DESCRIPTIVE EPIDEMIOLOGY

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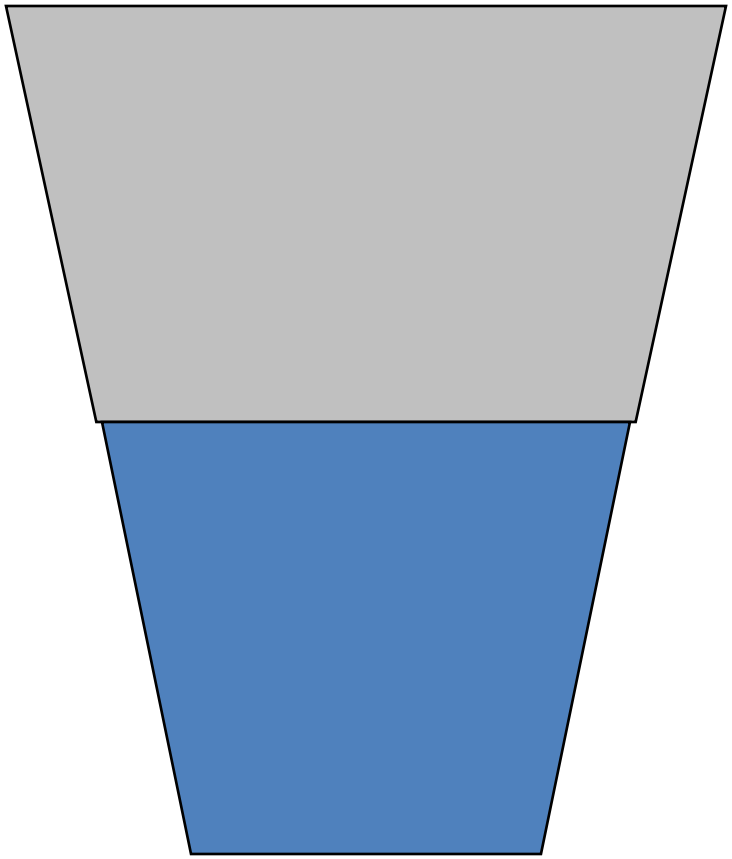
Framework

- Overview of Epidemiology
- Definition of Descriptive epidemiology
- Descriptive and analytical epidemiology
- Types of Descriptive Studies
  - Case Reports and Case Series
  - Cross Sectional and Longitudinal Descriptive Studies
- Epidemiological Descriptions according
  - **Time**
  - Person
  - Place

How we view the world…..



- ***Pessimist:*** The glass is half empty.
- ***Optimist*:** The glass is half full.
- ***Epidemiologist*:** As compared to what?

Epidemiology is...

- **"The worst taught course in Medical school."**

  –*Medical Student*

Epidemiology is...

- **"The science of making the obvious obscure."**
  - ***Clinical Professor***

Epidemiology is...

- **"The science of long division....**

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–Statistician

Definition of Epidemiology

"The STUDY of the DISTRIBUTION and DETERMINANTS of HEALTH-RELATED STATES in specified POPULATIONS, and the application of this study to CONTROL of health problems."

Components of Epidemiology

- **Measure disease frequency**
  - Quantify disease
- **Assess distribution of disease**
  - Who is getting disease?
  - Where is disease occurring?
  - When is disease occurring?
  - Formulation of hypotheses concerning causal and preventive factors
- **Identify determinants of disease**
  - Hypotheses are tested using epidemiologic studies

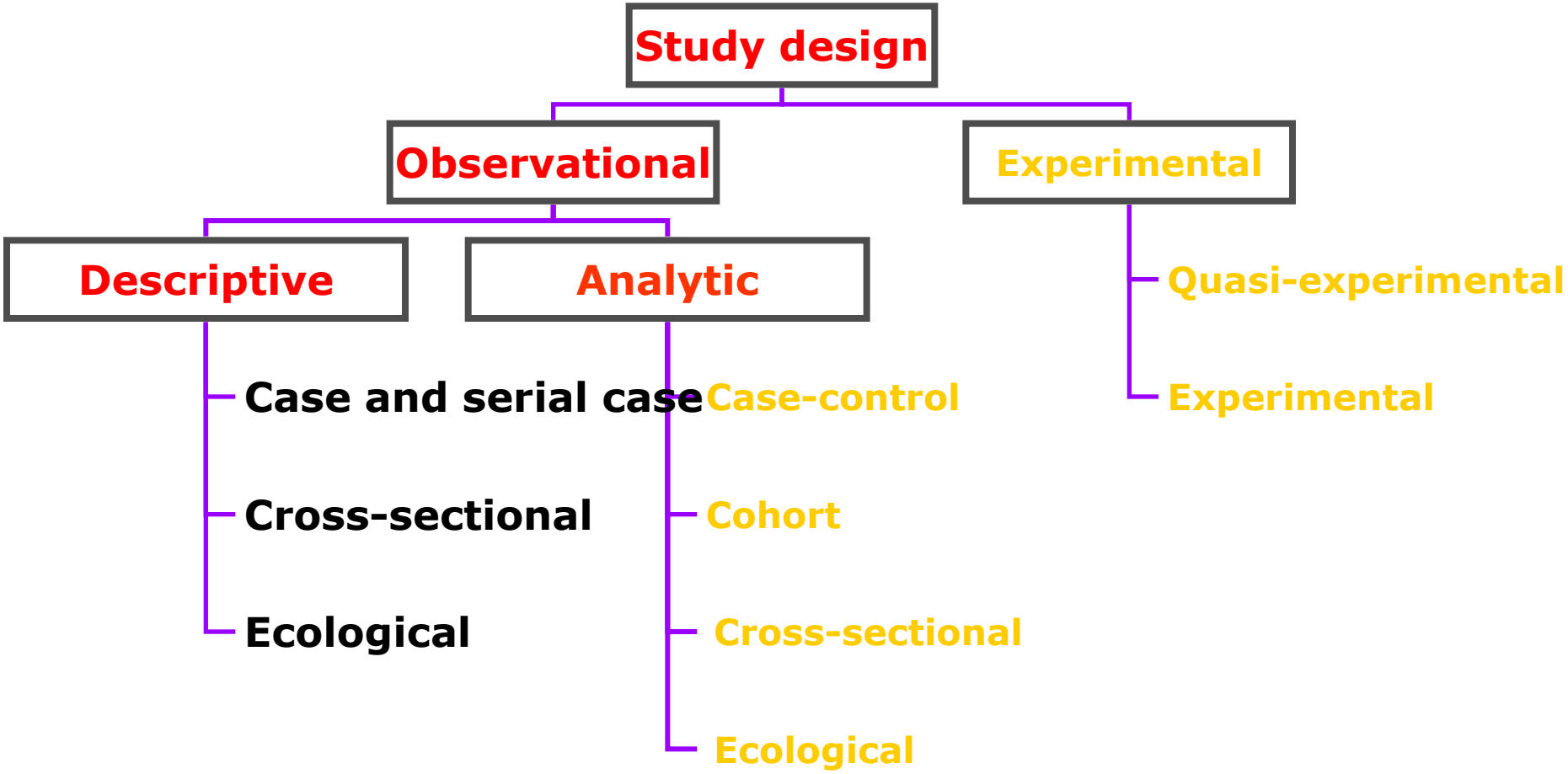
Clinician

- Patient's diagnostic
- Investigations
- Diagnosis
- Therapy
- Cure

Epidemiologist

- Community's diagnostic
- Investigations
- Predict trend
- Control
- Prevention

Types of study design



Main feature of each type of epidemiologic research

- **Observational :**
  - **no artificial manipulation** of the study factor

- **Experimental :**
  - artificial **manipulation of study factor** with **randomization**

- **Quasi-experimental study :**
  - artificial manipulation of the study factor **without randomization**

TYPE OF STUDY	ALTERNATE NAME	UNIT OF STUDY
A. Observational studies		
DESCRIPTIVE STUDIES		
ANALYTICAL STUDIES		
Ecological	Correlational	Populations
Cross-sectional	Prevalence	Individuals
Case -Control	Case -Reference	Individuals
Cohort	Follow-up/ Longitudinal	Individuals
B. Experimental/ intervention Studies		
Randomized Controlled Studies	Clinical Trial	Patients
Field Trial		Healthy person
Community Trial	Community intervention studies	Communities


Systematic Reviews and Meta-analyses
Randomized Controlled Double Blind Studies
Cohort Studies
Case Control Studies
Case Series
Case Reports
Ideas, Editorials, Opinions
Animal research
In vitro ('test tube') research

Descriptive epidemiology

- **Definition**
  - A study in which **only one group**, i.e. subjects having the outcome (disease or any other health related phenomena of interest) are studied**, without any comparison group**, for describing the outcome or health - related phenomena according to its frequency or such other summary figures (as mean), and its **distribution according to selected variables related to person, place and time.**

Descriptive Epidemiology

- Correlational studies (Ecological studies)
- Case reports
- Case series
- Cross sectional studies

Types of primary studies

- **Descriptive studies**
  - **describe occurrence of outcome**
- **Analytic studies**
  - **describe association between exposure and outcome**

Descriptive V/s Analytical study

Descriptive	Analytical
1 group is studied	At least 2 groups are studied
At the start – no hypothesis	At the start - definite hypothesis
At the end - possible hypotheses	At the end - confirms or rejects the hypothesis.

Descriptive vs. Analytic Epidemiology

Descriptive

- **Used when little is known about the disease**
- **Rely on preexisting data**
- **Who, where, when**
- **Illustrates potential associations**

Analytic

- **Used when insight about various aspects of disease is available**
- **Rely on development of new data**
- **Why**
- **Evaluates the causality of associations**

Both are important!

Descriptive Studies

- Relatively **inexpensive and less time-consuming** than analytic studies, they describe,
- **Patterns of disease occurrence**, in terms of,
  - Who gets sick and/or who does not
  - Where rates are highest and lowest
  - Temporal patterns of disease
- **Data** provided are useful for,
  - Public health administrators (for allocation of resources)
  - Epidemiologists (first step in risk factor determination)

Correlational Studies (Ecological Studies)

- Uses measures that represent characteristics of entire populations
- It describes outcomes in relation to age, time, utilization of services, or exposures
- ADVANTAGES
  - We can generate hypotheses for case-control studies and environmental studies
  - We can target high-risk populations, time-periods, or geographic regions for future studies

Correlational Studies

- LIMITATIONS
  - Because data are for groups, we **cannot link disease and exposure in individual**
  - We cannot control for potential **confounders**
  - Data represent average exposures rather than individual exposures, so we **cannot determine a dose-response relationship**
  - Caution must be taken to avoid drawing inappropriate conclusions, or ***ecological fallacy***

Case Reports (case series)

- Report of a single individual or a group of individuals with the same diagnosis
- Advantages

❖ We can aggregate cases from disparate sources to generate hypotheses and describe new syndromes. E.g. hepatitis, AIDS

- Limitations

❖ We cannot test for statistical association because there is no relevant comparison group

❖ Based on individual exposure {may simply be coincidental}

Case report/Case series(contd.)

- Important interface between clinical medicine & epidemiology
- Most common type of studies published in medical journals{1/3rd of all}
  - AIDS ~ b/w oct1980-may81, 5 cases of P.carinii pneumonia were diagnosed among previously healthy young homosexual males in L.A.

Cross-Sectional Studies (prevalence studies)

- Takes place at a single point in time
- Measures disease and exposure simultaneously in a well-defined population
- 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 or allergies
- Limitations
  - Cannot determine whether exposure preceded disease
  - It **considers prevalent rather than incident** cases, results will be influenced by survival factors
  - Remember: $P = I \times D$

Procedures in Descriptive Studies

1. Defining the population to be studied

2. Defining the disease under study

3. Describing the disease under study

4. Measurement of disease

5. Comparing with known indices

6. Formulation of an etiological hypothesis

1.Defining the population to be studied

- Investigations of populations and not an individual
- Define "**population base**".
- Defined population

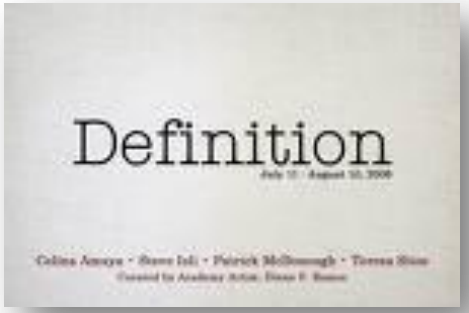
  -Whole population: (geographic area)

  - Representative sample
- Large enough and stable

- The concept of “defined population”(or population at risk) is crucial in epidemiological studies. It provides the denominator for calculating rates, which are essential to measure the frequency of disease and study its distribution and determinants.
- ***Epidemiologists*** have been labeled as men in search of a ***denominator***

2.Defining the disease under study

- Epidemiologist needs a precise and valid definition



- **Operational definition -**

  a definition by which the disease or condition can be identified and measured in the defined population with a degree of accuracy.

3.Describing the disease

- Study of the occurrence and distribution of disease
- Terms:

➢ ***Time***

➢ ***Place***

➢ ***Person***

Descriptive epidemiology

"I keep six honest serving Men. They taught me all I Know. Their names are – what, why, when, how, where and who."

Rudyard Kipling 1903

What are the three categories of descriptive epidemiologic clues?

Person: *Who* is getting sick?

Place: *Where* is the sickness occurring?

Time: *When* is the sickness occurring?

- **PPT** = person, place, time

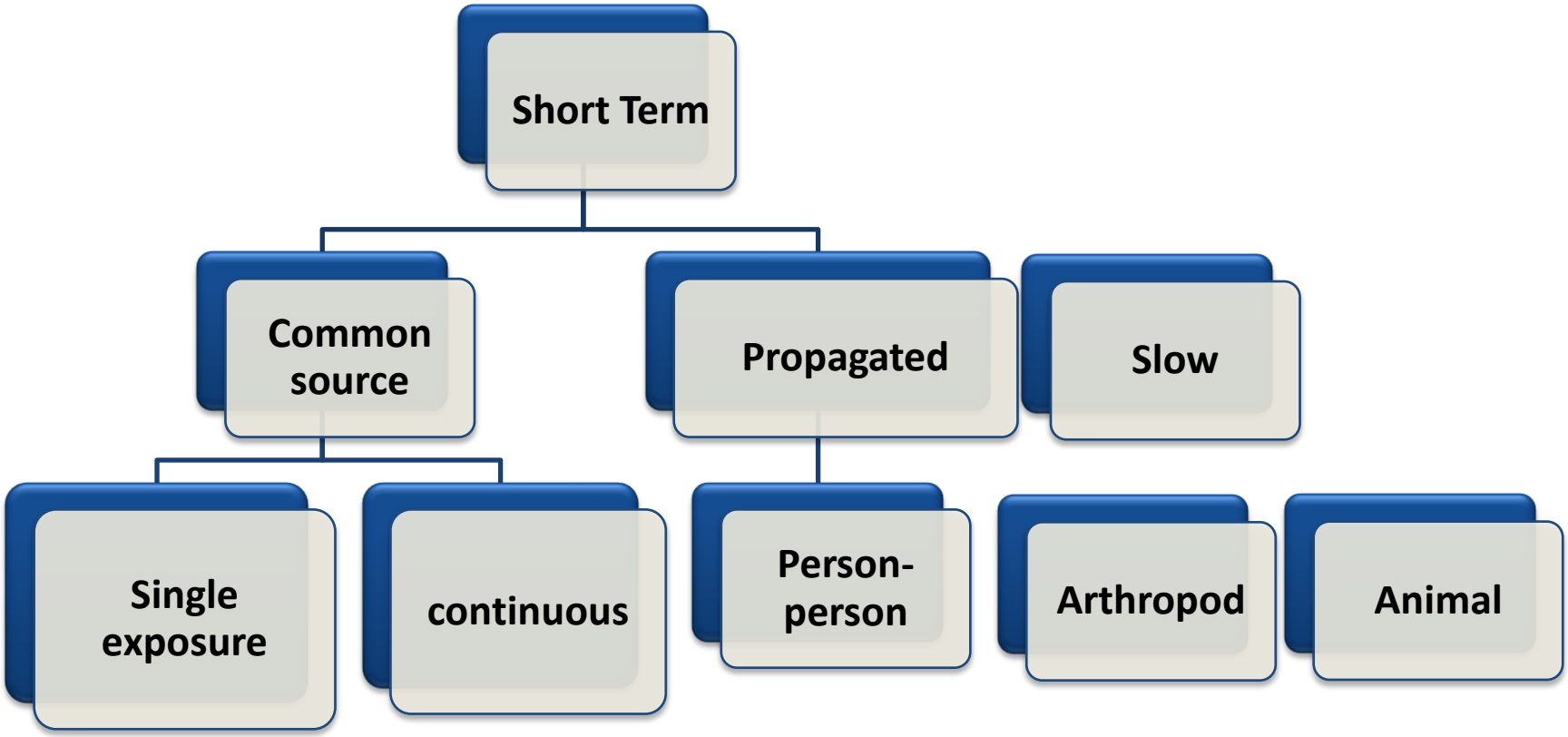
Characteristics frequently examined in descriptive studies

Time	Place	Person	
Year, Season	Climatic zones	Age	Birth order
Month, week	Country, region	Sex	Family size
Day, hour of onset	Urban/Rural Local community	Marital status	Height/Weight
Duration	Towns cities Institutions	Occupation Social status Education	Blood Pressure Blood Cholesterol Personal habits

Time distribution

- Short term fluctuations
- Periodic fluctuations
- Long term or secular trends

Types


Short Term
Common source
Propagated
Slow
Single exposure
continuous
Person-person
Arthropod
Animal

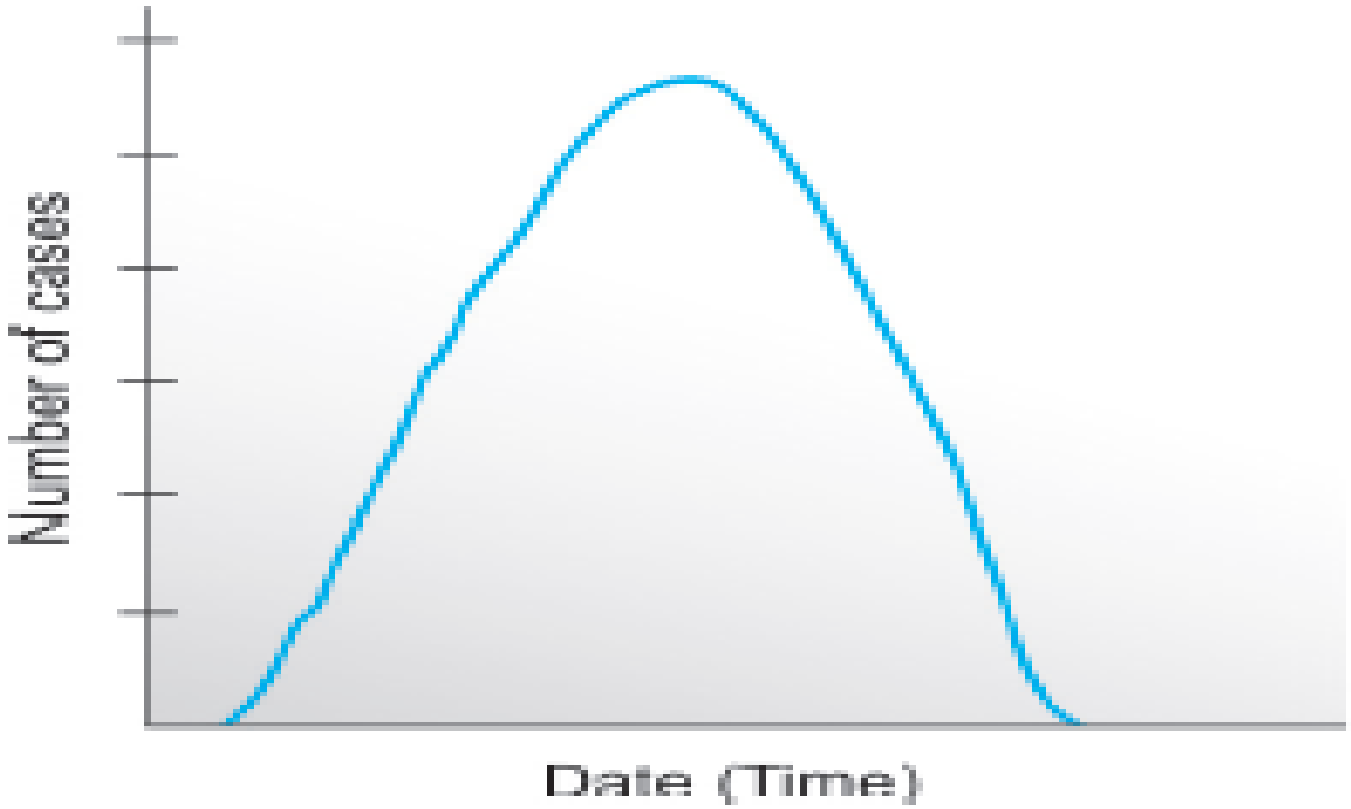
I. Short term fluctuations

- Best short term fluctuation is ***EPIDEMIC.***
- According to the modern concepts an epidemic is defined as

" *the **unusual occurrence** in a community or region of cases of an illness or other health related events clearly in excess of normal expectancy*"

Common source epidemic, single exposure or point source epidemic

- Known as '**point source'** epidemic.
- Exposure to the disease agent is brief
- Resultant cases all develop within **one incubation period.**
- Curve has **one peak**.
- **Features of point source epidemic:**
  - Epidemic curve rises & fall rapidly with **no secondary waves**
  - Epidemic tend to be explosive- clustering of cases
  - All cases- within **one incubation period**.



'Sudden rise and sudden fall' of the epidemic curve. This indicates 'common-source, single exposure' epidemic. For example, food poisoning.

- Common source epidemics are frequently, but not always, due to exposure to an infectious agent.

  E.g. : **Food poisoning, Bhopal gas tragedy**

- If epidemic continues over more than one incubation period then it is either continuous or multiple exposure.

Endemic, Epidemic and Pandemic

- Epidemic - The unusual occurrence of an infectious disease clearly in excess of normal expectancy, and generated from a common or propagated source
- Endemic - The habitual presence (or usual occurrence) of a disease within a given geographic area
- Pandemic - A worldwide epidemic affecting an exceptionally high proportion of the global population

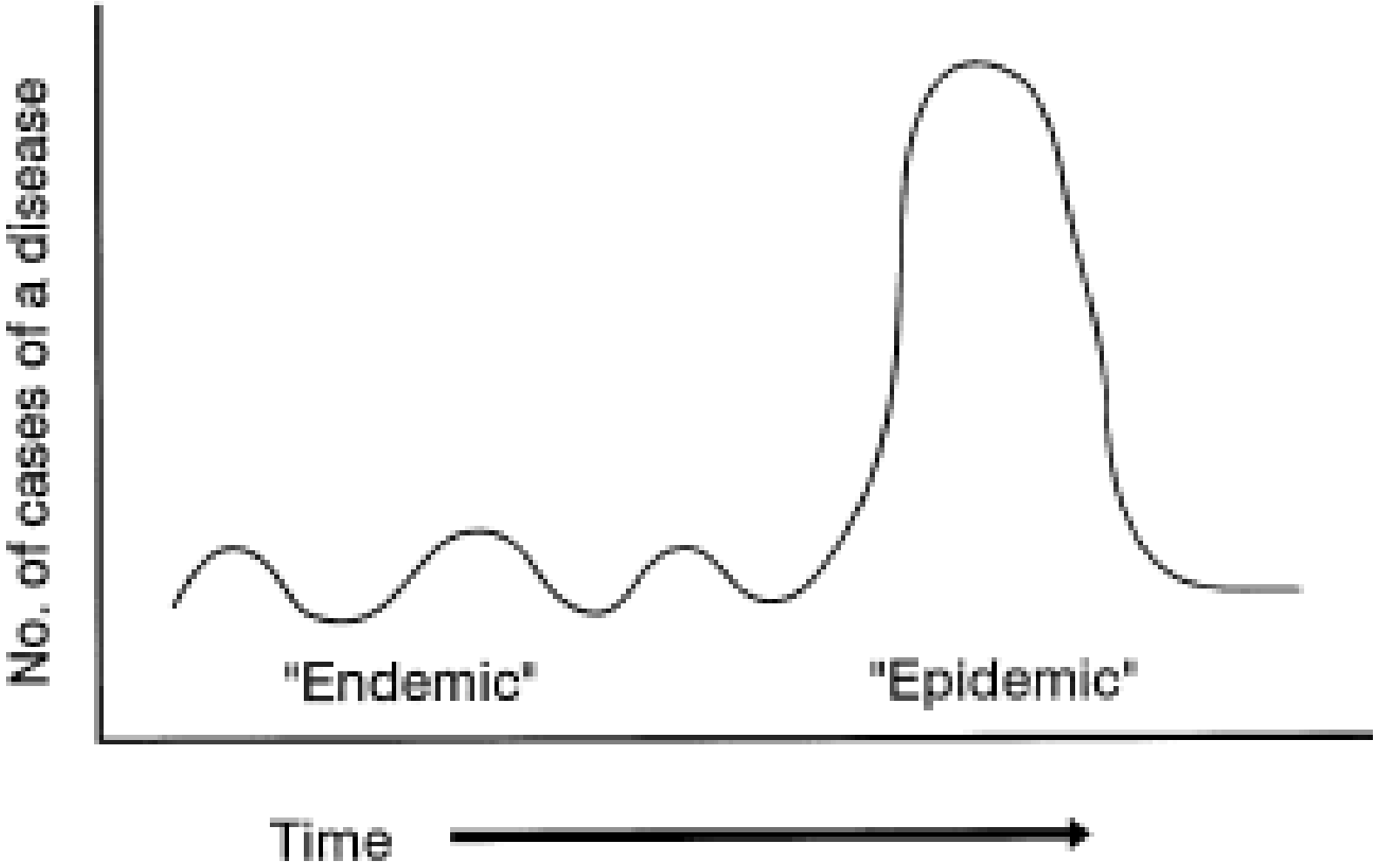
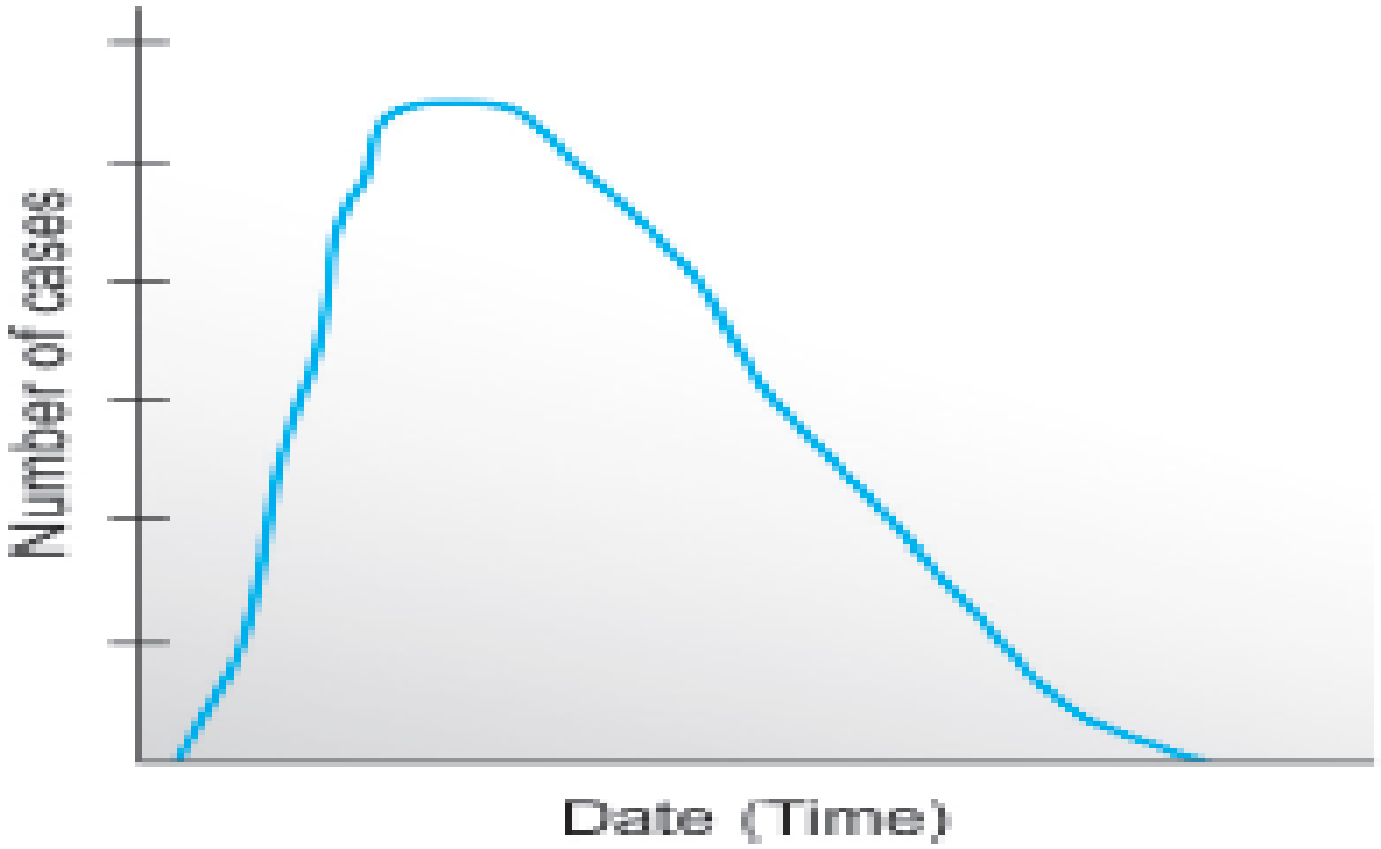


Figure 2-6. Endemic versus epidemic disease.

Common source, continuous or multiple exposure

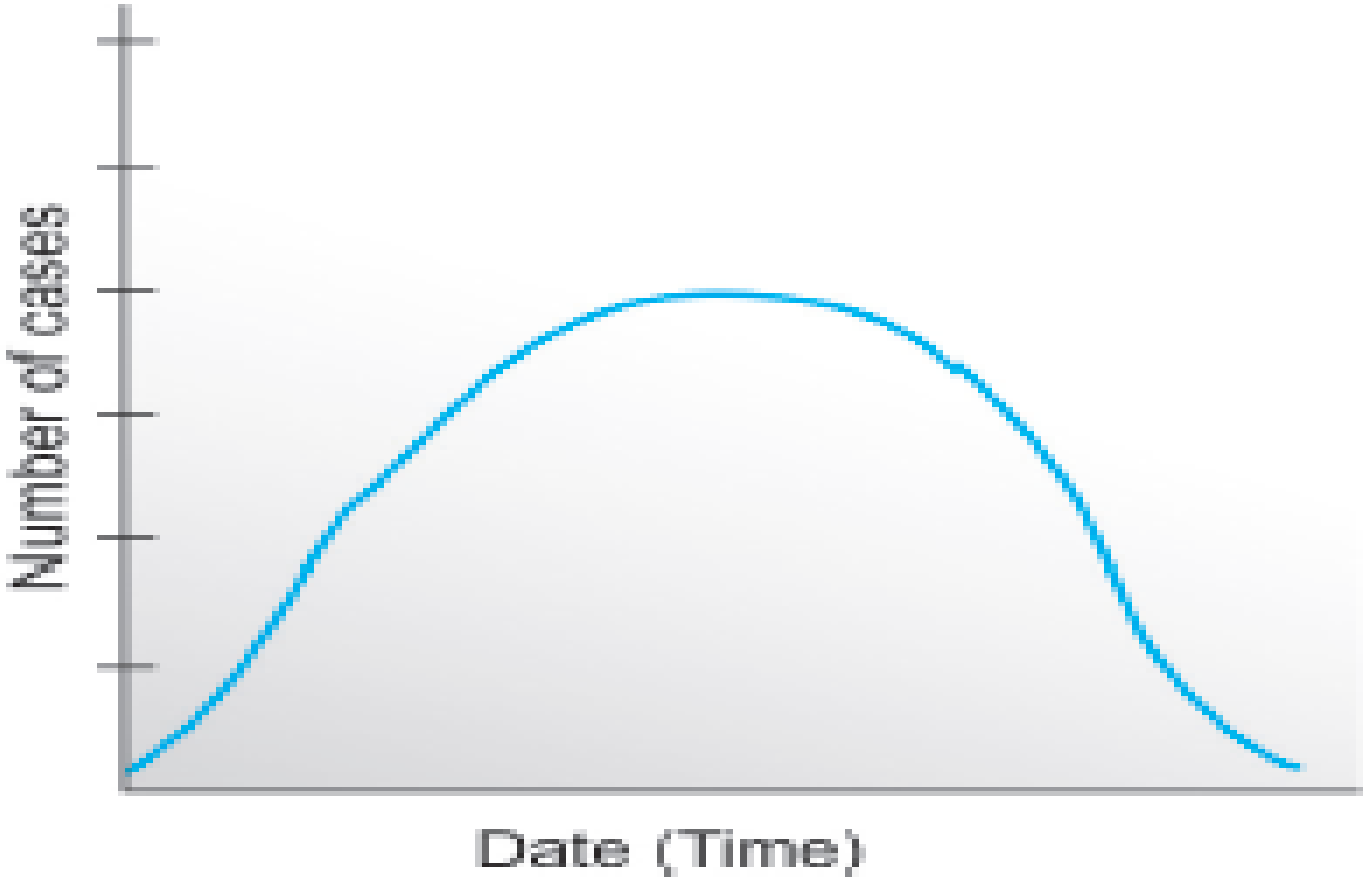
- Exposure from the source may be prolonged – continuous, repeated or intermittent- not necessarily at the same time or place.
- A variation may be that an epidemic may be initiated from a common source and then continue as a propagated epidemic.
- E.g. : **Water from contaminated well, Nationally distributed brand of vaccine or food** could result in similar out breaks.



'Sudden rise and sudden gradual fall' of the epidemic curve. This indicates 'common source, repeated exposure' epidemic. For example, cholera.

B) Propagated epidemic

- Most often of infectious origin and results from **person to person transmission** of the agent.
- Epidemic shows gradual rise and tails of over a much longer period of time.
- E.g.: Epidemics of Hepatitis A, Polio.



'Gradual rise and gradual fall' of the epidemic curve. This indicates 'propagated epidemic'. For example, viral hepatitis A.

- Transmission continues until the number of susceptible is depleted or susceptible individuals are no longer exposed to infected persons or intermediary vectors.
- Speed of spread depends on
  - Herd immunity
  - Opportunities for contact

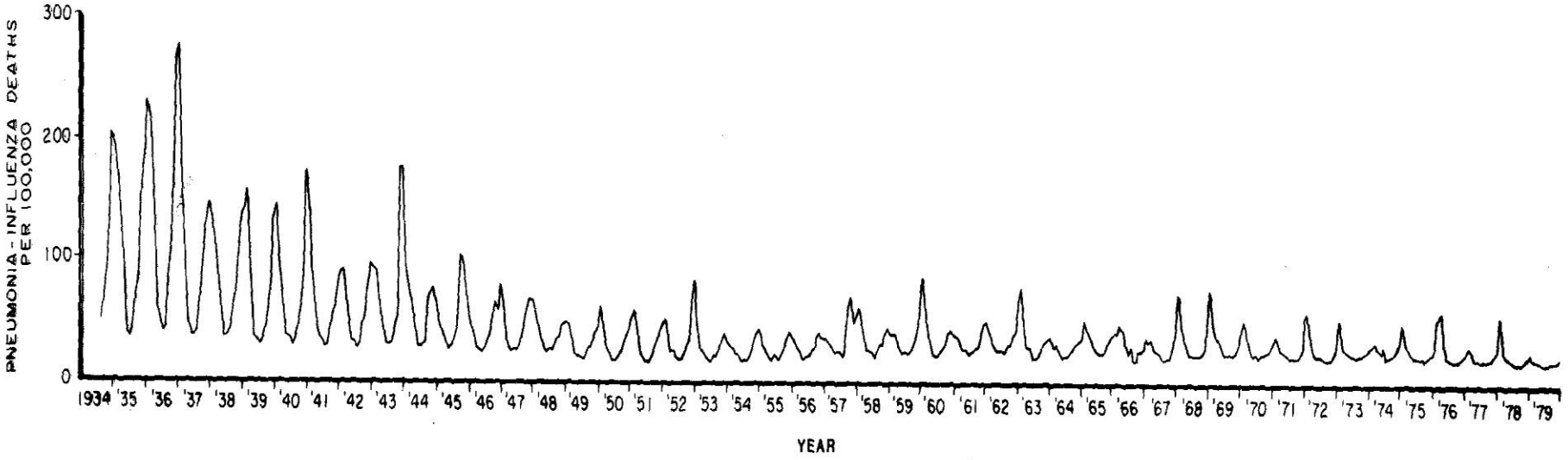
II. Periodic Fluctuations

a) **Seasonal trend**

Seasonal variation is a well known characteristic of many communicable diseases like measles, varicella, sunstroke , upper respiratory infections

Seasonal Trend

Pneumonia-Influenza Deaths – By year, 1934-1980

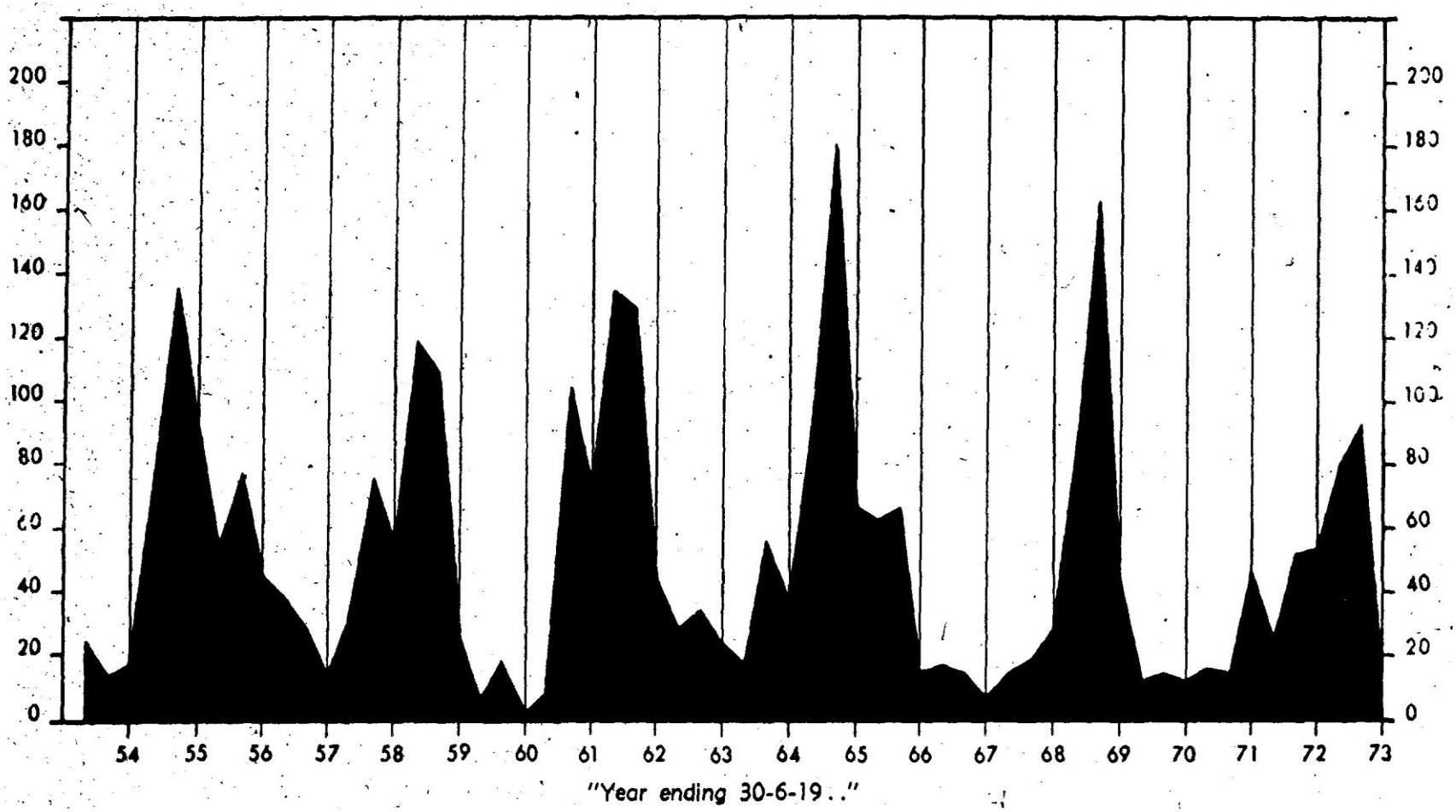


- For example,
  - **Measles**- at its height in **early spring** and so is varicella.
  - **Upper respiratory infections**- a seasonal rise during **winter** months.
  - **Gastrointestinal infections** - in **summer** months
  - The seasonal variations - related **to environmental conditions** (e.g., temperature, humidity, rainfall, overcrowding, life cycle of vectors, etc.) which directly or indirectly favor disease transmission.

(b) *Cyclic trend :*

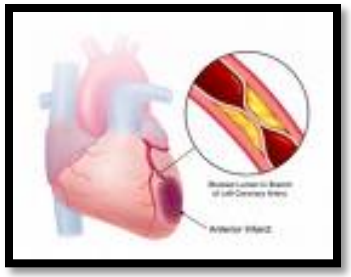
- *Some diseases occur in cycles spread over short* periods of time which may be days, weeks, months or years.
- For example,
  - measles in the pre-vaccination era appeared in cycles with major peaks every 2-3 years and rubella every 6-9 years. This was due to naturally occurring variations in herd immunity.
  - Influenza pandemics are known to occur at intervals of 7-10 years, due to antigenic variations.

Whooping Cough - Four-monthly admissions, 1954-1973



III. Long term or secular trends

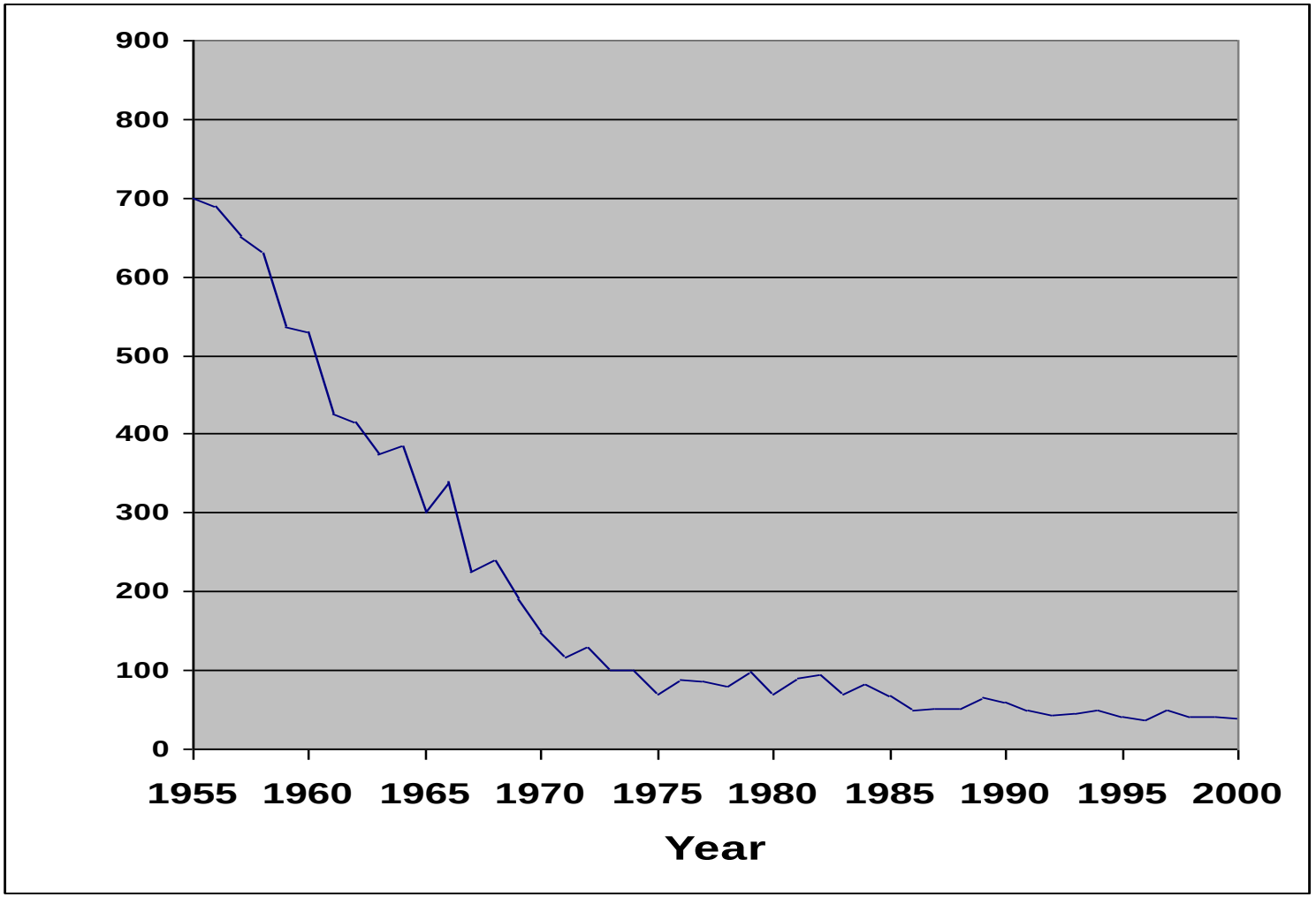
It implies changes in the occurrence of disease over a long period of time(i.e., a progressive increase or decrease) generally several years or decades.



E.G : Coronary heart disease, lung cancer, diabetes have shown a consistent upward trend and diseases like Tuberculosis , typhoid fever, diphtheria & polio have shown a downward trend.

Tetanus – by year, USA, 1955-2000

During 2000, a total of 35 cases of tetanus were reported. The percentage of cases among persons aged 25-59 years Has increased in the last decade. Note: A tetanus vaccine was first available in 1933.



Possible Reasons for Changes in Trends

Artifactual Errors in numerator due to

1. Changes in the recognition of disease
2. Changes in the rules and procedures for classification of causes of death
3. Changes in the classification code of causes of death
4. Changes in accuracy of reporting age at death
5. Errors in the denominator due to error in the enumeration of the population

Possible Reasons for Changes in Trends

- **Real**
  - Changes in age distribution of the population
  - Changes in survivorship
  - Changes in incidence of disease resulting from
    - Genetic factors
    - Environmental factors

- **<u>Interpretation of time trends</u>** :

  - Helps us to know which diseases are increasing and which are the emerging health problem and measures to **control** the old problems.

  - By studying the time trends, the epidemiologist seeks to **provide guidelines to the health administrator in matters of prevention or control of diseases.**

THANK YOU