



# ABC of Research

*Towards an informed society*

## Phase Two — Research Design

In the second issue of ABC of Research we covered the first phase of the research process related research question formulation. Much of what needs to be decided on in the second phase depends on the objectives of the study that have been declared at the end of the first phase.

During the second phase which is concerned with research design researchers

**PHASES OF RESEARCH**

- 1 Research question
- 2 Research design
- 3 Implementation
- 4 Analysis
- 5 Dissemination

must decide on what data to collect (research variables), what approach will they use (study type), what tools or instruments will they use, how will they use them, and how will the results be analyzed. The completion of this phase is established by the production of the research protocol.

This phase is expected to be covered over several issues of the newsletter.

**ABC of RESEARCH**

AIMS AT

*creating an awareness of issues related to research*

*providing a core of knowledge that is practice-based.*

*encouraging communication between researchers*

## Research Variables

### Introduction

The analysis of the research problem and the factors that might influence it usually performed in phase one of the research process directs the researcher to the data (variables) that needs to be available at the end of the study for analysis in order to answer the research question presented.

### Definition

A variable is a characteristic of a living subject, object, phenomenon which can take different values. These

may be in the form of numbers (age, weight, height, etc) or non-numerical characteristics (sex, nationality, occupation, color, etc).

### Classification of Variables

Values that are expressed in numbers are known as numerical variables (age: 18, 19, 20) while variables that are not expressed in numbers (color: red, blue, green) are better known as categorical variables.

**Numerical variables** can be further classified into con-

tinuous or discrete variables. **Continuous** variables can be measured in infinite accuracy depending on the tools available (height: 1.5m, 1.54m, 1.1543m, weight, etc). **Discrete** variables can only have full numerical values (no. of fingers: 10, no. of animals: 225, etc).

**Categorical variables** can be further classified into ordinal or nominal variables. **Ordinal** variables although non-numerical can be ordered or ranked into

different groups (income: high, medium, low; disease severity: mild, moderate, severe). **Nominal** variables cannot be ordered or ranked into different groups (blood group: A, B, AB, O; food: starch, protein, fat).

### Operational Definition

To ensure that everyone (researcher, assistants, data analyst, readers) understands exactly what has been measured and to ensure consistency of meas-

*(Continued on page 2)*

Variable	Operational definition	Measurement scale
Age	Age at time of entry into study	Continuous: in months
Marital status	As stated by study participant	Nominal: single, married, divorced
No. of children	As shown by birth certificates	Discrete

## Research Ethics...

Researchers have a duty towards the scientific community to be honest and transparent during all phases of the research process. Researchers also have a responsibility towards the wider community to select important topics and not to waste research funds on irrelevant topics.

Researchers have an ethical responsibility to stick to reputable scientific methods. Starting from suitable topic selection and formulation of research questions that are verified through proper literature reviews. Ending by proper study designs, adequate sample size, and established methods of experimentation.

Researchers have an obligation not to influence the conduct of the study in any manner. Researchers have to ensure that the research environment they are controlling does not bias the results towards a specific outcome. Researchers should do their utmost to ensure the validity of their studies both internal and external. In other words, to make sure that the study is measuring what it is supposed to measure and that the measurements present the real truth in life.

Researchers should not pressurize their fellow statisticians to manipulate the outcome data, otherwise known as data dredging, in search for any statistical significant relations that are not related to the study objectives or do not have any scientific verification for them.

Lastly, researchers have to publish their study results whether negative or positive. Researchers have to make sure that their results are known by their colleagues all over the world through publication in visible journals so they are spared from repeating them and are given the chance to build on their findings towards new research.

## Research Variables

Variable	Indicator	Measurement scale
Activity	Hours spent outside residence	Nominal: not active (0-2hrs), active (>2hrs)
Knowledge	Answering a set of questions	Ordinal: poor (0-3 correct), average (4-6 correct), good (7-10 correct)
Satisfaction	Self rating using a 1-10 score	Continuous

*(Continued from page 1)*

Measurements during the conduct of the study each variable has to be clearly defined including its measurement scale as shown in the table on page 1.

### Variable Indicators

Some variables cannot be directly measured such as the degree of physical activity, level of knowledge, customer or patient satisfaction, etc. These variables require the development of indicators so they can be measured or determined. In doing so, researchers use comparisons or create novel methods of measurements as shown in the above table.

### Variable Dependency

Researchers usually look for relations between variables and in that context variables can be classified into **dependent** and **independent** variables. The outcome variable that is under investigation is considered the dependent variable, while the factors that can affect the outcome variable are known as the independent variables. In the relation between smoking and cancer; cancer is the dependent (outcome) variable and smoking is the independent variable (factor). It has to be mentioned that the same variable can be an independent variable in one study and a dependent variable in another study. In the relation between smoking and friends; smoking is the dependent (outcome) variable and friends is the independent variable (factor).

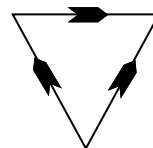
### Confounding Variables

There are variables that can affect the relation between dependent and independent variables. These variables are known as confounding variables and can either strengthen or weaken this relation. In the example of smoking and cancer; the smokers education level or culture could affect the strength of that causal relation.

### Background Variables

In all studies especially those involving human or animal subjects a group of variables that are characteristic of the subjects such as age, sex, education level, religion, income, animal strain, etc are known as background variables. Background variables are well known to have a confounding effect, however, only those related to the study should be collected.

**Cause / predictor**  
**Independent variable**  
Smoking



**Effect / outcome**  
**Dependent variable**  
Lung cancer

**Other factors**  
**Confounding variable**  
Culture