Research methodology – general concepts. Types of research.

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Discussion topics

1. Concept of Research. Definition, objectives, motivation.
2. Research methodology. Research design.
3. The steps in conducting research.
4. The basic types of research.

1. Research Definitions

- ***Research*** **is a structured activity utilizing appropriate scientific methodology to solve problems and create new knowledge that is generally applicable.**
- **Research is a process of collecting, analyzing and interpreting information**

Definitions

- Research is the systematic application of a group of methods that are employed to provide trustworthy information about problems

- An experience, attitude, the art of scientific investigation, the effort to gain new knowledge

- Redman and Mory define research as a “systematized effort to gain new knowledge.”

Objectivs of research

1. To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as exploratory or formulative research studies);
2. To portray accurately the characteristics of a particular individual, situation or a group (studies with this object in view are known as descriptive research studies);
3. To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as diagnostic research studies);
4. To test a hypothesis of a causal relationship between variables (such studies are known as hypothesis-testing research studies).

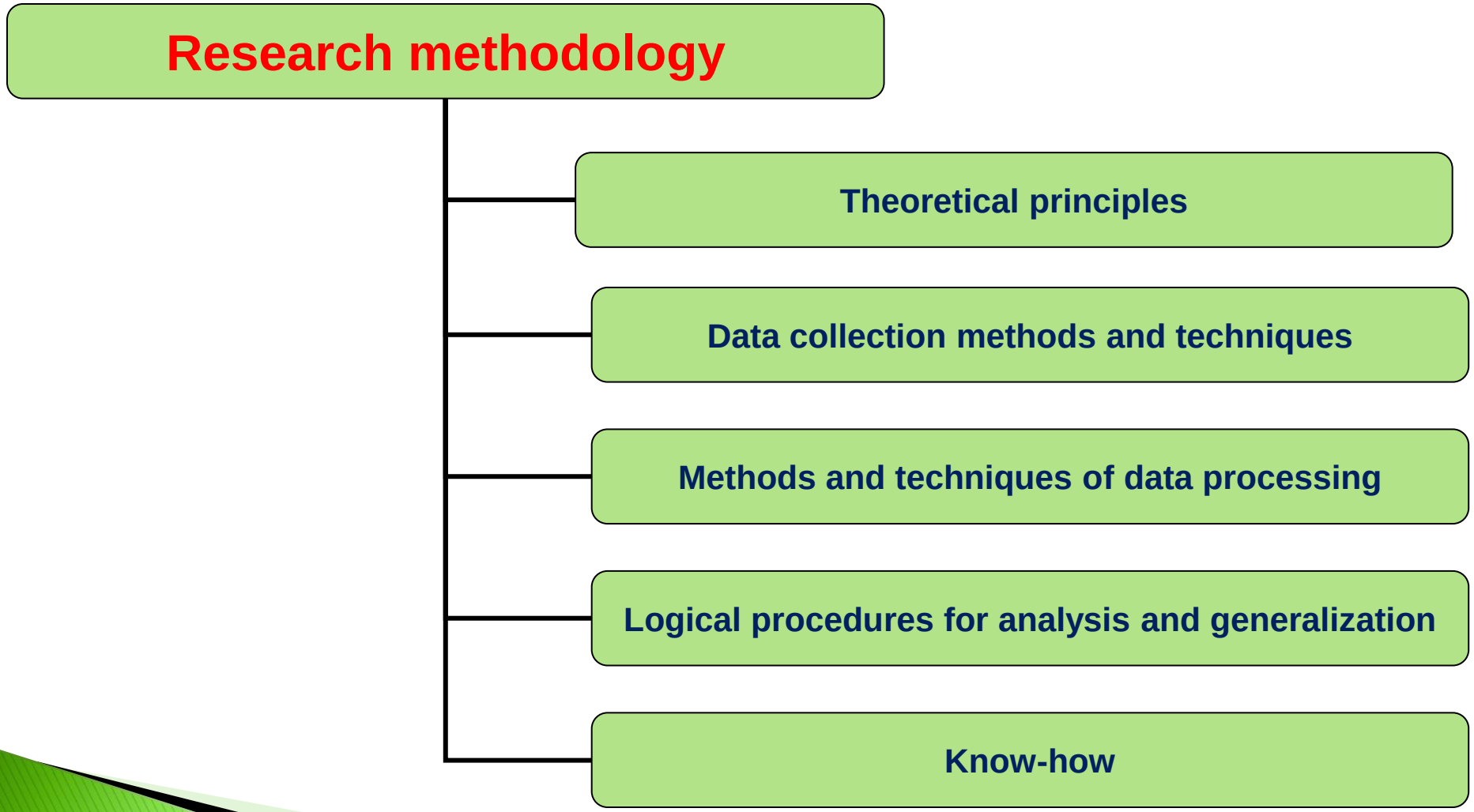
MOTIVATION IN RESEARCH

1. Desire to get a research degree along with its consequential benefits;
2. Desire to face the challenge in solving the unsolved problems, i.e., concern over practical problems initiates research;
3. Desire to get intellectual joy of doing some creative work;
4. Desire to be of service to society;
5. Desire to get respectability, social position.

Motivation for research – in brief

- To discover something new
- For personal development and accumulation of new knowledge
- To obtain a scientific degree
- To obtain a social position
- For pleasure

Research methodology



Research design

Is the preparation of the design of the research project, answering to the following questions:

- What is the study about?
- Why is the study being made?
- Where will the study be carried out?
- What type of data is required?
- Where can the required data be found?
- What periods of time will the study include?
- What will be the sample design?
- What techniques of data collection will be used?
- How will the data be analyzed?
  - In what style will the report be prepared?

Steps in conducting research

1. Identify a problem and purpose
2. Pose a research question
3. Review prior literature
4. Construct hypothesis
5. Choose research design and methods
6. Test hypothesis
7. Draw conclusions

The steps of Research Project

1. Formulating the research problem
2. Literature review
3. Development of working hypotheses
4. Developing the aim and objectives of the study
5. Preparing the research design
6. Determining of simple design
7. Collecting the data
8. Execution of the project
9. Analysis of data
10. Hypotheses-testing
11. Generalizations and interpretation
12. Data presentation (writing a report or thesis and oral public presentation)

1. Formulating the research problem

- A problem clearly stated is a problem half solved!!!

1. Formulating the Research Problem

Is the first and more important step in the research process. There are many considerations in a research problem selection

- Interest –one should make a selection of a topic of great interest to sustain the required motivation
- Magnitude – it is extremely important to select a topic that can be managed within the time and disposal resources.
- Relevance – the future study have to add to the existing body of knowledge.
- Availability of data
- Ethical issues

1. Formulating the research problem

- There are two types of research problems:

1. those which relate to states of nature
2. those which relate to relationships between variables.

At the very outset the researcher must single out the problem he wants to study, he must decide the general area of interest or aspect of a subject-matter that he would like to inquire into.

The formulation of a general topic into a specific research problem, thus, constitutes the first step in a scientific enquiry.

Essentially two steps are involved in formulating the research problem:

1. understanding the problem thoroughly
2. rephrasing the same into meaningful terms from an analytical point of view

1. Types of research problems addressed

Exploratory questions – What is the case? What are the key factors?

Descriptive questions – How many events? What is the incidence, prevalence of events? Are x and y related?

Causal questions – Why? What are the causes?

Evaluative questions – What was the outcome?

Predictive questions – What will the effect of one variable?

Historical questions – What caused the event, etc.

2. Literature review

- Once the problem is formulated, a brief summary of it should be written down.
- It is compulsory for a research worker writing a thesis for a Ph.D. degree to write a synopsis of the topic and submit it to the necessary Committee or the Research Board for approval.
- At this juncture the researcher should undertake extensive literature survey connected with the problem.

2. Reviewing the literature

- This step is essential preliminary task in order to find out about available body of knowledge in your interest area.
- Reviewing literature can be time consuming, daunting and frustrating, but is also rewarding.

Its functions are:

1. Bring clarity and focus to your research problem
2. Improve the study methodology
3. Broaden investigator's knowledge
4. Contextualize investigator's findings

2.Literature review includes

1. Review concepts and theories
2. Review previous research finding

2. Literature review

- For this purpose, the abstracting and indexing journals and published or unpublished bibliographies are the first place to go to.
- Academic journals, conference proceedings, government reports, books etc., must be tapped depending on the nature of the problem.
- The earlier studies, if any, which are similar to the study in hand should be carefully studied.
- A good library will be a great help to the researcher at this stage!!!

2. Search for literature

- **To effectively search for literature in your field of interest it is imperative to have in mind at least some idea of broad subject field and of the investigate problem, in order to set parameters for your search.**

There are many on-line medical databases:

- Medline (OVID)-**http://gateway.ovid.com**
- Mdconsult- **http:// home.mdconsult.com**

HINARI **http:/www.who.int/hinari/usinghinari/en/index.html**

- PubMed- **http:/ / www.ncbi.nlm.gov./pubmed**

3. Development of working hypotheses

- After extensive literature analysis, researcher should state in clear terms the working hypothesis or hypotheses: Null/ Alternative
- Working hypothesis is tentative assumption made in order to draw out and test its logical or empirical consequences, they provide the focal point for research.
- They also affect the manner in which tests must be conducted in the analysis of data and indirectly the quality of data which is required for the analysis
- Hypothesis should be very specific and limited to the piece of research because it has to be tested.
- It also indicates the type of data required and the type of methods of data analysis to be used

3. Research questions and hypotheses

1. Descriptive – describes what currently exist
2. Relational – identify a relationship between variables
3. Causal – identify a causal inference

- An operational definition of a predicted answer to the research question
- Matches a concept with a measurement method as survey or scale
- Operationalizing your concepts makes your hypothesis testable

Research questions

Hypotheses

3. Approach for developing working hypotheses

- Discussions with colleagues and experts about the problem, its origin and the objectives in seeking a solution;
- Examination of data and records, if available, concerning the problem;
- Review of similar studies in the area or of the studies on similar problems;
- Exploratory personal investigation which involves original field interviews on a limited scale with interested parties and individuals with a view to secure greater insight into the practical aspects of the problem.

4. The formulation of the aim and objectives

- Aim is the goal that is set out to attain in the study being an overall statement of the study.
- The aim includes the keywords from the subject of research and has 2 parts:

1. What we want to study?
2. For what? – practical reason

- Objectives/ purposes are the required tasks to be fulfilled for aim's accomplishment.
- It is extremely important to formulate them clearly and specifically.

Four categories of Research purposes

1. Exploration
2. Description
3. Diagnosis
4. Experimentation.

Characteristics of objectives

SMART

- It must be concrete, SPECIFIC
- It must be MEASURABLE.
- It must be ACHIEVABLE.
- It must be RELATED with the aim and other objectives.
- It must have concrete horizon line of prognosis, TIME.

4. The formulation of the aim and objectives

- The objectives should be numerically listed. Each objective should contain only one aspect of the study. When formulating objectives it is preferably to use oriented words or verbs.

Therefore the objectives should start with words such as:

- To identify To determine To find out
- To ascertain To describe To compare
- To measure To analyze To evaluate
- To study To explane To explore…

5. Preparing the research design

- Research design is the conceptual structure within which research would be conducted.
- The function of research design is to provide for the collection of relevant information with minimal expenditure of effort, time and money.
- The preparation of research involves the consideration of the following steps:
  1. To determine type of study
  2. To establish source of information-determining sample design
  3. To elaborate tools for data collection
  4. To adopt study design

5. The preparation of the research design

Involves usually the consideration of the following:

- the means of obtaining the information;
- the availability and skills of the researcher and his staff (if any);
- explanation of the way in which selected means of obtaining information will be organized and the reasoning leading to the selection;
- the time available for research;
- the cost factor relating to research, the finance available for the purpose.

Differences between Research Methods and Research Methodology

- Research methods may be understood as all those methods/techniques that are used for conduction of research. Research methods or techniques, thus, refer to the methods the researchers use in performing research operations
- Research Methodology is a science of studying how research is done scientifically, which contains the various steps that are generally adopted by a researcher in studying his research problem, including identification and application of research methods and techniques

Groups of research methods

1. In the first group we include those methods which are concerned with the collection of data. These methods will be used where the data already available are not sufficient to arrive at the required solution;
2. The second group consists of those statistical techniques which are used for establishing relationships between the data and the unknowns;
3. The third group consists of those methods which are used to evaluate the accuracy of the results obtained.

General Methods of Investigation

- Historical
- Mathematical
- Statistical
- Epidemiological
- Sociological
- Psychological
- Experimental
- Economic etc.

Methods versus Techniques

- Analysis of historical records
- Analysis of documents

- Recording of notes, Content analysis, Tape and Film listening and analysis
- Statistical compilations and manipulations, reference and abstract guides, contents analysis.

Methods	Techniques

Methods versus Techniques

- Non-participant direct observation
- Participant observation
- Mass observation

- Observational, use of score cards, etc.
- Interactional recording, possible use of tape recorders, photo graphic techniques
- Recording mass behavior, interview using independent observers in public places.

Methods	Techniques

Methods versus Techniques

- Questionnaire
- Opinionnaire
- Personal interview

- Identification of background of respondents
- Use of attitude scales, projective techniques, use of sociometric scales
- Interviewer uses a detailed schedule with open and closed questions

Methods | **Techniques**

Methods versus Techniques

Methods	Techniques
Focused interview	Interviewer focuses attention upon a given experience and its effects
Group interview/Focus Group	Small groups of respondents are interviewed simultaneously
Telephone survey.	Used as a survey technique for information and for discerning opinion; may also be used as a follow up of questionnaire

Methods versus Techniques

- Case study and life history
- Small group study of random behavior, play and role analysis.

- Cross sectional collection of data for intensive analysis, longitudinal collection of data of intensive character
- Use of audio-visual recording devices, use of observers, etc.

Methods	Techniques

Method of collecting information

Direct observational method (objective examination, percussion, palpation, auscultation)

Extracting information from an official statistical forms (clinical observation sheet, ambulatory sheet etc.)

Investigational method (X-ray examination, level of hemoglobin and leucocytes etc.)

Monographs (books with scientific results of somebody research)

Census of population

The basic types of research

1. Basic, fundamental, pure why, what, and how – generate new knowledge, develop existing theories or generate new one

2. Applied – solve concrete, specific problem

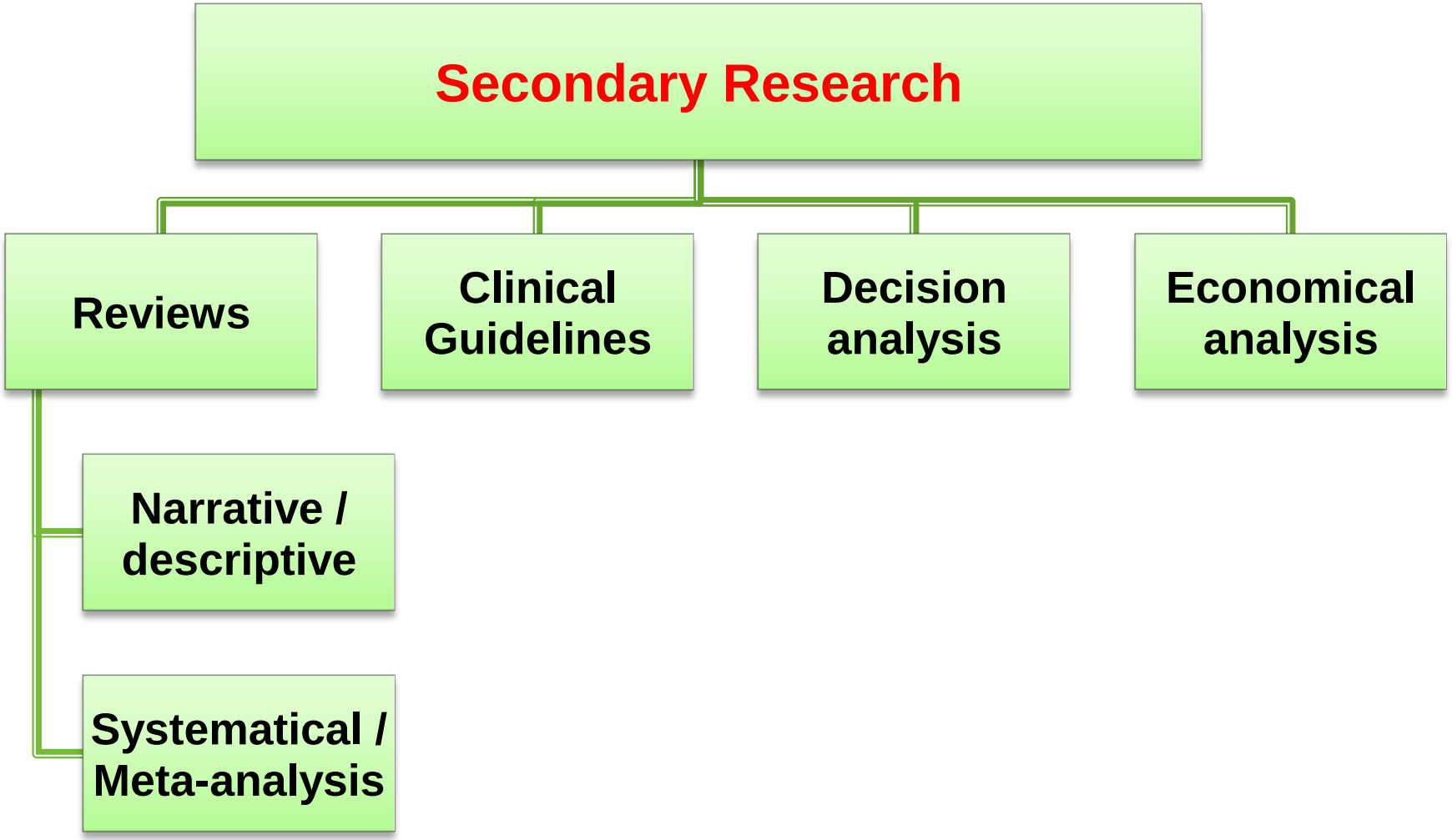
Applied research aims is finding a solution for an immediate problem facing a society or an organization

The basic types of research

- Conceptual – is that related to some abstract idea(s) or theory. It is generally used by philosophers and thinkers to develop new concepts or to reinterpret existing ones.
- Empirical – relies on experience or observation alone, often without due regard for system and theory. It is data-based research, coming up with conclusions which are capable of being verified by observation or experiment.

Types of research

1. Primary (quantitative or qualitative)- made by the researcher from a practical point of view
2. Secondary (quantitative or qualitative) – analyzing of the result of previous researches, published literature, as systematic reviews or meta-analyzing.


Secondary Research
Reviews
Clinical Guidelines
Decision analysis
Economical analysis
Narrative / descriptive
Systematical / Meta-analysis

The basic types of research

Qualitative – used to understand the nature or quality of phenomenon. The questions are: Who ? What? How? When? Why?

Quantitative – used to understand the magnitude of an occurrence or an association. the question is: How much?

Types of researches

1. Quantitative – collect data using questionnaire, survey – measured and quantify the data, use statistical analysis – deductive (logic)
2. Qualitative – collect data through observation, interview, focus group, surveys, word association tests, sentence completion tests, story completion tests – narrative description and field focused – inductive (empirical)

Qualitative / Quantitative

Criteria	Qualitative	Quantitative
Focus	Quality or meaning of experience	Quantity, frequency, magnitude
Philosophical roots	Constructivism, interpretivism	Positivism
Goals of investigation	Understand, describe, discover	Predict, control, confirm, test
Design characteristics	Flexible, evolving, emergent	Structured, predetermined
Data collection	Researcher as instrument	External instruments, tests, survey

Overview of Research Approaches

Qualitative	Quantitative
Understand and interpret human perspectives	Comparisons or correlations of population attributes
Less generalizable to populations	Generalization to population
Rich descriptions	Numerical summaries
Depth	Breadth
Small sample	Large sample
Selection of procedures to establish trust in the findings	Prescribed process to establish validity and reliability

Classification of research methods

- **Observational/ Non-experimental -** allow nature to take its course: the investigator measures but does not intervene (ex.exploratory, descriptive, historical)
- **Experimental / Interventional –** involve an active attempt to change a disease determinant – such as an exposure or a behaviour - or the progress of a disease through treatment, and are similar in design to experiments in other sciences.

Types of research

1. Fixed – design is fixed, measured quantitatively.

2. Flexible – more freedom in data collection, qualitative.

Types of research

- **Descriptive study** is limited to a description of the occurrence of a disease or other phenomenon . Generate hypothesis.
- **Analytical study** analyses relationships between health status and other variables. Test hypothesis.

2. Classification of study designs

I. Observational studies

A. Descriptive or case – series

B. Cross – sectional studies, surveys (prevalence)

C. Case-control studies (retrospective, analytical)

D. Cohort studies (prospective, retrospective, analytical)

E. Historical cohort studies (retrospective)

II. Experimental studies

A. Controlled trials

B. Studies with no controls

III. Systematical reviews. Meta - analyses

Classification of clinical trial

- **I. Controlled trials**

1. Parallel or concurrent controls

(a. randomized; b. not randomized)

2. Sequential controls (a. self-control; b. crossover)

3. External control

- **II. Studies with no controls**

Types of epidemiological study

Type of study	Alternative name	Unit of study
Observational studies		
Descriptive studies		
Analytical studies		
Ecological	Correlational	Populations
Cross-sectional	Prevalence	Individuals
Case-control	Case-reference	Individuals
Cohort	Follow-up	Individuals
Experimental studies	***Intervention studies***	
Randomized controlled trials	Clinical trials	Individuals
Cluster randomized controlled trials		Groups
Field trials		
Community trials	Community intervention studies	Healthy people Communities

6. Determining of simple design

- Researcher usually draws conclusions about large groups by taking a sample
- The researcher must decide the way of selecting a sample or what is popularly known as the sample design.
- A sample design is a definite plan determined before any data are actually collected for obtaining a sample from a given population.

6. Determining of simple design

- Designing the sample calls for three decisions:

1. Who will be surveyed? (The sample)
2. How many people will be surveyed? (Sample size)
3. How should the sample be chosen? (Sampling type)

6. Populations and Samples. The sampling.

- Population – statisticians term used to describe a large collection of items that have something in common. Almost having a meaning as a totality.

Ex.: population (as a demography term), patients, investigations, hospital discharges, etc.

- Sample–a segment of the population selected to represent the population as a whole.
- Sampling–the enquiry that utilizes special methods taking a sample.
- Study units (sampling units)– the individual elements in the population or sample of interest.

6. Types of sampling (the reminder of the notions)

- Deliberate sampling
- Simple random sampling
- Systematic sampling
- Stratified sampling
- Quota sampling
- Cluster sampling and area sampling
- Multi-stage sampling
- Sequential sampling

7. Collecting the data

- By observation
- Through personal interview
- Through telephone interviews
- By mailing of questionnaires
- Through schedules etc.

The researcher should select one of these and other methods of collecting the data taking into consideration the nature of investigation, objective and scope of the inquiry, financial resources, available time and the desired degree of accuracy.

8. Execution of the project

- Execution of the project is a very important step in the research process.
- If the execution of the project proceeds on correct lines, the data to be collected would be adequate and dependable.
- The researcher should see that the project is executed in a systematic manner and in time.
- If the survey is to be conducted by means of structured questionnaires, data can be readily machine-processed. In such a situation, questions as well as the possible answers may be coded.
- If the data are to be collected through interviewers, arrangements should be made for proper selection and training of the interviewers.

9. Analysis of data

The analysis of data requires a number of closely related operations such as:

- establishment of categories,
- grouping and sorting,
- coding,
- editing
- tabulation
- drawing statistical inferences.

Coding operation is done at this stage through which the categories of data are transformed into symbols that may be tabulated and counted.

Editing is the procedure that improves the quality of the data for coding.

Tabulation is a part of the technical procedure wherein the classified data are put in the form of tables.

9. Data analysis

- A great deal of data is tabulated by computers
- Programs such as: Microsoft Office Excel, Microsoft Office Access, Epi Info, SPSS, NCSS and PASS can be used
- Specific indicators are computed, depending on the type of study: descriptive, analytical, experimental, etc.

10. Hypoteses-testing

- After analyzing the data, the researcher is in a position to test the hypotheses.

- Various tests, such as Chi square test, t-test, F-test, ANOVA tests etc. have been developed by statisticians for the purpose.
- The hypotheses may be tested through the use of one or more of such tests, depending upon the nature and object of research inquiry.
- Hypothesis-testing will result in either accepting the null hypothesis or in rejecting it!!!

11. Generalizations and interpretation

- If a hypothesis is tested and upheld several times, it may be possible for the researcher to arrive at generalization, to build a theory.
- The real value of research lies in its ability to arrive at certain generalizations.
- If the researcher had no hypothesis to start with, he might seek to explain his findings on the basis of some theory. It is known as interpretation.
- The process of interpretation may quite often trigger off new questions which in turn may lead to further researches.

12. Data presentation

- Writing research report
- Oral presentation of medical research

The general structure of the research report/ PhD thesis, diploma thesis

- Title page;
- Contents;
- List of Abbreviations;
- Introduction;
- The content of the work as follows:
  - ▪ Chapter I. The bibliographic analysis of the theme;
  - ▪ Chapter II. Material and methods of research;
  - ▪ Chapter III – IV. Own results and discussions;
- General conclusions;
- Annexes (if required);
- Bibliography.

Oral presentation general design:

- · Title, authors (the first slide)
- · Introduction, importance (1-2 slides)
- · Aim and objectives (1-2 slides)
- · Material and Methods (1-2 slides)
- · Results- only most important (10 slides)
- · Discussions (1 slide)
- · Conclusions (1 slide)
- · Closing (1 slide)

Criteria of Good Research

1. The purpose of the research should be clearly defined and common concepts be used.
2. The research procedure used should be described in sufficient detail to permit another researcher to repeat the research for further advancement, keeping the continuity of what has already been attained.
3. The procedural design of the research should be carefully planned to yield results that are as objective as possible.
4. The researcher should report with complete frankness, flaws in procedural design and estimate their effects upon the findings.

Criteria of Good Research

5. The analysis of data should be sufficiently adequate to reveal its significance and the methods of analysis used should be appropriate. The validity and reliability of the data should be checked carefully.
6. Conclusions should be confined to those justified by the data of the research and limited to those for which the data provide an adequate basis.
7. Greater confidence in research is warranted if the researcher is experienced, has a good reputation in research and is a person of integrity.

- Thank you for your attention!!!