EPIDEMIOLOGY

Teresia Wamuyu Maina

BSc, MPH, PGD

Introduction

- Epidemiology is the basic science of preventive and social medicine.
- Epidemiology is derived from the word epidemic **(epi=among; demos=people; logos=study)**, which is a very old word dating back to 3 rd century B.C.
- Epidemiology has grown rapidly during the past three decades and has now become firmly established in medical education.

DEFINITION

- Epidemiology has been defined by John M. Last in 1988 as
- "The study of the distribution and determinants of health –related states or events in specified populations, and the application of this study to the control of health problems."

CONCEPT OF EPIDEMIOLOGY

- The concept of epidemiology compasses three components

1. **Disease frequency**

Measurement of frequency of disease, disability or death, and summarizing this information in the form of rates and ratios (e.g. prevalence rate, incidence rate, death rate, etc) thus the basic measure of disease frequency is rates or ratio.

CONCEPT OF EPIDEMIOLOGY

Disease frequency

- These rates are essential for comparing disease frequency in different populations or subgroups of the same population in relation to suspected causal factors. Such comparisons may yield important clues to disease etiology.
- Epidemiology is also concerned with the measurement of health-related events and states in the community (e.g., health needs, demands, activities, tasks, health care utilization) and variables such as blood pressure, serum cholesterol, height, weight, etc.

CONCEPT OF EPIDEMIOLOGY

2. **Distribution of disease**

An important function of epidemiology is to study the distribution patterns in various subgroups of the population by time, place, and person. That is, the epidemiologist examines whether there has been an increase or decrease of disease over time span;

- whether there is a higher concentration of disease in one geographic area than others
- whether the disease occurs more often in men or in a particular age-group, and whether most characteristics or behaviour of those affected are different from those not affected.

CONCEPT OF EPIDEMIOLOGY

3. **Determinants of disease**

A unique feature of epidemiology is to test etiological hypotheses and identify the underlying causes or risk factors of disease.

AIMS OF EPIDEMIOLOGY

According to the International Epidemiological Association (IEA), epidemiology has three main aims:

- To describe the distribution and magnitude of health and disease problems in human populations (descriptive studies)
- To identify etiological factors (risk factors)in the pathogenesis of disease; and(analytical studies)
- To provide the data essential to the planning, implementation and evaluation of services for the prevention, control and treatment of disease and to setting up of priorities among those services.

AIMS OF EPIDEMIOLOGY

The ultimate aim of epidemiology is to lead to effective action:

a. To eliminate or reduce the health problem or its consequences; and

b. To promote the health and well-being of society as a whole.

USES OF EPIDEMIOLOGY

- To study historically the rise and fall of disease in the population
  - ✓ It is well known that the health and disease pattern in a community is never constant .
  - ✓ There are fluctuations both over short and long periods of time.
  - ✓ Epidemiology provides a means to study disease profiles and time trends in human population.
  - ✓ By a study of these trends we can make useful projections into the future and identify emerging health problems and their correlates
- Community diagnosis

✓ Community diagnosis generally refers to the identification and quantification of health problems in a community in terms of mortality and morbidity rates and ratios.

✓ It helps to identify individuals or groups at risk or those who are in need of health care

USES OF EPIDEMIOLOGY

- Planning and evaluation
  - ✓ Epidemiological information about the distribution of health problems over a period of time and place provides the fundamental basis for planning and developing the needed health services and for assessing the impact of these services on the people's problems
  - ✓ Evaluation is an equally important concern of epidemiology .
  - ✓ Any measures taken to control or prevent a disease must be followed by an evaluation to find out whether the measures undertaken are effective in reducing the frequency of the disease.
- Evaluation of individuals risks and chances
  - ✓ One of the important tasks of epidemiologists is to make a statement about the degree of risk in a population

USES OF EPIDEMIOLOGY

- Completing the natural history of disease
  - ✓ Epidemiology is concerned with the entire spectrum of disease in the population.
  - ✓ The epidemiologist by studying disease patterns in the community in relation to agent, host and environmental factors is in a better position to fill up the gaps in the natural history of disease than a clinician.
- Searching for causes and risk factors
  - ✓ Epidemiology helps to identify the causes and risk factors of diseases.

TERMINOLOGIES USED IN EPIDEMIOLOGY

- INFECTION; The entry and development or multiplication of an infectious agent in the body of man or animals

- CONTAMINATION: The presence of an infectious agent on a body surface; also on or in clothes, beddings, toys, surgical instruments or dressings or substances including water, milk and food.

- INFESTATION: Infested articles or premises are those, which harbor or give shelter to animal forms, especially arthropods and rodents.

TERMINOLOGIES USED IN EPIDEMIOLOGY

- HOST: A person or other animal, including birds and arthropods, that affords subsistence or lodgment to an infectious agent under natural conditions.

- INFECTIOUS DISEASE: A clinically manifest disease of man or animals resulting from an infection.

- CONTAGIOUS DISEASE: A disease that is transmitted through contact. Examples-scabies, trachoma, leprosy STD

TERMINOLOGIES USED IN EPIDEMIOLOGY

- COMMUNICABLE DISEASE: An illness due to a specific infectious agent or its toxic products capable of being directly or indirectly transmitted from man to man, animal to animal, or from the environment (air, dust, soil, water, food) to man or animal

- EPIDEMIC: A widespread occurrence of an infectious disease in a community at a particular time.

- ENDEMIC: It refers to the constant presence of a disease or infectious agent within a given geographic area or population group, without importation from outside; may also refer to the "usual" or expected frequency of the disease within such area or population group. For example common cold is endemic because somebody always has one.

TERMINOLOGIES USED IN EPIDEMIOLOGY

- SPORADIC: The word sporadic means scattered about. The cases occur irregularly haphazardly from time to time, and generally in frequently. the cases are few and separated widely in space and time that they show little or no connection with each other, nor a recognizable common source of infection. e.g. polio, tetanus, herpes zoster.

TERMINOLOGIES USED IN EPIDEMIOLOGY

- PANDEMIC: 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 of 1918 and 1957 and COVID 19

- EXOTIC: Diseases which are imported into the country in which they do not otherwise occur, as for example, rabies in UK.

TERMINOLOGIES USED IN EPIDEMIOLOGY

- ZOONOSIS: An infection or infectious disease transmissible under natural conditions from vertebrate animals to man. May be enzootic or epizootic-e.g.rabies, plague.bovine tuberculosis, anthrax, brucellosis, salmonellosis, etc.

- EPIZOOTIC: An outbreak (epidemic) of disease in an animal population e.g.anthrax, influenza, rabies.

TERMINOLOGIES USED IN EPIDEMIOLOGY

- EPORNITHIC: An outbreak (epidemic) of disease in a bird population
- ENZOOTIC: An endemic occurring in animals e.g., anthrax, rabies
- NOSOCOMIAL INFECTION: - Nosocomial infection is an infection originating in a patient while in a hospital or other health care facility. It denotes new disorder associated with being in a hospital.

TERMINOLOGIES USED IN EPIDEMIOLOGY

- OPPORTUNISTIC INFECTION: This infection by an organisms that takes the opportunity provided by a defect in host defense to infect the host and hence cause disease. the organisms include herpes simplex,cytomegalovirus

- IATROGENIC INFECTION: Any untoward or adverse consequence of a preventive, diagnostic or therapeutic regimen or procedure, that causes, handicap, disability or death resulting from a physician's professional activity or from the professional activity of other health professionals.

TERMINOLOGIES USED IN EPIDEMIOLOGY

- SURVEILLANCE: Surveillance has been defined as “the continuous scrutiny of the factors that determine the occurrence and distribution of disease and other conditions of ill health.

- ERADICATION: Termination of all transmission of infection by extermination of the infectious agent through surveillance and containment. Eradication is an absolute process, an “all or none” phenomenon, restricted to termination of an infection from the whole world. It implies that disease will no longer occur in a population

TERMINOLOGIES USED IN EPIDEMIOLOGY

- PREVALENCE: The proportion of a population with a disease or a particular condition at a specific point in time (point prevalence) or over a specified period of time (period prevalence
- INCIDENCE: The occurrence of new cases of disease or injury in a population over a specified period of time
- AGENT: A causative factor either biological or chemical that must be present (or absent) in the environment for disease occurrence in a susceptible host.
- SUSCEPTIBLE HOST: Individuals who are likely to develop a communicable disease after exposure to the infectious agents
- RESERVOUR: The habitat in which the agent normally lives, grows, and multiplies. Reservoirs include humans, animals, and the environment.

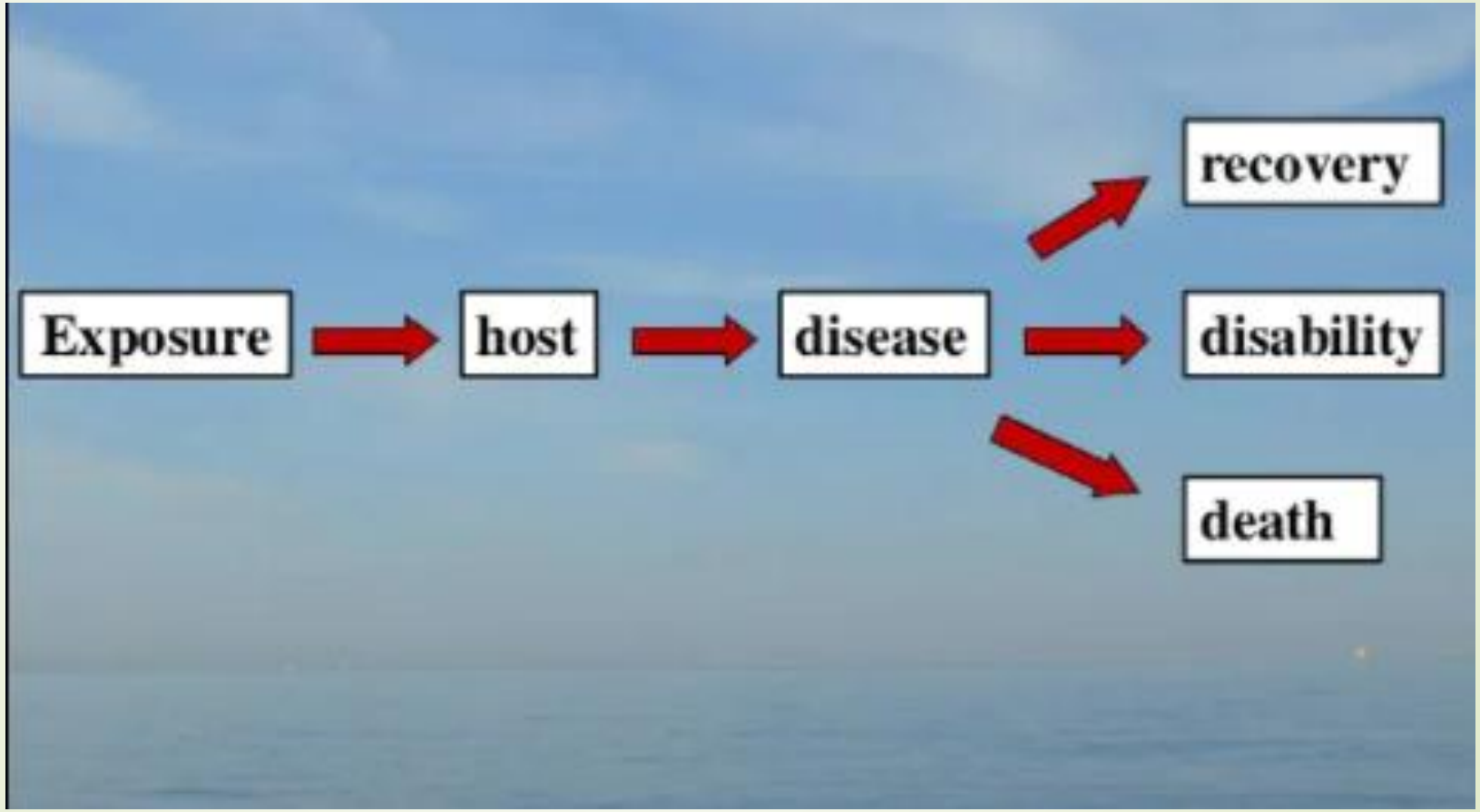
ACHIEVEMENTS IN EPIDEMIOLOGY

1. Vaccination
2. Motor-vehicle safety
3. Safer workplaces
4. Control of infectious diseases
5. Decline in deaths from coronary heart disease and stroke
6. Safer and healthier foods
7. Healthier mothers and babies
8. Family planning
9. Fluoridation of drinking water
10. Recognition of tobacco use as a health hazard

NATURAL HISTORY OF DISEASE

- Natural history of disease refers to the progress of a disease process in an individual over time, in the absence of intervention.
- The process begins with exposure to or accumulation of factors capable of causing disease.
- Without medical intervention, the process ends with
  - recovery ,
  - disability,
  - or death.

NATURAL HISTORY OF DISEASE



NATURAL HISTORY OF DISEASE

- Knowledge of the natural history of disease ranks alongside causal understanding in importance for disease prevention and control.
- Natural history of disease is one of the major elements of descriptive epidemiology.
- The natural history of disease is best established by cohort studies.
- As these studies are costly and laborious, understanding of the natural history of disease is largely based on other epidemiological studies, such as cross-sectional and retrospective studies, undertaken in different population settings

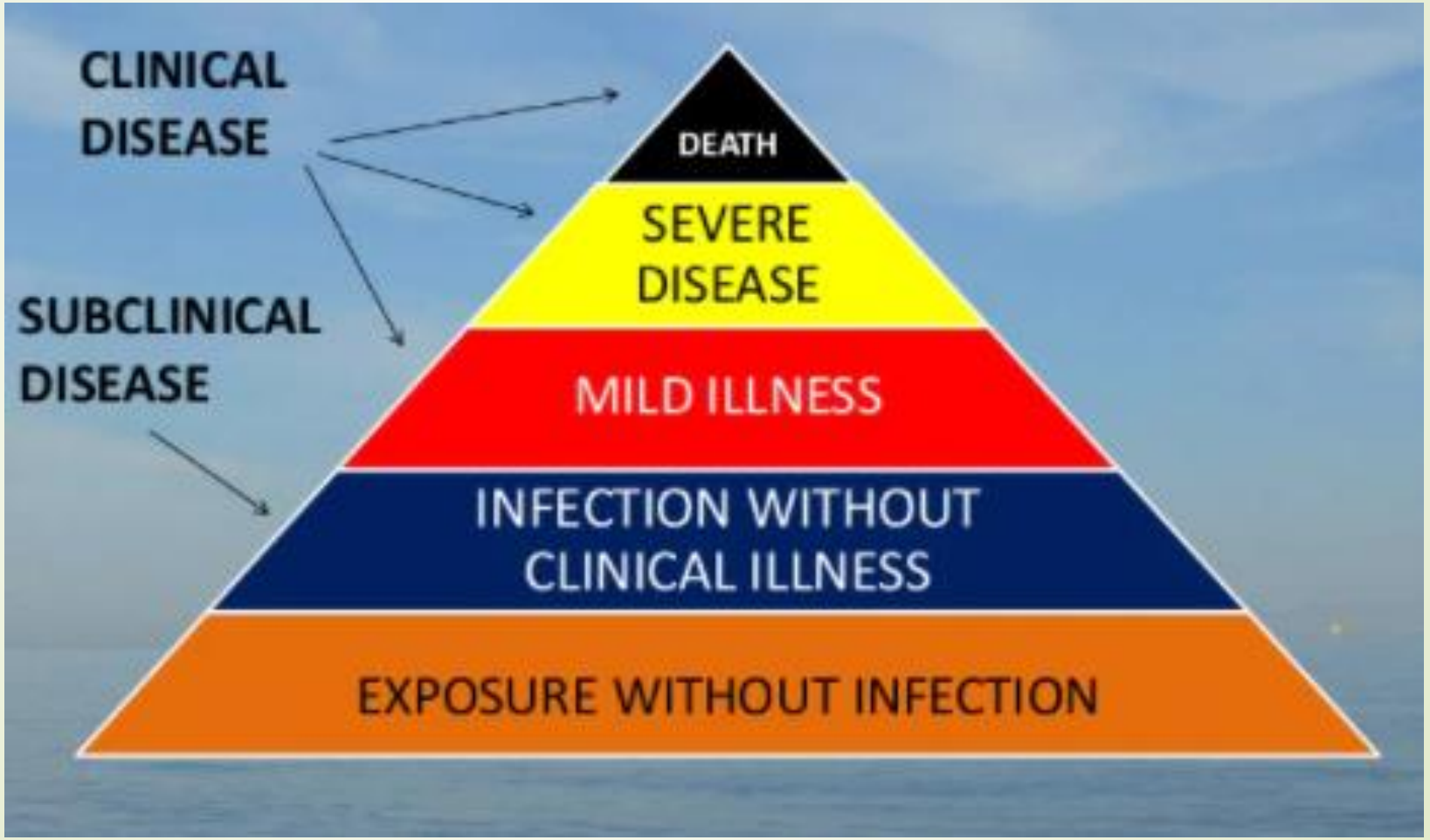
NATURAL HISTORY OF DISEASE

- What the physician sees in the hospital is just an "episode" in the natural history of disease.
- The epidemiologist, by studying the natural history of disease in the community setting is in a unique position to fill the gaps in the knowledge about the natural history of disease.

NATURAL HISTORY OF DISEASE

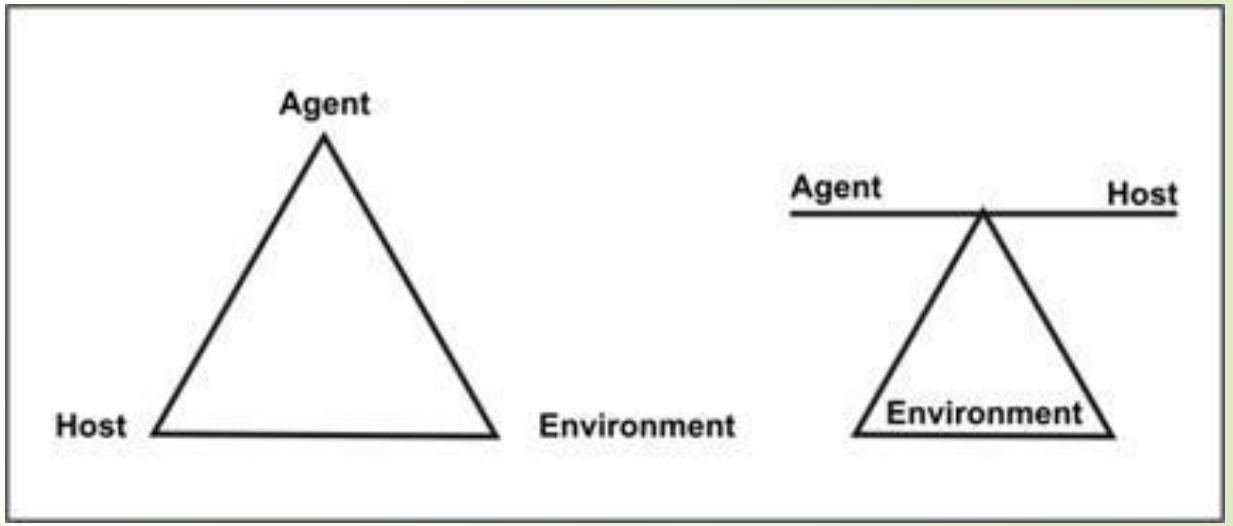
- The natural history and spectrum of disease presents challenges to the clinician and to the public health worker.
- Because of the clinical spectrum, cases of illness diagnosed by clinicians in the community often represent only the "tip of the iceberg." Many additional cases may be too early to diagnose or may remain asymptomatic.
- For the public health worker, the challenge is that persons with undiagnosed infections may nevertheless be able to transmit them to others

ICEBERG CONCEPT OF DISEASE



EPIDEMIOLOGICAL TRIAD

- A number of models of disease causation have been proposed.
- Among the simplest of these is the epidemiologic triad or triangle, the traditional model for infectious disease.
- The triad consists of an external **agent**, a susceptible **host**, and an **environment** that brings the host and agent together.
- In this model, disease results from the interaction between the agent and the susceptible host in an environment that supports transmission of the agent from a source to that host.



EPIDEMIOLOGICAL TRIAD

Agent

- Is an element or substance, animate or inanimate, the presence (or absence) of which may initiate or perpetuate a disease process.
- A disease may have a single agent, a number of independent alternative agents or complex of two or more factors whose combined presence is essential for the development of the disease.

EPIDEMIOLOGICAL TRIAD

Classification of agents

- Biological
- Nutrient
- Physical
- Chemical
- Mechanical
- Absence or insufficiency or excess of a factor necessary to health
- Social

EPIDEMIOLOGICAL TRIAD

Agent characteristics

- Infectivity refers to the proportion of exposed persons who become infected.
- Pathogenicity refers to the proportion of infected persons who develop clinical disease.
- Virulence refers to the proportion of persons with clinical disease who become severely ill or die.

EPIDEMIOLOGICAL TRIAD

Agent characteristics

- Hepatitis A virus in children has low pathogenicity and low virulence, since many infected children remain asymptomatic and few develop severe illness.
- In persons with good nutrition and health, measles virus has high pathogenicity but low virulence, since almost all infected persons develop the characteristic rash and illness but few develop the life- threatening presentations of measles (pneumonia, encephalitis).

EPIDEMIOLOGICAL TRIAD

Agent characteristics

- In persons with poor nutrition and health, measles is a more virulent disease, with mortality as high as 5-10%.
- Rabies virus is both highly pathogenic and virulent, since virtually 100% of all infected persons (who do not receive treatment) progress to clinical disease and death.

EPIDEMIOLOGICAL TRIAD

Host

- In epidemiological terminology, the human host is referred to as “soil” and the disease agent as “seed”.
- A person or other living animal, that affords subsistence or lodgment to an infectious agent under natural condition.
- Host factors: Intrinsic factors that influence an individual’s exposure, susceptibility, or response to a causative agent.

EPIDEMIOLOGICAL TRIAD

Environment

- Physical environment – Non living things and physical factors(air, water, soil, housing, heat, light, etc)
- Biological environment – Microbial agents, insects, animals, plants and man himself.
- Psychosocial environment – Lifestyle, poverty, urbanization, community life, income, education, stress etc.

LEVELS OF DISEASE PREVENTION

Definition of Disease Prevention

- "Activities designed to protect patients or the members of the public from actual or potential health threats and their harmful consequences."

• OR •

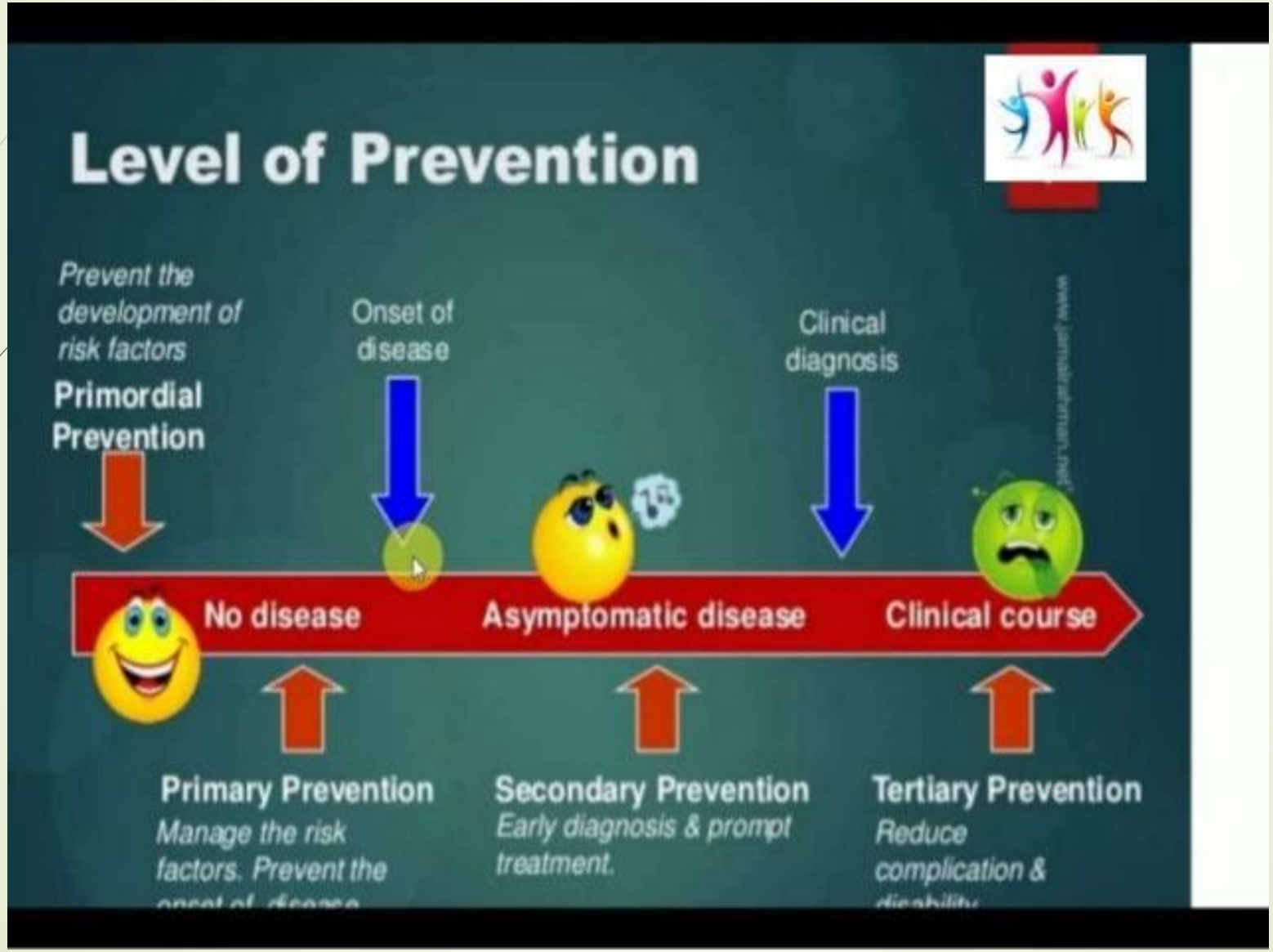
- "Prevention is the action aimed at eradicating, eliminating or minimizing the impact of disease and disability."

LEVELS OF DISEASE PREVENTION

Levels of Prevention

1) Primordial Prevention
2) Primary Prevention
3) Secondary Prevention
4) Tertiary Prevention

LEVELS OF DISEASE PREVENTION



LEVELS OF DISEASE PREVENTION

Primordial Prevention

- "This is a prevention of Development of risk Factors in a Population group , which they have not yet appeared."
- Special Attention is Given in preventing Chronic Disease.
- Main Intervention is Health Education.
- In this efforts are dedicated towards Discouraging people from adopting Harmful Life styles/Habits through Individual & Mass Education.

LEVELS OF DISEASE PREVENTION

Primordial Prevention

- "Primordial prevention is a relatively new concept and is receiving special attention in the prevention of chronic diseases. Ex., many adult health problems (e.g. obesity, hypertension) have their early origins in childhood, because this is the time when lifestyles are formed(Ex., smoking, eating patterns, physical exercise).

- Primordial prevention begins in childhood when health risk behavior begins. Parents, teachers and peer groups are important in imparting health education to children.

LEVELS OF DISEASE PREVENTION

Examples of Primordial prevention

- National programs and policies on:
  - Food and nutrition
  - Comprehensive Policies for discourage smoking , Alcohol & Drugs
  - To promote regular physical activity
  - Making major changes in lifestyle

LEVELS OF DISEASE PREVENTION

Primary Prevention

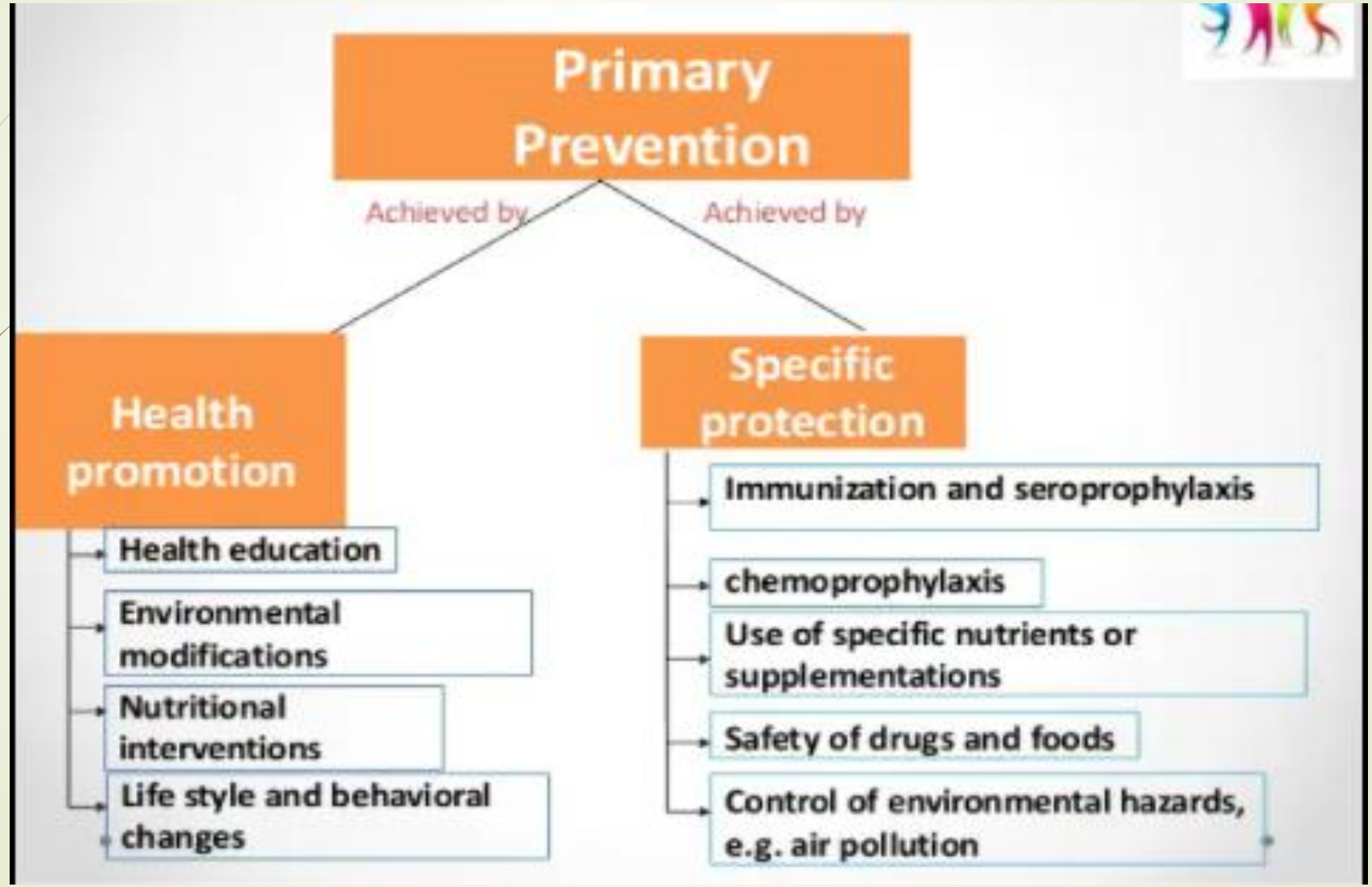
- "Primary prevention can be defined as the action taken prior to the onset of disease, which removes the possibility that the disease will ever occur."
- In this Action are taken before the onset of Disease.
- It signifies intervention in the pre- pathogenesis phase of a disease or health problem.

LEVELS OF DISEASE PREVENTION

Primary Prevention

- It includes the concept of "positive health", a concept that encourages achievement and maintenance of "an acceptable level of health that will enable every individual to lead a socially and economically productive life".

LEVELS OF DISEASE PREVENTION



LEVELS OF DISEASE PREVENTION

Secondary Prevention

- It is defined as " An Action which halts the progress of a disease at its incipient stage and prevents complications."
- The specific interventions are:

(i) Early diagnosis (e.g. screening tests, breast self examination, pap smear test, radiographic examinations etc.) & Treatment

(ii) Referral

LEVELS OF DISEASE PREVENTION

Secondary Prevention

- Secondary prevention attempts to arrest the disease process, restore health by seeking out unrecognized disease and treating it before irreversible pathological changes take place, and reverse communicability of infectious diseases.
- It protects others in the community from acquiring the infection and thus provide at once secondary prevention for the infected ones and primary prevention for their potential contacts.

LEVELS OF DISEASE PREVENTION

Objectives of Secondary Prevention

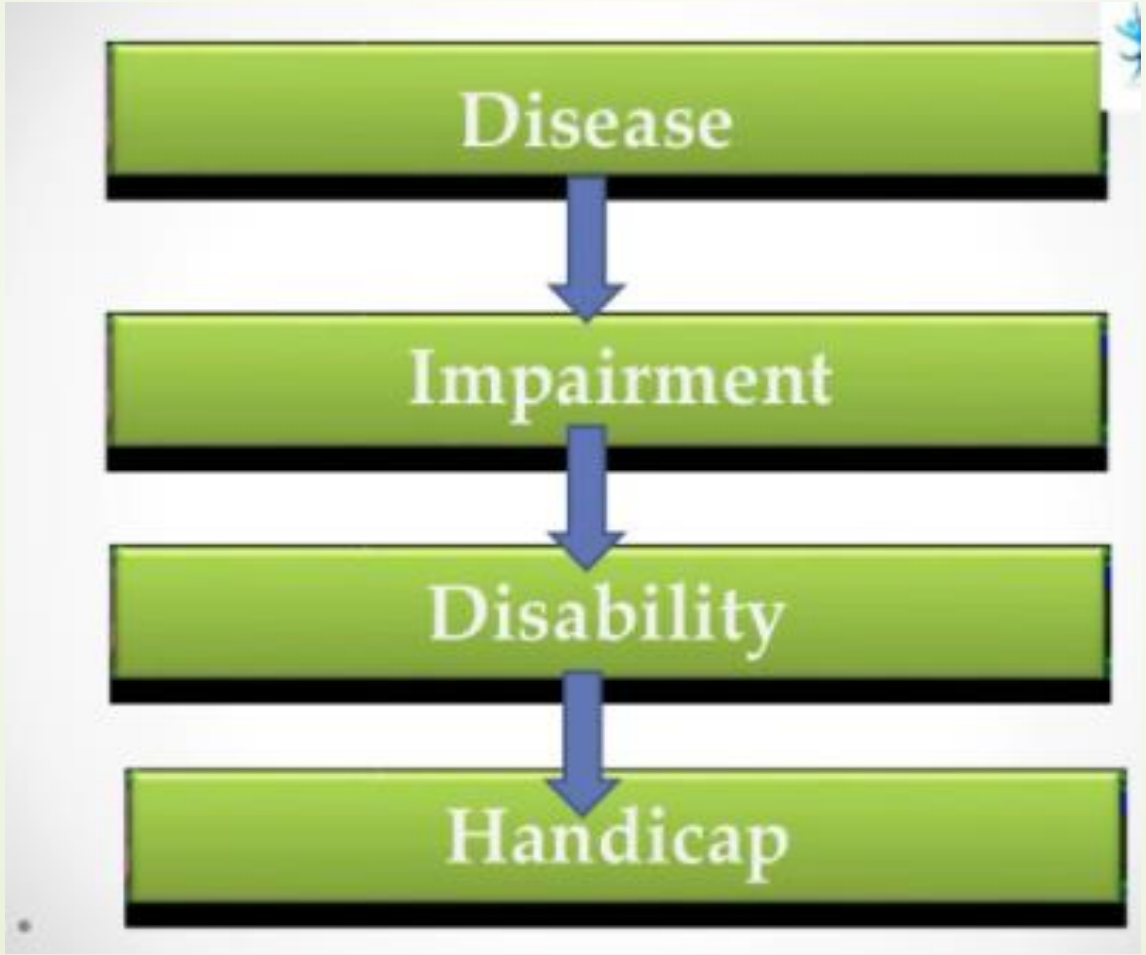
- Complete cure and prevent the progression of disease process.
- To prevent the spreads of disease by curing all the known cases.
- To prevent the complications and sequel of disease.
- To shorten the period of disability.

LEVELS OF DISEASE PREVENTION

Tertiary Prevention

- It is used when the disease process has advanced beyond its early stages.
- It is defined as "all the measures available to reduce or limit impairments and disabilities, and to promote the patients' adjustment to irremediable conditions."
- Intervention that should be accomplished in the stage of tertiary prevention are disability limitation, and rehabilitation.
- Intervention in Late Pathogenesis Phase.

LEVELS OF DISEASE PREVENTION



LEVELS OF DISEASE PREVENTION

Disability Limitation

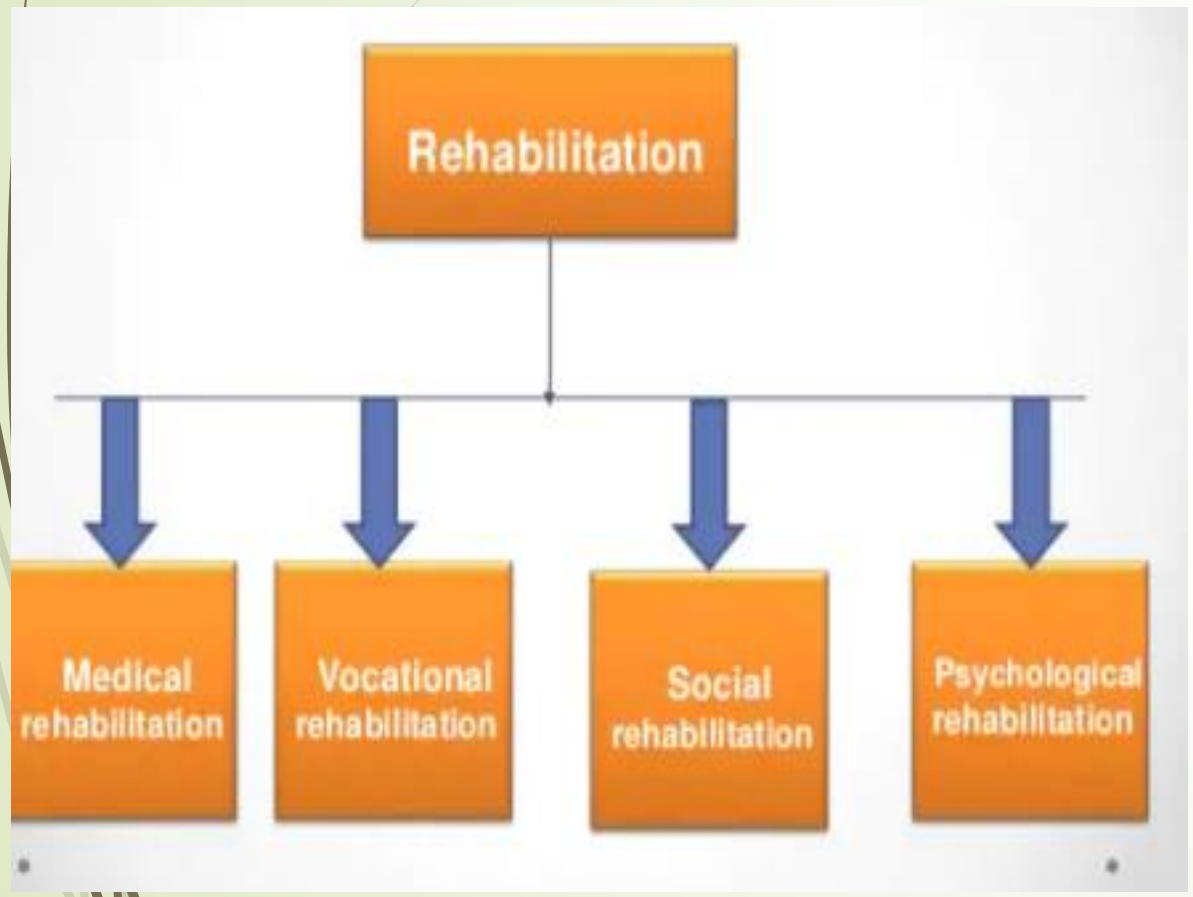
- To prevent or halt the transition of disease process from Impairment & Handicap.
  - Impairment: any loss or abnormality of psychological, physiological or anatomic structure or function.
  - Disability: any restriction or lack of ability to perform an activity in the manner considered normal for a human being.
  - Handicap: disadvantage for a given individual, resulting from impairment or disability, that limits or prevents the fulfillment of a role that is normal for that individual

LEVELS OF DISEASE PREVENTION

Rehabilitation

- Rehabilitation is " the combined and coordinated use of medical, social, educational, and vocational measures for training and retraining the individual to the highest possible level of functional ability."
- Requires cooperation from different sections of society.

TYPES OF REHABILITATION



- Medical rehabilitation: (restoration of Bodily Function).
- Vocational rehabilitation:(restoration of the capacity to earn a livelihood)
- Social rehabilitation: (restoration of family and social relationship).
- Psychological rehabilitation: (Restoration of personal dignity and confidence).

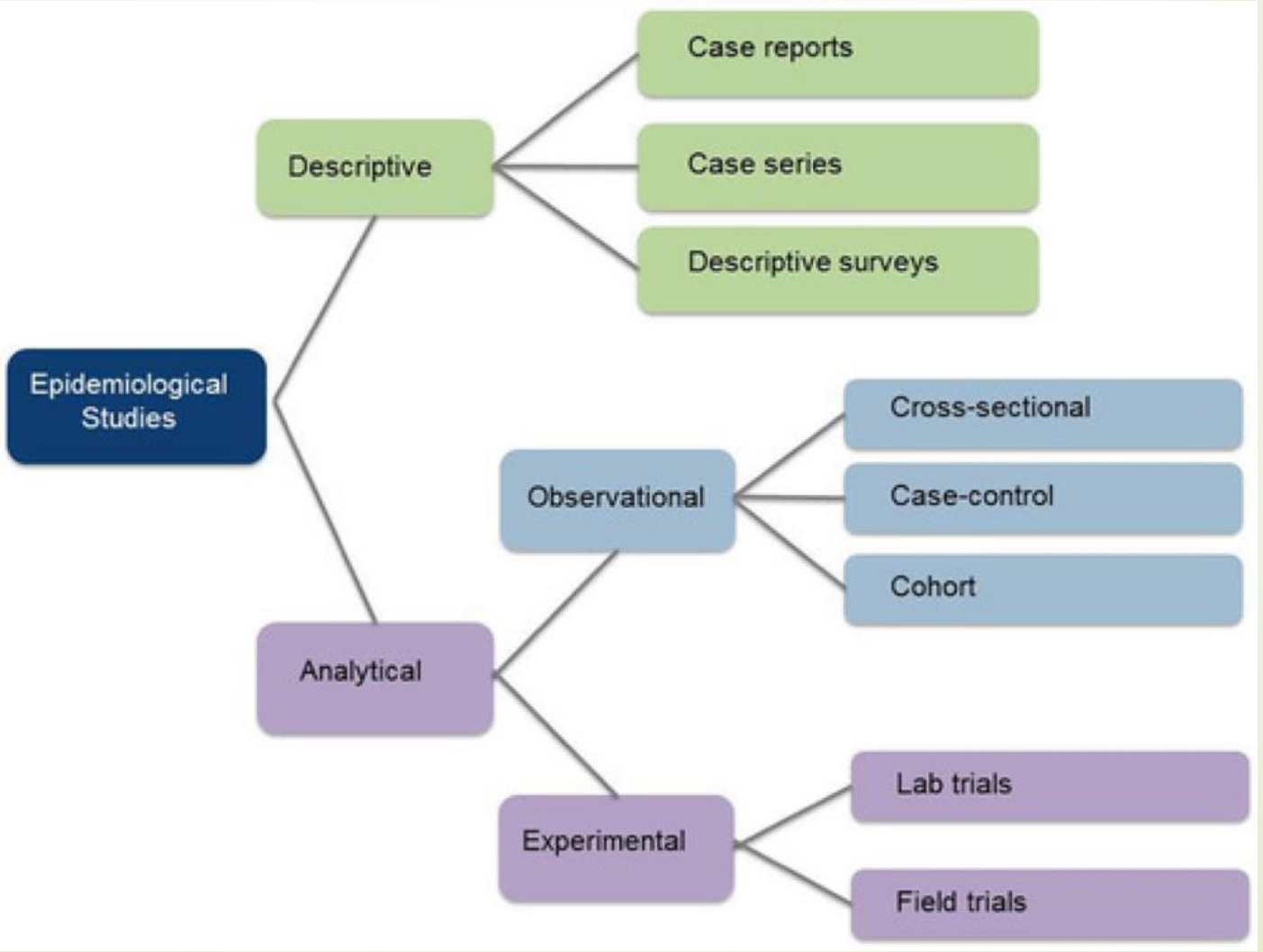
EXAMPLES OF REHABILITATION

- Establishing schools for the blind.
- Exercises in neurological disorders
- Prosthetic restoration of lost tooth
- Reconstructive surgery in Leprosy.
- Change of profession for a more suitable one and modification of life in general in the case of TB,etc.,

QUIZ

- The local hospital provides yearly cholesterol screening for the public.
- Mr. Lucas is referred to a cardiac rehabilitation program after Coronary artery bypass surgery?
- A nurse provides a vaccine for to clients in an immunization clinic.

EPIDEMIOLOGICAL STUDIES (Descriptive & Analytical)



EPIDEMIOLOGICAL STUDIES

- Descriptive
  - Case reports & case series (Clinical)
  - Cross-sectional (Epidemiological)
  - Correlation
- Analytical
  - Cohort
  - Case-control
  - Ecological

DESCRIPTIVE STUDIES

- These studies focus on the amount and distribution of disease or health status within a population by person, place and time.
- The studies involve determining the incidence, prevalence and mortality rate for disease in large population groups, according to characteristics such as sex, age, race and geographical area. These are studies of factors associated with distribution of health and disease in human population

Descriptive Studies
Case Reports

The features of the Case Report:

- It consists of a careful and detailed report (published in medical journals) by one or more clinicians of unusual medical condition.
- It represents the first clue in the identification of a new disease.
- It leads to formulation of a new hypothesis.

Descriptive Studies
Case Series

- In case series, clinicians describe the experience of a single patient or group of patients with similar diagnosis.
- This is common among clinicians whereby they use the unusual features of a unique disease among patients to make a diagnosis.
- It is through case series studies that clinicians are able to diagnose new or emerging diseases, such as ebola and chloroquine resistant malaria.

Descriptive Studies
Case Series

Case series Advantages

- Useful for hypothesis generation
- Informative for very rare disease with few established risk factors
- Characterizes averages for disorder

Disadvantages

- Cannot study cause and effect relationships
- Cannot assess disease frequency

Descriptive Studies
Cross-sectional Studies

- Cross-sectional studies provide information about the frequency and characteristics of a disease by studying the disease status in a population at a specific time period in a given year.
- Data is gathered over a large geographical area from a large sample over a short duration of time for, example a few months.

Descriptive Studies
Cross-sectional Studies

Advantages

- Relatively feasible and not too time-consuming, since there is no follow-up period (though random sampling in a large population can be expensive and problematic)
- We can study several diseases and/or exposures; thus, it is useful for screening new hypotheses
- We can describe disease frequency and health needs of a large population; thus, it is useful for health planning

Descriptive Studies
Cross-sectional Studies

Disadvantages

- It is inefficient for studying rare or highly fatal diseases or diseases with short durations of expression
- Cannot be used to analyze behavior over a period to time.

Descriptive Studies
Correlation studies

- Correlation studies use data of the entire population to compare disease frequencies between different groups of people during the same period of time.
- These types of studies are concerned with how a certain independent variable is related with one or several dependent variable(s).

Analytical Studies

- These types of epidemiological studies focus on disease determinants, that is agents of disease causation, host related factors, vectors (where applicable) and environmental factors.
- Analytical epidemiology studies the underlying causes of health problems. It seeks to uncover the source and mode of spread of disease; looking at multiple factors that bring about the disease in different population groups.
- Analytical epidemiology looks for reasons behind the relatively high or low frequency of disease in specific human groups (cause-effect relationships).

Analytical Studies

- Analytical studies are divided into two types; **observational** and **experimental studies**.
- The bulk of analytical studies are observational.
- This is because they are less invasive and less likely to raise ethical issues.

Analytical Studies
Observational studies

- In observational studies you observe events in the community as they occur.
- They may occur in seasons or be triggered by certain events such as floods that may lead to waterborne diseases or an outbreak of malaria.
- Another example is the increased incidence of fractures among children during the fruit picking season. As an epidemiologist, you need to put measures in place to prevent these problems.
- There are two main categories under these type of studies, that is **cohort studies** and **case control studies**.

Analytical Studies
Cohort studies

- Cohort study is a type of analytical study which is undertaken to obtain additional evidence to refute or support existence of association between suspected cause and diseases.
- Other names of cohort study are Longitudinal study, Incidence study and forward looking study

Analytical Studies
Cohort studies

Features of cohort studies

- Cohorts are identified prior to appearance of disease under investigation
- The study groups are observed over a period of time to determine the frequency of disease among them
- The study proceeds from cause to effects
- Indications for cohort study: There is good evidence of an association between exposure and disease, from other studies.

Analytical Studies
Case-Control Studies

- The observational epidemiologic study of persons with the disease (or other outcome variable) of interest and a suitable control (comparison/ reference) group of persons without the disease.
- Investigators start by enrolling a group of people with disease
- As a comparison group, the investigator then enrolls a group of people without disease (controls)

Analytical Studies
Case-Control Studies

- Investigators then compare previous exposures between the two groups.
- The control group provides an estimate of the baseline or expected amount of exposure in that population.
- If the amount of exposure among the case group is substantially higher than the amount you would expect based on the control group, then illness is said to be associated with that exposure.

Analytical Studies
Case-Control Studies

- The key in a case-control study is to identify an appropriate control group, comparable to the case group in most respects, in order to provide a reasonable estimate of the baseline or expected exposure.

Analytical Studies
Experimental Studies

- In experimental studies, you set up experiments with controls in order to see the cause and effect.
- For example, you can decide to give malaria prophylaxis or mosquito nets to one community during the rainy season and deny the same to another similar community.
- You then observe the two to see if they have the same incidence of malaria or if they have different incidence of malaria.

DISEASE SURVEILLANCE

Definitions

- Disease is the inability of the individual to function, physically, mentally, socially at a level that is both individually satisfying and appropriate to the stage of growth and development of the individual.

- Health, according to the World Health Organization, is "a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity."

DISEASE SURVEILLANCE
Measuring Disease Frequency

- Disease frequency is the measurement of how often a disease occurs and the disability or death caused.
- This information is summarised in the form of rates and ratios, that is, prevalence rate, incidence rate, death rate etc.

DISEASE SURVEILLANCE
Measuring Disease Frequency

- Disease frequency is the measurement of how often a disease occurs and the disability or death caused.
- This information is summarised in the form of rates and ratios, that is, prevalence rate, incidence rate, death rate etc.

DISEASE SURVEILLANCE
Measuring Disease Frequency

Incidence and Prevalence of Disease

Incidence

- Incidence measures new cases during a period of time among those at risk of acquiring the disease at the beginning of the duration in a given population.
- For instance, if there were 12 new cases of malaria in your area which has 1,200 people in January, then the incidence of malaria in January would be (12/1200 = 0.01) 1 case per 100 people in the population.

DISEASE SURVEILLANCE
Measuring Disease Frequency

Prevalence

- Prevalence gives information about the total number of cases of a disease or condition at a particular time - whether new or old cases.
- Prevalence helps you to know how big a problem is.
- For example, if on the 1 January you did a survey of your area, containing 1,000 people and found that the total number of cases of malaria was 41, you would say that the prevalence of malaria on 1 January was 41 cases per 1,000 people in that area. This knowledge would help you to plan your drugs, surgical and equipment supplies among other things.

DISEASE SURVEILLANCE
Measuring Disease Frequency

Case Fatality Rates

- Measure how many people who have a certain disease die from that disease
- There are two more rates that are useful to know about. These are: **Infant Mortality Rate (IMR)** and **the Child Mortality Rate (CMR).**
- These are two important indicators used to express the health of children. A country is considered healthy when the children of that country are healthy. Deaths among children are an important indicator of the health status of a community/country

DISEASE SURVEILLANCE
Measuring Disease Frequency

Case Fatality Rates

- All deaths occurring in children from the date of birth to the age of one year are grouped under Infant Mortality Rate or infant deaths.
- All deaths occurring in children after one year to the age of five years are grouped under Child Mortality Rate or child death.

Expressing Disease in Rates

Common Formulae for Calculating Health Rates	
Vital Health Rate	**Formula**
Incidence rate	$\frac{\text{Number of } \textbf{new} \text{ cases of a disease}}{\text{Population at risk from that disease}} \times 100$
Prevalence rate	$\frac{\text{Number of } \textbf{all existing (old and new)} \text{ cases of a disease}}{\text{Population at risk from that disease group}} \times 100$
Case fatality rate	$\frac{\text{Number of deaths from specified disease}}{\text{Number of persons with the disease (old and new)}} \times 100$
Cause specific death rate	$\frac{\text{Number of deaths from specified cause}}{\text{Total population in the year who died from different causes}} \times 100$
Age specific death rate	$\frac{\text{Number of deaths in a specified age group}}{\text{Estimated midyear population of that age group}} \times 1000\ (\%)$
Crude birth rate	$\frac{\text{Total number of live births}}{\text{Estimated midyear population}} \times 1000\ (\%)$
Crude death rate	$\frac{\text{Total number of deaths during a given year}}{\text{Estimated midyear population}} \times 1000\ (\%)$
Fertility rate	$\frac{\text{Number of live births}}{\text{Estimated number of females aged 15-49 at midyear}} \times 1000\ (\%)$

Expressing Disease in Rates

Common Formulae for Calculating Health Rates	
Vital Health Rate	**Formula**
Foetal death rate (Still birth rate)	$\frac{\text{No. of foetal deaths at 20 weeks or more gestation}}{\text{(No. of live births plus foetal deaths of 20 weeks or more gestation)}} \times 1000$ (%)
Infant mortality rate	$\frac{\text{No. of deaths under one year of age (in defined population)}}{\text{Number of live births}} \times 1000$ (%)
Maternal mortality rate	$\frac{\text{No. of deaths from puerperal causes (pregnancy, labour, etc)}}{\text{No. of live births during that year}} \times 1000$ (%)
Neonatal mortality rate	$\frac{\text{Number of deaths under 28 days of age}}{\text{Number of live births}} \times 1000$ (%)
Perinatal mortality rate	$\frac{\text{No. of foetal deaths 28 weeks or more and infant death under 7 days of age}}{\text{No. of live births and foetal deaths 28 weeks or more during the same year}} \times 1000$ 0/00
Postnatal mortality rate	$\frac{\text{No. of deaths at age 28 days 1 year}}{\text{No. of live births minus neonatal death}} \times 1000$ 0/00
Sex specific death rate	$\frac{\text{No. of deaths of males or females}}{\text{Estimated male or female population at midyear}} \times 1000$ 0/00
Dependency ratio	$\frac{\text{Total number of persons less than 15 yrs and those over 60 yrs (65) of age}}{\text{Total number of people aged 15-60 (15-65) yrs in the same population)}}$

DISEASE SURVEILLANCE

- Disease surveillance is “the ongoing systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know.”

Types of Surveillance

1. **Passive**

- Passive disease surveillance begins with healthcare providers or laboratories initiating the reporting to state or local officials. Reportable diseases are submitted on a case-by-case basis, based on a published list of conditions.

2. Active

- Active disease surveillance is when state or local officials actively search for information by contacting healthcare providers, laboratories, schools, nursing homes, work places, etc.
- For example, during a cluster investigation of *E. coli* O157:H7, epidemiologists might call pediatric nephrologists in the state to find out whether the clinician has treated any patients having hemolytic uremic syndrome (HUS) which could result from infection with this organism.

Types of Surveillance

There are advantages and disadvantages of both types of surveillance.

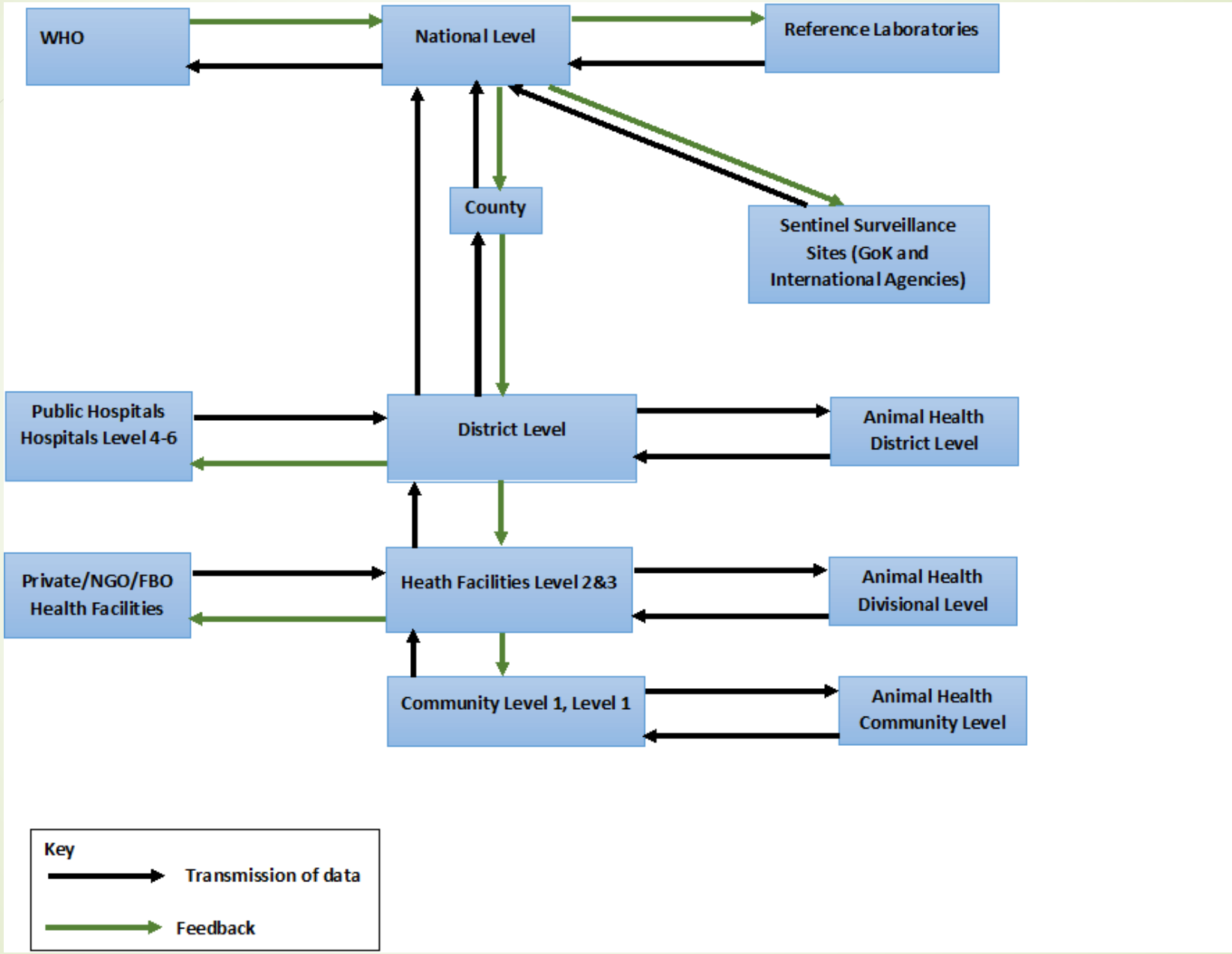
- **Passive surveillance** is effective because it casts a wide net and can be more easily conducted on an on-going basis. It is useful for routine surveillance activities. However, it may result in underreporting and incomplete data.

- **Active surveillance** should be used to investigate diseases with a high risk to the public's health, but it can also be resource intensive. Data collected through active surveillance generally provides more accurate and complete information than passive surveillance.

Integrated Disease Surveillance and Response (IDSR)

- To address the challenges of disease surveillance and response, the 48th World Health Organization Regional Committee for Africa meeting in Harare, Zimbabwe, adopted resolution AFRO/RC48/R2 in September 1998.
- The strategy is called Integrated Disease Surveillance and Response (IDSR)
- The goal of IDSR is to improve the ability of all levels of the system to detect, confirm, and respond to diseases and other public health events in order to reduce high levels of illness, death and disability.

Integrated Disease Surveillance and Response



Uses of Surveillance Data

Surveillance data can be used to:

- Estimate the magnitude of specific problems
- Determine the distribution of illness, portray the natural history of a disease
- Generate hypotheses, stimulate research
- Evaluate control measures, monitor changes, and facilitate planning.

THANK YOU