

Community MEDICINE

SUMMARY

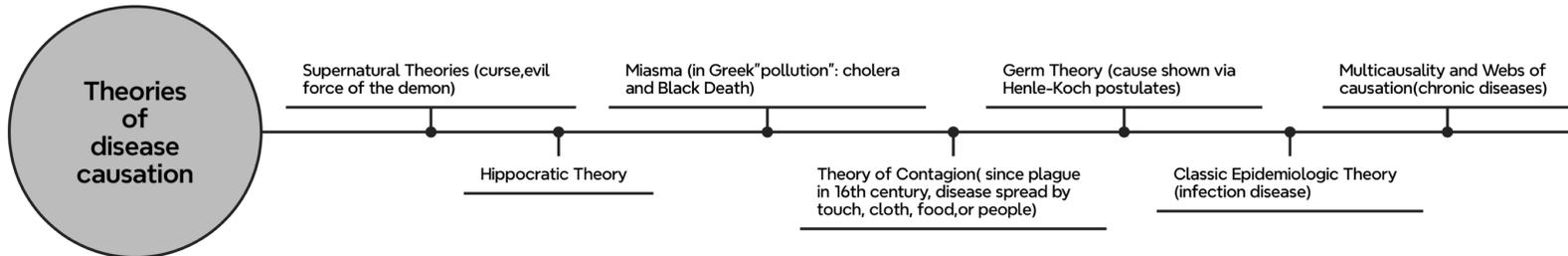
Lec 1



• Natural history of disease and chain of infection •

Cause of Disease in medical textbooks discussed under headings like **etiology, pathogenesis, mechanisms, risk factors**. Defined as “anything producing an effect or a result”.

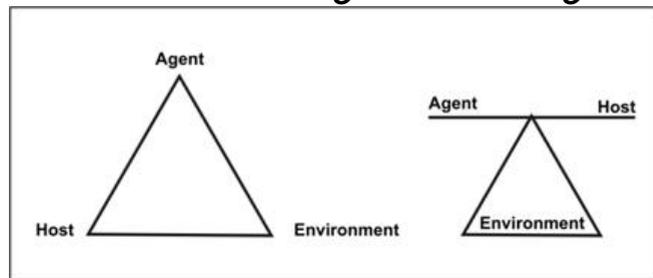
• Important to the physician **because it guides their approach to 3 clinical tasks prevention, diagnosis, treatment.**



Epidemiologic Triad

Disease is the result of forces within a dynamic system consisting of:

1. Agent of disease.
2. Susceptible host.
3. external environment.



• The infectious disease diseases result from the interaction of **agent, host** and **environment**.

• More specifically, transmission occurs when the **agent** leaves its **reservoir or host** through a **portal of exit**, is conveyed by some **mode of transmission**, and enters through an **appropriate portal of entry**

Factors Associated with Increased Risk of Human Disease

HOST (Intrinsic)

- Age
- Gender
- Ethnicity
- Religion
- Customs
- Occupation
- Heredity
- Marital status
- Family background
- Previous diseases

AGENTS

- Biological (bacteria, etc.)
- Chemical (poison, alcohol, smoke)
- Physical (auto, radiation, fire)
- Nutritional (lack, excess)

ENVIRONMENT (Extrinsic)

- Temperature
- Humidity
- Altitude
- Crowding
- Housing
- Neighborhood
- Water
- Milk
- Food
- Radiation
- Air pollution
- Noise

This is called **chain of infection**

to infect a **susceptible host**.

Reservoir the habitat in which the agent normally lives, grows, and multiplies

Human Reservoir

- Many common infectious diseases have human reservoirs.
- Diseases that are transmitted from **person to person** without intermediaries include the **sexually transmitted diseases, measles, mumps, streptococcal infection,** and many **respiratory pathogens**.
- Because humans were the only reservoir for the **smallpox virus**, naturally occurring smallpox was **eradicated** after the last human case was identified and isolated in Somalia in 1977.

Environmental Reservoir

- **Plants, soil, and water** in the environment are also reservoirs for some infectious agents.
- Many fungal agents, such as those that cause **histoplasmosis**, live and multiply in the soil.
- Outbreaks of **Legionnaires disease** are often traced to water supplies in cooling towers and evaporative condensers, which are the reservoirs for the causative organism **Legionella pneumophila**.

Animal Reservoir

- Humans are also subject to diseases that have animal reservoirs. Many of these diseases are transmitted from **animal to animal**, with **humans as incidental hosts**.
- The term **zoonosis** refers to an infectious disease that is transmissible under natural conditions from vertebrate animals to humans. Long recognized zoonotic diseases include **brucellosis (cows and pigs), anthrax (sheep), plague (rodents), and rabies (bats, raccoons, dogs, and other mammals)**.
- Many newly recognized infectious diseases in humans, including **HIV/AIDS, Ebola infection and SARS**, are thought to have emerged from animal hosts, although those hosts have not yet been identified.

Portal of Entry

- The portal of entry refers to the manner in which a **pathogen enters a susceptible host**.
- The portal of entry must provide **access to tissues** in which the **pathogen can multiply or a toxin can act**.

- In contrast, many pathogens that cause gastroenteritis follow a so-called **"fecal-oral" route** because they exit the source host in **feces**, are carried on inadequately washed hands to a vehicle such as food, water, or utensil, and enter a new host through the **mouth**.

- Often, infectious agents use the **same portal to enter** a new host that they used to **exit the source host**.
- For example, influenza virus exits the respiratory tract of the source host and enters the respiratory tract of the new susceptible host.

- Other portals of entry include the **skin (hookworm), mucous membranes (syphilis), and blood (hepatitis B, HIV)**.

Portal of Exit

is the path by which a pathogen leaves its host. The portal of exit usually corresponds to the site where the pathogen is **localized**.

For example, **influenza viruses** and **Mycobacterium tuberculosis** exit the **respiratory tract**, **cholera vibrios** in **feces**, **Sarcoptes scabiei** in scabies **skin lesions**.

Some **bloodborne agents** can exit by crossing the placenta from **mother to fetus** (rubella, syphilis, toxoplasmosis), while others exit through **cuts or needles** in the skin (**hepatitis B**) or blood-sucking insects (**malaria**).

Modes of Transmission

Direct transmission (person to person)

Direct contact: skin-to-skin contact, kissing (saliva), sexual contact, and soil. Droplet spread: spray with relatively large, short range droplets produced by sneezing, coughing, or even talking (influenza).

Indirect transmission

Airborne

infectious agents are carried by **dust or droplet nuclei** suspended in air (<5microns) (measles in a doctor's office).

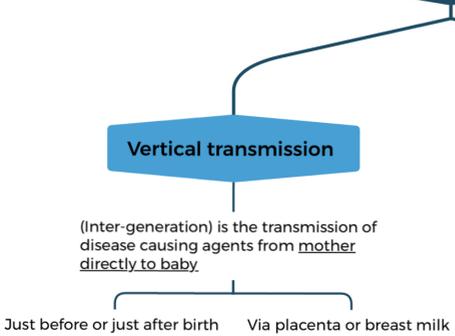
Vehicleborne

Inanimate objects, food (Clostridium Botulinum, E.coli), **water** (Hepatitis A virus, E.coli), **biologic products** (blood), and **fomites** (such as handkerchiefs, bedding, surgical scalpels, tooth brush, toys, cutting board).

Vectorborne

(mechanical or biologic): mosquitoes, fleas, lice, and ticks may carry an infectious agent through purely mechanical means or may support growth or changes in the agent (malaria)

Transmission of agents from mother to child (HIV, Hepatitis C, etc)



Horizontal transmission

All mods of transmission we have studies are horizontal

[Susceptible Host]

• depends on **genetic factors**, **specific immunity** (antibodies resulting from infection of vaccine), and **nonspecific factors** (skin, mucous membranes, gastric acidity, cilia in the respiratory tract, the cough reflex) that **affect an individual's ability to resist infection or to limit pathogenicity.**

• Factors that may increase susceptibility to infection by disrupting host defenses include **malnutrition, alcoholism, and disease or therapy (chemotherapy)**, that impairs immune response.

Knowledge of the portals of exit and entry and modes of transmission provides a basis for determining appropriate **control measures**. Control measures are usually directed against the **segment in the infection chain that is most susceptible to intervention:**

• Some interventions are directed at the **mode of transmission (isolation of someone with infection, or counseling persons to avoid the specific type of contact associated with transmission)** e.g. **personal hygiene and social distancing to prevent Covid-19.**

• Some strategies that **protect portals of entry** are simple and effective (bed nets for mosquitoes, mask, gloves, and face shield).

• Some interventions aim to **influence susceptibility and host's defenses (Vaccinations).**9

• Natural history and spectrum of disease refers to the progression of a **disease process in an individual over time**, in the absence of treatment.

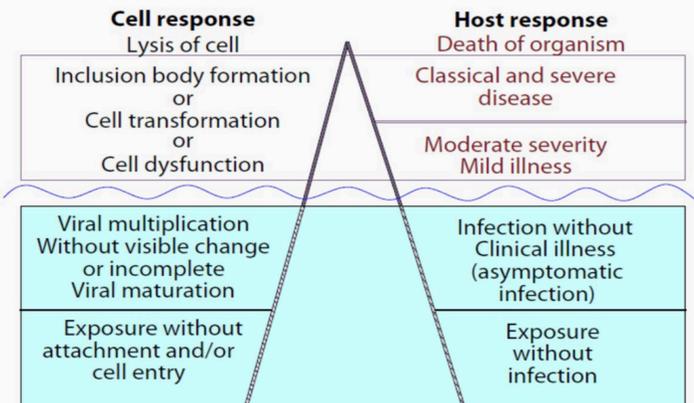
• For example, untreated infection with **HIV** causes a spectrum of clinical problems beginning at the time of seroconversion (primary HIV) and **terminating with AIDS** and usually death. It is now recognized that it may take 10 years or more for AIDS to develop after seroconversion.

• **Carriers:** are persons with **incubating disease** or **inapparent infection**, are infectious but have **subclinical disease.**

• Persons with measles, hepatitis A, influenza and several other diseases become infectious a few days before the onset of symptoms.

The "Iceberg" Concept of Infectious Diseases

■ (At the level of the cell and of the host)



Inapparent Infection

- **Preclinical disease:** in the early stage of disease progression, disease is not clinically detected but is destined to become clinical disease.

- **Subclinical disease:** disease is not detected but the host carries the organism or has antibody response (asymptomatic).

- **Chronic carriers** are those who continue to harbor a pathogen such as hepatitis B virus or Salmonella Typhi, the causative agent of typhoid fever, for months or even years after their initial infection.

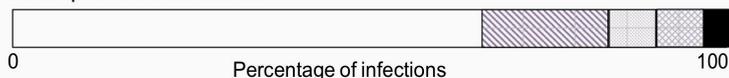
• One notorious carrier is Mary Mallon, or **Typhoid Mary**, who was an asymptomatic chronic carrier of Salmonella Typhi. As a cook in New York City and New Jersey in the early 1900s, she unintentionally infected dozens of people until she was placed in isolation on an island in the East River, where she died 23 years later.



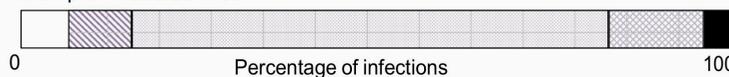
Distribution of Clinical Severity for Three Infections

(not drawn to scale)

Class A: unapparent infection frequent
Example: tubercle bacillus



Class B: clinical disease frequent; few deaths
Example: measles virus



Class C: infections usually fatal
Example: rabies virus

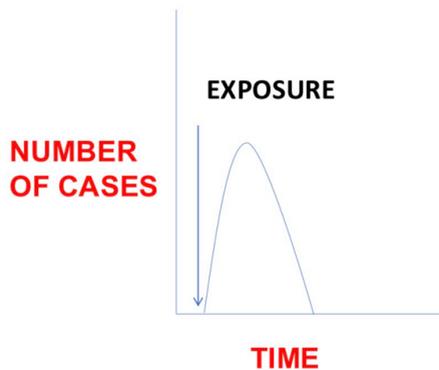


Unapparent Mild Moderate Severe (nonfatal) Fatal

Objectives of Epidemiology

- Investigate the etiology of disease and modes of transmission
- Determine the extent of disease problems in the community
- Study the natural history and prognosis of disease
- Evaluate both existing and new preventive and therapeutic measures and modes of health care delivery
- Provide a foundation for developing public policy and regulatory decision

EPIDEMIC CURVE



Common Steps in the Epidemiologic Approach

The steps in the epidemiologic approach to study a problem of disease etiology are:

- Perform an initial observation to confirm the epidemic (outbreak)
- Define the disease (or health problem)
- Describe the disease by time, place, and person
- Create a hypothesis as to the possible etiologic factors
- Conduct analytic studies
- Summarize the findings
- Recommend and communicate the interventions or preventative program