



Basic Epidemiology and Clinical Research

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Definition: what is epidemiology?

- *Epidemiology is the **study** of the **distribution and determinants** of **health-related states or events** in **specified populations**, and the **application** of this study to the control of health problems.*



Epidemiology - the basic science of public health

- Epidemiology is a quantitative discipline:
 - Probability, statistics
 - Research methods
- Epidemiology is a method of causal reasoning
 - Developing and testing hypotheses
 - Scientific fields as biology, behavioral sciences, physics, and ergonomics
 - Explain health-related behaviors, states, and events.
- An integral component of public health:
 - Directing practical and appropriate public health action.



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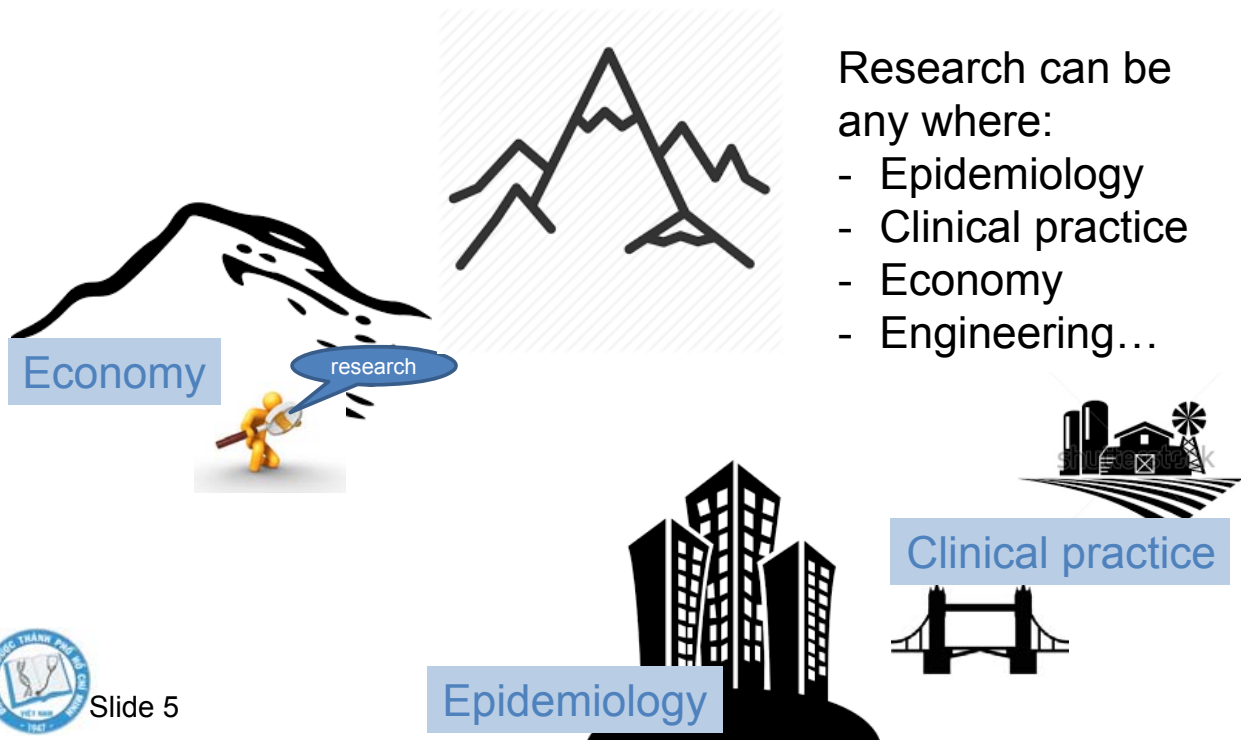
Why do we need research?

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

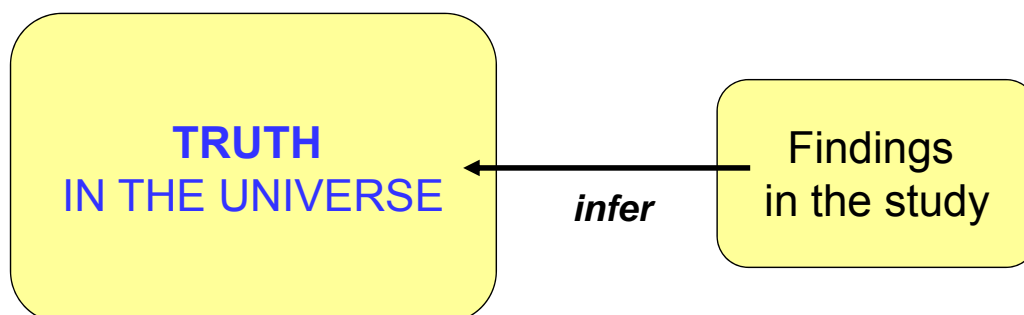


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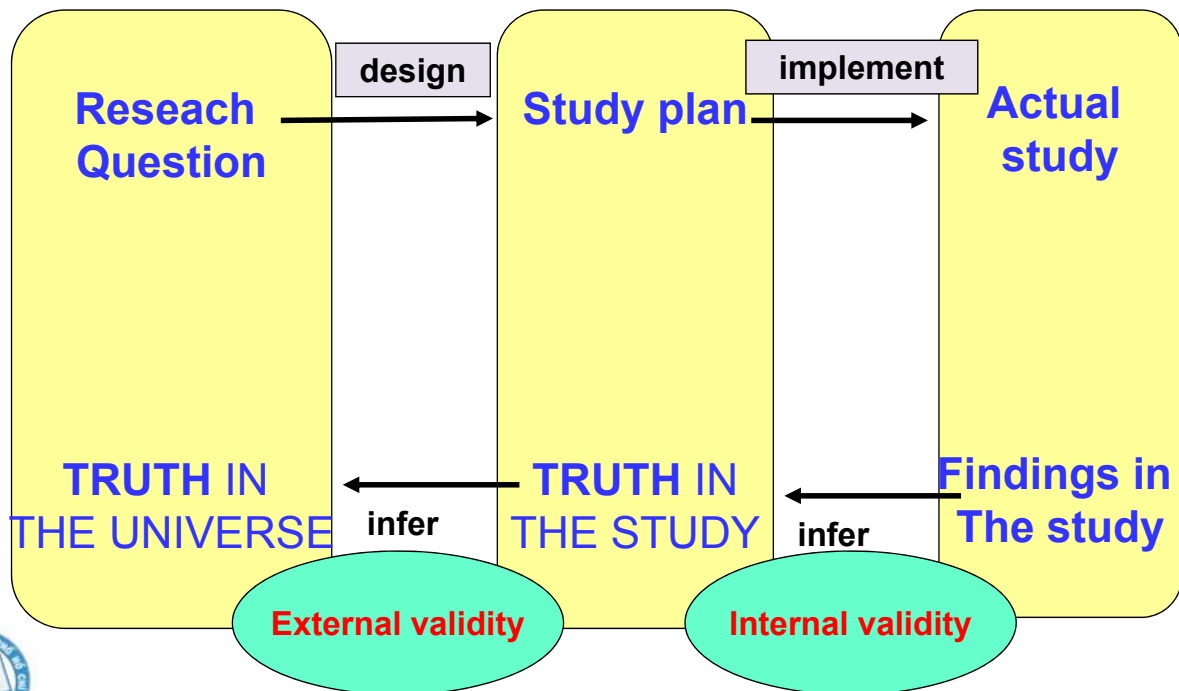
Research, epidemiology, clinical practice and others



The Purpose of Research



Physiology of Research



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Research Question

- 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?



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Origins of a research question

- Build on experience (his own prior studies, his own works, ... in the field).
- Mastering the published literature in an area of study.
- Senior scientist.



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Origins of a research question

- Be alert to new ideas
- A skeptical attitude about prevailing beliefs
- New technologies
- Careful observation of patients



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Origins of a research question

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



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A good research question: **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, ...)



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Design of Research

- Observational study vs. Interventional study
- Observational designs:
 - Case report
 - Case-series report
 - Cross-sectional study
 - Case-control study
 - Cohort study
- Interventional design:
 - RCT: randomized-controlled trial
 - Non-RCT



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Types of Research Design

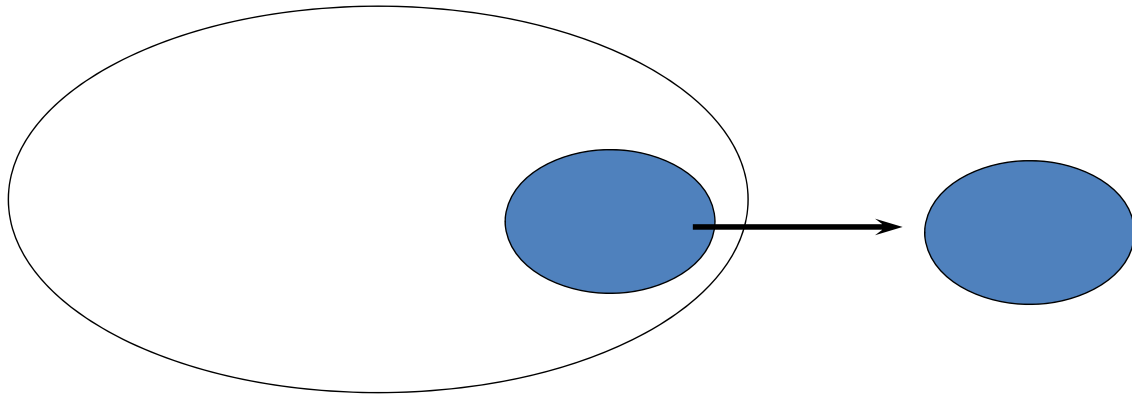
- Descriptive study - Analytic study
- Retrospective - Prospective
(Historical Prospective, Retro-prospective)



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Study Subjects

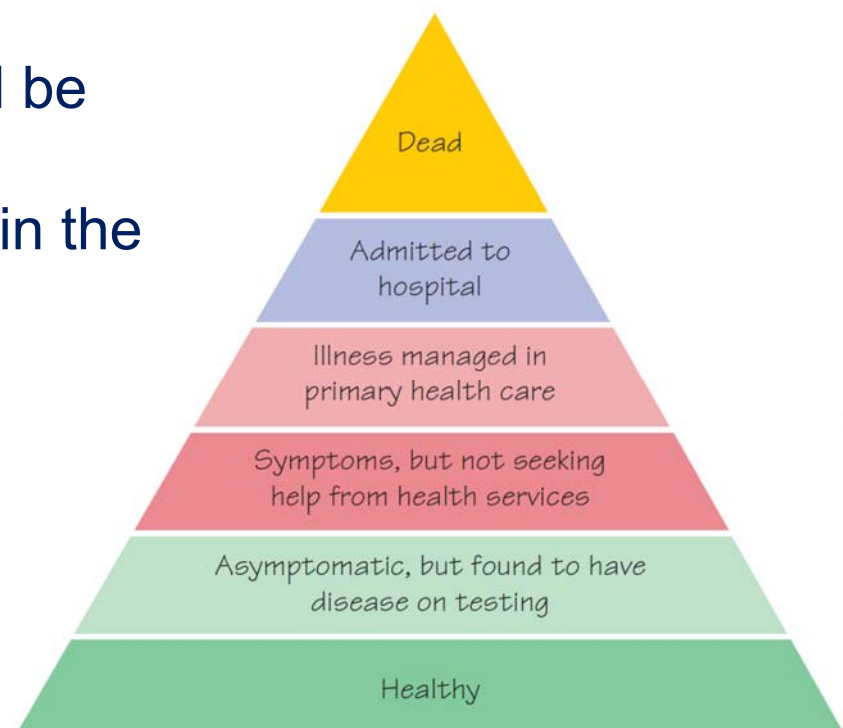
- Who ? => The target population (specific)
- How to recruit ? => Sampling



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Study Subjects

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



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Sample size

- How many subjects to sample?
 - Sample size: 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!**



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Variables

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



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Measurement Scales

- 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.



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Choosing a Measurement Scale

- A continuous variable can be collapse to a categorical variable (not vice verse).
- Ex. BP (mmHg) (discrete variable)
 - => degree 0, I, II, III (ordinal variable)
 - => Hypertension or Normal (binominal)



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The Errors of Research

- No study is free of errors.
- The inferences are never perfectly valid.
- GOAL: maximize internal & external validity
- Errors:
 - Design phase
 - Implementation phase
 - Analysis phase



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The Errors of Research

- Two type of Errors:
 - Random error = due to chance.
 - Systematic error = bias.



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