

(epidemiologie, kontrola  
chorob, faktory patogenicity,  
antibiotická terapie, virové,  
bakteriální, plísňové a  
parazitární choroby)

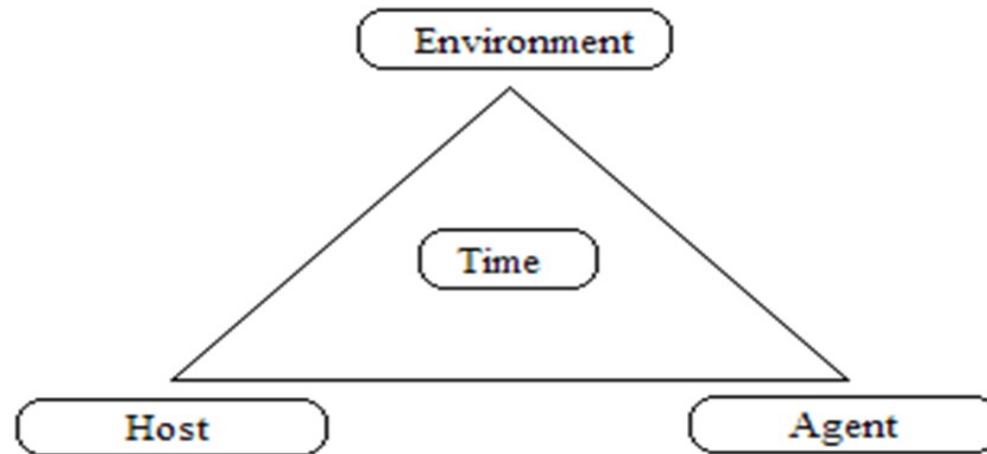
# Causes of Disease

- Identifying causes of disease and the mechanisms by which they spread remains a primary focus of epidemiology
- **Etiology:** Science and study of the causes of disease and their mode of operation



# Etiology of Disease

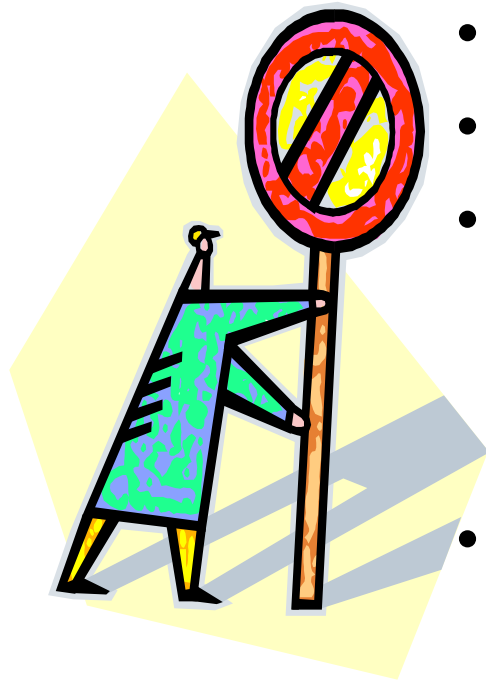
- The sum of all factors contributing to the occurrence of the disease
- Agent factors + Host factors + Environmental factors = Etiology of Disease



# Triangle is based on the communicable disease model

- **Agent**: the cause of the disease
- **Host**: an organism, usually a human or an animal, that harbors a disease
- **Environment**: those surroundings and conditions external to the human or animal that cause or allow disease transmission
- **Time**: accounts for incubation periods, life expectancy of host or pathogen, and duration of the course of the illness or condition.

# How can epidemics be stopped?



- At least one of elements of triangle must be:
- (1) interfered with
- (2) altered
- (3) changed, or
- (4) removed from existence, so that disease no longer continues in mode of transmission and routes of infection
- How? Clean up environment, change behavior, vaccinate, medicine, etc.

# Other important Epi terms

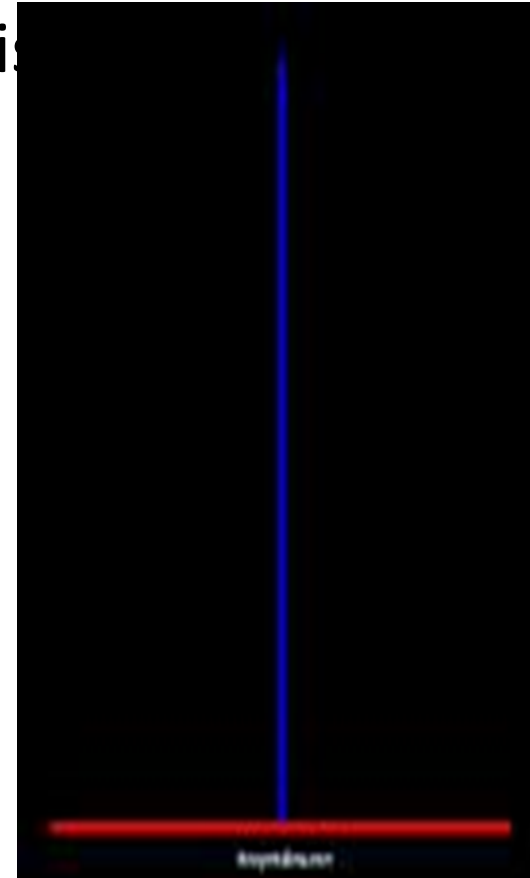
- **Invasiveness**: ability to get into a susceptible host and cause disease
- **Virulence**: disease-evoking power of a pathogen
- **Communicability**- ability of a disease to be transmitted from one individual to another or to spread in a population



*"OK, everybody get to work. She just lost her health insurance."*

# Diseases are classified according to infectivity and communicability

- Transmission of infectious communicable diseases through:
  - **Vertical** Transmission
  - **Horizontal** Transmission



# Vertical transmission of infectious communicable diseases

- Transmission from an individual to its offspring through sperm, breastmilk, placenta, or vaginal fluids
- Examples:
  - yeast infection, hepatitis B, C, rabies





# Horizontal transmission of infectious communicable diseases

- Transmission of infectious agents from an infected individual to a susceptible contemporary (another person)
  - **Example:**
    - 1. Common vehicles (blood-, water- or food-borne illnesses)
    - 2. Airborne pathogen (TB, flu)
    - 3. Vector borne pathogen (malaria, dengue, West Nile)



Picture retrieved from: <http://phil.cdc.gov/phil/details.asp?pid=11161>

- Direct and indirect transmission

# 1. Direct transmission:

- Disease transmitted by direct physical contact

## **Examples:**

- Touching with contaminated hands
- Skin-to-skin contact
- Kissing

## 2. Indirect transmission:

- Disease transmitted when pathogens or agents are transferred or carried by some intermediate item, organism, means, or process to a susceptible host, resulting in disease

### **Examples:**

- fomites
- vectors
- air currents
- dust particles
- water droplets
- water or food
- oral-fecal contact

# Diseases are classified by Severity and Duration:

- **Acute** – disorder with sudden onset, relatively severe, and short duration of symptoms (e.g. common cold)
- **Chronic** – develops slowly, lasting over long periods if not a lifetime (e.g. tuberculosis)
- **Subacute disease-** intermediate between acute and chronic (e.g. endocarditis)
- **Latent disease-** agent remains inactive for a period of time, but then activates to cause disease (e.g. shingles)

# Patterns of Disease

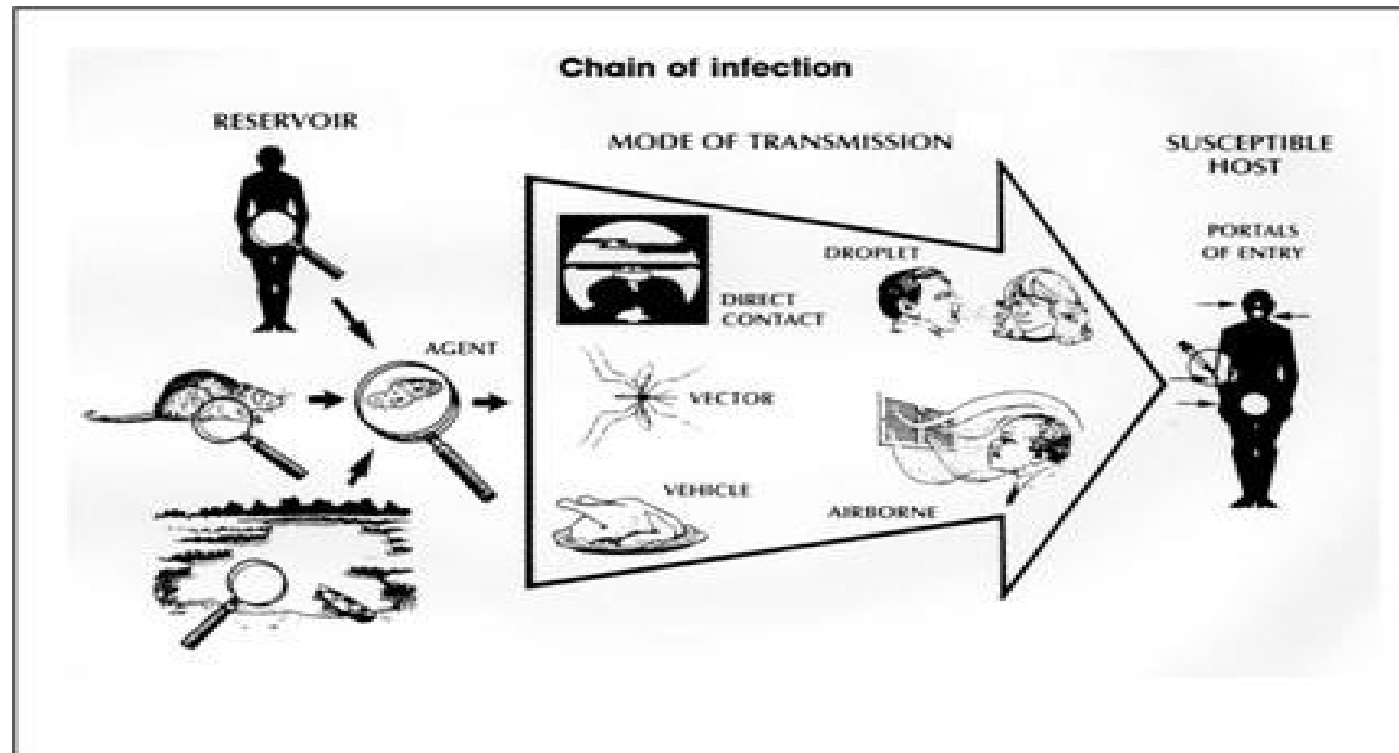


Fig. from cdc.gov

# Natural History of Disease

- **Pre-pathogenesis:** Before agent reacts with host
- **Pathogenesis:** After agent reacts with host
  - Later stages include development of active signs and symptoms.
    - Clinical end points are: recovery, disability, or death
  - Each disease has natural history of progression if no medical intervention is undertaken and is allowed to run full course

# 4 Common Disease Stages

- **1. Stage of susceptibility** (precedes disease; risk for acquiring disease)
- **2. Stage of pre-symptomatic disease** (begins with exposure & subsequent pathologic changes before symptom onset)
  - **Incubation period**: begins with exposure & subsequent pathologic changes before symptom onset (infectious diseases)
  - **Latency period**: time from exposure to clinical symptoms (non-communicable chronic diseases)



# Learning Check

- Has disease occurred during the stage of susceptibility?
  - What could be some risk factors that promote development?
    - Unvaccinated child is susceptible to measles
    - Alcohol consumption for Cirrhosis of liver
    - High Cholesterol, obesity, Type of personality: Heart Diseases
- What could be an example for the pre-symptomatic stage of disease?
  - Ova of intestinal parasite in the stool of apparently healthy children.

# 4 Common Disease Stages

- **3. Stage of clinical disease:** when disease signs and symptoms appear
- **4. Stage of recovery, disability, or death** (influenced by multiple factors including time of detection and treatment)

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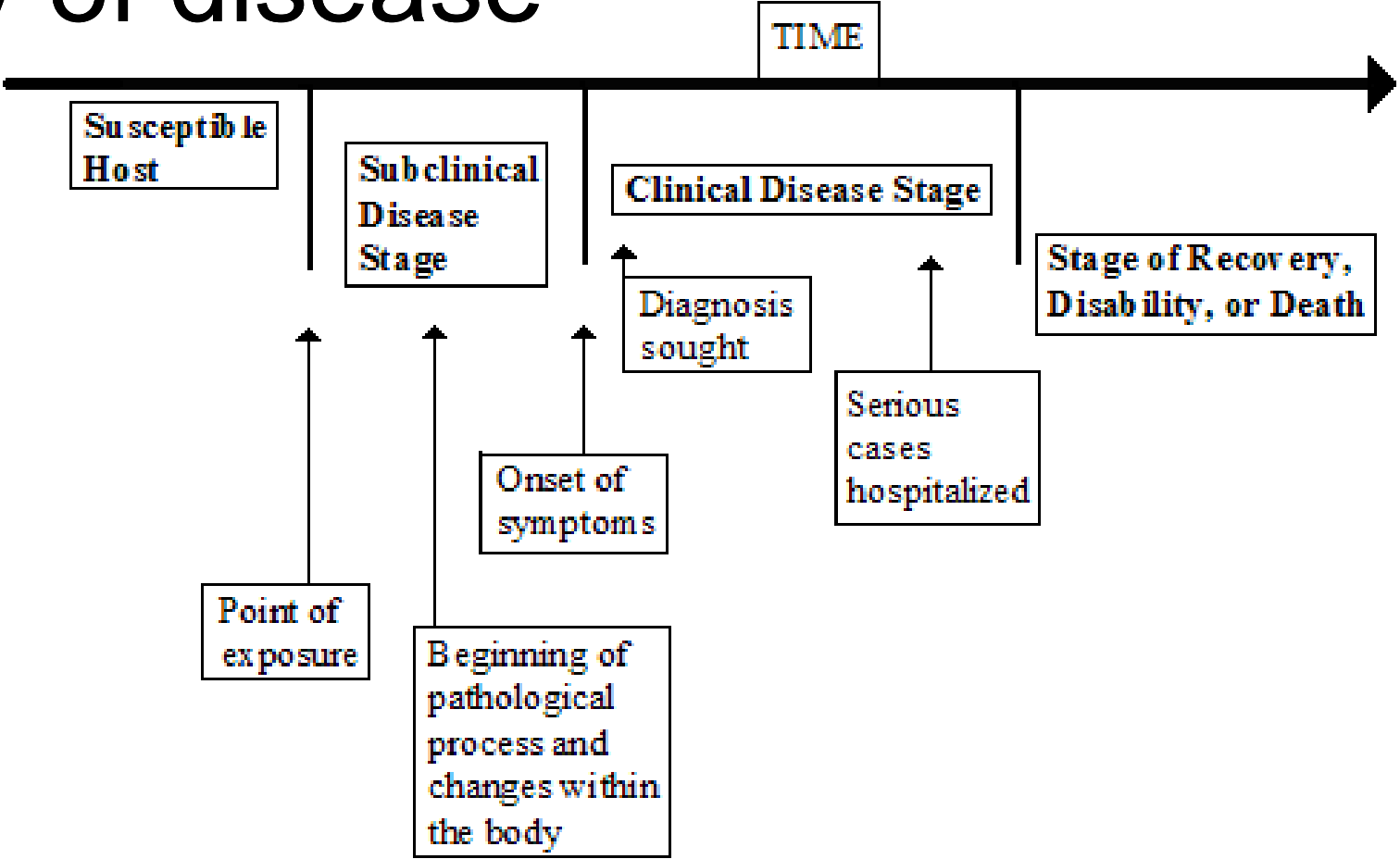


**“An aspirin a day will help prevent a heart attack if you have it for lunch instead of a cheeseburger.”**

# Learning Check

- What would be an example of the stage of clinical disease?
  - Common cold has a short and mild clinical stage and almost everyone recovers quickly
    - If a common cold lasts for a short period of time and a person recovers fairly quickly, how would you classify its severity and duration?

# A generalized presentation of the natural history of disease



# Identification of Cases

- A **case** is a person who has been diagnosed as having a disease, disorder, injury, or condition



# Primary case, index case

- The first disease case in the population is the **primary case**.
- The first disease case brought to the attention of the epidemiologist is the **index case**.
- Note: index case is not always the primary case.

# Secondary cases

- Persons who become infected and ill once a disease has been introduced into a population
- Those who become infected from contact with the primary case
- **Ex:** MDR TB case (primary) from Chiapas who spread disease to family members (secondary) after visiting them in Los Angeles.

# Different levels of diagnosis for Cases

- Suspect  
↓
- Probable  
↓
- Confirmed

- **Suspect:** individual or group who have all of the signs and symptoms of a disease/condition but haven't been id'ed as having disease, nor have cause of the symptoms been yet connected to a suspected **pathogen**





# Different levels of diagnosis

- As more info (such as lab results) becomes available to the physician, he/she generally upgrades his/her diagnosis
- When all criteria are met and they meet the case definition, the case is classified as a confirmed case.

# Categories of Disease Carriers

# 5 major types of carriers

- **1. Active carrier:** persons who have been exposed to and who harbor a pathogen (disease-causing organism)
  - Has done so for some time even though may have recovered from the disease
- **2. Convalescent carrier:** persons who harbor a pathogen and who are in the recovery phase of the course of a disease but are still infectious

# Types of carriers

- **3. Healthy (or passive) carrier:** persons who have been exposed to and harbor a pathogen but still haven't become ill nor shown any of the symptoms of the disease. *[Often referred to as a subclinical case]*
- **4. Incubatory carrier:** persons who have been exposed to and who harbor a pathogen, are showing symptoms, and have ability to transmit the disease

# Types of carriers

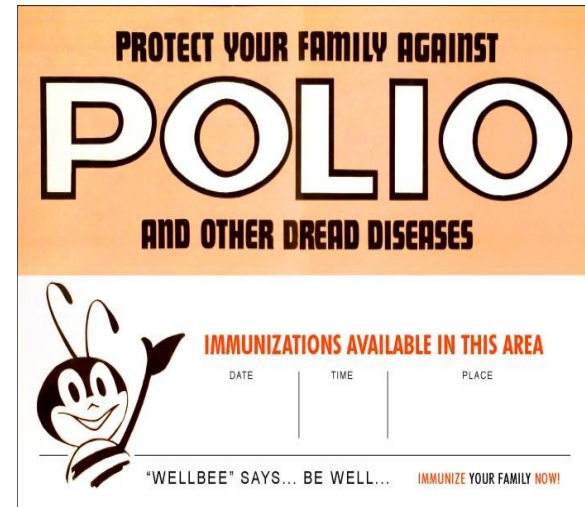
- **5. Intermittent carrier:** persons who have been exposed to and harbor a pathogen and who can spread the disease at different places or intervals

# Levels of Disease Prevention

- Three major levels of disease prevention

- **Primary Prevention**

- Targeted at healthy people
- Objectives are:
  - Promotion of health
  - Prevention of exposure
  - Prevention of disease
- Examples:
  - Immunization, sanitation, education, media campaigns



# Level of Disease Prevention

- **Secondary Prevention**

- Targeted at sick individuals

- Objective is to:

- Stop or slow the progression of disease and to prevent limit permanent damage through early detection and treatment

# Level of Disease Prevention

- **Tertiary Prevention**

- Targeted at people with chronic diseases and disabilities that can't be cured
  - Objective is to:
    - Prevent further disability or death and limit impacts of disability through rehabilitation



# ***KEY Epi CONCEPT:***

## Herd immunity



- Viewed as resistance a population has to invasion/spread of an ID
- Based on notion that if a population or group is mostly protected from a disease by immunizations ( $\geq 85\%$ ), then chance of a major epidemic occurring is limited

# Herd Immunity

- Herd immunity provides barrier to direct transmission of infections through population
- Lack of susceptible persons stops spread of a disease through throughout group

# Herd Immunity

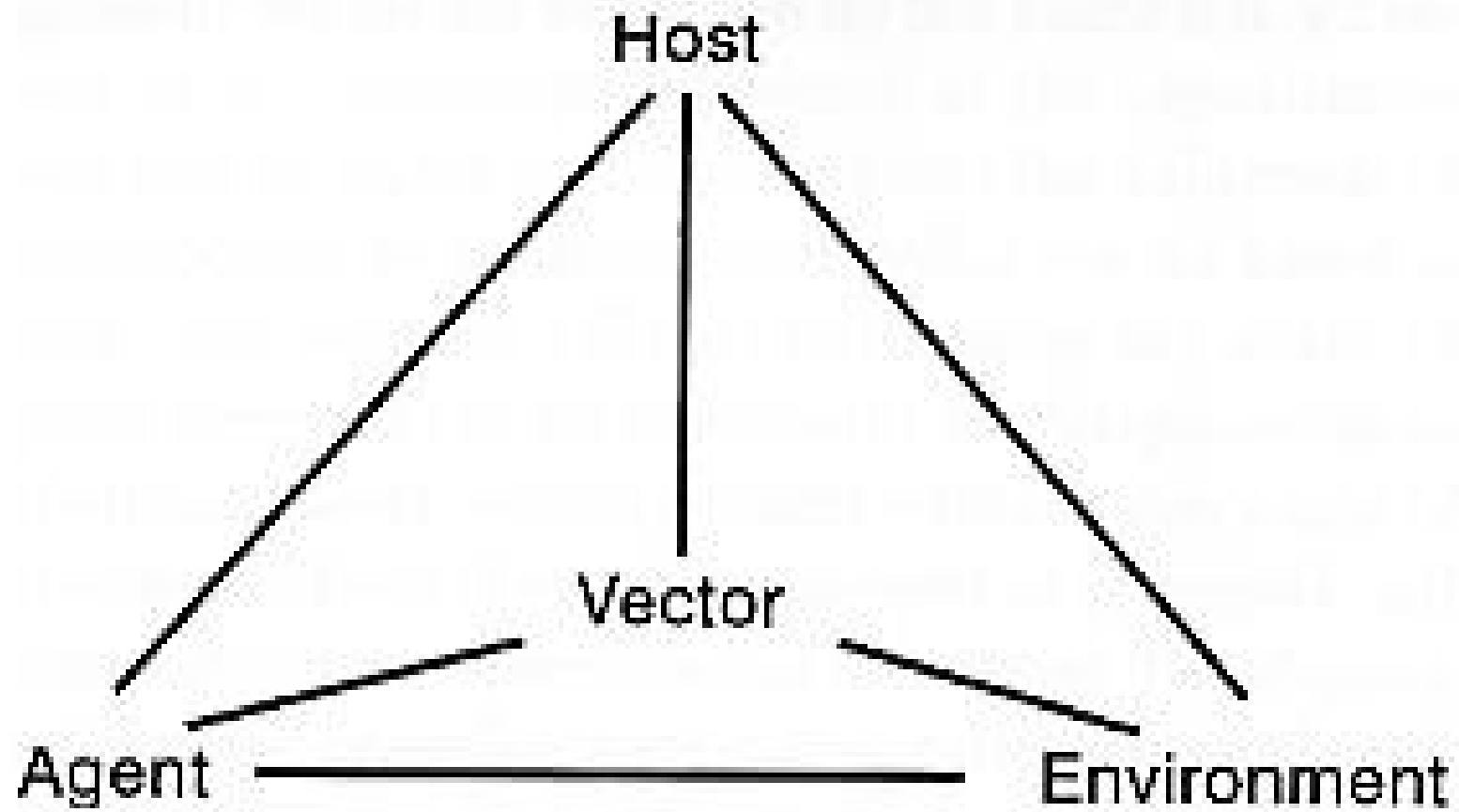


- Public health immunization program goal: attain as close to 100% coverage as is possible to prevent even one case from occurring

# Diseases for which vaccines are used

<p>Anthrax Cholera Chickenpox Diphtheria German measles (rubella) Hepatitis A Hepatitis B Influenza Measles Meningitis Mumps Pertussis</p>	<p>Plague Pneumonia Polio Rabies Smallpox Spotted fever Tetanus Tuberculosis Typhoid fever Typhus Whooping cough Yellow fever</p>
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**FIGURE 2-1.** The epidemiologic triad of a disease.

**INCREASED RISK OF NUTRITION DISEASE**

<b>Host Characteristics</b>	<b>Type of Agents and Examples</b>	<b>Environmental Factors</b>
Age	Biologic	Temperature
Sex	Bacteria, viruses	Humidity
Race	Chemical	Altitude
Religion	Poison, alcohol,	Crowding
Customs	smoke	Housing
Occupation	Physical	Neighborhood
Genetic profile	Trauma, radiation,	Water
Marital status	fire	Milk
Family background	Nutritional	Food
	Lack, excess	Radiation
Previous diseases		Air pollution
Immune status		Noise

# Terms Associated with Disease Causation & Transmission

- Host
- Agent
- Environment
- Fomites
- Vector
- Carrier – active
- Incubatory
- Convalescent
- Healthy
- Intermittent



**You will cover  
these in today's  
discussion.**

# Modes of Transmission

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- Direct
- Indirect



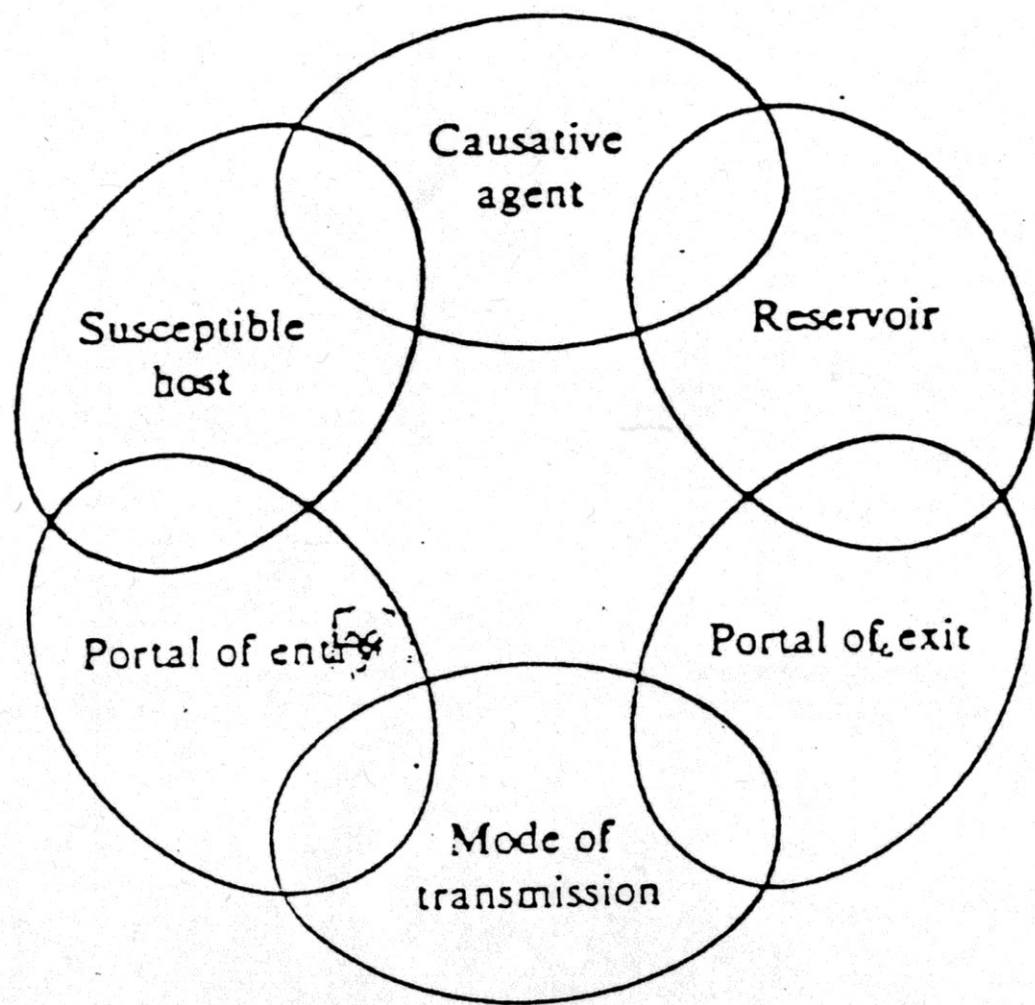
**TABLE 2–2. *Modes of Disease Transmission***

- A. Direct
  - 1. Person-to-person contact
- B. Indirect
  - 1. Common vehicle
    - a. Single exposure
    - b. Multiple exposures
    - c. Continuous exposure
  - 2. Vector

# Chain of Infection

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- Etiological agent
- Source/Reservoir
- Portal of exit
- Mode of transmission
- Portal of entry
- Susceptible host




**FIGURE 1.2** The chain of infection. Components of the infectious disease process.

# Forms of Disease

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- Clinical
  - acute
  - sub-acute
- Non-clinical (Inapparent)
  - pre-clinical
  - sub-clinical
  - chronic (persistent)
  - latent



**Your Assignment:**  
familiarize yourself  
with the definitions  
of these terms

# Disease Investigation

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- Establish diagnosis
- Identify specific agent
- Describe according to person, place and time
- Identify source of agent
- Identify mode of transmission
- Identify susceptible populations

# Steps in the Investigation of an Epidemic

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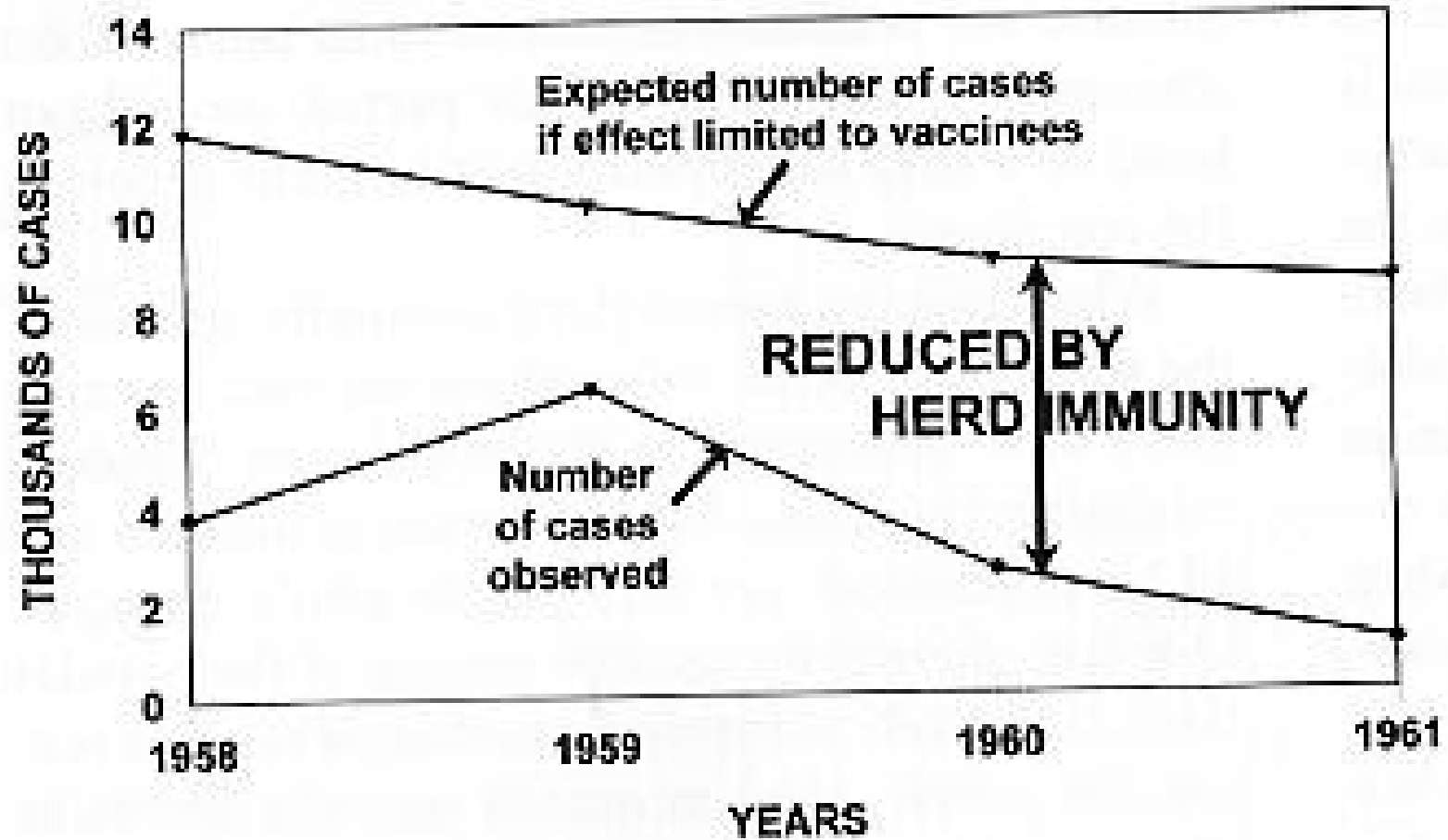
- Define the epidemic
- Examination the distribution of cases
- Look for combinations of variables
- Develop hypothesis (es)
- Test hypothesis
- Recommend control measures

# Determinants of Disease Outbreak

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- Based on balance of disease in a population
  - herd immunity
    - disease restricted to single host
    - transmission must be relatively direct

# Effect of Herd Immunity



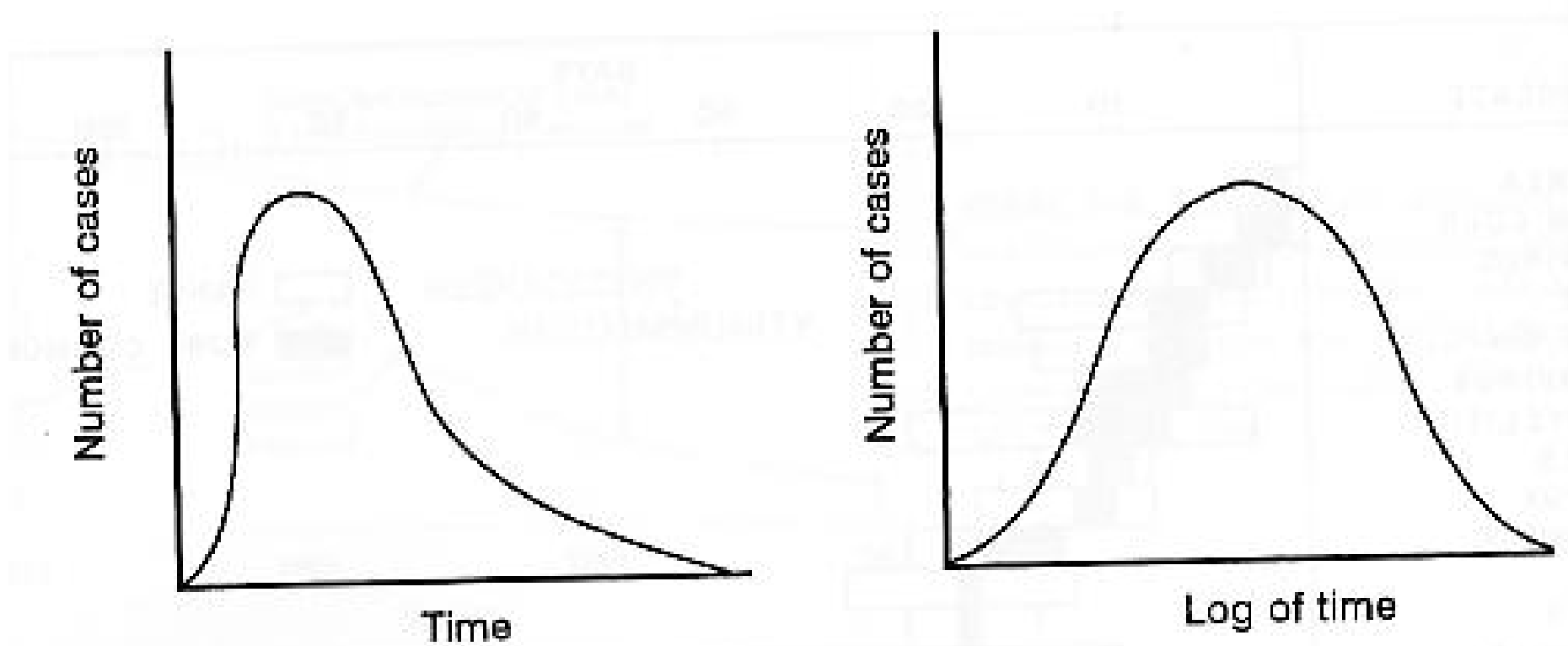


# Incubation Period

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- The period of time after an infection is established but before the first signs or symptoms appear
- Different diseases generally have different incubation times and symptoms
- Therefore, can derive epidemic curves

# Epidemic Curve for Single Exposure Common-Vehicle Outbreak



**FIGURE 2-11.** Number of cases plotted against time and against the logarithm of time.



# Incubation Period

**Your Assignment:**

define the variables  
in this formula

