CHAPTER I. GENERAL INFORMATION

I.1 DEFINITIONS OF KEYS TERMS AND MEDICAL TERMS

Infection: Invasion by and multiplication of pathogenic microorganisms (bacteria, fungi, viruses, parasite,…) in a bodily part or tissue, which may produce subsequent tissue injury and progress to overt disease through a variety of cellular or toxic mechanisms. The term "infection" has some exceptions. For example, the normal growth of the usual bacterial flora in the intestinal tract is not usually considered an infection. Is defined as the process by which germs enter a susceptible site in the body and multiply, resulting in disease. It occurs when the body is unable to protect itself from microorganism. Or is colonization of a host organism by parasites species.

Infectious disease: Any disease caused by the entrance, growth, and multiplication of microorganisms in the body; a germ disease.

Parasitic organism: is one that lives on or in another organism and draws its nourishment there from

A communicable disease is a disease that can spread from one person to another; or from animals to people. Since communicable diseases are caused by infection i.e entry of harmful living organisms in a body of host (e.g humans, they are also known as infectious diseases. All communicable diseases are associated with the status of the environment

.**Tachycardia**: a rise in the heart rate above the normal range.
Tachypnoea: unusually rapid breathing.
Tetraplegia: paralysis of the body's four limbs, also called quadriplegia.
Thiersch's graft: the term given to a method of skin grafting in which strips of skin are shaved from a normal area and placed on a burned, injured or scarred area to be grafted.
Thoracoplasty: the operation of removing a varying number of the ribs so that underlying lung collapses. It was formerly done to treat pulmonary TB.
Thromboangiitis obliterans: also known as Buerger's disease, this is an inflammatory disease involving the blood vessels and nerves of the limbs, particularly the low limbs.
Thrombocytopenia: a fall in the number of platelets (thrombocytes) in the blood caused by failure production or excessive destruction of the platelets.
Thrombophlebitis: inflammation of the veins combined with blood clot formation.
Thyrotoxicosis: a disorder of the thyroid gland in which excessive amounts of thyroid hormones are secreted into the bloodstream.
Thyroidectomy: surgical removal of the thyroid gland.
Tomy: a suffix indicating an operation by cutting.
Tracheostomy: also known tracheotomy. The operation in which the trachea or windpipe is opened from the front of the neck, so that air may be directly drawn or passed into the lower AIR PASSAGES.

Appendicectomy: or appendectomy is the operation for the removal of the vermiform appendix in the abdomen.
Gastrectomy: a major operation to remove the whole or part of the stomach.
Gastrostomy: an operation on the stomach by which, when the gullet is blocked by a tumor or other cause.
Haematuria: blood in the urine.
Haematemesis: vomiting of the blood.
Splenomegaly: the enlargement of the spleen.
Hepatomegaly: the enlargement of the liver.
Actinomycosis: a chronic infectious condition caused by an anaerobic microorganism.
Aphasia: inability to speak.
Asepsis: a technique to produce a germ-free environment to protect patients from infection.
Antiseptic: a technique to prevent the growth of disease-causing microorganism without damaging living tissues.
Atresia: the absence of natural opening, or closure of it by a membrane.
Bacteraemia: condition in which bacteria are present in the bloodstream.
Hoemoptysis: the coughing-up of blood from the lungs.
Haemolysis: the destruction of red blood corpuscles by the action of pathogen

I.2 IMPORTANCE OF COMMUNICABLE DISEASES IN AFRICA

Communicable diseases are very important in Africa because,

- Many of them are very common
- Some of them are very serious and cause death and disability
- Some of them cause widespread outbreaks of disease(i.e epidemics]
- Many are particurarly serious and more common in infants and children

I.3 FACTORS NECESSARY FOR THE EXISTENCE OF A COMMUNICABLE DISEASE

The presence of a particular communicable disease in an area at a certain time depends on three main factors;

A. **Agent of a disease ,** this is a living organism that causes the disease e.g a bacteria, a virus……
B. **The host ,** this is a human or animal in which or on which an infectious agent lives and develops. It is a living organism that develops the disease
C. **The environment,** this consists of the various elements i.e components surrounding a person. There are

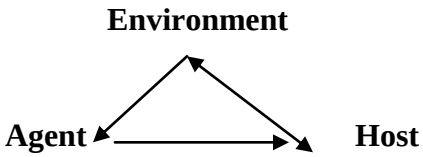
***Physical environment ,** the material things around

***Biological environment,** the living things around
***Economic and political environment,** their level of stability and
***Social cultural environment,** their influence on behavior of a person

All of these components of the environment affect the community, the family and the individual person

*RELATIONSHIP OF THE ENVIRONMENT, DISEASE AGENT AND HOST

The three factors, environment, agent and host are related in a triangular manner as follows



The interrelationship of the three factors can be explained as follow;

*__The agent of a disease__

The agents must be present in a suitable environment in which to grow and multiply, spread and infect other hosts. If the agents do not succeed to grow, multiply and spread, they die out (disappear)

*__Hosts (e.g people]__

People (hosts) can change the environment and thus eliminate the source of the infection e.g by sanitation, personal hygiene, or treating the sick

*__The environment__

It can be changed so that it doesn't support the multiplication of the disease agent

The environment brings the host and the agent together. The environment influences the agent, the host, and the route of transmission of the agent from a source to the host.

The above triangle is called **epidemiologic triangle or Triad** which is a traditional model of infectious disease causation

I.4THE HOST AND INFECTION

1. **DEFINITIVE HOST**

This is a host in which the adult or sexually mature forms of a parasite are found e.g Humans in schistosomiasis, anopheles mosquito (malaria}

2. **INTERMEDIATE HOST**

This is the host in which only immature forms of the parasite are found e.g snails in schistosomiasis, humans in plasmodium (malaria]

NB. Definitive and intermediate hosts are terms used where there is an indirect life cycle of the infectious agent
e.g parasite like malaria requires two hosts; a human and anopheles mosquito

3. SUBCLINICAL INFECTION

This is an infection that has not yet shown the clinical symptoms of the disease. The infection can be detected by the laboratory diagnosis and not by the clinical symptoms. In some diseases the decline in the immunity status of the host causes the subclinical infection to become active and symptoms appear e.g syphilis, tuberculosis …

4. CLINICAL INFECTION

This is an infection that shows the clinical symptoms of the disease

I.5 PHASES OF AN INFECTIOUS ILLNESS EVOLUTION

Any disease evoluates into **five distinct phases**.The duration of each phase varies from one disease to another.

A. THE INCUBATION PHASE

This is the time between penetration of the pathogen in the body of the receptive and the onset of clinical signs of disease.

The penetration of the pathogen in a healthy organism will cause a series of events in the infected individual.

- The host will respond to the action of the germ by inflammatory reactions and stimulation of the immune defense system (antibody production).

The phase or the incubation period is characteristic for each disease. It is that in which the germ will grow, reproduce, produce toxin and acquire skills that will enable it to cause disease and show signs clinics.

The duration of the incubation period depends on:
-The amount of absorbed or inoculated germs
- The speed of propagation
- The distance between the gateway and the preferred site for the proliferation of germ

Diseases with shorter incubation period can spread faster and / or die out faster in the community. This is because,

*A lot of effort can be made to control the disease
*There can be development of immunity in the population
*The susceptible hosts can die away fast

B. INVASION PHASE

This is the stage of embryo transport after multiplication and reproduction at the site entrance via blood or lymph to the target organ of infection or spread throughout the body. The period of invasion is characterized by the appearance of non specific clinical signs , prodrome of fever, malaise, fatigue.

C. THE STATE PERIOD OR PHASE

This is the period of onset of specific clinical manifestations and disease-specific response to physiological and biological target organs caused by the pathogen. It was during this period that made the clinical diagnosis of the disease.

D. **DEFFERVESCENCE PHASE OR PERIOD**

This phase is the gradual reduction of the intensity of the disease and the gradual disappearance of clinical symptoms.

E. THE CONVALESCENT PHASE OR PERIOD

This phase is the restoration of function and morphology of organs.
No signs and symptoms of the disease.

I.6 CARRIER OF INFECTION

This is a person who contains (i.e harbours) and disseminates subclinical infections but the carrier individual doesn't show any clinical evidence or symptoms of the infection.

TYPES OF CARRIERS OF DISEASES

i. **Incubating carrier,** this is a person in the incubation period of a disease before clinical symptoms appear e.g HIV, Measles
ii. **Convalescent carrier,** this is a person who continue to harbour the infection after recovery from the disease (after disappearance of the clinical symptoms) e.g 3% of those no longer ill from typhoid remain carriers for 5 months (after recovery}, for shigellosis (bacillary dysentery} they can remain convalescent carriers for up 3 months.
iii. **Temporary carrier ,** this is a person remaining a carrier for less than 3 months
iv. **Chronic carrier,** this is a person remaining a carrier for three months or more
v. **Intermittent carrier,** this is a person from whom the infectious agent leaves the body at irregular intervals.

I.7 EPIDEMIOLOGY OF THE INFECTIOUS AND PARASITIC ILLNESSES

A. TRANSMISSION CYCLE OF AN INFECTIOUS AGENTS

The transmission cycle is the way an infectious agent grows, multiplies and spread. Usually humans are an integral part of the transmission cycle as well as being the main reservoir e.g in malaria or schistosomiasis.
Cows are reservoirs for brucellosis, dogs are reservoirs for rabies, the soil is a reservoir for a few infectious agents e.g tetanus

Three parts of the transmission cycle of an infectious agent include; Source of infection, transmission route and susceptible host.

1. SOURCES OF INFECTIOUS DISEASES:

-The sick person or healthy carriers
-Animals eg: rabies virus in dogs
-Soil: tetanus.
-Object from where the infectious agent comes from to the host e.g water, food, materials….
-Reservoirs of infection

2. TRANSMISSION ROUTE

This is the way the infectious agent is transferred from source (i.e person, animals, soil } to the susceptible host.
The main routes of transmission of communicable diseases are;

i. Direct contact (skin, mucous membrane or sexual} e.g syphilis, gonorrhea….
ii. Vector e.g malaria
iii. Faecal contamination of soil, food and water which is ingested. It is also called faecal- oral route e.g cholera, typhoid…
iv. Contact with animals and their products
v. Air (inhalation} e.g tuberculosis, measles,,,
vi. Transplacental (during pregnancy} e.g toxoplasmosis, syphilis
vii. Blood contact (injection, surgery, blood transfusion] e.g HIV,…

On the basis of routes of transmission, common communicable diseases can be conveniently classified as follow;

i. Waterwashed diseases e.g scabies
ii. Sexually transmitted diseases(STI] e.g gonorrhea, syphilis
iii. Waterborne disease e.g cholera
iv. Airborne diseases e.g meningitis
v. Vectorborne diseases e.g malaria
vi. Water based diseases e.g bilharzia

vii. Zoonotic diseases or Zoonoses; these are diseases that are transmitted to humans by animals e.g rabies, trypanosomiasis, anthrax…
viii. Faecal-oral diseases e.g ascariasis, staphylococcal food poisoning….

N.B; some diseases can be transmitted through more than one route. e.g
*Syphilis by sex or contact with infective clothes

3. SUSCEPTIBLE HOST

A susceptible host is an individual who has low resistance to the particular infection
Low resistance may be due to the fact that;
*The person has not been infected before by the infectious agent, and therefore doesn't have any immunity for it e.g measles
*If the person has not been actively immunized
*The person has another serious illness e.g AIDS at the same time , whereby such people have a high risk of developing other disease like Tuberculosis
*The body is malnourished thereby making the infectious worse.

B. MODE OF TRANSMISSION OF INFECTIOUS DISEASE

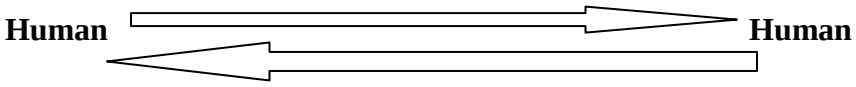
There are two modes of transmission;
- Direct transmission: there is immediate transfer of the agent from a reservoir to a susceptible host by direct contact or droplet spread.
Direct contact occurs through kissing, skin to skin contact, and sexual intercourse. Direct contact refers also to contact with soil, vegetation harboring infectious organisms. Thus , gonorrhea is spread from person to person by direct contact. Hookworm is spread by direct contact with contaminated soil.
Droplet spread refers to spray with aerosols produced by sneezing, coughing, or even talking.
Thus, direct transmission may be happen though direct contact and droplet spread
-Indirect transmission: in indirect transmission an agent is carried from a reservoir to a susceptible host by suspended air particles or by animate (**vector**} or inanimate (**vehicle}** intermediaries.
A vector; an insect in which the germ develops and undergoes transformations e.g arthropods such as mosquitoes, flies, ticks….
N.B. The vector may carry the agent through purely **mechanical means** e.g flies carry shigella and deposit the agent on the skin of a new host. In mechanical transmission, the agent doesn't multiply or undergoes physiologic changes in the vector.
A vehicle ; a support which carries mechanically an agent e.g water, food, hands , contaminated objects, biologic products(blood}, handkerchiefs,..
Thus, indirect transmission may be ; Airborne, Vehicleborne, Vectorborne, Mechanical indirect transmission
Airborne transmission is by particles that are suspended in air. Two types of those particles are dust and droplet nuclei(the residue of dried droplets} . The nuclei are less than 5 microns in size and may remain suspended in the air for long periods , may be brown over great distances, and are easily inhaled into the lungs and exhaled.

Tuberculosis, for example is believed to be transmitted more often indirectly , through droplet nuclei, than directly , through droplet spread.

C. CATEGORIES OF TRANSMISSION CYCLES

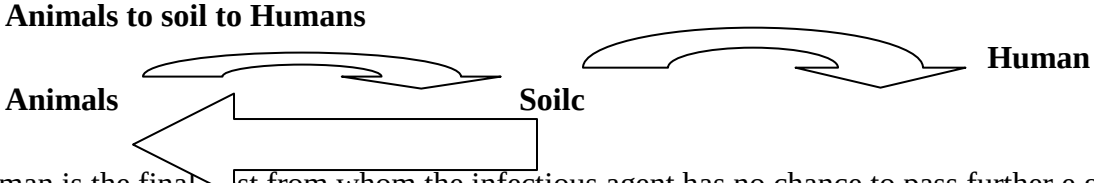
Transmission cycles can be generally be grouped into four categories;

a. Human to human transmission



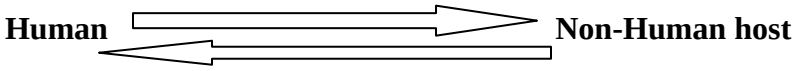
No host other than human is involved. Human is the obligate host.
Transmission is commonly direct but may be indirect through articles of various kinds which have been contaminated with infection
e.g Airborne diseases like measles, meningitis and mumps
Contact diseases like ringworm, candidiasis, scabies
Some faecal oral diseases like cholera,..

b. Animals to soil to Humans



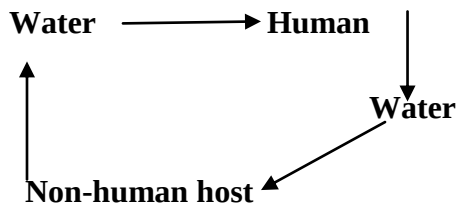
The human is the final host from whom the infectious agent has no chance to pass further e.g Tetanus

c. Human to non –Human host



There is one non-human host (e.g mosquitoes] involved in the transmission cycle of the infectious agent e.g malaria, trypanosomiasis, taeniasis

d. Human to more than one non-human host



This is the transmission in which part of the life cycle of the agent passes through one or more non human host (e.g snail} and water
e.g Schistosoma

D.CHAIN OF SPREAD OF COMMUNICABLE DISEASES

As described earlier, the epidemiologic triad illustrates that infectious diseases result from the interaction of the 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**

- **PORTAL OF EXIT**

It is the pathway by which an agent leaves the source host. The portal of exit usually corresponds to the site at which the agent is localized.
Thus, the tubercle bacilli and influenza viruses exit the **respiratory tract**, schistosomes through **urine**, cholera vibrios in **feces**, sarcoptes scabiei in **skin lesions.**
Some blood borne agents can exit by crossing the **placenta** (syphilis...], **blood-sucking arthropods** (malaria]

- **PORTAL OF ENTRY**

An agent enters a susceptible host through a portal of entry. Often, organisms use the same portal to enter a new host that they use to exit the source host. They are many such as'
*The skin and mucous membranes; cuts, natural orifices (skin hair, sebaceous glands,…] e.g staphylococcus
*Respiratory tract e.g meningococcus, tubercle bacilli,…
*Digestive tract e.g S.typhi, shigella, vibriocholera, poliomyelitis virus..
*Genital tract e.g STIs, post abortion septicemia, hepatitis B,..
*Accidental ways; during therapeutic maneuvers (injection with non sterile needles, transfusion, venous puncture, lack of asepsis,..

- **RESERVOIR**

The reservoir of an agent is the habitat in which an infectious agent normally lives, grows and multiplies and from which it can be transmitted to susceptible hosts.
Reservoirs include humans, animals and environment
The reservoir may or may not be the source from which an agent is transferred to a host.
Human reservoirs
Two types of human reservoir are;
-Persons with symptomatic illness

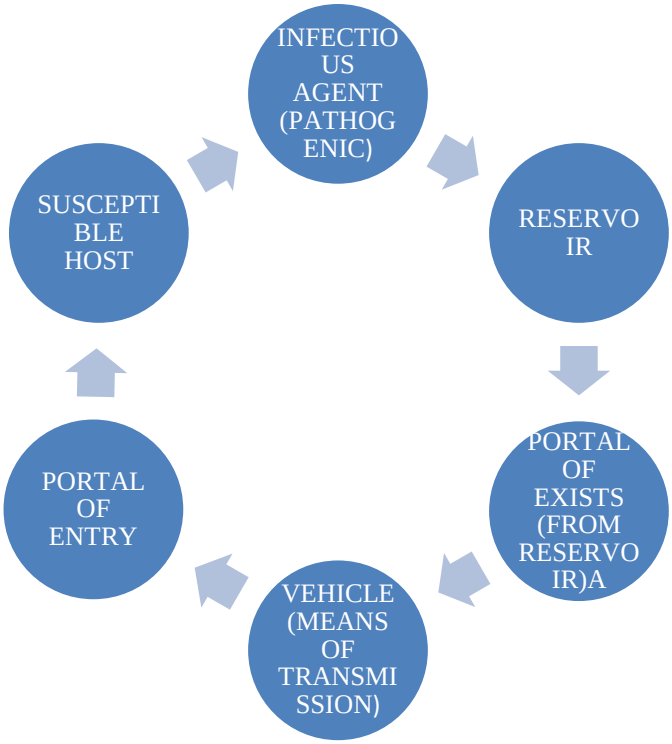
-Carriers

Animal reservoirs

- In case of zoonoses; diseases that are transmitted from animals to humans, reservoirs are; Cows and pigs for brucellosis, Sheep for anthrax, rodents for plague, dogs for rabies
- Another group of diseases with animal reservoirs are those caused by parasites that have complex life cycles, with different reservoirs at different stages of development such as malaria(requiring mosquitoes} and schistosomiasis (requiring fresh water snails}

Environmental reservoirs

- Plants, soil, and water in the environment are also reservoirs for some infectious agents. e.g Soil for hookworm, Legionnaires' bacillus live in pools of water
    - **SUSCEPTIBLE HOST:** is a organism in which a microorganism can enter and cause a disease.
    - **ETIOLOGY:** is a microorganism which can cause a diseas to a susceptibly host.
    - **MODE OF TRANSMISSION:** is the way in which the microorganism is transmitted from the reservoir to the susceptibly host.



I.8 DEFINITIONS OF SOME TERMINOLOGY

1. **ENDEMIC DISEASE**

This is a disease that causes almost a constant number of people to become sick all the time when there is balance between agent , host and environment e.g Malaria in an area where transmission is 6 months and above (i.e malaria is stable]

2. **EPIDEMIC DISEASE**

This is a disease that causes a larger number of cases of the disease(sick people} to occur than expected for a given time and place as a result of shifting the balance in favor of the disease agent e.g cholera, measles un rural areas, malaria in some places

3. **PANDEMIC DISEASE**

This is an epidemic which has become worldwide in distribution e.g HIV/ AIDS

4. **SPORADIC DISEASE**

This is a disease that has isolated (occasional} cases of the disease in various and scattered places

I.9 PRINCIPALS OF COMMUNICABLE DISEASE CONTROL

Control of communicable diseases is the management of communicable diseases involving both trying to protect the people from getting the disease(i.e prevention] and looking after those people who have the disease (i.e case management including treatment].

*Doing prevention alone or case management(e.g treatment} alone is doing half the job, and therefore prevention is done together with case management

*To be able to control a communicable disease, it is important to understand the factors which affect the balance between the host, the agent, and the environment and to know what can be done to disrupt(disturb} the balance in favour of control

Therefore control of communicable disease can be achieved as follows;

i. Attacking the source
ii. Interrupting the route of transmission
iii. Protecting the host

Table to show main methods of communicable disease control;

Attacking the source	**Interrupting transmission**	**Protecting the host**
-Treatment -Isolation /Quarantine -Reservoir control -Notification -Screening and Surveillance	-Environmental sanitation -Personal hygiene and behavior change -Vector control -Disinfection and Sterilization	-Immunization -Chemoprophylaxis -Personal protection -Better nutrition

1.ATTACKING THE SOURCE

a. Treatment

This is the use of drugs that destroys the infectious agent in the susceptible host(i.e people} so that fewer or none of such infected people are available to spread the infection to new hosts.
The effectiveness of the treatment as a control measure depends on;
*Coverage; How many cases can be reached in the country. The more cases are treated better.
*Whether the drug adversely affects the capacity of the infectious agent to reproduce. E.g Drugs like amodiaquine or sulfadoxine / pyrimethamine (SP|] which do not kill gametocytes of plasmodium are not adequate to be used alone in the control of malaria
*Subclinical cases and carriers must also be treated, after first actively screening for them in the community as they do not come for treatment because they are not ill. E.g cholera, ankylostomiasis, asymptomatic sexually transmitted diseases
*Where a high percentage of the population are known to have a disease, it is sometimes advisable to treat every body without checking whether individuals are infected or not. This is called **MASS TREATMENT** e.g in schistosomias control among school children mass treatment has been used.
N.B. Where malaria is endemic, it may not be advantageous to treat people who are not ill. This is because mild infections, which are subclinical, help to build the immunity in the person (except in infants < 12 months and pregnant women.

b. Isolation of cases

Isolation of persons with a disease is to keep them away such they do not come into close contact with other people except those who are providing care, in order to prevent the spread of the infectious agent.

- Isolation is used to control highly infectious and serious conditions causing high morbidity and mortality such as haemorrhagic viral fever e.g ebola fever
  N.B Measles is highly infectious before it erupts, but not very much so afterwards. So isolation is not of much use when the disease has shown signs and symptoms

  For isolation to be effective;

*It must be prompt(implemented as soon as possible}
*It needs to be conducted some distance away from homes e.g at hospital, or at erected (i.e built} structure(in rural areas}
*There should be disinfection of materials
* Destruction by fire of some temporary structures may be necessary at the end of isolation period
*Isolation should continue until a patient is no longer infective

Disadvantages of isolation

- It is difficult to enforce
- People are frightened of being isolated
- Fear of isolation stops people from coming for treatment
- Disease may spread further as people fail to come for treatment
-

Quarantine; this is the limiting of movement of apparently healthy persons (but who have been exposed to a communicable disease} for the length of time equal to the incubation period to prevent contact with those not yet exposed.

C.Reservoir control; it includes;
i. Mass treatment, or chemoprophylaxis or immunization of animals which are the main reservoirs e.g in Brucellosis caused by brucella species in cows, goats, sheep and pigs
Ii.Separating humans from animals
Iii.Killing the animals (i.e reservoirs} e.g rodents, dogs…
Iv.Killing infected animals used as source of food

d.Notification
This is the reporting of the number of some infectious diseases to appropriate authorities e.g to the District Medical Officer, so that the authorities can confirm the cases and take measures to prevent the spread of the disease
Notification must be done immediately and by the most rapid means possible e.g telephone, fax, e-mail, radio,
The notifiable diseases may differ from country to country
Notified diseases in Rwanda to be reported every two weeks include; cholera, Meningococcal meningitis, measles, flaccid paralysis, neonatal tetanus, ebola, rabies, blood diarrhea, non bloody diarrhea, clinical malaria and confirmed malaria
Some diseases that spread so quickly require international control measures. Such diseases are reported by the authorities (e.g Ministry of Health} to the WHO

e.Surveillance
This is a routine system of reporting diseases in community about disease occurrence and spread
Disease surveillance uses two main types of data collection methods;

a. **Routine reporting**

* The type of information is collected on ILLNESS by health workers of a health unit in a given area
*The number of cases of communicable diseases that occur in the area is recorded and compiled according to diseases

*The report is sent to the District Medical officer at the end of every month
*Therefore, dispensaries and health centers are the basics units in routine reporting
*At the end of the month, health workers should compare the number of cases seen this month with those seen in previous months
* If abnormal (unusual} increase in the number of cases are seen, this situation should serve as an early warning of an outbreaks (i.e epidemic} of that particular disease

Limitation of routine reporting

i. Not all cases come for treatment to health facilities
ii. Some health facilities are more attended than others
iii. Not all health facilities may report cases regularly, and some may report inconsistently

b. **Sentinel reporting**

***** It involves only a few selected health facilities in reporting e.g 10% of health facilities in a district
*It shows whether routine reporting is done well or not
N.B Staff in sentinel sites are usually more motivated facilitated

Limitations of sentinel reporting

i. The report doesn't include actual cases attending in all health units
ii. Therefore information may be of limited use at higher levels(i.e beyond areas of concern}

Two other methods of data collection are;

c. **Case / outbreak investigation**; this is a follow up of suspected cases as already described
d. **Special studies**; these are studies conducted by trained health staff, investigators (researchers} or epidemiologists
They are used to measure the number of cases of disease in an area and to evaluate the reliability of routine reporting or sentinel reporting e.g household morbidity and mortality surveys

f.Screening

This is the identification of people who appear healthy but have infection or disease in community
There are different types of screening;

i. **Mass screening**; involves the screen of whole population
ii. **Multiple or multiphasic screening;** involves the use of various screening tests on the same occasion

iii. **Targeted screening;** involves screening groups of people with specific exposures e.g for schistosomiasis in school children who like to swim in water bodies, for smokers, sex workers…

iv. **Case- finding or opportunistic screening**; this involves and is restricted to patients who visit a healthy facility for some other health matters (affairs} e.g screening pregnant women attending antenatal for HIV, Syphilis…

1. INTERRUPTING TRANSMISSION

a. Environmental sanitation ; environmental sanitation is;

- The promotion of hygiene and the prevention of disease and other conditions of ill health related to environmental influencing factors
  Activities of environmental sanitation include;

i. **Management of environmental factors** directly affecting the infectious agent and transmission of disease through;
-Disposal of human and animal excreta
-Solid waste management
-Water drainage to control disease vectors
-Domestic water supply (adequate and safe}
-Housing (building must provide adequate space, ventilation,..}

ii. Sanitation **behavior (practices] ;** these sanitation practices include;
-Personal hygiene e.g washing, dressing, eating,
-Household cleanliness e.g kitchen, bathroom cleanliness, ..
-Community cleanliness e.g waste collection from public places

b**. Vector control, intermediate host (e.g snail} control and rodent control**
This is the control of organisms such as arthropods, snails and rodents that are involved in the transmission of diseases by killing them
This includes;
-Using chemical such as insecticides like DDT, Molluscicides to kill snail intermediate hosts e.g Niclosamide, Rodenticides to kill rodents e.g warfarin, zinc phosphide,,,
-Environmental modification

c. Disinfection and sterilization
These are methods used to destroy organisms that cause disease when they are in the environment, in order to make any substance or object non infective.
Sterilization; kills both the vegetative form and spore form of the disease agents and leaves the article (object} free of them
Disinfection; this destroys the vegetative forms of the disease causing agents but not the spores

2. **PROTECTING THE HOST**

a. **Immunization;** is the process of inducing immunity in the human body through vaccination

It is one of the most effective methods of control for some communicable diseases. Some communicable diseases in Africa that can be controlled through immunization include measles, poliomyelitis, whooping cough, diphtheria, tuberculosis and tetanus

b. **Chemoprophylaxis**

This is the use of drugs to suppress on infection (i.e not to show clinical symptoms} or to prevent infection

i. **Mass chemotherapy;** treating everybody in the community e.g in the control of Oncocerciasis with Ivermectin

ii. **Selective population chemotherapy;** treat infected ones as shown by surveys

iii. **Targeted chemotherapy;** targeting certain groups of the population infected or not due to their behavior or occupation (high risk groups}

c. **Personal protection**

This is the use of barriers to prevent agents of disease from entering the human body

e.g Shoes against hookworms from the soil

Bednets to prevent mosquito bites

Condoms (in STI and HIV]

Health education to the community and individuals

d. **Better nutrition;** improved nutrition especially for children and very old people reduces infection and severity of infection

I.10 APPLICATION OF COMMUNITY CONTROL MEASURES AGAINST COMMUNICABLE DISEASES

Application of community control measures against communicable diseases can be done at three levels as follow;

1. Individual level and village levels
2. Dispensaries and health centers levels
3. District and other higher levels

1. Individuals and villages levels

Individuals and groups of people at village level are responsible for;

i. Completing immunization

ii. Personal, household and food hygiene

iii. Protective barriers; shoes, bednets,…

iv. Chemoprophylaxis e.g for malaria, intestinal parasites .

v. Avoiding unprotected sexual contacts, using condoms
vi. Protecting of water supplies and boiling or filtering water
vii. Building and using latrines
viii. Rubbish collection and disposal
ix. Vector control; clearing the surroundings, drainage
x. Avoiding bilharzias infested water
xi. Eliminating rats and bedbugs and lice

2. Health centres and Dispensaries

Health centres and Dispensary staff also get help from the District Health Management teams in order to ensure

i. Support and encourage community based disease control programmes
ii. Increase immunization coverage
iii. Reservoir control
iv. Larviciding , molluscicide
v. Water protection and purification
vi. Inspection of food supplies, markets and shoaps
vii. Sanitary control of public toilets
viii. Information, education and communication on health promotion and disease prevention
ix. Notifying diseases

3. District, Regional and Central Ministry services

Staff of these higher levels is responsible for;

i. Mass immunization campaigns
ii. Mass chemotherapy
iii. Vector control schemes (programmes]
iv. Mass media information (programmes]
v. Health legislation
vi. Research into control methods
vii. Famine relief/ refugee camps services
viii. Emergency epidemiolology and control teams
ix. Continuing education of staff

I.11 PROCEDURE FOR INVESTIGATION, MANAGEMENT AND CONTROL OF EPIDEMICS

Investigation, management and control activities are carried out immediately and concurrently (at the same time] as soon as an outbreak is reported
The investigation team must be formed to work together and should consult higher authorities/ experts on major findings and strategies to be taken
The team must include a clinician, a laboratory technologist, a public health expert and nurses

- The team should carry out the following 10 main activities which are also the purpose of the investigation , management and control of the epidemic

1. Verify (confirm} that the outbreaks is present through a population. Communication with local people and medical staff, b. Checking medical records and laboratory results in health facilities
2. Confirm the nature of the disease through data detailed examination of affected individuals
3. Manage all cases according to standard treatment guidelines and as close to the site of outbreaks as possible. **DO NOT REFER PATIENTS**
4. Determine the extent of the outbreak(i.e how big the outbreak is}
   Find out the numbers of patients affected and then specific population groups affected (e.g age groups, sex, occupation}
5. Determine the source and mode of transmission of disease through examination of contacts (people close to the sick]
6. Determine areas and persons at risks
7. Control the epidemic by using appropriate strategies e.g cleaning and protecting sources of water, improving sanitation, treating contacts, immunization, public health education
8. Communicate with the community and authorities about the results of the investigation and control measures
9. Educate the community and train health workers to prevent future outbreaks and to ensure a rapid appropriate response in the future
10. Continue with surveillance (i.e monitoring of disease] after the epidemic has been controlled, in order to monitor the level of the disease in the population, and detect a rise in the number of cases as early as possible

Although disease control includes both disease prevention and case management, the concept of prevention of disease is sometimes used to mean disease control at different levels. Then, the following are the 4 levels of prevention of disease;

1. **PRIMORDIAL PREVENTION;**

The aim of primordial prevention is to avoid the emergence and establishment of risky social, economic and cultural patterns that contribute to an elevated risk of disease.
Strong political will is needed to put in place primordial preventive measures such as;

- Avoidance of unhealthy lifestyles
- Prohibiting promotion of smoking/ alcohol

- Appropriate nutrition and food policies
- Prohibiting loud music in public places
- Formulation and enforcement of traffic rules

2. PRIMARY PREVENTION

The purpose of this level is to limit the incidence of disease by controlling known causes and risk factors e.g

- Use condoms in the prevention of HIV/AIDS
- Education programs to communities on HIV transmission and prevention
- Immunization
- Chemoprophylaxis
- Personal hygiene
- Personal protection
- Child spacing
- Environmental control;
  -Water and food hygiene
  -Excreta and rubbish disposal
  -Disinfection and sterilization
  -Vector and reservoir control
  -Living and working condition
  -Health education

3. SECONDARY PREVENTION

This level aims at curing patients and reducing the serious consequences of disease through early treatment and diagnosis.It aims at reducing the prevalence of disease e.g of secondary prevention measures are;

- BP measurement and treatment of hypertension among middle aged and elderly persons
- Testing for hearing loss and advice concerning protection against noise in industrial workers
- Skin testing and chest X-Rays for diagnosis TB and subsequent treatment
- Surveillance

3. TERTIARY PREVENTION

This level aims at reducing the progress or complications of established disease (therapeutic and rehabilitation medicine}
It consists of measures intended to;
-Reduce impairments and disabilities
-Minimize suffering
-Promote patient's adjustment to incurable conditions
e.g Rehabilitation of patient with poliomyelitis, blindness, TB….

I.12 RESISTANCE TO INFECTIOUS DISEASES (IMMUNITY]

Resistance to infectious disease is called immunity. Humans have or can develop immunity to some diseases.

IMMUNITY; is a biological term that describes a state of having sufficient biological defenses to avoid infection, disease, or other unwanted biological invasion.

Immunity involves both **specific** and **non specific** immunity

NON -SPECIFIC IMMUNITY; act either as **barriers** or as **eliminators** of wide range of pathogens irrespective of antigenic specificity (no antigen-antibody reaction]

e.g ***skin barriers and mucosal immunity;** the skin can not be penetrated by most organisms unless it already has an opening such as a scratch or a cut

Mechanically, pathogens are expelled from the lungs by ciliary action, coughing and sneezing eject both living and non living things from the respiratory system, tears, saliva and urine also force out pathogens

Sticky mucus in respiratory tract traps many microorganisms

Acid Ph <7.0 of skin secretions inhibits bacterial growth

Hair follicles secrete sebum that contains **lactic acid** and **fatty acids** both of which inhibit the growth of some pathogenic bacteria and fungi. This is the reason why areas of the skin not covered with hair, such as the palms and soles of the feet, are most susceptible to fungal infections e.g **athlete foot.**

Saliva, tears, nasal secretions and perspiration contain **lysozyme** , an enzyme that destroys gram positive bacterial cell walls causing cell lysis

Spermine and **zinc** in semen destroy some pathogens

Lactoperoxidase is a powerful enzyme found in mother's milk.

SPECIFIC IMMUNITY; There is antigen-antibody reaction.

1. CLASSIFICATION OF IMMUNITY

A. PASSIVE IMMUNITY;

Passive immunity is the transfer of active immunity in the form of readymade antibodies, from one individual to another. It can occur;

-**Naturally**; when maternal antibodies are transferred to the fetus through the placenta

-**Artificially**; when high levels of human antibodies specific for a pathogen or toxin are transferred to non-immune individuals

Passive immunization is used when there is a high risk of infection and insufficient time for the body to develop its own immune response, or to reduce the symptoms of ongoing or immunosuppressive diseases.

Passive immunity provides **immediate protection**, but the body doesn't develop **memory**, therefore the patient is at risk of being infected by the same pathogen later.

- **Naturally acquired passive immunity**

Maternal antibodies are passed through the placenta to the fetus by a receptor on placental cells. Thus occurs around the third month of gestation. **IgG** is the only antibody that can pass through the placenta.
This immunity can also be provided through the transfer of **IgA** antibodies found in breast milk that are transferred to the gut of the infant, protecting against bacterial infections until the new borne can synthesize its own antibodies.

- **Artificially acquired passive immunity**

It is a short term immunization induced by the transfer of antibodies, which can be administered in several forms, as human or animal blood plasma for intravenous or intramuscular use. Passive transfer is used prophylactically in immunodeficiency diseases, in the treatment of acute infections.
The artificial induction of passive immunity has been used for over a century to treat infectious disease, and prior to the advent of antibiotics, was often the only specific treatment for certain infections e.g immunoglobulin therapy in the treatment of severe respiratory diseases.

B. ACTIVE IMMUNITY

Active immunity is induced in the host itself by an antigen.
Due to the formation of immunological memory, re-infection at later time points leads to a rapid increase in antibody production.
When B cells and T cells are activated by a pathogen, memory B-cells and T-cells develop. These memory cells will remember each specific pathogen encountered, and be able to mount a strong response if the the pathogen is detected again.

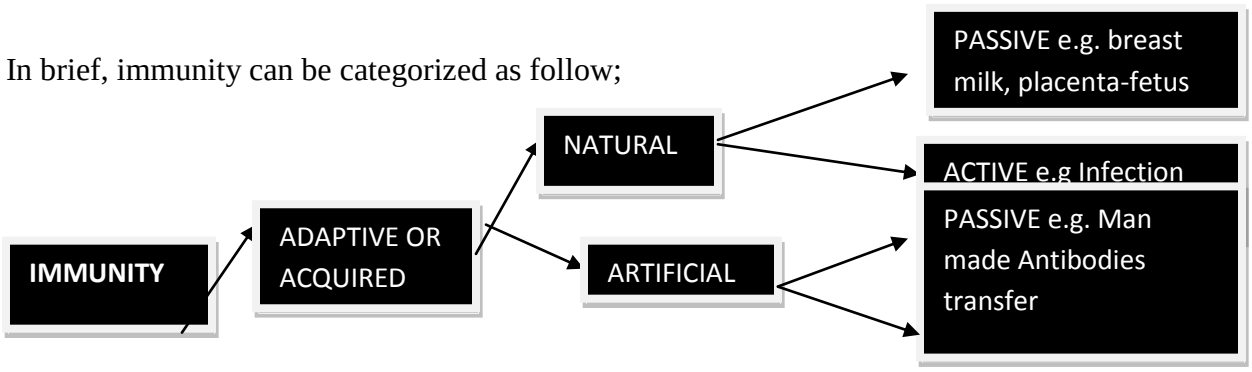
- **Naturally acquired active immunity**

It occurs when a person is exposed to a live pathogen, and develops a primary immune response, which leads to immunological memory. This type of immunity is natural because it is not induced by man.

- **Artificially acquired active immunity**

It can be induced by a vaccine or a substance that contains antigen
A vaccine stimulates a primary response against an antigen without causing symptoms of the disease.

In brief, immunity can be categorized as follow;



TYPES OF VACCINES

***Inactivated vaccines;** are composed of microorganisms that have been killed with chemicals and/ or heat and are no longer infectious.

E.g Vaccines against flu, cholera, hepatitis A

Most vaccines of this type are likely to require booster shots (rappel]

***Live, attenuated vaccines;** are composed of microorganisms that have been cultivated under conditions which disable their ability to induce disease

These response are more durable and do not generally require booster shots.

E.g vaccines against yellow fever, measles,polio, rubella and mumps

***Toxoids;** are inactivated toxic compounds from micro organisms in cases where these (rather than the microorganism itself} cause illness.

E.g Vaccines against tetanus, diphtheria

***Subunit;** vaccines are composed of small fragments of disease causing organisms

E.g Subunit vaccine against hepatitis B virus

CALENDAR FOR VACCINATION OF INFANTS IN RWANDA

AGE	VACCINE	DOSE/ ROUTE
At birth	BCG	0.05ML/ ID
	POLIO	2 drops/ ORAL
6weeks (1.5 months}	POLIO	2 drops/ ORAL
	DPT, Hib+HepB, PCV7	0.5ML/ IM on the thigh
10 weeks(2.5 months]	POLIO	2 drops/ ORAL
	DPT, Hib+HepB, PCV7	0.5ML/ IM on the thigh
14 weeks (3.5 months]	POLIO	2 drops/ ORAL
	DPT, Hib+HepB, PCV7	0.5ML/ IM on the thigh
9 months	Measles	0.5 ML/ S/C

BCG; Bacille de Calmette et Guerin], for tuberculosis

D; Diphtheria, P; Pertussis (Whooping cough] , T; Tetanus,

Hib; Hemophilis influenza b(Meningitis}, Hep B; Hepatitis B

PCV7; Pneumococcal Vaccine (Pneumonia]

CALENDAR FOR VACCINATION OF WOMEN OF REPRODUCTIVE AGE AGAINST TETANUS

VACCINE	TIME OF VACCINATION	PROTECTION PERIOD
ATV1	First contact	unknown
ATV2	1month afterATV1	1years
ATV3	6 months after ATV2	5 years
ATV 4	1 year after ATV 3	10 years
ATV 5	1 year after ATV 4	Life

ATV; Antitetanus Vaccine Route; IM Dose; 0.5 ML

I.13 SYMPTOMATOLOGY OF INFECTION; INFECTIOUS SYNDROME

In case of infection, different symptoms may occur;
-Fever; the more frequent symptom
-Chills
-Sweating
-Malaise, Asthenia, Headache, Anorexia
-Thirst
-Delirium for adult and convulsion for children
-Rapid pulse
-Rapid respiratory rate (polypnea)
-Decreased diuresis (oliguria) and concentrated urine
-Digestive signs; vomiting, diarrhea…
N.B. *In certain infections, there isn't fever. E.g. Syphilis, Cholera… (In this case the client may even have hypothermia)

* In addition, they are some non infectious diseases with fever; e.g. Cancer …

I.14 INFLAMMATION

- It is the response of the living tissue to mild to moderate irritant (Bacteria, virus, fungi, parasite, injury, burn,chemicals...)
- The response is directed to defend the tissue for foreign irritants and to prevent further damage
- The aim is to bring more blood to the damaged area by acceleration of the blood stream

It is denoted by the suffix **"itis"**

EXUDATE

- An **exudate** is any fluid that filters from the circulatory system into lesions or areas of inflammation
- Its composition varies but generally includes water and the dissolved solutes of the blood, some or all plasma proteins, white blood cells, platelets and RBC

TYPES OF EXUDATE

- **Serous** exudate is usually seen in mild inflammation, with little protein content. seen in certain disease states like tuberculosis
- **Purulent** or **suppurative** exudate consists of plasma with both active and dead neutrophils, fibrinogen, and necrotic parenchymal cells. referred to as pus.
- **Fibrinous** exudate is composed mainly of fibrinogen and fibrin. It is characteristic of **rheumatic carditis**, but is seen in all severe injuries such as strep throat and bacterial pneumonia
- **Hemorrhagic** exudate is seen in injury that causes rupture of blood vessels.
- **Pleural**.
- **Catarrhal** exudate is seen in the nose and throat and is characterized by a high content of mucus.

TRANSUDATE

- A fluid that passes through a membrane which filters out much of the protein and cellular elements to yield a watery solution.
- A transudate is due to increased pressure in the veins and capillaries ,pressure forcing fluid through the vessel walls or low levels of protein from the blood serum
- The transudated fluid accumulates in tissues outside the blood vessels and can cause edema

Difference between exudates and transudate

	EXUDATE	TRANSUDATE
Cause	Inflammation	Venous congestion
Protein	High above 4mg/m3	Normal
Fibrin	Increased	Normal
Appearance	Turbid	Clear
Fibrin clot	Positive	Negative
RBC and WBC	Increased	Poor

- **Effects of inflammation**
    1. Vascular phenomena
        1. Transient vasoconstriction rapidly followed by
        2. Vasodilatation
        3. Stasis
        4. Migration of leucocytes

2- Exudative stress

- Emigration of leukocytes

- Inflammation fluid exudate

- Composition and function of inflammation fluid exudates
  - Fluid exudates
    - Dilution of bacterial toxins
    - fibrin threads : help the movement of leucocytes and limit the spread of infection

    Also contain antibodies

  - Cellular part
    - **Phagocytosis:** engulfing of and destruction of bacteria and necrotic tissue by phagocytes
  - **Chemotaxis:** the movment of WBC in the area of inflammation towards the irritant
  - **Emigration of leukocytes:** the migration of WBC from within the blood vessel towards the inflammation site
  - **Diapedesis**: the passage and movment of RBC from within the blood vessel towards the inflamed area

CARDINAL SIGNS OF INFLAMMATION;

- **Redness;** Caused by dilation of arterioles/ increased blood flow
- **Heat;** Increased chemical activity & increased blood flow to skin surface
- **Swelling (edema)** due to inflammatory exudate
- **Pain:** due to pressure of edema on nerves and irritation of nerve ends by Chemical irritants – bradykinin, histamine, prostaglandin or by direct injury to nerve fibers.

In brief; **INFLAMMATION RESPONSE** happens as follow

When there is entry of infectious agent, the organism sends the messengers of inflammation (Prostaglandin, Histamine, Bradykinin, and Serotonin) at the inflammation site. These chemicals are the vasodilators and cause the dilation of vessels at the inflammation site. Due to the vasodilatation, there is increased capillaries permeability and increased blood flow to that area. This increased blood flow causes the **redness** at the inflammation site. Then, there is a shifting of fluid or exudate (water and the dissolved solutes of the blood, some or all plasma proteins, white blood cells, platelets and RBC) from circulatory system into areas of inflammation(interstitial tissue). This response is directed to defend the tissue for foreign irritants and to prevent further damage. The accumulation of fluid (inflammatory exudates) in interstitial tissue causes the **swelling or edema** at that area. The **pain** is caused by the edema that exerts a pressure on the nerve endings and also due to chemical irritants (bradykinin, histamine, prostaglandin and

serotonin) on nerve endings. The **Heat** is due to increased chemical activity & increased blood flow to skin surface.

I.15 CLASSIFICATION OF INFECTIOUS DISEASES

The classification of infectious disease is characterized by the causative organism. Then There Are:

1. **BACTERIAL DISEASES**
   - **Gram-positive**

   E.g. Staphylococcus, streptococcus, listeria, bacillus..
   - **Gram-negative bacteria**

   E.g. Neisseria, vibrio, haemophilus, brucella, salmonella, shigella, Pseudomonas…

2. **VIRAL DISEASES**

-**DNA viruses**: e.g. Herpes zoster virus, cytomegalovirus, hepatitis B Virus…

- **RNA viruses**: e.g Influenza virus, polyovirus, retrovirus (HIV), Hepatitis virus A, C, D, Rhabdovirus, ebola virus…

-**Enveloped vs. Non-Enveloped**

3. **FUNGAL DISEASES**

- Disseminated Fungi
- Localized fungi

4. **PARASITIC DISEASES**

Include **METAZOA** and **PROTOZOA**

I. PROTOZOA

1. RHIZOFLAGELLA

-Flagella: *Trichomonas, Trypanosome, Giardia*

-Rhizopodes: *Entamoeba*

2. CILIA

-*Balantidium coli*

3. SPOROZOA

-*Plasmodium*

II. METAZOA

1. NEMATHELMINTHES

-Nemathodes: *Ascaris, Trichocephalus, Anguillule, Ancylostoma*

2. PLANTHELMINTHES

-Cestodes: *Tapeworm (taenia)*
-Trematodes: *Schistosomas*