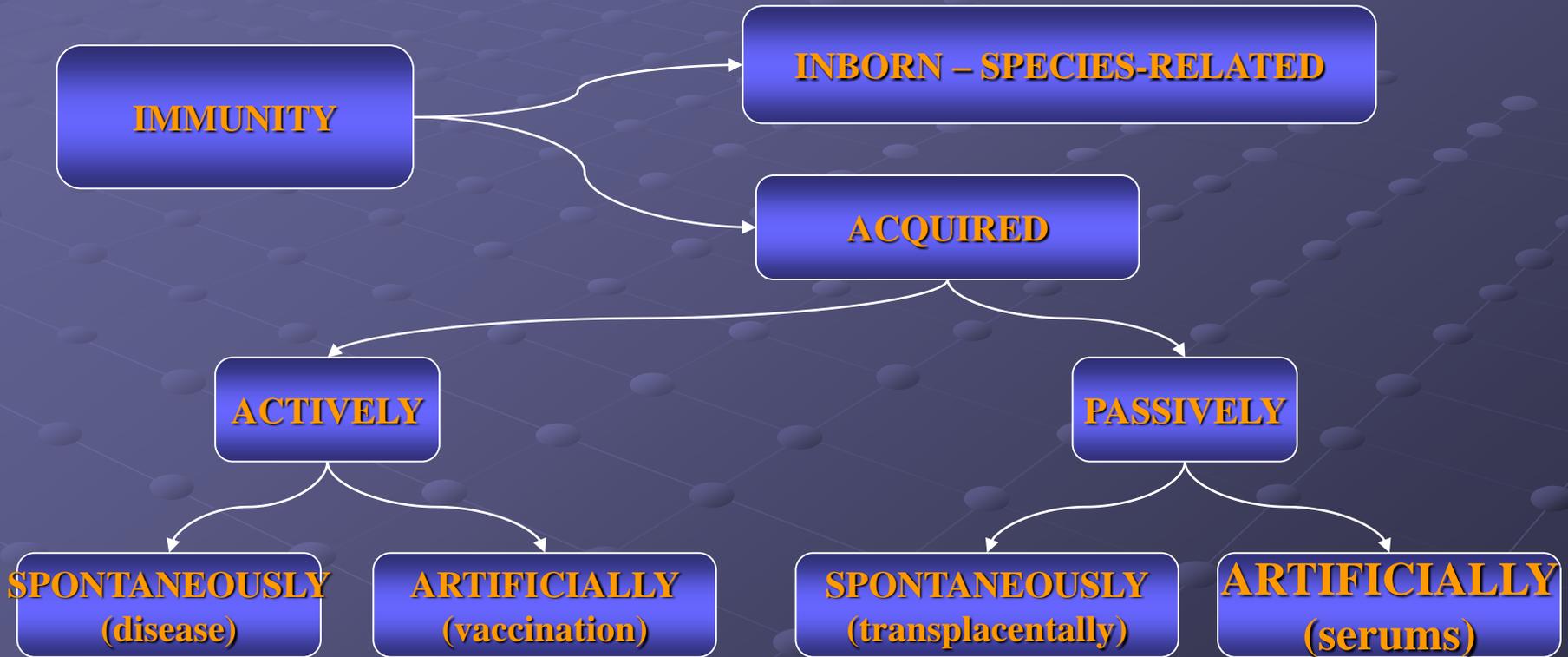


- A mass of people prone to the disease.
- The degree of receptiveness to infectious diseases is different.  
An organism can be:
  - Receptive or
  - Resistant – specific/non-specific;
- **Receptiveness** – is the state of the organism that allows the pathogen to survive and multiply;
- **Non-receptiveness or resistance** – gives the organism the ability to prevent the entry of the pathogen, to destroy it or to eliminate it as quickly as possible.

# *The receiving population*

- **The individual's immunity** – is the organism's property of not contracting an infection in case of an infecting contact with a pathogen or its toxins.
- **Collective immunity** – is not merely a sum of the immune individuals at a given moment, but the capacity of the collectivity to resist being affected by the pathogen, to prevent or limit the spreading of the pathogen in the collectivity.

# *The receiving population*



# *The receiving population*

- The individual factor is especially important because no infection that spreads in a collectivity occurs in an identical form in each individual.
- Thus, in some people it is manifested:

**TYPICALLY**

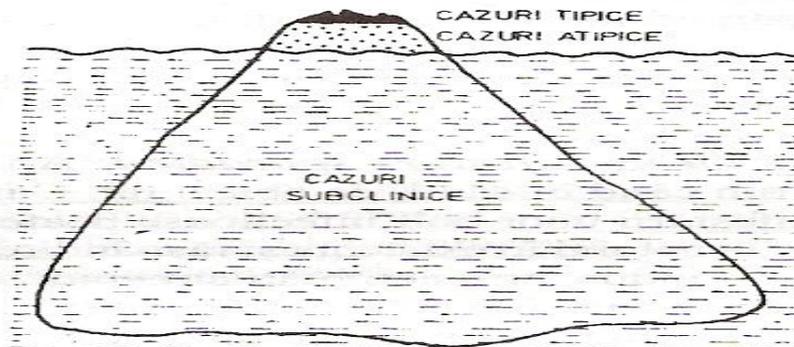
**ATYPICALLY**

**INAPPARENTLY**  
(immunological and biochemical changes)

- **The contagiousness index** – is the percentage of individuals in a receiving collectivity who, when exposed to the infection, develop the typical disease;

# *The receiving population*

- For some diseases, **90-100% of those exposed** develop the typical disease – **Measles**;
- There are diseases with a **high percentage of inapparent infection** – **POLIOMYELITIS** – there are several hundred inapparent infections for 1 typical or atypical sick person;



**Fig. 31: Fenomenul iceberg în procesele epidemiologice**

# *The receiving population*

- In this case, the person has high receptiveness for infection, but a low tendency to develop the disease;
- The inapparent infection is also immunizing, so, by assessing the number of immunizing individuals taking into account only those that have already had the disease, we would be making **an exact calculation for measles and an incorrect one for poliomyelitis;**
- In the case of poliomyelitis – **the sum** of individuals that are immune after having had the disease is not equal to, but much smaller than, the collective immunity.

# *The receiving population*

- There are infections from which all individuals gain **strong, long-term post-infectious immunity: MEASLES**
- However, there are also infections with **short-term, labile post-infectious immunity: INFLUENZA**



# *The immunological structure of a population*

- ❑ It is determined by 2 categories of factors:

## Specific factors:

- ✓ Going through the disease;
- ✓ Going through the inapparent infection;
- ✓ Applying chemoprophylaxis;
- ✓ Applying vaccination;
- ✓ Other measures of specific prophylaxis.

## Non-specific factors:

- ✓ Age,
- ✓ Food;
- ✓ Recent anergic diseases;
- ✓ Work type;
- ✓ Economic, cultural, sanitary level.

# *The immunological structure of a population*

- In some diseases, collective immunity is determined by **specific factors: MEASLES** (through vaccination, post-infectious immunity);
- In other diseases, the determining role is played by **non-specific factors: DYSENTERY** (through methods concerning hygiene, food, lifestyle);
- In others, the 2 categories of factors **are combined: CHOLERA.**

# *The favouring factors*



## ■ **Natural environmental factors:**

- **The seasons** – can favour or prevent the occurrence of morbid processes:
- **The cold** – favours aerogenous infections;
- **The heat** – favours digestive infections (higher intake of liquids, cellulose-rich foods, development of vectors, of rodents, etc.);
- **Atmospheric pressure oscillations** – temperature drops followed by sudden rises → influenza epidemics;
- **Heavy rainfall**, water from melting snow → digestive infections;
- **Natural disasters (floods, earthquakes)** → epidemic manifestation of the epidemiological process;
- Climatic, geographic, geologic, hydrologic factors

# *The favouring factors*



■ **Economic and social factors:** they act on all determining factors and are represented by:

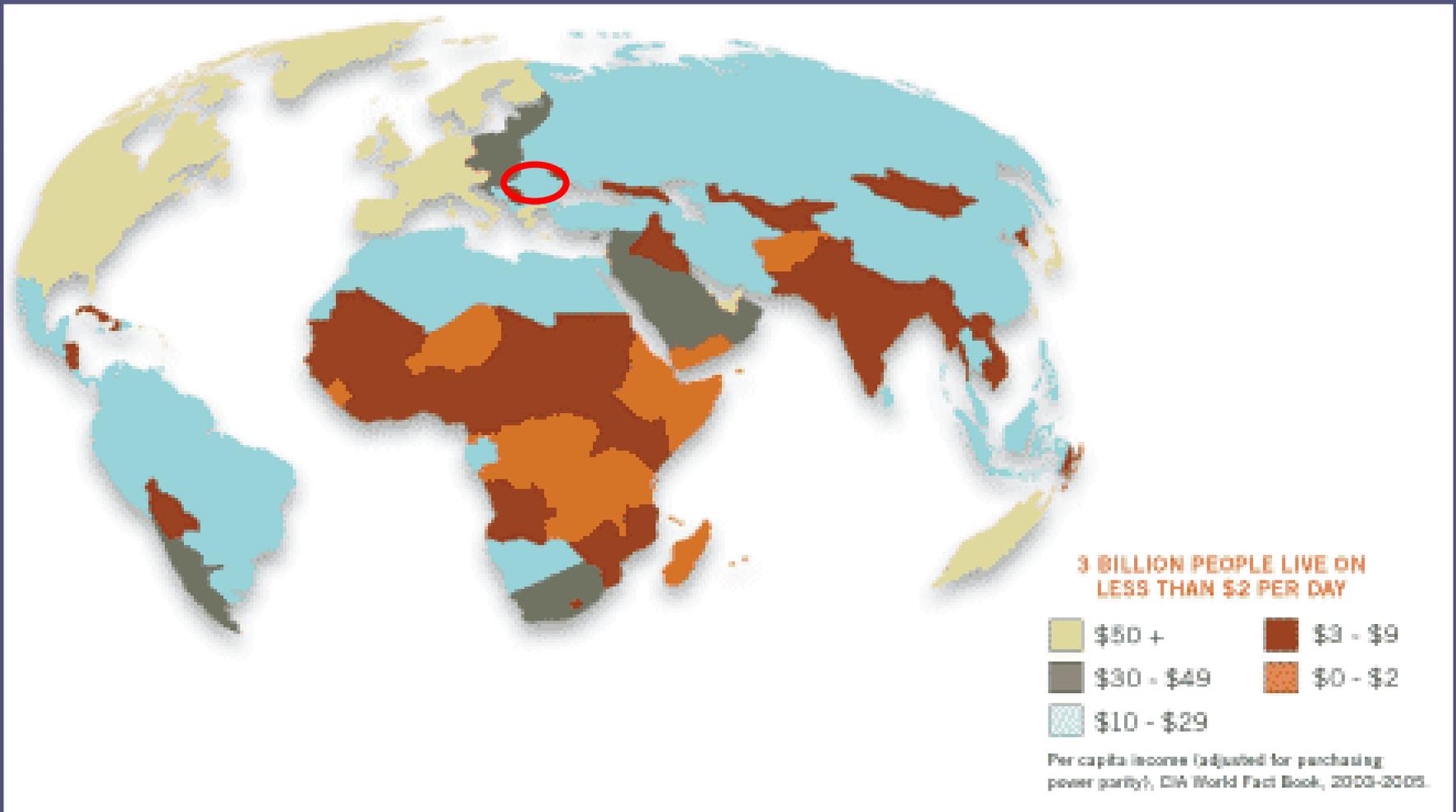
- ✓ Social life conditions;
- ✓ The population's economic state;
- ✓ Working conditions;
- ✓ Conditions of living together;
- ✓ Food;
- ✓ Population movements;
- ✓ Sanitary and moral level;
- ✓ Certain religious habits.

# *The favouring factors*



- **Social life conditions – economic and social factors:**
  - **Insalubrious home** – influenza, viral hepatitides, tuberculosis;
  - **Agglomerations** – aerogenous infections, vector infections;
  - **Improper eating** (quantitatively or qualitatively) – decreases the body's resistance and favours the onset of diseases;
  - **Contaminated food** – food poisoning;
  - **Contaminated water** – hydric transmission diseases;
  - **Job and working conditions** – viral B hepatitis is a job-related disease for the medical staff;
  - **Social calamities** – wars – the epidemic manifestation form of the epidemiological process;

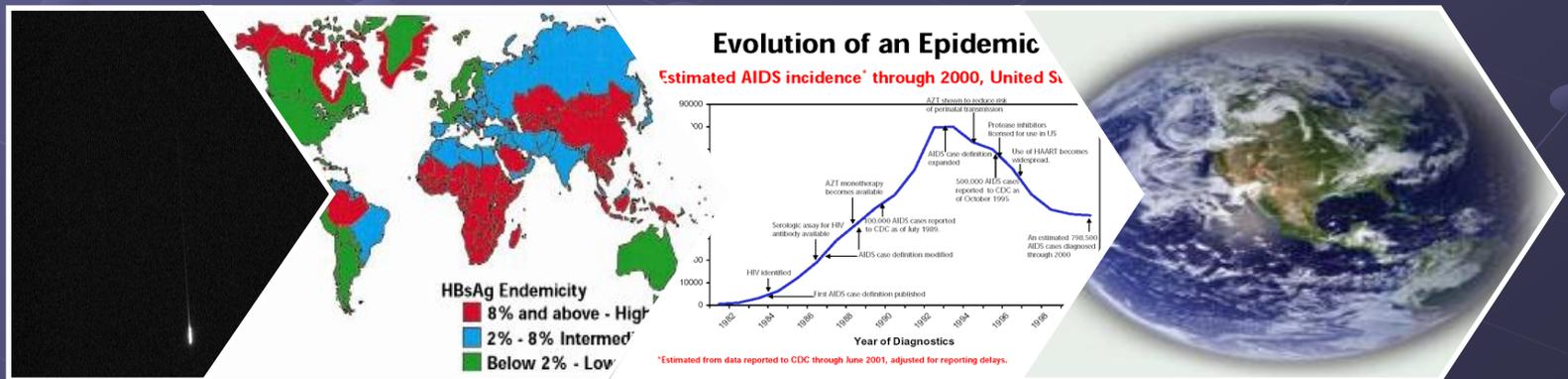
# *World poverty map*



# Manifestation forms of the epidemiological process

- The intensity of the epidemiological process is labelled through 4 forms of quantitative manifestation:

- ✓ Sporadic;
- ✓ Endemic;
- ✓ Epidemic;
- ✓ Pandemic.



# *Manifestation forms of the epidemiological process*

- These manifestation forms are assessed according to: morbidity, mortality, fatality, contagiousness, diffusion ability and periodicity – in other words, according to the criteria for assessing the manifestation forms;
- **Morbidity** – expresses the number of cases of a certain disease occurring in a population living on a certain territory, over a certain period of time;
- **Mortality** – records the deaths within a population occupying a certain territory over a given period of time;

# *Manifestation forms of the epidemiological process*

- **Lethality** – is expressed as the ratio of the number of deaths generated by a certain disease to the number of deaths by all causes in a certain territory and over a certain period of time;
- **Fatalitaty** – expresses the ratio of the cases with a certain pathology resulting in death over a certain period of time to the global number of cases over the same period;

# *Manifestation forms of the epidemiological process*

- **Diffusion ability or expansion** – expresses the propagation speed of an infectious disease in a fully receptive population;
- The spreading speed depends on:

- ✓ the number of infection sources,
- ✓ the number of transmission routes,
- ✓ the number of receptors,
- ✓ the duration of incubation, and
- ✓ the economic and social factors

**Diseases with no expansion tendency**  
**TETANUS**

**with slow expansion**  
**DYSENTERY**

**with rapid expansion**  
**INFLUENZA, RUBELLA**

# *Manifestation forms of the epidemiological process*

- **Periodicity** – is the increase in morbidity at certain intervals in the form of seasonal and multi-annual oscillations;
  - **Seasonal oscillations** – express the increase of morbidity in a certain season regardless of the manifestation form of the epidemiological process during the rest of the year;

**Digestive entry diseases**  
**CHOLERA – SUMMER**

**Respiratory entry diseases**  
**INFLUENZA – WINTER/SPRING**

# *Manifestation forms of the epidemiological process*

- **Multiannual oscillations** – are the recurrence of acute and extensive manifestations of the epidemiological process in the form of an epidemic or pandemic, in a collectivity, on a territory, after a time of interepidemic tranquility;
- During this interval that can last years, the disease has not manifested itself at all or has only manifested itself sporadically and endemically.
- Multi-annual oscillations manifest themselves in a population that has become 100% receptive after a while following the previous epidemic:
  - either through the loss of the weak immunity remaining after a disease
  - or through the accumulation of population segments that have not yet been vaccinated.

**RUBELLA 3 to 5-year periodicity**

**INFLUENZA 2 to 3-year periodicity**

# Multi-annual oscillations

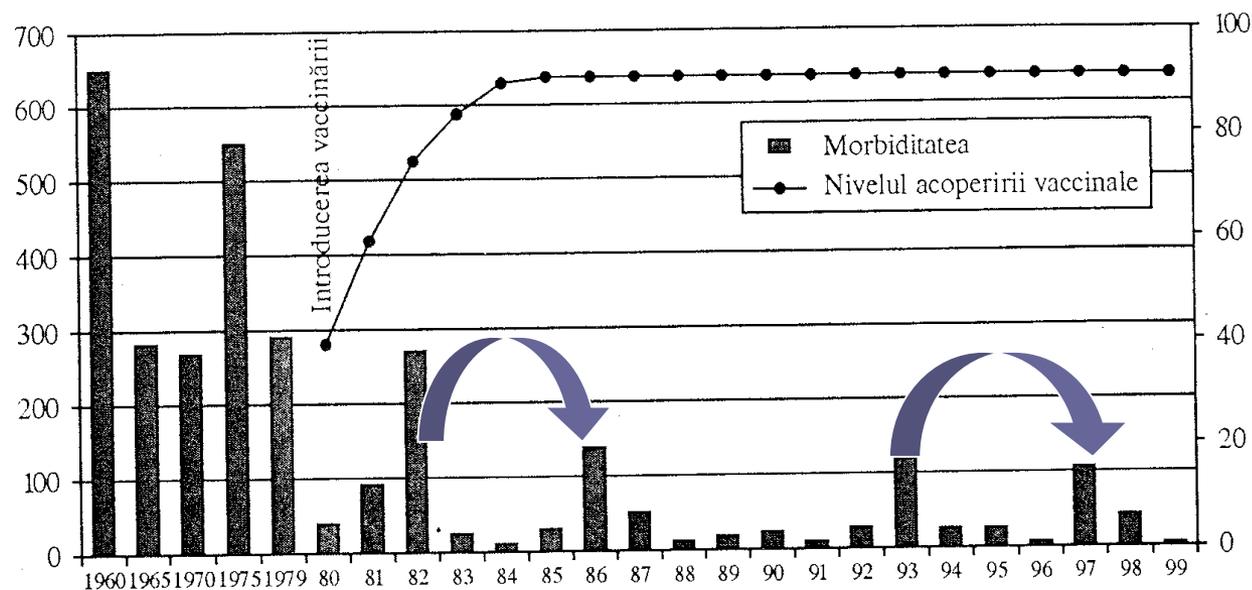
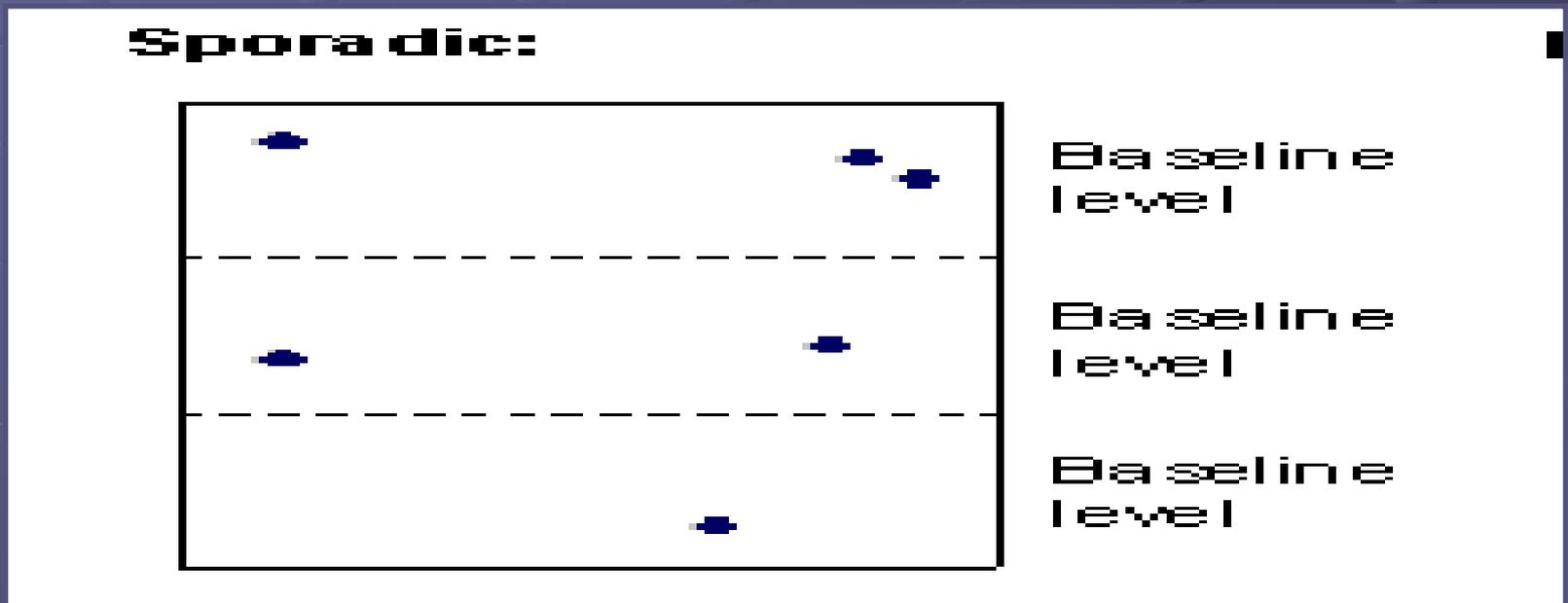


Fig.2. Incidența anuală a cazurilor de rujeolă raportate, comparativ cu acoperirea vaccinală, în România, în perioada 1960-1999 (după CCSSDM-MSF-2000)

# 1. The sporadic form

- Manifests itself in a small number of disease cases, recorded at large intervals, with no apparent link between them and disseminated on a wide geographic area – **tetanus, anthrax;**

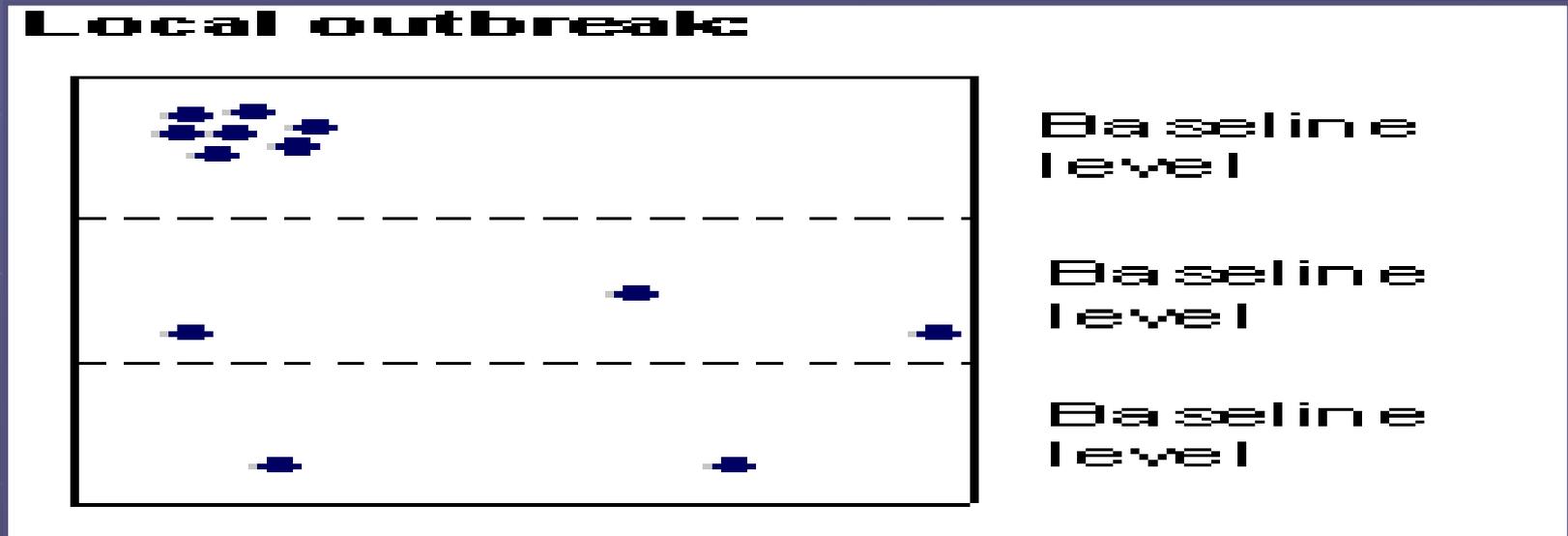


# *1. The sporadic form*

- The sporadic nature may be a natural manifestation of some diseases or it may be determined by the existence of a population mass that is refractory to the disease as a result of post-infectious and/or post-vaccine immunity;
- The sporadic form may also occur in a receptive population when the transmitting vector is missing or the infecting contact is sporadic;
- It may also occur in highly contagious diseases when the sick people became infected outside the collectivity and the correct prevention and control methods have been taken within the community.

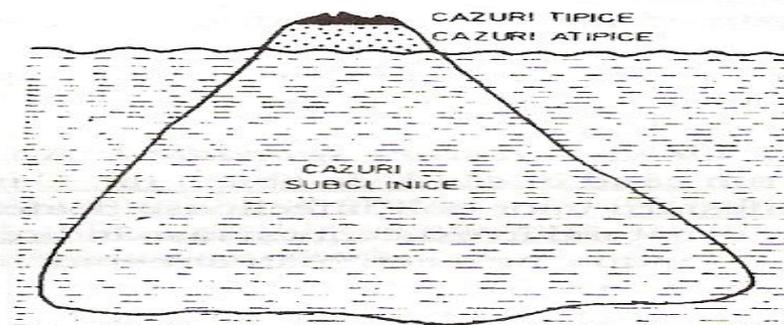
## 2. The endemic form

- There is a curve of **relatively low and uniform morbidity**;
- The endemic nature of a disease can be transformed, either naturally or through prevention and control methods, into a sporadic form or it may evolve towards an epidemic form;



## 2. The endemic form

- Making a territory endemic by getting the population to be massively interested in that particular infection is known as **HYPERENDEMIC**.
- In this phase, there are many individuals with latent forms or inapparent infections, so that the clinically manifested

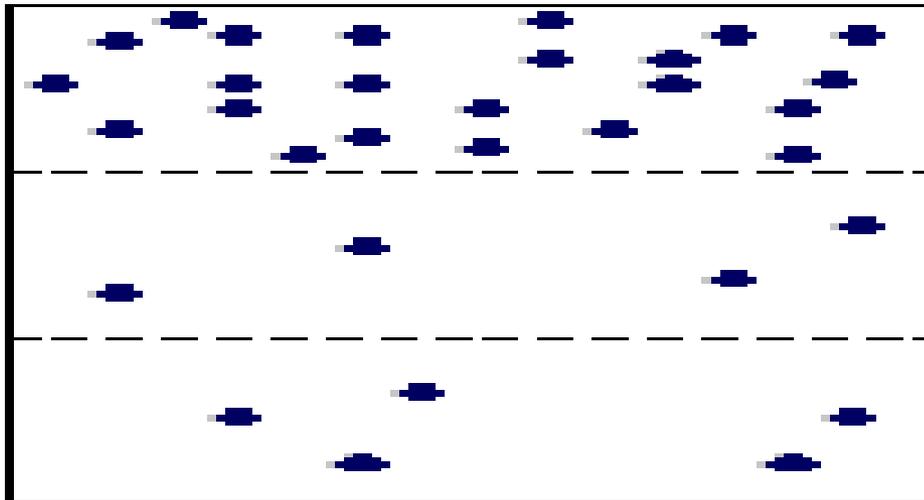


**Fig. 31: Fenomenul iceberg în procesele epidemiologice**

### 3. *The epidemic form*

- It is represented by numerous cases of the disease occurring in a collectivity on a given territory;

**Regional activity:**



Above  
baseline

Baseline  
level

Baseline  
level

### *3. The epidemic form*

■ The epidemic appears as a large scale manifestation in:

- ✓ Highly contagious diseases – influenza,
- ✓ When the population is 100% receptive,
- ✓ When the population is partly receptive, but there is an influx of many infection sources,
- ✓ When germs display maximum virulence,
- ✓ When there are many transmission routes,
- ✓ When favouring factors occur

## 3. *The epidemic form*

- In practice, we can encounter **explosive or slow epidemics**;

### **Explosive epidemics:**

- ✓ They have a sudden outbreak and are characterized by a large number of cases in a short time,

#### Types of epidemics:

- **Hydric**
- **Food-related** (milk) – food poisoning;
- **Vector-based**
- **Respiratory** - influenza

### **Slow epidemics:**

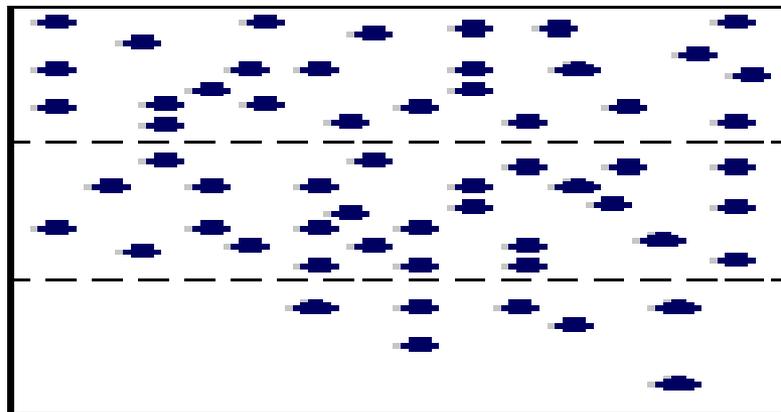
- ✓ Due to infecting contacts occurring intermittently and individually or in small population groups;
- ✓ They are usually transmitted through contact, and contamination occurs at the level of the transmission route, with small doses of germs or weakly virulent germs

**Example – Recurrent fever**

## 4. *The pandemic form*

- It is an amplified manifestation of the epidemic, where the disease foci expand successively and permanently,
- Currently, pandemic manifestations are noticed in the case of **type A influenza**, while in the case of viral hepatitides, through their universal spreading, a slowly evolving pandemic manifestation is taking place.

**Widespread activity:**



Above  
baseline

Above  
baseline

Baseline  
level

# *Thank you!*



*Images – sources  
The Internet*