# PRINCIPLES OF EPIDEMIOLOGY

## DEFINITION

Epidemiology is an aspect of medical science that deals with **frequency, distribution, determinants and deterrents** of diseases and health-related events in human population with the hope of taking appropriate measures to address the problems

Questions asked in epidemiology = what, why, when, how, where and who are affected by dxs and health-related problems

## DISEASE FREQUENCY - is measured by **Rates and Ratio**

1. **Proportion**
    a. A fraction, in which the numerator includes only individuals who meet the case definition and the denominator includes individual in the study population who do & do not meet the case definition but are at risk
    b. i.e. A/(A+B) where A is a target event of your case definition; A+B = total no. of events (target + Non-target)
    c. E.g. proportion of females with HTN in clinic today = [females with HTN] / [All females]
2. **Rates**
    a. Essential to compare disease burden in different populations, to give clue to the etiology of the dx and this initiates strategies for control of the dx
    b. It is same as **Proportion BUT with Time** dimension
    c. = A / (A+B), both event occurring over a period of time
3. **Ratio**
    a. A/B
    b. A special fraction in which the numerator includes only individuals who meet the case definition and the denominator includes only individual in the study population who do not meet the case definition but are at risk

NB: Difference btw Rate and Ratio: In Rates, numerator is part of denominator but for Ratio, it is not like that

## DISEASE DISTRIBUTION:

- Disease occur in patterns and these patterns are used to generate hypothesis about the possible etiology
- Dx may be distributed in form of (1) Person, (2) Place; (3) Time PPT
- **Time distribution**
    - Seasonal trends/changes in disease occurrence. E.g. Malaria occurrence in rainy season
    - Secular trends/changes
        - Dx does not increase in the community but appears to do so because of interventions put in place. E.g. If, in a community, HTN is defined as ≥125/95 mmHg (instead of ≥ 140/90 mmHg), then you would have an increase in cases of people with HTN, who were not initially defined as HTNsive
    - Periodic changes

        - E.g. Comparing dx outbreaks of previous years with that of present year
- **Person distribution** (who is affected): here dx is characterized based on
    - Age group
        - Extremes of ages OR
        - Working age grp
    - Gender
    - Marital status
    - occupation
    - Ethnic grp
    - Religion
    - Socioeconomic
    - Personal habits e.g. alcoholic intake, cigarette smoking
- **Place distribution** (where is the dx occurring?)
    - Variation in climatic zones
    - Variations btw states in a country/nation (National variation)
    - Variations btw LGAs in a state (Rural-urban variation)

## DETERMINANTS OF DISEASE [= ETIOLOGY]

- Biological agents
    - Viruses
    - Bacteria
    - Fungi
    - Parasites
- Physical agents
    - Temperature = extremes of temp
    - Radiation
    - Noise
    - Vibration
- Chemical agents
    - Pesticides
    - Caustic agents
    -
- Mechanical agents
    - Trauma
    - Falling from height
    - RTAs
    - Cuts
- Behavioural factors (Lifestyles)
    - Cigarette smoking
    - Alcohol intake
    - Drug abuse
    - Indiscriminate sexual pregnancy
- Socioeconomic practices
    - Traditional practices
    - Beliefs
    - Religious practices

## DETERRENTS of dx processes (PREVENTION]

To prevent dx one or more of the following shd be taken care of:

- Reservoir
- Route of transmission (ROT)
- Susceptible host

Reservoir

- Elimination of reservoir via chemicals, Radiation, sanitation
- For Human reservoir
    - Early diagnosis and prompt tx by introducing screening
    - Mass Chemotherapy (depending n the dx condition)
    - Segregation/Isolation/Quarantine

Interrupting ROT by:

- Medical method
- Chemical agents
- Proper sewage disposal
- Food sanitation
- Environmental sanitation

Build-up Herd immunity of suspecting population

- Chemoprophylaxis
- Vaccination
- Improving lifestyle e.g. stop smoking cigarette, etc...

Relocation of settlements, if interruption of ROT and building immunity does not work

## USES & APPLICATION OF EPIDEMIOLOGY

1. To identify Etiology of a dx condition = in terms of Host factors, Risk factors, Genetic factors and Social factors
2. For dx classification
    a. Classify dx in relation to organism involved or body systems affected
3. To study the Natural History of disease (i.e. the broad spectrum of dx)
    a. i.e. Stages of exposure, infection, latent period of dx manifestation, Full recovery, Recovery with disability
4. To Access the Health status of the population
    a. To know the trend of dx occurrence
    b. ...
    c. To observe dx occurring over.....
5. Used in Health Planning
6. To study the impact of control strategies
7. For community diagnosis

## ASSESSING THE HEALTH STATUS OF THE COMMUNITY

To assess health status of a community, the population of the community should be assessed Holistically by looking at:

- Hospitals
- Laboratory
- Health establishment
- …
- ….
- Morbidity and Mortality data

RATES is used to Assess health status:

- Crude Rate
- Specific rate

### MEASURE OF MORBIDITY

1. **Incidence Rate (IR)**

$$= \frac{Total\ No.of\ NEW\ CASES\ of\ dx\ in\ a\ particular\ population\ over\ a\ period\ of\ TIME}{Population\ at\ Risk}$$

   a. It estimates the Risk of developing a dx in specified population during a specified period of time

2. **Prevalence Rate**

$$= \frac{Total\ No.\ of\ NEW\ and\ OLD\ cases\ in\ a\ population,\ \ over\ a\ period\ of\ TIME}{Total\ polation\ [NOT\ just\ population\ at\ risk]}\ X\ 100$$

   **Prevalence Rate =** $\boldsymbol{Incidence\ rate\ \times Duration\ of\ dx\ (years)}$

   It is usually expressed a **percentage**

3. **Attack Rate**

   a. Is the same as incidence rate, BUT it is **expressed in percentage** and is used esp in **Epidemics or Outbreaks**

   b. $= \frac{\boldsymbol{Total\ No.of\ NEW\ CASES\ of\ dx\ in\ a\ particular\ population\ during\ the\ outbreak\ PERIOD}}{\boldsymbol{Population\ at\ Risk}}$ X 100

4. **Secondary Attack rate**

   a. $= \frac{No.\ of\ NEW\ CASES\ of\ a\ dx\ in\ a\ captive\ population\ after\ exposure\ of\ an\ index\ case\ within\ \ one\ incubation\ period\ of\ the\ dx}{Populattion\ at\ Risk}$ X 100

   b. It measures the frequency of new cases of a dx among contacts of Known/index/primary cases during the epidemic period

   c. Example:
      i. 7 cases of Hepatitis occurred among 70 elderly patients in a place. The total no. of relations/family members + those that came in contact with these 7 infected patients were 32.
      ii. In several wks, 5 family members of the 7 infected px also developed hepatitis
      iii. Attack Rate = 7/70 X 100 = 10% …… 70 = populatn at risk
      iv. Secondary attack rate = 5 / (32-5) X100 = 20% ……. 32-5 = population at risk

## MEASURES OF MORTALITY

1. **Crude Mortality Rate**
   a. A measure of the frequency of occurrence of death in a defined population over a specified period of time
   b. = $\frac{\textbf{\textit{Death occuring during a given period of time}}}{\textbf{\textit{total mid-popuation among the deaths occured}}}$ x $10^n$
   c. E.g. In 2001, there were 12,000 deaths from all causes among 2 million population of Atlanta, Georgia.
      i. Crude MR = $\frac{12000}{2{,}000{,}000}$ X 1000 = 6 deaths per 1000 population per year
2. **Case Fatality Rate**
   a. Is the proportion of persons with a particular condition (cases) that die from the condition.
   b. It is usu. expressed in %
   c. = $\frac{\textbf{\textit{Number of Deaths due a disease}}}{\textbf{\textit{Number of poople with the same disese}}}$ X 100
   d. Usually used in Epidemics
3. **Age-specific MR**
   a. Is the MR limited to a particular age group
4. **Infant MR**
   a. Is one of the most commonly used measures of comparing health service among nations
   b. = $\frac{\textbf{\textit{Number of Infants deaths LESS THAN 1 YEAR of age}}}{\textbf{\textit{Total No.of LIVE birth during the same year}}}$ X 1000
   c. Defined as **no. of infant (<1yr) deaths per 1000 live birth per year**
5. **Perinatal Mortality rate**
6. **Neonatal mortality rate**
   a. Neonatal period is defined as period from birth up to 28 days
   b. NMR = $\frac{\textbf{\textit{Number of Neonatal deaths}}}{\textbf{\textit{Total no.of Live births during the same year}}}$ X 1000
   c. Defined as no. of Neonatal death per 1000 live birth per year
7. **Post-natal Mortality rate**
   a. Post-natal period is the period from 28 days of age up to but not including 1 year of age
   b. PNMR = $\frac{\textit{No of Deaths in children btw 28 days and 1 yr of age}}{\textit{No. LIVE births during the same time period}}$ X 1000
   c. Defined as no. of death of children btw 28 days to 1 year per 1000 live births per year
8. Proportional Mortality rate
9. Maternal Mortality rate

10. Paternal Mortality rate

## DEATH CERTIFICATE

- It is a legal document, signed by a licensed doctor who saw the patient 24 hrs b4 death or by a coroner, after death, indicating the following information:
    - Cause of death
        - Direct cause, … on the first line
        - Antecedent cause
        - Contributing cause … last line
    - Name, Gender, Place of residence, Date of death,
    - Other information
        - Birth Date, birth place, Occupation
-

- **Observational studies**
  - Descriptive studies
  - Analytic studies
- **Investigational studies**
  - Interventional/Experimental experiment

## DESCRIPTIVE STUDIES

- **AIM**
  - To formulate hypothesis and identify any associations with the etiology of the dx
- 3 Variables for description
  - **Time, Place, Person**
  - *These 3 variables helps descriptive epidemiology to determine the distribution of a dx (w.r.t time, place and person)*
- 3 types
  - Case report
  - Case series
  - Cross-sectional/prevalence studies
- **Case Report**
  - **Is a report of A single (or a handful) case of Unusual or New findings** (in scientific meetings for others to learn from)
  - *E.g. reporting the use of OCP can cause DVT*;
  - **Advantages**
    - We can aggregate cases from disparate (unrelated or uncomparable) sources to **generate Hypothesis and describe new syndromes**
      - Example: Hepatitis, AIDS
  - **Limitations**
    - We **cannot test for statistical association** because there is no relevant comparison group
- **Case Series**
  - **Report of Multiple/accumulated cases of Similar findings**; i.e. cases series reports a single individual or a group of individual with the same diagnosis
  - It assesses prevalent disease
  - Also reports on unusual or new conditions, as well
  - **Advantages**
    - Useful for **hypothesis generation**
    - **Informative for very rare disease** with few established risk factors
  - **Disadvantages**
    - Cannot study cause and effect relationships
    - Cannot assess disease frequency

- **Cross-sectional / Prevalence studies**
  - Measures disease and exposure simultaneously in a well-defined population i.e. it **assess the prevalence of disease and the prevalence of risk factors at the same point in time in a defined population**
  - Is the simplest form of an observational study.

- It is based on a single examination of a cross-section of population at one point in time – the results of which can be projected on the whole population provided the sampling was done correctly.
- **Advantages**
  - They cut across the general population, not simply those seeking medical care
  - Good for identifying prevalence of common outcomes, such as arthritis, blood pressure and allergies
  - Not costly to perform and does not require a lot of time
  - Contains multiple variables at the time of 'data snapshot'
  - Many findings and outcomes can be analyzed to creates new theories/studies or in-depth research
  - There is no loss of follow-up
- **Disadvantages**
  - Difficult to determine temporal relationship between exposure and outcome (because of lack of time element; i.e. data is not collected over a period of time)
  - **Prevalence-incidence bias (a.k.a. Neyman bias).** Especially in the case of longer-lasting disease, any risk factor that results in death will be under-represented among those with the disease

## ANALYTIC STUDIES

- 2 types
  - Case-control studies
  - Cohort studies
- **CASE-CONTROL STUDIES**
  - A **RETROSPECTIVE STUDY**; a.k.a. **CASE-HISTORY STUDY**
  - You have:
    - Pple with a disease (= Case) e.g. Cancer of the lungs
    - People with another disease (control) e.g. stomach cancer
    - A suspected cause e.g. Cigarette smoking
  - You want to test if the suspected cause is the actual cause.
  - So, you impute your data like this:

| RISK FACTORS | Case (lung Ca) | Control (stomach Ca) | TOTAL |
|---|---|---|---|
| Smoking | a | b | a+b |
| Not smoking | c | d | c+d |
| TOTAL | a + c | b + d | a+b+c+d |

  - Next, do your **ANALYSIS**. For your level → **ODD RATIO (OR)** = $\frac{ad}{bc}$
  - Next, **INTERPRETATION**
    - If OR = 1, no relationship between cigarette smoking and lung cancer
    - If OR >1, smoking is a cause cancer; i.e. the more you smoke the more likelihood of developing cancer
    - If OR <1. Smoking is protective; the more you smoke the less likelihood of developing cancer
  - **Advantages of case-control**
    - Used to study rare diseases
    - Used for disease with long-incubation period
    - Easy to carry out; no manipulation of studies
    - Quick to carry out

- Cheap
- Use to establish relationship btw multiple risk factors

- **Disadvantages**
  - Missing information, esp for long-period cases
  - Biased, in terms of selection of cases and control
  - Mis-classification of cases and control
  - Unable to calculate incidence rate

- **COHORT STUDIES**
  - A **PROSPECTIVE** study
  - Here, you deal with **healthy populations**, who may be at risk of having a dx, with exposure to a particular risk factor. This is unlike the case-control study where the subjects are diseased
  - E.g. correlation between alcohol consumption and cirrhosis
    - 2 Groups: A group of healthy patients consume alcohol; the other group of equal no. do not consume alcohol. After monitoring both groups, determine the no. of pxs that have cirrhosis in both alcoholic group & non-alcoholic groups

| RISK FACTORS | Cirrhosis | No Cirrhosis | TOTAL |
|---|---|---|---|
| Consumes alcohol | a | b | a + b |
| Not consume alcohol | c | d | c + d |
| TOTAL | a + c | b + d | a + b + c + d |

  - **ANALYSIS: RELATIVE RISK (RR)**
    - $= \frac{\textbf{Incidence Rate} \text{ in exposed or diseased}}{\textbf{Incidence rate} \text{ in non-diseased}}$
    - $IR_{exposed} = \frac{a}{a+b}$ ; $IR_{non-exposed} = \frac{c}{c+d}$
    - **RR** = $\left(\frac{a}{a+b}\right) \Big/ \left(\frac{c}{c+d}\right)$
  - **INTERPRETATION**
    - RR = 1; No relationship between alcohol intake and liver cirrhosis
    - RR > 1; more intake of alcohol, more risk of liver cirrhosis
    - RR < 1; alcohol is protective i.e. more alcohol, less cirrhosis
  - **Advantages**
    - IR can be calculated
    - **ATTRIBUTABLE RISK** can also be calculated
    - **RELATIVE RISK** can be calculated
    - Dose-response ratios can also be calculated
    - Gives a more direct estimation of the risk from exposure to each factor
    - Several possible outcomes related to exposure can be studied simultaneously
  - **Disadvantages**
    - Very expensive
    - Take long time to complete (e.g. 20-30 years)
    - More difficult to do
    - Involves a large no. of people
    - Generally not suitable for investigating uncommon diseases or diseases with low incidence in the population.
    - Problem of attrition e.g. people dropping out of the study
    - Ethical problems

- Problem with follow-up

## INTERVENTIONAL STUDY

- Experimental study
- Here, the investigator manipulates exposure
- Is **PROSPECTIVE** in nature
- And is done over a long period of time, on most cases
- Involves studies in which one group which is deliberately subjected to an experience is compared with a control group which has not had a similar experience.
- **2 Examples:**
  - Clinical or therapeutic trial
  - Population-based trial
- **Clinical trial or Therapeutic trial or Randomized clinical trial**
  - Is conducted among individual with a particular disease to test the efficacy and side effects of a drug or procedure, before you generalizing the drug use for the Nation
  - Usually a technique known as BLINDING is adopted, which will ensure that the outcome is not biased
    - Single blind trial
    - Double blind trial
    - Triple Blind trial
- **2 types**
  - **Randomized controlled/clinical trials (RCT)**
    - Normally used in testing new drugs and treatments
    - There is an Experimental group and Control group (receiving placebo); members of these groups were **'randomly'** allocated to either experimental or control group, by chance
    - Usually a technique known as BLINDING is adopted, which will ensure that the outcome is not biased
      - **Single blind trial:** is when neither the investigator nor the study participant is aware of treatment assignments. However, this design is not always possible
      - **Double blind trial:** is when neither the investigator nor the study participant is aware of treatment assignments. However, this design is not always possible
      - **Triple Blind trial:**
    - **Advantages**
      - Controls for all main forms of bias;
      - Good for both etiological and evaluative research
      - To test preventive interventions
      - Can calc. Absolute Risk Reduction
      - Can calc. Relative Risk Reduction
    - **Disadvantages**
      - Often uses selected populations: issue of generalizability
      - Ethical concerns in etiological applications
  - **Quasi-Experimental trials or Population-based trials**
    - …

## SCREENING FOR DISEASE

Screening refers to application of a **Test** to people who are **asymptomatic** for the purpose of **classifying them** with respect to the likelihood of having a particular dx

It is not primarily a diagnostic test

BH screening is conducted, a decision must be made to know if it is worthwhile based on Scientific, Ethical and even Financial justifications

In dx screening, 2 considerations are very important:

1. Dx to be screened
2. Test to be performed

### TYPES OF SCREENING

a. **Mass screening**
    a. ALL eligible population is subjected to a particular screening test
    b. Expensive and time-consuming
    c. Gives poor yield
b. **Selective or High-risk screening**
    a. The test or intervention is given to pple who have propensity of developing a particular problem
    b. Gives greater yield within limited time and resources
c. **Multi-phasic screening**
    a. Is done in stages;
    b. Individuals or a large populations are subjected to a variety of tests to rule out the presence of several dxs, at one time.

### CRITERIA FOR SCREENING or PRINCIPLES OF SCREENING

The criteria for screening are based on 2 considerations: (1) the DISEASE to be screened, and (2) the TEST to be applied:

**DISEASE CRITERIA** : The Disease to be screened should fulfil the following criteria before it is considered suitable for screening:

- The dx to be screened for must be of public health importance
- There shd be a recognizable Early asymptomatic stage or Latent stage of the disease
- Natural history of the dx must be known
- There must be a test, with high level of accuracy, for detecting the dx prior to onset of signs and symptoms
- Facility for diagnosis and treatment must be available
- Effective tx must be available
- Evidence that early detection and treatment reduces morbidity and mortality
- Expected benefits of early detection must exceed the Risks and Cost
- There should be an Agreed Policy on whom to treat as patient

When the above criteria are satisfied, then only, it would be appropriate to consider a suitable screening test.

**TEST CRITERIA** or features of a good screening test

- **Acceptability of test** (must be acceptable to the population)

- **High Repeatability or reliability** or precision or reproducibility
    - The repeatability of the test depends uon there major factors, namely
        - Observer variation
            - Intra-observer variation (within observer)
            - Inter-observer variation (between observers)
        - Biological (subject) variation
        - Error relating to Technical methods
- There must be **Validity OR Accuracy** (i.e. highly sensitive and Highly specific) --- refers to what extent a test accurately measures what it intends to measure. Accuracy has 2 components: (1) sensitivity and (2) specificity
    - **Sensitivity** is the ability of a test to identify correctly those that have a particular disease i.e. those with Positive screening test.
    - **Specificity** is the ability of a test to identify correctly those who do not have a particular dx.

## USES OF SCREENING

- Case detection
- Research purposes
- Control of disease
- Educational opportunity: to train people on risk factor of dx……

## EVALUATION OF SCREENING TEST

- SENSITIVITY (TRUE-POSITIVES)
    - Defined as the ability of the test to be +ve, if the dx is truly present i.e. the ability of a test to identify correctly those who have the disease i.e. true-postives
- SPECIFICITY (TRUE-NEGATIVES)
    - The ability of test to be -ve if the dx is truly absent; i.e. ability of a test to identify correctly those who do not have the disease. i.e. "true-negatives"
- **Predictive value** --- reflects the diagnostic power of the test
    - POSITIVE PREDICTIVE VALUES (PPV) OR 'PREDICTIVE VALUE OF A POSITIVE TEST'
        - Indicates the probability that a patient with a positive test result has, in fact, the disease in question.
        - The more prevalent a disease is in a given population, the more accurate will be the predictive value of a positive screening test; as prevalence decreased the predictive value of a positive test falls

          s
    - NEGATIVE PREDICTIVE VALUE (NPV)
        - Indicates the probability that a patient with a negative test result does not, in fact, have the disease in question.
- **False positives and False Negatives**
    - Whereas the epidemiologist thinks in terms of sensitivity and specificity, **the clinician thinks in terms of false negatives and false positives.**
    - FALSE-NEGATIVES:
        - The term "false-negative" means that patients who actually have the disease are told that they do not have the disease.

        - A screening test which is very **sensitive** has few "false negatives". The lower the sensitivity, the larger will be the number of false negatives.
    - **FALSE-POSITIVES:**
        - means that patients who do not have the disease (i.e. normal healthy persons) are told that they have the disease.
        - A screening test with **a high specificity** will have few false positives. False-positives not only burden the diagnostic facilities, but they also bring discredit to screening programmes.
        -

**YIELD**

- It is the amount of previously unrecognized disease that is diagnosed as a result of screening efforts.
- It depends on many factors:
    - Sensitivity
    - Specificity
    - Prevalence of the disease --- that determines +ve and -ve predictive value
    - The participation of the individuals in the detection program.

**SOME SCREENING TESTS**

- **Pregancy**
    - Anemia
    - Hypertension Toxemia
    - Rh status
    - Diabetes
    - Neural tube defects
- **Middle-aged men and women**
    - HTN
    - Cancer
    - DM
    - Serum Cholesterol
    - Obesity
- **Infancy**
    - Spinal bifida
    - Congenital heart dx
    - SCD
    - Hearing defect
- **Elderly**
    - Nutritional disorder
    - Cancer
    - TB
    - Chronic bronchitis
    - Glaucoma

3 components

- Agents
- Route of transmission
- Host

## DEFINITIONS

### Agents

1. **Reservoir of infection:** defined as the specific ecological niche upon which infectious agents depends for survival. These niche could be **Human, animal or non-living reservoir**
    a. Infective agents adapted to man include Measles, HIV, typhoid, meningococcal meningitis, syphilis, gonorrhea
    b. Human reservoir = includes both healthy population and Sick population.
    c. If reservoir is shared with animals, it is termed as Zoonosis infection
2. **Carrier**
    a. A person who habours the infective agents without showing signs of the dx but is capable of transmitting the agents to other persons
    b. Types
        i. Healthy carrier
        ii. Incubatory or precocious carrier
        iii. Convalescence
        iv. Chronic
    c. Importance
        i. Determines spread of the dx from the magnitude of the problem in the population e.g. HBV
3. **Zoonosis**
    a. Those infectious dx of vertebrate animals which are transmissible to man under natural conditions
    b. E.gs.
        i. Where human uses the animal as food e.g. taeniasis
        ii. Where Vectors transmit infections from animal to man e.g. viral hepatitis (by mosquito), Plague, etc.
        iii. Where animal bites human being e.g. Rabies
        iv. Where animal contaminate human environment e.g. salmonellosis
4. Non-living reservoir
    a. Many of these agents are saprophytes living in the soil and they are fully adapted to living free in nature. They can withstand various environmental changes and humidity and some of them develop resistant spores e.g. Clostridium tetani (tetanus), Clostridium welchi (gas gangrene) and C. botilinum (botulism)

**Routes of transmission:** Examples

1. Contact e.g. Scabies, STI
2. Penetratioin of skin e.g. schistosomiasis, hookworm, malaria, tetanus
3. Inhalation e.g. Meningitis and many other resp infections
4. Transplancetal e.g. syphilis, toxoplasmosis, HIV
5. Ingestion e.g. Typhoid

**Host Factors that affect infection**

- Types
  - Non-specific host factors
    - Reflexes e.g. sneezing, coughing, … etc. .that Protect against infections
  - Specific
    - Genetic or Acquired
    - Acquired through vaccination, etc
- Factors that determine host immunity
  - Age, Gender, Pregnancy, nutrition, Trauma, Fatigue
- Herd Immunity
  - **Ability of population to resist infection**
  - *Is a form of indirect Acquired protection from infectious disease that occurs when a large percentage of a population has become immune to an infection, thereby providing a measure of protection for individual who are not immune*
    - *The greater the proportion of individuals in a community who are immune, the smaller the probability that those who are not immune will come into contact with an infectious individual*
  - When Herd immunity is high, the burden of the disease in that pop. is low
  - When herd immunity is low, the burden of the dx is high

**Control of Communicable Disease**

- Elimination of reservoir
  - This can be done depending on the reservoir considered
- Interruption of R.O.T
  - Personal hygiene
  - Environmental sanitation
- Protect susceptible host
  - Immunization
  - Chemoprophylaxis

**QUESTION: Describe the epidemiology and control of a named communicable disease**

MEASLES, for e.g.

INTRO

- Acute infectious dx of children
- Organism = measles

EPIDEMIOLOGY

- **Case Definition:** Measles is suspected in any person who develops
  - Fever,
  - Maculopapular rash, and
  - Any of these 3:
    - Cough
    - Corrhyza

        - Conjunctivitis
- This is confirmed by a +ve lab test result of the infection
- **Infectivity/Communicability**
    - Infectivity period of measles occurs from the appearance of prodromal symptoms (fever, running nose, cough, loss of appetite and conjunctivitis) to 4 days after the onset of rash
    - However, Infectivity of measles is greatest in the 3 days before the onset of rash (around the time **koplik** spots appears), and 75%-90% of susceptible household contacts develop the disease
- **Virulence**
    - The virulence of measles is attributable to the presence of Hemaglutinin and fusion glycoprotein on the envelope of the virus
- Host Factors
    - .
    - .
    - .
- Environmental Factors
    - .
    - .
    - .

**CONTROL**

- 4 **STRATEGIES** for measles contro
    - To **strengthen Routine Immunization Activity** i.e. the child must be vaccinated by 9 months of age (so that seroconversion is 85-95% )
    - **Supplemental Immunization Activity (SIA)** i.e. giving a 2nd opportunity for the child to be protected. This is achieved through
        - ***Catch-up campaigns***
            - Age-wide immunization that is done once in a life cycle of a population
            - Btw 9 month to 14 years
        - ***Follow-up campaigns***
            - Vaccinate child between 9 mo to 5 years
    - **Disease Surveillances** (= Measles case-based surveillance)
        - First, Detection of disease based on clinical features
        - Next, Report the disease
        - Take blood samples to laboratory to confirm
    - **Mx of cases with:**
        - Antibiotics
            - For treatment of secondary infections (e.g. otitis media or bacterial pneumonia)
        - Vitamin A
            - Esp in children with clinical signs of vitamin A deficiency assoc. with measles
        - Good nutrition

# DISEASE SURVEILLANCE

## DEFINITION:

It is the **continuous scrutiny and watchfulness** of disease and factors that determine the occurrence and distribution of the disease and other conditions of ill-health with sufficient accuracy and completeness to provide basis for effective control.

Disease surveillance involves

1. Collection,
2. Collation,
3. Evaluation, and
4. Dissemination of information to those in position of taking action.

## OBJECTIVES OF SURVEILLANCE

1. to define the demographic, temporal and geographic distribution of disease
2. to test hypotheses regarding causation or transmission
3. to detect outbreaks or new strains,
4. to guide or evaluate disease control strategies
5. to assess cost of a condition
6. to detect changes in public health practice
7. to facilitate planning and identify research needs, and/or
8. to define the natural history of disease
9. Prepare and distribute surveillance reports to health care professionals participating in disease prevention and control activities.

## TYPES OF DISEASE SURVEILLANCE

1. Active surveillance
2. Passive surveillance
3. Epidemiological surveillance
4. Nutritional surveillance
5. Demographic surveillance
6. Sentinel surveillance

### Epidemiologic surveillance

- Is the ongoing systematic collection, recording, analysis, interpretation, and dissemination of data reflecting the current health status of a community or population.
- Surveillance is **based on both passive and active data collection processes**.

### Active surveillance

- Refers to daily, weekly or monthly contacting of physicians, hospitals, laboratories, schools or others to "actively" search for cases.
- It is more time- and resource- intensive, relative to passive surveillance, and therefore less commonly used in emergencies, But it is of more complete than passive surveillance.
- It is Used during high diseases frequencies and also during outbreaks
- E.g.
    - Health surveys
    - Census

**Passive surveillance**

- Done on a routine/regular basis i.e. data taken by institution that see patients are being routinely or regularly submitted for analysis. There is no active search for cases
- Relies on cooperation or compliance of health-care provider (laboratories, hospitals, private practitioners) to report the occurrence of diseases to a higher administrative level, where the data is compiled and analyzed to monitor disease patterns and identify possible outbreaks
- It is the Most common type of surveillance for
    - **humanitarian emergencies**
    - **Communicable disease**
    - **the detection of vaccine-preventable disease**
- Is often incomplete; because there are few incentives for health workers to report.
- E.g.
    - Hospital and billing data
    - Vital statistics: Births and deaths

**Nutritional surveillance**

- is a systematic approach used to **detect malnutrition and identify populations at risk of suffering from it**.
- Usually done for population of <5yrs of age
- Then, Classify population into: (a) stunted; (b) kwashiorkor; (c) marasmus; (d) underweight; (e) obesity; (f) well nourished

**Demographic surveillance**

- Relating obtained data to demographic data (age, sex, marital status, …)
- **Demographic surveillance systems (DSS)** work by monitoring individuals, households and residential units in a well-defined geographic area, known as a **demographic surveillance area (DSA)**. They begin with an **Initial Census**, which defines and registers each individual in the target population, as well as a**ge, sex and marital status**. Data are collected, at this stage, on household composition, religion, ethnicity, education levels, occupation, household wealth and access to facilities such as water and sanitation.
- Subsequently, **regular data collection** monitor changes to this population by gathering information on births, deaths and migrations. These **update rounds** also record other key events such as marriage, divorce, pregnancy and changes in employment status.

**Sentinel surveillance**

- You carry out a study on a **specific condition**, it rate of occurrence and its stability within a **particular subgroup of a population**. The data obtained are **generalized** for the whole population.
- To assess burden of a disease on a population
- Sentinel surveillance system is used when high-quality data are needed abt a particular dx that cannot be obtained thru a passive system.

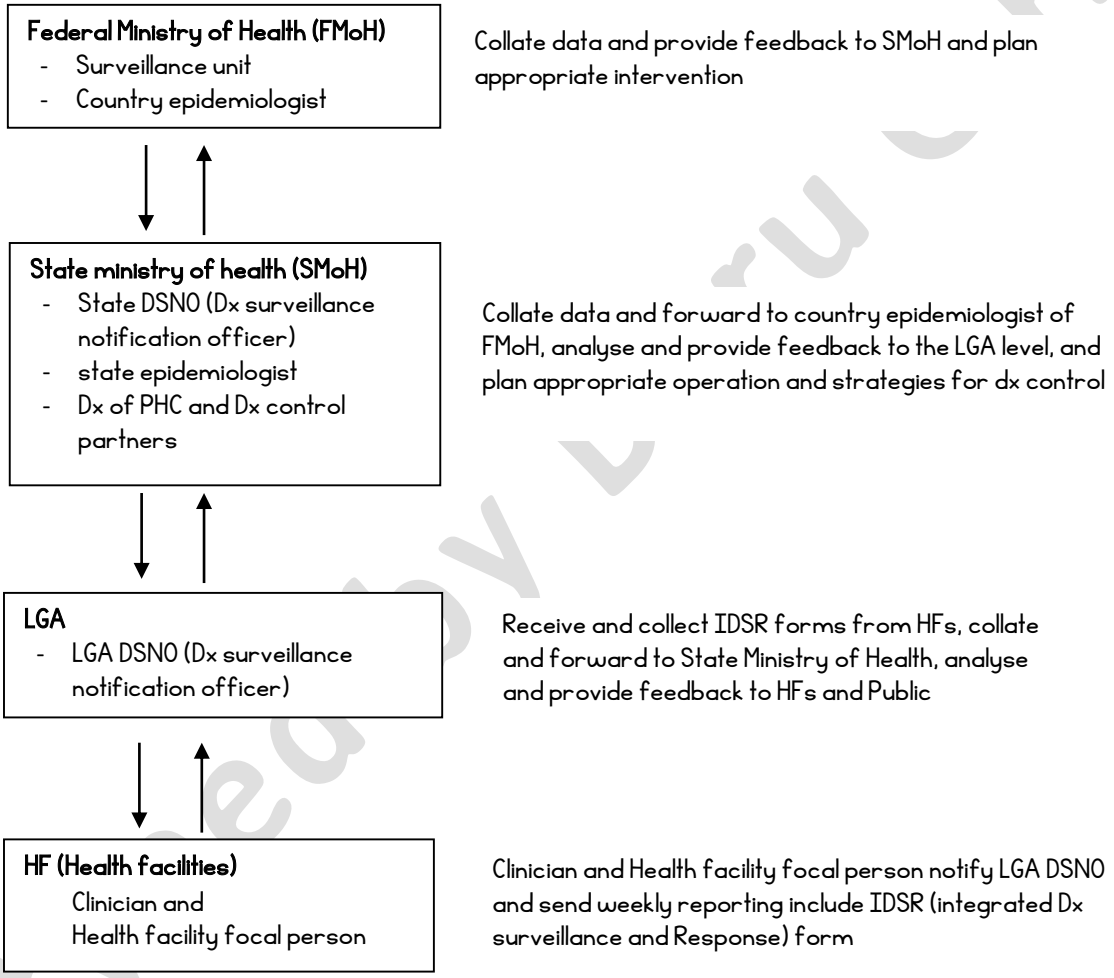
**FACTORS AFFECTING DISEASE SURVEILLANCE IN NIGERIA**

- Inadequate supervision

- Lack of logistic support
- Frequent turn-over of staff
- Inadequate training
- Deficient or unharmonized data.....
- Lack of political will, and therefore depending on donor
- Data falsification

## STRUCTURE OF DISEASE SURVEILLANCE IN NIGERIA

See below



# EPIDEMICS

**DEFINTION:** Epidemics is the increase in the no. of cases of a disease in a population, in excess of the usual no. for that place and that particular time.

## OTHER TERMS

- **PANDEMIC** – increase in the no. of cases of a dx in a particular place, over a period of time, in excess of the usual, that has spread beyond a country
- ENDEMIC – habitual presence of a dx in a place throughout the year

## OBJECTIVES OF INVESTIGATION OF EPIDEMICS

1. To help define magnitude of outbreak in terms of time, place and person
2. To identify factors responsible
3. To identify Cause, source and Route of transmission or mode of transmission
4. To prevent future occurrence

## STEPS IN INVESTIGATION OF EPIDEMICS

1. Verify diagnosis
2. Confirmation of existence of epidemics
3. Defining the population at risk
4. Rapid search for all cases and their characteristics through medical survey, epidemiological ….
5. Data analysis in terms of time, place and person, for the dx.
6. Formulation of hypothesis
7. Testing of hypothesis
8. Evaluation of ecological factors
9. Further investigation to determine population at risk
10. Report writing

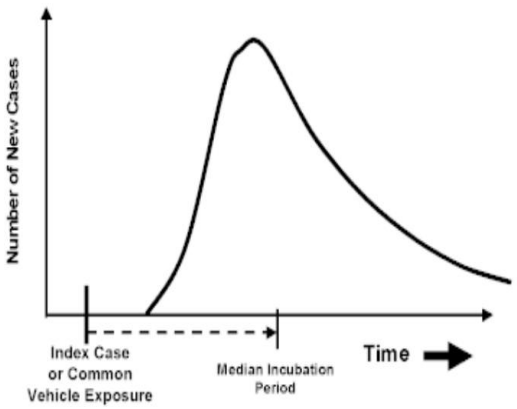
## MANAGEMENT OF EPIDEMICS

- Is a team approach
- Get the history of dx from pxs while treating them

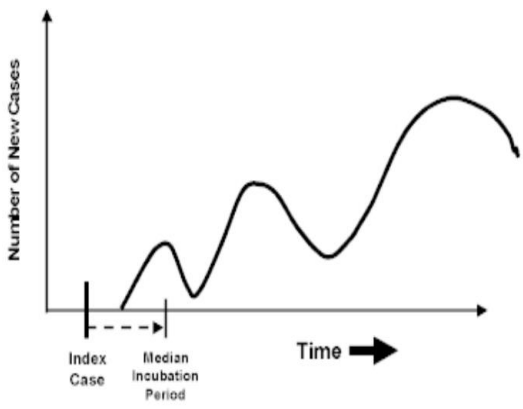
## TYPES OF EPIDEMICS

1. Point-source epidemics – because of a single exposure
2. Propagated epidemics – because of multiple exposures

Epidemic Curve of Point Source Epidemic




Epidemic Curve of Propagating Epidemic




ISOLATION – You isolate peope with the disease

QUARANTINE - you quarantine those with suspected cases of the dx

PRIMORDIAL PREVENTION - government policies/legislations that are in place to prevent the dx e.g.

a. Adequate town planning in a population that has never been exposed
b. In Ochocerciasis, people should not build houses around riverine areas