Đại học Y Dược TP. Hồ Chí Minh
University of Medicine and Pharmacy at Ho Chi Minh City

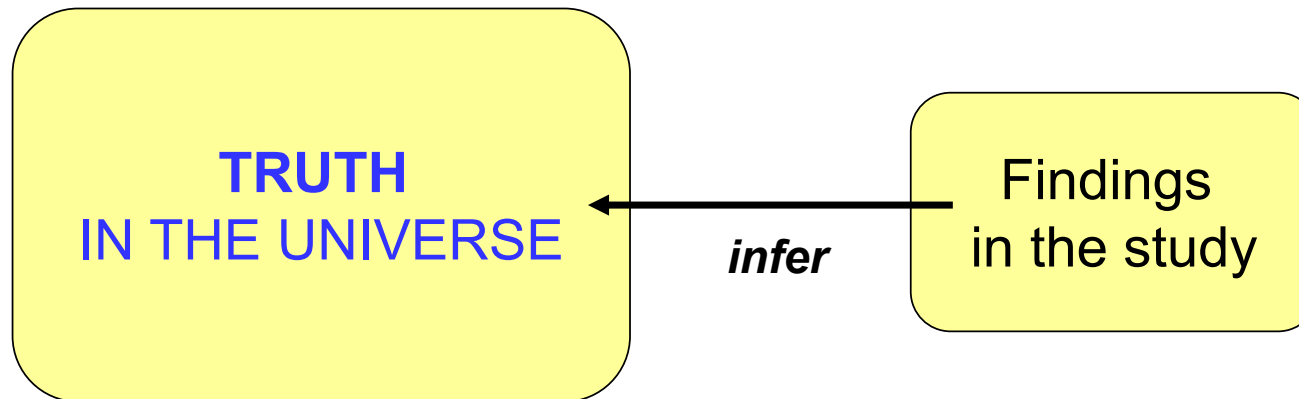# Brief Review of Epidemiology and Biostatistics Terms

Dr. Tran The Trung

Department of Endocrinology

Why do we need research?

- Improve the knowledge
  - To understand society and social processes
  - To test and or create theories
- Improve social conditions:
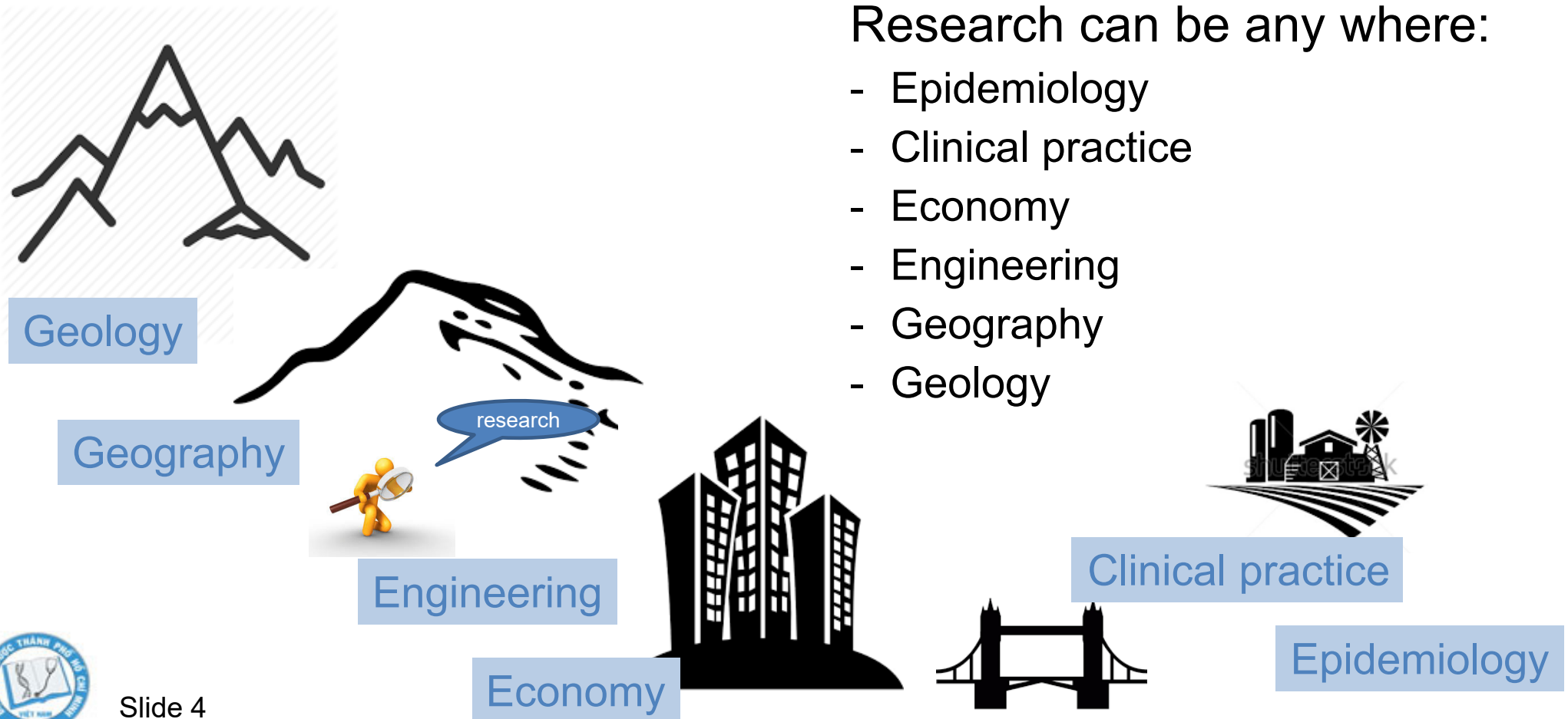 - Help to make decision

The Purpose of Research

TRUTH
IN THE UNIVERSE

infer

Findings
in the study

No study is free of errors
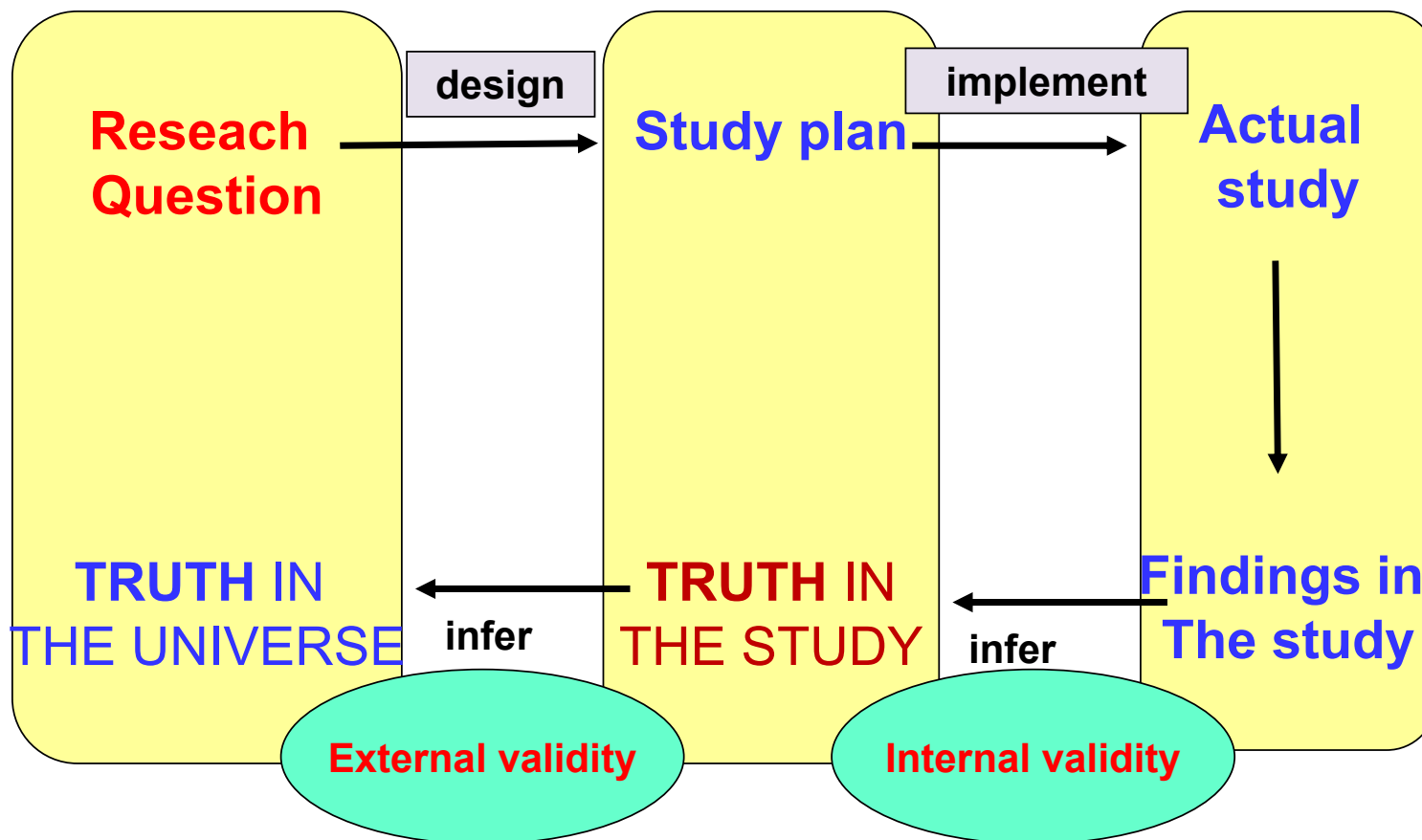
Research, epidemiology, clinical practice and others

Research can be any where:
- Epidemiology
- Clinical practice
- Economy
- Engineering
- Geography
- Geology

Geology

Geography

research

Engineering

Economy

Clinical practice

Epidemiology

Slide 4

Physiology of Research

Research Question: What is it?

- The objective of the study – *What?*
- The uncertainty to resolve – *Why?*
- Must be *narrowed* (specific): *Who, when, where, how …?*
- Significance:
  - What is known at hand?
  - Why is the research question important?
  - What kind of answers will the study provide?

Research Question: Where is it from?

- Build on experience (your own prior studies, your own works, … in the field)
- Mastering the published literature in an area of study
- Senior scientists
- Be alert to new ideas
- A skeptical attitude about prevailing beliefs
- New technologies
- Careful observation of patients

Research Question: How to catch one?

- Keep the imagination roaming
- Creativity
- Inspirations:
  - Collegue conversation
  - Brainstorming session
  - Preparing a lecture
  - Sitting and thinking
- Tenacity, until the problem have a resolution that feels comfortable.

Slide 8

Research Question: A good one - FINER

- **F**easible:
  - Subjects (adequate number of subjects).
  - Technical expertise (adequate).
  - Cost in time and money (affordable).
  - Scope (manageable, narrow).
- **I**nteresting (to the investigator)
- **N**ovel (confirms, extends, provides new findings)
- **E**thical
- **R**elevant (knowledge, policy, future research, …)

Slide 9

Make a Plan: Research Design

- Types of Research Design
  - Observational study vs. Interventional study
  - Descriptive study vs. Analytic study
  - Retrospective vs. Prospective vs. Retro-prospective

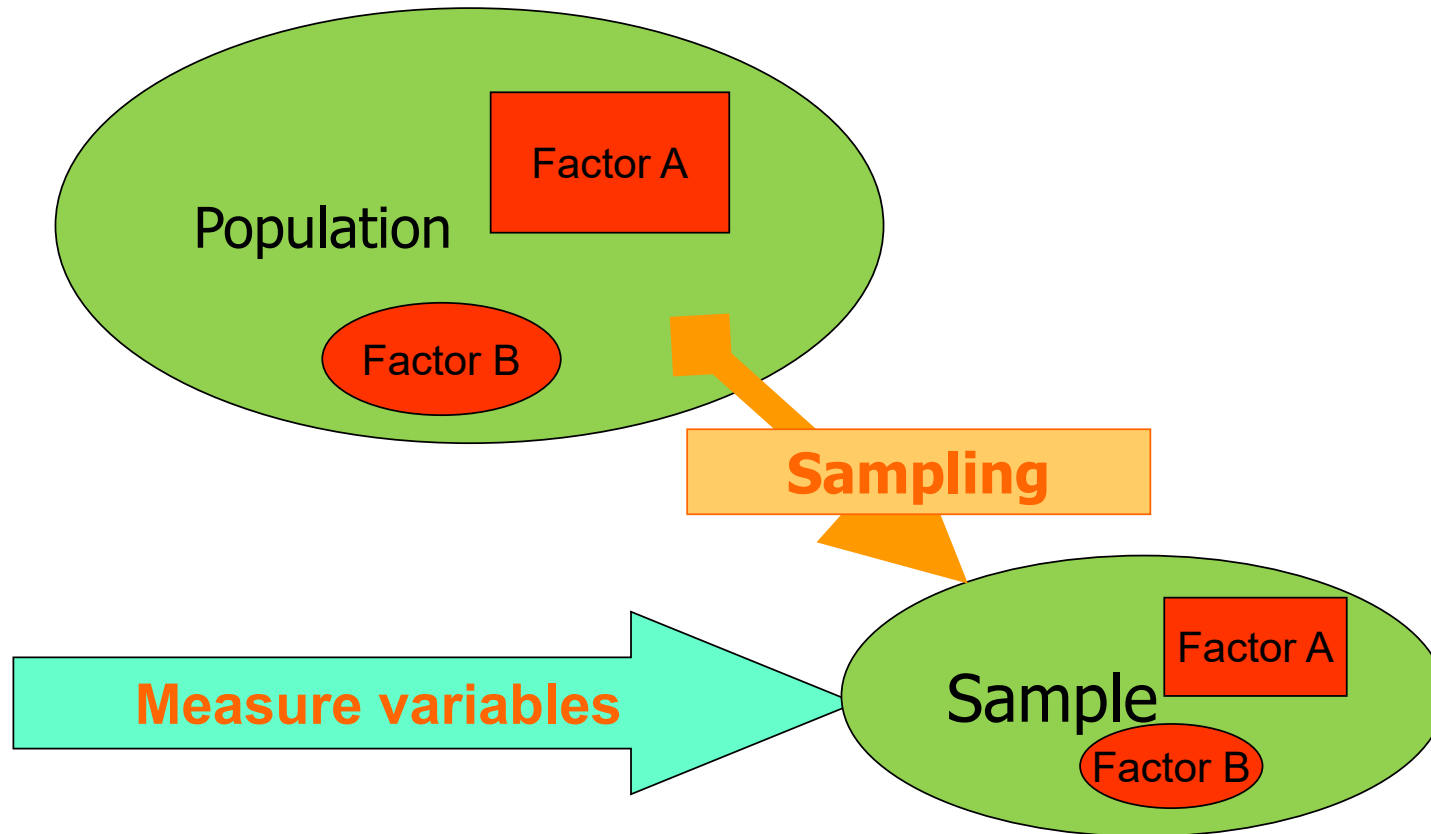   (Historical ~ Retrospective)
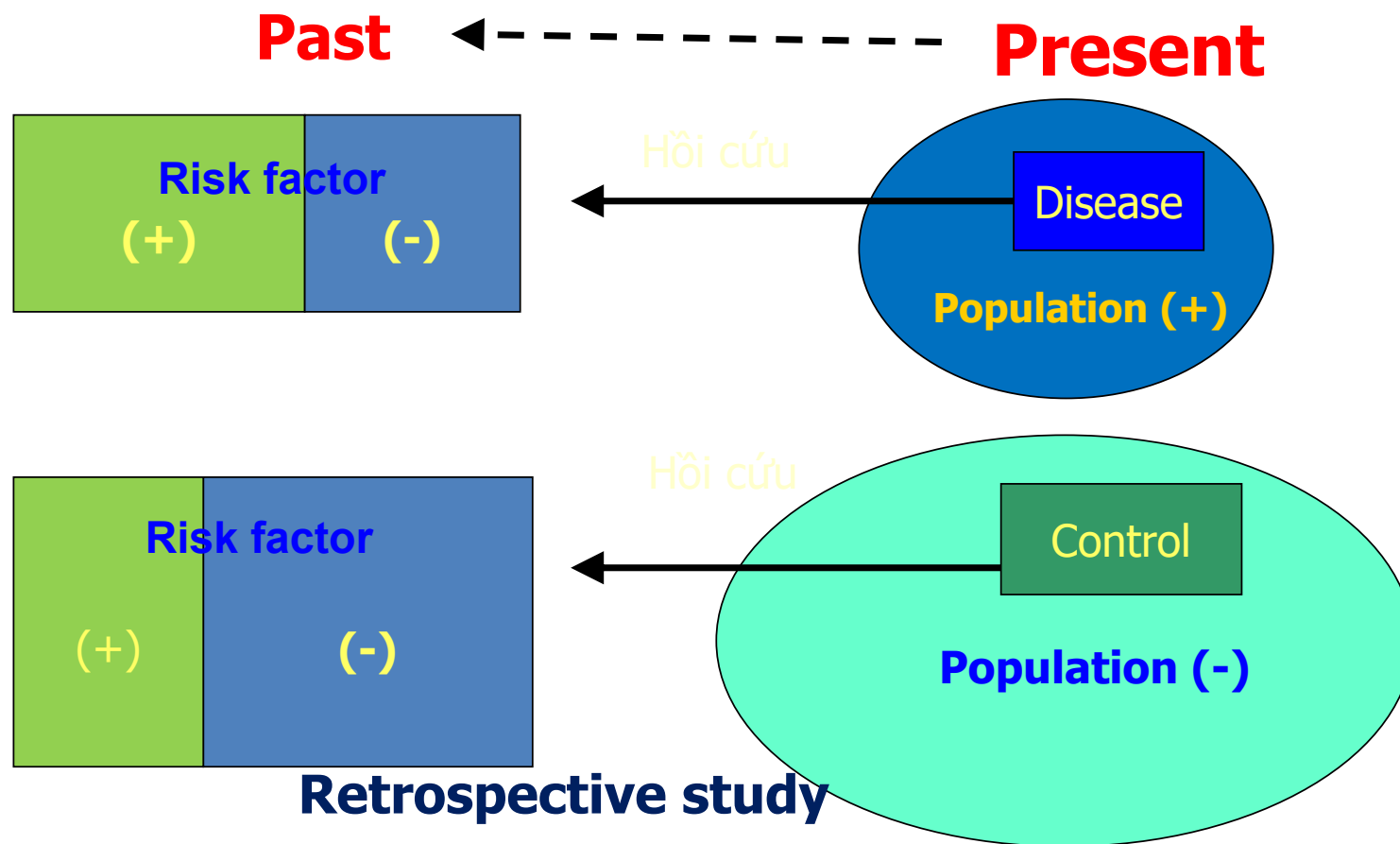
Make a Plan: Research Design

- Observational design:
  - Case report
  - Case-series report
  - Cross-sectional study
  - Case-control study
  - Cohort study
- Interventional design:
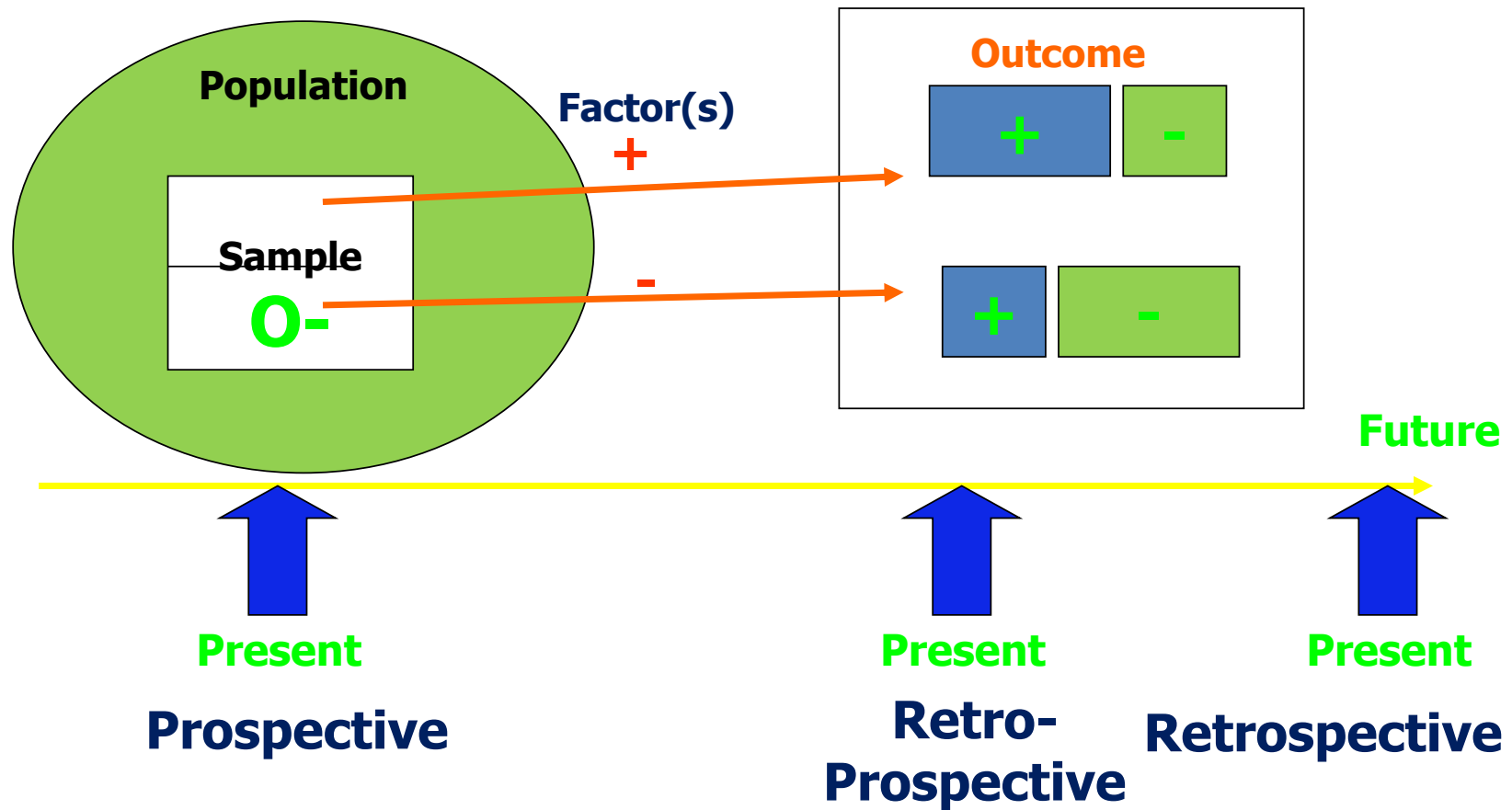 - RCT: randomized-controlled trial
  - Other (Non-RCT) trial

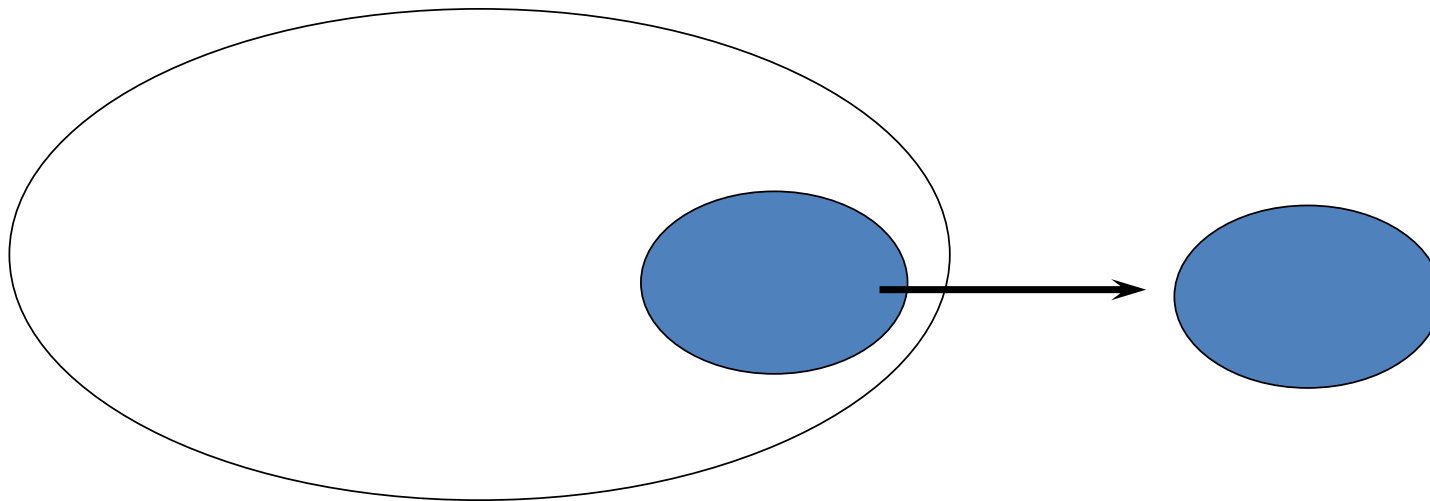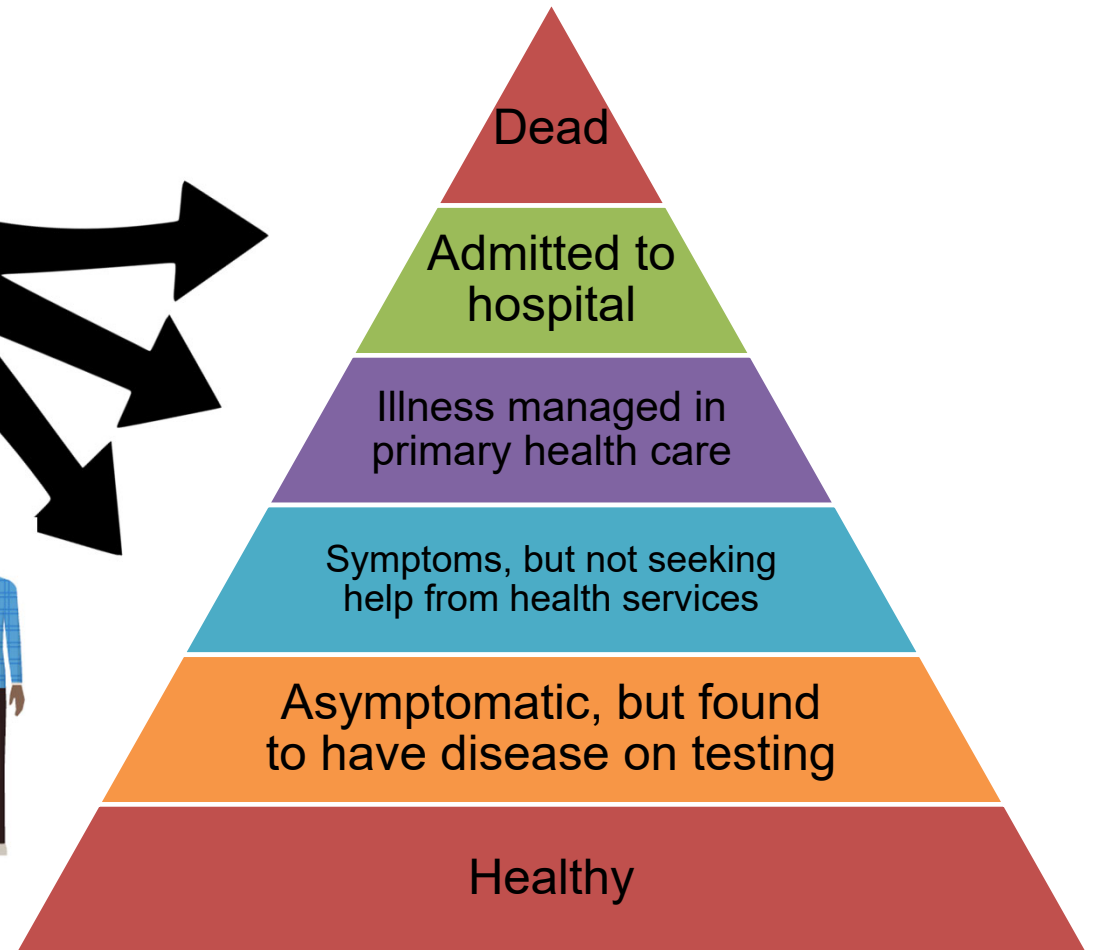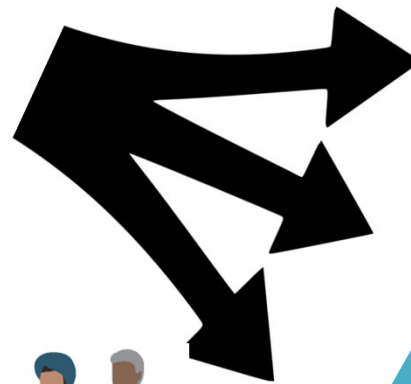# Cross-sectional study

Case – control study

Cohort study

Who would be investigated? Study Subjects

- Who ? => The target population (specific)
- How to recruit ? => Sampling

Study Subjects

- Who would be included (recruited) in the study?

Pyramid (top to bottom):
- Dead
- Admitted to hospital
- Illness managed in primary health care
- Symptoms, but not seeking help from health services
- Asymptomatic, but found to have disease on testing
- Healthy

How many people is enough? Sample size

- How many subjects to sample?
  - Too small, may fail to answer the **research question**.
  - Too large: more difficult and costly.

=> *Appropriate* number.

- Estimate:
  - based on data (often guesses)
  - Feasible ? Variables ? Any change?

=> **Sample size** should be estimated **early**!

What we do with participant? Variables

- Variables = Barebones of research
- Which variables are needed?
  - Predictor variables
  - Outcome variables

Variables: Measurement Scale

- Continuous variables:
  - Continuous variables: weigh, height, length,...
  - Discrete variables: a finite number of intervals, ex. number of cigarettes a day, age,
- Categorical variables:
  - Binominal variables = Dichotomous variables. Ex. Sex, death, ...
  - Nominal variables: unordered categories. Ex. blood type.
  - Ordinal variables: ordered categories, unquantifiable intervals. Ex degree of pain, severity of disease.
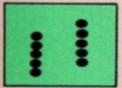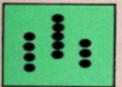
Variable analysis: Statistic works

- Descriptive statistic:
  - Percent
  - Mean, median, quatile, percentile, min, max
- Analytic statistic:
  - Comparing
  - Corellation
  - Regression
  - Hypothesis testing

Choosing a suitable statistic test

Data type	Parametric	Non-parametric
Contingency table (E+ / E− , D+ / D−)		Large sample Chi-square test Small sample Fisher's exact test
Comparison of means		
(2 groups, independent)	T-test	Mann-Whitney U test
(2 groups, paired)	Paired t-test	Wilcoxon signed rank test
(≥3 groups, independent)	ANOVA	Kruskal-Wallis test
Association of two continuous variables		
(Correlation)	Pearson's correlation	Spearman's correlation
(Regression)	Linear regression	Median regression

The Errors of Research

- No study is free of errors.

- The inferences are never perfectly valid.

- GOAL: maximize internal & external validity

=> Minimize Errors:

- – Design phase

- – Implementation phase

- – Analysis phase

Errors of Variable Measurement

- **Random error**

    => is the nature of quantitative data

- **Systematic error (= bias)**

    => should be minimized at the designing state

Ex. Recall bias in mothers with neonatal defects

Errors of Hypothesis Testing

	Truth Null hypothesis is NOT true	Truth Null hypothesis is true
Reject the null hypothesis	😊 Power	Type I error False positive Alpha P value
NOT reject the null hypothesis	Type II error False negative Beta	😊