



Chapter 2

Introduction to Epidemiology Part II

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THE INFECTION SOURCE

✚ The body or the environment in which the pathogen is hosted, in which it multiplies and from which it is released into the outer environment through various routes, contributing to the onset, persistence, and spread of an infectious disease among the population mass.

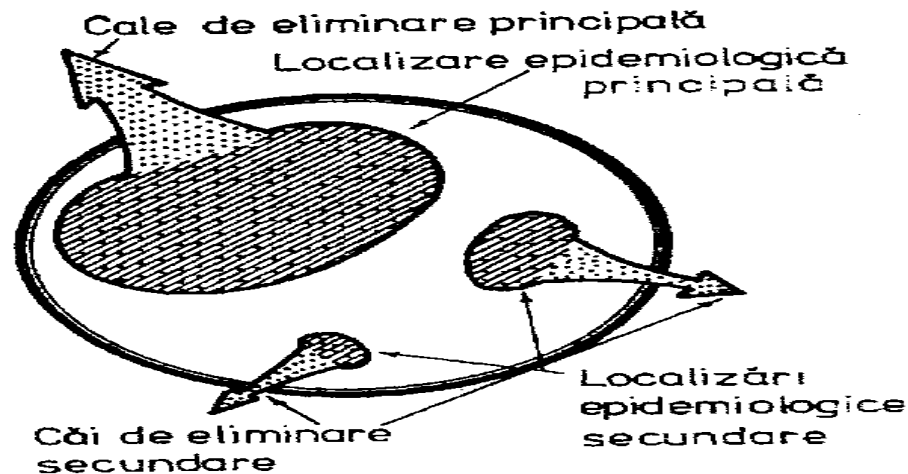


Fig. 27: Izvorul de infecție

THE INFECTION SOURCE

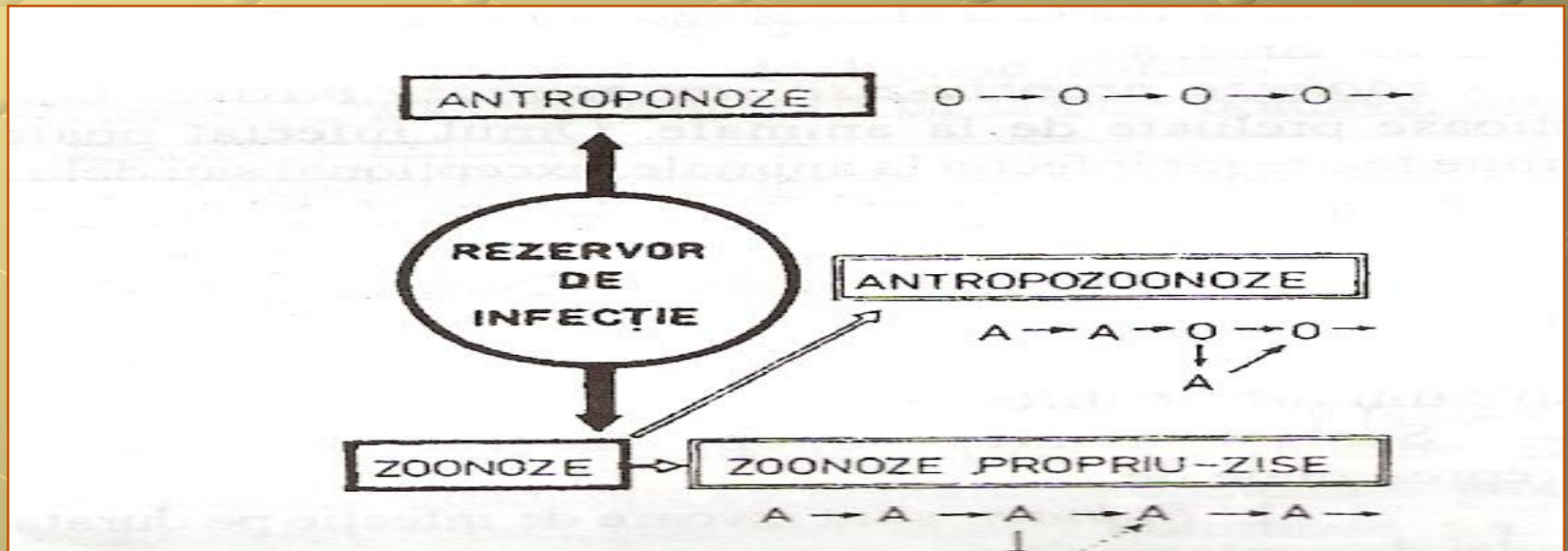
✚ According to the infection source, infectious diseases are classified into two main groups:

- ✓ **anthroponoses** – human-specific diseases, transmitted from human to human (**rubella, measles, syphilis, gonorrhea, scarlet fever, viral hepatitis**);
- ✓ **zoonoses** – animal-specific diseases that can accidentally be transmitted to humans as well (**anthrax, brucellosis**).



THE INFECTION SOURCE

- Some authors speak of a separate group of diseases, where the share of the animal infection source is close to that of the human infection source.
- These diseases are called anthropozoonoses. Influenza is one such example.



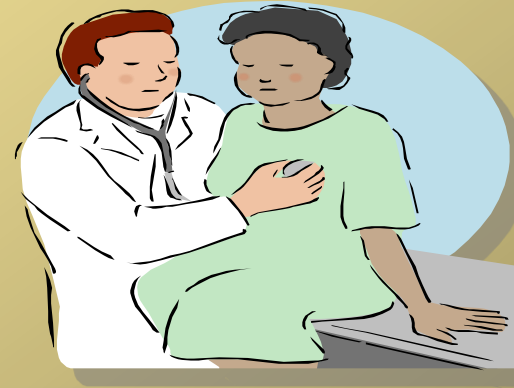
The human infection source

❖ As an infection source, humans can be classified into the following groups:

- Humans with a typical disease;
- Humans with an atypical disease;
- Humans with a chronic disease;
- Humans as germ carriers.



1. Humans with a typical disease (sick people)



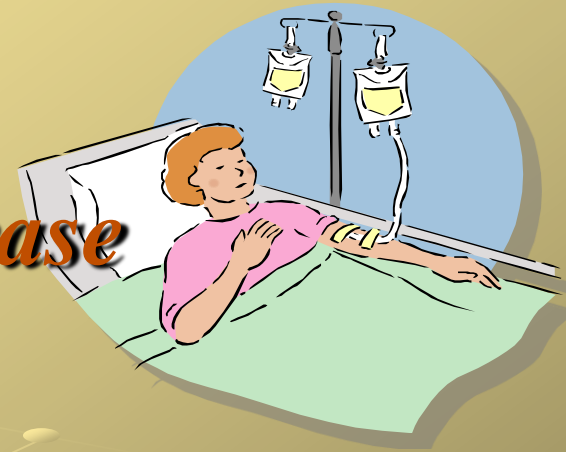
- ✿ They are an infection source with various germ-release degrees, depending on the evolutionary stage of the disease;
- ✿ Thus, a sick person eliminates the pathogen:
 - ✓ During the incubation period (typhoid fever, whooping cough, rubella, measles, mumps, influenza, viral respiratory infections);
 - ✓ During the latency period – in all types of infectious diseases;
 - ✓ The sick person can remain an infection source during convalescence – in the case of diseases such as typhoid fever and dysentery.

2. Humans with an atypical disease (subclinical, or abortive)

✚ This infection source is difficult to identify; it may go unnoticed and thus remain unisolated, which has major clinical and epidemiological implications.



3. Humans with a chronic disease



- ✚ They preserve their capacity as an infection source during recrudescence and relapses;
- ✚ Consequently, a chronic disease can also be an infection source, generally contributing to the endemization of a territory (**e.g. malaria, dysentery, viral hepatitides**).

4. *Humans as germ carriers*



- ✿ These can be any healthy or apparently healthy person that hosts and releases germs into the external environment, either continuously or intermittently;
- ✿ According to the evolution period of the disease, in which the carrier releases germs, the following classification can be made:
 - ✓ Pre-infectious people – actually sick people in the incubation period, releasing germs a few days before the invasion (**typhoid fever, whooping cough, rubella, measles, mumps, influenza, viral respiratory infections**).

Humans as germ carriers



✓ Post-infectious (previously sick people) that can, in turn, be subdivided into:

- Convalescent people – with temporary carriage of 1-3 weeks, occurring in **typhoid fever, dysentery, scarlet fever, diphtheria**;
- Chronically ill people – with a longer-term carriage that can span months, years, or a lifetime. This type of chronic carriage is favored by dystrophy, diseases of gall bladder, chronic colitis, sinusitis, urinary and genital diseases, with the pathogen remaining stationed in: the gallbladder, bone marrow, blood, etc.

The germ carrier



- ✚ We must also mention the category of **healthy carriers**. This category includes immune organisms, which have acquired this status following immunization (whether occult, artificial etc.)
- ✚ They can release germs in full health for 1-3 weeks;
- ✚ They are generally found in the environment around the infection source.

The germ carrier



- ✚ According to the way in which germs are released, carriers can be classified into:
 - ✓ **Permanent carriers** – continuously releasing germs;
 - ✓ **Intermittent carriers** – excreting germs at certain intervals;
 - ✓ **Closed or encysted carriers** – not excreting germs.
- ✚ All carrier categories mentioned above are very important in epidemiology. Consequently, measures must be taken to limit their epidemiological role.

The germ carrier



🐞 These measure generally consist in:

- ✓ Clinical, epidemiological, and laboratory identification, followed by the elimination (sterilization) of the carrier state;
- ✓ Setting strict hygiene rules that carriers must follow (moral isolation of the carriers);
- ✓ Observing a strict therapy during the disease;
- ✓ Temporarily or permanently removing the carriers from the workplaces with high epidemiological risk (groups of children, the food sector, drinking water supply).

The animal infection source



- ✚ The features mentioned for the human infection source also apply to the animal one, with the mention that pathogens can be transmitted from animals to humans through biting, scratching, touching.**
- ✚ For example, animal furs and, generally, animal slaughtering products used for human consumption can be involved in the transmission of diseases from animals to humans.**

The secondary infection source

- ❖ The organism or the environment that hosts the pathogen, where the pathogen multiplies, and which represents, at the same time, a transmission route of the pathogen;
- ❖ Example – organism - **the anopheles mosquito**;
- environment – **milk**.



Natural focus infection



- ✿ This is an infectious disease occurring in a certain geographic area, where there is a certain biocoenosis.
- ✿ Humans become sick by entering such a geographic area, and the contamination and disease are caused by the following types of animals:
 - ✓ Wild;
 - ✓ Domestic;
 - ✓ Rats and mice;
- ✿ E.g. : pest, rabies, anthrax, yellow fever, Japanese B encephalitis, Russian spring-summer (taiga) encephalitis, toxoplasmosis, typhus, Q fever, etc.

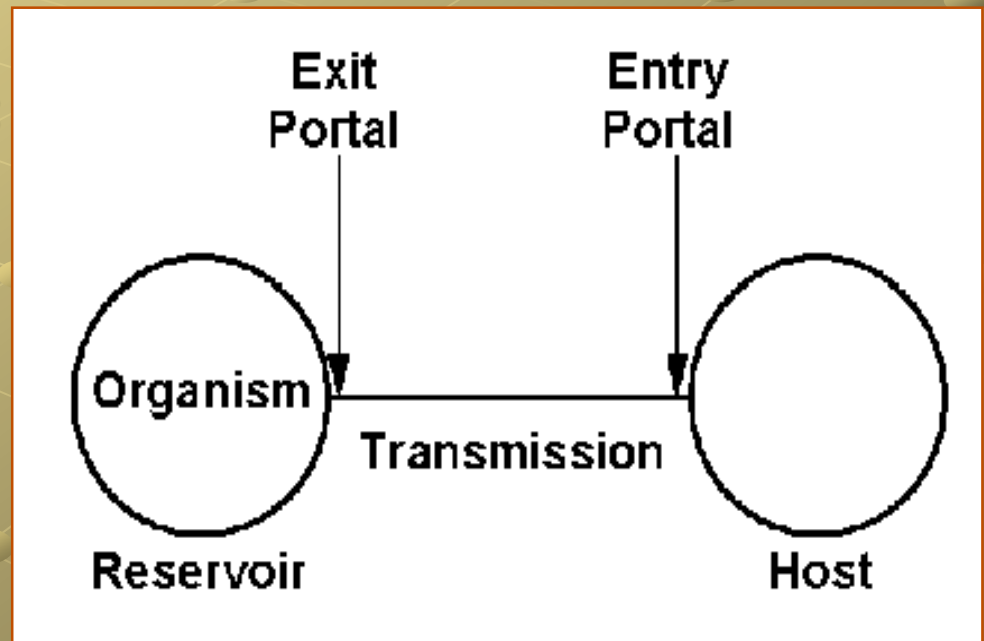
THE TRANSMISSION ROUTE

🦠 This is the route taken by the pathogen from the infection source to the receiving organism, as well as the way this route is covered, which is ultimately influenced by external physical environment factors.

🦠 The transmission can be:

✓ Direct;

✓ Indirect.



Direct transmission

✚ **No element** from the external environment is interposed between the infection source and the receiving organism;

✚ **E.g.:**

- cutaneous contamination – **scabies;**
- cutaneous through biting – **rabies;**
- neonatal contamination – **herpetic infection in neonates;**
- transplacental contamination – **rubella during the first trimester of pregnancy;**
- sexual contamination – **syphilis;**
- contamination through blood transfusions – **malaria, HVB, HIV/AIDS.**
- Aerogenous contamination from less than 1 m.

Indirect transmission

- ✚ One or several elements from the external physical environment are interposed between the infection source and the receiving organism;

Aerogenous transmission



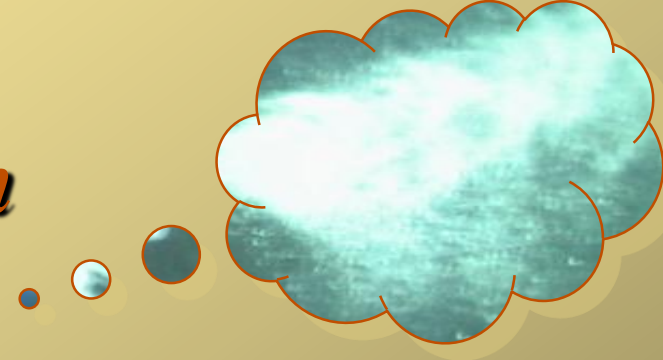
- ✚ Transmission by air is classified among the direct mechanisms, by projection on the host's nasopharyngeal mucosa from less than 1 m, or among the indirect mechanisms, by dissemination over longer distances;
- ✚ Although it is not a good environment for multiplication, air is a favorable transmission agent: **whooping cough, meningitides, viral respiratory infections, hospital germs,**

Aerogenous transmission



- ✚ The determining role is played by Flügge's droplets, which can travel to 2-4 m by sneezing and to 1-2 m by coughing;
- ✚ The aerogenous transmission route is the most efficient and the hardest to block;
- ✚ Flügge's droplets can dehydrate, forming nucleosols that, due to the loss of weight, can travel over longer distances, which may give rise to special epidemiological events;
- ✚ The larger particles are less harmful because they deposit sooner due to their weight.

Aerogenous transmission



- ✿ **Air can also be polluted by dust particles, fragments of organic substances or soil fragments on which pathological products are deposited;**
- ✿ **The pathological products dehydrate and the pathogens continue to adhere to the dust particles – thus travelling over even longer distances, contaminating both the external environment and people located far away from the starting point of the pathogen.**

Indirect transmission

❖ Indirect transmission involves one or several elements from the external environment:

- ✓ Water;
- ✓ Soil;
- ✓ Food;
- ✓ Objects;
- ✓ Residues;
- ✓ Dirty hands and
- ✓ Vectors.



Transmission through water



Due to industrial pollution and the lack of correlation between urbanization and the development of drinking water supply, this element of the complex indirect route has become a significant method of propagation of infectious diseases;

The survival and multiplication of pathogens in water is conditioned by:

- ✓ Turbidity;**
- ✓ UV radiation;**
- ✓ and, generally, the self-purification ability of the water.**

Transmission through water

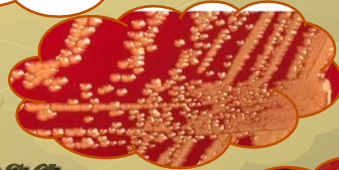


- ❖ **Clear, deep, and cold waters have low self-purification ability.**
- ❖ **At the opposite end, we have the waters with high self-purification ability.**
- ❖ **The contamination of surface water is done by: animal carcasses, water from melting snow, washing of the soil (rain), residual water, used water coming from hospitals, the animal farming sector, etc.**
- ❖ **Humans become ill through direct consumption, consumption in the household, washing fruits and vegetables, and even bathing.**

Transmission through water


🦠 The most frequently responsible germs are:

- ✓ *Salmonella* sp.,
- ✓ VHA, VHE,
- ✓ *Shigella* sp.,
- ✓ *Pseudomonas aeruginosa*,
- ✓ cholera vibrio,
- ✓ Polio, Coxsackie, ECHO viruses,
- ✓ *Mycobacterium tuberculosis*,
- ✓ parasite eggs and cysts.



Transmission through water



 In the case of many contaminations transmitted through water, we are dealing with a hydric epidemic with the following features:

- ✓ A large number of contaminations in a short time;
- ✓ morbidity matches the water distribution area;
- ✓ contaminations decrease in frequency when the contaminated water is removed.

Transmission through the soil



- ✚ The soil is not a good environment for germ multiplication. Nevertheless, vegetative and, more often, sporulated forms can be transmitted through it.**
- ✚ From the soil, germs can be inhaled or ingested through dirty hands; the soil can also contaminate other transmission routes (water, vectors), which leads to chain transmission;**
- ✚ Whenever a transmission route contaminates another transmission route, we get the phenomenon mentioned above.**

Transmission through the soil



✚ The soil is permanently contaminated through feces, residual and surface water, household waste, carcasses, various contaminated objects.

✚ The soil can host etiological agents of:

✓ Dysentery;

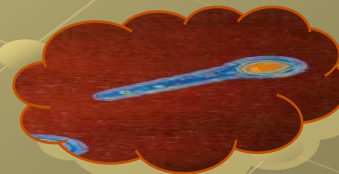
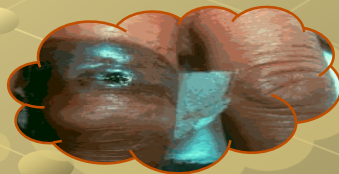
✓ Cholera

✓ Brucellosis;

✓ Anthrax;

✓ Tetanus;

✓ Gas gangrene (*Clostridium p.*).



Thank you!



*Images – sources
The Internet*