Principles of Epidemiology

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Epidemiology

The study of distribution and determinants *of health problems in specified* ***populations*** *and the application of this study to the control of these problems. It is the scientific method of problem solving used by "disease detectives"--epidemiologists, laboratory scientists, statisticians, physicians and other health care providers, and public health professionals--to get to the root of health problems in a community.*

Epidemiology Define ?

- A study of all diseases/health events
  - infectious/non-infectious
  - acute/chronic
  - communicable/non-communicable.
- Science of rates expressed as probability
- ***"Anything that happens to people"***

Epidemiology: Gen. Objectives

- Explaining the Causal mechanism of disease and process of deviation in Health.
- Explaining the reason for Local disease occurrence.
- Effective planning and administration of Health Care Services.

Specific Objectives

1. Understanding causation of disease with specific purpose of--
   - Formulation and selection/rejection of hypothesis.
   - Testing hypothesis through

     ***Survey**

     ***Observation studies**

Specific Objectives…

2. Testing validity of rationale of control /intervention programs
3. Classify disease/disability based on :
   - Distribution
   - Causal factors, and
   - Natural history of disease

Specific Objectives

4. Explaining local disease pattern
5. Administrative Guidance
   - In assessing Need, Utilization & Effectiveness
   - In monitoring & evaluation of control programs (cost effectiveness & cost benefit analysis)
   - In Logical Planning of
     - Services
     - Resources
     - Programs
     - Reach &
     - Risk Approach

Planning: Terms

- **Planning**-“an act or process of choosing between alternatives to accomplish preset goals”.
- **Plan** denotes a blue print of action
- **Program** is a strategy with defined Objectives.

Goal:

- The proposed long-range benefits of the program for a specified area, defined in general terms. A goal is the ultimate objective; for example, “reducing the incidence of HIV in (a country).”

Purpose:

- The overall objective (also called strategic objective) of the program, for example, “to increase the accessibility to and use of palliative care facilities in (a particular geographic area).”
- ultimate measure of the program’s effectiveness.

Objectives:

- The anticipated outcomes or benefits that are the expected results of implementing a strategy. They are described in measurable terms and indicate a specific period of time during which these results will be achieved.
- Should be SMART
  - specific,
  - measurable,
  - appropriate,
  - realistic, and
  - time-bound

Strategy

- A strategy is a plan (to choose) to achieve a particular goal or result; and reveals the logic of your choices.

Approach:

A statement that describes how the program will achieve its objective. That is, activities that will help the program achieve its objectives most effectively and feasibly.

Monitoring

- A methodological arm of evaluation that tracks the program's incremental steps to its effect and informs the final evaluation report.
- **A continual, routine effort** requiring data gathering, analysis, and reporting on results at periodic intervals
- **Periodic, regular**
- Focuses on inputs, outputs, process outcomes, work plans
- Basic purpose is **improve efficiency** and adjust work plan

Evaluation

- A technical activity that measures the **program's impact** and effectiveness as a whole.
- Is not about assigning a "grade" of success or failure at the end of a project.
- **Episodic**
- **Focuses on effectiveness**, relevance, impact, cost-effectiveness
- Basic purpose - **improve effectiveness, impact, and future programming**

Epidemiology: Basic approach

- Counts cases (events).
- Defines involved population.
- Determines rates/proportions
- Compares rates.
- Makes inferences

Epidemiology?

"Study of **distribution** and **determinants** of health related state or events & disease in human population"

"Science of rates expressed as probability"

Uses of Epidemiology

- Describe Health events
- Identify the cause of disease
- Identify the Risk factors
- Describe clinical pattern of disease and identify syndromes
- Identify effective control and/or preventive measures
- Risk Approach

Uses of Epidemiology

- Take suitable administrative measures in-
  - Assessing Need, Utilization & Effectiveness
  - Monitoring & evaluation of control programs (cost effectiveness & cost benefit analysis)
  - Logical Planning of
    - » Services
    - » Resources
    - » Programs
    - » Reach &

Epidemiological studies

- **Descriptive**
  - Correlation studies
  - Individual studies
- **Analytical**
  - Case control studies
  - Cohort studies
- **Experimental**
  - Randomized design
    - Blind
    - Double blind
    - Triple blind
  - Clinical trials

Epi. Studies- Types

Study	Alternative Name	Unit of Study
Observational		
Descriptive		
Analytical		
Ecological	Correlation	Population
Cross sectional	Prevalence	Individuals
case control	Case reference	individuals
cohort	follow-up	individuals
Experimental	Intervention	
Randomized	Clinical trial	Patients
field trials		Healthy people
Community trials	Community intervention	community

Descriptive Epidemiology?

Study of distribution of a disease in a population, and **observing** the basic features of its distribution in terms of **time, place,** and **person.**

Descriptive Epidemiology: Objectives

- To evaluate trends and allow comparison among different population groups
- To provide basis for planning, provision and evaluation of services
- To identify problems to be studied by analytical methods

Descriptive Epidemiology describes-

- Who gets sick and who does not
- Where Rates are highest and lowest
- Temporal pattern of Disease
- Seasonality
- Secular trends decided by changes in-
    - Diagnostic techniques
    - Denominator data
    - Age distribution of population
    - Survival
    - Actual incidence

Reasons for changes in Trends: Real

- Changes in Age distribution of population
- Changes in Survival pattern
- Changes in Actual incidence for
    - Genetic
    - Environmental factors

Reasons for changes in Trends: Artifactual

- Errors in Numerator due to-
  - Changes in disease recognition
  - Change in classification of cause
  - Change in classification codes of cause of death
  - Changes in accuracy of reporting age at death
- Errors in denominator due to errors of enumeration
- ICD-10 has 8000 categories as compared to 4000 in ICD-9

Descriptive Epidemiology

Descriptive epidemiological approach attempts to describe the disease in terms of its attributes & variables and answers the questions like-

- Who (Person)
- Where (Place)
- When (Time)

Descriptive Epidemiology

Who?

Person:

Where?

Place:

When?

Time:

Who (Person) ?
Is getting the disease

Attributes & Variables

- Age
- Sex
- Ethnicity
- Marital status
- Occupation
- Education
- Income group……

Age

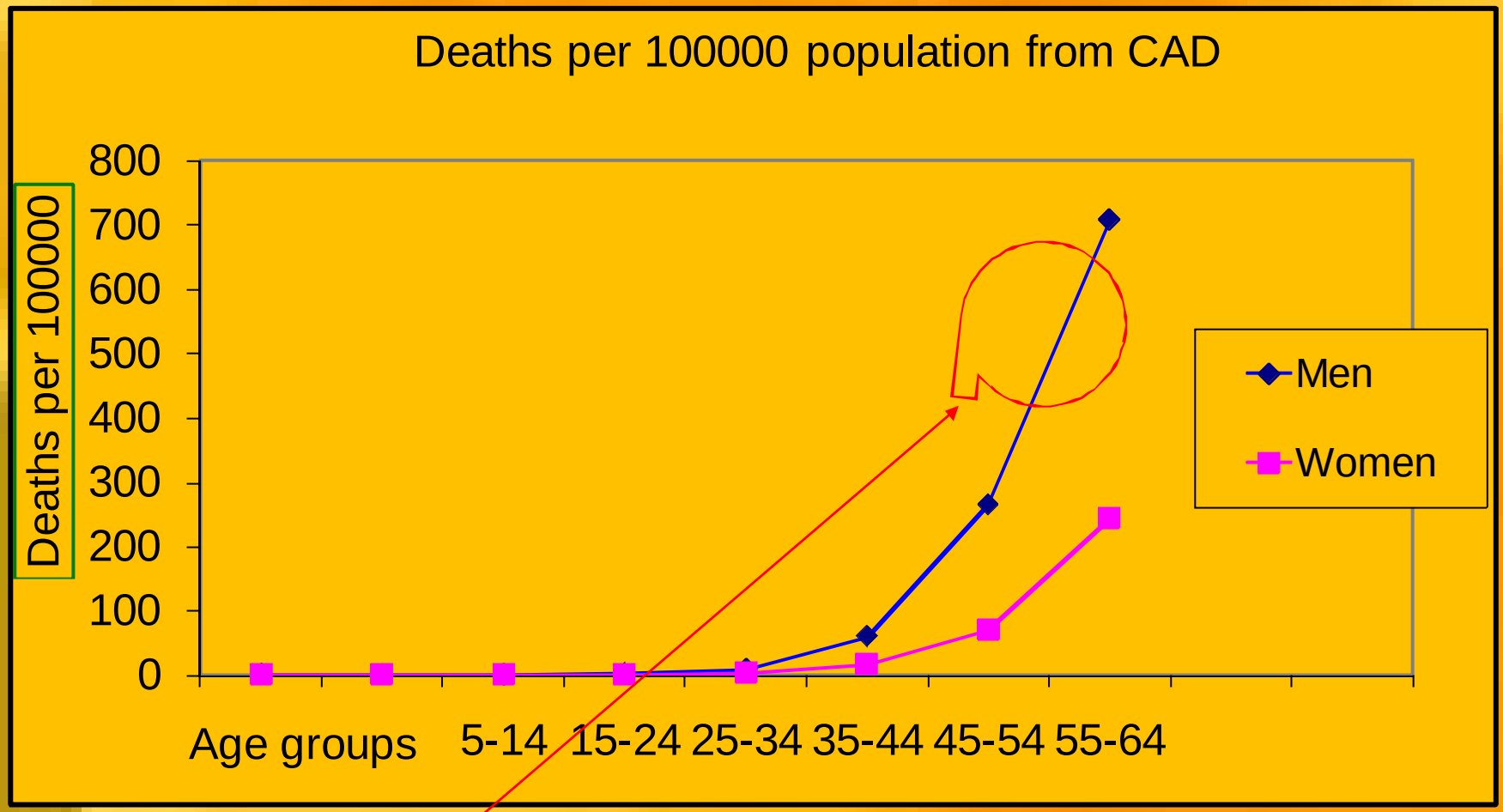
Malnutrition

Measles

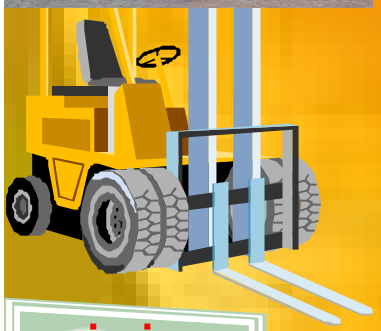
STI

Arthritis/ Cancer

Sex



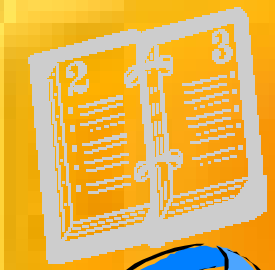
Gap starts narrowing after 54 (menopause), suggests protective effect of estrogen



Where (Place) ?
Where Rates are highest and lowest

- Residence
- Occupation/ Work place
- At specific events
- Geographic sites

Time (When) ?
Reflects on trend



- Year
- Season
- Day
- Date of Onset
- Duration

Time trends

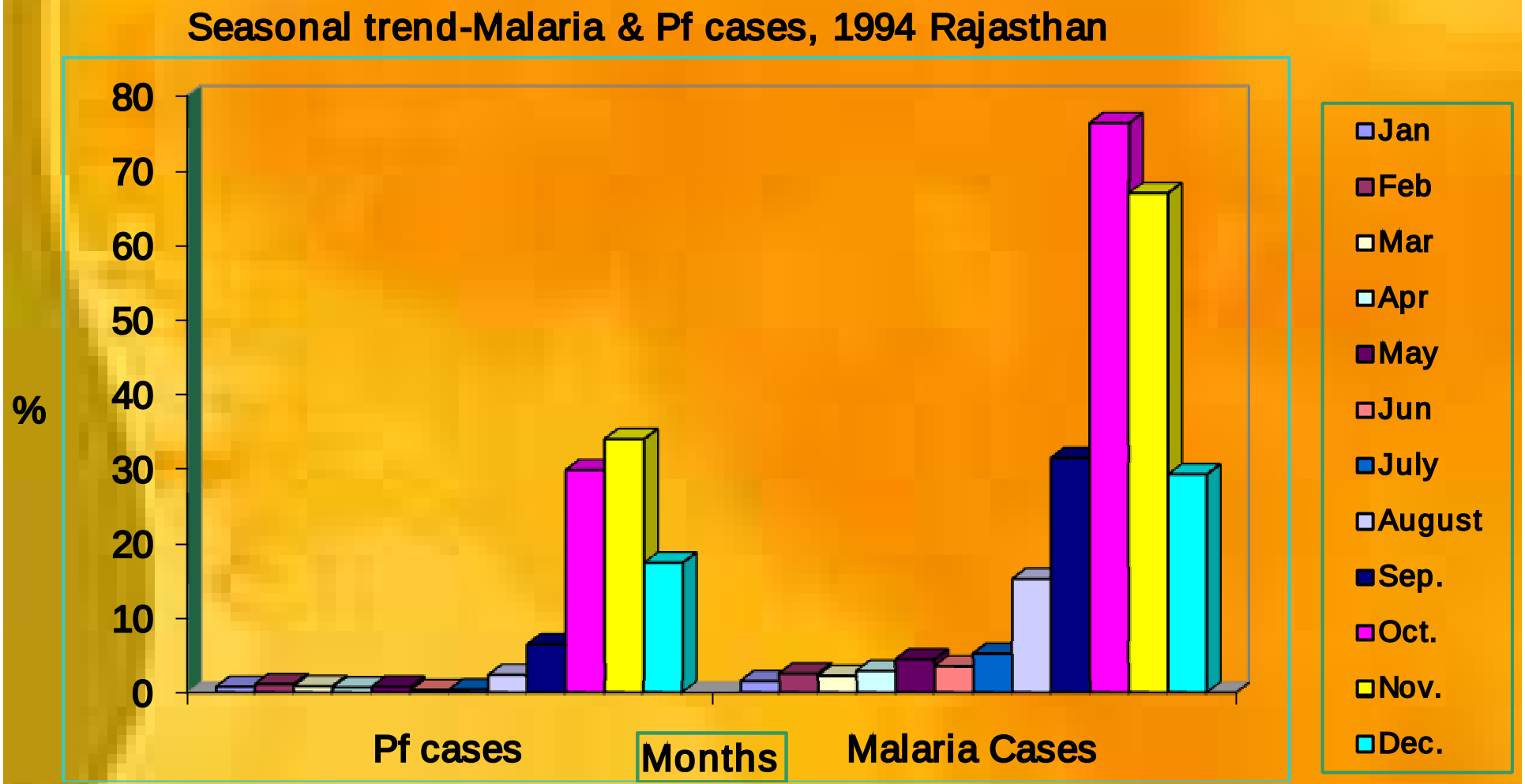
- Secular (Changes that occur over long periods of time)
- Periodic (short term)
- Cyclic (Seasonal)
- Epidemic

Secular trend is influenced by:

- Changes in completeness of source of data
- Changes in diagnostic ability
    - Experience
    - Techniques
- Changes in data classification approach (ICD-9 to ICD-10)
- Demographic changes in population
- Changes in environment other than that which is related to disease
- Changes in clinical concepts, Diagnosis, Terminology

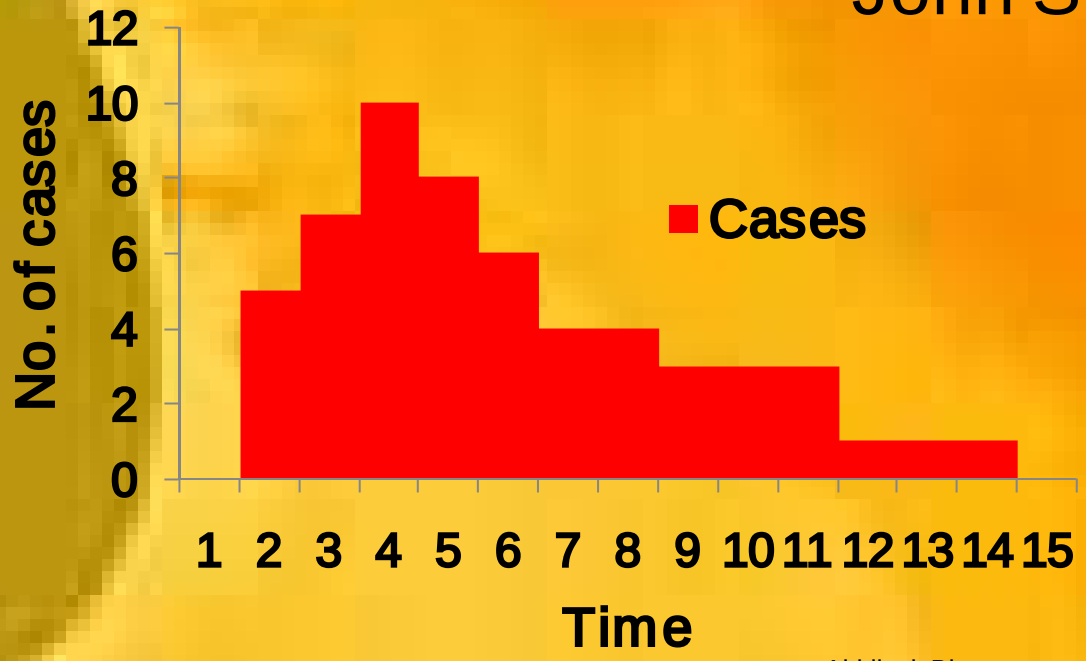
Cyclic (Seasonal) trends

Changes in frequency over: Days, Weeks, Months, Years

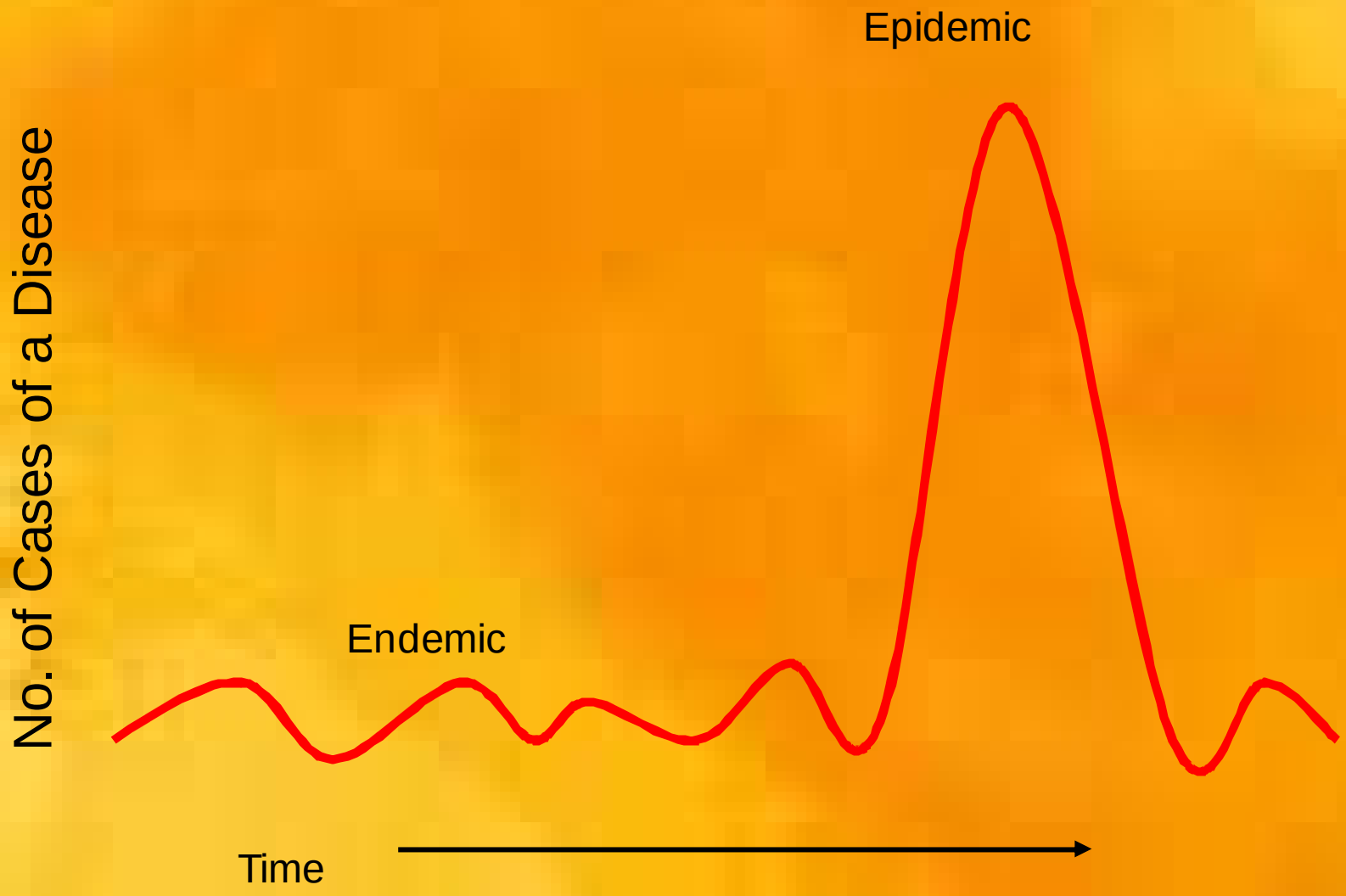


Periodic (short term)

- Changes that occur in hours/ days / weeks
- Simultaneous exposure to single source (Point source)
- John Snow- Cholera



Endemic vs. Epidemic



Let us make an educated guess: Hypotheses

- Why some people get the disease and others do not
- Why disease occurs in some places and not others
- Why disease occurs at some time and not at others

Developing Hypotheses

- Interrogate usual suspects!
- Source of agent
- Mode of transmission
- Usual reservoirs
- Known risk factors
- Exposures that caused disease
- Look at person, place and time for clues

Developing a hypotheses

- Requires familiarity with disease
- Hypothesis should be testable
- Still clueless?
- Talk with cases again
- Visit cases in their own situation
- Don’t forget outliers