Study Designs in Epidemiology

Descriptive and Cross-sectional Designs

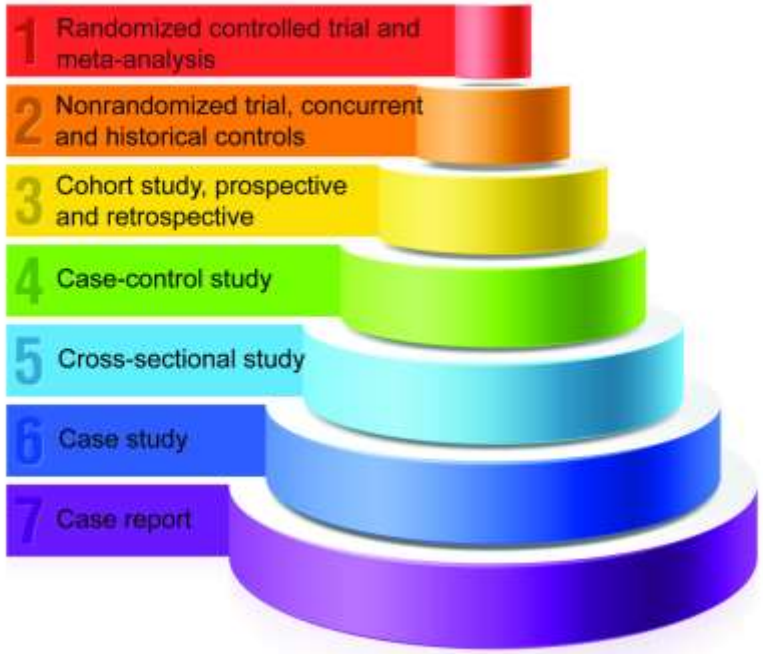

Figure. Hierarchy of Research Design

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Epidemiologic Study Design

Study design is the arrangement of conditions for the collection and analysis of data to provide the most accurate answer to a question in the most economical way.

Types of Epidemiologic Study Designs

I. Based on objective/focus/research question:

1. Descriptive studies

Describe: what, who, when, where

2. Analytic studies

Analyze: How and why

Types of Epidemiological Study Designs

II. Based on the role of the investigator

1. Observational studies

- The investigator observes what naturally happens
- No intervention

2. Intervention/Experimental studies

- Investigator intervenes: changes things and introduce exposure.
- Researcher has control over the situation

Types of Epidemiological Study Designs

III. Based on timing :

1. One-time (one-spot) studies

- Conducted at a point in time
- An individual is observed at once

2. Longitudinal (Follow-up) studies

- Conducted over a period of time
- Individuals are followed over a period of time

Types of Epidemiological Study Designs

IV. Based on direction of follow-up/data collection:

1. Prospective

Data collection occurs forward in time: into the future

2. Retrospective

Conducted backward in time: past events

Types of Epidemiological Study Designs

V. Based on type of data they generate:

1. Qualitative studies:

- Generate textual data
- Also called exploratory studies

2. Quantitative studies:

- Generate numerical data
- Also called explanatory studies

Types of Epidemiological Study Designs

The most widely used classification:

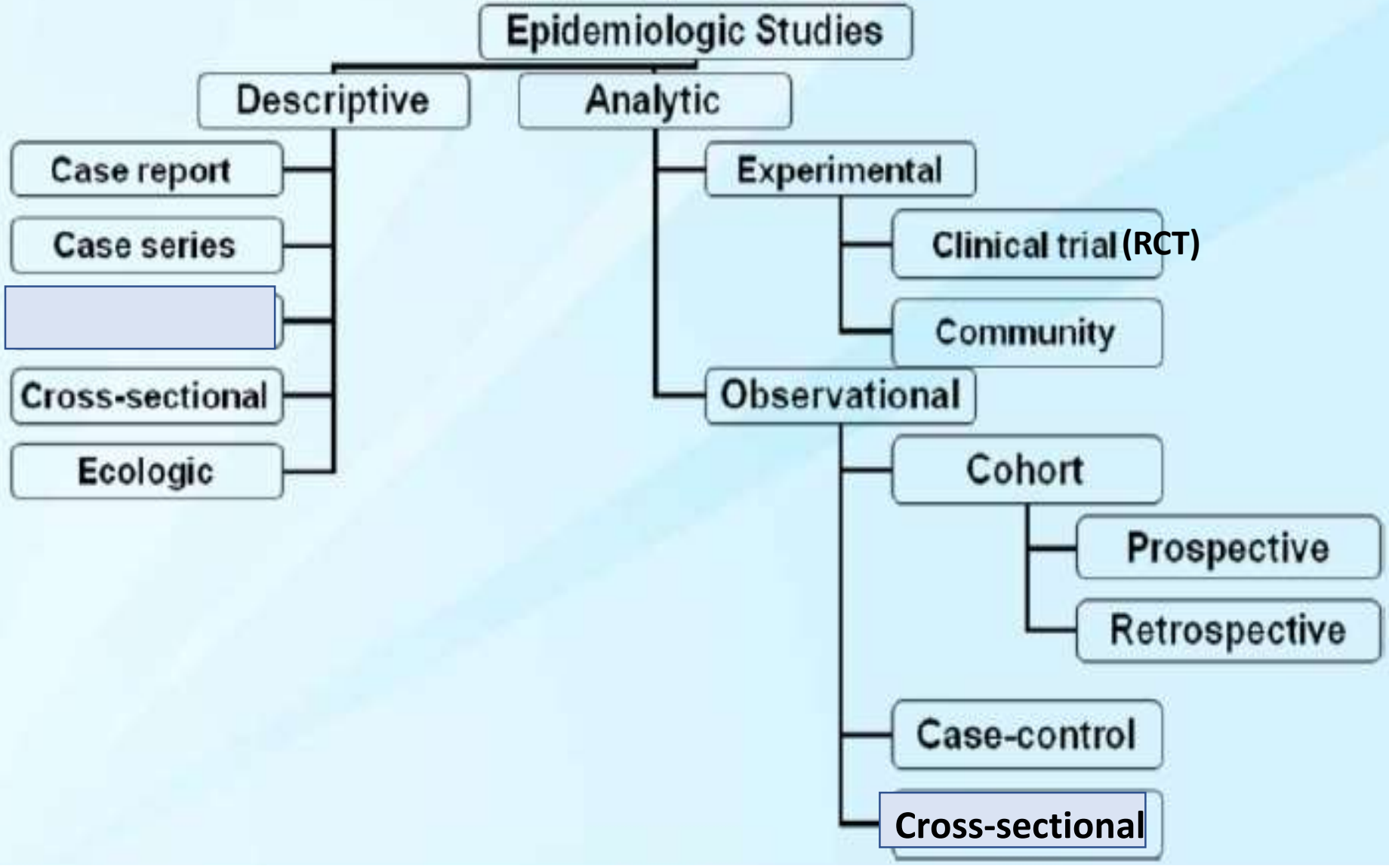
- **Descriptive studies (who, when, where)**
  describe occurrence of outcome

- **Analytic studies (how, why)**
  describe **association** between exposure and outcome

Basic Research Study Designs in Epidemiology

Study design is the arrangement of conditions for the collection and analysis of data to provide the most accurate answer to a question in the most economical way.

Taxonomy of Epidemiologic Studies



Descriptive Studies

- Descriptive studies are usually the first phase of an epidemiological investigation.
- These studies are concerned with observing the distribution of disease or health – related characteristics in human populations.
- Such studies basically ask the questions of what, who, where, and when.
- Useful for generating new hypothesis (provides clues to disease etiology)

Research Hypothesis

A hypothesis is a supposition, arrived at from observation or reflection.

- It can be accepted or rejected using the techniques of analytical epidemiology.

A hypothesis should specify the following:

1. The population.
2. The specific cause being considered.
3. Expected outcome – disease.
4. Time response relationship (expectation).
5. Be understandable, measurable and testable.

Develop a research question & Hypothesis

- General concern – Hb of mother and Birth weight of baby.

RQ -

- Is Anemia in pregnancy associated with low birth weight in newborn?

Null Hypothesis

- There is no difference in the incidence of LBWs in the mothers who are anemic and those who are not anemic.

Research Hypothesis

- The incidence of LBWs in mothers who are anemic is higher than those who are not anemic

Descriptive studies

1. Case Reports:

- presentation of a single case or handful of cases
- Generally report a new or unique finding
    - e.g. previous undescribed disease
    - e.g. unexpected link between diseases
    - e.g. unexpected new therapeutic effect
    - e.g. adverse events

Descriptive studies

2. Case Series

Experience of a group of patients with a similar diagnosis

- Cases may be identified from a single or multiple sources
- Generally report on new/unique condition
- May be the only realistic design for rare disorders

Case report and Case Series

- Advantages
  - Useful for hypothesis generation
  - Informative for very rare diseases with few established risk factors
- Disadvantages
  - Cannot study cause and effect relationships
  - Cannot assess disease frequency in a population

3. Ecological Studies (correlation study)

The ecologic study is a hypothesis generating study. Usually using group-level data (population-level), it examines if two factors are correlated with each other.

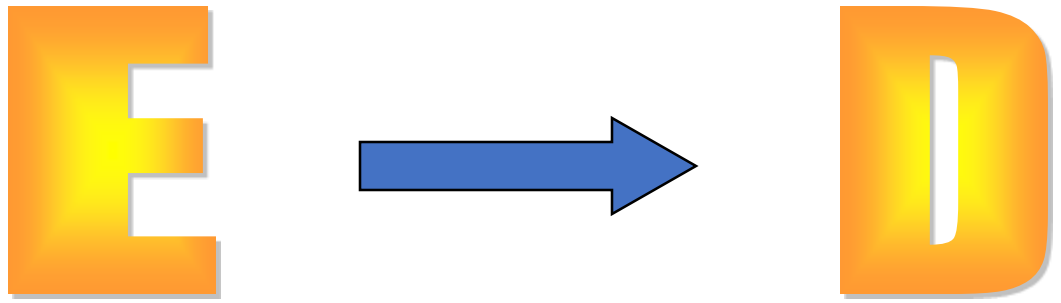
- It involves the collection of events over a defined population base and by the use of denominator data to determine rates.

It results in Ecological Fallacy: Failure in reasoning that arises when an inference is made about an individual based on aggregate data for a group

e.g. Higher rates of coronary heart disease in countries with higher income, Higher rates of leukemia in larger cities , higher rates of car accidents in countries or regions with higher smoking rates.

Analytical Epidemiology

Are exposure and disease linked?



Exposure **Disease**

Analytical Studies (testing hypothesis)

Observational Studies

- Cross-sectional
- Case-control
- Cohort

Experimental Studies

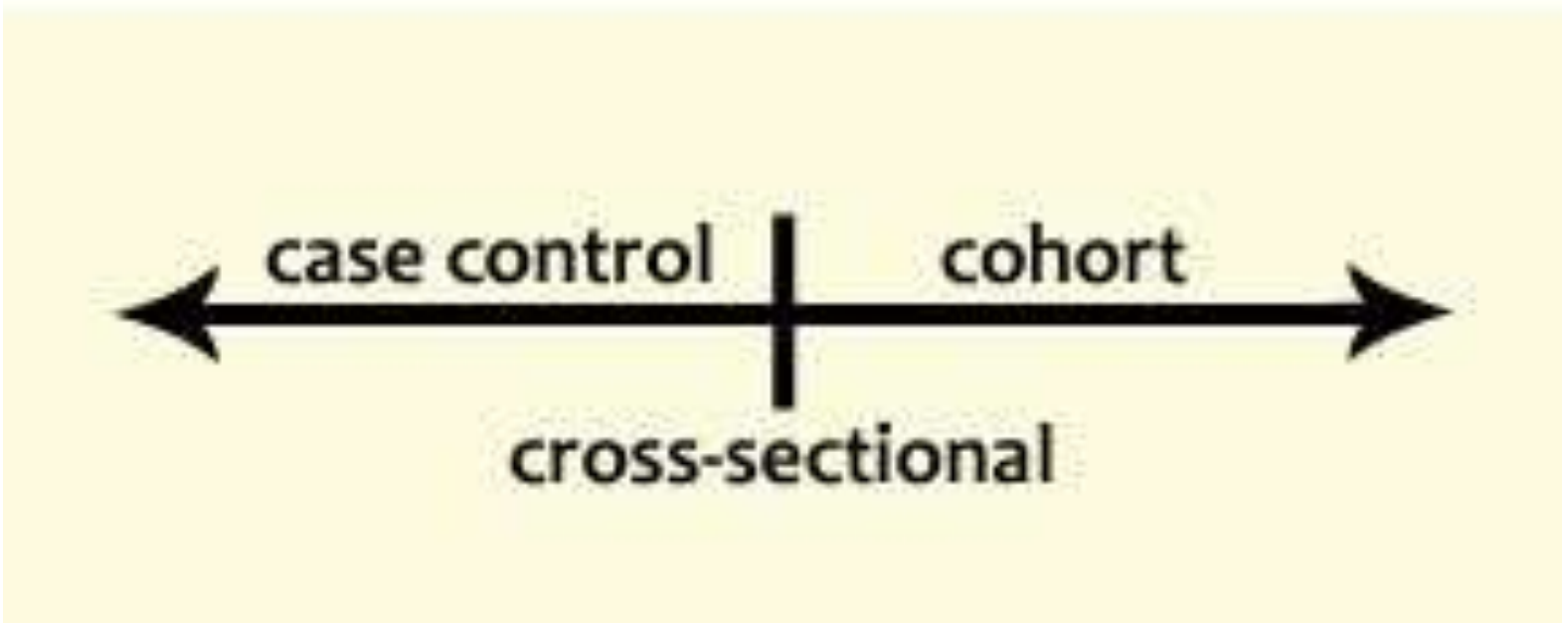
- Randomized controlled clinical trials
- Community trials

Observational Studies

Non-experimental study designs:

- Observational because there is no individual intervention
- Treatment and exposures occur naturally
- Individuals can be observed prospectively, retrospectively, or currently

Observational Studies

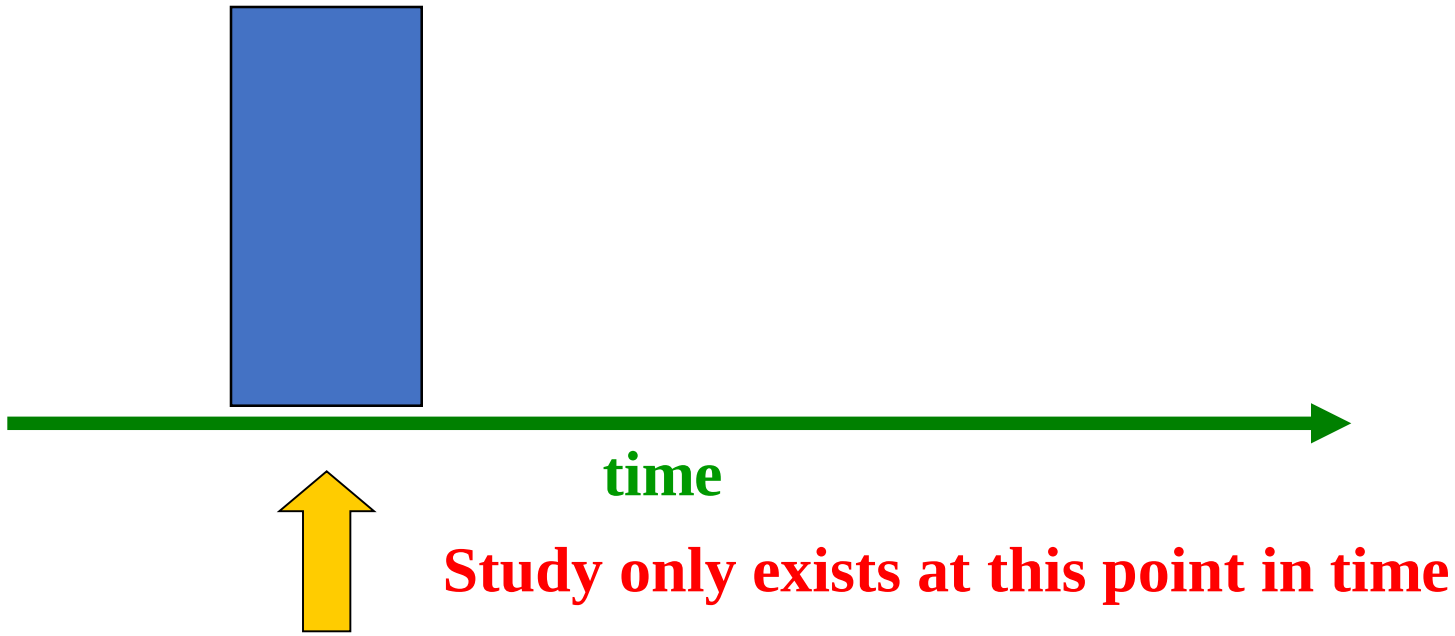


http://www.medbullets.com/step1-stats/1001/types-of-studies

Cross-sectional studies

An “observational” design that surveys exposures and disease status at a single point in time (a cross-section of the population)

It is named “prevalence study”



Cross-sectional studies

- Based on a single examination of a cross section of population at one point in time, by studying a sample that represents the population.
- Results of CS study can be generalized to the whole population (provided the sampling has been done correctly).
- Longitudinal studies are Based on multiple observations in the same population over a multiple points of time.

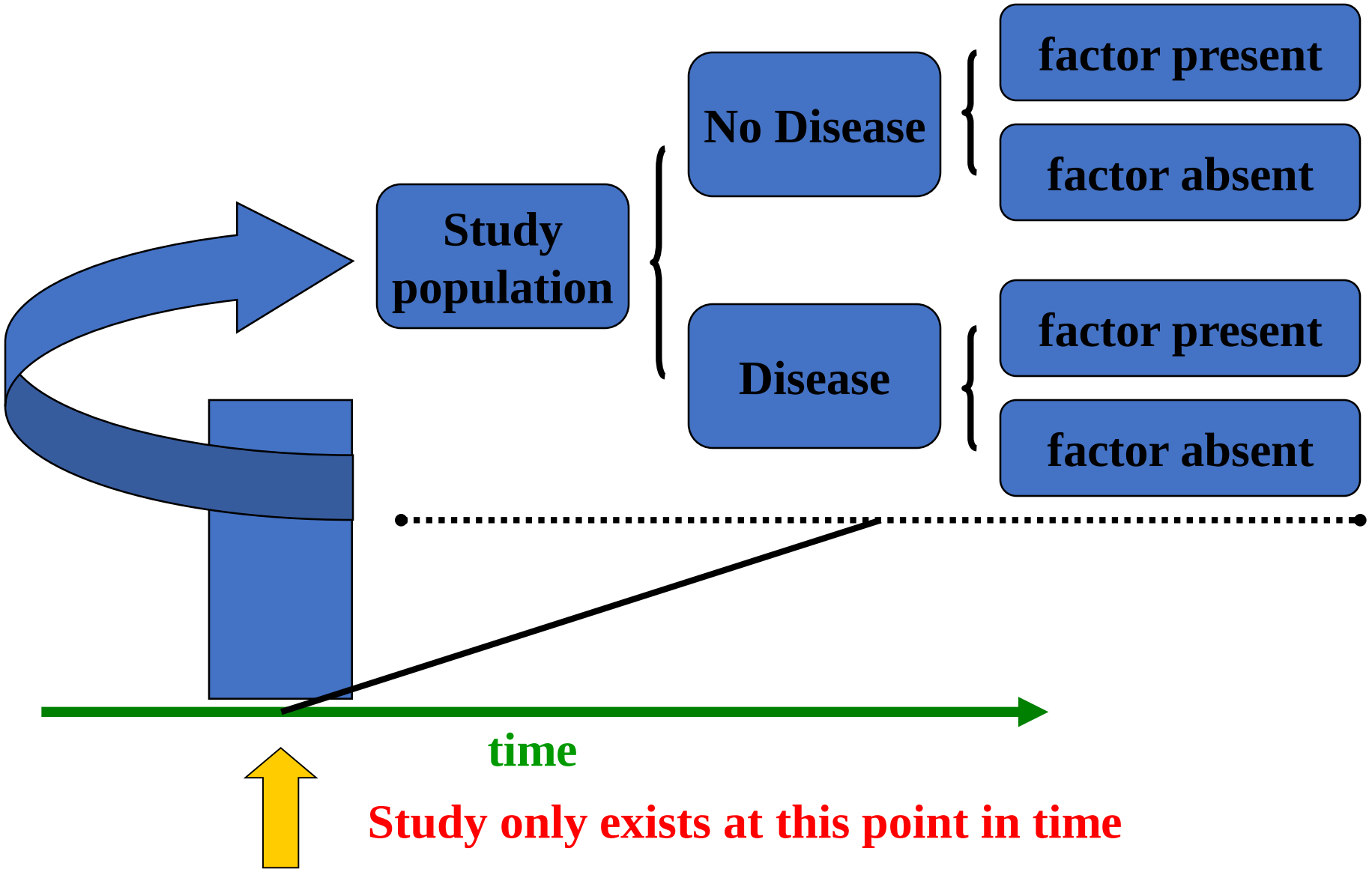
e.g. What is the prevalence of diabetes in Jordan?
What is the prevalence of malnutrition among children in Jordan?
A survey of asthma among animal handlers
A survey of dietary habits among university students

Cross-sectional studies

Used to learn more about the disease to explore factors that have role in the etiology of the disease:

- Physical characteristics of people, material and environment
- Socio-economic characteristics e.g., age, education , marital status, number of children and income
- Behavior or practices of people, knowledge, and attitude and beliefs (KAP)
- Events that occur in population

Cross-sectional Design



Cross-sectional Studies

- Are the simplest form of observational studies.
- Often used to study conditions that are relatively frequent with long duration of expression (nonfatal, chronic conditions)
- It measures prevalence, not incidence of disease
- Example: community surveys
- Not suitable for studying rare or highly fatal diseases or a disease with short duration of expression.

Cross-sectional…

Advantages of cross-sectional studies

- Less time consuming
- Less expensive
- Provides more information (lots of variables)
- Describes the population well
- Generates hypothesis

Cross-sectional study provides a snap-shot or a photograph of a population at a certain point in time.

Cross-sectional studies

Disadvantages

- Weakest observational design, (it measures prevalence, not incidence of disease). Prevalent cases are only the survivors.
- The temporal sequence of exposure and effect may be difficult or impossible to determine.
- Usually don't know when disease occurred
- Rare events a problem.
- Quickly emerging diseases are also a problem.
- Least useful in establishing causation (among analytical studies).

Is Cross-sectional design Descriptive or Analytical?

- It may be difficult to decide whether the disease or the exposure came first, so causation should always be confirmed by stronger studies.
- The collection of information about risk factors is retrospective, running the risk of recall bias.
- In practice cross-sectional studies include elements of both descriptive and analytical design.