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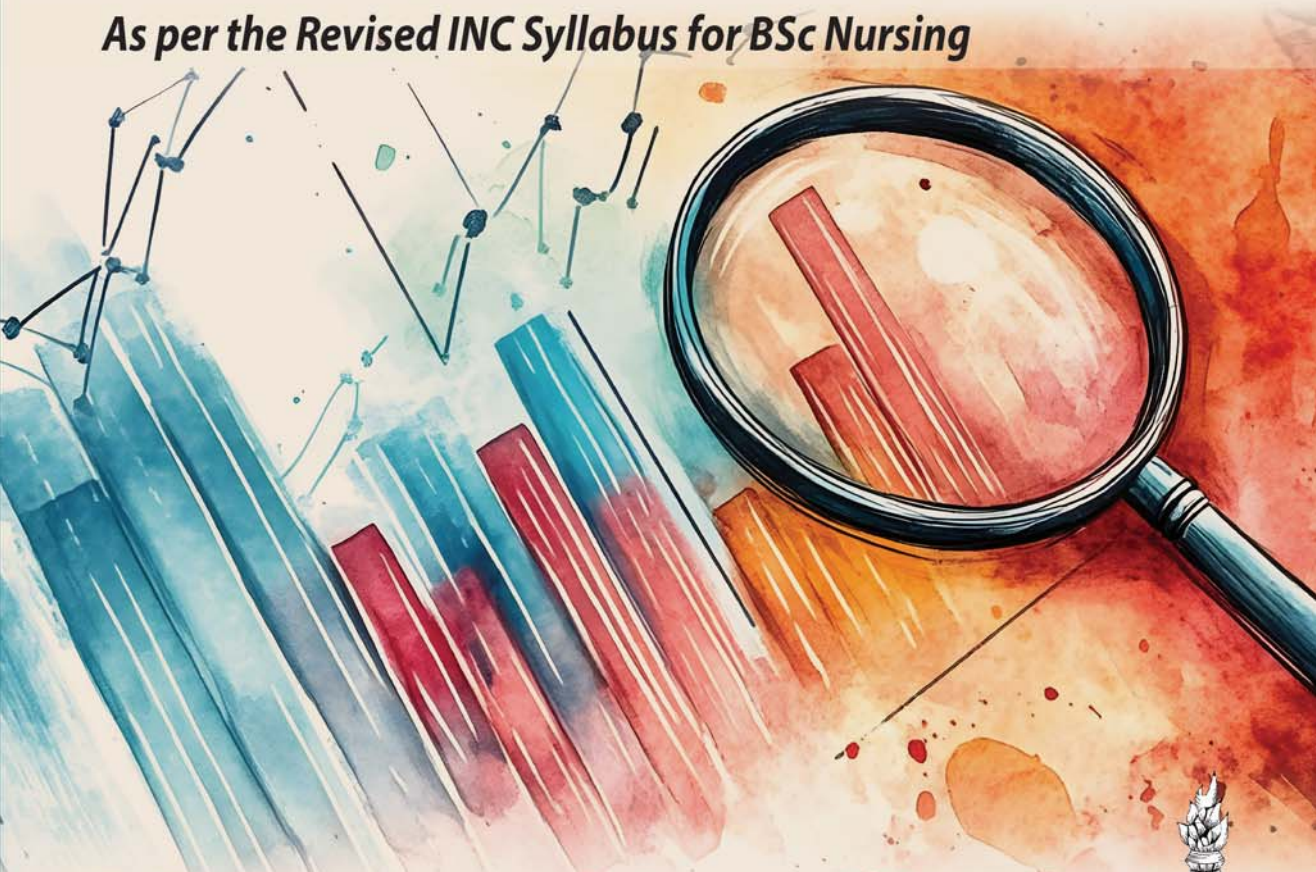
Fundamentals of
NURSING RESEARCH AND STATISTICS

As per the Revised INC Syllabus for BSc Nursing



R Sreevani

Semester VII

JAYPEE

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CHAPTER

4 Research Approaches and Designs



Chapter Outline

- **Research design:** Meaning, purposes, selection and types
- **Nonexperimental designs:** Reasons for undertaking and types
- **Types of nonexperimental designs:** Descriptive or explorative designs, correlational designs, cross, sectional designs, longitudinal designs, retrospective designs, prospective designs
- **Elements of experimental research**
- **Types of true experimental designs:** Post-test only control group design, pretest-post-test control group design, Solomon four-group design, crossover design, factorial design, randomized block design, randomized controlled trials
- **Types of quasi-experimental designs:** Nonequivalent control group pretest post-test design, after-only nonequivalent control group design, one group pretest post-test design, time-series design
- **Qualitative research designs:** Types—ethnography, phenomenological design, grounded theory approach and case study
- **Mixed method designs**
- **Historical research**
- **Methodological studies**
- **Secondary analysis**
- **Meta-analysis**

A research approach or method is a general framework guiding the research study that includes broad assumptions, methods of data collection, analysis, and interpretation. It depends upon the nature of the research problem being investigated. There are three basic methodologies or approaches used in any research, viz. qualitative, quantitative, or mixed methods.

Research design is a specific outline detailing how chosen method or approach will be applied to answer a particular research question. It is a framework used for the planning, implementation and analysis of the research study intended to connect the conceptual research problem to the achievable empirical research.

MEANING AND DEFINITION

Research design is a blueprint or master plan specifying the methods and procedures for conducting a research study involving the description of research setting of the study, sample size, sampling technique, tools and methods of data collection, and analysis to answer specific research questions or test the research hypothesis.

On the whole, a research design is a plan to investigate a research problem covering description of all methods and materials that have a bearing on the quality of evidence the study yields.

Research design is "a plan that describes how, when, and where data are to be collected and analyzed". **—Parahoo, 1997**

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PURPOSE OF A RESEARCH DESIGN

The main purpose of a research design is that it:

- Allows smooth implementation of various research processes, making research efficient with minimal outlay of resources.
- Guides the researcher in planning and implementing the study in a way to answering the research question.
- Helps the researcher to arrange the ideas in a systematic way so as to get a glimpse of flaws and inadequacies.
- Specifies the controlling mechanisms that will be used in the research study. The control provided by the design increases the probability that the study results are accurate reflection of reality.
- Provides a set of instructions to the researcher regarding study setting, sample size and techniques, time period, selection of variables, tools and methods of data collection, data analysis, and style of research report preparation.
- Research design has a great bearing on the reliability of the results arrived and constitutes a firm foundation for the entire structure of the research work. Preparation of research design should be done with great care as any error in it may upset the entire research process.

SELECTION OF RESEARCH DESIGN

A number of considerations influence the selection of research design. The researcher should select the most appropriate design to meet the objectives of the study. Selection of research design is influenced by several factors. Some of them are listed in **Figure 4.1**.

Current Knowledge of the Research Problem

- The choice of a research approach depends to a great extent on the nature of the research problem that has been identified. Quantitative approaches are appropriate when the purpose of the study is to find out the effect of an intervention (evaluating the effect of spiritual intervention on depression among cancer patients), test the relationship between the variables (correlation between well-being and spirituality among cancer patients), or describe a phenomenon with precision (determining the incidence of depression among fourth stage cancer patients).
- Qualitative approaches are appropriate when the purpose of the study is to understand the meaning of a phenomenon about which little is known (understanding the spiritual needs of end-stage cancer patients).

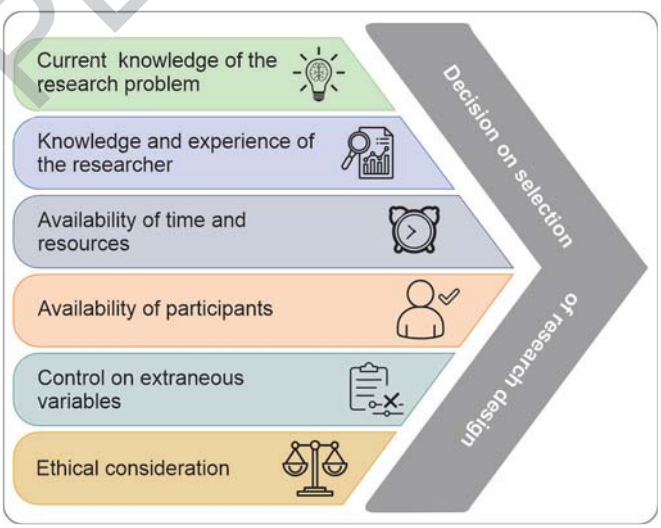

Figure 4.1: Factors influencing the selection of research design

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- A mixed method is appropriate when a combination of meaning and control is needed. This method is followed when a qualitative approach is used to design an instrument (development of spiritual needs assessment tool using qualitative interviews) and an intervention that is subsequently tested for effectiveness using quantitative methods (assessment tool is used to measure the spiritual needs of cancer patients).

Knowledge and Experience of the Researcher

- Researchers' knowledge and experience play a key role in the selection of research approach. A researcher with scientific knowledge, skill in scientific writing, familiarity with statistical packages, and quantitative journals would most likely select a quantitative design.
- On the other hand, a researcher efficient in conducting interviews, making close observations, and writing narrative descriptions prefers the qualitative approach.
- If the researcher is efficient in both qualitative and quantitative methods, he would prefer the mixed methods research.

Availability of Time and Resources

- Resources like equipment, facilities, and support from colleagues are important for conducting research. Availability of resources for a research study affects the selection of research design.
- Time is also an important factor in the selection of research design. For example, longitudinal studies require more time than cross-sectional studies do.

Availability of Participants

The selection of research design may be influenced by number and availability of study subjects. If only few subjects are available with specific characteristics, a qualitative research approach may be selected. On the other hand, if a large sample is available, the researcher can select quantitative research.

Control on Extraneous Variables

- An efficient design can maximize true results, decrease error, and control extraneous variables that may affect outcome. To get accurate results, the researcher should maximize control.
- The selection of research design is either true experimental or quasi-experimental based on the possibility of control over the extraneous variables. If control over the extraneous variables is possible, true experimental designs can be chosen. However, if the researcher is unable to control the selected extraneous variables, quasi-experimental designs can be selected.

Ethical Considerations

- These include respect for participants, informed consent, and protection from harm.
- The consideration of ethics may affect the selection between an experimental design and a nonexperimental design.

TYPES OF RESEARCH DESIGNS

Different types of research designs cater to different types of questions or hypothesis. They are often classified as quantitative or qualitative or mixed designs. Various types of research designs are presented in **Flowchart 4.1**.

Types of Quantitative Research Designs

- Quantitative research is designed to collect numerical data which can be transformed into usable statistics for answering research question or hypothesis.
- Quantitative research designs are well structured and specify the research methodology in detail which includes sample characteristics and selection, setting, nature of intervention, tools to measure the variables, methods used to control extraneous variables, time and type of data collection, methods used for data collection, and information to be shared with the participants.

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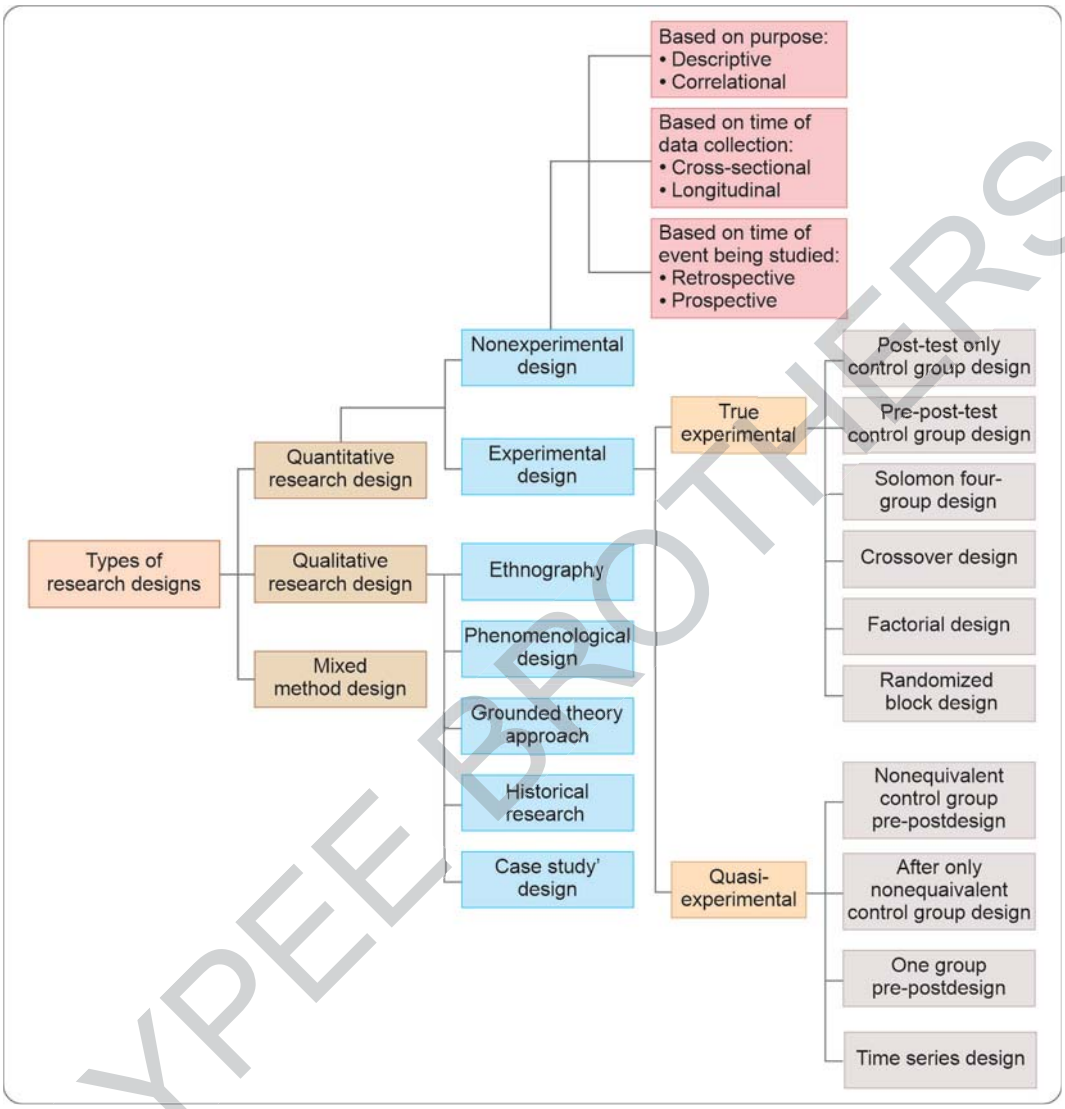
Flowchart 4.1: Types of research designs



- A variety of research designs are used in nursing research, which are categorized differently by individual authors. According to Dickoff and James (1968), the four most commonly used types are:
  1. Descriptive
  2. Correlational
  3. Quasi-experimental
  4. Experimental research designs

While descriptive and correlational designs are referred to as nonexperimental designs, quasi-experimental, and true experimental research designs are referred to as experimental designs. **Flowchart 4.2** helps in the selection process of research design.

Nonexperimental Designs

- Nonexperimental designs focus on examining variables as they naturally occur in the environment and not on the implementation of a treatment by the researcher.
- Nonexperimental designs describe, differentiate, or examine associations among the variables.

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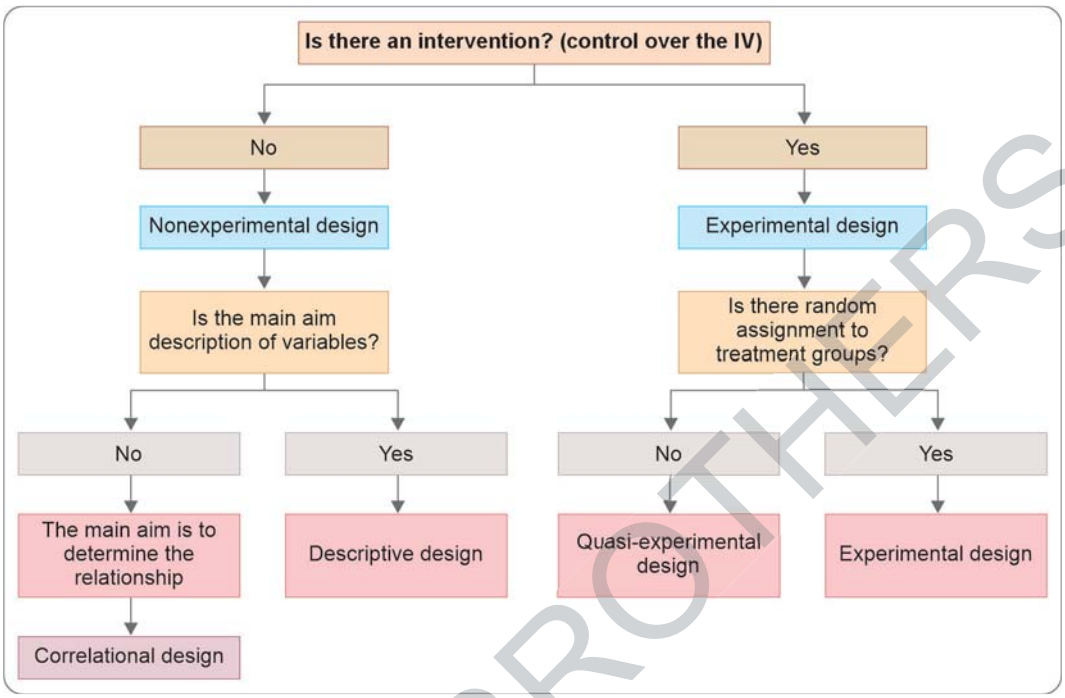
Flowchart 4.2: Schematic diagram depicting the selection process in research design



- These designs do not use control groups or manipulation of independent variable or random assignment of sample to the groups as they only employ observation.
- This type of research is also a rich source of data that helps the researcher to formulate questions for use in experimental or quasi-experimental designs.

Reasons for undertaking nonexperimental designs

- In many instances some variables are not amenable to experimental manipulation or randomization (height or gender).
- In some instances no control over the independent variables is possible as they have already occurred.
- At times there are practical constraints or ethical considerations to manipulate variables.
- As the phenomena exists in a natural setting, the researcher in order to get a realistic understanding of it deliberately chooses not to manipulate the variables.

Types of Nonexperimental Designs

The three basic categories of nonexperimental designs are presented in **Flowchart 4.3**.

Classification Based on Purpose of the Study

Based on the purpose of study, non-experimental designs can be classified into either descriptive or correlational.

1. Descriptive or Explorative Designs

The main aim of descriptive research is the accurate depiction of individual characteristics, events, or groups and the frequency of occurrence of phenomena using statistics to describe and summarize the data (Polit and Hungler, 2013).

The purpose of descriptive research is the exploration and description of phenomenon in real life situations. It describes what actually exists, determines the frequency of occurrence, and categorizes the information. Instruments used to obtain data in descriptive studies

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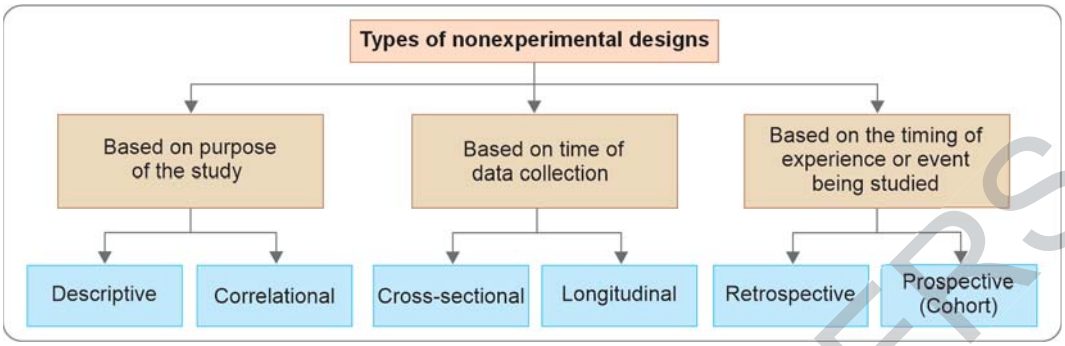
Flowchart 4.3: Types of nonexperimental designs



include questionnaires, interviews (closed questions), and observations (checklists, etc.). Sample subjects who represent the population at large are chosen. No attempt is made to explain or predict what the situation in future might be or how it might change. In a descriptive design, bias can be controlled through:

- Conceptual and operational definitions of variables
- Sample selection and size
- Use of valid and reliable instruments
- Following appropriate procedure in data collection

Purposes

- These designs are used to develop theories, identify problems and trends in illness
- Explore new areas of research
- Describe situations as they exist in the world
- Provide knowledge base for other types of quantitative research methods

Thus, descriptive studies can provide valuable evidence regarding disease prevalence, nature, and intensity. In nursing, the only way to understand the beliefs and values of different individuals and groups is by describing them. This descriptive knowledge helps in developing nursing interventions that benefit individuals, families, or groups so as to obtain desirable and predictable outcomes.

Advantages

- More flexible and broad in scope
- Can focus on range of topics and also applicable to any population
- Great deal of information can be obtained from a larger population
- Its methodology can be explicitly stated making it easier to evaluate and replicate

Disadvantages

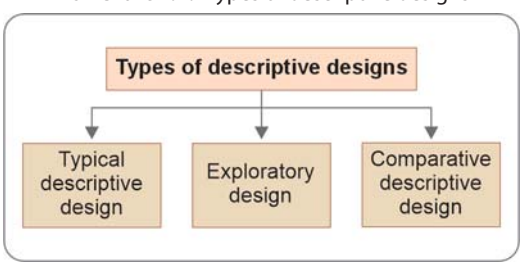
- Collected information is superficial. The breadth rather than depth of information is emphasized.
- Large-scale studies are time consuming and costly.

Types of descriptive designs

Descriptive designs can be classified into typical descriptive, exploratory, and comparative descriptive designs **(Flowchart 4.4)**.

a. **Typical descriptive design:** This design is used to examine variables in a single sample, which includes identifying the variables, measuring the variables, and describing them. Schematic presentation of typical descriptive design is presented in **Figure 4.2**. *Example:* A study to assess the pain experiences among patients with rheumatoid arthritis. In this study, the researcher describes the intensity and frequency of pain among patients.

Flowchart 4.4: Types of descriptive designs



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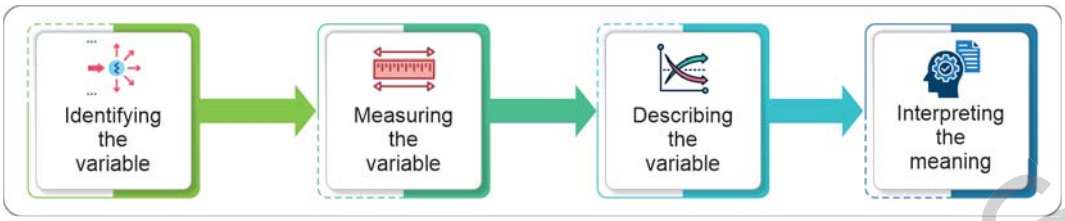

Figure 4.2: Schematic presentation of typical descriptive designs

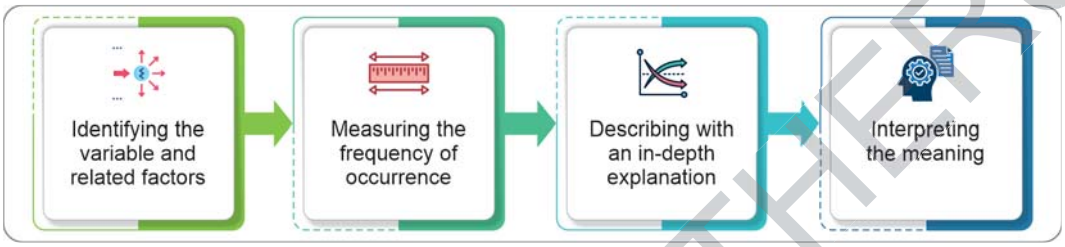

Figure 4.3: Schematic presentation of exploratory design

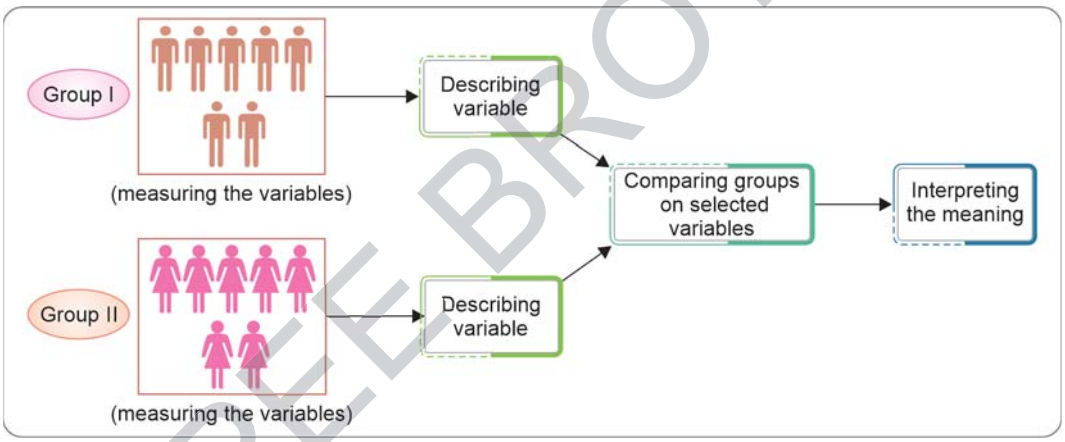

Figure 4.4: Schematic presentation of comparative descriptive design

b. **Exploratory design:** This design is used to explore related factors of the existing phenomenon in order to enhance the understanding of the less understood phenomena. This includes identifying the variables and related factors, measuring frequency of occurrence and describing them with an in-depth explanation. Schematic presentation of exploratory design is presented in **Figure 4.3.**
Example: An explorative study to assess various factors associated with pain and coping measures among patients with rheumatoid arthritis. In this study, the researcher may describe various factors associated with pain and related coping mechanisms, measure those factors and provide an in-depth explanation.

c. **Comparative descriptive design:** In this design, two or more groups are compared on the basis of selected variables. This includes measuring the differences in variables occurring naturally between the two or more groups and comparing them on selected variables. Schematic presentation of comparative descriptive design is presented in **Figure 4.4**.
Example: A comparative study on pain symptoms among male and female patients suffering with rheumatoid arthritis.

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2. Correlational Designs

Correlational research assesses the inter-relationships among study variables without any active intervention by the researcher (Polit and Hungler, 2013).

A correlational research design investigates relationships between variables without the researcher controlling or manipulating any of them. These are usually cross-sectional **(Figure 4.5).**

Purposes

- These designs study whether changes in one or more variables are related to changes in another variable (covariance).
- A correlation reflects the strength and/or direction of the relationship between two (or more) variables.
- Correlations assess direction and degree (magnitude and strength) of the relationships, or associations among variables.
- The direction of a correlation can either be positive or negative.
- Hypotheses are generated from correlational study results which are tested by quasi-experimental and true experimental studies.

Advantages

- It is an efficient means for collecting large amount of data about a problem and discover a large number of inter-relationships in a relatively short period of time.
- Correlational research usually takes place in a natural setting and is thus better suited to solve practical problems in everyday life.
- It is relatively uncomplicated to plan and implement.
- The researcher has the flexibility in exploring the relationships among variables.

They demonstrate strength and direction of a relationship between the variables thereby helping the researcher to narrow down on the findings and determine cause-and-effect relationship by conducting experimental studies.

Disadvantages

- As these studies lack randomization and control between the variables, they are susceptible to faulty interpretation of relationships.
- As correlation research only uncovers a relationship and cannot manipulate variables of interest, causality cannot be established, i.e., it cannot provide a conclusive reason for why there is a relationship.
- It only demonstrates the relationship between the variables but does not explain which variable is the cause and which the effect. For example, a study demonstrated that education and wealth are highly correlated. However, the study does not explain whether having more wealth leads to higher education or higher education leads to more wealth. Though the reasons for either can be assumed, causation cannot be determined until experimental research is done.

Example: Ahuja (2014) conducted "a correlational analysis of physical, mental, emotional, spiritual, social, and self-

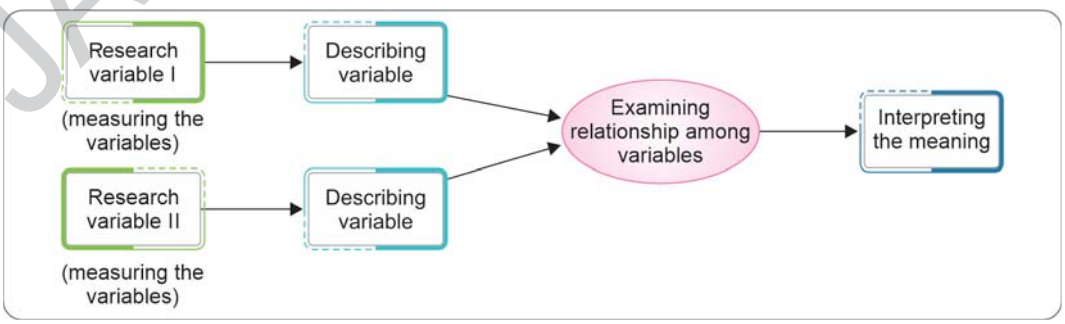

Figure 4.5: Schematic presentation of correlational design

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consciousness among students pursuing teacher education program". This study is a nonexperimental descriptive correlational study that looks at the relationship among different dimensions of consciousness, viz. physical, mental, social, spiritual, and self. Participants were 135 college students pursuing BEd course at Agra.

Classification Based on Time of Data Collection

Nonexperimental designs can be classified as either cross-sectional or longitudinal based on time of data collection.

1. *Cross-Sectional Design (Data Collected at One Point in Time)*

Cross-sectional studies involve observing a single phenomenon across multiple populations at a single point in time without any follow-up for determining the relationship between variables **(Figure 4.6)**. This design is an observational one, meaning the researcher records information about the subjects without manipulating the study environment. This design is appropriate for describing the characteristics or status of a disease in a population and also relationships among risk factors and conditions at a time point.

Retrospective studies are typically cross-sectional wherein exposure and outcome are measured at the same time point, i.e., data on dependent and independent variables are collected simultaneously. In nursing, cross-sectional designs are used to understand the association between variables pertaining to individuals and their health status.

Example: In a study to assess the cholesterol level among daily walkers and nondaily walkers, the cholesterol level is assessed among two age groups and genders at one time between daily walkers and nondaily walkers. The study compared the cholesterol levels of daily and nondaily walkers among two age groups, i.e., over 40 and under 40, both in male and female categories at a given time point.

This cross-sectional study allows the researcher to compare the educational level, income and diet patterns in relation to walking and cholesterol level without any additional cost. However, it may not offer specific information about cause-and-effect relationships as such studies offer information at one single time point and do not consider what happened before or after the said time point. Therefore, the researcher is not sure if the daily walkers had low cholesterol before the walking routine or daily walking helped them to reduce the previously high cholesterol level. The outcome in a cross-sectional study needs to be replicated using a longitudinal design to validate these differences and assure they are truly activity related.

Advantages

- Suitable for describing the phenomenon at a fixed time point
- Less time consuming, inexpensive, and easy to conduct
- Large amounts of data can be collected at a single time point; the results are readily available
- Allows researchers to compare many different variables at the same time
- Confounding variables like maturation (long periods of experimental research may lead to certain biological or psychological changes in subjects with passage of time rather than effect of treatment) resulting from the elapsed time is not present
- Ethical, as it involves minimum risk to subjects

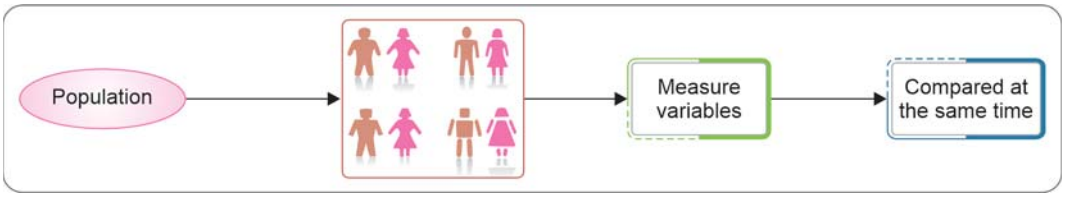

Figure 4.6: Schematic presentation of cross-sectional design

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- There is no loss of subjects due to study attrition

Disadvantages

- Cause-and-effect relationship cannot be established
- As different individuals are involved, the personal characteristics may differ
- Cannot study the dynamics of the phenomenon over time

2. *Longitudinal Designs (Data Collected at Multiples Time Points)*

In a longitudinal design, researcher records numerous observations of the same subjects over a period of time, which at times may last for many years, i.e., the data is collected at multiple time points over an extended period. Therefore, these studies are also termed as repeated measures or cohort studies. These designs study the changes in the phenomenon over time and describe the chronology of phenomenon for establishing causality. Collection of data at multiple time points strengthens causal inferences. In longitudinal studies, the nature of the study and available resources decide the number of data collection points and the time intervals between them. When the changes in the phenomenon are rapid, frequent data collection points with relatively short intervals may be required to understand the trend. These studies usually focus on nonclinical population. These designs are also used for follow-up studies of a clinical population to assess the subsequent status of people with a specified condition or who received a specific intervention **(Figure 4.7)**.

Examples

- A study to assess the effect of daily walking on cholesterol level among men and women included 40-year-old daily walkers and nondaily walkers. The study assessed the initial cholesterol level and followed up for 20 years to find out the daily walking effect on cholesterol level.
- A longitudinal study to assess the cognitive development among Down syndrome infants. In this study, infants with Down syndrome were assessed for cognitive development and later followed up for 18 years to assess the subsequent cognitive development.
- A longitudinal study to assess the incidence of cardiovascular diseases among individuals. In this study, diabetics and nondiabetics were followed up for 5 years and the results compared to know the incidence of cardiovascular disorders.
- A longitudinal study to assess the effect of holistic relapse prevention intervention among individuals with alcohol dependence. In this study, the subjects received holistic relapse prevention and were followed up for 1 year to know the relapse status.

Advantages

- As same subjects are followed throughout the study, personal factors are the same
- Can study dynamics of phenomenon over time

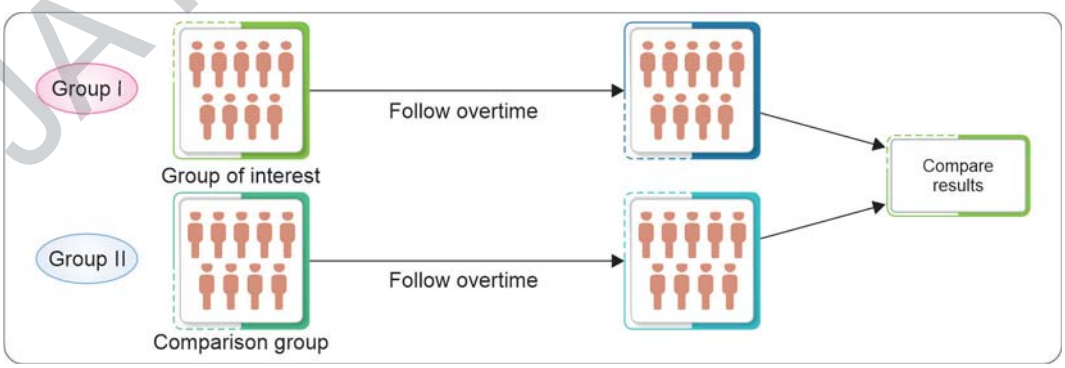

Figure 4.7: Schematic presentation of longitudinal study

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- Can document a causal factor and preceded outcome, hence strengthening hypothesis about causality

Disadvantages

- As research takes years to complete, the probability of subject dropout (attrition) is high
- The effect of testing may influence the result
- Expensive

Classification Based on Timing of Event being Studied

Nonexperimental designs can be classified as either retrospective or prospective based on timing of the experience or the event being studied. These are also called cohort studies. In epidemiology, the term "cohort" is used to define a set of people followed for a certain period of time.

1. *Retrospective Designs*

Retrospective (Ex post facto—is from after the fact) means the study has been conducted subsequent to the dependent variable being affected by the independent variable and the researcher attempts to link the present events with the past events. The researcher collects the data on an outcome occurring in the present and then linking it retrospectively to previous circumstances **(Figure 4.8)**. Retrospective studies are typically cross-sectional, i.e., data about both present outcomes and past events are collected at a single time point.

Example: A retrospective correlational study was conducted among alcoholic liver cirrhosis patients to find out alcohol consumption pattern. In this study, dependent variable cirrhosis of liver had already occurred. Here, the researcher collects the alcohol consumption pattern and links it to the present diagnosis.

Features

- The study proceeds backwards from effect to cause
- Both exposure and outcome have occurred before the start of the study
- It uses the control or comparison group to approve or disapprove the inference

Advantages

- Less time consuming, inexpensive, and easy to conduct
- No risk for subjects
- Several etiological factors can be studied at the same time
- Ethical, as it involves minimum risk to subjects
- Can cover extended past periods without losing subjects in less time
- Can investigate rare conditions
- Risk factors can be identified
- Prevention and control programs can be established

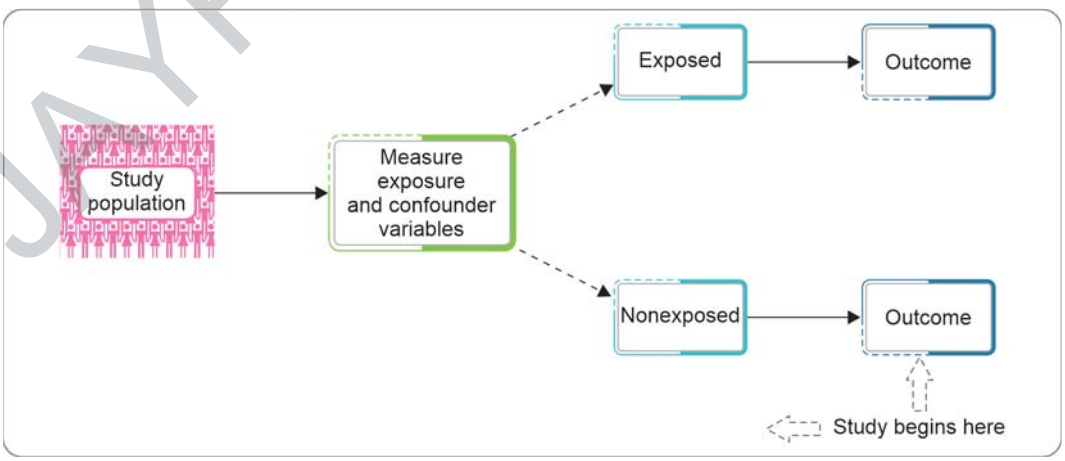

Figure 4.8: Schematic presentation of a retrospective study

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Disadvantages

- Study depends on the respondent's memory and knowledge
- Validation of collected information is difficult
- Selection of control group is difficult
- Cause-and-effect relationship cannot be established
- Not suitable for evaluation of intervention

2. *Prospective Designs*

This study begins with identification of presumed cause (alcohol consumption) and goes further in time to observe the presumed effects (cirrhosis of liver). Prospective studies are those in which data are collected about events as they occur moving forward in time. The researcher initially collects the data about presumed cause (independent variable) and subsequently the effect on outcome is measured (occurrence of dependent variable) **(Figure 4.9)**.

Examples of nonexperimental prospective study

- A researcher wanting to assess the incidence of rubella during pregnancy and related malformations in the offspring. In this study, the researcher would begin with a sample of pregnant woman who have been infected with rubella disease during their pregnancy while others have not. Then, the subjects are subsequently followed up for the occurrence of congenital anomalies in their newborns.
- A researcher wanting to test the hypothesis that the incidence of smoking is related to lung cancer. In this study, the researcher would begin with subjects who have been smoking while others have not. Then, the smokers and nonsmokers are subsequently followed-up for the occurrence of lung cancer.

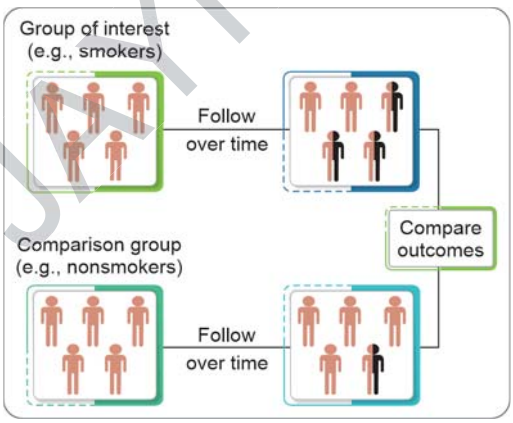

Figure 4.9: Schematic presentation of prospective design

Advantage

Collects specific exposure data.

Disadvantages

- Time consuming and expensive
- Repeated testing and changing environment threaten the study results
- Inefficient for investigating diseases with long latency periods
- Drop out of the subjects due to long follow-up period

EXPERIMENTAL RESEARCH

Experimental research is an objective, systematic, and controlled investigation carried out to predict and control phenomena wherein the researcher manipulates and controls one or more variables while observing the effect of manipulation on other variables.

Elements of Experimental Research

Experimental research designs deal with investigation of the effect of independent variable on the dependent variable where the independent variable is manipulated through intervention or treatment and the effect of these interventions (independent variable) is observed on the dependent variable.

This design is powerful for testing hypothesis of casual relationship among variables, i.e., to find out the exact relationship between cause-and-effect in a most efficient way. To examine the cause, the researcher must eliminate all the factors influencing the dependent variable other than the independent variable being studied (minimizing the effect of extraneous variables). Experimental design provides

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greatest amount of control with the least error possible. Following are the elements of experimental research:

- Random assignment of subjects to groups
- Precisely defined independent variable
- Manipulation of independent variable
- Having a comparison group
- Clearly identified sampling criteria
- Carefully measured dependent variables
- Controlled environment for conducting study

The experimental designs are classified into true experimental and quasi-experimental designs.

TRUE EXPERIMENTAL DESIGNS

True experimental designs investigate the cause-and-effect relationship between independent (predictor) and dependent (outcome) variables under controlled conditions. In these designs, researchers have control over the extraneous variable, which allows them to confidently predict that the observed effect on the dependent variable is only due to the manipulation of the independent variable. Some of the symbols regularly used in research studies are:

- R—Random assignment of the subjects to groups
- O—Observation or measurement of dependent variable
- X—Experimental treatment or intervention.

Essential characteristics of true experimental design: Characteristics of true experimental design are presented in **Figure 4.10**.

- **Manipulation:** It means administering the treatment or intervention to some participants and withholding it from others (by administering alternative treatment or no treatment). Here, the researcher intentionally controls the independent variable and observes its effect on the dependent variable.
  - *Example:* A study evaluated the effectiveness of gentle back massage on improving quality of sleep among depressive patients. Receiving gentle back massage is the independent variable in this example. This could be manipulated by giving back massage to some patients and withholding it for others. Later patient's quality of sleep (dependent variable) is compared among the two groups to infer whether differences in receiving the intervention resulted in differences in quality of sleep.
- **Randomization:** Randomization means introduction of chance into the selection or assignment of subjects to treatments. Randomization can occur at two levels: random selection and random assignment. Random selection refers to the process of drawing the sample from a population for study by way of chance. It can be simply put as "each subject in the population has an equal chance of selection". In other words, it refers to the random assignment of subjects to different groups or treatment conditions. Here "every subject has an equal chance of being assigned to any of the experimental or control groups". Random assignment is sufficient for a study to be

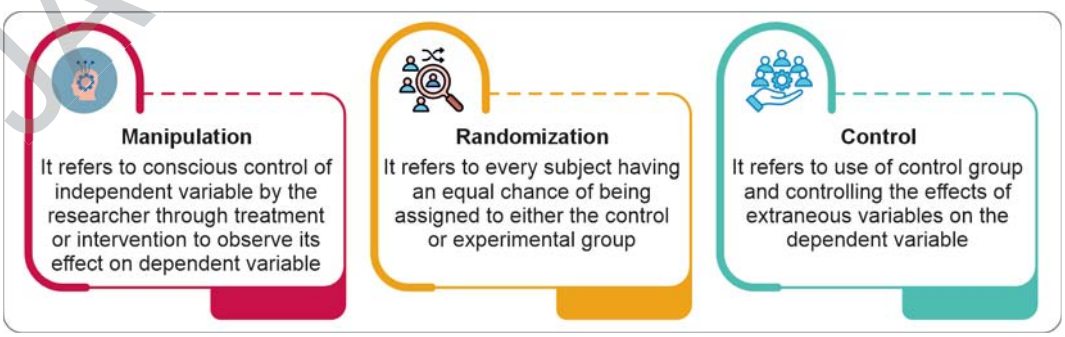

Figure 4.10: Characteristics of true experimental design

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referred to as experimental. Through this random assignment systematic bias is eliminated. *Example*: In the above example, if 60 depressive patients are selected among 100 available depressive patients by using lottery method or random number table, it denotes random selection. Now, if the selected 60 depressive patients are randomly assigned to experimental and control groups by using random number tables or computerized random number generators, it denotes random assignment.

- **Control:** Control means use of control group and controlling the effects of extraneous variables on the dependent variable.
  - The control group refers to a group of subjects or conditions that match as closely as possible with an experimental group, but is not exposed to any experimental treatment. The subjects in both control and experimental groups are similar in characteristics. While the experimental group receives planned treatment or intervention, the control group receives no experimental treatment or may receive another intervention/routine intervention. Later, comparison is made between control and experimental groups to observe the effect of this treatment or intervention.
  - *Example*: In the above example, experimental group subjects receive gentle back massage while the control group subjects do not. Later, quality of sleep is compared between the groups.
  - The effects of extraneous variables on dependent variable can be controlled by manipulation, randomization, use of strict protocols, blinding, and matching.
    - Strict protocol refers to identical management of treatment group subjects with respect to administration of intervention, which can be achieved by a well-designed protocol.
    - Blinding refers to the concealment of group allocation from study participants, i.e., being unaware of which group, control or experimental they are in.
      - In single-blind experiments, it is only the study participants who are kept unaware of their status as members of the control or experimental groups. For example, in a study to investigate the effect of a new drug, the researcher administers new drug to experimental group participants and placebo (sugar pill) to the control group participants. In this study, the subjects are unaware of whether they are receiving the new drug or the placebo.
      - In double-blind experiment, both the investigator (individual implementing the intervention) and the participants are unaware of which participant is allotted to the experimental group, i.e., who is receiving the real treatment. This is done to improve the reliability and validity of the experiment. For example, to investigate the effect of a new drug, both the researcher and the study participants are unaware of who is receiving the new drug and who is receiving a placebo.
    - Matching is a technique wherein the subjects are matched based on a particular variable and then put into groups. The researcher matches every subject in one group with an equivalent in another group thus creating equivalent groups for the study. It reduces the bias by controlling the confounding variables.
      - *Example*: In a study to evaluate the effectiveness of daily exercise on reducing cardiovascular disorders, the researcher matches the subjects based on their age, gender, and smoking habits.

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TYPES OF COMMONLY USED TRUE EXPERIMENTAL DESIGNS

The six types of commonly used true experimental designs are depicted in **Figure 4.11**.

1. Post-test Only Control Group Design (After Only Design)

In this design, dependent variable is measured only once after the experimental treatment has been administered.

Steps

1. Subjects are randomly assigned (R) to either of the control or experimental groups.
2. The subjects are not pretested.
3. Experimental group subjects receive the experimental treatment or intervention (X). The control group receives the routine treatment or no treatment.
4. Post-test observations (O) are carried out on both the groups to assess the effect of manipulation **(Figure 4.12)**.

Example: A study to evaluate the effectiveness of antenatal exercises on labor outcome among antenatal mothers.

Advantages

- This design is helpful in situations where pretest is not feasible for the subjects. In the above example, the antenatal mothers are assigned to experimental and control groups. Experimental group antenatal mothers are given exercise program and labor outcome is compared between the two groups. In this study, labor outcome



Figure 4.11: Types of true experimental designs

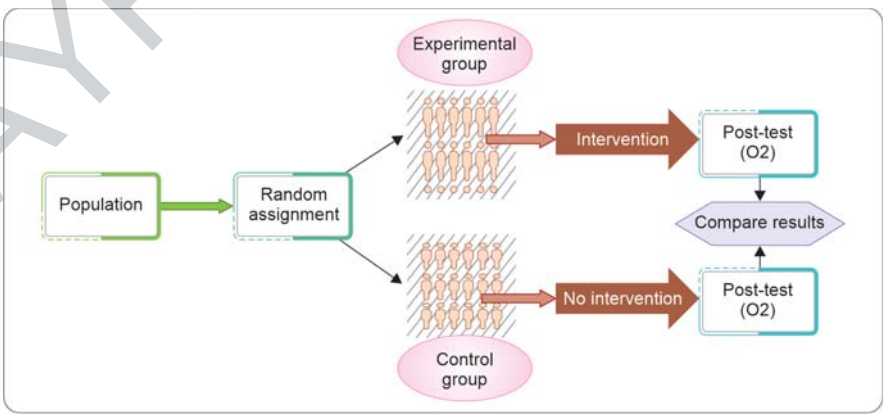

Figure 4.12: Schematic presentation of post-test only control group design

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is the dependent variable that cannot be assessed at antenatal period.

In another study "To assess the effects of immediate versus delayed pushing by women in the second stage of labor on fetal well-being", the fetal well-being is the dependent and outcome variable of interest, which cannot be assessed before labor.

- The post-test comparison between subjects, controls for the main effects of history, maturation, and pretesting. It is because without a pretest, the interaction effect of pretesting cannot be observed.

Disadvantage

Though random assignment should ensure equality of groups, in the absence of pretest, the researchers are not definite whether the groups are similar.

2. Pretest-Post-test Control Group Design

This is a classic experimental design wherein the dependent variable is measured at two points in time, i.e., before and after the experimental intervention.

Steps

1. Subjects are randomly assigned (R) to either a control or an experimental group.
2. The subjects in both the groups are pretested (O1).
3. Experimental group subjects receive the experimental treatment or intervention (X). The control group receives the routine treatment or no treatment.
4. Both the groups are post tested (O2).

Researchers often use this design to assess change from the pretest to the post-test as a result of a treatment or intervention **(Figure 4.13)**.

Example: The efficacy of body-mind-spirit intervention on well-being and quality of life among depressive patients.

Advantages

- The main advantage is the randomization. Through randomization it can be assured that both the groups are equal in all the characteristics and any change in the post-test could be the result of the treatment or intervention.
- This design controls for all threats to internal validity.

Disadvantage

The external validity or generalizability of the study is limited by the possible effect of pretesting.

3. Solomon Four-Group Design

This design has four groups—two experimental and two controls. While one experimental and

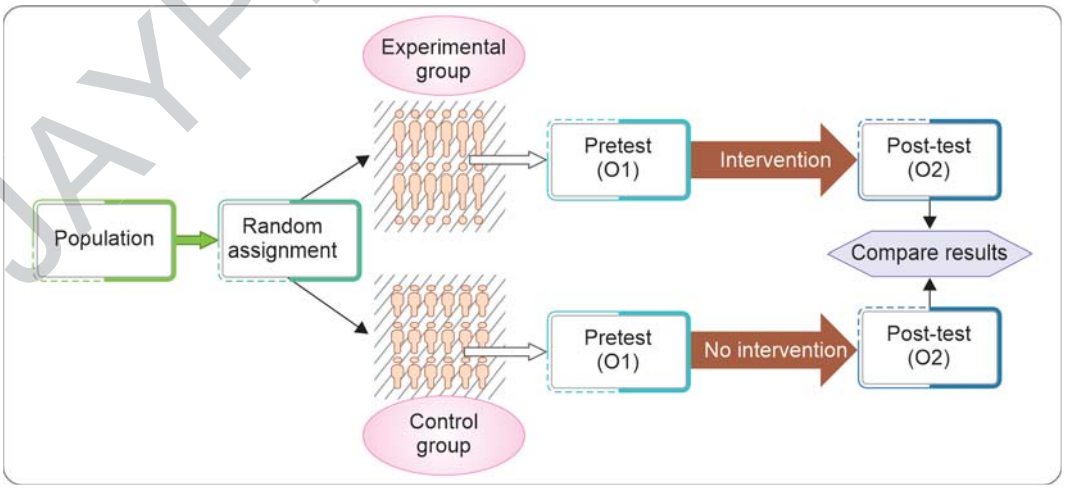

Figure 4.13: Schematic presentation of pretest-post-test control group design

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one control group are administered pretest, the other two groups are not. Post-test is conducted for all the groups.

Steps

1. Subjects are randomly assigned (R) to one of the four different groups.
2. The subjects in experimental group one and control group one are pretested (O1).
3. Two experimental group subjects receive experimental treatment or intervention (X). The two control group subjects receive routine treatment or no treatment.
4. All the groups are post-tested (O2) **(Figure 4.14)**.

In studies where pre and post assessments are done, the pretest measure has the potential to distort the post-test results. The change in post-test measures may not solely be due to treatment but also by the exposure to the pretest. To avoid reactive effects of the pretest, this design has two experimental and control groups. One experimental and control group each is administered pretest while other two groups are not. This allows the effects of the pretest measure and intervention to be segregated.

Example: Nursing students completed a questionnaire measuring their knowledge scores on drug calculation as a pretest. Later, the students might look up for answers to some unknown questions. This might result in scoring better on the post-test compared to scoring without taking the pretest. This example suggests that pretest sensitization had an influence on post-test scores. To avoid this sensitization, Solomon four-group design is used.

Advantages

- It minimizes the threat to internal and external validity.
- This design is helpful in reducing the effect of pretest measures on post-test (reactive effects of the pretest).
- Any differences between the experimental and control group post-test scores can be confidently associated with the experimental treatment.

Disadvantages

- It requires more samples
- Data analysis is complicated

4. Crossover Design

Crossover design is also known as repeated measures design. In this design, same subjects are exposed to more than one experimental treatment, i.e., subjects are administered two treatments, one experimental, and the other control or reference. The subjects are randomly assigned to one of the two groups. While one group receives the experimental treatment initially the other group receives the reference treatment first. After a certain time period, the treatments are crossed over thereby allowing the subjects to serve as their own controls. Multiple crossover designs involve several treatments.

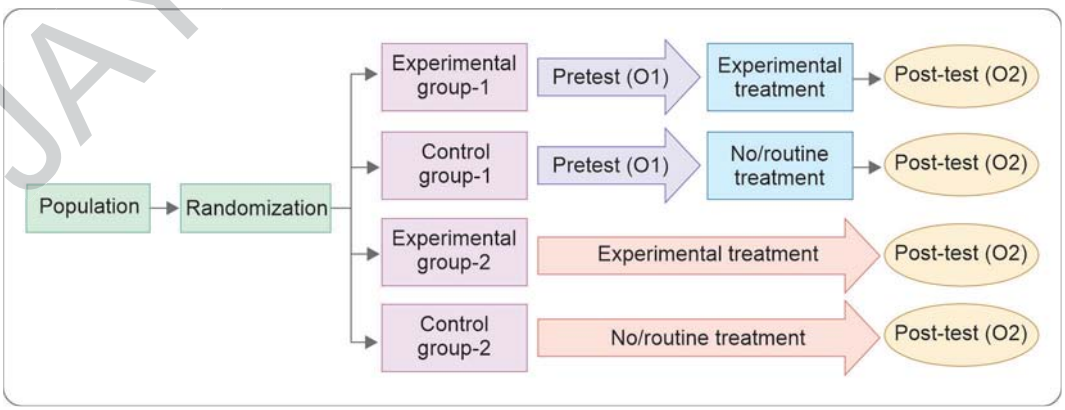

Figure 4.14: Schematic presentation of Solomon four-group design

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Steps

1. Subjects are randomly assigned (R) to one of the two groups
2. Subjects in both the groups are pretested (O1)
3. Experimental group subjects receive first set of treatment (X1)
4. The control group subjects receive second set of treatment (X2)
5. Both the groups are post-tested (O2)
6. After a period of time, the treatments are swapped among the experimental and control groups [experimental group subjects receive second set of treatment (X2) and control group subjects receive first set of treatment (X1)]
7. Both the groups are post-tested (O3) **(Figure 4.15)**.

Example: A study to compare the effectiveness of massage and music therapy on the development of premature infants. In this study, some infants are randomly assigned to receive massage therapy first and music therapy later. However, the other infants receive music therapy first and massage therapy later.

Advantage

It is used to test multiple hypotheses in a single study.

Disadvantage

Crossover effects (when subjects are exposed to two different treatments, the likelihood of being influenced during the second treatment due to their experience with the first treatment is high).

5. Factorial Design

Independent variables are sometimes called factors. When the researcher uses multiple independent variables in a study, it is called factorial design. In this design, two or more independent variables are manipulated by the researcher simultaneously to observe their effects on the dependent variable. In such designs, the researcher studies the effect of each independent variable on the dependent variable as well as the effect of interaction between independent variables on the dependent variable. It incorporates 2 × 2 or 2 × 3 factorial, which can be in any combination. This facilitates testing of several hypotheses in a single study.

Steps

1. Subjects are randomly assigned (R) to four groups (A, B, C, and D).
2. Subjects in all the groups are pretested (O1)
3. Group A subjects receive intervention 1 and 2 (X1 + X2)

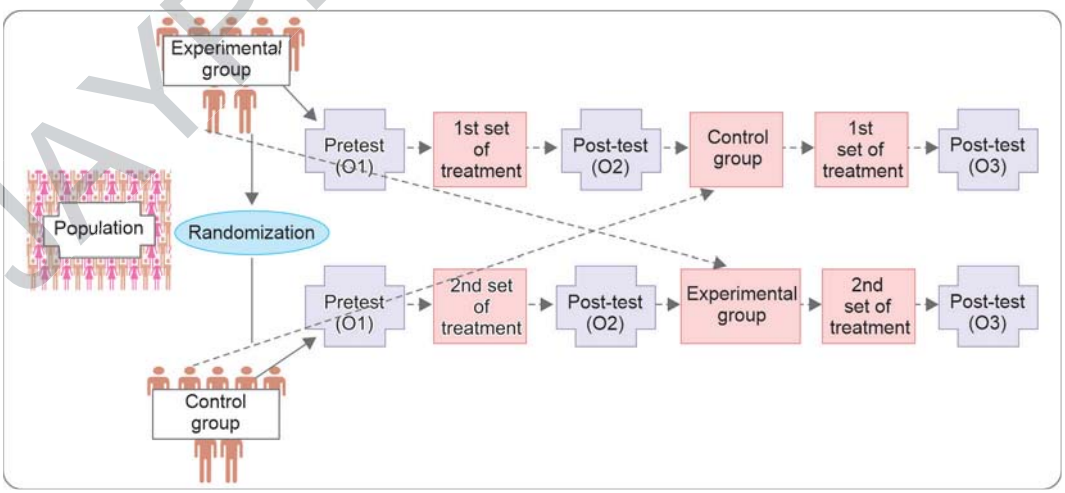

Figure 4.15: Schematic presentation of crossover design

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4. Group B subjects receive intervention 1 only (X1)
5. Group C subjects receive intervention 2 only (X2)
6. Group D subjects receive no intervention
7. Subjects in all the groups are post-tested (O2) **(Table 4.1 and Figure 4.16)**.

Example: In a study to evaluate the effectiveness of relaxation and distraction on reduction of pain among cancer patients, a 2 × 2 factorial design with four cells (A, B, C, and D) are used. Each cell contains equal number of subjects. Cell A subjects receive distraction and relaxation intervention, cell B subjects receive only distraction intervention, cell C subjects receive only relaxation intervention, cell D subjects receive no intervention and serve as a control group. Cell A subjects allow the researcher to examine the interaction between two independent variables, relaxation and distraction.

Advantage

Factorial designs allow the examination of theoretically proposed inter-relationships between multiple independent variables.

Table 4.1: Schematic presentation of factorial design

Levels of relaxation	*Levels of distraction*	
	Distraction (Intervention X1)	*No distraction*
Relaxation (Intervention X2)	Group A (X1 + X2)	Group C (X2)
No relaxation	Group B (X1)	Group D (No intervention)

Disadvantage

These designs require large samples.

6. Randomized Block Design

In this type of design, the researcher divides the subjects into subgroups or blocks such that the variation within the blocks is less compared to the variation between them. This is followed by random assignment of subjects within each block. Randomized block design is most useful in situations where the experimental subjects are heterogeneous and it is possible to divide the experimental subjects into homogeneous groups or units called blocks. In these designs, there are two independent variables (factors). While one independent variable can be manipulated, the other cannot be manipulated experimentally called the blocking variable. When the researcher is comparing the effects of vaccine versus placebo therapy for male and female individuals, the design could be 2 × 2 (four cells) experiment with type of intervention as one factor and gender as the other. Gender cannot be manipulated known as the blocking variable.

Steps

1. Subjects are divided into homogenous subgroups (Block A—males and Block B—females)
2. Subjects within each block are randomly assigned to experimental and control groups (each block has experimental and control groups)

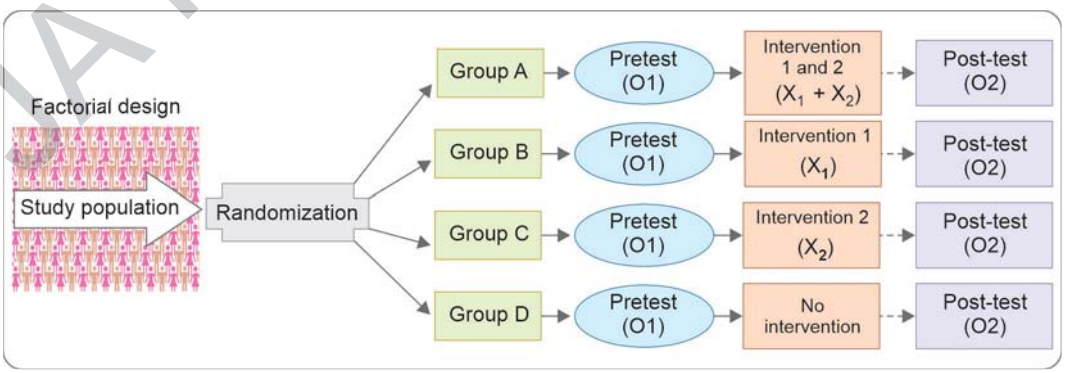

Figure 4.16: Schematic presentation of factorial design

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3. Subjects in each block are pretested (O1)
4. Block A and B experimental group subjects receive experimental treatment (X)
5. Block A and B control group subjects do not receive experimental treatment
6. Subjects in all the groups are post-tested (O2) **(Table 4.2 and Figure 4.17)**.

Example: In a 2 × 2 experiment, 500 male subjects and 500 female subjects are available for the study. The researcher makes two blocks based on gender (male and female). Subjects from each block are randomly assigned to either vaccination or placebo thereby having 250 subjects in each cell. 250 men and women get the placebo and the other set of 250 men and women get the vaccine.

Men and women are born physiologically different and react differently to vaccination. In the above example, the design eliminates gender as a potential source of confounding variable since each treatment condition has an equal number of male and female in vaccine and placebo cells. This ensures that differences between treatment conditions cannot be attributed to gender.

Table 4.2: Schematic presentation of randomized block design

Gender	*Treatment*	
	Placebo (control group)	*Vaccine (experimental group)*
Male (Block A)	250	250
Female (Block B)	250	250

Advantage

Reduces the variation in the treatment by a homogeneous combination of subjects through randomized block design.

Disadvantage

These designs require large samples.

7. Randomized Controlled Trials

Well-designed randomized controlled trials (RCTs) are considered the gold standard for measuring the intervention effect. This method is used in various fields such as medicine, nursing, psychology, education, and administration. In the field of medicine, these designs are used to evaluate the effectiveness of prevention strategies, screening and diagnostic tests, treatment procedures, and educational modules.

Randomized controlled trials are quantitative, comparative, controlled experiments wherein the investigator evaluates the effect of intervention by administering it to subjects who have been randomly assigned to either of the intervention or control groups.

Steps

1. Subjects are randomly assigned to intervention or control groups.
2. The intervention to be tested is called the experiment and the group receiving this intervention is called the experimental group. The other intervention is regarded as

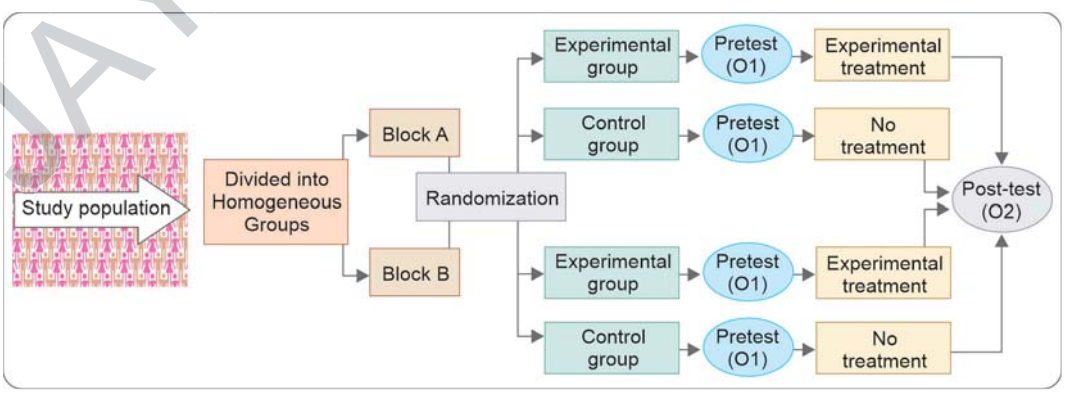

Figure 4.17: Schematic presentation of randomized block design

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a standard of comparison or control and the group which receives it is called the control group.
3. Subjects in one group receive the treatment being tested; the other receives an alternate treatment or placebo or no treatment.
4. Both the groups are followed up and outcomes measured at specific intervals.
5. These outcome measures are statistically compared to assess the difference in response between the groups so as to study the effect of experimental treatment.

Randomization procedure ensures that all the subjects have an equal chance of being allocated to intervention or control groups, characteristics of the subjects are similar in both the groups and any significant differences between groups in the outcome measures can be attributed to the intervention.

Advantages

- The most powerful way to find out cause-and-effect relationship
- Blinding is possible
- Completely removes effect of extraneous variables
- Strict protocols are followed

Disadvantages

- Recruitment of sample may be difficult
- Costly and time consuming
- Hawthorne effect (Refers to people's tendency to behave differently when they become aware that they are being observed)

Strengths of True Experimental Designs

- It is most scientific in nature
- True experiments because of their rigor, precision, and control properties are considered the most powerful methods for testing hypothesis of cause-and-effect relationship between variables
- Randomized controlled trial is placed at the highest level on the evidence-based practice pyramid

Limitations of True Experimental Designs

- Experiments are sometimes criticized for their artificiality
- Due to ethical reasons certain manipulations cannot be done in human studies
- Pretest can affect the response of post-test

QUASI-EXPERIMENTAL DESIGNS

Quasi-experimental designs facilitate the examination of causality in situations wherein complete control is not possible. In these designs, one of the components of true experimental design, i.e., either the random assignment of subjects to groups or control groups for comparison are typically lacking. Due to this, they are not as powerful as true experimental designs in establishing the cause-and-effect relationship between independent and dependent variables. Degree of control that the researcher has over the subjects and the study variables is the major distinction between the true and quasi-experimental designs. Though these designs are conducted in natural settings, they may be exposed to many threats, which may reduce the generalizability of the study findings.

Types of Quasi-experimental Designs

The four types of commonly used quasi-experimental designs are depicted in **Flowchart 4.5**.

1. Nonequivalent Control Group Pretest Post-test Design

This design is similar to pre–post control group design except that the participants are not randomly (NR) assigned to groups. Both experimental and control group subjects are pretested (O1); the experimental group subjects receive experimental treatment (X) and comparison group subjects receive standard care; both the groups are post-tested (O2).

Steps

1. Nonrandom assignment (NR) of subjects to either a control or an experimental group
2. The subjects in both the groups are pretested (O)

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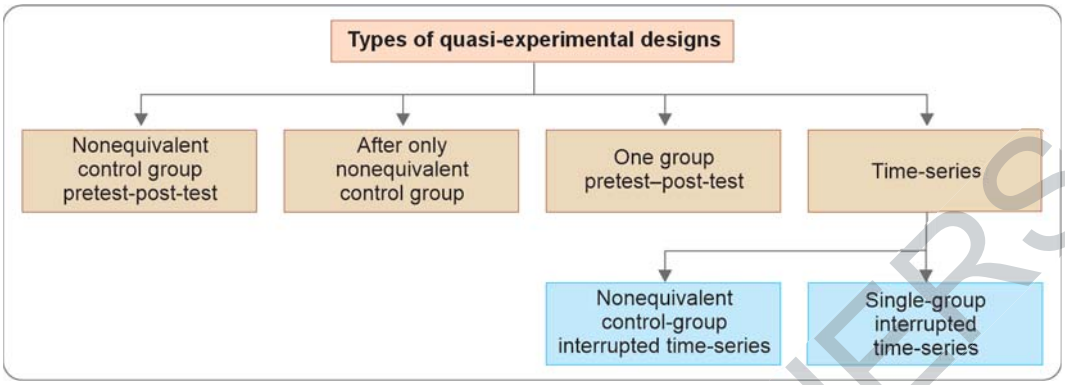
Flowchart 4.5: Types of quasi-experimental designs



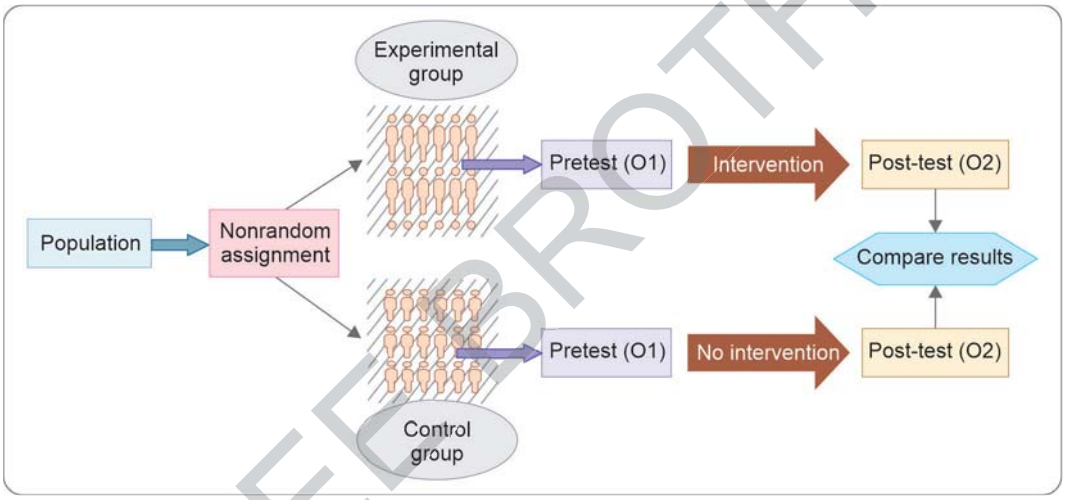


Figure 4.18: Schematic presentation of nonequivalent control group pretest–post-test design

3. Experimental group subjects receive the experimental treatment or intervention (X). The comparison group receives the routine treatment or no treatment
4. Both the groups are post-tested (O) **(Figure 4.18)**.

Example: In a study to evaluate the effectiveness of therapeutic environment on conflict and containment rates among schizophrenia patients, the experimental group and comparison group subjects were admitted to different psychiatric wards. As the ward environment is manipulated for the study purpose, the researcher preferred different wards for experimental and control subjects to avoid contamination of treatment conditions. With pretest, the researcher ensured that the two groups were equal in demographic parameters, conflict, and containment rates.

In another study to evaluate the effectiveness of group therapy on well-being of diabetic patients, the researcher chose experimental group and control group subjects from two different hospitals to avoid intervention contamination.

Advantages

- This design is relatively strong because the gathering of data at the time of pretest allows the researcher to compare the

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equivalence of the two groups on variables before the intervention is administered.
- It is used in situations where random assignment or control group is not possible for an experimental study.
- If the subjects are equivalent in pretest scores, it will allow the researcher to infer that it was the intervention that was responsible for improvement in post-test scores of the experimental group subjects.

Disadvantages
- Due to lack of randomization, it can no longer be assumed that the groups are equivalent.
- The biggest threat to internal validity is selection bias.
- If differences exist in pretest scores, it is difficult to infer the effectiveness of the intervention. It can only be controlled statistically in the analysis.

2. After-Only Nonequivalent Control Group Design

In this design, the dependent variable is measured only once after the experimental treatment has been introduced. For this design, groups must be similar or one must control for these differences to make valid comparisons and conclusion regarding the effect of intervention.

Steps

i. Nonrandom assignment (NR) of subjects to either a control or an experimental group.
ii. Experimental group subjects receive the experimental treatment or intervention (X) The comparison group receives the routine treatment or no treatment.
iii. Both the groups are post-tested (O) **(Figure 4.19)**.

Example: "A study to evaluate the efficacy of distraction in reducing pain perception among children". In this study, the researcher provides distraction to the experimental group children while no distraction is provided to the control group children during the painful procedure. He then examines the differences in amount of pain during the procedure between the subjects in two groups. In this study, it is not possible to pretest the amount of pain before the procedure.

Advantage

This design is used in situations in which a pretest is not possible.

Disadvantage

Selection bias may occur.

3. One Group Pretest Post-test Design

This design is used when only one group is available for study. Dependent variable is assessed (pretest) before implementation of the intervention to the subjects followed by post-test observation. Prepost assessments are compared to assess the effect of intervention on subjects. In this design, both randomization

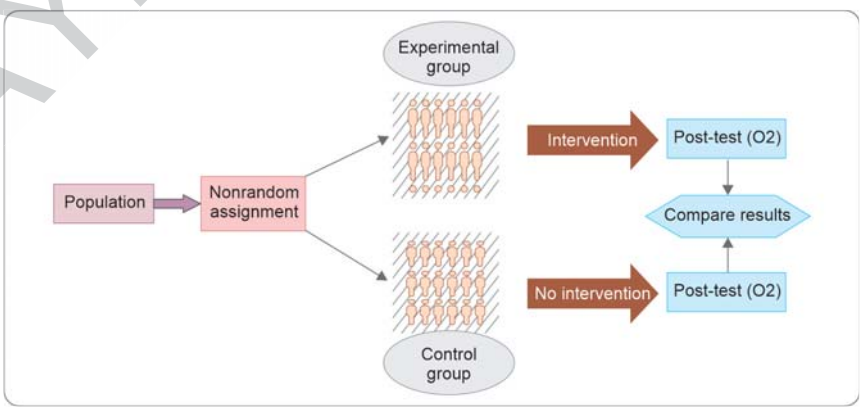

Figure 4.19: Schematic presentation of after only nonequivalent control group design

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and control are absent. It is considered very weak because the researcher has very little control over the experiment. Evidence generated from this type of design is interpreted with careful consideration because of design limitations. In some textbooks, this design is considered as pre-experimental design.

Steps

i. The subjects are pretested (O1)
ii. Receive the experimental treatment or intervention (X)
iii. Subjects are post-tested (O2) **(Figure 4.20)**
Example: In a study on sexual behavior in teens, behavior is measured baseline (pretested), a nurse-based educational intervention is administered and subsequent behavior is measured again (post-test).

Advantage

This design can be used, if no control group is available for an experimental study.

Disadvantages

- Effectiveness of the intervention cannot be proved on account of threats to internal validity
- Results cannot be generalized

4. *Time-Series Design (Repeated Measures Design)*

In this design, the researcher collects data multiple times at pretest level, i.e., before introduction of treatment to establish a baseline point of reference on outcomes. Later, subjects are administered experimental treatment, which is followed by collection of data at multiple time points to determine the change from baseline. Multiple data collection points help to rule out the history effects. These designs may be experimental, quasi-experimental, or nonexperimental.

Advantage

Several observations of the dependent variable help strengthen the validity of the design.

Disadvantage

History and testing are the greatest threats to validity.

Commonly used time-series designs are nonequivalent control group interrupted time-series design and single-group interrupted time-series design.

- **Nonequivalent control-group interrupted time-series design:** In this design, subjects are not assigned randomly to groups. Here, the researcher collects data multiple times at pretest level after which subjects are administered experimental treatment followed by collection of data at multiple time points.

Steps

i. Nonrandom assignment (NR) of subjects to either a control or an experimental group.
ii. The subjects in both the groups are pre-tested at multiple times (O1, O2, and O3).
iii. Experimental group subjects receive experimental treatment or intervention (X), whereas the comparison group receives the routine treatment or no treatment.
iv. Both the groups are post-tested at multiple times (O4, O5, and O6) **(Figure 4.21).**

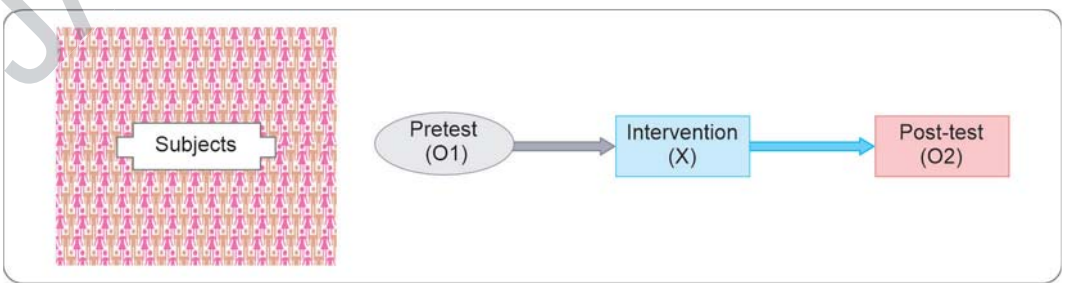

Figure 4.20: Schematic presentation of one group pretest–post-test design

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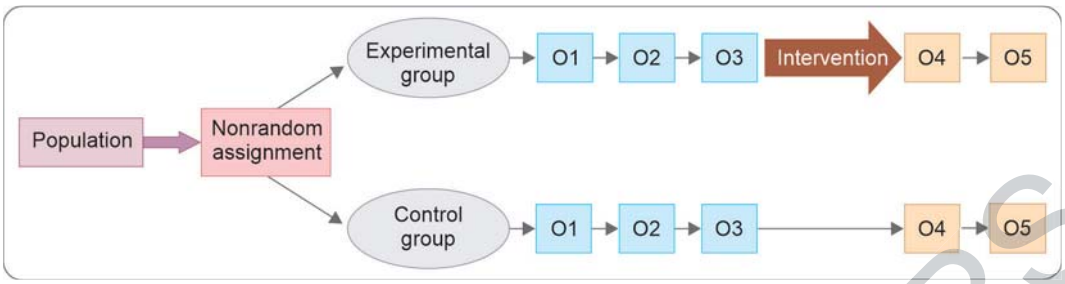

Figure 4.21: Schematic presentation of nonequivalent control-group interrupted time-series design.

Examples: A researcher may evaluate anxiety levels of school students studying in class 10. After assessing for anxiety levels for 3 weeks at weekly intervals (both the groups), the subjects in experimental group are provided cognitive behavioral therapy to reduce anxiety. The anxiety levels are again evaluated for the next 3 weeks.

A researcher evaluated experimental and control group children's school work on a weekly basis. Experimental group children were introduced to new teaching method while the control group children received routine teaching. The school work of children from both groups was evaluated on a weekly basis.

- **Single-group interrupted time-series design:** This design consists of a single group, wherein the researcher collects data multiple times at pretest level. Later, subjects are administered experimental treatment, which is followed by collection of data at multiple time points.

Steps

i. The subjects in group are pretested at multiple times (O1, O2, and O3)
ii. Subjects receive the experimental treatment or intervention (X)
iii. Subjects are post-tested at multiple times (O4, O5, and O6) **(Figure 4.22)**.

Examples: A researcher may evaluate pain levels of arthritis patients. After assessing for pain levels for 3 weeks at weekly intervals, the subjects are provided physiotherapy to reduce pain. The pain levels are again evaluated for the next 2 weeks.



Figure 4.22: Schematic presentation of single-group interrupted time-series design

Strengths of Quasi-experimental Designs

- Feasible, practical, and generalizable
- More adaptable to the real-world practice setting than true experimental designs
- For some hypotheses, these designs may be the only way to evaluate the effect of the independent variable of interest
- Introduce some research control when full experimental rigor is not possible

Limitations of Quasi-experimental Designs

- There is no control over extraneous variables influencing the dependent variable.
- Lack of randomization or absence of control group makes the results of the study less reliable and weak for establishing the cause-and-effect relationship between independent and dependent variables.

Experimental designs are considered level I and quasi-experimental designs are considered level II evidence.

QUALITATIVE RESEARCH DESIGNS

A qualitative design is selected when little is known about a particular phenomenon, experience, or concept. These designs are based on the naturalistic paradigm philosophy (reality is subjective, not objective, and that multiple realities exist rather than one). This

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approach typically uses inductive reasoning, wherein it begins with assumptions and specific observations of a particular instance, which are then combined into a large whole or general statement leading to development of concepts and themes. Once the concepts or themes are identified, these themes are grouped into a theory, which can then be tested using a quantitative design. Qualitative designs primarily involve the analysis of words. Research design in a qualitative study is not concrete. As the data is being gathered, the researcher makes deliberate modifications in line with new findings.

Types of Qualitative Research Designs

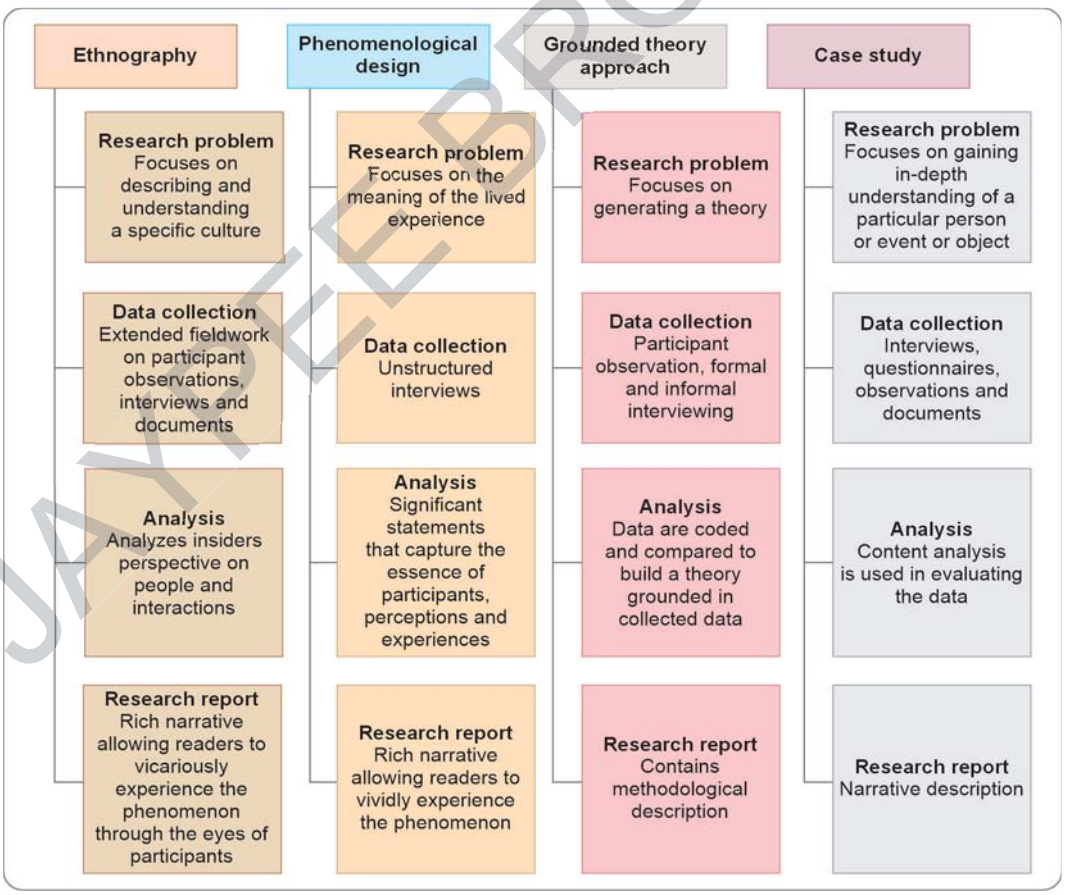
The four types of qualitative research designs most often used to conduct nursing research include—(1) ethnography, (2) phenomenological design, (3) grounded theory approach, and (4) case study **(Flowchart 4.6)**.

Ethnography

Ethnography means study and description of a culture of a particular group of people. It involves collection and analysis of data about cultural or social groups.

- **Research problem and question:** The research problem in ethnography research focuses on describing and understanding a specific culture.
- **Conducting research:** The planning and implementing of an ethnographic research study takes place in three stages—(1) pre-fieldwork, (2) fieldwork, and (3) post-fieldwork.

Flowchart 4.6: Types of qualitative research designs



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- **Activities in pre-fieldwork:**
  - Choose the problem and people
  - Search the literature and gather information on the problem and people
  - Formulate a systematic plan of investigation
- **Activities in fieldwork:**
  - Focuses on making contacts and gaining entry, establishing relationships, and beginning to describe the culture experience.
  - As a participant observer, the researcher enters into the everyday life and activities of the people of the culture being studied.
  - The researcher studies the group's apparent and learned patterns of behavior, sociocultural practices and traditions mainly focusing on culture, and how people interact with each other.
  - Researcher spends over a year in the field setting long enough to see a full cycle of activity on emic (insiders views about their culture) and etic (outsiders view about experiences of that culture) perspectives to gain a better understanding of behavior, values and social relationships. This spending of extended time with respondents in their native culture is termed as prolonged engagement.
  - Data collection methods used in ethnography are census taking (collection of basic demographic data), mapping (identifying the location of people, culture, environmental features), document analysis (vital statistics, records, newspapers, personal diaries), life histories (comprehensive biography of an informant's life), and event analysis (detailed written and photographic documentation of events as wedding, funeral, and festivals). Techniques used are observation, unstructured in-depth interviews, records, physical evidences like diaries, letters, photographs, etc.
  - Identify emerging themes and categories and analyze general features of the culture.
  - Refine the theme by double checking and monitoring the field information, evaluating gathered data to broaden understanding of how representative the research findings are of members of the culture.

    Ethnographers usually seek three broad types of information:
    1. Culture behavior (what people do)
    2. Culture artifacts (what members of the culture make use of)
    3. Culture speech (what people say)
- **Activities of post-fieldwork:**
  - Ethnographic research report includes a rich and holistic description of the culture under study and provides access to health beliefs, health practices, and cultural problems. It begins with a brief overview of the setting and the people being studied, followed by a review of the specific problem being addressed and a discussion of the fieldwork.
  - *Example*: Wittig (2001) conducted an ethnonursing study involving 10 African–American women focusing on organ donation beliefs among their community in the rural area. He conducted in-depth interviews during his numerous visits to the site.

Phenomenological Design

It is the study of phenomenon, wherein the researcher describes the subjective reality of an event as perceived by the study participants. Phenomenology systematically uncovers and describes the meaning or essences of an experience. In phenomenological terms, these experiences are called the lived experience. Nursing phenomenological studies have contributed greatly to our knowledge about human experiences in health and illness, healing, and dying (for example, loss of an unborn child, recurrence of cancer), and the meaning of these experiences to the patients.

- **Research problem and question:**
  - The research question focuses on the meaning of the lived experience.
  - The main goal is to develop rich, full, and insightful description of the lived experience.

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- **Sample:**
  - Commonly purposive sample is selected from persons who have actually lived the experience under study and are able and willing to describe the experience.
  - Participants are requested until there is redundancy in the data or saturation. Saturation refers to the participants descriptions becoming repetitive with no new or different ideas or interpretations emerging.
- **Data collection:**
  - Data is collected using unstructured interviews and written description. Interaction between the researcher and participant is focused on achieving a full description of the lived experience.
  - Researcher often starts by identifying participant perceptions or expectations about the phenomenon to be studied and then attempts to consciously bracket them (hold them separate) so that they will not color either the data collection or the analysis process.
  - Bracketing is a reflective self-assessment methodological device in phenomenological inquiry where the researcher deliberately puts aside one's own belief about the phenomenon under investigation or what one already knows about the subject prior to and throughout the phenomenological investigation (Carpenter, 2007).
  - The researcher must be an empathetic and skilled listener and encourage full description.
  - Interviews are recorded and transcribed verbatim.
- **Data analysis:**
  - Read the entire disclosure of the lived experience straight through to obtain a sense of the whole
  - Reread the disclosure to discover the essences of the lived experience under study
  - Formulate a consistent description of the lived experience for all participants

Example: Rungreangkulkij (2001) conducted a phenomenological study involving 12 Thai mothers' having adult schizophrenic children. The study focused on experiences of the mothers in caring for their schizophrenic children.

Grounded Theory Approach

Grounded theory is the discovery of theory from data that have been systematically obtained through research. It combines both inductive and deductive research methods. With the use of inductive processes, theory emerges from the data. Deduction is then used to test the theory empirically. The research process ends with a theoretical formulation or integrated set of conceptual hypotheses. Grounded theorists study social processes in everyday human life and interactions. For nurse researchers, the grounded theory approach facilitates the development of mid-range theory grounded in the life and language of people living with illness conditions.

- **Research problem and question:** The goal of grounded theory approach is to generate a theory, propose theoretical propositions or models that illustrate the theory.
- **Sample:** Sample is determined by generated data and analysis. Sampling is continued until the categories are saturated.
- **Data collection:**
  - Grounded theorists must view the environment as informants do and focus on the interaction under study.
  - Participant observation, informal interviewing, and formal interviewing are the three main sources of data generation.
  - The grounded theorist writes field notes and also uses audio-taped records to capture the participant's interview word for word.
- **Data analysis:**
  - The process of data collection and analysis occurring simultaneously is referred to as constant comparison. Here, the previous data are constantly compared to current data as they are being gathered.
  - Significant concepts are identified and codes assigned. These concepts

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are constantly reviewed as new interpretations of the data are made.
  - Once the concepts have been identified and their relationship specified, the researcher reviews the literature to find out if any similar associations have already been investigated.

Example: Knobf (2002) sought to develop a substantive theory to explain women's responses to chemotherapy-induced premature menopause within the context of breast cancer.

Case Study

Case study is an approach to qualitative research that focuses on gaining an in-depth understanding of a particular person or object or an event at a specific time. This design is used for intensive exploration of a single unit of study such as a person, a very small number of subjects, family, group, community, or institution.

- Case study may be quantitative or qualitative depending on the purpose of the study and the design chosen by the researcher.
- In qualitative case studies, the researcher must be interested in exploring the meaning of experiences from the subject's perspective rather than generalizing the results to other groups of people.
- Data collection:
  - Data are collected using a variety of means and methods such as interviews, questionnaires, observations, audio and video recordings, and documents.
  - During data collection, the researcher examines all the variables that have an impact on the situation being studied.
  - The researcher explores the subject's history and previous behavioral pattern in detail. Both quantitative and qualitative information are likely to be integrated into the case–study design.
  - The case studies can be classified into single case versus multiple case. In a single case, the focus is on a particular person or an event at a specific time; while in a multiple case (collective case), the focus is on more than one person or an event at a specific time or over different time periods.
- **Data analysis:** It involves examination of communicated messages. Content analysis method is used to analyze the data from case studies.

Example: A study to determine the responses of diabetic patients in use of insulin pump. In this study, one patient or few patients with diabetes are studied for a time to understand their experiences in use of insulin pump.

MIXED METHOD DESIGNS

Designing quantitative experimental studies with controls may provide strong external validity but at times may have limited internal validity. Qualitative studies may have strong internal validity but weak external validity. Any one approach to measure the concept may be inadequate.

Researchers are more likely to capture the essence of the phenomena by combining qualitative and quantitative methods. In mixed methods, research elements of both qualitative and quantitative approaches are present. In this approach, representativeness and generalizability of quantitative research and in-depth contextual nature of qualitative research are combined in a single research study.

Meaning

Mixed methods research is a research approach that combines philosophical assumptions of both qualitative and quantitative approaches and goes beyond simply collecting and analyzing both kinds of data. It uses both approaches in tandem, so that the overall strength of the study is greater than either qualitative or quantitative research (Creswell and Plano Clark, 2007).

The benefits of combining the qualitative and quantitative methods can increase the confidence in study data, expand understanding of the phenomena and integration of theories. Denzin (1989) believed

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that combining multiple theories, methods, and data sources can assist researchers in overcoming the bias that comes from single method. He defines triangulation as the combination of two or more theories, data sources, methods, or investigators in the study of a single phenomenon.

Triangulation method evolved to include using multiple data collection and analysis methods, multiple data sources and multiple theories. Triangulation can be done in four basic ways:

1. **Data triangulation:** It refers to use of multiple data sources to validate conclusions. It includes time, space, and person triangulation. In time triangulation, data on the same phenomena is collected at different times. In space triangulation, the researcher collects data on the same phenomenon at different sites. In person triangulation, data is collected from different types of subjects. Collection of data from many sources widens the perspective on the phenomenon of interest.
2. **Methods triangulation:** It refers to use of multiple data collection methods to collect the information.
3. **Researcher triangulation:** In this, more than one researcher may collect the data to ensure the validity of the collected information and minimize the researcher bias.
4. **Theory triangulation:** In this, the researcher uses more than one theory or hypothesis to analyze and interpret the data. This helps the researcher to avoid preconceived ideas to guide data analysis and interpretation.

Example: Daaleman TP et al. (2008) conducted a qualitative study to explore spiritual care needs among end-life patients. The main aim of this study was to explore the views of medical professionals on spiritual care provided to dying patients and their family members. This study collected information from 12 clinicians and other healthcare providers by conducting interviews.

HISTORICAL RESEARCH

Historical research is the systematic collection, critical evaluation, and interpretation of historical evidence. It answers questions relating to causes, effects, or trends relating to past events that may throw light on the prevalent behavior or practices. Many nurse researchers have undertaken biographical histories to become aware of the prevailing values and beliefs that may have shaped the successive developments in nursing. Data sources include records, video tapes, photographs and interviews, review of published reports, etc.

Lusk (2000) conducted historical research to evaluate the relative status of nurses in advertisements by analyzing their images in advertisements from 1930 to 1950. She hypothesized that nurse's relative status in advertisements would be higher in 1940 (when women were encouraged to enter nursing as a patriotic duty) than in 1930 or 1950.

METHODOLOGICAL STUDIES

These are conducted to develop, validate, test, and evaluate the research instruments and methods.

Tejero (2010) conducted a methodological study to develop and validate an instrument to measure nurse–patient bonding.

SECONDARY ANALYSIS

It uses previously gathered data to test new hypotheses, explore new relationships among variables, or create new insights. Because the process of data collection is time consuming and extensive, use of secondary data is an efficient way to create new insights and knowledge. The various clinical nursing databases available as management and policy tools serve as important sources of data for secondary analysis.

Harris et al (2016) conducted secondary analysis by using existing data to find out patients' experiences of psychiatric care in emergency departments.

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META-ANALYSIS

In this technique, findings from several studies are utilized to create a data set that may be analyzed as a single piece of datum. It is the analysis of analyses. It involves taking the findings from several studies on the same subject and analyzing them using standardized statistical procedures. This helps to draw conclusions and detect relationships between findings. It offers a possibility to classify and measure the conditions and results of studies on a more precise and rigorous way compared to verbal descriptions of research.

Zangaro and Soeken (2007) conducted a meta-analysis of studies of nurses' job satisfaction. 31 studies were included in meta-analysis. This study examined the strength of the relationship between job satisfaction, autonomy, job stress, and nurse–physician collaboration among registered nurses working in staff position.

SYNOPSIS

- A research approach or method is a general framework guiding the research study that includes broad assumptions, methods of data collection, analysis, and interpretation.
- Research design is a specific outline detailing how chosen method or approach will be applied to answer a particular research question.
- A number of considerations influence the selection of research design. The researcher should select the most appropriate design to meet the objectives of the study. Selection of research design is influenced by several factors: current knowledge of the research problem, knowledge and experience of the researcher, availability of time and resources, availability of participants, control on extraneous variables, ethical considerations.
- Different types of research designs cater to different types of questions or hypothesis. They are often classified as quantitative or qualitative or mixed designs.
- Quantitative research is designed to collect numerical data, which can be transformed to usable statistics for answering research question or hypothesis.
- The four most commonly used types are: (1) descriptive, (2) correlational, (3) quasi-experimental, and (4) experimental research designs.
- While descriptive and correlational designs are referred to as nonexperimental designs, quasi-experimental, and true experimental research designs are referred to as experimental designs.
- Nonexperimental designs focus on examining variables, as they naturally occur in the environment and not on the implementation of a treatment by the researcher. These designs describe, differentiate, or examine associations among the variables.
- The basic categories of nonexperimental designs are descriptive, correlational, cross sectional, longitudinal, retrospective and prospective.
- The main aim of descriptive research is the accurate depiction of individual characteristics, events, or groups and the frequency of occurrence of phenomena using statistics to describe and summarize the data.
- Correlational research assesses the inter-relationships among study variables without any active intervention by the researcher.
- Cross-sectional studies involve observing a single phenomenon across multiple populations at a single point in time without any follow-up for determining the relationship between variables.
- In a longitudinal design, researcher records numerous observations of the same subjects over a period of time, which at times may last for many years, i.e., the data is collected at multiple time points over an extended period.
- Retrospective (Ex post facto—is from after the fact) means the study has been conducted subsequent to the dependent variable being affected by the independent variable and the researcher attempts to link the present events with the past events.
- This study begins with identification of presumed cause (alcohol consumption) and goes further in time to observe the presumed effects (cirrhosis of liver).

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- Experimental research is an objective, systematic, and controlled investigation carried out to predict and control phenomena, wherein the researcher manipulates and controls one or more variables while observing the effect of manipulation on other variables.
- True experimental designs investigate the cause-and-effect relationship between independent (predictor) and dependent (outcome) variables under controlled conditions.
- The three essential characteristics of true experimental designs are manipulation, randomization and control.
- The six types of commonly used true experimental designs are: post-test only control group design, pretest-post-test control group design, Solomon four group design, crossover design, factorial design, randomized block design.
- Quasi-experimental designs facilitate the examination of causality in situations in which complete control is not possible. In these designs, one of the components of true experimental design, i.e., either the random assignment of subjects to groups or control groups for comparison are typically lacking.
- The four types of commonly used quasi-experimental designs are: nonequivalent control group pretest-post-test design, after only nonequivalent control group design, one group pretest-post-test design and time series design.
- A qualitative design is selected when little is known about a particular phenomenon, experience, or concept. These designs are based on the naturalistic paradigm philosophy.
- The four types of qualitative research designs most commonly used in nursing research include—(1) ethnography, (2) phenomenological design, (3) grounded theory approach, and (4) case study.
- In mixed methods, research elements of both qualitative and quantitative approaches are present. In this approach, representativeness and generalizability of quantitative research and in-depth contextual nature of qualitative research are combined in a single research study.



REVIEW QUESTIONS

I. Long Essays

1. Write the classification of research design. Discuss advantages and disadvantages of experimental research.
2. What is qualitative research design? List out the types and explain any one type with an example.
3. List various nonexperimental research designs. Explain correlational research designs with examples.
4. List various quasi-experimental designs. Describe its advantages and disadvantages.

II. Short Essays

1. Explain characteristics of true experimental research design.
2. What are the factors to be considered while selecting research methods?
3. Explain descriptive research designs.
4. Explain in detail about retrospective designs.
5. Narrate survey methods.

III. Short Answers

1. List the types of true experimental research design.
2. Types of survey studies
3. Hawthorne effect
4. Meaning of cross-sectional designs
5. Attrition
6. Manipulation
7. Randomization
8. Control

IV. Multiple Choice Questions

1. **Blueprint of research work is called:**
   a. Research problem
   b. Research design
   c. Research tools
   d. Research methods
2. **Research design involves description of:**
   a. Research approach
   b. Setting of the study
   c. Sample size
   d. All of these

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3. **Which research paradigm is least concerned about generalizing its findings?**
   a. Quantitative research
   b. Qualitative research
   c. Mixed research
   d. None of the above
4. **What is the key defining characteristic of experimental research?**
   a. Extraneous variables are never present
   b. A positive correlation usually exists
   c. A negative correlation usually exists
   d. Manipulation of the independent variable
5. **Which of the following best describes quantitative research?**
   a. The collection of non-numerical data
   b. An attempt to test the researcher's hypotheses
   c. Research that is exploratory
   d. Research that attempts to generate a new theory
6. **"A study to assess the experiences of patients suffering from rheumatoid arthritis." Which of the following designs is suitable to this study?**
   a. Descriptive study
   b. Correlation study
   c. Historical study
   d. Experimental study
7. **Which of the designs is suitable for the given example? "A comparative study on pain symptoms between male and female rheumatoid arthritis patients."**
   a. Descriptive design
   b. Correlational design
   c. Comparative design
   d. Explorative design
8. **The most appropriate research design for testing the cause-and-effect relationship between the variables is:**
   a. Experimental
   b. Correlational
   c. Descriptive
   d. Qualitative
9. **Which of the designs is suitable for the given example? "To assess the cholesterol level among daily walkers and non-daily walkers."**
   a. Experimental design
   b. Historical design
   c. Cross-sectional design
   d. Case–study design
10. **Which of the following designs is suitable for the given example? "To assess the incidence of cardiovascular diseases among individuals followed up for 5 years."**
    a. Retrospective design
    b. Longitudinal design
    c. Cross-sectional design
    d. Explorative design
11. **Which of the following designs is suitable for the given example? "A study to assess the multifactorial dimensions of pain and coping measures of rheumatoid arthritis patients."**
    a. Experimental design
    b. Longitudinal design
    c. Retrospective design
    d. Explorative design
12. **A longitudinal or prospective study is also referred to as a/an:**
    a. Ecological study
    b. Cross-sectional study
    c. Cohort study
    d. Observational study
13. **Which of the following are essential characteristics of true experimental design, *except:***
    a. Manipulation
    b. Randomization
    c. Control
    d. Nonrandomization
14. **In_____, you make observations prior to and immediately after introducing your independent variable.**
    a. Descriptive design
    b. Explorative design
    c. Pretest–post-test design
    d. Post-test only design

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15. Which type of research provides the strongest evidence about the existence of cause-and-effect relationships?
a. Nonexperimental research
b. True experimental research
c. Descriptive research
d. Correlational research

16. A positive correlation is present when_____.
a. Two variables move in opposite direction
b. Two variables move in same direction
c. One variable goes up and down
d. Several variables never change

17. When two groups, control and experimental take a post-test after intervention without taking a pretest the design is called:
a. Crossover design
b. After-only design
c. Solomon four-group design
d. Pretest–post-test design

18. Which of the following is a true experimental design?
a. Single-group, post-test-only design
b. Single-group, pretest-post-test design
c. Ex post facto design
d. Factorial design

19. Quasi-experimental designs have:
a. An independent variable and dependent variable
b. Nonrandom allocation of participants to experimental and control groups
c. Both (a) and (b)
d. No manipulation

20. The group that does not receive the experimental treatment condition is the_____.
a. Experimental group
b. Control group
c. Treatment group
d. Independent group

21. John is conducting research on effects of eating bananas on memory. To investigate this, participants are given a memory test followed by either a rest period with a banana to eat or a rest period alone. They then complete a second memory test. The results of the first and second memory test are compared. This an example of a/an ____ design.
a. Cross-sectional
b. Longitudinal
c. Survey
d. Experimental

22. Which of the following is an advantage of retrospective design?
a. Several etiological factors can be studied at the same time
b. Suitable for descriptive studies
c. Suitable for evaluation of intervention
d. Cause-and-effect relationship can be established

23. "A study to determine the effect of lack of sleep on attention span of students the following day" is an example of which type of research design?
a. Descriptive
b. Correlated
c. Experimental
d. Nonexperimental

24. The quasi-experimental design does not include:
a. Manipulation of independent variable or control
b. Random sample or control group
c. Random or manipulation of independent variable
d. Manipulation of independent or dependent variables

25. Experimental studies differ from other research approaches on account of following:
a. Controlled manipulation of at least one treatment variable
b. Exposure of all the subjects to the treatment
c. Study participants will be easily available
d. Conducting the study will be easy

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26. Case studies may concern an in-depth examination of:
a. Individuals
b. Group of people
c. Institutions
d. All of the above

27. Which of the following designs controls for the sensitization of subjects to a pretest?
a. Pretest–post-test control group design
b. Solomon four-group design
c. Case study
d. Crossover design

28. Which research is a study of past records and other information source?
a. Fundamental research
b. Applied research
c. Historical research
d. Basic research

29. _____ involves the collection and analysis of the culture of a group.
a. Phenomenological research
b. Ethnographical research
c. Grounded theory
d. Historical research

ANSWER KEY

1. b	2. d	3. b	4. d	5. b	6. a
7. c	8. a	9. c	10. b	11. d	12. c
13. d	14. c	15. b	16. b	17. b	18. d
19. c	20. b	21. d	22. a	23. b	24. b
25. a	26. d	27. b	28. c	29. b	

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