Research

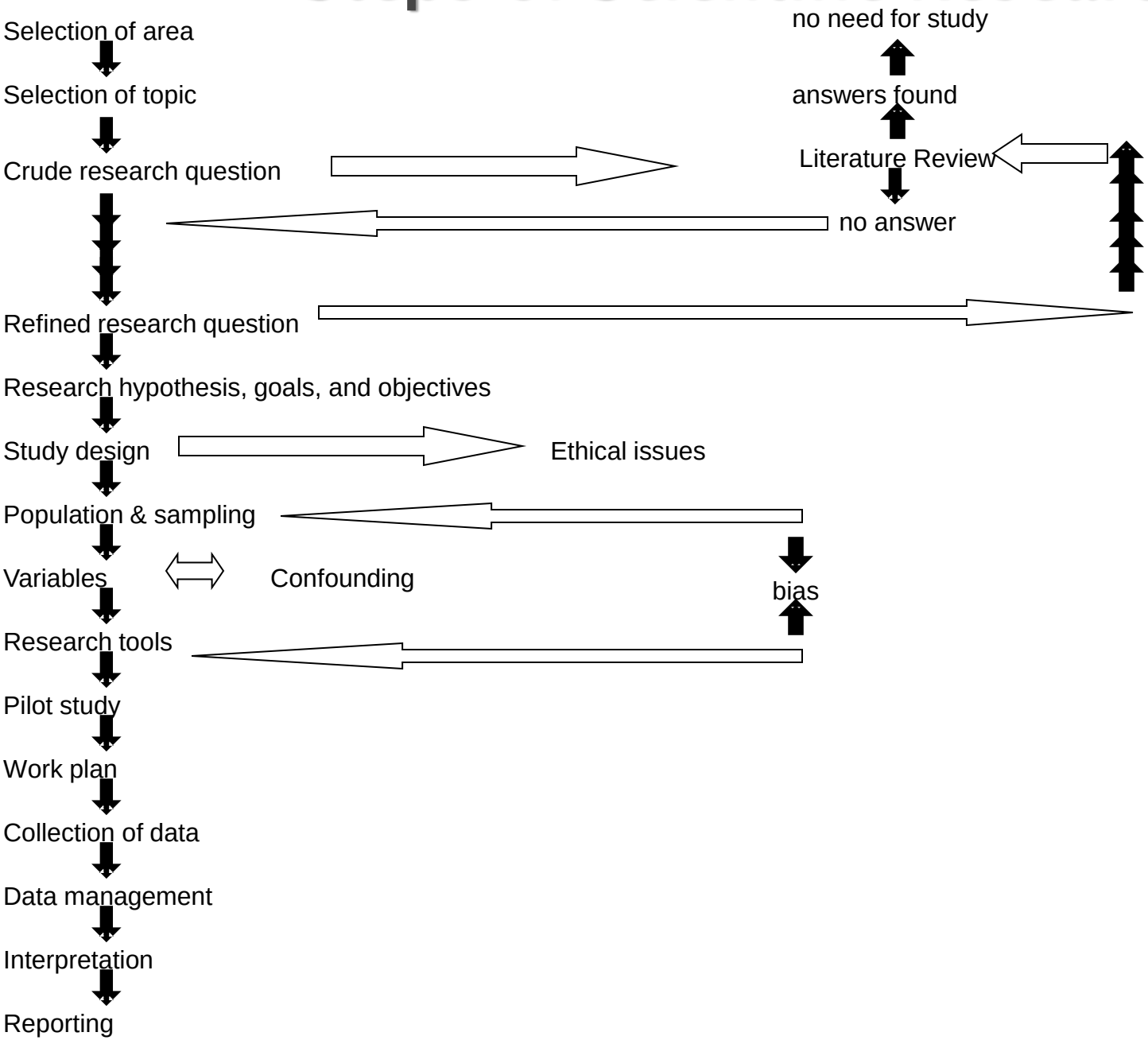
Session 1

- Research is the *systematic collection, analysis and interpretation* of data to answer a certain question or solve a problem.
- It is crucial to follow specific steps when conducting a research.

Research Steps/Process

- Choose a problem
- Review the literature
- Evaluate the literature
- Be aware of all ethical issues
- Be aware of all cultural issues
- State the research question or hypothesis
- Select the research approach
- Determine how the variables are going to be measured
- Select a sample
- Select a data collection method
- Collect and code the data
- Analyze and interpret the data
- Write the report/manuscript
- Disseminate the publication

Steps of Scientific Research



Selection of Research Area

- Selection of this broad entity of research is based on the following:
  - Researcher's
    - Specialty
    - Interest
    - Scientific background
    - Experience
  - Actual need for research in this area
  - Available resources (interest of funding body)

Selection of Research Topics

- The priority of a topic for research depends on:
  - The characteristics of the problem (topic):
    - Impact on health:
      - Magnitude
      - Seriousness
      - Preventability
      - Curability
    - Available interventions
    - Proposed solutions
  - The characteristics of the proposed study:
    - Feasibility
    - Cost-effectiveness
    - Applicability of the results

Identification of Study Population

- The study or target population is the one upon which the results of the study will be generalized.

- It is crucial that the study population is clearly defined, since it is the most important determinant of the sampling population.

Research Question

The investigator must make sure that:

- He/she has a research question
- The question is clear and specific
- It reflects the objectives of the study
- It has no answer by common sense
- It has no answer in the **LITERATURE**
- Finding an answer to the question will solve or at least help in solving the problem to be studied

Doing a Literature Review

21st Century!

The Past!

What is a “Literature Review”?

A literature review surveys scientific articles, books, medical journals, dissertations and other sources … relevant to a particular issue, area of research, or theory, providing a description, summary, and critical evaluation of each work.

Purpose of Literature Review

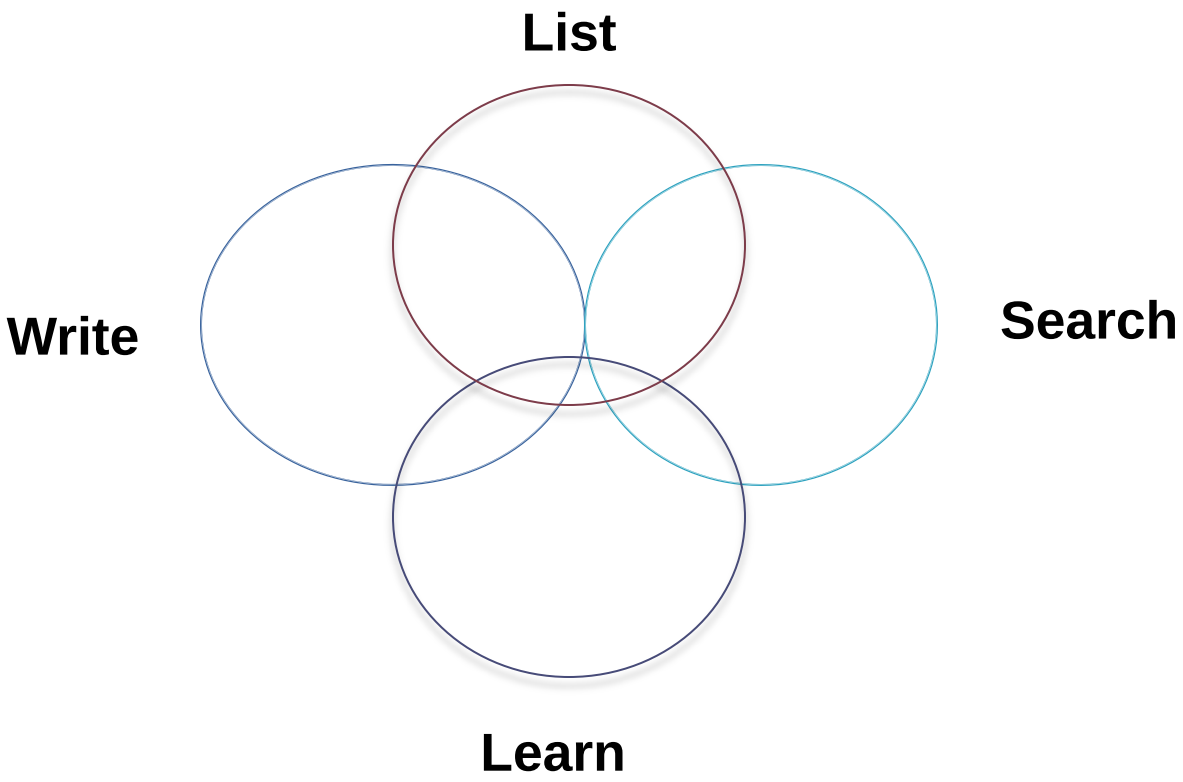
A literature review may constitute an essential chapter of a thesis or dissertation, or may be a self-contained review of writings on a subject. In either case, its purpose is to:

- Place each work in the context of its contribution to the understanding of the subject under review
- Describe the relationship of each work to the others under consideration
- Identify new ways to interpret, and shed light on any gaps in, previous studies

Purpose of Literature Review

- Identify new ways to interpret, and shed light on any gaps in, previous studies
- Resolve conflicts amongst seemingly contradictory previous studies
- Identify areas of prior research to prevent duplication of effort
- Place one's original work (in the case of theses or dissertations) in the context of existing literature

Literature Review as a Process



Components of Literature Review

Development of the literature review requires four stages:

1. Problem formulation–which topic or field is being examined and what are its component issues?
2. Literature search–finding materials relevant to the subject being explored
3. Data evaluation–determining which literature makes a significant contribution to the understanding of the topic
4. Analysis and interpretation–discussing the findings and conclusions of pertinent literature

Sources of Literature

Journal articles:

- These are good sources, especially for the up-to-date information. They are frequently used in literature reviews because they offer a relatively concise, up-to-date format for research.
- Depending on the publication, these materials may be refereed materials.

Sources of Literature (cont.)

Books: Remember that books tend to be less up-to-date, as it takes longer for a book to be published than for a journal article.

- They are still likely to be useful for including in your literature review as they offer a good starting point from which to find more detailed and up-to-date sources of information.

Sources of Literature (cont.)

- **Conference Proceedings**: These can be useful in providing the latest research, or research that has not been published.

- They are also helpful in providing information about people in different research areas, and so can be helpful in tracking down other work by the same researchers.

Sources of Literature (cont.)

Government/Corporate reports:

- Many government departments and corporations commission carry out research.
- Their published findings can provide a useful source of information, depending on your field of study.

Sources of Literature (cont.)

Theses and Dissertations: These can be useful sources of information. However, there are disadvantages:

- They can be difficult to obtain since they are not published, but are generally only available from the library or interlibrary systems.
- The student who carried out the research may not be an experienced researcher and therefore you might have to treat their findings with more caution than published research.

Sources of Literature (cont.)

Internet: the fastest-growing source of information is on the Internet.

Bear in mind that anyone can post information on the Internet so the quality may not be reliable.

The information you find may be intended for a general audience and so not be suitable for inclusion in your literature review (information for a general audience is usually less detailed).

What about Non-Refereed Journals?

- Non-refereed materials such as **Trade Journals**, or **Magazines** use less rigorous standards of screening prior to publication.

- Non-refereed materials may not be checked as intensely as refereed materials, but many can still be considered useful, although not for scientific literature and research.

In assessing each piece, consideration should be given to:

- Provenance-What are the author's credentials? Are the author's arguments supported by evidence (e.g. primary historical material, case studies, narratives, statistics, recent scientific findings)?
- Objectivity-Is the author's perspective even-handed or prejudicial? Is contrary data considered or is certain pertinent information ignored to prove the author's point?
- Persuasiveness-Is the author's thesis convincing?
- Value-Does the work ultimately contribute in any significant way to an understanding of the subject of my research?

Writing Literature

- Three components:
  - The Introduction
  - The Body
  - The Conclusion

Writing the Introduction

In the introduction, you should:

- Define or identify the general topic, issue, or area of concern, thus providing an appropriate context for reviewing the literature.
- Point out overall trends in what has been published about the topic; or conflicts in theory, methodology, evidence, and conclusions; or gaps in research.
- Establish the writer's reason (point of view) for reviewing the literature; explain the criteria to be used in analyzing and comparing literature.

Writing the Body

In the body, you should:

- Group research studies and other types of literature (reviews, theoretical articles, case studies, etc.) according to common denominators such as qualitative versus quantitative approaches, conclusions of authors, specific purpose or objective, etc.
- Summarize individual studies
- Make comparisons and analyses

Writing the Conclusion

In the conclusion, you should:

- Summarize major contributions of significant studies and articles to the body of knowledge under review, maintaining the focus established in the introduction.

- Evaluate the current "state of the art" pointing out major methodological flaws or gaps in research, inconsistencies in theory and findings, and areas or issues pertinent to future study.

- Conclude by providing some insight into the relationship between the central topic of literature review and a larger area of study (rationale).

Rationale

- An explanation of the fundamental reasons for your research
- Justification of your work

A few things that worked …

- Learn/use effective search strategies
- Keep a credible research journal
- Write about **everything** you read
- Don't write a lit review (yet)
- Write a summary (today)
- Read others' lit reviews
- Ask questions!

Research Goal & Objectives

- The goal (aim) and objectives must be stated at the very beginning of the study, since they will guide the investigator during the process of formulating research questions and hypothesis.
- They will also help in the prioritization process.
- They will enable the reader or consumer of the work to judge whether the investigator had achieved these objectives or not.

Goals

- It describes the aim of the work in broad terms

Objectives

- These are more specific and relate directly to research question. They may be divided into two types:

  - Primary objectives ➡ (bound to be achieved)
  - Secondary objectives ➡ (by the way)

Research Objectives

- The research objectives should be:
  - Closely related to the research question
  - Covering all aspects of the problem
  - Very specific
  - Ordered in a logical sequence
  - Stated in action verbs that could be evaluated (e.g. to describe, to identify, to measure, to compare, etc.)
  - Achievable, taking into consideration the available resources and time
  - Mutually exclusive, with no repetitions or overlaps

SMART Objectives

- S → Specific
- M → Measurable
- A → Achievable
- R → Relevant
- T → Time-bound

Research Objectives

- Properly formulated, specific objectives will facilitate the development of your research methodology and will help to orient the collection, analysis, interpretation, and utilization of data.

Research Hypothesis

Research hypothesis is a statement of the research question in a measureable form

Research Hypothesis (cont.)

- A hypothesis can be defined as a prediction or explanation of the relationship between one or more independent variables (PREDISPOSING/RISK FACTORS) and one dependent variable (OUTCOME/CONDITION/DISEASE)

- A hypothesis, in other words, translates the problem statement into a precise, clear prediction of expected outcomes.

- It must be emphasized that hypotheses are not meant to be haphazard guesses, but should reflect the depth of knowledge, imagination and experience of the investigator.

Example 1: (A Study)

- Area: Family medicine
- Topic: Communicable Diseases (hepatitis)
- Goal: To contribute to the reduction of hepatitis in (e.g., Mississippi) through studying public perceptions about the disease
- Objective: To assess the awareness, knowledge, and attitudes of the general public towards hepatitis in Mississippi

Example 2: (Interventional Study)

- Research area: Cardiology
- Research topic: Ischemic Heart Disease (IHD)
- Goal: To contribute to prevention of IHD
- Primary Objective: To determine the effect of reducing LDL on the occurrence of MI
- Secondary Objective: To describe the side effects of lowering LDL
- Research question: Does hypocholesterolemic agent “A” decrease the risk of MI?
- Research hypothesis: The risk of MI among patients treated with hypocholesterolemic agent “A” is lower than the risk among controls not treated with hypocholesterolemic agents

Population and Sampling

- Sampling is the process of selection of a number of units from a defined study population.

The process of sampling involves:

1. Identification of study population
2. Determination of sampling population
3. Definition of the sampling unit
4. Choice of sampling method
5. Estimation of the sample size

Feasibility

- Time
- Manpower [human capital]
- Equipment
- Money

Identification of Study Population

- The study or target population is the one upon which the results of the study will be generalized.

- It is crucial that the study population is clearly defined, since it is the most important determinant of the sampling population.

Determination of Sampling Population

- The sampling population is the one from which the sample is drawn.

- The definition of the sampling population by the investigator is governed by two factors:
  - **Feasibility**: reachable sampling population
  - **External validity**: the ability to generalize from the study results to the target population

Estimation of the Sample Size

"How many subjects should be studied?"

- The sample size depends on the following factors:

I. Effect size
II. Variability of the measurement
III. Level of significance

http://www.surveysystem.com/sscalc.htm

I. Effect Size

Magnitude of the difference to be detected

- A large sample size is needed for detection of a minute difference.

  Thus, the sample size is inversely related to the effect size.

II. Variability of the Measurement

- The variability of measurements is reflected by the standard deviation or the variance.

- The higher the standard deviation, the larger the sample size is required. **Thus, sample size is directly related to the SD.**

III. Level of Significance

- Relies on a error or type I error. The maximum level error has been arbitrarily set to 5% or 0.05.

- Alpha error can be minimized to 0.01 or even 0.001 but this consequently increases the sample size. **Thus, sample size is inversely related to the level of a error.**

Collection of Data

- Data collected are “variables”
- Variables are classified according to their:
  - Type:
    - QT (continuous, discrete)
    - QL (ordinal, nominal)
  - Role in the study:
    - Dependent
    - Independent
  - Relationship with the other study factors:
    - Main study variables
    - Confounding variables
    - Effect modifiers
    - Intermediate factors

Methods of Collection of Data (Research Tools)

- Selection of the suitable technique depends on:
  - The availability of information
  - The type of data
  - The resources available
  - The characteristic of the tool

Research Tools

- Most important techniques:
  - Using available information (records)
  - Observation (checklist)
  - Self-administered questionnaire
  - Interviewing (individual/group)
  - Measuring (all lab tests and other investigations)

Choosing the Format of Your Questionnaire Questions

- Fixed alternative
  - Yes/No
    - Reliable
    - Not powerful
  - Likert
- Open-ended
  - May not be properly answered
  - May be difficult to score

Choosing the Format of Your Interview

- Unstructured
  - Interviewer bias is a serious problem
  - Data may not be hard to analyze
- Semi-structured
  - Follow-up questions allowed
  - Probably best for pilot studies
- Structured
  - Standardized, reducing interviewer bias

Editing Questions: Nine Mistakes to Avoid

1. Avoid leading questions
2. Avoid questions that invite the social desirability bias
3. Avoid double-barreled questions
4. Avoid long questions
5. Avoid negations/contractory
6. Avoid irrelevant questions
7. Avoid poorly worded response options
8. Avoid big words
9. Avoid ambiguous words & phrases

Measurement Errors

- Definition of “error”

“A false or mistaken result obtained in a study or an experiment” John Last, 2001

- Types of errors:
  - Systematic error: bias:

  “an error having a certain magnitude and direction repeated with every measurement”
  - Random error:

  “error with no fixed pattern of magnitude or direction”

Sources of Errors

- Subject
- Observer
- Instrument

Administering the Research

- Informed consent
- Clear instructions
- Debriefing
- Confidentiality

Data Management

- Data management is the whole process of dealing with data from the very beginning of the study. Data analysis is just the last part of it.
- It can be divided into the following phases:
  - Preparation of data entry
  - Data entry
  - Data analysis

Data Management (cont.)

- Preparation for data entry:
  - Review of questionnaire forms
  - Unique identifier
  - Coding
  - Preparation of master-sheets (manual) or spread-sheets (computer)
  - Dummy tables
  - Quality control
- Data entry

Data Management (cont.)

- Data analysis:
  - Descriptive:
    - Tabular presentation:
      - Frequency distribution tables
      - Cross tabulations
    - Graphic presentation:
      - Bar charts
      - Pie charts
      - Line graphs
      - Others
    - Numeric presentation:
      - Percentages and percentiles
      - Measures of central tendency
      - Measures of dispersion

Analytic

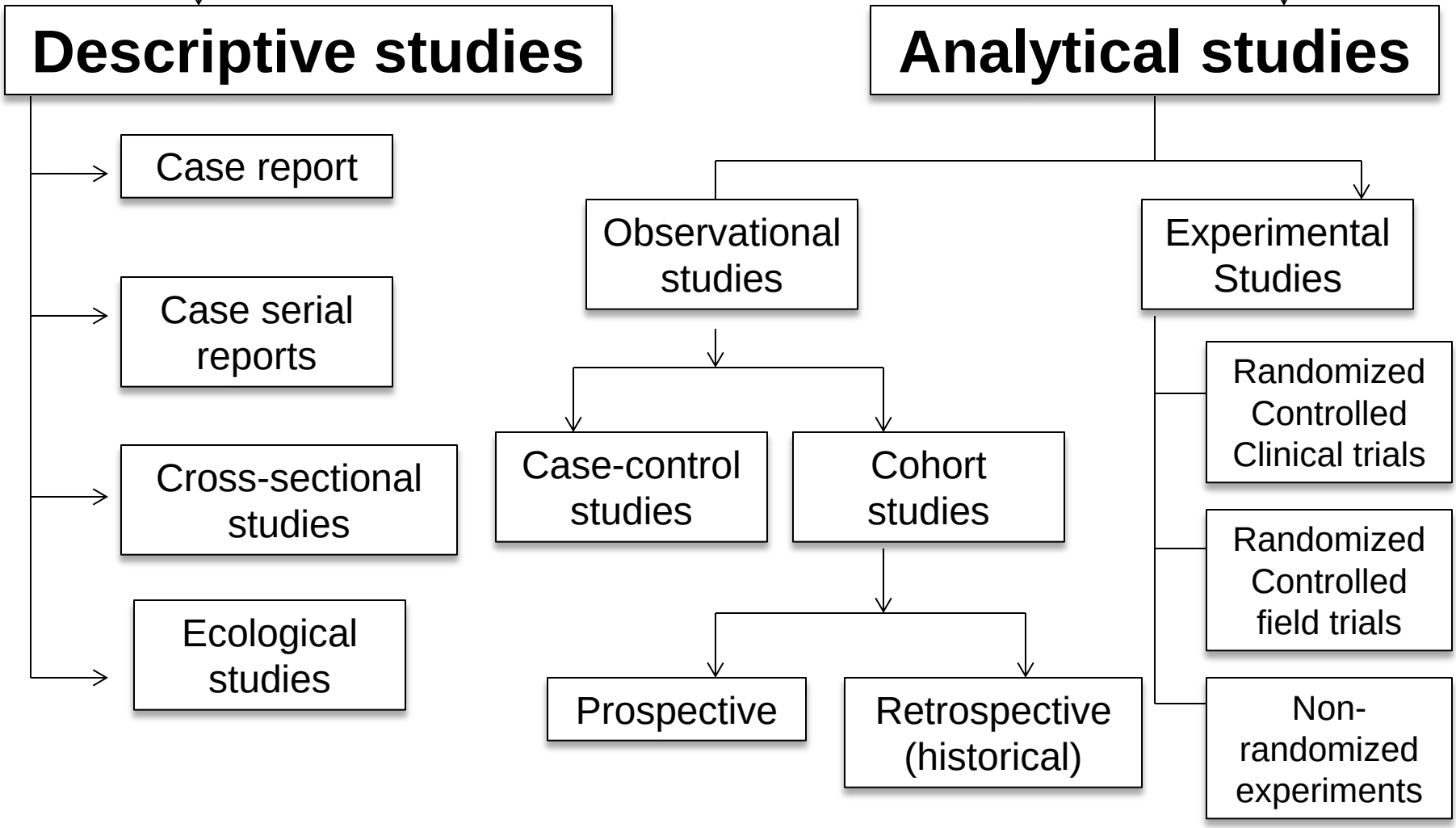
- The researcher uses principles of biostatistics to test the hypothesis. Detection of proper statistical test depends on:

  - The objective of the study:
    - Descriptive
    - Looking for a difference
    - Looking for an association
  - Type of variable:
    - QT (continuous, discrete)
    - QL (ordinal, nominal)

Interpretation

- Discussion of the results in a way that relates data obtained to each other clarifying the associations and other findings.

Study Design



How Could We Select the Best Study Design?

- Purpose of the study
- State of existing knowledge (in relation to study question)
- Characteristics of the study variables
- Latency / how practical is it?
- Feasibility

Qualitative Research

Not everything that can be counted counts and not everything that counts can be counted.

(Albert Einstein)

What is qualitative research?

Qualitative Research is collecting, analyzing, and interpreting data by observing what people do and say. In general, it is a human-focused approach to research design. Qualitative research aims to delve into people's experiences, behaviors, and belief. While quantitative research documents *who, what, where, how and such descriptive* details; qualitative research explores *why questions* that addresses various phenomena/refers to the meanings, concepts, definitions, characteristics, metaphors, symbols, and descriptions of things).

Qualitative research uses very different methods of collecting data/information, including individual, in-depth interviews and focus groups. The nature of this type of research is exploratory and open-ended.

http://uk.geocities.com/balihar_sanghera/ipsrIn mehrigiulqualitativequantitativeresearch.html

Why Qualitative Methods?

- Qualitative methods, as one of many tools, help us understand underlying:
  - Behavior
  - Attitudes
  - Perceptions
  - Culture

Qualitative versus Quantitative Research

Qualitative Research Advantages

- Provides detailed perspectives of a few people
- Captures the voices of participants
- Allows participants' experiences to be understood in context
- Is based on the views of participants nor of the research
- Appeals to people's enjoyments of stories

Quantitative Research Advantages

- Draws conclusions for large numbers of people
- Analyzes data efficiently
- Investigates relationships within data
- Examines probable causes and effects
- Control bias
- Appeals to people's preference for numbers

Qualitative versus Quantitative Research

Qualitative Research Disadvantages

- Has limited generalizability
- Provides only soft data (no #s)
- Studies few people
- Is highly subjective
- Minimizes use of researcher's expertise due to reliance on participants

Quantitative Research Disadvantages

- Is impersonal, dry
- Does not record the words of participants
- Provides limited understanding of the context of participants
- Is largely researcher driven

Mixed Method Research Is:

an approach to research in the social, behavioral, and health sciences in which the investigator gathers both quantitative (closed-ended) and qualitative (open-ended) data, integrates the two, and then draws interpretations based on the combined strengths of both sets of data to understand research problems.

Core Characteristics of Mixed Method Research are:

- collection and analysis of quantitative and qualitative data in response to research questions
- Use of rigorous qualitative and quantitative methods
- Combination or integration of quantitative and qualitative data using a specific type of mixed methods design, and interpretation of this integration
- Sometimes, framing of the design within a philosophy or theory

Mixed Method Research Designs

The three basic mixed methods designs are:

- *convergent design* – collecting data and comparing one with the other for validity

- *explanatory sequential design* – collect quantative data and use qualitative methods to help explain the quantitative results in more depth

- *exploratory sequential design* – explore the problem with qualitative methods then use such findings to build a second quantitative phase

Mixed Method Research Designs

Continued…

The three advance mixed methods designs are:

- *intervention designs* –
- *social justice or transformation designs* –
- *multistage evaluation designs* –

It is better to view quantitative and qualitative researches not as dichotomous but as various tools.

Thank You!