



IT ALL STARTS WITH A QUESTION!

Moazzam Ali MBBS, PhD, MPH

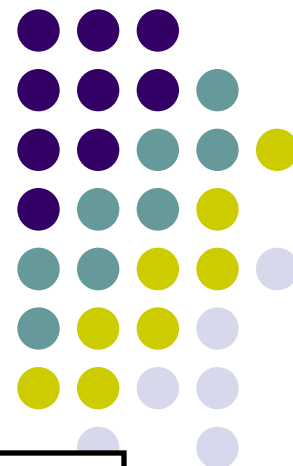
Department of Reproductive Health and Research

World Health Organization

Geneva, Switzerland

Training course in research methodology,
research protocol development and
scientific writing

September 2025





Learning objectives

At the end of this lecture you will be able to understand the concepts of;

- Ideas for research questions
- Research question
- Variables
- Hypothesis
- Aims, objectives and;
- Research process



What is research...

- *"... an attempt to increase the sum of what is known, usually referred to as 'a body of knowledge', by the discovery of new facts or relationships through a process of systematic inquiry, the research process".*

(Macleod Clark and Hockey 1989 cited by Cormack 1991 p4)

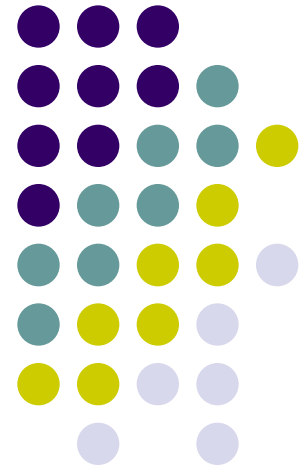
Information overload



- No one can know everything. Thus, the important thing is to be able to find and evaluate the information you need.



Research idea

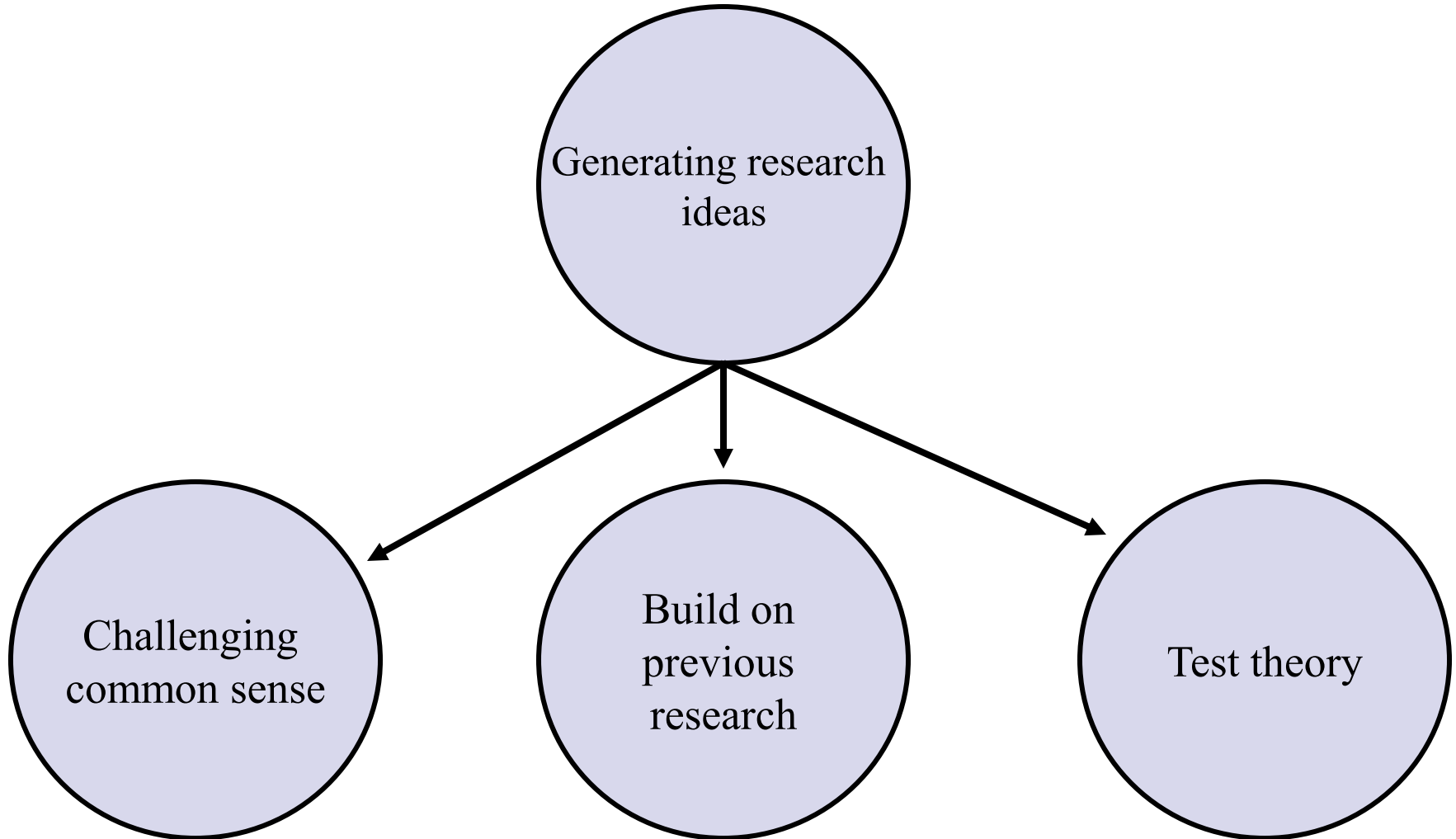


"How do I get a research idea?"

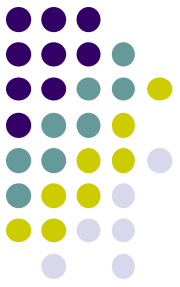


- *Let's see how we can work towards it...*

There are three basic ways of getting ideas:



1. Generating ideas from common sense



- Question everything, including old sayings:
 - True?
 - When is it **not** true?
 - Why is it true?
- Attack practical problems

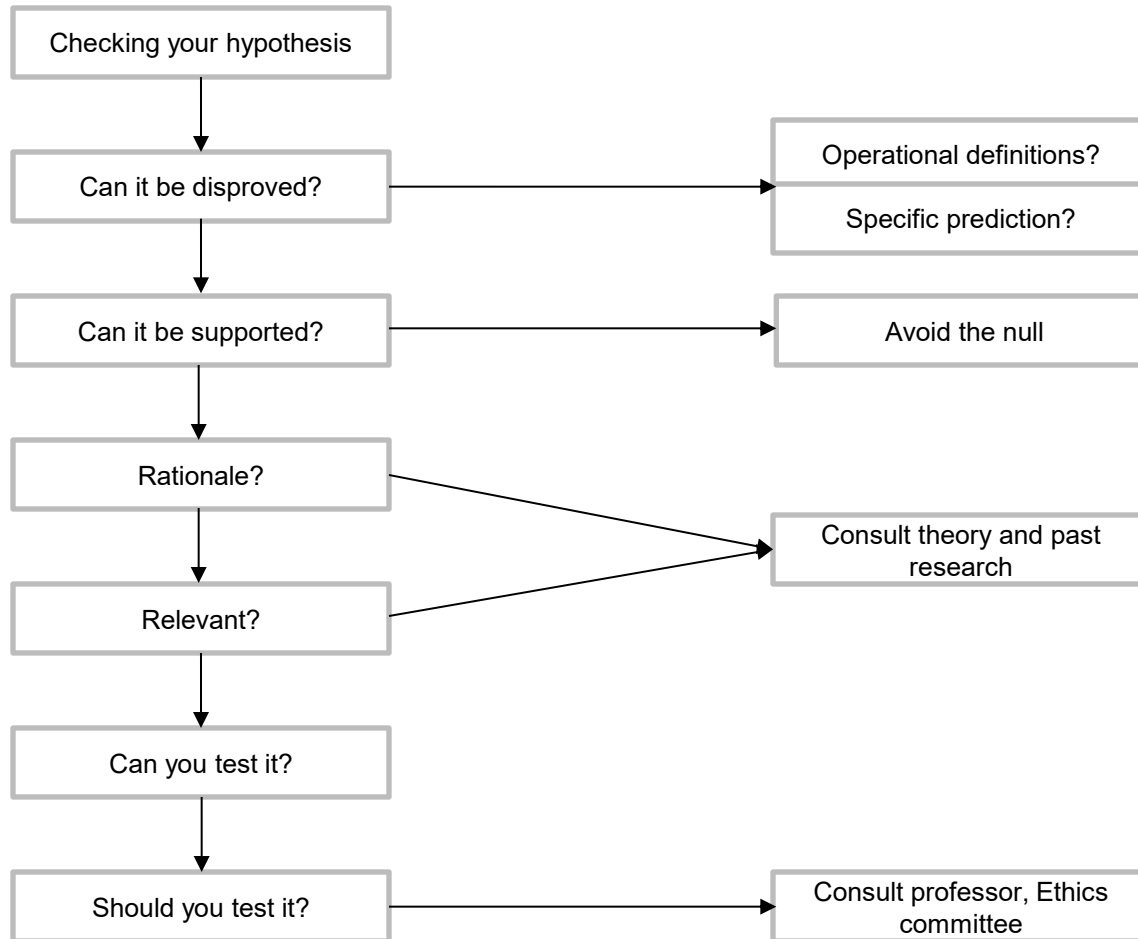
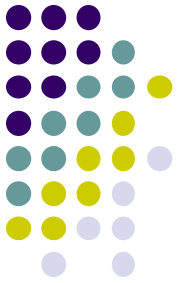
- Questions to ask about a phenomenon:
 - Who/When/Why/How
 - What are its effects (short-term, long-term, good, bad)?

2. How to Get Research Ideas from Previous Research



- Repeat studies
 - Do a study suggested by a journal article's author(s)
 - Improve the study's external validity
 - Improve the study's internal validity
- Look for practical implications of the research
 - Try to reconcile studies that produce conflicting results

3. Testing theory

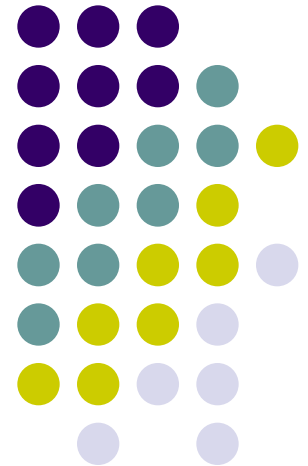


Criteria for Prioritizing Problems for Research:



- Relevance
- Avoidance of Duplication
- Feasibility
- Political Acceptability
- Applicability
- Urgency of Data Needed
- Ethical Acceptability

Research Question





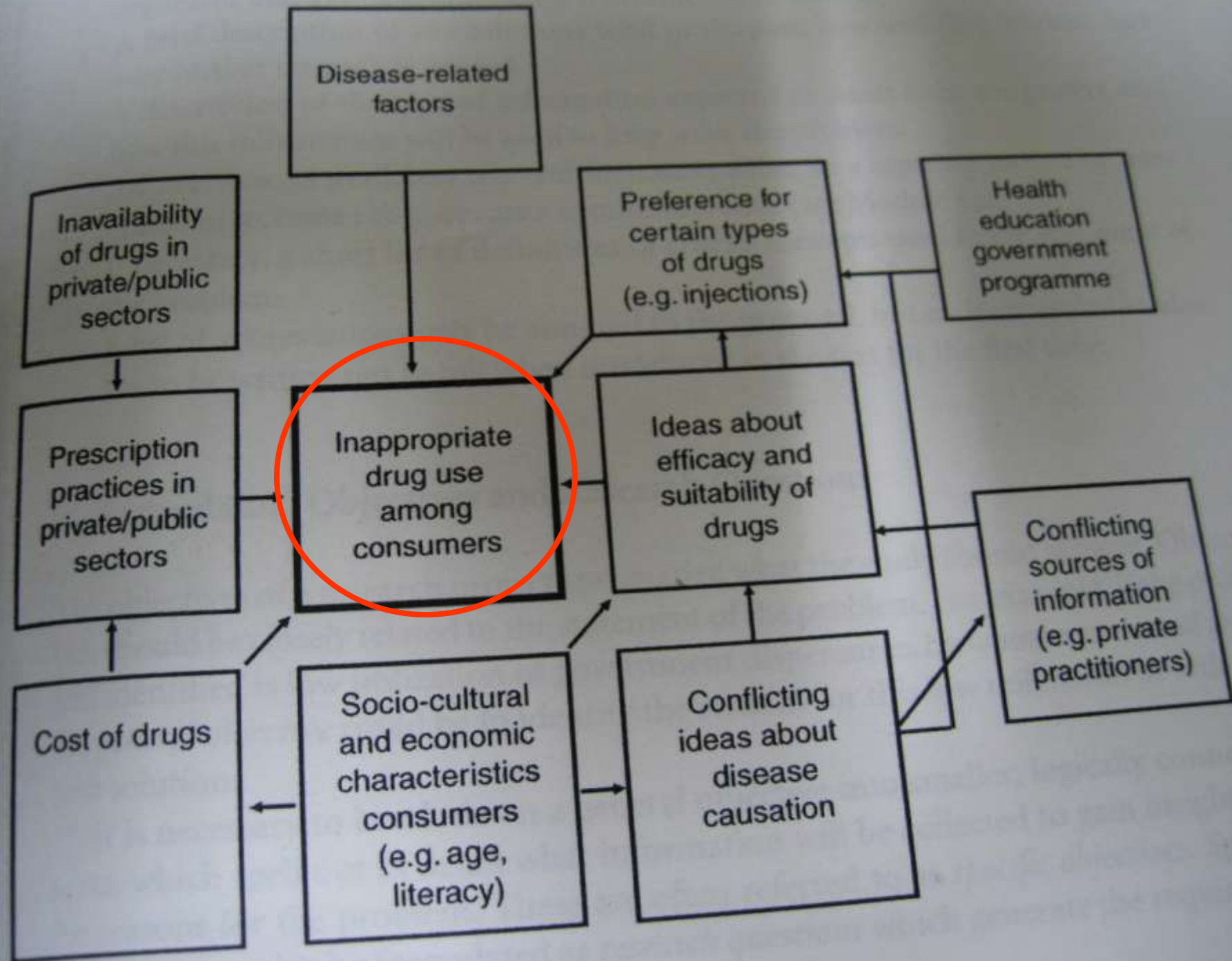
The research question

- What do you want to do
- Should be in line with main objectives of the study
- Must be general
- Must be answerable
- Should be limited in scope
- And it needs to be realistic



The research question

- Remember that a problem exists when there is discrepancy between, 'what is there' and 'what should be'.
- Therefore, the perceived problems should be worded in such a way as to illustrate this discrepancy.





Types of research question

- In research, the problem is phrased in a research question. Research questions may be
 - a) *Interrogative*, or
 - b) *declarative*.
- a) **Interrogative questions** identify a gap in knowledge, e.g.,
"What is the relationship between health promotion and change in health behavior?"
- b) **Declarative questions** define the purpose of the study by declaring the intention to investigate a particular event, phenomenon or situation e.g., *"The purpose of this research is to investigate the relationship between health promotion and change in health behavior."*

A research question...



1. *If it is in a question form, we call it a research question: e.g., "What is the relationship between motivation to teach and satisfaction level as a first-year teacher?"*
2. *If it is in a declarative sentence form, we call it a problem statement: e.g., "This study is to determine the relationship between motivation to teach and satisfaction level as a first-year teacher."*



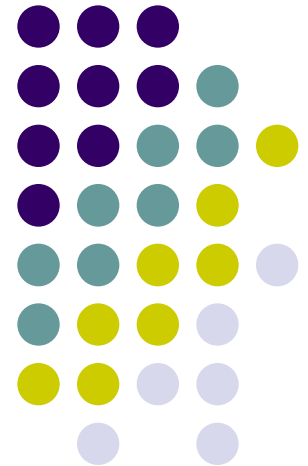
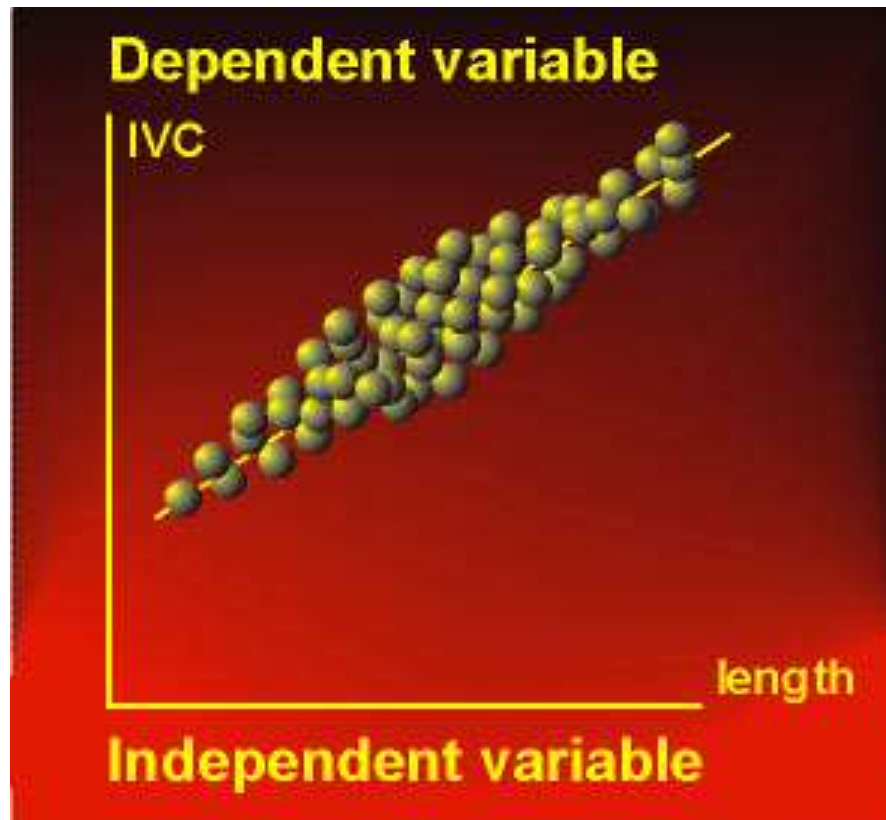
A good research question

- "Good" research questions are free from value judgments and bias in order to achieve "scientific objectivity".
- Research questions enable the progression of the study to be planned and efficient, focusing thoughts and efforts.

What makes a research question "good":

- Short
- Sharp
- Specific
- Clear statement or implication that a relationship exists between variables
- Variables capable of observation and / or measurement

Variables





Why We Need Data

- To provide input to survey/study
- To measure performance of service
- To evaluate conformance to standards
- To assist in formulating alternative courses of action
- To satisfy curiosity



What is a "Variable?"

- Variable is a characteristic of a person, object or phenomenon which can take on different values.
- These may be in the form of numbers (e.g., age) or non-numerical (e.g., sex).
 - Age (in months or years)
 - Weight (in kilograms or in pounds)
 - Sex (Male/Female)
 - Education (Literate/Illiterate)
- **To sum up, variable is a characteristic that is being measured in a research.**



Types: Categorical & Numerical variables

Categorical

- Outcome of disease:
 - Recovery
 - Chronic Illness
 - Death
- Main type of staple food eaten
 - Maize
 - Rice
 - Millet
 - Wheat
- Color of eyes
 - Black
 - Blue
 - Green

Numerical

- Age (in months or years)
- Weight (in kilograms or in pounds)
- Home-clinic distance (in kilometers or minute walking distance)
- Monthly income (expressed in dollars, yen, etc.)
- Number of children (1,2, etc.)



Factors rephrased as variables

Factors	Variables
Long waiting time	Waiting time
Absence of drugs	Drug availability
Maternal education	Years of schooling
Infant mortality	Infant deaths during last 12 months
Immunization coverage	No. of children fully immunized
Hypercholesterolemia	Serum cholesterol level
Lack of supervision	Frequency of supervisory visits



Dependent & Independent variables

- The variable that is used to describe or measure the problem under study is called the **DEPENDENT** variable.
- The variables that are used to describe or measure the factors that are assumed to cause or at least to influence the problem are called **INDEPENDENT** variables.

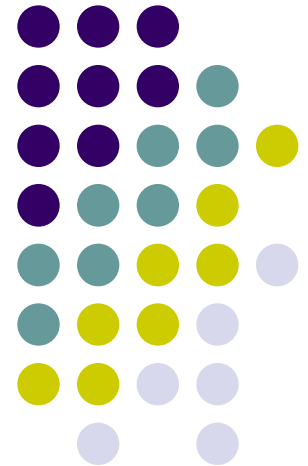


Example:

- In a study of the relationship between knowledge of family planning methods and utilization of contraceptives, ‘utilization of contraceptives’ (with values ‘yes’ and ‘no’) would be the dependent variable and ‘awareness of family planning methods’ the independent variable.

Hypothesis

A hypothesis is a statement that can be tested.





Types of Hypotheses

Research hypothesis

- **your true interest or true hypothesis**

Null Hypothesis

- **opposite of your research hypothesis**



Types of Hypothesis: Null

Null hypotheses (H_0):

- Null Hypothesis states that there is no difference between outcome variables from each group, or no association between predictor and outcome variables.
 - *E.g., Health promotion activity has no significant effect on health behavior.*



Types of Hypothesis: Alternative

- Alternative hypothesis (H_a): the proposition that there is a difference or association
- Goal is to perform the study to discredit the null hypothesis

Example of a problem statement and its related hypothesis:



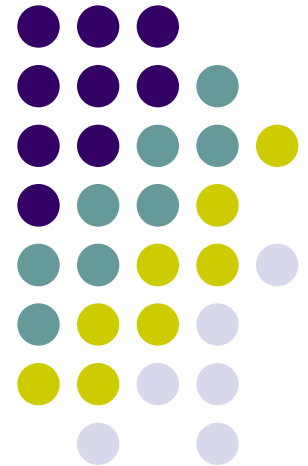
Problem Statement:

This study is to determine the effects of a peer-assisted method of teaching reading, as compared to the traditional method, in terms of reading comprehension.

Hypothesis:

Students taught by the peer-assisted method of teaching reading will score significantly higher on a reading comprehension test than students taught by the traditional method.

Aims & Objectives





Aim

- Aims are long term, or ultimate, intent of a service.

For example;

- Universal health coverage
- Improving maternal health in a country
- Decreasing infectious diseases among infants

Aim



Examples:

- Aim 1: To identify families at high risk of...
- Aim 2: To assess anxiety and stress among patient diagnosed with...
- Aim 3: To determine the association between risk of X and Y
- Aim 4: To improve the maternal and child health in ...



Objectives

- Objectives are tasks which have to be accomplished before aim may be realized.
- Objectives are the milestones through which we can reach an Aim.



Why to develop objectives

- ***Focus*** the study (narrowing it down to essentials)
- ***Avoid*** the collection of data which are not strictly necessary for understanding and solving the problem you have identified
- ***Organize*** the study in clearly defined parts or phases

Objectives are “*SMART*”



- Simple
- Measurable
- Achievable
- Realistic
- Time bound



How to state your objectives

- Logical sequence
- Clearly phrased
- Realistic
- Action verbs (to determine, to compare, to verify, to calculate, to describe and, to establish etc.)



Example of putting aim and objectives

Aim

The aim of the study is to reduce infant mortality in district A.

Study Objectives

1. Estimate the infant mortality rate in district A during the year 2021;
2. Identify the five most common causes of infant mortality in the district A by age.

Sub-objectives for Objective 1 (*Sometimes*)

- 1a. Estimate the number of infant deaths during 2021 in the study sample
- 1b. Estimate the number of live births in the study sample during 2021

Sub-objectives for Objective 2 (*Sometimes*)

- 2a. Identify the number of infant death in the study sample during 2021;
- 2b. Determine the age of infant deaths;
- 2c. Determine the five most common causes of infant deaths.

Purpose

The purpose of the study is to identify the magnitude of the problem of infant mortality, determine the important causes of infant deaths and make recommendations for reducing these.



Statistical Methods

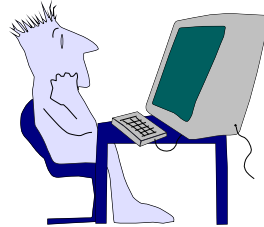
- Descriptive statistics
 - Collecting and describing data
- Inferential statistics
 - Drawing conclusions and/or making decisions concerning a population based only on sample data



Descriptive Statistics

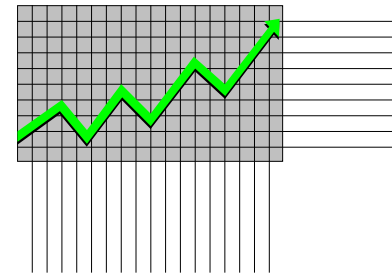
- Collect data

- e.g. Survey



- Present data

- e.g. Tables and graphs



- Characterize data

- e.g. Sample mean =
$$\frac{\sum X_i}{n}$$

Inferential Statistics



- Estimation
 - e.g.: Estimate the population mean weight using the sample mean weight
- Hypothesis testing
 - e.g.: Test the claim that the population mean weight is



Drawing conclusions and/or making decisions concerning a population based on sample results.

Data Sources



**Primary
Data Collection**

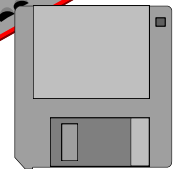
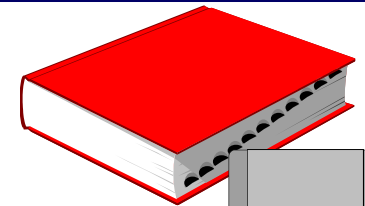
**Secondary
Data Compilation**

Observation

Survey

Experimentation

Print or Electronic





Resources for information

Levels of Information	Possible Sources
Local Level (Community, District etc.)	<ul style="list-style-type: none">▶ Clinic and hospital records;▶ Information from key informants;▶ Local surveys, annual reports;▶ Statistical reports produced at district level.
Provincial and National	<ul style="list-style-type: none">▶ Articles from journals, books identified during literature searches; at national public health libraries;▶ WHO, UNICEF, WB etc. libraries in country offices▶ Reports from MoH, Central Statistical Offices, NGOs▶ Computerized literature searches for national literature
International	<ul style="list-style-type: none">▶ Search through Index Medicus, Medline▶ Computerized literature searches (e.g. Popline)▶ Reports of Bilateral and Multilateral Organizations



Research process

Note that different authors identify different stages in the research process for example Parahoo and Reid (1988) refer to the following phases.

- Selection and formulation of a research problem
- Stating aims and objectives
- Design of the study and choice of methods
- Funding
- Ethical considerations
- Construction of instruments (tool development)
- Pilot study
- Data collection
- Analysis
- Report writing/ Presentation of findings
- Publication/ dissemination of information