Introduction to Epidemiology

Contact information:

Melsew Getnet
(GMPH, MPH-EPI-BIOST, PhD Cand)
Assistant Professor of public health
Melsew.getnet@sphmmc.edu.et
melsewg@gmail.com
+251920258142
Location: SPHMMC, Addis Ababa
Office hour: Up on request

What is Public Health?

- Preventing disease
- Prolonging life
- Improving the quality of life
- Eliminating health inequalities
- Organizing community to promote active participation

Identifying Issues of Public Health Importance

Consider:

- **Magnitude of the problem**: Incidence and prevalence
- **Seriousness of the problem**: case fatality rate
- **Availability of effective intervention**: evidence of effectiveness of interventions
- **Impact of the disease** on health, social, and economic welfare
- **Proportion of people potentially affected** by the disease

Sources of Information

Standard scientific methods

- **Epidemiology**
- **Demography**
- **Health Services Research…**

Other Methods

- **Expert assessment**
- **Community assessment**

Epidemiology

“Basic Science of Public Health”

Definition

The study of

frequency, distribution and determinants

of health related events in specific populations, and

the application of it to prevention and control of health problems.

Epidemiology: “Distribution”

Person (Who)

– Young Vs Old

– Female Vs Male

– Rich Vs Poor

Place (Where)

– Lowland Vs Highland

– Urban Vs Rural

Time (When)

– Day Vs Night

– Seasonal Variations

– Long term variations

Epidemiology: “Determinants”

How: mechanism

– Mode of transmission

Why: cause

– Genetic Vs environmental

– Social and cultural conditions

Historical Perspective of Epidemiology[1]

Hippocrates - 5th century

- Association between external environment and personal characteristics and health
- Whoever wishes to investigate medicine:
    - Season of the year
    - The wind
    - The water
    - The earth
    - Drinking and eating pattern of the people
    - Exercise and labor

Historical Perspective of Epidemiology[2]

Lind -1747

- Used an "experimental" approach to prove the cause of scurvy by showing it could be treated effectively with fresh fruit.

Historical Perspective of Epidemiology[3]

John Snow – 1853

Cholera epidemic in London

- Lambeth, Southwark and Vauxhall Company (1949 – 1954) polluted by the sewage from London.
- Lambeth changed the source
  - ***Rate of Cholera declined***
- In the area supplied
  - *Southwark and Vauxhall Company continued*

- 1937 Austin Bradford Hill, suggested the criteria for establishing causation from epidemiological studies.
- 1950's-1970's. Major epidemiology successes in the area of non-infectious diseases

Basic Epidemiological Assumptions

1. ***Human disease does not occur at random.***

***2. Human disease has causal and preventive factors that can be identified through systematic investigation*.**

USES OF EPIDEMIOLOGY

- Monitoring the Public Health
- Studying the natural history of disease
- Looking for causes of disease, death and disability - etiological agents
- Evaluating interventions and health service provision
- Planning health services
- Decision making in clinical medicine

Evolution of Modern Epidemiology

- Milestones have been broadly divided into three stages:
  - *Sanitary statistics*
  - *Infectious disease epidemiology and*
  - *Chronic disease epidemiology**
  - *Multi-level causality**

Era of sanitary statistics

- First half of the19th century
- Prevailing etiologic theory was "miasma theory"

  (i.e., poisoning by foul emanations from soil, air, and water).

- Focused on assessing the clustering of morbidity and mortality and on preventive measures such as drainage, sewage, and sanitation.

Era of infectious disease epidemiology

- Late 19th c - first half of the 20th C
- The germ theory prevailed.

  "Period of bacteriology"
- Analytic approach
  - ***Laboratory isolation and culture***
- Preventive approach
  - ***Interrupt transmission of the infectious agent.***

Era of chronic disease epidemiology

- ***the "black box" approach***
  - *Exposures are related to outcomes without always understanding the intervening factors or pathogenesis*
  - Primary analytic methods
  - ***Risk ratios to relate exposures to outcomes.***
- Preventive measures
  - *Control of risk factors by modifying the environment or human behavior* ***(e.g., smoking, physical inactivity).***

Multi-level Causality

- Multiple risk factors interacting to cause disease.
- Cascade of causation from ecosystem risk factors to molecular causes of diseases.

Features of Epidemiology

- Studies are conducted on human population
  - *Ethics*……observational studies**
- Examines Patterns of events in groups of people
- Can establish cause and effect relationship without the knowledge of biologic mechanism
  - *Smoking and lung cancer*
- Covers a wide range of conditions
  - *From infectious to non-infectious*
  - *From simple survey to complex drug trials*

Levels of Disease Occurrence

1. **Expected Levels**
   - **Endemic**
   - **Hyper-endemic**
   - **Sporadic**
2. **Excess occurrence**
   - **Epidemic/Outbreak**
   - **Pandemic**

Broad Categories of Epidemiology

1. Descriptive Epidemiology - Defines the amount and distribution of health problems in relation to person, place and time.

2. Analytic Epidemiology – involves explicit comparison of groups of individuals to identify determinants of health and diseases.

Descriptive Epidemiology

Characteristics:

- Numerical presentation of events
- Person, place and time.
- To describe the occurrence of a disease fully, the following questions must be answered.
  - Who is affected?
  - Where? and
  - When do the cases occur?
  - How many?

Analytic Epidemiology

Involves explicit comparison of groups of individuals to identify determinants of health and diseases.

Testing of hypotheses, which in turn may arise from:

- *Case reports*
- *Case series*
- *Laboratory studies*
- *Descriptive epidemiologic studies*
- *Other analytic studies*

Major Approaches in Epidemiology…

- Descriptive and analytic classification is more of a continuum than a dichotomy.
- Many studies have both descriptive and analytic aspects.
- data collected in one mode may end up being used in the other as well.

Sources of Epidemiologic data

- Census
- Vital records
- Data from health institutions
- Data from morbidity data
- Other sources

2. Epidemiological aspects of communicable disease

MG.

2. Epidemiological aspects of communicable disease

Communicable/Infectious Disease Epidemiology

- The study of circumstances under which infection and disease occur in a population; and the factors that influence their frequency, spread and distribution.

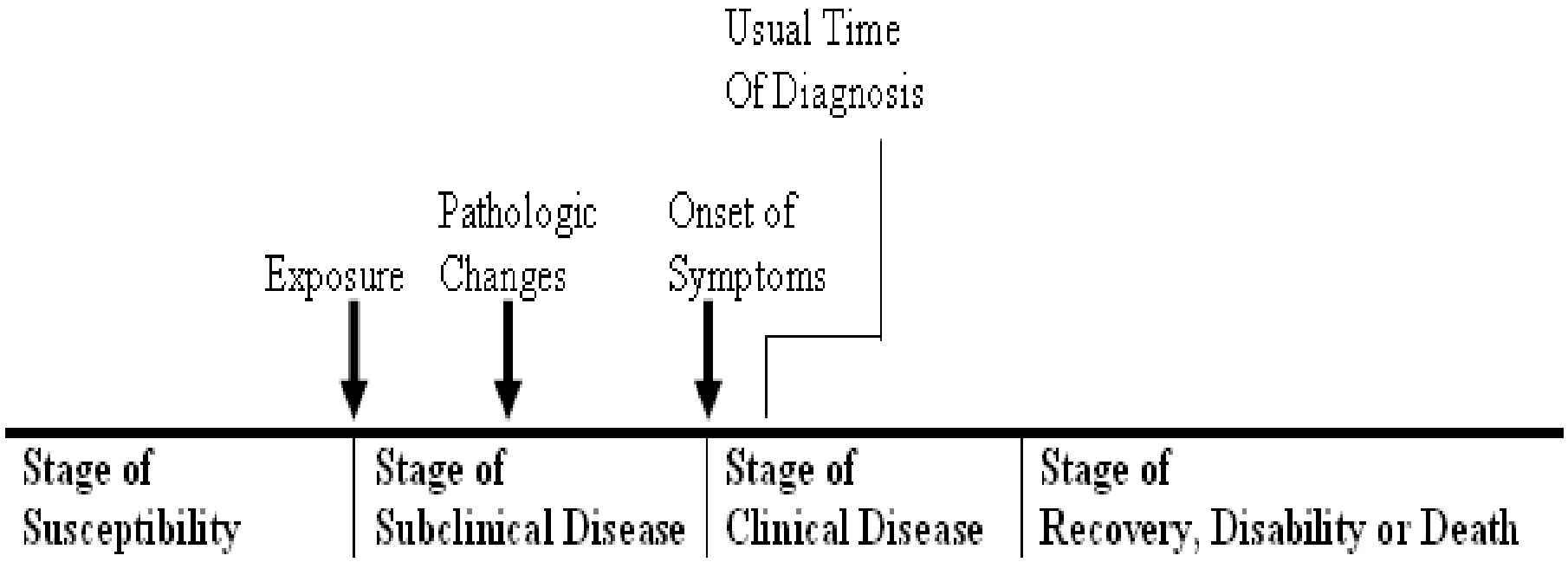
Natural History of Diseases:

- It refers to the progression of a disease process in an individual over time, in the absence of intervention.
- The process begins with exposure to the causative agent capable of causing disease;
- Without medical intervention, the process ends with recovery, disability, or death.

The usual course of a disease may be stopped at any point in the progression by:

- ✓ *preventive and therapeutic measures,*
- ✓ *host factors, and*
- ✓ *other influences.*

The stages in the natural history of disease



Factors that affect exposure:

- ✓ age, sex, race,
- ✓ socioeconomic status, and
- ✓ behaviors (smoking, drug abuse, lifestyle, sexual practices and contraception, eating habits)

Environmental factors

Are extrinsic factors which affect the agent and the opportunity for exposure.

- Physical factors such as geology, climate
- Physical surrounding (e.g. Hospital);
- Biologic factors such as insects that transmit the agent; and
- Socioeconomic factors such as crowding, sanitation, and the availability of health services.

Causal Concepts of Disease

- Not all associations between exposure and disease are causal.
- A cause of a disease can be defined as a factor (characteristic, behavior, event, etc.) that influences the occurrence of disease.
- If disease does not develop without the factor being present, then we term the causative factor "necessary".
- If the disease always results from the factor, then we term the causative factor "sufficient“

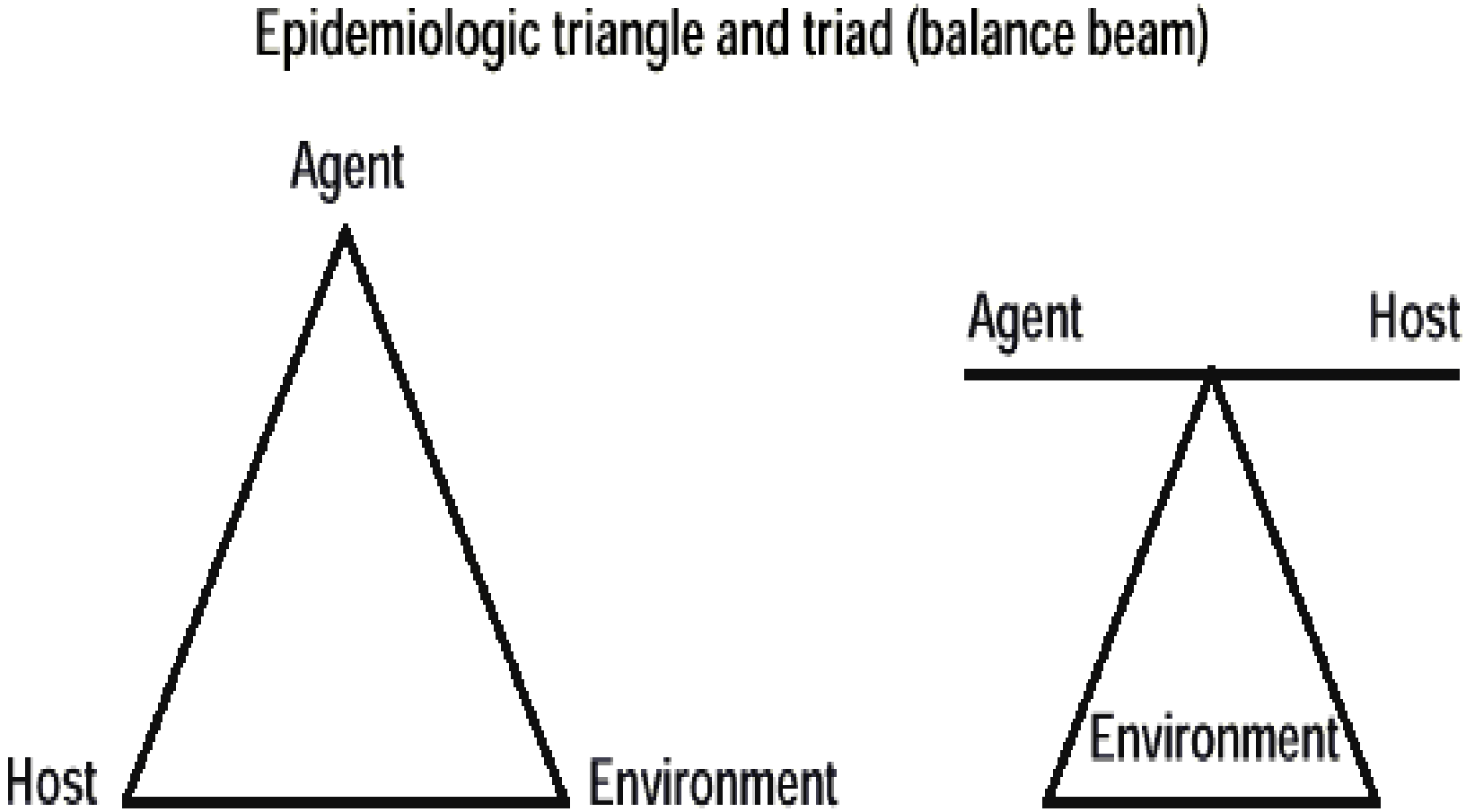
Example:

- Tubercle bacillus is a necessary factor for tuberculosis.
- Rabies virus is sufficient for developing clinical rabies.

Causal concepts… Epidemiologic triad

- The epidemiologic triad or triangle is the traditional model of infectious disease causation.
- **It has three components:**
  - ✓ an external agent
  - ✓ a susceptible host and
  - ✓ an environment that brings the host and agent together

Traditional model of infectious disease causation



Examples of causes of disease by host, agent and environmental factors

Host factors	Agent factors	Environmental factors
▪ Sex ▪ Behavior ▪ Genetic inheritance ▪ Height ▪ Weight	organisms • Serotype of organisms • Antibiotic resistance • Cigarette-tar content	overcrowding • Air pollution • Workplace hygiene • Weather • Water composition • Food contamination • Animal contact

Disease Classification

Disease is often classified according to:

1) its time course, or

2) its cause.

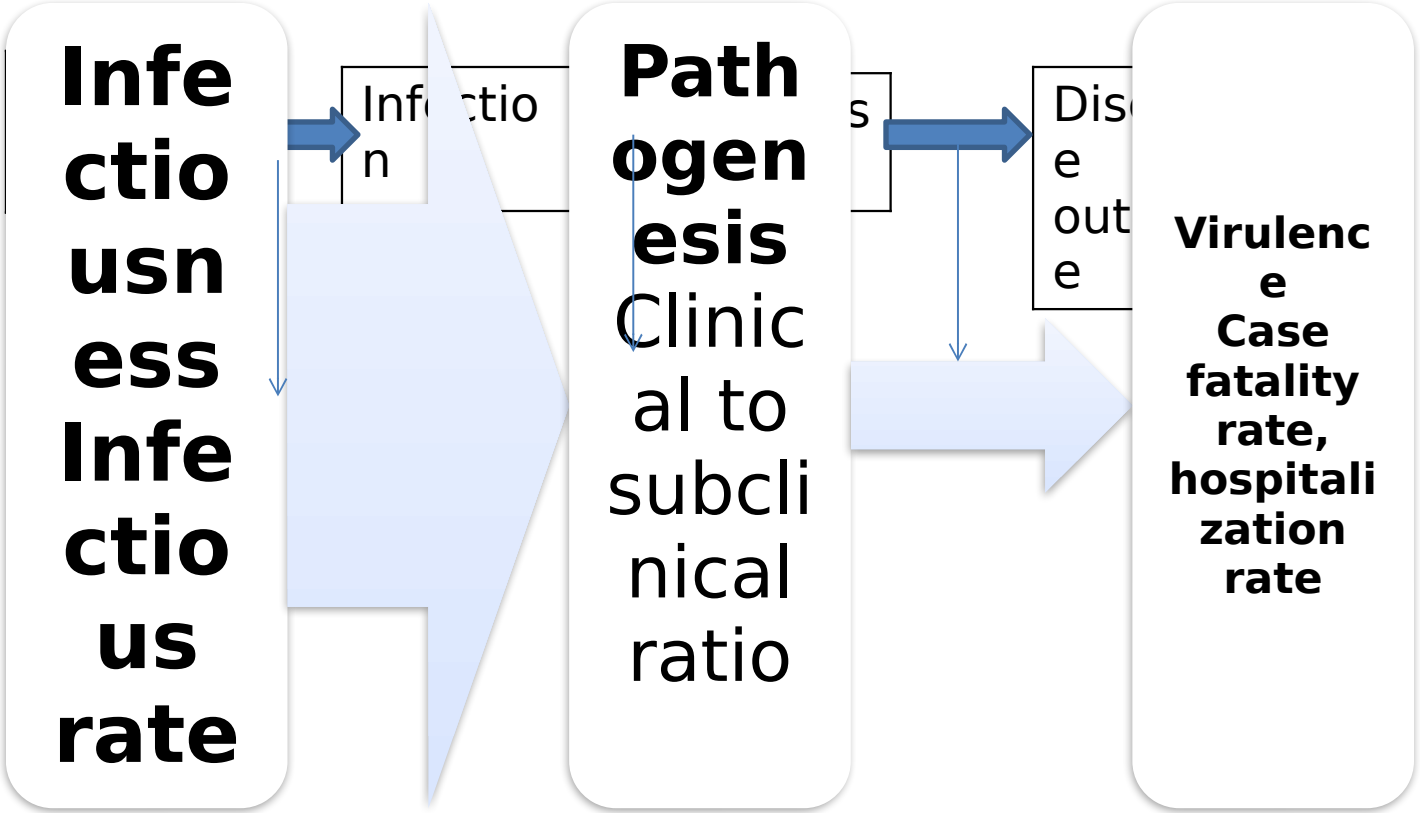
The time course classifies disease as:

- **Acute** (characterized by a rapid onset and short duration) or **chronic** (characterized by a prolonged duration).
- The cause of a disease may be classified as infectious or non-infectious.

The outcomes of exposure to an infectious agent are referred as:

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

Outcomes at Each Stage of Infection



Variation in Severity of Illness

- The effect depends on the nature of the infectious agent and host susceptibility.
- Case fatality rate (CFR) is the measure of severity of illness.

CFR= Number of deaths from a disease

Number of clinical cases of that disease

Spread of Disease through Person to Person transmission

- Person to person transmission of an infectious agent is one of the main methods of disease spread in a community and is dependent on:

1. Generation time:

- This refers to the period between exposure/infection and the maximum communicability of the exposed host regardless of whether the disease is apparent or in-apparent

2. Herd immunization:

- This refers to a community resistance to spread of an infectious agent as a result of immunity gained by high proportion of individual members of the community.
- Though it may not be important to achieve 100% immunity, successful breakage of the chain of infection can be achieved if the immunity is close to 100%.

3. Secondary attack rate: This is an important measure of spread of disease among contacts of an index case.

- It has great use in epidemic situations.

Secondary AR =

$$\frac{\textbf{New cases among contacts of index cases during the period}}{\textbf{Total number of contacts with the index cases}} \textbf{*100\%}$$

- The index cases are excluded from both numerator and denominator.
- Index case: The case that brings a household or any other group (community) to the attention of the public health personnel.

3. Epidemiological Measures

Melsew Getnet

(Ass. professor of Epidemiology)

Objectives

After completing this chapter, the student will be able to:

- Describe advantages of measuring frequency
- Describe nature and components of epidemiologic transition
- Identify and calculate commonly used rates of mortality and morbidity
- Determine prevalence and incidence from a given data

Why We Measure Disease Frequency ?

Fundamental to epidemiology:

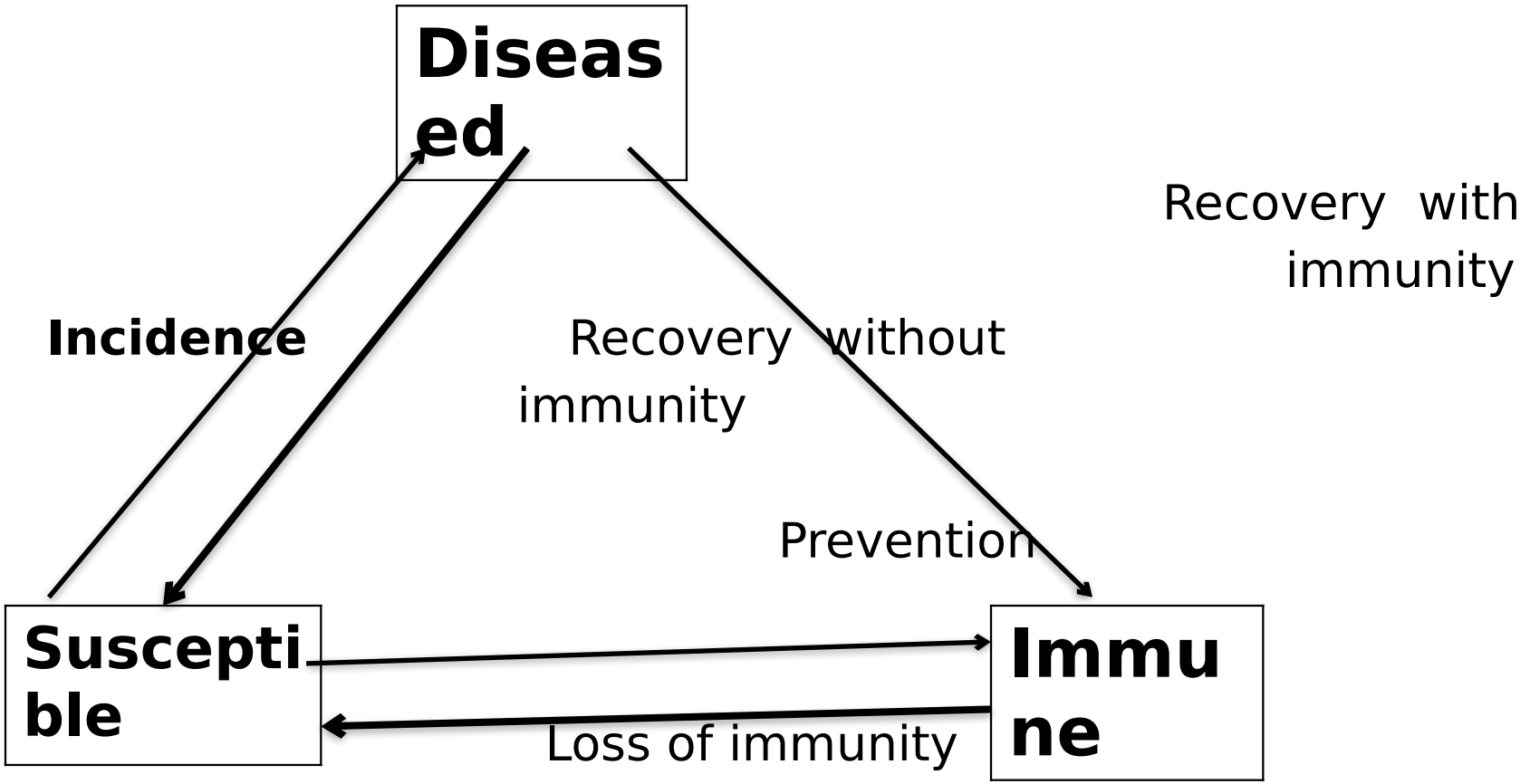
- distribution of disease and to make comparisons.
- Monitoring the health status of the population and
- planning health services.

Epi…Transition

At any given time, an individual can be in one of three states:

1. Diseased: Currently afflicted.
2. Susceptible: not currently afflicted, but capable of developing the disease in the next moment of time.
3. Immune: not currently afflicted, and incapable of developing the disease in the next moment (and possibly longer).

In general, the transitions can be interpreted and labeled as:



Disease in populations (1)

In a population that is observed over time,

- membership in the population may or may not change.
- If no changes in membership occur, it is called a **Closed Population (or “fixed cohort”).**

Examples:

- Persons involved in a food borne illness outbreak that occurs over a short period of time.

Disease in populations (2)

- If membership of the population changes during the observation period, it is called an **Open Population (or “dynamic cohort”).**
- People may join – e.g., births, in-migration.
- People may leave – e.g., deaths, out-migrants.

Examples:

- Population of Hawassa City during 2009.
- Employees of the Federal government during 2005-2010.

Tools in Measures of frequency

- Counts
- Ratio
- Proportion
- Rate

Simple Count

- Number of cases in a defined population
- May be sufficient by itself for some purposes

e.g., to determine the quantity of health care resources required to meet needs for people who currently have the disease.

Ratio

Used to compare two quantities

Commonly used ratios:

- *Ratio of female to male births*
- *Maternal mortality ratio*
- *The ratio of people with tuberculosis to those without tuberculosis.*

Proportion

- A specific type of ratio in which the numerator is included in the denominator
- Usually presented as a percentage

Calculation of proportion:

Number of infants who are immunized in Addis Ababa*100%

Total eligible infants for immunization in Addis Ababa

$$\frac{55{,}000}{75{,}000} = 73.3\%$$

Rate

- Special form of proportion that includes a specification of time
- Most commonly used in epidemiology because it most clearly expresses probability or risk of disease or other events in a defined population over a specified period of time

Number of infants who are immunized in Addis Ababa in 2009

Total eligible infants for immunization in Addis Ababa in 2009

$$\frac{55{,}000}{75{,}000} = 73.3\%$$ in a year (the year 2009)

Epidemiologic rates: classification

- Crude rates
- Category specific rates

Crude Rates

- Are summary measures

Crude rate =

$$\frac{\text{total number of cases of the outcome in the population}}{\text{total number of individuals in that population in a specified time period}} * 1000$$

Examples of crude rates: CDR, CBR

- No distinction is made for different categories or ages and sex

Category Specific Rates

Calculation of factor specific disease frequency measures such as:

- ✓ ***Cause specific rates***
- ✓ ***Age specific incidence rates***
- ✓ ***Age specific death rate***
- ✓ ***Sex-specific death rates***
- ✓ ***Race-specific rates***
- ✓ ***Place-specific rates***

4. MEASURES OF MORBIDITY AND MORTALITY

Morbidity measures

- Prevalence (point, period, lifetime)
  - burden
- Incidence (CI)
  - risk

Prevalence (P)

- Measures the no. of people in a population who have the disease at a given point/period in time.
- A measure of disease **status**, disease burden
  - In contrast to incidence which measures disease onset events

Types of Prevalence

Point prevalence:

number of cases that exist at a given point in time.

Life-time prevalence:

proportion of the population that has a history of a given disorder at some point in time.

Period prevalence:

number of cases that exist in a population during a specified period of time

- Used when it is difficult to know when the disease considered present.

Incidence:

Cumulative Incidence (CI)

- The proportion of a closed population at risk that becomes diseased within a given period of time
- Is an estimate of average risk

Prevalence: Exercise

On January 1, 2009 there were 10 medical students with Influenza A and there were a total of 300 students in the class. These 10 students were immune from contracting Influenza A again during the next nine months. From January 2, 2009 through April 2, 2009, 15 more students developed Influenza A and the class size remained at 300.

A. What was the prevalence of Influenza A on January 1, 2009?
B. what was the period prevalence of influenza A?
C. What was the cumulative incidence of Influenza A from January 2, 2009 through

Cumulative Incidence (CI)

$$CI = \frac{\text{No. of new cases of disease during a given period}}{\text{Total population at risk during the given period}}$$

Example: During a 1-year period, 10 out of 100 “at risk” persons develop the disease of interest.

CI= 10/100 = 0.1 or 10 cases of diseases per 100 population at risk

Special types of Incidence:

Attack Rate

Variant of a cumulative incidence

- ✓ ***Narrowly defined population***
- ✓ ***Observed for a limited time (e.g. epidemic).***

- Usually expressed as a percent.

Attack rate =

$$\frac{\text{Number of new cases among the population during the period}}{\text{Population at risk at the beginning of the period}} \times 100$$

Attack rate: Example

Of 75 persons who attended a church picnic, 46 subsequently developed gastroenteritis.

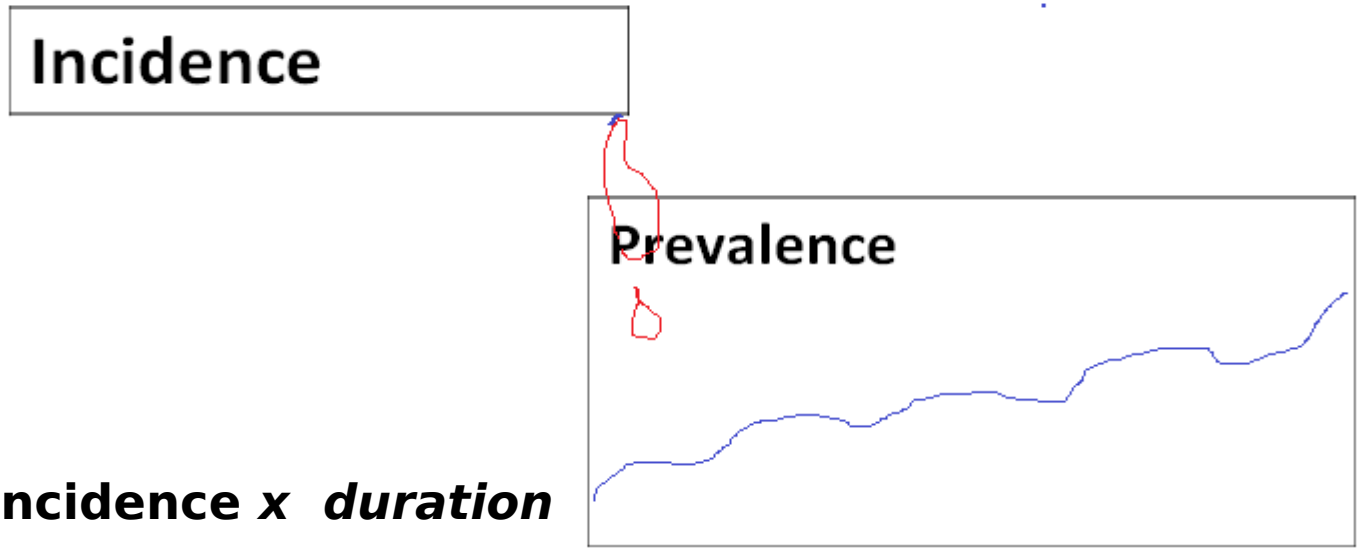
a) Calculate the attack rate of gastroenteritis :

x = Cases of gastroenteritis occurring within the incubation period for gastroenteritis among persons who attended the picnic = 46

y = Number of persons at the picnic = 75

AR= 46/75 x 100%

Relationship between Incidence and Prevalence



Prevalence =Incidence *x* *duration*

Measures of Mortality

“Mortality is the fundamental factor in the dynamics of population growth ….”

Mortality in a population can be monitored through a variety of measures:

- ***Crude death rates***
- ***Category specific death rate***

Measures of mortality: Crude rates

- Probability of death increases with age;
- Commonly, CDR reflects the age structure of the population;

$$\text{CDR} = \frac{\text{Number of deaths in a given interval}}{\text{Total population in mid-year}} \times 1000$$

CRUDE DEATH RATE (CDR)

- The number of deaths in a given interval (usually a year) divided by the population at mid-year.
- usually expressed per 1000 population.

Category Specific rates:

- Used to construct rates for specific segments of the population;
- So we can compare among strata or between groups (used especially for age, race, ethnicity, gender)
- We can also construct cause-specific rates to compare rates among causes

Category Specific rates…

Examples:

- Age-specific rates
- Gender- specific rates
- Race-specific rates
- Cause-specific rates

AGE-SPECIFIC DEATH RATE

The number of deaths of persons of a given age divided by the mid-year population in that same age category.

ASDR **=** [da/pa] X1000

Where,

- ***ASDR***=death rate for a specific age group
- ***d*a and *p*a** correspond to the deaths and the mid-year population for age category *a*, respectively.

Mortality Measures…

Neonatal Mortality rate =

$$\frac{\text{Number of deaths of neonates (28 days or less) in a given interval}}{\text{Number of live births during the same interval}} \times 1{,}000$$

Mortality Measures

Infant Mortality rate =

Number of deaths of under 1 year during a given interval X 1,000

Number of live births during the same interval

Used for international comparisons; high rates indicate unmet public health needs and poor socioeconomic and environmental conditions

Mortality Measures: Cause specific rates

Maternal Mortality Ratio =

$$\frac{\text{Number of deaths assigned to causes related to pregnancy during a given interval}}{\text{Number of live births during the same interval}} \times 100{,}000$$

Reflect health care access and socioeconomic factors

Mortality measures…

Cause Specific Death Rate

CSDR = # Of deaths from a specified cause in a year **x 100,000**

Average population in the same period

Identifies the proportion of people who died due to disease X.

Mortality measures…

PMR* = No. of deaths from a sp. Cause during a given time x 100

Total no. of deaths from all other causes in the same time

*** Proportionate mortality ratio**

Mortality measures….

Case Fatality Rate (CFR) =

No. of deaths from a sp.disease during a given time __x 100

-

No. of cases of that disease during the same time

Mortality measures….

- What proportion of total cases die from disease X ?
- CFR tells the virulence of the organism.

Mortality measures….

Sex- specific mortality rate =

No. of deaths in a specific sex during a given time X 1000

Estimated mid interval population of same sex

Summary of main results from EDHS 2016:Population-based indicators

Indicator	EDHS 2005	EDHS 2011	EDHS 2016	Performance
Under 5 Mortality Rate (U5MR) (per 1000 live births)	123	88	67	↑
Infant Mortality Rate (U5MR) (per 1000 live births)	77	59	48	↑
Neonatal Mortality Rate (per 1000 live births)	39	37	29	↑
Maternal Mortality Ratio (MMR) (per 100,000 live births)	673	*676*	*412*	↑
Total Fertility Rate (TFR) (%)	5.4	4.8	4.6	

MANY THANKS!

5. Methods of Epidemiological studies

Melsew Getinet

Study Designs

After completion of this session, the learner will:

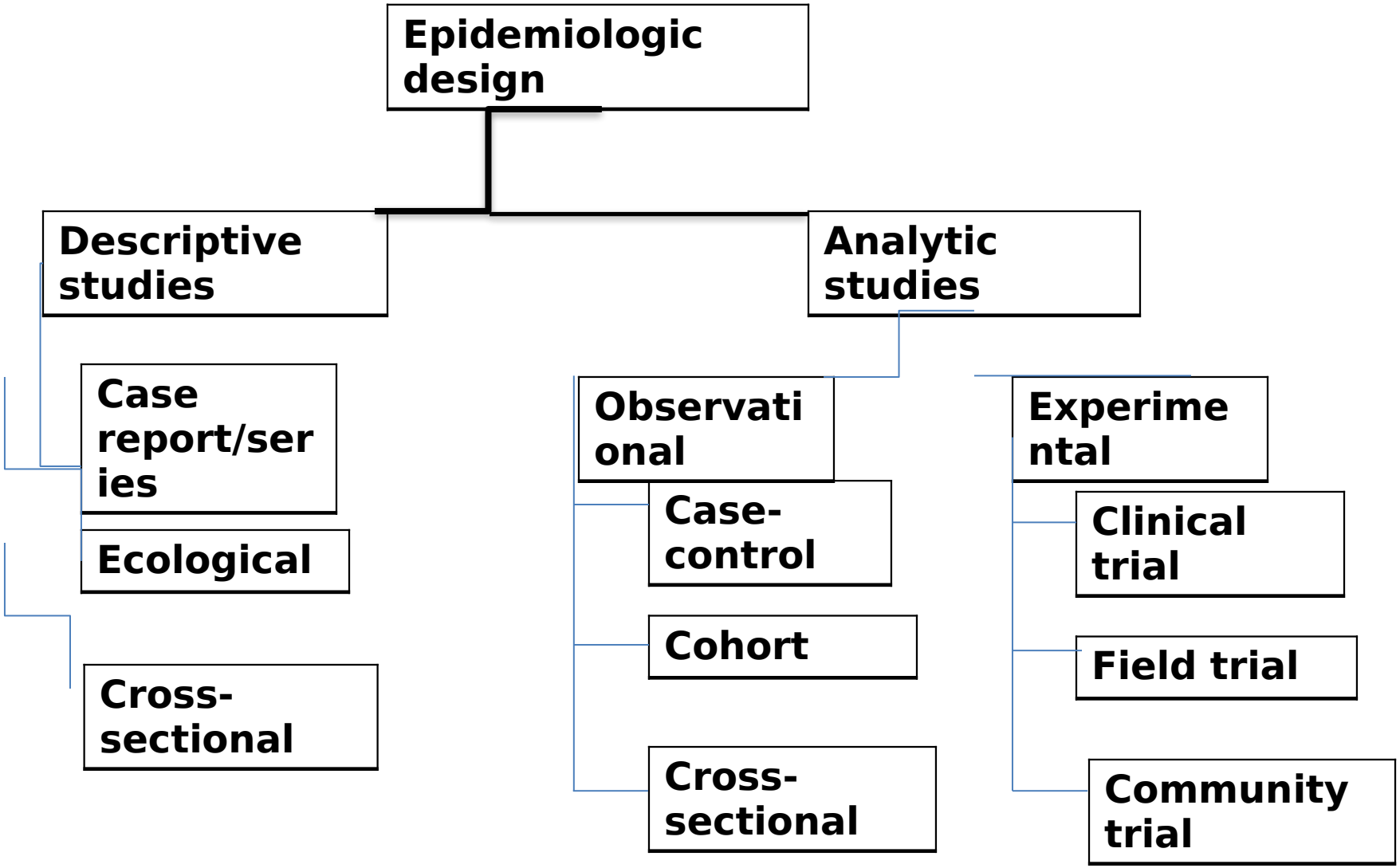
- Be able to classify study designs
- Describe the characteristics of descriptive and analytic study designs
- Design and describe the advantages and limitations of cross-sectional, ecologic and case report/series studies.

Features of Descriptive Study

- Distribution of diseases
- Useful for health managers to allocate resource and to plan effective prevention programs.
- Useful to generate epidemiological hypothesis
- Inexpensive and less time-consuming
- Most common type of epidemiological study in the medical literature.

Features of Analytic Study

- Focus on identifying risk factors
- Always use comparison group
- Test hypotheses
- Relatively costly
- Less often used than descriptive studies


Epidemiologic design
Descriptive studies
Analytic studies
Case report/series
Ecological
Cross-sectional
Observational
Case-control
Cohort
Cross-sectional
Experimental
Clinical trial
Field trial
Community trial

Descriptive Designs

Case Report and Case Series

- Documentation of unusual medical occurrence with detailed description in single/group of patient/s/.
- First clue in the identification of new disease or adverse effect of exposure
- Are the most common types of studies published in medical literature/field

Case report

- The profile of a single patient is reported in detail by one or more clinicians

Example

- *In 1941 Gregs (An Australian Ophthalmologist) reported a new syndrome of congenital cataract linked to rubella in the mother during pregnancy.*

Case series

- Collection of individual case reports, which occur with in fairly short period of time.
- Helps in identifying the beginning or presence of epidemic.
- Helps in hypothesis formulation
- Lack comparison group

Case series

An individual case report that has been expanded to include a number of patients with a given disease

Example:

- *15 young women develop breast cancer;9 of whom reported at least once weekly ingestion of foods packed with the estrogenic chemical bisphenol A(BPA). Urine testing confirms the presence of BPA among all nine cases.*

Case report/series: Advantages

- Clue to identification of new diseases/ syndromes/associations
- The first clue to disease–risk factor association
  - ✓ Helps formulate hypothesis

Case report/series: Limitations

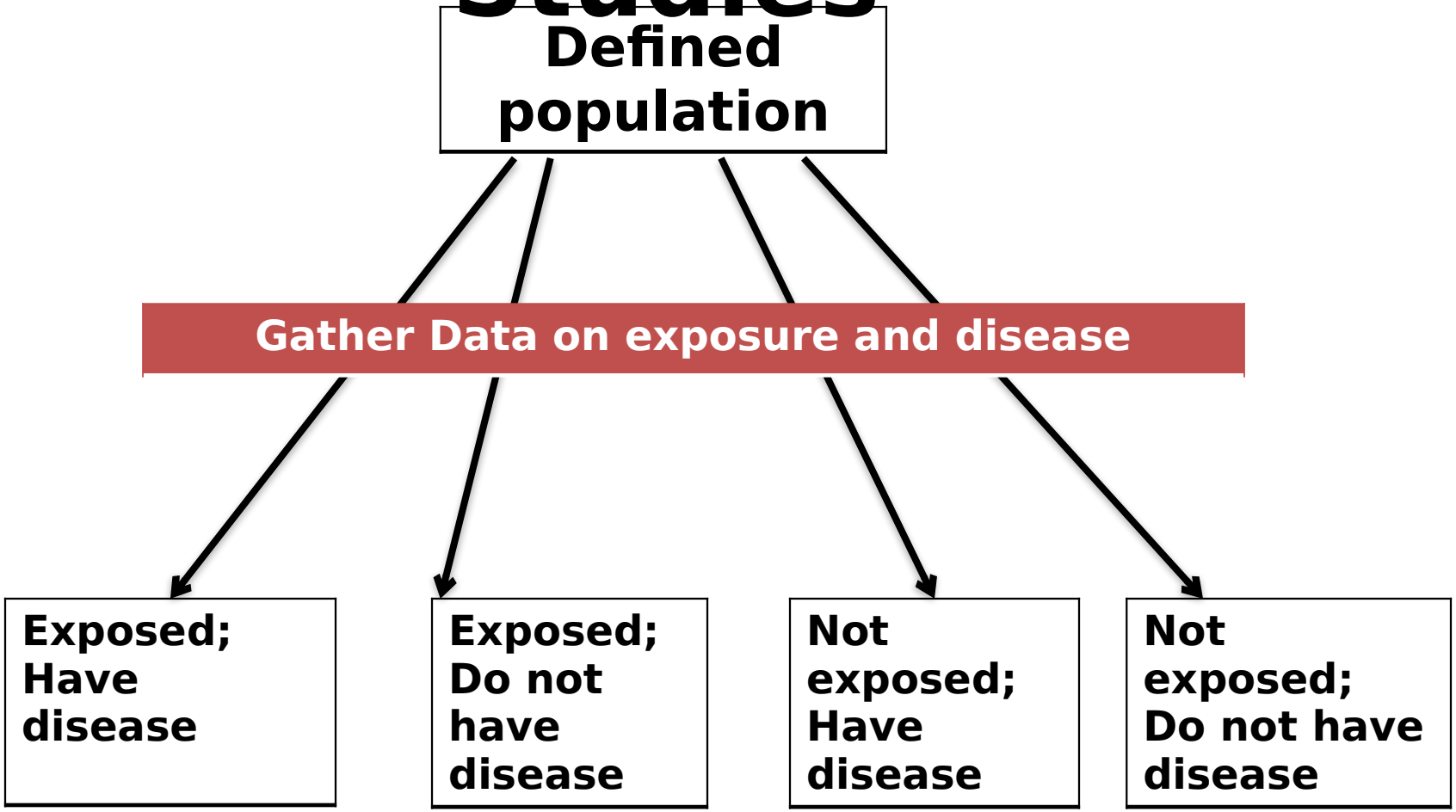
- Lack of denominator to calculate rates of disease
- Lack of comparison group
- No selection of appropriate study populations
- Sampling variations
  - ✓ no sampling employed, emerging cases are reported.

Cross-Sectional Studies

A **cross-sectional study** is an observational study in which exposure and disease are determined at the same point in time in a given population.

- *The temporal relationship between exposure and disease cannot be determined*

Design of Cross-sectional Studies



Design and Analysis of Cross-Sectional Studies[1]

Exposed

Not exposed

	a	**b**
	c	d
	Disease	No disease

diseased not diseased

Exposed

Not exposed

	a	**b**
	c	d

a	**b**	Exposed
c	**d**	Not exposed

Design and Analysis of Cross-Sectional Studies[2]

Prevalence of exposure in disease and not diseased

a/a+c Vs. b/b+d

Prevalence of disease in exposed compared to not exposed

a/a+b Vs. c/c+d

Cross-Sectional Studies

Examples of Cross Sectional Studies in Ethiopia:

- Census
- DHS
- TB survey 2003
- Other surveys

Ecological study[1]

An ecological study is one in which the units of analysis are population or groups of people rather than individuals.

Gives inference on the association between exposure and outcome at population level rather than individual level

Ecological study[2]

- Compare disease frequencies – among different groups during the same period of time, or in the same population at different points in time.

Ecological study[3]

Exposure and risk factors are known only at the group level

- Disease occurrence is at group level
- Used to generate hypothesis
- Comparison of groups than individuals
- Missing individual information
- Low cost
- Interest in ecological effects

Ecological Fallacy

o *Concluding that because an association exists between exposure and disease at the group level it therefore exits at the individual level.*

- Across level inference from group to individual.

o We don’t know the link between exposure and disease among individuals within each group

Ecological fallacy: example-1

- Imagine a study of the rate of coronary heart disease in the capital cities of the world relating the rate to average income.
  - Within the cities studied, coronary heart disease is higher in the richer cities than in the poorer ones.
    - *We might predict from such a finding that being rich increases your risk of heart disease.*
- *In the industrialized world the opposite is the case – within cities such as London, Washington and Stockholm, poor people have higher CHD rates than rich ones.*
- The ecological fallacy is usually interpreted as a major weakness of ecological analyses.
- Ecological analyses, however, inform us about forces which act on whole populations.

Ecological Studies: Limitations

1. Inability to link exposure with outcome at individual level.
2. Lack of ability to Control potential confounders.
3. It represent average exposure levels rather than actual values.
4. Ecological Fallacy.

Analytic Designs

- **Case-control Studies**
- **Cohort Studies**

Case-control studies

After completing this session learners will be able to:

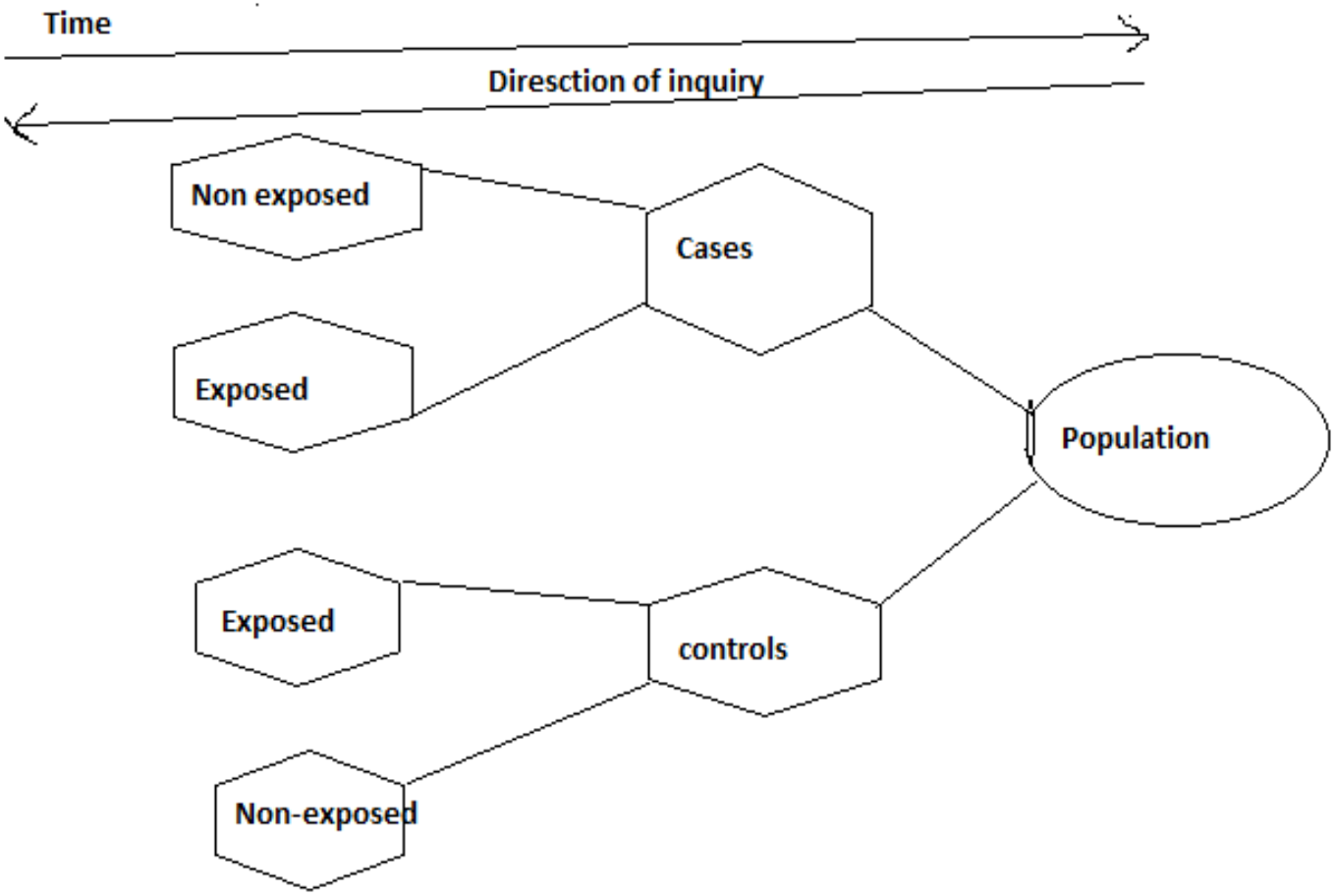
1. Define a case control study
2. Identify proper application of case control studies
3. Explain problems and merits related to case control studies

Definition

A case-control study is one in which persons with a condition ("cases") and suitable comparison subjects ("controls") are identified, and then the two groups are compared with respect to prior exposure.

– *subjects are sampled by their outcome status.*

Case-control Design



Case-Control studies[1]

- First, select

	Cases (with disease)	Controls (without disease)
	a	b
	c	d
Totals	a + c	b + d

Case-Control studies[2]

- First, select

Then measure Past exposure

	Cases (with disease)	Controls (without disease)
Were exposed	a	b
Were not exposed	c	d
Totals	a + c	b + d

Case-Control study: Example[1]

(causes of coronary heart disease)

Cases (CHD)	Controls(without disease)
Total 200	400

Case-Control study: Example[2]

(causes of coronary heart disease)

	Cases (CHD)	Controls (without disease)
Smoked cigarettes	112	176
Did not smoke	88	224
Total	200	400

% smoking cigarettes 112/200 = 56% 176/400 = 44%

When Is a Case-Control Study Warranted?

- Before a cohort or an experimental study
  - Less cost and shorter time.
- To investigate multiple exposures (if the real exposure is not known)for a given disease.
- If the disease is rare *because investigators can intentionally search for the cases.*
  - cohort will have to take many cases

Case-control Studies…cont'd.

A. Case Control Study:

- Cases and controls are compared for their exposure status.
- Assess retrospectively on exposure status
- Relatively cheaper (Time and Cost)
- Measure of association is using Odds ratio

Selection of Cases

- Setting clear definition of cases
- Incident Vs Prevalent cases:
  - Incident cases are preferable to prevalent cases for reducing:

    a.recall bias and

    b.over-representation of cases of long duration(length bias)

Representing spectrum of disease: mild, moderate and severe groups;

Hospital-based Vs population-based cases

Hospital-based:

– easy and inexpensive to conduct

– prone to selection bias.

Population-based:

- avoids selection bias
- allows the description of a disease in the entire population
- direct calculation of rates possible.

Selection of Controls

Considerations:

- Avoiding selection bias.
- Avoiding information (‘recall’) bias.
- Controls should come from the same population at risk for the disease as the cases
- Controls should be representative of the target population.

Case-control studies… cont’d.

Advantages	Disadvantages
Useful for studying several potential exposures.	Prone to selection bias and recall bias.
Efficient for rare diseases.	Not suitable for rare exposures
Efficient in resources and time	May be difficult to establish that "cause" preceded "effect”
Relatively quick, disease and exposure measurements can be made at the same point in time.	Cannot yield a population level measure of disease incidence or prevalence.

Assessing Exposure

Recall bias and *interviewer bias.*

- *Blinding interviewers and carefully phrasing interview questions.*

COHORT STUDIES

Objectives

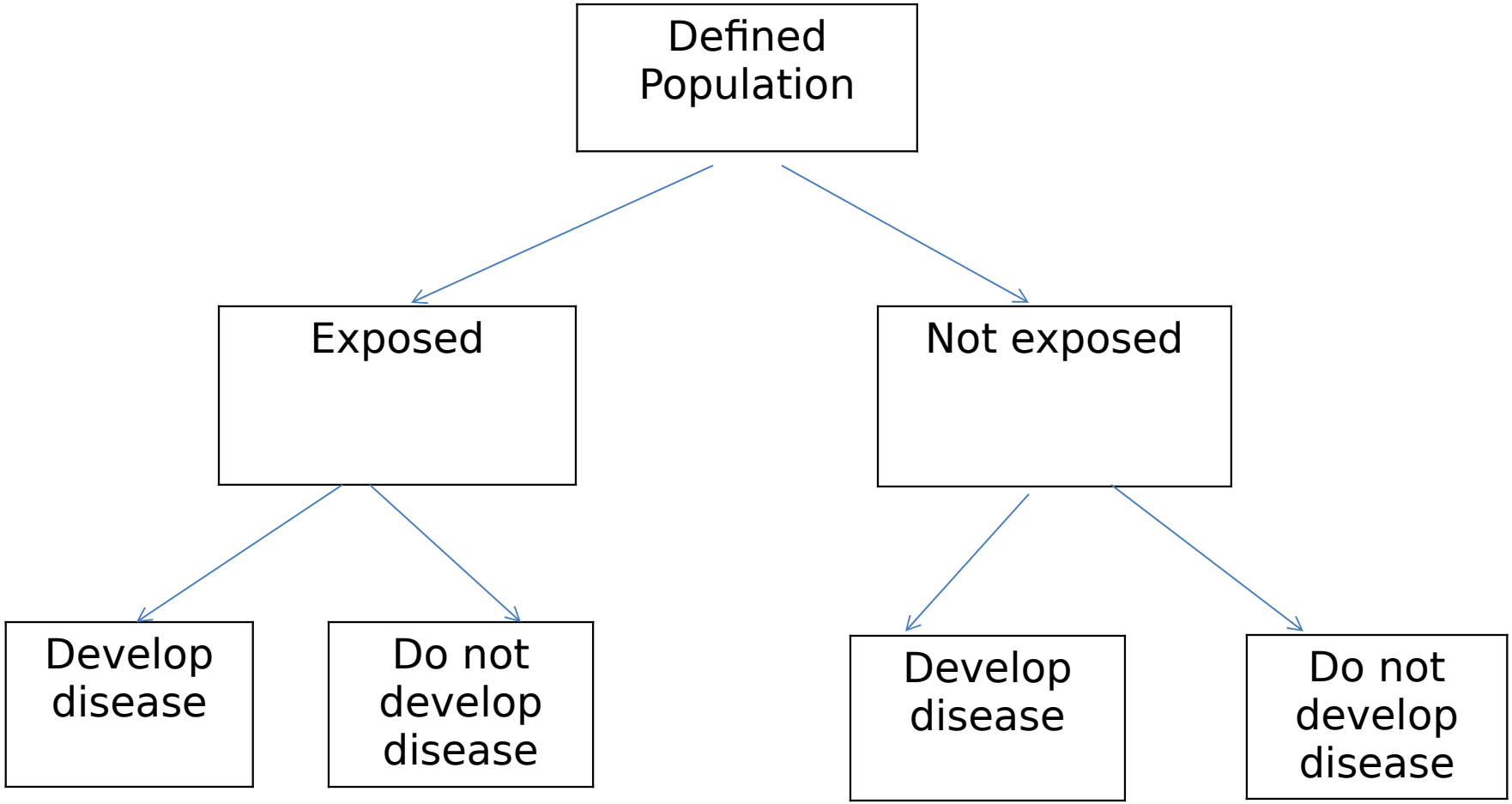
After completing this session learners will be able to:

1. Describe the characteristics of cohort studies
2. Explain challenges and advantages of cohort studies
3. Describe when cohort studies are appropriate to use

Definition

Cohort studies are epidemiologic designs that identify comparison groups according to their exposure status.

Design of Cohort Studies



Characteristics of a Cohort Study

- Groups of individuals defined on the basis of **presence/absence of exposure** to the suspected risk factor
- All potential subjects must be **initially free of the disease** under investigation
- Eligible participants are then **followed over time** to assess occurrence of disease

Factors in Selection of Exposed Group

- Frequency of the exposure of interest
  - ability of obtaining sufficient exposed individuals in a reasonable period of time
- Ability to obtain complete and accurate exposure and outcome information on all study subjects

Selection of Non-Exposed (controls)

Need to be comparable to the characteristics of the exposed population.

Are the two groups comparable?

Exposed groups Characteristics

- Smokers
- Largely Educated
- Urban residents
- Male

Controls Characteristics

- Not smokers
- Largely Educated
- Urban residents
- Male

Follow-up: challenges

- Cost in terms of time and resources
- Obtaining complete information for all comparison groups
- Loss to follow-up

Analysis of Cohort Studies[1]

- Compare groups to check similarity at baseline
- Calculate incidence of the outcome for exposed and non-exposed
- Calculate the relative risk
- Control of confounding

Analysis of Cohort Studies[2]

- Then follow to see whether:

First , identify

	Disease develops	Disease doesn't develop	Total
Exposed	**a**	**b**	**a + b**
Not Exposed	**c**	**d**	**c + d**

Analysis of Cohort Studies[3]

calculate and compare

First, identify

	Disease develops	Disease doesn't develop	Totals	Incidence of disease
Exposed	a	b	a + b	a / a + b
Not exposed	c	d	c + d	c / c + d

a / a+b = incidence of disease in exposed **c/ c+d = incidence of disease in not exposed**

Analysis of Cohort Studies[4]

- First, select

	Develop CHD	Do not develop CHD	Totals	Incidence of disease
Smoke Cigarette	84	2916	3000	84/3000
Do not Smoke Cigarette	87	4913	5000	87/5000

84/3000 = 0.028 = “incidence in smoke cigarette”

87/ 5000 =0.0174 = incidence in Not smoke cigarettes’

Analysis of Cohort Studies2

- Calculate the relative risk

RR= **Incidence in smokers / incidence in non-smokers**

When Is a Cohort Study Warranted?

- When the exposure is known
- When exposure is rare and incidence of disease among exposed is high (even if the exposure is rare, determined investigators will identify exposed individuals)
- When the time between exposure and disease is relatively short
- When adequate funding is available
- When the investigator has a long life expectancy??

Cohort Design: Advantages

- Valuable when the exposure is rare
- Allows direct measurement of risk
- Can elucidate temporal relationship
- Can examine multiple effects of a single exposure

Cohort Design: Disadvantages

- Not suitable for rare disease
- Cost in terms of time and resources
- Obtaining complete information for all comparison groups
- Loss-to-follow-up

Cohort Vs Case-control

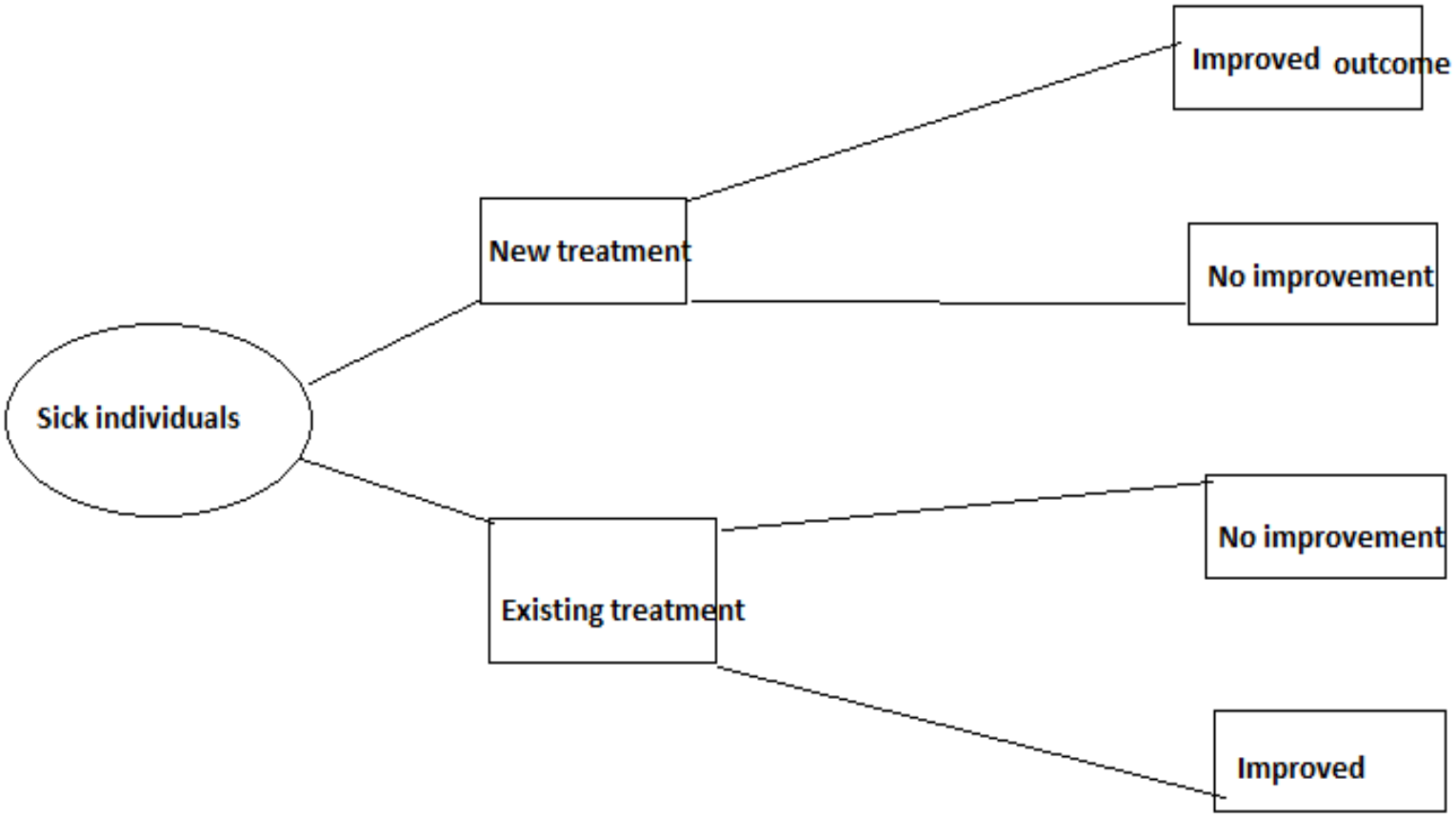
	Cohort studies	Case-control studies
Groups compared	Exposed cohort & Non exposed cohort	Diseased group & non-exposed group
Study measurements	Disease exposure	Exposure history
Measurement of risk	Possible	Impossible
Measurement of relative risk	Risk ratio	Odds ratio

Experimental/Intervention studies

Key Features of Experimental Design:

1. **Investigator manipulates the condition under study**
2. **Always prospective**

Intervention (Experimental) Design
Therapeutic trial



Classification of Intervention Studies:

Based on population

Clinical trial - usually performed in clinical setting and the subjects are patients.

Field trial- used in testing medicine for preventive purpose and the subjects are healthy people.

Community trial - a field trial in which the unit of the study is group of people/ community.

Subject Selection

1. Potential benefits and risks of intervention(s)
2. Need to think proactively about internal validity of trial
3. Assessing external validity

Exclusions

Subjects whose illness is “too mild or too severe to permit the form of treatment being studied” must be excluded.

Ethical Considerations

- Risks *vs* benefits
- Comparison: Standard care *vs* placebo
- Ethical approval
- Informed consent & confidentiality
- Freedom to withdraw
- Duty of care
- Stopping/Monitoring
- Reporting findings
- Quality: ‘Poor’ quality research is unethical!

7. Outbreak/ Epidemic Investigation

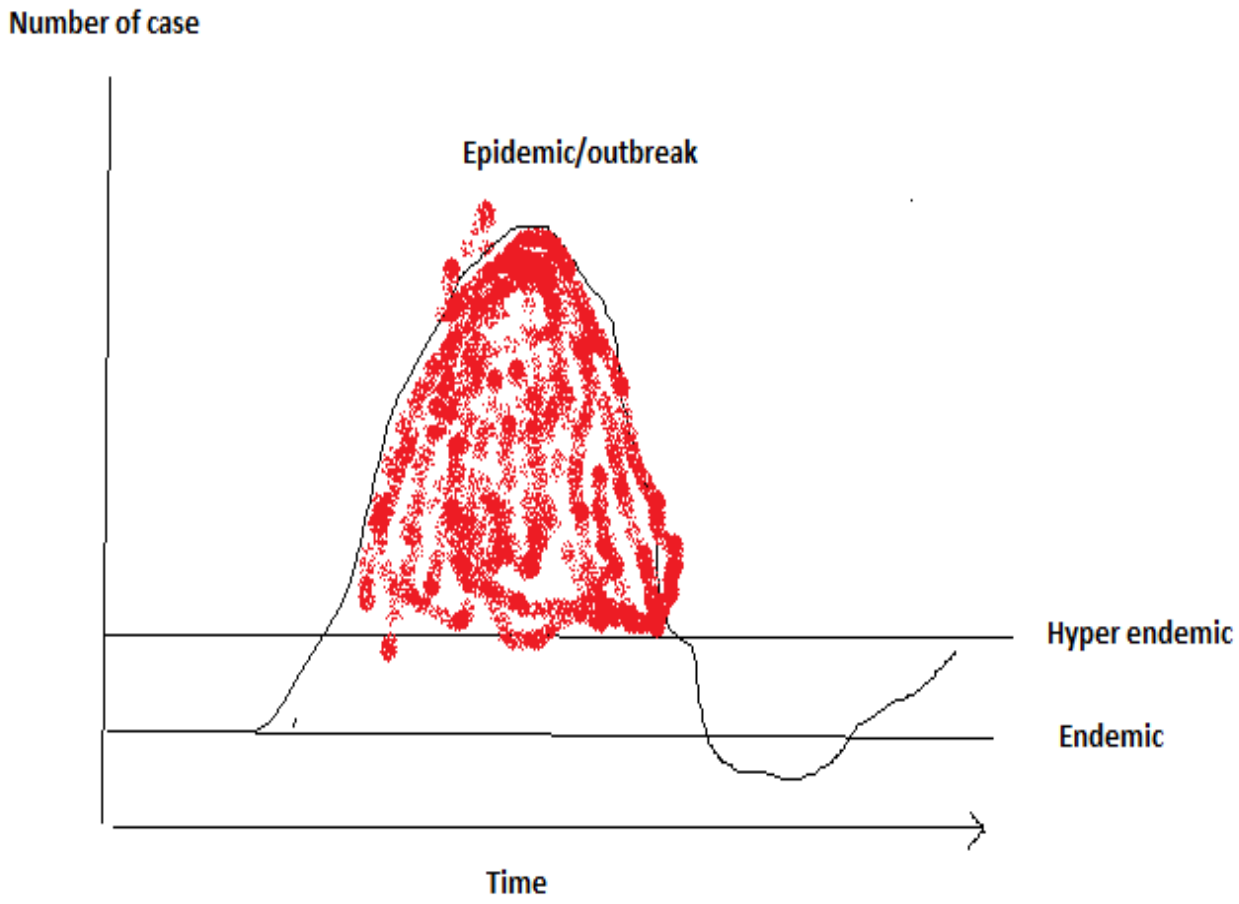
?

Outbreak/epidemic:

Definition:

Outbreak (epidemic) *is the occurrence of a specific disease more than the expected* ***number*** *in a given* ***area*** *or among a specific* ***group of people*** *over a specified* ***period*** *of time.*

Expected Vs Excess Cases



Why investigate outbreaks?

1. Program consideration
2. Public, Political and legal obligation
3. A good opportunity for research and training.

Steps in Outbreak Investigation

1. Prepare for field work
2. Establish the existence of an outbreak
3. Verify the diagnosis
4. Define and identify cases
5. Perform descriptive epidemiology
6. Develop hypotheses
7. Evaluate hypotheses
8. Implement control and prevention measures
9. Communicate findings

1. Prepare for fieldwork

A. **Investigation related:** obtain appropriate scientific knowledge, supplies, and equipment to carry out the investigation.

- Who will be responsible for what? Day-today activities, supervision, day writing report...

B. Administration related:

C. Establish local contacts

2. Establish the existence of an epidemic

Compare the reported/observed number of cases with the expected number of cases in the area.

3. Verify the diagnosis

Review clinical and laboratory findings to establish diagnosis.

3.1. Case definition

3.2. Surveillance - identifying and counting cases

Case Definition

Case definition is a standard set of criteria for deciding whether an individual should be classified as having the health condition of interest.

- Includes clinical criteria, restricted by time, place, and person as necessary.

Case Definition: application

- Set simple and objective measures, and apply them consistently and without bias to all persons under investigation.
- Do not include an exposure or risk factor
- Use "loose" case definition early in the investigation to identify the extent of the problem and the population affected.

Classification of Cases identified by case definition

Definite: laboratory confirmed case

Probable: cases with objective signs and symptoms consistent with the case definition + supportive lab.evidences

Possible: cases with subjective signs and symptoms consistent with the case definition

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

- **Attack rates** calculate rates of illness in population at risk.

Outbreak described by PERSON: Overall Attack Rate of Reported Meningococcal

Meningitis Cases by age group

Age group	Estimated population from 1994 census	Cumulative number of cases	AR per 100,000
0-14	170,667	117	68.5
5-14	599,146	293	48.9
15-29	820,316	531	64.7
30+	522,608	173	33.1
Total	2,112,737	1114	52.7

5. Formulate and Test Hypotheses

- Identify cause
- Identify events/factors leading to epidemics

Additional Data Collection

6. Search for additional cases: locate unrecognized or unreported cases.

7. Analyze the Data

8. Make a decision on the hypotheses tested

9. Intervention and follow-up

- Appropriate and Adequate interventions
- Make sure the epidemics is controlled

10. Report of the investigation

- At the end prepare a comprehensive report and submit to the appropriate/concerned agencies.
- **Scientific format:** introduction, methods, results, discussion, and recommendations.

Detecting Outbreaks

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

Managing Outbreak/epidemics

1. **Measures Directed Against the Reservoir**
2. **Measures that interrupt the transmission of organisms**
3. **Measures that reduce host susceptibility**

Measures Directed Against the Reservoir

Domestic animals as reservoir	•Immunization •Testing of herds •Destruction of infected animals
Wild animals as reservoir	•Post-exposure prophylaxis
Humans as Reservoir	•Removal of the focus of infection •Isolation of infected persons. •Treatment to make them noninfectious. •Disinfection of contaminated objects

Measures that interrupt transmission of organisms	
For diseases transmitted by ingestion	Purification of water Pasteurization of milk Improve housing condition
For disease transmitted by respiratory route	Chemical disinfection of air and use of UV light Work on ventilation patterns, like unidirectional (laminar) airflow
For diseases whose cycles involve an intermediate host	Clearing irrigation farms snails to control schistosomiasis

Measures that reduce host susceptibility

Active immunization	• Mass vaccination • Selective vaccination
Passive immunization	• Transfer of maternal antibodies to the fetus through the placenta • Prophylaxis administration of Immune serum globulin (ISG)
Chemoprophylaxis	• Use of antibiotics for known contacts of cases • Use of prophylaxis

8. Evaluation of Epidemiological Evidence

Melsew G.

Purpose of Evaluation of Evidence

Is the observed finding a reflection of the truth?

<u>Observed:</u>

- **Prevalence**
- **Incidence**
- **RR**
- **OR**

are they true??

Evaluation of evidence…

- Does the study have VALIDITY (close to the truth) ?
- Consider other things that might account for the RR being increased or decreased.
  - **Chance, bias and confounding**

THREATS TO VALIDITY

A study's internal validity, or how close its findings are to the TRUTH, can be compromised by three things:

- ***CHANCE***
- ***BIAS***
- ***CONFOUNDING/ 3rd Variables***

CHANCE

- There is always the possibility that the inference will be either inaccurate or imprecise, because of sampling variability (chance).
- How likely is it that a result could have occurred simply by chance ?
  - **P-value and confidence intervals**

Width of CI

- **Indicate variability**
- **Suggest adequacy of the sample size**
- **Particularly important in interpreting non-significant results**
  - Narrow CI: suggest that truly there is no association
  - Wide CI: suggest inadequacy of sample size to have adequate statistical power

Bias (1)

- Systematic error (not random) in a study that leads to an incorrect estimate (RR) of the association between exposure and disease
- Can occur in the design, implementation, or analysis stages of a study

Bias(2)

- Selection Bias
- Information Bias

Selection Bias

Response Bias *– those who agree to be in a* study may be in some way different from those who refuse to participate

- ✓ *Volunteers may be different from those who are enlisted*

Example: non-response bias in case-control study

	Target population		Study population	
	Cases	Non-cases	Cases	Non-cases
Exposed	200	20000	180	200
Unexposed	400	40000	300	400
Total	600	60000	480	600
OR	**1.2**		**= 1.0**	

CONTROLLING FOR SELECTION BIAS

In a case-control study…

- pick controls whose eligibility for inclusion in the study is the same as cases.
- pick controls who have the same opportunity for exposure as cases.

CONTROLLING FOR SELECTION BIAS

In a cohort study…

- Instill mechanisms for high participation rates
- Get basic information on those who refuse to participate
- Develop effective follow-up mechanisms

INFORMATION BIAS[1]

a flaw in measuring exposure or outcome data that results in a differing quality (accuracy) of information between comparison groups

- *also called Observation Bias*
- *distorts the true strength of association*
- *occurs in all study designs but often described as RECALL BIAS in case-control studies*

Information Bias-Examples[2]

1. Interviewer bias
2. Recall bias
3. Social Desirability bias
5. Surveillance bias
6. Reporting Bias /Wish bias
7. Length time bias

Interviewer Bias – *an interviewer's knowledge* may influence the structure of questions and the manner of presentation, which may influence responses

Recall Bias – *those with a particular outcome* or exposure may remember events more clearly or amplify their recollections

Reporting/wish Bias – *observers may have* preconceived expectations of what they should find in an examination

Loss to follow -up – *those that are lost to* follow-up or who withdraw from the study may be different from those who are followed for the entire study

Hawthorne effect – people act differently if they know they are being watched.

Surveillance bias – *the group with the known* exposure or outcome may be followed more closely or longer than the comparison group

CONTROLLING FOR INFORMATION BIAS

Blinding

- prevents investigators and interviewers from knowing case/control or exposed/non-exposed status of a given participant

Multiple checks in medical records

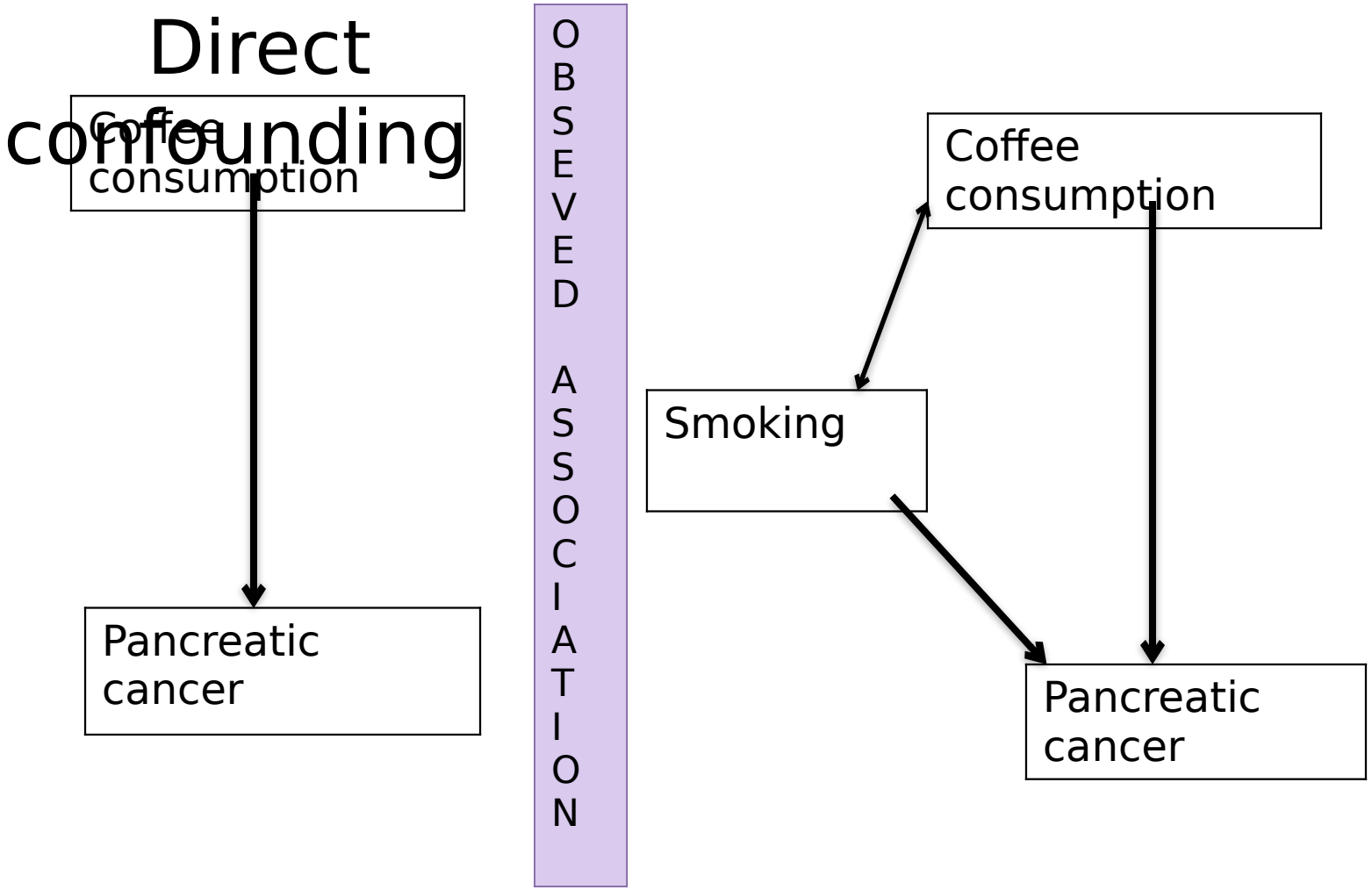
- gathering diagnosis data from multiple sources

Confounding[1]

Confounding: is an apparent association between disease and exposure caused by a third factor not taken into consideration.

Confounder: is a variable that is associated with the exposure and, independent of that exposure, is a risk factor for the disease.

Confounding[2]



Confounding: Example

- Study B found a protective effect between animal companions and heart attack
  - ✓ The study may be confounded by the fact that pets require care and pet owners were more active or able to physically care for them.
  - ✓ The study may also be confounded by the fact that those who can tolerate pets are more easy-going (Type B personalities).

Screening

Melsew G.

Diagnostic and Screening Test

A diagnostic test is used to determine the presence or absence of a disease when a subject shows signs or symptoms of the disease.

A screening test identifies asymptomatic individuals who may have the disease

"The diagnostic test is performed after positive screening test to establish a definitive diagnosis".

Screening tests (examples)

- Pap smear for cervical dysplasia or cervical cancer
- Fasting blood sugar for diabetes
- Blood pressure for hypertension
- Fecal occult blood for colon cancer
- TSH for hypothyroid and hyperthyroid

Main Aim of Screening[1]

- To reverse, halt, or slow the progression of disease more effectively than would probably normally happen.
- To alter the natural course of disease for a better outcome for individuals affected.
- Protect society from contagious disease

Main Aim of Screening[2]

- Selection of healthy individuals: employment, military
- Research: study on natural history of disease

“Reduce morbidity and mortality through early detection and treatment”

What characteristics of a disease make it appropriate for screening?

1. Important public health problem – frequent or serious
2. Reasonably long, recognizable pre-symptomatic - symptomatic stage
3. Effective treatment exists and is available, or effective ways of preventing spread

Characteristics of a disease appropriate for screening?...

4. A suitable screening test or procedure should be available and be:

    1. Reliable

    2. Sensitive and specific

    3. Acceptable to the population screened

    4. Reasonably inexpensive and safe

WHO Criteria for Screening

- Is it a health problem?
- Is there treatment?
- Are there facilities in place?
- Is it detectable pre-clinically?
- Is there a suitable screening test?
- Is the screening test acceptable to people?
- Is the natural history of disease understood?
- Are the costs acceptable?

Screening tests

When examining a screening test we tend to look most closely at its:

- ***Validity***
- ***Reliability (Reproducibility)***

How do we judge the validity of a screening test?

- We compare the screening test against Some “gold standard”

Test result	Disease status (Gold standard)	
	Present	Absent
Positive	True positive (a)	False positive (b)
Negative	False negative (c)	True negative (d)

- Measures of validity: sensitivity and specificity

Disease “Gold standard”			
Screening Test Result	**Present**	**Absent**	**Total**
Positive	**TP**	**FP**	**All who test +**
Negative	**FN**	**TN**	**All who test -**
Total	**All with disease**	**All without disease**	

Sensitivity=TP/TP+FN, Specificity = TN/TN+FP

Sensitivity of a Screening Test

Test result	Disease status (gold standard)	
	Present	Absent
Positive	TP (a)	FP (b)
Negative	FN (c)	TN (d)

Se n a disease who have a positive test for the disease

a/a+c

Specificity of a Screening Test

Specificity is the proportion of people without the disease who have a negative test

d/b+d

Test result	Disease status (gold standard)	
	Present	Absent
Positive	TP (a)	FP (b)
Negative	FN (c)	TN (d)

Predictive Value

The probability that a person tested positive or negative will or will not have a disease.

Depends on

- ***Sensitivity***
- ***Specificity***

- Positive Predictive Value
- Negative Predictive Value

Test result	Disease status (gold standard)	
	Present	Absent
Positive	TP (a)	FP (b)
Negative	FN (c)	TN (d)

probability of the presence of the disease in a person with a positive (abnormal) test result.

(+PV = a/a+b)

Test result	Disease status (gold standard)	
	Present	Absent
Positive	TP (a)	FP (b)
Negative	FN (c)	TN (d)

Negative predictive value: is the probability of not having the disease when the test result is negative (normal).

(-PV = d/c+d)

Yield

The proportion of disease identified by the screening test.

The yield of a test result is a function of:

- ***Specificity of the test***
- ***Prevalence of the disease***

Gold standard

Test	+	–	
+	450	50	500
–	50	450	500
	500	500	1000

PPV=90%

Specificity=90%

NPV=90%

Reliability

- Also called reproducibility
- *Intra-observer* reliability – agreement among measurements made by the same observer
- *Inter-observer* reliability – agreement among measurements made by different observers
- *Test-retest* reliability – agreement among measurements on the same subject at different times

Measures of Reliability (concordance)

- Applies to categorical measures
- The proportion of all tested subjects for whom measurements are the same when the subject is tested twice for the same measurement
- Also called *percent agreement*
- Does not take chance into account

Agreement between Two Observers

Observer 1

Observe

	Positive	Negative
Positive	a	b
Negative	c	d

Over all percent agreement=

$$\frac{a+d}{a+b+c+d} * 100$$

Percent positive agreement =

$$\frac{a}{a+b+c} * 100$$

Percent Agreement- Example

Radiologist A

Radiologist

	Positive	Negative
Positive	4	2
Negative	5	6

Over all percent agreement =?

Positive percent agreement =?

10. EPIDEMIOLOGICAL SURVEILLANCE

Surveillance

It is a continuous and systematic process of collection, analysis, interpretation, and dissemination of descriptive information for monitoring health problems.

Basic Principle

Public health surveillance main function is to serve as an **“early warning system” –** providing timely information needed for action

(rapid reporting, confirmation, decision making and response)

Surveillance Characteristics

- Dynamic/continuous
- Current/timely
- Purposeful/Orientation to action

Characteristics of a good surveillance system

- Simple
- Flexible
- Acceptable
- Sensitive; able to detect the problem
- Good predictive value positive; good yield
- Representative
- Timely
- Cost effective
- Stability

Importance of Surveillance

- Estimate magnitude of the problem
- Setting priorities
- Plan intervention
- Evaluate / monitor health intervention
- Assess long term disease trend
- Mobilize and allocate resources
- Detect epidemics early
- Initiate prompt response to epidemics
- Monitor changes in infectious agents
- Projections of future trends
- **Generate hypotheses and stimulate research**

Surveillance: types

- **Passive**
- **Active**
- **Sentinel**

Passive surveillance

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

Advantages of passive surveillance

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

The disadvantages of passive surveillance

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

Active surveillance

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

Example: investigation of out-breaks

The advantages of active surveillance

- the collected data is complete and accurate
- information collected is timely.

The disadvantages of active surveillance

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

Sentinel Surveillance

- Means of monitoring trends of health events in chosen population groups and chosen sites in a regular and consistent (Uniform) way.
- Need not be representative:
  - *However it is very important to keep sites, facilities, procedures and populations remain similar*

Main Purposes of Sentinel Surveillance

- To detect changes
- To direct and focus control efforts
- To develop intervention strategies
- To promote further investigations
- Provide the basis for evaluating preventive strategies and activities

Activities in Surveillance

The different activities carried out under surveillance are:

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

Analysis of Surveillance Data

Descriptive analysis: distribution by time, place and person

- – Frequency of events

Observe trends: comparison of current data with expected value, identify differences, and assess the relevance of the difference

- Draw graphs to show long term (secular) trends

Dissemination of Surveillance Data

- Disseminate surveillance data to all stakeholders
  - ✓ Those who provide the reports (health providers)
  - ✓ The community – affected/potentially affected
  - ✓ Decision makers
- Disseminate report locally, nationally or globally; as deemed necessary
- Disseminate report timely and regularly
- Disseminate through appropriate media: newsletter or bulletin (paper or electronic)

Common Limitations of Surveillance Systems

- Under reporting
- Lack of representativeness of reported cases
- Lack of timeliness
- Inconsistency of case-definitions
- Lack and shortage of qualified staff
- Lack of motivation

Integrated Disease Surveillance and Response (IDSR)

Integrated Disease Surveillance and Response (IDSR)

- IDSR brings many surveillance activities together to try and make sure that priority diseases can be controlled and prevented more effectively.

What is the goal of IDSR?

- To improve the ability of districts/ health facilities to detect and respond to diseases and conditions that cause high levels of illness, disability and death

Uses of IDSR

- It is cheap, since the same health personnel and reporting formats are also used for routine reports of health-related data.
- It creates an opportunity to computerise all the available data at the central level.
- It provides training and capacity building opportunities for health personnel to develop new skills.
- It encourages community participation to detect and respond to disease epidemics.

Organization of IDSR

Major outputs of IDSR in Ethiopia: Adopting and initiating IDSR.

- Established and maintained a national IDSR taskforce
- Adopted National IDSR technical guidelines
- Adopted and utilized National IDSR Training Modules for IDSR
- Produced standard case definitions for priority Diseases

Case definition

- A case definition is a set of criteria used to decide if a person has a particular disease, or if the case can be considered for reporting and investigation.
- If the use of case definition is agreed by every one in the country or across boundaries is “standard case definition”
  - ✓ Clinical criteria:
  - ✓ Restriction by time, place and person

Case definition

- Confirmed
- Probable
- Possible/ suspected

Advantage of case definition

- Facilitate early detection and prompt Management even if diagnosis is not confirmed
- Lab test is expensive, difficult to obtain
- Observation of trends
- Comparison from one area to another

FDRE MOH
standard case definitions: Example

Cholera	Any person 5 years age or more who develops sever dehydration or dies from acute watery diarrhea
Diarrhea with blood (shigella)	Any person with diarrhea and visible blood in the stool

Disease Reporting in IDSR-Ethiopia
Priority disease criteria

- High potential for causing epidemics
- Targeted for eradication or elimination
- Significant public health importance causing many illnesses and deaths
- Can be effectively controlled and prevented.

Priority diseases

- Twenty priority diseases
  - ✓Immediately reportable (13)
  - ❖ reported within 30 minutes of recognition
  - ✓Weekly reportable (7)
- Other public health emergency conditions to be reported immediately

Immediately Reportable

1. AFP/Polio
2. Measles
3. SARS
4. Anthrax
8. Pandemic Influenza
9. Viral hemorrhagic fever
10. Cholera
11. Rabies
5. Neonatal Tetanus
6. Small pox
7. Avian Human Influenza
12. Yellow fever
13. Dracunculiasis (Guinea worm)

2. Weekly Reportable

1. Malaria
2. Meningitis
3. Dysentery
4. Typhoid fever
5. Relapsing fever
6. Epidemic Typhus
7. Severe Acute Malnutrition
   - MUAC < 11cm and/or Bilateral Edema in under 5 years children (new cases only)

Other Reporting Priorities: immediately reportable health emergencies-1

- Clusters of respiratory illness (including difficulty in breathing)
- Clusters of gastrointestinal illness (including vomiting, diarrhea, abdominal pain, or any other gastrointestinal distress)
- Influenza-like symptoms and signs, such as fever, cough and runny nose

Reporting Procedures

- **Immediately reportable disease:**
  - Health facilities to woreda within 3o minute
  - Woreda report to zone/region also within 30 minutes
  - Zone report to region within another 30 minutes;
  - Region to FMOH within 30 minutes using any available communication mechanism.
- **Weekly report:**
  - Health facilities to woreda from Monday to Sunday to Monday till midday;
  - Woreda to zone/region every Tuesday till midday;
  - Zone to region every Wednesday till midday;
  - Region to FMOH every Thursday.

Disease Surveillance Forms in Ethiopia

- Daily epidemic reporting forms
- Weekly reporting forms
- Rumor log book
- AFP investigation form
- NNT reporting format
- Case-based reporting format

Exercises

Exercise 1

"Fifty percent of malaria cases in North Gondar Zone occurred in Metema Woreda." This statement shows, please choose the best?

a. the distribution of malaria

b. the causes of malaria

c. the time of the year when malaria is prevalent

Is epidemiology important to know the causes of malaria epidemicity in your area?

Exercise 2

A patient with tuberculosis is treated with drugs. Is it possible to learn (know) the natural history of tuberculosis on this patient? Why?

Suppose you want to determine the prevalence of hypertension among adult population in your kebele. How do you conduct cross-sectional studies for this purpose?

Exercise 3

Choose the best answer for questions 1,2, and 3.

1. Malaria mainly affects children.

This is:

a. Distribution by person

b. Distribution by place

c. Distribution by time

2. Pregnant women are highly affected by malaria. This is:

a. Distribution by person

b. Distribution by place

c. Distribution by time

3. Epidemic of malaria occurs in October, November and April. This is:

a. Distribution by person

b. Distribution by place

c. Distribution by time

Exercise 4

1. In Ginbot 2003 there were 50 new cases of relapsing fever in “Kebele X”. The average total population of “Kebele X” was 5000.

- Calculate the incidence rate of relapsing fever in “Kebele X” in Ginbot 2003?

2. On Tir 19, 2006, 100 people were invited by Ms.Derartu for dinner. All of them ate the food that was served for dinner. The next day (Tir 20, 2006) 90 of the 100 people who ate that food developed diarrhea. Calculate the attack rate of diarrhea which occurred on Tir 20,2006?

Exercise 5.

1. One public health officer conducted a survey in one of the nearby elementary schools on Hidar 20,2006 to know the prevalence of trachoma in that school. The total number of students in that school was 200. The public health nurse examined all the 200 students for trachoma. Hundred students were found to have trachoma.

Calculate the point prevalence rate of trachoma for that school and interpret it?

2. In 2005, there were 1000 tuberculosis patients in Kolfe-keranio sub-city. Out of the 1000 patients 100 died in the same year. Calculate the case fatality rate of tuberculosis and interpret it ?

Exercise 6.

In 2005 there were a total of 5000 live births in “Zone B”. Two hundred of them died before 28 days after birth. Calculate the Neonatal Mortality Rate (NMR) and interpret ?

Exercise 7.

The following information is about woreda X which was collected for the year 2004:

- Total average population = 40,000
- Total number of live births = 4000
- Total number of deaths = 400
- Total number of deaths before the age of 28 days = 50
- Total number of infant deaths = 200
- Number of women who died from pregnancy related causes = 160
- New cases of tuberculosis = 100
- All cases of tuberculosis = 300
- Deaths from tuberculosis = 60

Exercise 7 continued

Based on the above information calculate the following.

1. The incidence rate of tuberculosis.
2. The period prevalence rate of tuberculosis.
3. The case fatality rate of tuberculosis.
4. The Neonatal mortality rate.
5. The infant mortality rate.
6. The maternal mortality ratio

Exercise 8.

1. What is the purpose of surveillance?
2. What is the difference between active and passive surveillance?
3. What is the most important use of active surveillance?
4. What are the activities in surveillance?
5. What is the advantage of integrated disease surveillance strategy?

Exercise 9.

- In a rural county with 2000 children within pre-school age there have occurred 15 new cases of leukemia within 10 years. Calculate Incidence rate?

Exercise 10.1

A cohort study is conducted to evaluate the relationship between dietary fat intake and the development in prostate cancer in men. In the study, 100 men with high fat diet are compared with 100 men who are on low fat diet. Both groups start at age 65 and are followed for 10 years. During the follow-up period, 10 men in the high fat intake group are diagnosed with prostate cancer and 5 men in the low fat intake group develop prostate cancer. Calculate the relative risk?

Exercise 10.2

Here we had a cohort study on radiation exposure where 52 tumours developed among 2872 exposed and 6 tumours developed among 5049 unexposed individuals. Calculate the RR and interpret?

Exercise 10.3

- In a study of two toothpastes, 10 out of 100 caries-free children using a new toothpaste (exposure) develop caries after 1 year. In another group of 100 caries-free children using a standard toothpaste, 25 develop caries. Calculate the Risk ratio and interpret?

Exercise 10.4

In a group of 1000 persons with heavy sun-exposure, there were 40 cases of skin cancer. In a comparative, equally sized, non-exposed group there were 10 cases of skin cancer. What is the RR and interpret?

Any questions????