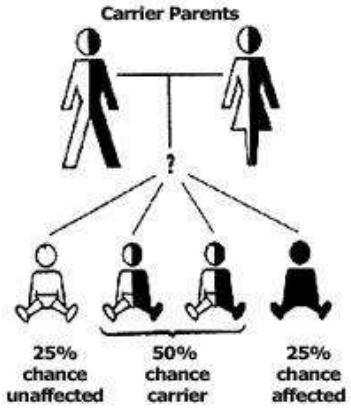
Introduction to Infectious Diseases and Veterinary Epidemiology

Epidemiology

- The science concerned with the study of factors determining and influencing the frequency and distribution of disease, injury, and other health-related events and their causes in a defined human population for the purpose of establishing programs to prevent and control their development and spread. Also, the sum of knowledge gained in such a study.

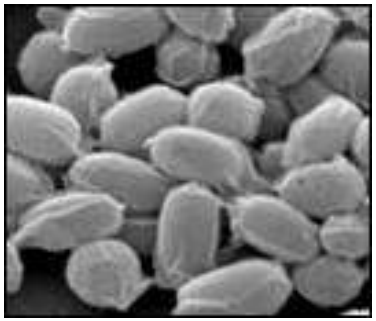
- *Epidemiology*, literally meaning "**the study of what is upon the people".** Derived from Greek *epi*, meaning "upon, among", *demos*, meaning "people, district", and *logos*, meaning "study, word, discourse", suggesting that it applies only to human populations.
- In studies of zoological populations (veterinary epidemiology).

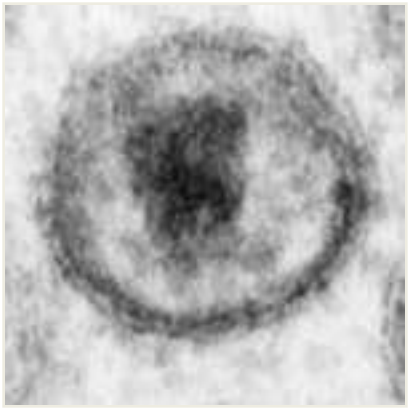
There are different kinds of disease

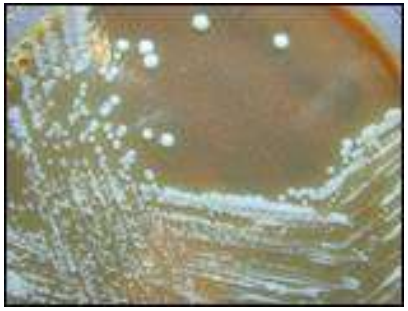


- Genetic
- Biological
- Physical
- Chemical

Infectious Diseases







Disease – a pathological condition of body parts or tissues characterized by an identifiable group of signs and symptoms.

Infectious disease – disease caused by an infectious agent such as a bacterium, virus, protozoan, or fungus that can be passed on to others.

- **Infection** – occurs when an infectious agent enters the body and begins to reproduce; may or may not lead to disease.
- **Pathogen** – an infectious agent that causes disease.
- **Virulence** – the relative ability of an agent to cause rapid and severe disease in a host.

Infectious Disease Agents

- Most infectious agents that cause disease are microscopic in size and thus, are called microbes or microorganisms.
- Different groups of agents that cause disease are:
  - Bacteria
  - Viruses
  - Protozoa (Protists)
  - Fungi
  - Helminthes (Animals)





Terminology and Definitions (cont.)

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

Infection

- Infection is the entry and development or multiplication of an infectious agent like bacteria, viruses, and parasites that are not normally present within the body of man or animals. An infection does not always cause illness.
- There are several levels of infection
  - Subclinical or inapparent infection.
  - Latent infection (virus of herpes simplex).
  - Clinical infection.

- **latent infection,** infection that may lie dormant in the body for a time but may become active under certain conditions. latent infection the animal is infected but there are no clinical signs nor infectious agent detectable in discharges.

- endogenous infection that due to reactivation of organisms present in a dormant focus, as occurs in tuberculosis, Actinobacillosis, Cl. novyi, etc.
- **exogenous infection** that caused by organisms not normally present in the body but which have gained entrance from the environment.

subclinical infection: infection associated with no detectable signs but caused by microorganisms capable of producing easily recognizable diseases, such as mastitis or brucellosis; often detected by the production of antibody, or by delayed hypersensitivity exhibited in a skin test reaction to such antigens as tuberculoprotein.

- **Sign: is an objective change in body function (e.g., health) that may be observed and measured by an individual in addition to the patient.**

Contrast with symptom.

- **Symptom: is a changes in body function felt by the patient. *Symptoms* are not measurable by a physician.**

- **A *local infection* is an infection that is limited to a small area of the body.**
- **A *systemic infection* is an infection that is found throughout the body.**

- **Acute infection: is an infection that develops rapidly and only lasts a short time.**
- **Chronic infection: is an infection that develops slowly and lasts a long time.**
- **Sub acute infection :is an infection intermediate to acute and chronic.**

- **Bacteremia refers to the presence of bacteria in the blood.**
- **Septicemia refers to the presence of replicating bacteria in the blood.**
- **Viraemia refers to the presence of viruses in the blood. Note that since viruses are obligate intracellular pathogens, it is often possible for viruses which do not infect blood cells to be present in the blood, but not actively replicating.**

- Communicable disease **is an infectious disease that readily spreads from person to person. That is, just because a disease is infectious does not mean that it is easy to catch. A *communicable disease* is readily easily caught, especially from an infected person.**

- **Contagious disease is a very communicable disease, i.e., an infectious disease that *very* readily spreads from animal to animal. It is** transmitted through direct and indirect contact. Examples include scabies, Brucellosis, pox leprosy.

The *period of incubation* **is the interval occurring between the start of an infection and the appearance of symptoms. The patient is infected but does not yet know it.**

The length of the *period of incubation* is dependent on various host and pathogen characteristics.

For many pathogens an infected individual can spread disease to others prior to realizing that they are sick.

contamination

- The presence of an infectious agent on a body surface, on or in clothes, beddings, toys, surgical instruments or dressings, or other articles or substances including water and food.

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.

Host

- A person or an animal that affords existence or lodgment to an infectious agent under natural conditions. Types include: an obligate host, definitive (primary) host, intermediate host and a transport host.

Vector of infection

- 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.

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** is a measure of the **risk** of developing some new cases of a specific disease within a specified period of time. Although sometimes loosely expressed simply as the number of new cases during some time period
- **Incidence proportion** (also known as cumulative incidence) is the number of new cases within a specified time period divided by the size of the population initially at risk. For example, if a population initially contains 1,000 non-diseased persons and 28 develop a condition over two years of observation, the incidence proportion is 28 cases per 1,000 persons, i.e. 2.8%

- Incidence should not be confused with prevalence, which is a measure of the total number of cases of disease in a population .
- Thus, incidence conveys information about the risk of contracting the disease, whereas prevalence indicates how widespread the disease is.

- Syndrome: is the association of several medical signs, symptoms, and or other characteristics that often occur together. Some syndromes, such as Down syndrome, have only one cause; others, such as Parkinsonian syndrome, have multiple possible causes. In other cases, the cause of the syndrome is unknown.
- Disease flare-up: A transient increase in severity of the manifestations of an already enzootic disease; as flaring up in cases of glanders in the eightieths of the last century

Epidemic

- Epidemic occurs when new cases of a disease, in a given human population, and during a given period, exceed what is expected based on recent experience. Epidemiologists often consider the term outbreak to be synonymous to epidemic, but the term outbreak is more local and less serious than epidemics.

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.
- (En = in; demos = people)

- An Enzootic disease is an endemic disease occurring in animals, e.g. bovine TB, glanders.

Pandemic and Exotic

- Pandemic occurrence of a disease usually affects 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 imported into a country in which they do not otherwise occur, as for example, Render pest in Iraq before the eighties.

Sporadic

- The word sporadic means “scattered about”. The cases occur irregularly, 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. Listeriosis, meningococcal meningitis, tetanus….
- However, a sporadic disease could be the starting point of an epidemic when the conditions are favorable for its spread.

Zoonosis, epizootic and enzootic

- Zoonosis is an infection that is transmissible under natural conditions from vertebrate animals to man, e.g. rabies, plague, bovine tuberculosis, brucellosis…..
- An epizootic is an outbreak (epidemic) of disease in an animal population, e.g. rift valley fever.
- An Enzootic is an endemic occurring in animals, e.g. bovine TB, glanders.

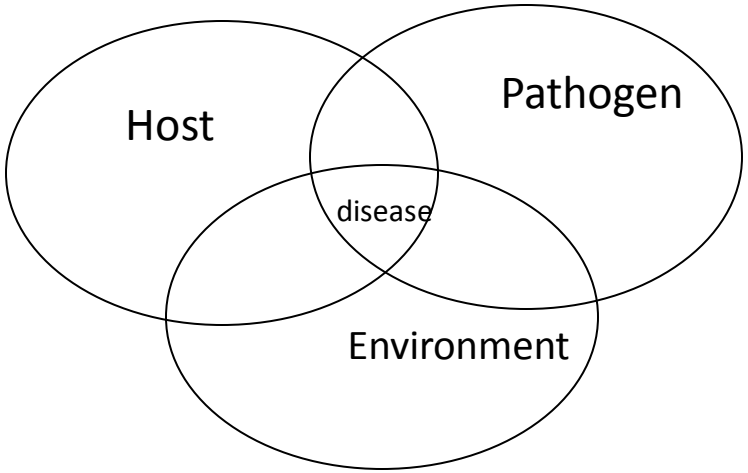
Opportunistic infection

- 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, Candida albicans, Staph. Sp. etc.

How Infectious Agents Cause Disease

- Production of poisons, such as toxins and enzymes, that destroy cells and tissues.
- Direct invasion and destruction of host cells.
- Triggering responses from the host's immune system leading to disease signs and symptoms.

Infectious Disease Model



- Infection: The invasion and multiplication of microorganisms such as

An infection may :

- cause no symptoms and be subclinical.
- may cause symptoms and be clinically apparent.

- Pathogenicity: The ability of an infectious agent to cause disease.
- Virulence: The quantitative ability of an agent to cause disease. Virulent agents cause disease when introduced into the host in small numbers. Virulence involves invasiveness and toxigenicity.
- Toxigenicity: The ability of a microorganism to produce a toxin that contributes to the development of disease.

Pathogenesis

- The pathogenesis of bacterial infection includes the initiation of the infectious process and the mechanisms leading to the development of signs and symptoms of an infectious disease.

- Invasion: The process whereby bacteria, parasites, fungi and viruses enter the host cells or tissues and spread in the body.

- Pathogen: A microorganism capable of causing disease.

- Non-pathogen: A microorganism that does not cause disease. It may be part of the normal flora.