

COMMUNICABLE DISEASES AND ITS CONTROL

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Course objectives

At the end of this course, the students will be able to:-

- **Identify common terms and definition used in communicable disease**
 - Define and differentiate communicable and non-communicable diseases.
 - Diagnose and investigate the causative agents and mode of transmission
 - Identify method of treatment and prevention
 - Explain the principles of communicable disease control and undertake epidemic investigation

INTRODUCTION TO COMMUNICABLE DISEASE

Disease

- The term **disease** broadly refers to any condition that impairs normal function, and is therefore associated with dysfunction of normal homeostasis.
- A disease is an abnormal condition that affects the body of an organism.
- It is often construed as a medical condition associated with specific symptoms and signs.
- It may be caused by factors originally from an external source, such as infectious disease, or it may be caused by internal dysfunctions, such as autoimmune diseases

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- Illness and *sickness* are generally used as synonyms for *disease*.
- However, this term is occasionally used to refer specifically to the patient's personal experience of their disease.
- In this model, it is possible for a person have a disease without being ill (to have an objectively definable, but asymptomatic, medical condition).
- *Ill* without being *diseased* (such as when a person perceives a normal experience as a medical condition, or medicalizes a non-disease situation their life)

Signs and Symptoms

- Signs and symptoms are diagnostic "tools" which help the assessor determine the condition of the patient.
- A medical sign is an objective indication of some medical fact or characteristic that may be detected by a physician during a physical examination or by a clinical scientist by means of an in vivo examination of a patient.
- Signs may have no meaning to the patient, and may even go unnoticed, but may be meaningful and significant to the healthcare provider in assisting the diagnosis of medical condition(s) responsible for the patient's symptoms.

Cont...

- **Symptom:-** Is subjective evidence of disease or physical disturbance observed by the patient. <headache is a *symptom* of many diseases> <visual disturbances may be a *symptom* of retinal arteriosclerosis>

Classification of disease

Diseases can be classified according to two major dimensions, i.e. **Based on time course and cause of the disease**

1. According to the time course, they are classified as

- a. **Acute disease:-** is characterized by a rapid onset and a short duration
- b. **Chronic disease :-** is characterized by prolonged duration.

Cont...

2. Based on the cause , it can categorized as:-

a. ***Infectious (communicable)***:- caused by living parasitic organisms such as viruses, bacteria, fungus parasites etc.

B. ***Noninfectious(non communicable)***:- which are caused by something other than a living parasitic organism. **Such as, heart disease, renal disease, blood disorder etc**

Communicable diseases

- **These are illnesses due to specific infectious agent or its toxic products.**
- **Arise through transmission of infectious agent or its toxic products from an infected person, animal, or inanimate reservoir to a susceptible host.**
- **Transmission is either directly or indirectly, through an intermediate plant or animal host, vector or inanimate environment.**

Cont. ...

- **Most of the common diseases in Africa including Ethiopia are infectious diseases due to infection by living organisms.**
- **These are called communicable diseases, because they spread from person to person, or sometimes from animals to people.**
- **They occur at all ages but are most serious in childhood and they are to a great extent preventable.**

- **Therefore, communicable diseases remain very important in developing countries, because:**
 - **Many of them are very common**
 - **Some of them are serious and cause death and disability**
 - **Some of them cause widespread out breaks of disease or epidemics**
 - **Most of them are preventable by fairly simple means.**
 - **Poor socio-economic status of the individuals makes them vulnerable to a variety of diseases**
 - **Low educational status**
 - **Lack of access to modern health care service**

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- **Communicable diseases can be conveniently divided based on**
 - the ***mode of transmission*** and the ***causative agent***.

A. **Based on mode of transmission**

1. **Airborne diseases:-** those diseases need droplet nuclei or dust for transmission. E.g. Tuberculosis
2. **Vehicle borne diseases:-** They need non-living substance or object for transmission. E.g. Cholera
3. **Vector Borne disease:** They need vectors (living organisms, usually insects) for transmission. E.g. Malaria
4. Other STI, contact diseases, etc

cont....

B. Based on the Biologic agent (causative organism)

- 1. Bacterial diseases e.g. syphilis, gonorrhea, etc**
- 2. Protozoal diseases e.g. Malaria**
- 3. Viral diseases e.g. HIV/AIDS**
- 4. Helminthes diseases e.g. Ascariasis**
- 5. Fungal diseases e.g. Candidiasis**

Epidemiology in communicable diseases

- Epidemiology is the study of the **frequency, distribution and determinants** of diseases and other health related conditions in human populations, and the application of this study to the promotion of health, and to the prevention and control of health problems.
- Epidemiology is considered as the **basic science of public health**.
- It provides useful **tools and methods** to describe **variations** in disease occurrence and identify factors that influence the occurrence of disease among population groups.
- The **occurrence** of disease is dependent on variations in exposure of individuals in the population to the causes of the disease that are commonly **behavioural and environmental**.

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- **Epidemiology studies the nature of diseases, and their causes, and it uses systematic methods of measurement to test ideas, questions and hypotheses, and hence it is a science (bio-science), serving medicine and public health.**
- **The unique contribution of epidemiology to health sciences is the fact that epidemiological studies are conducted in human populations.**
- **Thus, due to ethical and practical reasons epidemiological studies are largely observational**

Use or purposes of epidemiology

- The ultimate purpose of epidemiology is **prevention and control of disease**, in an effort to improve the health status of population.
- Epidemiology has been used in several ways in the **planning and evaluation** of health intervention in an effort to improve the health status of the population.
- Some of the uses of epidemiology in public health practice are mentioned below:

1. ***Diagnostic purposes or Assessment of the population health status***

- Just as the doctor caring for an individual patient requires diagnosis so does the community health worker needs community diagnosis or group diagnoses.
- **Community** wide health **interventions** are **costly** in terms of **resource** and should always be based as much as possible on **sound community diagnosis**.
- Epidemiological studies provide data for **community diagnosis** which encompasses the **identification and detail analyses** of the health needs, demands, priorities and resources of a defined community.
- This would serve as basis for the planning and implementation of health intervention measures.

2. Identification of determinants (causation) of a disease.

- Identification of determinants leads to prevention and control of diseases.

3. Evaluation of methods of disease control:

- It is important in measurement of effectiveness in reducing the frequency of the disease.
- If not effective method, then necessary alterations are made accordingly.
- E.g. effectiveness of residual DDT spraying is measured by the reduction in the incidence of malaria.

4. Observation of the natural history of disease

- **Essential to make prognosis or the likely outcome of a patient's illness.** This prognosis is the basis for rational decision about Rx.

5. Classification of a disease: the epidemiological diagnoses of a disease are an integral part of its basic description by means of which it is **defined and recognized**.

- E.g. **Gonorrhoea** classified as **STIs** based on its mode of transmission.

6. Define standards and ranges for normal values of biological and social measures.

7. Guide health and healthcare policy and planning.

8. Assist in the management and care of health and disease in individuals

Major definition Of terms in Epidemiology

a. Population. The main focus of epidemiology is on the effect of disease on the population rather than individuals.

For example

- Malaria affects many people in Ethiopia but lung cancer is rare.
- If an individual develops lung cancer, it is more likely that he/she will die.
- Even though lung cancer is more killer, epidemiology gives more emphasis to malaria since it affects many people.

b. Frequency. This shows that epidemiology is mainly a quantitative science.

- Epidemiology is concerned with the frequency (occurrence) of diseases and other health related conditions.
- Frequency of diseases is measured by morbidity and mortality rates.

C. Health related conditions. Epidemiology is concerned not only with disease but also with other **health related conditions** because every thing around us and what we do also affects our health.

- Health related conditions are conditions which directly or indirectly affect or influence health. These may be injuries, births, health related behaviors like smoking, unemployment, poverty etc.

d. Distribution. Distribution refers to the geographical distribution of diseases, the distribution in time, and distribution by type of persons affected.

e. Determinants. Determinants are factors which determine whether or not a person will get a disease.

f. Application of the studies to the promotion of health and to the prevention and control of health problems.

e. This means the whole aim in studying the frequency, distribution, and determinants of disease is to identify effective disease prevention and control strategies.

Importance of Studying Communicable Diseases Epidemiology

- **Epidemiology helps to make a community diagnosis, identify and describe health problems in a community**
 - **(for example, the prevalence of anemia, or the nutrition status of children).**
- **To monitor continuously over a period of time the change of health in a community.**
 - **(for example, the effect of a vaccination program, health education, nutritional supplementation).**
- **To practice surveillance for a specific disease in order to be able to act quickly and so cut short any outbreak (example cholera).**

- **To investigate an outbreak of a communicable disease**
 - **To analyze the reasons for it, plan a feasible remedy and carry it out, and monitor the effects of the remedy on the outbreak.**
 - **To plan effective health services.**
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- **Effective services, interventions and remedies all depend on accurate community data.**

Terminologies and definition commonly used in communicable disease

Terminology and Definitions used in CDC

- Infection
- Contamination
- Infestation
- Contagious disease
- Incidence and prevalence
- of infectious diseases
- Epidemic
- Endemic
- Hyper-endemic
- Holo-endemic
- Pandemic
- Exotic
- Sporadic
- Attack rate
- Primary/secondary cases
- Zoonosis, epizootic and Enzootic
- Nosocomial infection
- Opportunistic infection
- Eradication
- Elimination

cont.

- **Virulence**
- **Reproductive rate of infection**
- **Host**
- **Vector (source)**
- **Reservoir**
- **Incubation period**
- **Infectivity period**
- **Serial interval**
- **Latent period**
- **Transmission Probability ratio**

Common terminologies

1. **Incubation period:** The time interval between infection of the host and the first appearance of symptoms and signs of the disease.
2. **Prodromal period:-** The time interval between the onset of symptoms of an infectious disease and the appearance of characteristic manifestations.
 - ✓ E.g. In measles from the onset of fever to the development of characteristic skin lesions.
3. **Prepatent period:** The period in people between the time of exposure to a parasite and the time when the parasite can be detected in blood or in stool.

4. **Extrinsic incubation period (Incubation period in a vector):** is the time between entrance of an organism in to the vector and the time when that vector can transmit the infection.
6. **Illness:** Individual or subjective feeling of discomfort (uneasiness).
7. **Disease:-** A state of physiological and psychological dysfunction.
8. **Contamination:-** Presence of living infectious agent on a body surface, in cloths, bedding toys, surgical instruments or dressings or other articles or substances including water and food.

Cont'd...

9. **Infestation:-** For persons or animals, the lodgment, development and reproduction of arthropods (insects) on the surface of the body or in the clothing.
 10. **Infectious agent:-** an agent capable of causing infection.
 11. **Period of communicability (communicable period):-** It is the period during which an infectious agent is transmitted from the infected person to the susceptible host.
- E.g. In diphtheria and streptococcal infection, the period of communicability is from the date of first exposure to a source of infection until the infecting microorganism is no longer disseminated from the involved mucus membrane.

Cont'd...

- Some diseases are more communicable during the **incubation period** than during the actual illness. e.g. hepatitis A, measles.
- In diseases such as **TB, leprosy, syphilis, gonorrhea and some of the salmonellosis**, the communicable state may exist over a long period and sometimes intermittent period when active chronic lesions permit the discharge of infectious agent from the source of the skin or through any of the body orifices.
- In diseases transmitted by **arthropods**, such as **malaria and yellow fever**, the period of communicability is during which the infectious agent occurs in the blood or other tissues of the infected person in sufficient number to permit infection of the vector.

12. **Transmission cycle:-** is a cycle which describes how an organism grows, multiplies and spreads.

- In some cases man may be the only host in which case the infection spreads directly from man to man. Eg.: measles.
- In some cases like malaria the transmission cycle involves man and mosquito.

Cont'd...

13. **Exposure:-** The contact between the agent and susceptible host.
14. **Infectivity:-** The ability of an agent to invade and multiply in a host.
15. **Pathogenicity:-** The ability of an agent to produce clinically apparent disease, or the property of an infectious agent that determines the extent to which overt disease is produced.
16. **Virulence:-** The ability of infectious agent to produce severe disease among clinically infected persons.
17. **Immunogenicity:-** The ability of an agent to produce specific immunity.

Cont...

18. **Symptoms of a disease:** Refers to malfunctions in which the patient himself claims to feel. (E.g. fever, headache)
19. **Signs of a disease:** Manifestations of a disease that can be examined by others.
20. **Transmission:** The travel or spread of an infectious agent from its source to a susceptible host.
21. **Source of infection:** A person, animal or inanimate environment from which the particular organism spreads to its new host.
22. **Viability:** - Ability of an organism hard enough potentially to live.
23. **Survival or longevity:** Ability of an organism to live for long duration.

Cont'd...

24. **Infected individual:** A person or animal that harbors an infectious agent and who has either manifests disease or unapparent infection.
25. **An infectious person or animal** is one from which an infectious agent can be naturally acquired.
26. **Unapparent infection:** The presence of infection in a host without recognizable clinical signs and symptoms.
- It can be identified only by laboratory means (blood).
 - Asymptomatic, sub clinical and occult infections are synonymous.

27. **Infection** is the entry and development or multiplication of an infectious agent in the body of man or animals.

28. **Infestation:-** It is the lodgment, development and reproduction of arthropods on the surface of the body or in the clothing, e.g. lice, itch mite.

- This term could be also used to describe the invasion of the gut by parasitic worms, e.g. ascariasis

29. **Contagious disease:-** A contagious disease is the one that is transmitted through contact. Examples include scabies, trachoma, STD and leprosy.

30. **Host:-** Is a person or an animal that affords subsistence or lodgement to an infectious agent under natural conditions.

- Types include: an obligate host, definitive (primary) host, intermediate host and a transport host.

31. **Vector of infection :-** is an insect or any living carrier that transports an infectious agent from an infected individual or its wastes to a susceptible individual or its food or immediate surroundings.

- Both biological and mechanical transmissions are encountered.

32. **Reservoir:-** Any person, animal, arthropod, plant, soil, or substance, or a combination of these, in which an infectious agent normally lives and multiplies, on which it depends primarily for survival, and where it reproduces itself in such a manner that it can be transmitted to a susceptible host.

- It is the natural habitat of the infectious agent.

Incidence and prevalence of infectious diseases

Incidence of an infectious disease:

- Is number of new cases in a given time period expressed as percent infected per year (cumulative incidence) or number per person time of observation (incidence density).

Prevalence of an infectious disease:

- Is number of cases at a given time expressed as a percent at a given time.
- Prevalence is a product of incidence x duration of disease, and is of little interest if an infectious disease is of short duration (i.e. measles), but may be of interest if an infectious disease is of long duration (i.e. chronic hepatitis B).

Epidemic:-The unusual occurrence in a community of disease, specific health related behavior, or other health related events clearly **in excess of expected occurrence”**

Endemic:- It refers to the constant presence of a disease or infectious agent within a given geographic area or population group.

- It is **the usual or expected frequency of disease** within a population.

Hyper-endemic:-expresses that the disease is constantly present at high incidence and/or prevalence rate and affects all age groups equally

Holoendemic:- expresses a high level of infection beginning early in life and affecting most of the child population, leading to a state of equilibrium such that the adult population shows evidence of the disease much less commonly than do the children (e.g. malaria)

Pandemic;- Is an epidemic usually affecting a large proportion of the population, occurring over a wide geographic area such as a section of a nation, the entire nation, a continent or the world, e.g. Influenza pandemics.

Exotic diseases :-are those which are imported into a country in which they do not otherwise occur, as for example, rabies in the UK.

sporadic means “scattered about”. The cases occur irregularly, haphazardly from time to time, and generally infrequently.

- ❖ The cases are few and separated widely in time and place that they show no or little connection with each other, nor a recognizable common source of infection
- ❖ e.g. polio, meningococcal meningitis, tetanus....
- ❖ However, a sporadic disease could be the starting point of an epidemic when the conditions are favorable for its spread.

Attack rates and primary/secondary cases

- **Attack rate:** proportion of non-immune exposed individuals who become clinically ill.
- **Primary (index) cases:** The person who comes into and infects a population is the primary case.
- secondary cases :-** Those who subsequently contract the infection are secondary cases. Further spread is described as "waves" or "generations" .
- 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 infections

- **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.
 - **Examples include infection of surgical wounds, hepatitis B and urinary tract infections.**
- **Opportunistic infection:-** This is infection by organisms that take the opportunity provided by a defect in host defense (e.g. immunity) to infect the host and thus cause disease.
 - **For example, opportunistic infections are very common in AIDS. Organisms include Herpes simplex, cytomegalovirus, M. tuberculosis....**

Eradication and Elimination

- Termination of all transmission of infection by the extermination of the **infectious agent** through surveillance and containment.
- **Eradication** is an absolute process, an “all or none” phenomenon, restricted to termination of infection from the whole world.
- The term **elimination** is sometimes used to describe eradication of a disease from a large geographic region.
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- Disease which are amenable to elimination in the meantime are polio, measles and diphtheria.

Reproductive rate of infection:

- **Reproductive rate of infection**: potential for an infectious disease to spread.
- Influential factors include:-
 - **the probability of transmission between an infected and a susceptible individual**
 - **frequency of population contact;**
 - **duration of infection;**
 - **virulence of the organism and population immune proportion .**

Source or Reservoir

- The starting point for the occurrence of a communicable disease is the existence of a reservoir or source of infection.
- The source of infection is defined as “the person, animal, object or substance from which an infectious agent passes or is disseminated to the host (immediate source).”
- The reservoir is “any person, animal, arthropod, plant, soil, or substance, or a combination of these, in which an infectious agent normally lives and multiplies, on which it depends primarily for survival, and where it reproduces itself in such a manner that it can be transmitted to a susceptible host. It is the natural habitat of the infectious agent.”

A case:- is defined as “a person in the population or study group identified as having the particular disease, health disorder or condition under investigation.

Carriers;-It is “an infected person or animal that harbors a specific infectious agent in the absence of discernible (visible) clinical disease and serves as a potential source of infection to others.

• **It occurs either due to inadequate treatment or immune response, the disease agent is not completely eliminated, leading to a carrier state.**

Three elements have to occur to form a carrier state:

- 1. The presence in the body of the disease agent.**
- 2. The absence of recognizable symptoms and signs of disease.**
- 3. The shedding of disease agent in the discharge or excretions.**

Virulence: is the degree of pathogenicity; the disease evoking power of a micro-organism in a given host.

- Numerically expressed as the ratio of the number of cases of overt infection to the total number infected, as determined by immunoassay.
- When death is the only criterion of severity, this is the case fatality rate.
- **Case fatality rate for infectious diseases:** is the proportion of infected individuals who die of the infection.
- This is a function of the severity of the infection and is heavily influenced by how many mild cases are not diagnosed.

Serial interval and Infectious period

- **Serial interval:** (the gap in time between the onset of the primary and the secondary cases) i.e., the interval between receipt of infection and maximal infectivity of the host (also called generation time).
- **Infectious (communicable) period:** length of time a person can transmit disease (sheds the infectious agent).
- **Latent period:** the period between exposure and the onset of infectiousness (this may be shorter or longer than the incubation period).

Transmission Probability Ratio (TPR)

- **TPR;-** is a measure of risk transmission from infected to susceptible individuals during a contact.
- TPR of differing types of contacts, infectious agents, infection routes and strains can be calculated.

There are 4 types of transmission probabilities.

Transmission probabilities:

- ✓ **p00:** Tp from unvaccinated infective to unvaccinated susceptible
- ✓ **p01:** Tp from vaccinated infective to unvaccinated susceptible
- ✓ **p10:** Tp from unvaccinated infective to vaccinated susceptible
- ✓ **p11:** tp from vaccinated infective to vaccinated susceptible

TPR (cont.)

- To estimate the effect of a vaccine in reducing susceptibility, compare the ratio of p_{10} to p_{00} .
- To estimate the effect of a vaccine in reducing infectiousness, compare the ratio of p_{01} to p_{00} .
- To estimate the combined effect of a vaccine, compare the ratio of p_{11} to p_{00} .

Chain of disease transmission

(Diseases transmission dynamics)

- **At the end this session the students will be able to:-**
- **Explain disease causation**
- **Host parasite interaction**
- **Chain of disease transmission**
- **Natural history of the disease**
- **General method prevention and control of communicable disease**

Disease causation

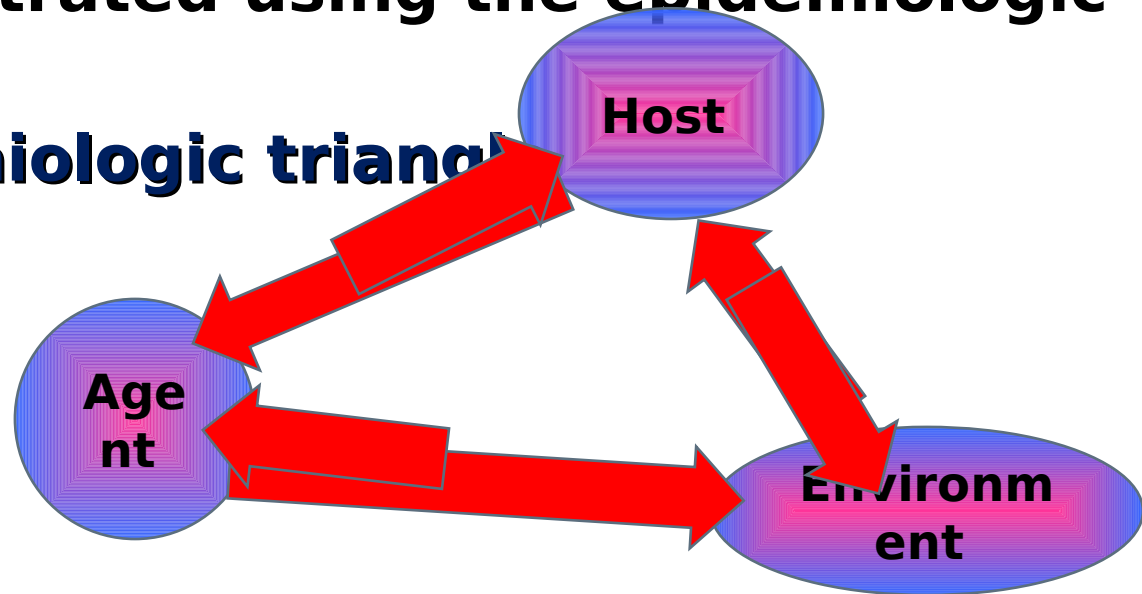
- ***Cause of disease:*** is an event, condition, characteristic or a combination of these factors which plays an important role in producing the disease.
- **The causes of disease can be classified in to two:**
 - a. **Primary causes** – these are the factors which are necessary for a disease to occur, in whose absence the disease will not occur.
 - **The term “*etiologic agent*” can be used instead of primary cause for Infectious causes of diseases.**
 - **For example “*Mycobacterium tuberculosis*” is the primary cause (etiologic agent) of pulmonary tuberculosis.**

B. Risk factors (contributing, predisposing, or aggravating)

- These are not the necessary causes of disease but they are important for a disease to occur.
- A factor associated with an increased occurrence of a disease is risk factor for the exposed group; and
 - **a factor associated with a decreased occurrence of a disease is a risk factor for the non exposed group.**
- Risk factors could be related to the **agent, the host and the environment.**
- ***The etiology of a disease*** is the sum total of all the factors (primary causes and risk factors) which contribute to the occurrence of the disease.

Host parasite interaction

- It is the interaction of the agent, the host, and the environment which determines whether or not a disease develops, and this can be illustrated using the epidemiologic triangle.
- **The epidemiologic triangle**



- **The epidemiologic triangle, depicts the relationship among three key factors in the occurrence of disease or injury: *agent, environment, and host*.**
- **An agent is a factor whose presence or absence, excess or deficit is necessary for a particular disease or injury to occur.**
- **The environment includes all external factors, other than the agent, that can influence health.**
- **These factors are further categorized according to whether they belong in the social, physical, or biological environments.**

- The social environment encompasses a broad range of factors, including education, unemployment, culture regarding diet; and many other factors pertaining to political, legal, economic, communications, transportation, and health care systems.
- **Physical environmental factors** :-are factors like climate, terrain, and pollution.
- **Biological environmental** influences includes **vectors, humans and plants** serving as reservoirs of infection.
- **From the perspective of epidemiologic triangle, the host, agent, and environment can coexist harmoniously.**
- **Disease and injury occur only when there is altered equilibrium between them.**

Chain of disease transmission

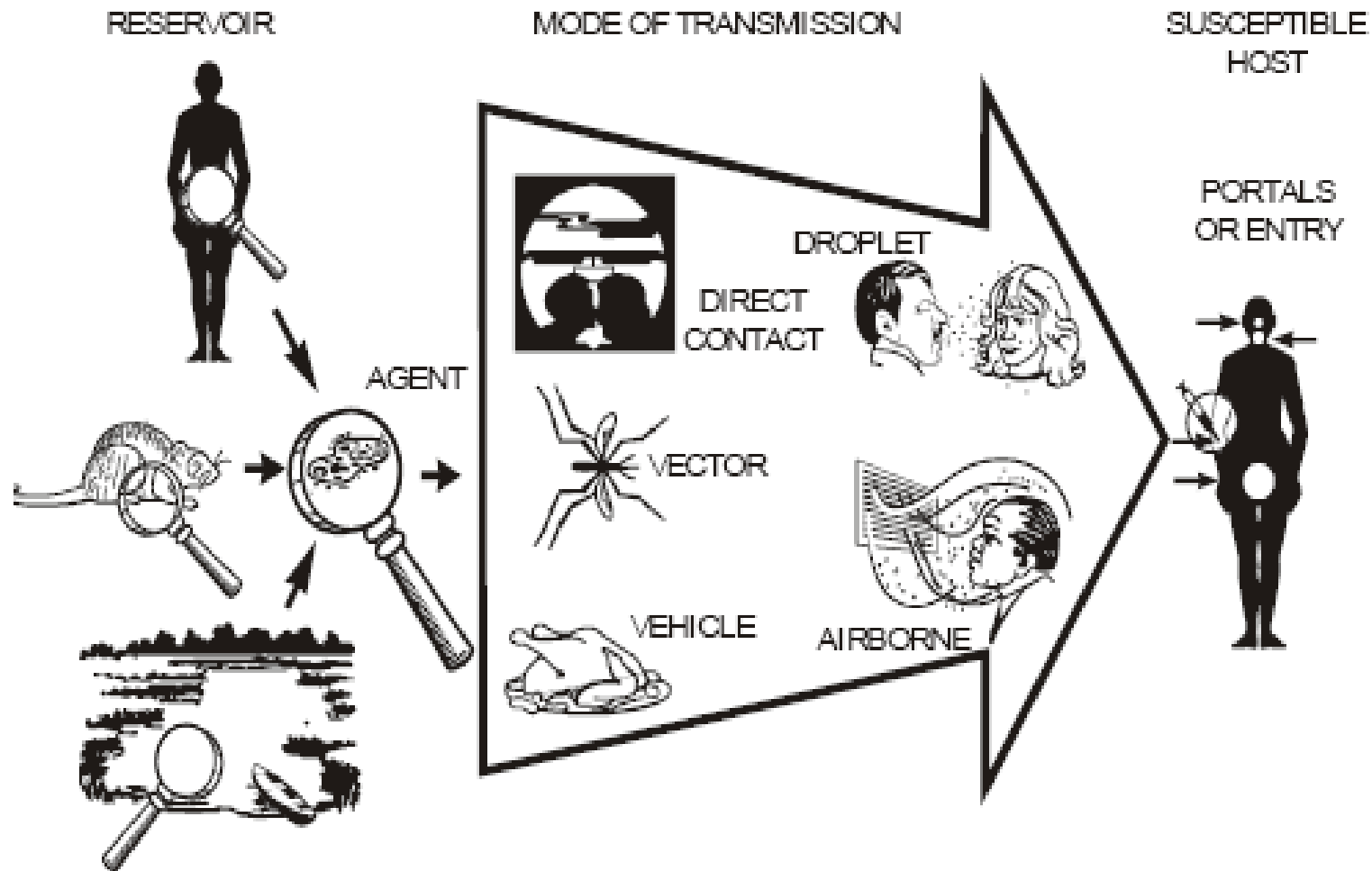
- **Refers to a logical sequence of factors or links of a chain that are essential to the development of the infectious agent and progression of disease.**

- **It has six components:**
 - **The infectious agent**
 - **Its reservoirs**
 - **Its portal of exits**
 - **Its mode of transmission**
 - **Its portal of entry, and**
 - **The susceptible host**

Chain ...

- The traditional model (**epi triad**) illustrates that infectious 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, and**
 - **is conveyed by some mode of transmission, and**
 - **enters through an appropriate portal of entry to infect a susceptible host.**
- This is sometimes called the chain of infection and is illustrated in the next Figure.

Chain ...



Chain ...

1. **The infectious agent / Etiology /causative organism**
 - It is an agent capable of causing infection or infectious disease.
 - They range from viral particles to complex multicellular organisms.
 - Infectious agents may bring about pathologic effect through different mechanisms. The mechanisms include:
 - *Direct tissue invasion*
 - *Production of a toxin*
 - *Allergic reaction*
 - *Immune suppression*

Chain ...

Classification of infectious agent by size and type

a. **Metazoa (multicellular organisms e.g. helminthes):**

- The largest, like tape worms or the filariae, are visible to the naked eye.
- They are made up of many cells and are called metazoan.

b. **Protozoa (unicellular organisms e.g. amoeba):**

- Complicated but single-cell organisms, like **malaria parasite and amoeba** are called protozoa.
- They are smaller and can only be seen when magnified by a microscope.

Cont ...

c. Bacteria (e.g. T.pallidum, M.tuberculosis):

- Smaller than protozoa simple, single cells best seen under a microscope after they have been stained with dyes.

d. Rickettsiae and Chlamydiae are smaller and can only multiply within cells.

e. Viruses: Smallest of all which can't even be seen with an ordinary microscope.

f. Fungus e.g. Candidiasis albicans

2. Reservoir

- **Any person, animal, arthropod, plant, soil or substance (or a combination of these) in which an infectious agents could be:-**
 - ❑ **Normally lives and multiplies,**
 - ❑ **On which it depends primarily for survival and**
 - ❑ **Where it reproduces itself in such a manner that it can be transmitted to a susceptible host.**
- **Is the habitat in which an infectious agent normally lives, grows, and multiplies.**

- Reservoirs include humans, animals, and the environment.
- **The reservoir may or may not be the source from which an agent is transferred to a host.**
- **For example, the reservoir of *Clostridium botulinum* is soil, but the source of most botulism infections is improperly canned food containing *C. botulinum* spores.**

Types of Reservoirs

- a. Man:** There are a number of important pathogens that are especially adapted to man such as measles, small pox, typhoid, *M. meningitis*, gonorrhea and syphilis.
 - The cycle of transmission is from man to man.

- ❑ Many of the common infectious diseases have human reservoirs.
- ❑ Diseases which are transmitted from person to person without intermediaries include
 - ❑ **Small pox, sexually transmitted diseases, measles, mumps, streptococcal infection, most respiratory pathogens, and many others.**

❖ **Two types of human reservoir exist:**

- 1. Persons with symptomatic illness**
- 2. Carriers**

1. Carrier

- Is that persons with unapparent or undiagnosed infections may nonetheless be able to transmit them to others.
- Persons who are infectious but have subclinical disease are called **carriers**.
- It is an infected person or animal who does not have apparent clinical disease but is a potential source of a disease.
- Frequently, **carriers** are persons with incubating disease or unapparent infection.

Types of Carriers

A. **Healthy or Asymptomatic Carriers:** These are persons whose infection remains unapparent throughout its course. E.g. In polio virus, meningococcal meningitis and hepatitis virus infections, there is a high carrier rate.

B. **Incubatory or Precocious Carriers:** These are individuals or persons who **excrete the pathogens during the incubation period** (before the onset of symptoms or before the characteristic features of the disease are manifested).

- Who are capable of transmission before they are clinically ill
- E.g. Measles, mumps, chicken pox and hepatitis

C. **Convalescent Carriers:**-These are those who continue to harbor (re-infect with) the infective agent after recovering from the illness.

- Who are capable of transmission after they are clinically ill.

- E.g. Diphtheria, Hepatitis B virus

D. **Chronic carriers:** - is one who continues to harbor an agent (such as hepatitis B virus or *Salmonella typhi*—the agent of typhoid fever) for an extended time (months or years) following the initial infection.

- E.g. Typhoid fever, HB & HIV virus infection.

- **Carriers** commonly transmit disease because they do not recognize themselves as infected and consequently take no special precautions to prevent transmission.
- ***Symptomatic persons***, on the other hand, are usually less likely to transmit infection widely because their symptoms increase their likelihood of being diagnosed and treated, thereby reducing their opportunity for contact with others.

- b. **Animals**: Some infective agents that affect man have their reservoir in animal.
- **Zoonosis**: transmission of disease from animals to man under normal conditions. E.g.:
- **Bovine TB is from cow to man**
 - **Brucellosis is from cow, pigs and goats to man**
 - **Anthrax is from cattle, sheep, goats, horses to man**
 - **Rabies is from dogs, foxes etc to man**

Chain ...

- N.B. Man is not an essential part (usual reservoir) of the life cycle of the agent.

Animal Animal.....Animal



Human

Chain ...

c. Environmental reservoirs

- Plants, soil, and water in the environment are also reservoirs for some infectious agents. Many fungal agents, such as those causing **histoplasmosis**, live and multiply in the soil.
- Biologically, they are usually equipped to withstand marked environmental changes in temperature and humidity.
- E.g. *Clostridium botulinum*, etiology of botulism; *Clostridium tetani*, etiology of tetanus; ***Clostridium welchi*** etiology of gas gangrene.

3. Portal of exit

- **IS mode of escape from the reservoir)**
- **Is the path by which an agent leaves the source host.**
- **Possible portal of exit include all body secretions & discharges: mucus, saliva, tears, breast milk, vaginal discharges, excretions (feaces & urine), blood, etc.**

E.g.

- **Gastrointestinal tract: typhoid fever, bacillary dysentery, amoebic dysentery, cholera, Ascariasis etc.**
- **Respiratory: TB, common cold etc.**
- **Skin and mucus membrane: syphilis**

4. **Mode of Transmission/mechanism of transmission**

- This refers to the mechanism by which an infectious agent is transferred from a reservoir to a new host.
 - **Transmission may be direct or indirect**
- I. ***Direct transmission:*** Consists of essentially immediate transfer of infectious agents from an infected host or reservoir to an appropriate portal of entry.

This direct transmission is of two types:

- A. *Direct vertical:*** such as transplacentally transmission of TORCHS- (Toxoplasmosis, Rubella, Cytomegalovirus infection, Herpes simplex infection, syphilis, others)
- B. *Direct horizontal:*** This may be by direct contact such as touching (Feaces – hand - mouth e.g. shigellosis), biting (Rabies), kissing (e.g. mononucleosis), sexual intercourse, or
 - By direct projection (droplet spread) on to the conjunctiva or on to mucus membrane of eyes, nose or mouth during sneezing, coughing, spiting, or talking;
 - **Usually limited to a distance of about one meter or less.**

II. Indirect transmission

a. *Vehicle borne transmission*:

A vehicle is defined as any non-living substance or object by which an infectious agent can be transported and introduced in to a host.

E.g. food, water, milk, fomites, towels, clothes, etc.

- This is indirect contact through contaminated inanimate objects or
- **Any substance serving as intermediate means by which an infectious agent is transported and introduced in to a susceptible host through a suitable portal of entry.**

b) Vector borne transmission: A vector is an organism (usually an arthropod such as an insect, tick, or louse), which transports an infectious agent to a susceptible host or to a susceptible vehicle.

I. Mechanical transmission: the agent does not multiply or undergo physiologic changes in the vector.

- The arthropod transports the agent by soiling its feet or proboscis.
- It is simple mechanical carriage by a crawling or flying insect through soiling of its feet or proboscis, or by passage organism through its GIT.
- E.g. *Common house fly*.

II. **Biological transmission**: When the agent undergoes changes within the vector, the vector is serving as both an intermediate host and a mode of transmission. This type of indirect transmission is a **biologic transmission**

- Guinea worm disease and many other vector borne diseases(malaria) have complex life cycles which require an intermediate host.
- Since the agent undergoes part of its life cycle in the intermediate host, the agent cannot be transmitted by the intermediate host until the agent has completed that part of its life cycle.

III. Sal Varian transmission: In which case infective saliva is injected in to the host. E.g. Female anopheles mosquito causes malaria.

IV. Stercorarian transmission: In which case infective fecal or regurgitated material will be deposited near the bite wound, and then the agent enters the host through autoinoculation.

E.g. Body louse causes relapsing fever.

- c). ***Air-borne transmission:*** Dissemination of microbial organisms by air to a suitable portal of entry, usually the respiratory tract.
- Two types of particles are implicated in this kind of spread:
 - **i) Dusts:** - Airborne dust includes infectious particles blown from the soil by the wind as well as material that has settled on surfaces and become suspended by air currents.

- ii) ***Droplet nuclei:*** are the residue of dried droplets.
- The nuclei are less than 5 μ (microns) in size and may remain suspended in the air for long periods, may be blown over great distances, and are easily inhaled into the lungs and exhaled.
- This makes them an important means of transmission for some diseases.
- Tuberculosis, for example, is believed to be transmitted more often indirectly, through droplet nuclei, than directly, through droplet spread.
- Microbial aerosols are suspensions of particles in the air consisting partially or whole of microorganisms.

5. **Portal of entry**

- Is the site via which the infectious agent enters to the susceptible host.
- The portal of entry must provide access to tissues in which the agent can multiply or a toxin can act.
- Often, organisms use the same portal to enter a new host that they use to exit the source host.
 - **For example, influenza virus must exit the respiratory tract of the source host and enter the respiratory tract of the new host.**

- **The route of transmission of many enteric (intestinal) pathogenic agents is described as “Feco-oral” because the organisms are shed in feces, carried on inadequately washed hands, and then transferred through a vehicle (such as food, water, or cooking utensil) to the mouth of a new host.**
- **Other portals of entry include the skin (hookworm), mucous membranes (syphilis, trachoma), and blood (hepatitis B).**

6. **Susceptible Host**

- The final link in the chain of infection is a susceptible host.
- Susceptibility of a host depends on genetic factors, specified acquired immunity, and other general factors which alter an individual's ability to resist infection or to limit pathogenicity.
- An individual's genetic makeup may either increase or decrease susceptibility.
- General factors which defend against infection include the skin, mucous membranes, gastric acidity, cilia in the respiratory tract, the cough reflex, and nonspecific immune response.

- General factors that may increase susceptibility are
 - **malnutrition, alcoholism, and disease or therapy which impairs the nonspecific immune response.**
- **Specific immunity** refers to protective antibodies that are directed against a specific agent.
- Individuals gain protective antibodies in two ways:-
 1. They develop antibodies in response to infection, vaccine, or toxoid; immunity developed in these ways is called active immunity.
 2. They acquire their mothers' antibodies before birth through the placenta or they receive injections of antitoxins or immune globulin; immunity that is acquired in these ways is called passive immunity.

- **Note that** the chain of infection may be interrupted when an agent does not find a susceptible host.
- This may occur if a high proportion of individuals in a population is resistant to an agent.
- These persons limit spread to the relatively few who are susceptible by reducing the probability of contact between infected and susceptible persons. This concept is called herd immunity.

NATURAL HISTORY OF DISEASE

Natural History of a disease

Defn; It is the progression of disease process in an individual overtime, in the absence of intervention.

- Each disease has its own life history, and thus any general formulation of this process is **arbitrary**.
- However it is important to develop a **schematic picture** of the natural history of the disease as a **framework** within which to :-
 - **Understand and plan intervention** measures including prevention and control of diseases.

- **Every disease in a host follows a potentially predictable life cycle from onset to final outcome, which is known as its natural history.**
- **Understanding the natural history of disease is important to:-**
 - **Clinicians in establishing appropriate treatment and accurate prognosis, and**
 - **It is vital to public health professionals in developing effective disease prevention and control strategies.**
- **The natural history of a communicable disease refers to the sequence of events that happen one after another, over a period of time, in a person who is not receiving treatment.**

- **Recognizing these events helps you understand how particular interventions at different stages could prevent or control the disease.**
- **Events that occur in the natural history of a communicable disease are grouped into four stages:**

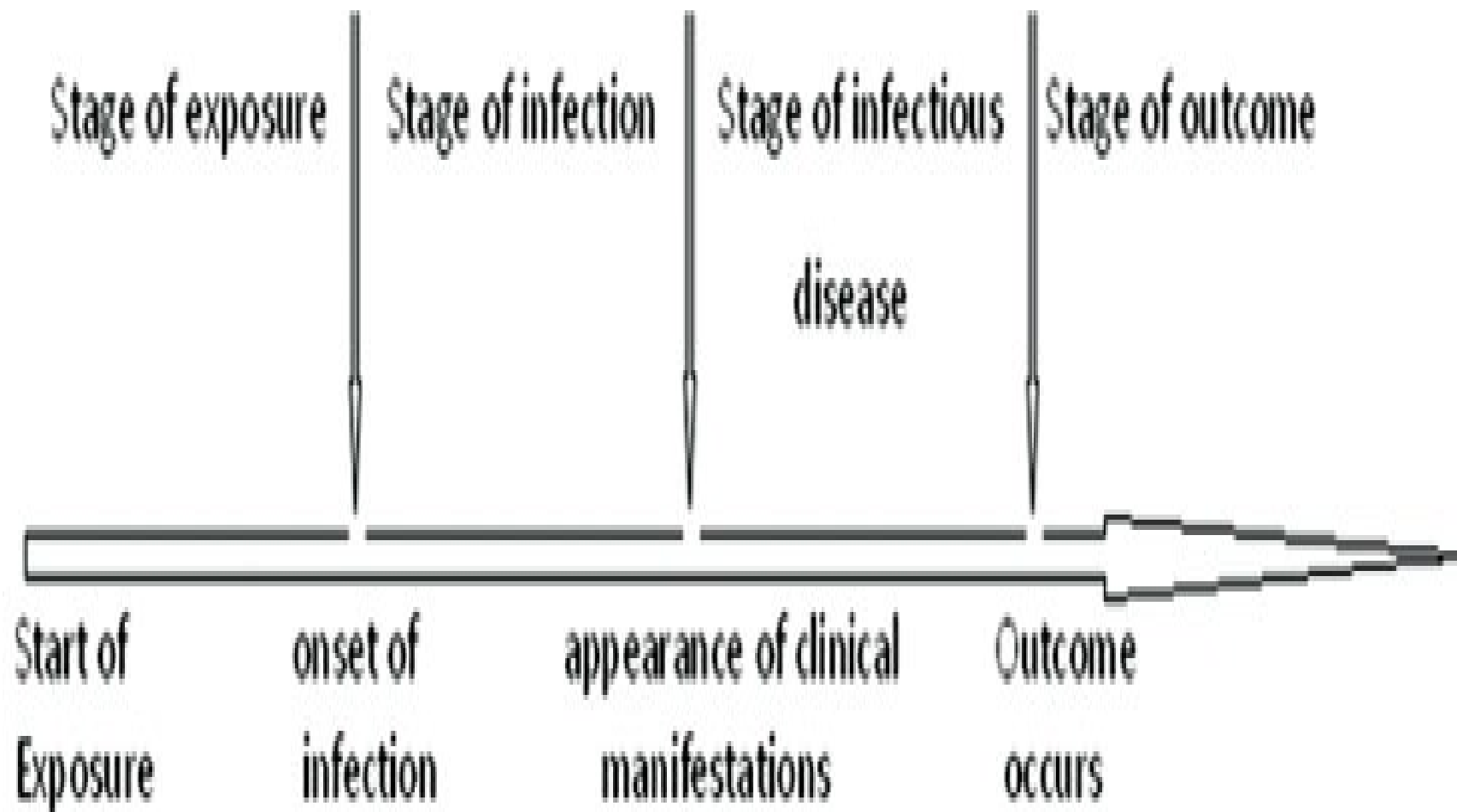
1. Exposure/Stage of susceptibility

2. Infection/ Stage of subclinical disease

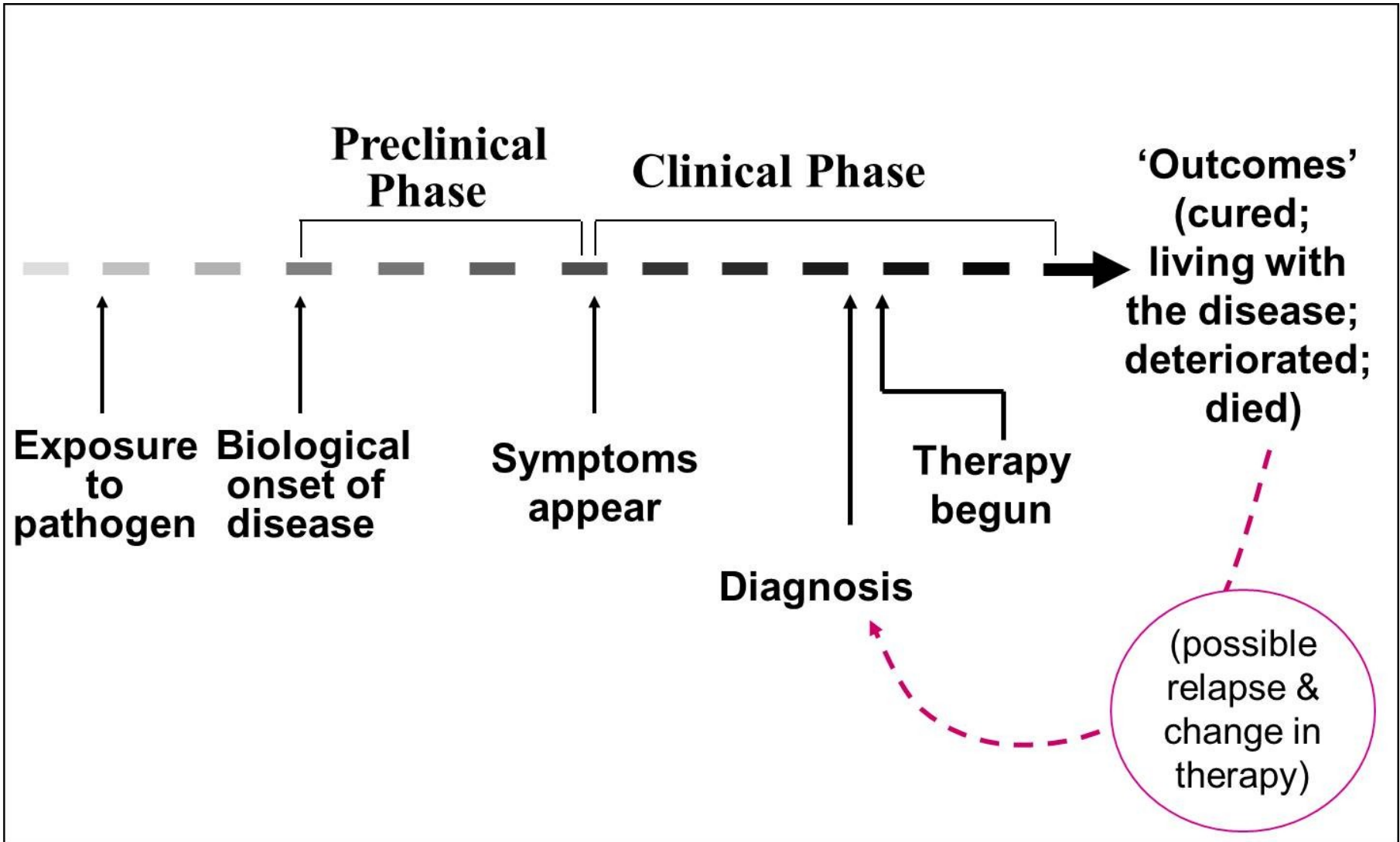
3. Infectious disease/ Stage of clinical disease and

4. Outcome/ Stage of recovery, disability or death

Natural history of the Ds



Natural.....



1. Stage of susceptibility/ Exposure -

- Precedes the onset of disease. The disease has not yet developed, but the host is susceptible due to the presence of risk factors.
- Individuals with high serum cholesterol, hypertension, a sedentary lifestyle, and diabetes, for example, have an increased risk of developing coronary heart disease.
- Likewise lack of sleep, excessive stress, and poor eating habits may predispose one to the common cold.

2. Stage of subclinical /infection

- The disease process has begun, but no overt signs or symptoms are evident to the host.
- After the disease process has been triggered, pathological changes then occur without the individual being aware of them.
- This stage of subclinical disease, extending from the time of exposure to onset of disease symptoms, is usually called the incubation period for infectious diseases, and the latency period for chronic diseases.

- This period may be as brief as seconds for hypersensitivity and toxic reactions to as long as decades for certain chronic diseases.
- For example, the typical incubation period for hepatitis A is as long as 7 weeks.
- The latency period for leukemia to become evident among survivors of the atomic bomb blast in Hiroshima ranged from 2 to 12 years, peaking at 6–7 years.
- Most screening programs attempt to identify the disease process during this phase of its natural history.
- since intervention at this early stage is likely to be more effective than treatment given after the disease has progressed and become symptomatic.

Natural.....

3. Stage of clinical disease-

- The onset of symptoms marks the transition from subclinical to clinical disease. Most diagnoses are made during the stage of clinical disease.
- The disease process may result in illness that ranges from mild to severe or fatal. This range is called the spectrum of disease.

4. Stage of Recovery, disability or death:

- Some diseases run their course and then **resolve** completely either spontaneously or by treatment.
-
- In others the disease may result in a **residual defect**, leaving the person disabled for a short or longer duration.
- Still other diseases will end in death.
- **Disability**: A limitation of a person's activities including his role as a parent, wage earner, etc.

PREVENTION AND CONTROL OF COMMUNICABLE DISEASES

Disease prevention

- Is Inhibiting the development of a disease before it occurs or if it occurs interrupting or
- slowing down the progression of diseases.
- **There are three levels of prevention.**
 - **Primary prevention**
 - **Secondary prevention**
 - **Tertiary prevention**

1. Primary prevention

- ❑ **Primary prevention seeks to reduce the frequency of new cases of disease occurring in a population and, thus is most applicable to persons who are in the stage of susceptibility.**
- ❑ **It focuses on promoting health, preventing exposure, and disease.**
- ✓ **Health promotion:** any intervention that promotes a healthier and happier life.
 - Interventions that enhance health and the body's ability to resist diseases.
- ✓ **Improvement of socioeconomic** status; education and vocational training; affordable and adequate housing, clothing and food; old age pension benefits; emotional and social support, relief of stress etc.

- ✓ **Prevention of exposure:** any intervention which prevents the coming in contact between an infectious agent and a susceptible host.

Eg. ***Provision of safe and adequate water***

- ***proper excreta disposal; vector control***
- ***safe environment at home (proper storage of insecticides and medicines), at school and at work***
- ***(proper ventilation, monitoring of harmful substances in factories), on the streets (driver licensing laws)***
- ✓ **Prevention of disease:** This occurs during the latency period between exposure and the biological onset of the disease. Eg. Immunization.

Remember breast feeding is:

- **Health promotion:** by providing optimal nutrition for a young child, either as the sole diet up to six months of age, or as a supplement in later age.
- **Prevention of exposure:** by reducing exposure of the child to contaminated milk.
- **Prevention of disease after exposure:** by the provision of ant-infective factors, including antibodies, WBCs and others.

2. Secondary prevention

- ❑ **Secondary prevention attempts to reduce the number of existing cases in a population and, therefore, is most appropriately aimed those in the stage of pre symptomatic disease or the early stage of clinical disease.**
- ❑ Acted after the biological onset of the disease, but before permanent damage sets in.
- ❑ The objective here is to stop or slow the progression of disease so as to prevent or limit permanent damage, through the early detection and treatment of diseases.

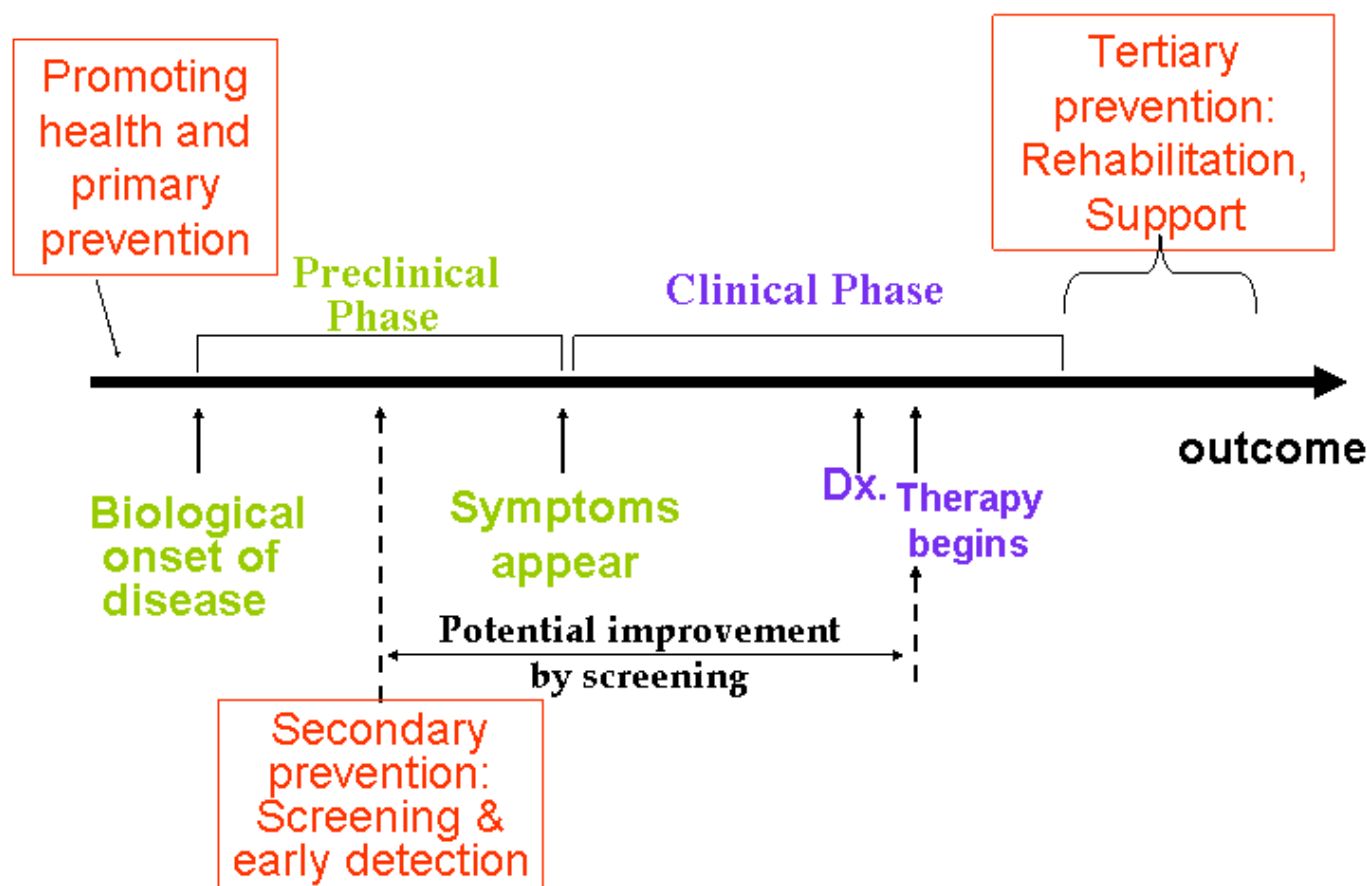
3. Tertiary prevention

- - ✓ Tries to limit disability and improve functioning following disease or its complications, often through rehabilitation.
 - ✓ Therefore, it is most applicable during the late clinical stage or the stage of outcome.
 - ✓ After permanent damage sets in, the objective of tertiary prevention is to limit the impact of that damage.
 - ✓ The impact can be physical (physical disability), psychological, social (social stigma), and financial.
 - ✓ **Rehabilitation** : is to the retraining of remaining functions for maximum effectiveness, and should be seen in a very broad sense, not simply limited to the physical aspect.

- **The natural history of disease and the levels of prevention are closely linked.**
- **As illustrated in next figure, appropriate levels of prevention may be applied at each stage of the natural history of disease.**

PREVENTION.....

Prevention and the Natural History of Disease



Principles of communicable disease control

Disease control: Involves all the measures designed to reduce or prevent the incidence, prevalence and consequence of a disease to a level where it cannot be a major public health problem.

❖ **The actions may be effected through:**

- **Attacking the source**
- **Interrupting the mode of transmission and**
- **Protecting the host (susceptibility)**

1. **Attacking the source**

- ✓ Domestic animals as reservoirs
 - Immunization e.g. Brucellosis
 - Destruction of infected animals e.g. Rabies
- ✓ Wild animals as reservoirs
 - Post exposure prophylaxis e.g. Rabies

Human as a reservoirs

✓ **Isolation** of infected persons & separation of infected persons from others for the period of communicability.

- **Not suitable when:-**
- Large proportion are apparently infected, or
- In which maximal infectivity precedes over illness.

Treatment

- **Of cases (clinical) and carriers**
- **Mass treatment:** where large proportion are known to have a disease, it is sometimes advisable to treat everybody, without checking whether individuals have disease or not.

Quarantine:-

- ✓ The limitation of freedom of movement of apparently healthy persons or animals who have been exposed to a case of infectious disease.
- Cholera, plague, Ebola and yellow fever are the among internationally quarantinable diseases by international agreement.
- These diseases are very infectious, so cases shouldn't be referred but seniors must be requested to visit the health center.

2. **Interrupting transmission**

✓ ***For Transmission by ingestion:***

- Purification of water
- Pasteurization of milk
- Inspection procedures designed to ensure safe food supply.
- Improve housing conditions

✓ **For Transmission by inhalation**

- Chemical disinfections of air
- Improving ventilation

- **For transmission by vector or intermediate hosts**
 - Vector control measures
 - Environmental manipulation (sanitation)

Measures that reduce host susceptibility

❖ **Immunization**

- Active immunization: when either the altered organism or its products is given to a person to induce production of antibodies
 - E.g. BCG
- Passive immunization: provision of ready-made antibodies
 - E.g. TAT

- ✓ **Chemoprophylaxis:** use of antibiotics for known contacts to a case.

E.g. Ciprofloxacin for contacts to a case of M. meningitis

- **Better nutrition:** Malnourished children get infections more easily & suffer more severe complications.

EPIDEMIC DISEASE OCCURRENCE



Levels of Disease Occurrence

- **Diseases occur in a community at different levels at a particular point in time.**
- **Some diseases are usually present at a predictable level. This is called the expected level.**
- **But sometimes they occur in excess of what is expected.**
- **The examples, of expected level are endemic and hyper endemic.**
- **When the disease occur as epidemic, outbreak, and pandemic it is considered as excess of what is expected.**

Definition of terms related to the level of occurrence of disease

- 1. Endemic:** Presence of a disease at more or less stable level.
✓ Malaria is endemic in the lowland areas of Ethiopia.
- 2. Hyper endemic:** Persistently high level of disease occurrence.
- 3. Sporadic:** Occasional or irregular occurrence of a disease.
When diseases occur sporadically they may occur as epidemic.
- 4. Epidemic:** The occurrence of disease or other health related condition in excess of the usual frequency in a given area or among a specific group of people over a particular period of time.
- 5. Outbreak:** Epidemics of shorter duration covering a more limited area.
- 6. Pandemic:** An epidemic involving several countries or continents affecting a large number of people. For example the worldwide occurrence of HIV/AIDS is a pandemic.

Definition of Epidemics

- **Epidemic** – disease occurring in **excess** of what is expected.
- Occurrences of disease or health related condition in excess of usual occurrence in a given area or among specific group of people over specified period of time.

➡ The number of cases showing epidemics depends on:

- ➡ *Infectious agent*
- ➡ *Size and type of the population exposed*
- ➡ *Previous experience or lack of exposure to disease*
- ➡ *Time and place of occurrence*

Causes of epidemic :when do epidemic arise?

- Any communicable disease in an individual or in a community results from a dynamic interaction between the agent, the host and the environment (Ecological concept).
- Agent and host are always engaged in a constant struggle for survival.
- The winner depends on the environment of interaction.
- The recent increase in amount or virulence of agent
- The recent introduction of the agent into a setting where it has not been before.

More specifically the causes may be

- An enhanced **mode of transmission** so that more susceptible are exposed.
- Some **change** in the susceptibility of the **host response** to the agent
- Factors that increase host exposure or involve introduction through **new portal of entry**.

Types of epidemics

- Epidemics can be classified according to the **method of spread or propagation, nature and length of exposure to the infections agent, and duration.**

There are three principal types of epidemics.

1. **Common source epidemic:** Disease occurs as a result of exposure of a group of susceptible persons to a **common source of a pathogen**, often at the **same time** or within a brief time period.
 - A. **a point source epidemic (PSE):** Is occur when the exposure is simultaneous, the resulting cases develop within **one incubation period**
 - In Point Source Epidemics:- the epidemic curve will commonly show a **sharp rise and fall.**
 - e.g. A food borne epidemic following an event where the food was served to many people

B. a continuous common source epidemic (CSE):

- Occurs If the exposure to a common source ***continues over time.***
 - **E.g. A water born outbreak that is spread through a contaminated community water supply.**
- The epidemic curve may have a **wide peak** because of the range of exposures and incubation periods.

2. Propagated (progressive) or contact epidemics:

- ✓ The infectious agent is transferred (propagated) from one host to another.
- ✓ It can occur through **direct person to person transmission** (by mode of transmissions) or it can involve more complex cycles in which the agent must pass through a **vector** as in yellow fever and malaria.
- Initial rise in the number of **cases** is usually **gradual**.
- Epidemic extends over *a number of incubation periods*.
- The epidemic curve is relatively **gentle upslope and somewhat sleeper tail**. E.g. Out breaks of malaria.

- When it is difficult to differentiate the two types of epidemics by the curve use spot map (studying the geographic distribution): in propagated one there will be successive generations of cases.

3. Mixed epidemics: The epidemic begins with **single, common source** of an infectious agent with the subsequent propagate spread.

E.g. Many food borne pathogens

Levels of epidemic Disease occurrence

- Disease occurs in community at different level at particular point in time.
 - Some diseases are usually occur at predicted level.
 - This is called ***expected level of disease, and sometimes they occur in excess of what is expected.***
- a. Endemic - the presence of disease at more or less stable level.***

b. Habitual presence of disease in a given geographic area.

- Occurring in a community at roughly **constant level**.
- The *prevalence and incidence of the disease* fairly constant over time.
- It is the persistent level of occurrence with a low to moderate disease level.
- Example - TB in Ethiopia, malaria in low land area

c. Sporadic -occasional or irregular occurrence of disease in an interval.

✓ Those which are not present in population normally but give rise irregularly to epidemic. Example - plague

❖ ***Endemic disease can rapidly become epidemic due to:-***

- Accumulation of **susceptible individual** by **birth or immigration** from non-endemic area.
 - **E.g. new comers from highland or non-malarias area to a lowland malarias area**
- **Ecological change** e.g. . Favour breeding of insect vectors
- **Increase of organism on carriers** or animal before it occurs in human population
 - **E.g. Plague epidemics in rat and yellow fever in monkey before it attack the man**

Investigation of an Epidemic

- **The purpose is to determine the specific cause or causes of the outbreak at the earliest time and to take appropriate measure directed at controlling the epidemic and preventing future occurrence.**
 - **The following questions should be answered when investigating an epidemic.**
 - ✓ **- What is the etiological agent responsible for the epidemic?**
 - ✓ **What is/are the predominant modes of transmission?**
 - ✓ **What specific source/s of disease can be identified?**
- E.g. human carriers, breeding sites for vectors, etc.**

- **What specific practices or environmental deficiencies have contributed to the outbreak?**
 - E.g. improper food handling, human made breeding sites for mosquitoes.
- **What is the chain of events that led to the outbreak?**
 - E.g. accumulation of susceptible hosts in an area.

Uncovering outbreaks:- Outbreaks are detected in one of the following ways:

- Through timely analysis of routine surveillance data
- Report from clinician.
- Report from the community, either from the affected group or concerned citizen.

Steps in Epidemic Investigation

- There is no fixed step in the investigation of epidemics but the following step can be considered as one option.

1. Prepare for fieldwork

- Before leaving for the field you should be well prepared to under take the investigation. *Preparations can include:-*

- i. Investigator must have the appropriate scientific knowledge, supplies, and equipment to carry out the investigation.

- ✓ It might be difficult for the health extension worker to fully investigate the epidemic, hence, he/she should inform and involve other high level health professionals from the outset.

- ii. collect sample questionnaire.

- iii. arrange transportation and organize personnel matters.

- iv. clarify your and your team role in the field. Arrange where and when to meet them.

2. Verify (confirm) the existence of an epidemic

- **This initial determination is often made on the basis of available data.**
 - **Compare the number of cases with the past levels to identify whether the present occurrence is in excess of its usual frequency.**
 - **Instead of comparing absolute numbers it is advisable to compare rates like incidence rate**

3. Verify (confirm the diagnosis).

- **Always consider whether initial reports are correct. Carry out clinical and laboratory investigations on the reported cases.**
 - **For example the already collected blood film slides can be seen by laboratory experts to check whether the initial report was correct. It is important to**

- **Investigate the index case** (the first case that comes to the attention of health authorities) and other early cases.
 - The importance of the index case and other early cases for diseases that are *known to occur in epidemic form*, such as *relapsing fever*, is as an indication to health authorities of the possible start of an outbreak.
 - The sooner the index case and other early cases are investigated, the greater the opportunity to arrest the outbreak at earliest stage possible.
 - The health extension worker requests support from the Woreda Health Office or the nearest Health Center for confirming the diagnosis.

4. Identify and count cases

- Prepare “case definition” before starting identification of cases.

Case definition is defined as a standard set of criteria to differentiate between cases and non cases.

Cases can be one of the following:

Confirmed / definite: A case with laboratory verification.

Probable: A case with typical clinical features but without laboratory confirmation.

Possible: A case with fewer of typical clinical features.

- Cases can better be identified by active case detection using all available means including house to house visits.
- They can also be identified by stimulated passive case detection, for example by alerting the public about the epidemic and requesting them to report to the nearest health institution when they have signs and symptoms of that disease.
- The health extension worker can identify and count cases based on the sign and symptoms of the disease.
- If there is effective drug for the treatment of that disease, cases can be treated while identifying them.
- Additionally other control measures can be taken side by side to arrest the epidemic before many people are affected.

5. Describe the epidemic with respect to person, place and time

- Each case must be defined according to standard epidemiologic parameters: the date of onset of the illness, the place where the person lives or became ill, and the socio-demographic characteristics (age, sex, education level, occupation).
- The tools to be used when characterizing the epidemic are epidemic curve, spot map and attack rates.
- **Epidemic curve** is an important tool for the investigation of disease outbreaks. In epidemic curve the distribution of cases is plotted over time, usually in the form of histogram, with the date of onset of cases on the horizontal axis, and the number of cases corresponding to each date of onset on the vertical axis.
- **Spot map** is a map of locality where the outbreak has occurred, on which the location of cases is plotted.
- The spot map is often helpful in detecting the source of an outbreak. Mapping disease can be done at kebele, woreda, regional, and national level.
- One limitation of spot map is that it does not take into account underlying geographic differences in population density.
- Thus the spot map needs to be supplemented by calculation of place specific attack rates.

Person specific attack rates: The tool that is important for the analysis of disease outbreaks by personal characteristics is person specific attack rates like attack rates by age, sex, occupation, income, religion etc.

6. Identify the causes of the epidemic

- All factors that can contribute to the occurrence of the epidemic should be assessed. The epidemic investigating team should try to answer questions like:

- **Why did this epidemic occur?**

- Are there many susceptible individuals? Is the temperature favorable for the transmission of the diseases?
- Are there breeding sites for the breeding of vectors? Etc
- Confirmation of the diagnosis can be done by using additional tests which are more accurate.
- In addition to knowing the etiologic agent, more emphasis should be given to identify the risk factors.
- Investigate the environmental conditions such as food sanitation, suspected breeding sites, animal reservoirs, according to the type of disease outbreak being investigated.

7. Management of epidemic and follow up

- Although it is discussed late, intervention must start as soon as possible depending on the specific circumstances.
- One might aim control measures at the specific agent, source, or reservoir. For example, an outbreak might be controlled by destroying contaminated foods, disinfecting contaminated water, or destroying mosquito breeding sites or an infectious food handler could be suspended from the job and treated.

General principles in the management of epidemics

- Management of epidemics requires an urgent and intelligent use of appropriate measures against the spread of the disease.
- Action to be taken is dependent on the type of the disease as well as the source of the outbreak.
- However, the actions can be generally categorized as presented below to facilitate easy understanding of the strategies.

1. Measures Directed Against the Reservoir

- Understanding the nature of the reservoir is necessary in the selection of an appropriate control methods and their likelihood of success.

- The following are examples of control measures against diseases with various reservoirs:

- **Domestic animals as reservoir:**

- Immunization. Example - giving anti-rabies vaccine for dogs
- Destruction of infected animals e.g anthrax

- **Wild animals as reservoir:**

- post-exposure prophylaxis for human beings- Example: rabies

- **Humans as reservoir**

a. **Isolation of infected persons.** This is separation of infected persons from non-infected for the period of communicability.

- This is not suitable in the control of diseases in which a large proportion are in apparent infection (without signs and symptoms) or in which maximal infectivity precedes overt illness.

b. **Treatment to make them noninfectious-** e.g., tuberculosis.

Quarantine- is the limitation of freedom of movement of apparently healthy persons or animals who have been exposed to a case of infectious disease.

- Usually imposed for the duration of the usual maximal incubation period of the disease.
- Cholera, Plague, and yellow fever are the three internationally quarantable diseases by international agreement.
- Now quarantine is replaced in some countries by active surveillance of the individuals; maintaining close supervision over possible contacts of ill persons to detect infection or illness promptly; their freedom of movement is not restricted.

B. Measures that interrupt the transmission of organisms

➤ Action to prevent transmission of disease by ingestion:

- i. Purification of water**
- ii. Pasteurization of milk**
- iii. Inspection procedures to ensure safe food supply.**
- iv. Improve housing conditions.**

➤ Actions to reduce transmission of respiratory infections

- include ventilation of rooms.**
- In the case of diseases that involve an intermediate host for transmission, for example schistosomiasis, clearing irrigation farms from snails is an appropriate measure.**

C. Measures that reduce host susceptibility

- **immunization (vaccination).** Example vaccination for meningitis
- **Chemoprophylaxis:** for example, use of chloroquine to persons traveling to malaria endemic areas.
- After the epidemic is controlled, strict follow up mechanisms should be designed so as to prevent similar epidemics in the future.

8. Report of the investigation

- At the end prepare a comprehensive report and submit to the appropriate/concerned bodies like the Woreda Health Office.

➤ The report should follow the usual scientific format:

- **introduction, methods, results, discussion, and recommendations.**

• **The report should discuss in detail:-**

- Factors leading to the epidemic.
- Measures used for the control of the epidemic.
- Recommendations for the prevention of similar episodes in the future.

EPIDEMIOLOGICAL SERVILLANCE IN ETHIOPIA

Epidemiological Surveillance

Definition

- Surveillance is defined as the *continuous (ongoing)* scrutiny of the factors that determine the occurrence and distribution of diseases and other health related events through a systematic collection of data.

Purpose of surveillance

- To be able to identify diseases, injuries, hazards and other health related factors as early as possible, i.e. prediction and early detection of outbreaks.
- To provide scientific baseline data and information for priority setting, planning, implementing and evaluating disease control program for both communicable and non-communicable health problems.
- To define the magnitude and distribution of diseases by time, person and place dimension

Types of surveillance

- The two common types of surveillance are passive and active surveillance.

1. Passive surveillance

- Passive surveillance may be defined as a mechanism for routine surveillance based on passive case detection and on the routine recording and reporting system.
- The information provider comes to the health institutions for help, be it medical or other preventive and promotive health services.
- It involves collection of data as part of routine provision of health services.

Advantages of passive surveillance

- *covers a wide range of problems*
- *does not require special arrangement*
- *it is relatively cheap*
- *covers a wider area*

The disadvantages of passive surveillance

- **The information generated is to a large extent unreliable, incomplete and inaccurate**
- **Most of the time, data from passive surveillance is not available on time**
- **Most of the time, you may not get the kind of information you desire**
- **It lacks representativeness of the whole population since passive surveillance is mainly based on health institution reports**

2. Active surveillance

- **Active surveillance is defined as a method of data collection usually on a specific disease, for relatively limited period of time.**
- **It involves collection of data from communities such as in house-to-house surveys or mobilizing communities to some central point where data can be collected.**
- **This can be arranged by assigning health personnel to collect information on presence or absence of new cases of a particular disease at regular intervals.**
- **Example: investigation of out-breaks**

The advantages of active surveillance

- **The collected data is complete and accurate**
- **Information collected is timely.**

The disadvantages of active surveillance

- **It requires good organization**
- **It is expensive**
- **It requires skilled human power**
- **It is for short period of time(not a continuous process)**
- **It is directed towards specific disease conditions**

Conditions in which active surveillance is appropriate

- **Active surveillance has limited scope. Unlike passive surveillance, it cannot be used for routine purposes.**
- **There are certain conditions where active surveillance is appropriate. These conditions are:-**
 - **For periodic evaluation of an ongoing program**
 - **For programs with limited time of operation such as eradication program**
- **In unusual situations such as:**
 - **New disease discovery**
 - **New mode of transmission**
 - **When a disease is found to affect a new subgroup of the population.**
 - **When a previously eradicated disease reappears.**

Activities in Surveillance

- **The different activities carried out under surveillance are:**

- 1. Data collection and recording**
- 2. Data compilation, analysis and interpretation**
- 3. Reporting and notification**
- 4. Dissemination of information**

Features of a good surveillance system

- **Using a combination of both active and passive surveillance techniques**
- **Timely notification**
- **Timely and comprehensive action taken in response to notification**
- **Availability of a strong laboratory service for accurate diagnoses of cases**

The integrated disease surveillance system

- **The integrated disease surveillance system is a relatively new strategy, which is being implemented in Ethiopia.**
- **In this strategy several activities from the different vertical programs are coordinated and streamlined in order to make best use of scarce resources.**
- **The activities are combined taking advantage of similar surveillance functions, skills, resources, and target population.**
- **Integrated disease surveillance strategy recommends coordination and integration of surveillance activities for diseases of public health importance.**

Diseases included in the integrated disease surveillance system

- **Among the most prevalent health problems 21 (twenty one) communicable diseases and conditions are selected for integrated disease surveillance to be implemented in Ethiopia.**
- **The diseases are recommended because they fall into one or more of the following categories:**
 - **Are top causes of high morbidity and mortality in Ethiopia (for example, malaria, pneumonia, diarrheal diseases, tuberculosis, and HIV/AIDS)**
 - **Have epidemic potential (for example yellow fever and cholera)**
 - **Surveillance required internationally (for example plague, yellow fever and cholera)**
 - **Have available effective control and prevention interventions for addressing the public health problem they pose (for example schistosomiasis, onchocerciasis, trypanosomiasis)**
 - **Can easily be identified using simple case definition; and**
 - **Have intervention programs for prevention, control, eradication or elimination of the diseases (for example EPI and Integrated Management of Childhood Illness Strategy (IMCI))**

List of Priority Disease in Ethiopia

1. Epidemic-Prone Diseases

- Cholera
- Diarrhea with blood (Shigella)
- Yellow fever
- Measles
- Meningitis
- Plague
- Viral hemorrhagic fevers
- Typhoid fever
- Relapsing fever
- Epidemic typhus
- Malaria

B. Diseases Targeted for Eradication and Elimination

- **Acute flaccid paralysis (AFP)/ polio**
- **Dracunculiasis (Guinea worm)**
- **Leprosy**
- **Neonatal tetanus**

C. Other Diseases of Public Health Importance

- **Pneumonia in children less than 5 years of age**
- **Diarrhea in children less than 5 years of age**
- **New AIDS cases**
- **Onchocerciasis**
- **Sexually Transmitted Infections (STIs)**
- **Tuberculosis**

NB:- Viral Hemorrhagic Fever (VHF) is not in the National priority diseases list, but every health worker should be aware of its epidemic proneness and high fatality

**THANK
YOU!!!**