

PART
A



NURSING RESEARCH

PART OUTLINE

CHAPTER 1	Fundamentals of Nursing Research
CHAPTER 2	Overview of Research Process
CHAPTER 3	Ethics in Nursing Research
CHAPTER 4	Research Problem
CHAPTER 5	Hypothesis and Assumption
CHAPTER 6	Literature Review
CHAPTER 7	Theoretical and Conceptual Framework in Nursing Research
CHAPTER 8	Research Approaches and Designs
CHAPTER 9	Sampling Techniques in Nursing Research
CHAPTER 10	Tools and Techniques of Data Collection
CHAPTER 11	Validity and Reliability of Research Tools
CHAPTER 12	Analysis and Interpretation of Data
CHAPTER 13	Communication, Critiquing and Utilization of Research Findings



Fundamentals of Nursing Research

LEARNING OBJECTIVES

After the completion of the chapter, the readers will be able to:

- Define research.
- Describe scientific methods of acquiring knowledge.
- Describe the need and purposes of nursing research.
- Enlist the importance of nursing research.
- Describe the historical development of nursing research.
- Enlist the characteristics of a good research.
- Enlist the qualities of a good researcher.
- Elaborate on types of research.
- Explain the scope and areas of nursing research.
- Identify the gaps and challenges in nursing research.
- Explain the concept of evidence-based practice.

CHAPTER OUTLINE

• Introduction	• Historical Developments of Nursing Research
• Meaning of Research and Nursing Research	• Characteristics of Good Research
• Methods of Acquiring Knowledge in Nursing	• Qualities of a Good Researcher
• Problem-Solving	• Types of Research
• Scientific Methods	• Scope and Areas of Nursing Research
• Needs and Purposes for Nursing Research	• Gaps and Challenges in Nursing Research
• Importance and Significance of Nursing Research	• Concept of Evidence-Based Practice

KEY TERMS

Empiricism: It is based on observable and measurable data that is gathered through systematic observation, experimentation, and testing.

Evidence-based practice: The integration of the best available research evidence, clinical expertise, and patient preferences to inform health care decision-making and deliver high-quality care.

Nursing research: Nursing research is a systematic and scientific investigative process, with the objective of advancing knowledge and enhancing nursing practice, nursing education, and nursing administration and management.

Problem-solving process: A systematic approach to identify, analyze, and resolve issues or challenges by gathering relevant information and generating effective solutions.

Research: Research is a systematic inquiry and examination of materials and sources, conducted with the aim of confirming established facts and deriving fresh insights or conclusions.

Research utilization: The application of research findings and evidence in practical settings to improve outcomes, decision-making, or practice in various fields.

Scientific methods: The scientific method is a systematic and structured approach to acquiring and evaluating knowledge.

Variables: Factors or characteristics that can vary and are measured, observed, or manipulated in research or experiments to study their impact on outcomes or phenomena.

INTRODUCTION

Nursing is an emerging profession that focuses on improving people's health. Nurses play a major role in providing quality health care to patients. Nursing is a profession that has a long history, but it is constantly changing and developing. To keep improving, it needs new information and knowledge acquired through research. Nurses need to have a strong understanding of their subject and stay updated on new information and knowledge gained from research. Using the latest evidence from research helps nurses ensure better quality of care for patients.

Nursing research is a systematic and scientific process of investigating questions and problems related to nursing practice, education, administration and management. The goal of nursing research is to generate new knowledge and evidence to inform and improve nursing practice, education, and health care outcomes. Nursing research involves the use of various methodologies, such as quantitative research, qualitative research, mixed methods research, to gather data and test theories. By conducting nursing research, nurses can stay current with best practices, understand patient needs, and provide quality care to those in their care.

The current chapter introduces the concepts of nursing research to the budding nursing researchers. It discusses the historical development, purposes, significance and characteristics of a good research. It enumerates the qualities of a good researcher. It also highlights the gaps and challenges in nursing research.

MEANING OF RESEARCH AND NURSING RESEARCH

Research

The term "research" is derived from the Middle French "recherche," which means "to investigate thoroughly". The word "recherche" is a verb form of "rechercher", which means "to seek".

The word "research" is made up of two parts: the prefix "re-" and the root word "search". The prefix "re-" often signifies "again" or "back", implying that research involves going back over existing information and



knowledge to gain a deeper understanding. The root word “search” refers to the process of looking for or seeking information or knowledge. When combined, the term “research” suggests a systematic and organized process of seeking knowledge through investigation and examination.

Research is an orderly and systematic investigation into a subject in order to discover or revise facts, solve new or existing problems, or establish principles.

—Campbell and Stanley

Research is a systematic inquiry that uses disciplined methods to answer questions or solve problems.

—John W Creswell

Research is a systematic investigation into and study of materials and sources in order to establish facts and reach new conclusions.

—Martyn Shuttleworth

Research is a systematic and objective process of gathering, analyzing, and interpreting data for the purpose of discovering, refining, or verifying knowledge.

—Neil J Salkind

Research is a systematic and systematic investigation of a phenomenon in order to describe it, explain it, or predict future occurrences.

—William M Trochim

Nursing Research

Nursing research is a systematic and scientific process of investigating questions and issues related to nursing practice, health care, and the promotion of health. The goal of nursing research is to generate new knowledge, validate existing knowledge, and provide evidence-based solutions to nursing problems that can improve the quality of patient care. Nursing research involves the collection and analysis of data using various research methods and tools to test hypotheses, answer questions, and draw conclusions. The findings of nursing research can be used to improve nursing practice, guide health care decision-making, and to inform policy and legislation makers related to health care. Ultimately, nursing research aims to advance the nursing profession and improve the health and well-being of individuals and communities.

Nursing research is a systematic and scientific process of investigation aimed at expanding knowledge and improving nursing practice.

—International Council of Nurses

Nursing research is a systematic inquiry designed to develop knowledge about issues of concern to nurses and the nursing profession.

—Polit and Hungler

Nursing research a scientific process that validates and refines existing knowledge and generates new knowledge that directly and indirectly influences the clinical nursing practice.

—Burns and Grove

Nursing research is a systematic inquiry designed to develop knowledge relevant to nursing practice.

—Nola J Pender

Nursing research a systematic and rigorous process of inquiry aimed at expanding the understanding of human experiences and phenomena in the field of nursing.

—Marilynn J Wood

METHODS OF ACQUIRING KNOWLEDGE IN NURSING

One of the fundamental principles of categorizing nursing as a profession is that it has its own “Body of Knowledge”. Nursing is a profession that involves the development of body of knowledge related to nursing practice. It is a constantly evolving field and nurses acquire knowledge from both formal and informal methods. Nurses learn from experience, other health care professionals, and continuing education.



Nurses use different sources of information to make decisions about patient care and support their actions with evidence.

The methods of acquiring knowledge can be divided into two categories: Unstructured and structured methods. Unstructured methods are more informal and based on personal experiences, while structured methods are systematic and based on a structured process or method.

Unstructured Methods (Informal)

Unstructured methods of acquiring knowledge are informal ways of gaining information, such as traditions, personal experiences, authority, intuition, and trial and error. These methods may not follow a set of process or structure and can be based on individual understanding or perception.

- **Tradition:** This method of acquiring knowledge refers to the passing down of knowledge and practices from one generation to another, based on cultural and historical beliefs and values. Knowledge and the practices are passed down to the nurses from their seniors and become the basis of traditional understanding for them. These traditional practices can be communicated or passed on to others through *observed practices, role modelling, and written documents such as notes and books*. Tradition may involve using established practices or techniques that have been proven to be effective over time. However, it is important to critically evaluate traditional practices and consider new evidence-based research when making decisions in patient care. The use of tradition in nursing should be balanced with the use of evidence-based practices to ensure the best possible outcomes for patients.
- **Intuition:** Intuition is an unconscious and automatic mental process that guides a person's judgment and decision-making. It is often characterized by empathy and a gut feeling, without a clear rationale or explanation. Intuition can be a valuable source of knowledge building in nursing as it allows the nurse to draw on their personal experiences and understandings of situations, emotions and body language to inform their decisions and approach to care. However, it is important to note that intuition should not be relied on as the sole source of knowledge, as it may not always be based on evidence or rational thinking, and may also be influenced by personal biases or emotions.
- **Authority:** Authority refers to the person or group that is considered knowledgeable and trustworthy in a particular subject matter or field. In nursing, information and knowledge from authoritative sources such as expert nurses, physicians, and health care organizations can be used to inform clinical decision making and patient care. However, it is important to critically evaluate information from authority sources and consider all relevant evidence before making decisions in patient care, as information and recommendations may change over time and not always be the best course of action.
- **Personal experiences:** It involves acquiring knowledge, skills and insights through direct observation and participation in a situation or activity. Personal experience can play an important role in shaping attitudes, beliefs and values, and can also be a valuable source of information and learning. Nurses can gain knowledge and insights through their own hands-on experiences while working with patients and other health care professionals. Personal experience can provide practical and real-life perspectives that complement formal education and training. However, personal experience should not be relied upon as the sole source of knowledge, as it may not be scientifically sound and validated.
- **Trial and error:** It is a method of acquiring knowledge in which individuals experiment and make repeated attempts to solve a problem or find the solution to a question. The process involves trying different options, observing the results, and making adjustments until the desired outcome is achieved. An example of using trial and error as a method of acquiring knowledge in nursing could be trying

different strategies for managing a patient's pain, observing their response and making adjustments until the most effective approach is found. This method can be useful for understanding a problem, but it can be slow and has potential risks, so it should be used carefully, especially in nursing care as it involves potential risk to the patients.

Structured Methods (Formal/Scientific)

Structured methods of acquiring knowledge are systematic and organized processes used to gain information and understanding. These methods typically involve the use of research studies and evidence-based practices for building body of knowledge. The structured methods of acquiring knowledge include Logical Reasoning, Assembled Information, Problem-solving, and Scientific Methods.

- **Logical reasoning:** It is a structured method of acquiring knowledge in which arguments or conclusions are reached by applying systematic and rational thinking. It involves analyzing and evaluating information and evidence, making connections and deductions, and coming to well-supported conclusions. This method can be applied in nursing to make informed decisions and solve problems based on reason and evidence. Inductive reasoning and deductive reasoning are two forms of reasoning.
 1. **Inductive reasoning:** It is the logical thought process of drawing conclusion from a specific observation. It starts with specific observations and draws a conclusion based on general principles.
 2. **Deductive reasoning:** It is a logical thought process of reasoning from general to specific conclusion. It starts with a general principle and applies it to specific cases to arrive at a conclusion. This approach entails that there is a theory or knowledge in existence which will be tested through the research process.

Example for inductive versus deductive reasoning

Inductive Reasoning

Observation: Every time Ravi eats peanuts, he develops a rash on his skin.

Conclusion: Ravi has developed an allergy to peanuts.

In this example, the specific observation that Ravi develops a rash after eating peanuts leads to the general conclusion that he has developed an allergy to peanuts.

Deductive Reasoning

Premise 1: All mammals have lungs.

Premise 2: A horse is a mammal.

Conclusion: Therefore, a horse has lungs.

In this example, the general principle that all mammals have lungs (Premise 1) is applied to the specific case of a horse being a mammal (Premise 2) to reach the conclusion that a horse has lungs.

- **Problem-solving:** Problem-solving method of acquiring knowledge involves using critical thinking, creativity, and logical reasoning to identify and solve a problem. This method of acquiring knowledge is often used in situations where a person needs to find a solution to a complex or challenging issue. In nursing, problem-solving is an essential skill that is used on a daily basis to ensure that patients receive the best possible care. Some examples of problem-solving in nursing include formulating nursing diagnosis, responding to medical emergencies, and addressing patient safety concerns.
- **Assembled information:** It refers to a method of acquiring knowledge by gathering, organizing, and analyzing information from various sources. This method of acquiring knowledge involves collecting information from a range of sources, such as books, journals, online resources, and personal experiences,

and then organizing and synthesizing that information to form a comprehensive understanding of a particular topic.

- **Scientific methods/research:** Research is a systematic and structured process of investigating a specific topic or problem to gain new knowledge and insights. Knowledge acquired through research are most reliable, valid, and accurate. Research is an important method of acquiring knowledge because it allows us to test our assumptions, verify facts, and make informed decisions based on evidence.

PROBLEM-SOLVING

Problem-solving is the process of identifying, analyzing, and resolving a problem in a logical and systematic manner (Fig. 1.1). The research process and the problem-solving process have different purposes, processes and goals. Problem-solving is a simple process and targets a single problem of an individual or organization. The purpose is to find an immediate solution to a practical problem in an actual setting. However, the basic purpose of research goes far beyond solving the immediate problem. Research provides new knowledge that is systematically derived and is often capable of being generalized to a broader setting.

Steps of Problem-Solving Process

The steps of problem-solving process (Fig. 1.1) are described in Table 1.1 with a practical problem example, i.e., the nursing staff is facing a shortage of personal protective equipment (PPE).

SCIENTIFIC METHODS

The scientific method is a systematic and structured approach to acquiring and evaluating knowledge. It is widely used in the natural and social sciences, including nursing, to guide the development and testing of theories, evaluate interventions, and make decisions based on empirical evidence.

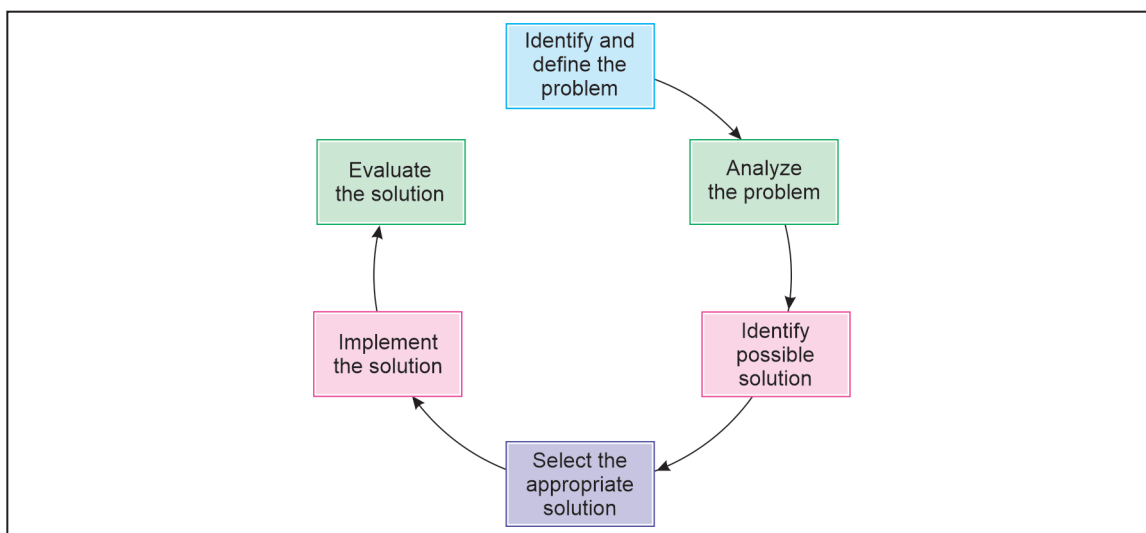


Figure 1.1: Steps of problem-solving process



Table 1.1 Steps of problem-solving process for nursing staff is facing a shortage of personal protective equipment

Step of problem-solving process	Description	Example
1. Identify and define the problem	The first step is to identify, define and clearly understand the problem that needs to be solved.	The nursing staff is facing a shortage of PPE. The identified problem is 'shortage of PPE that needs to be solved'.
2. Analyze the problem	Analyze the problem appropriately. It involves breaking down the problem into smaller, more manageable parts and examining each part in detail.	The nursing administrator conducts an inventory of the current PPE supply and reviews the hospital's budget and purchasing history. They also speak with other department heads to gather information about their PPE usage.
3. Identify possible solution	Brainstorm to generate the probable solutions to solve the problem. Creative and analytical thinking is required for the same. Write down all the solutions in the order of priority.	The nursing administrator considers various options, such as ordering additional PPE, reallocating PPE from other departments, or implementing a rationing system
4. Select the appropriate solution	Prioritize the ideas/solutions generated to solve the problem and select the most appropriate one to solve it. Before making a final decision, think about the objective of problem-solving.	The nursing administrator decides to order additional PPE and implement a rationing system until the new supplies arrive.
5. Implement the solution	Implement the most appropriate solution and monitor its effectiveness.	The nursing administrator places the PPE order and communicates the rationing system to the nursing staff.
6. Evaluate the solution	The last step is to evaluate the implemented solution. Reassess the problem to ensure the effectiveness of the selected solution. Whenever possible, brief the group and follow this up with written communication to ensure that everyone knows what is expected of them.	The nursing administrator assesses the effectiveness of the solution by monitoring the PPE supply and surveying the nursing staff for their feedback. If the shortage persists, repeat the problem-solving process with an alternate solution.

Characteristics of Scientific Methods

The characteristics of scientific methods are as follows:

- **Empiricism:** It is based on observable and measurable data that is gathered through systematic observation, experimentation, and testing.
- **Objectivity:** Scientific methods aim to be impartial, unbiased, and free from personal interpretations or opinions.
- **Hypothesis-driven:** Scientific methods start with a hypothesis or prediction of a phenomenon, which is then tested and revised as new evidence is gathered.

Table 1.2 Comparison of research process and problem-solving process

Characteristics	Research process	Problem-solving
Purpose	To acquire new knowledge and insights	To find a solution to a specific problem
Methodological approach	structured and systematic approach	Flexible and creative approach
Timeframe	Long-term process: Months to years	Short-term process: Days to weeks
Process	Begins with identifying the research problem and ends with analyzing the data to answer the research problem	The process begins with defining the problem and ends with implementing the identified strategies or solution
Data collection	Involves collection of data/information	Relies on personal experience, expert's opinions, and available data.
Analysis	Involves analysis of gathered data	Involves analysis of the problem itself
Steps	- Defining the research problem - Determining objectives - Formulating hypothesis - Reviewing the literature - Developing research methodology - Collecting data - Analyzing and interpreting data - Communicating the findings	- Identifying the problem - Analyzing the problem - Developing alternative solutions - Selecting the best solution - Implementing the solution - Following up the action taken
Scope	A research problem is more rigorous and broader in scope	A problem to be solved is less rigorous and less broad
Output	Development of theory, model, or answer to research questions	Remedial action plan that can often be generalized

- **Evidence-based:** Scientific methods use data and evidence to support hypotheses and theories.
- **Replicability:** Scientific methods are repeatable and testable, which allows other researchers to verify the results and build upon them.
- **Skepticism:** Scientific methods maintain a critical attitude toward claims and theories, subjecting them to rigorous testing and evaluation. It involves the systematic evaluation of evidence and arguments, with the aim of discovering and verifying the truth.
- **Progressive:** Scientific methods are self-correcting, allowing for the refinement and improvement of theories over time.

Refer to Table 1.2 to know about the comparative overview of research process and problem-solving process.

Steps of Scientific Methods

The steps of scientific methods typically include:

1. Observing a phenomenon or problem
2. Defining the objectives of the study
3. Reviewing the literature to gain insight about the problem
4. Define variables to be studied
5. Formulating a hypothesis to explain the phenomenon or problem.
6. Designing and conducting experiments to test the hypothesis.

7. Review for ethical considerations
8. Collecting the data
9. Analyzing and interpreting the data
10. Drawing conclusions based on the data and revising the hypothesis as needed.
11. Communicating the results and conclusions to others for peer review and further testing.

Limitations of Scientific Methods

Although scientific methods are considered a highly effective means of acquiring knowledge, there are certain limitations in using these approaches to address problems in the field of nursing, which include:

- **Ethics:** Nursing problems often involve ethical considerations, such as informed consent and patient confidentiality, that can limit the types of research that can be conducted.
- **Human factors:** Nursing problems often involve human factors, such as emotions and relationships, that can influence outcomes and make it challenging to control for variables in scientific research.
- **Subjectivity:** Nursing problems often involve subjective experiences, such as pain or emotional distress, that cannot be easily quantified or measured.
- **Complexity:** Nursing problems often involve multiple, interrelated factors that can make it challenging to determine cause and effect relationships.
- **Lack of standardization:** Nursing interventions and assessment tools can vary widely across different settings, making it difficult to compare and replicate research findings.
- **Time constraints:** Nursing practice often requires quick decisions and actions, which can limit the ability to gather and analyze data using scientific methods.

NEEDS AND PURPOSES FOR NURSING RESEARCH

Nursing practice based on solid evidence is essential to meet its mandate to society for effective and efficient patient care. The need for nursing research arises from the ever-changing and complex health care environment. Nursing research provides evidence-based information that helps improve the quality of patient care. The need for nursing research is essential for the continued growth and development of the nursing profession and for improving the quality of patient care. Evidence-based nursing research helps to ensure that patients receive the best possible care and improves patient outcomes.

Some key reasons for the need of nursing research include:

- **Gaining new knowledge:** This is acquired by an organized and logical process of inquiry during which data are methodically collected, analyzed and interpreted.
- **Improving patient outcomes:** Nursing research provides information about effective interventions and treatments that can improve patient outcomes.
- **Addressing health care challenges:** Nursing research helps to address complex and challenging health care issues, such as patient safety, quality of care, and patient satisfaction.
- **Evidence-based practice:** Nursing research provides evidence-based information that can be used to inform and improve clinical practice.
- **Advancing the nursing profession:** Nursing research helps to advance the nursing profession by providing new knowledge and insight into the practice of nursing. Nursing research contributes to the development and refinement of nursing theories.
- **Promoting interdisciplinary collaboration:** Nursing research promotes interdisciplinary collaboration and helps to bridge the gap between different health care professions.

IMPORTANCE AND SIGNIFICANCE OF NURSING RESEARCH

Nursing personnel provide services to the society in various health care organizations and settings. These services should be based on accurate knowledge and empirical evidences acquired through research. Significance of nursing research can be highlighted from the following facts:

- Knowledge acquisition is critical for the progress of any profession, and nursing research is a reliable, objective, and systematic means of obtaining knowledge.
- Nursing research is an important constituent of health care field. Research in nursing helps to recognize the recent advancement and trends in nursing practices.
- Nursing research gives credibility to the nursing profession by establishing a distinct body of knowledge.
- Nursing research aids in the implementation of new changes in patient care.
- It focuses on developing new interventions for the prevention as well as for the treatment of disease.
- It helps in developing standards and protocols, in order to provide quality care to the patients.
- Nursing research provides the best possible care based on the best available evidences.
- Researchers can develop skills in advanced data analysis techniques in nursing research.
- Nursing research provides accountability to nursing practice. The general public is becoming more knowledgeable of their health related interventions.
- Nursing research enhances accountability in nursing practice as the public becomes more informed about their health interventions and has increased expectations of care from nurses.
- Effective nursing care based on research results can lead to shorter hospital stays, reducing health care costs.

HISTORICAL DEVELOPMENTS OF NURSING RESEARCH

Florence Nightingale's contribution to nursing research is significant and foundational. She was the first to apply a systematic and scientific approach to nursing, using data and statistics to improve patient outcomes. During the Crimean War in 1854, she collected and analyzed data on the mortality and morbidity rates of soldiers, leading to her conclusion that a clean and hygienic environment, proper diet, and good sanitation were crucial for patient recovery. Nightingale's innovative approach to nursing transformed the way care was provided and helped establish nursing as a distinct profession. She was also a strong advocate for education and professional development for nurses, emphasizing the importance of evidence-based practices and continuous learning. Her work laid the foundation for the development of nursing research and helped establish the field as an important contributor to the advancement of health care.

Initially, nurses were not ready to conduct research. Hence, many of the research studies were conducted by members of other disciplines. The evolution of nursing research went from Florence Nightingale's investigations in the 19th century to studies on nursing education in the 1930s and 1940s, and then to studies on nurses and their role in the 1950s and 1960s.

Development of Nursing Research in Western Countries

Certain historical events influencing research at international level have been enumerated in Table 1.3.

**Table 1.3** Historical events influencing research in nursing (International)

Years	Events
1850	Nightingale, first nurse researcher and the statistician
1859	The first ever published nursing research "Notes on Nursing" by Florence Nightingale
1900	First American Journal of Nursing published
1920	First case study published in American Journal of Nursing
1923	Teachers College at Columbia University offered the first educational doctoral program for nurses
1929	First Master's in nursing Degree offered at Yale University
1936	Sigma Theta Tau, National Honour Society for Nursing, started funding nursing research
1950	American Nurses Association (ANA) study of nursing functions and came into being
1952	The first issue of 'Nursing Research' journal was published
1953	Institute of Research and Service in Nursing Education was established
1955	American Nurses Foundation established to fund nursing research
1963	First issue of International Journal of Nursing Studies published
1965	ANA sponsored first nursing research conference
1967	First issue of Image (Sigma Theta Tau Journal) was published, now entitled as 'The Journal of Nursing Scholarship'
1970	The National Commission for the study of nursing and nursing education, funded by ANA published its findings
1972	ANA Council of Nurse Researchers established
1976	The Commission on Nursing Research of the ANA recommended that research preparation be included in undergraduate, graduate, and continuing education program
1978	The first issue of Research in Nursing and Health and Advances in Nursing Science was published
1979	The first issue of Western Journal of Nursing Research was published
1982–83	Conduct and Utilization of Research in Nursing (CURN) Project was published
1983	First issue of Annual review of Nursing Research was published
1986	National Center for Nursing Research (NCNR) was established within the National Institute of Health (NIH)
1987	First Scholarly Inquiry for Nursing Practice was published
1988	First issue of Applied Nursing Research was published First issue of Nursing Science Quarterly was published
1989	Agency for Health care Policy and Research (AHCPR) was established Clinical practice guidelines were first published by the AHCPR
1992	Healthy People by 2000 was published by US Department of Health and Human Services The first issue of Clinical Nursing Research was published
1993	NCNR was renamed as the National Institute of Nursing Research (NINR) First Journal of Nursing Measurement was published
1994	The first issue of Qualitative Research Journal was published
1999	The first issue of 'Biological Research for Nursing' was published AHCPR was renamed as Agency for Health care Research and Quality (AHRQ)
2000	Healthy People 2010 was published by US Department of Health and Human Services First Biological Research for Nursing was published
2004	The first issue of worldviews on Evidence-Based Nursing journal was published

Contd...

Years	Events
2005	NINR identified mission and funding priorities for 2000 to 2005
2005	AHRQ identified mission and funding priorities
2008	Courtney Lyder becomes the first male minority dean of a nursing school in the United States
2009	Carnegie Foundation releases the results of its study of nursing education, "Educating Nurses: A Call for Radical Transformation"
2010	Institute for the Future of Nursing (IFN) releases evidence-based recommendations to lead change for improved health care
2010	A national registration for all nurses and midwives came into force in Australia in July
2011	National Institute of Nursing Research (NINR) released its new strategic plan (Bringing Science to Life) which detailed NINR's strategic priorities for the next five years and beyond
2014	NINR launched Palliative Care: Conversations matter, an evidence-based communications campaign to increase awareness of and improve communications around pediatric palliative care
2016	Three schools of nursing in the West were ranked in the top ten for NIH funding
2017	NINR released 'Milestones in NINR history which included significant accomplishments, discoveries, and initiatives over NINR's 30-year history
2019	NINR added a women's health page to its website that highlights research, both conducted at and funded by NINR. It explains how nursing research informs women's health and demonstrates how NINR helps to advance the careers of women scientists

Development of Nursing Research in India

As already stated about nursing research, in India also, it has its roots in the philosophy of Florence Nightingale. Many Indian eminent nursing leaders had made tremendous contributions in the development and to uplift nursing research to greater heights. Major milestones in the history of nursing research in India are enumerated in Table 1.4.

Table 1.4 Historical events influencing research in nursing in India

Years	Events
1910	The Trained Nurses' Association of India (TNAI) published the Nursing Journal of India for the first time.
1946	- Bhore Committee in its report recommended for the improvement of various aspects of nursing profession including nursing education, nursing research, working conditions, nursing services both in hospitals and the community settings and also sending the nurses for higher education - Following this, nurses from India were sent to Columbia University to attain qualification in research
1953	In 1953, Ms Edith Buchanan, Vice Principal, Raj Kumari Amrit Kaur (RAK) College of Nursing, New Delhi, was sent to Columbia University for Doctorate in Education under World Health Organization (WHO) fellowship program
1955	Ms Margaretta Craig, Principal, College of Nursing, New Delhi (Now RAK college) attended International Council of Nurses (ICN) meet in France to present a paper on the need for nursing research in India
1959	TNAI established a Standing Committee for Nursing Research with Miss M Craig as a Chairperson

Contd...

Years	Events
1960	- Two years master degree program in nursing was started by RAK College of Nursing, New Delhi and at College of Nursing, Christian Medical College, Vellore. - The master degree program included nursing research as a full subject with a thesis work on some nursing topics
1963	- Indian Nursing Council (INC) conducted a study on health services in India to revise syllabus of General Nursing and Midwifery (GNM) program - The study provided valuable insights into the trends in the health services and implications for nursing
1964	- Dr Marie Ferguson, a Public Health Nurse, joined RAK College of Nursing, New Delhi - Dr Ferguson along with her team conducted a study to define nursing and non-nursing functions of nurses in selected health institutions of India - Understanding and value of research in nursing for nursing practices, administration, and education was generated
1966	- Trained Nurses' Association of India (TNAI) conducted a 'Time Utilization Study' with the help of Ms Anna Gupta, principal, RAK, CON, New Delhi, under the able guidance of Dr Sulochana Krishnan - TNAI also established a research section under the guidance of Ms Margaretta Craig
1971	TNAI conducted a study on the socioeconomic status of nurses in India
1976	A seminar on nursing research for educationists was conducted at Delhi, Mussoorie (Uttarakhand) and Yercaud (Tamil Nadu) by Dr Marie Farrell and Dr Aparna Bhaduri of RAK College of Nursing, New Delhi to strengthen the nursing research in India
1978–80	A series of articles on nursing research were published by Dr Aparna Bhaduri and Dr Marie Farrel in Nursing Journal of India
1981	Dr Farrell and Dr Bhaduri authored a book on 'Health Research: A Community Based Approach'. It was published by the WHO
1982	First national conference titled 'Nursing Research in India: Prospect and Retrospect' was organized at College of Nursing, Bengaluru. It was recommended that: - Each college of nursing should have a research cell - The nursing students should be encouraged and provided time for conducting research - Central and state governments and private organizations should include nursing research in their budget - Opportunities should be provided for faculty to visit foreign countries on short-term basis to learn about research - Efforts should be taken to establish collaborative activities in the area of research and scholastic interactions with the nursing colleges in other countries
1984	University Grants Commission sponsored a nursing research workshop on 'Teaching Nursing Research to Nursing College Teachers' for all the teachers of India at Bengaluru
1986	- The Nursing Research Society of India (NRSI) was established to promote research related to nursing. The society is very regular in organizing research conferences every year till date - MPhil program for nurses was started at RAK. - PhD in nursing was started in College of Nursing, PGIMER, under Punjab University, Chandigarh. It was later discontinued because of certain unavoidable circumstances - Manipal College of Nursing, Manipal and Shri Ramchandran College of Nursing, Chennai, also started PhD Nursing programs
2002	Indian Nursing Council included nursing research as a full subject in the revised syllabus of General Nursing and Midwifery Course (revised, 2002) and Post-Basic BSc Nursing (revised, 2005)

Contd...

Years	Events
2005	National Institute of Nursing Education, PGIMER, Chandigarh published an exclusive research-based journal titled Nursing and Midwifery Research Journal and is being published quarterly till date
2005	Indian Nursing Council in collaboration with Rajiv Gandhi University of Health Sciences, Bengaluru initiated PhD degree program in nursing. Six centers were designated as study centers, i.e., College of Nursing, NIMHANS, Bangalore; RAK College of Nursing, New Delhi; CMC College of Nursing, Vellore; CMC College of Nursing, Ludhiana; Government College of Nursing, Thiruvananthapuram; and Government College of Nursing, Hyderabad. These centers are connected by video-conferencing facilities to impart the education
2009	Central Institute of Nursing and Research (CIN) came into existence under the supervision of Trained Nurses Association of India, New Delhi
2009	Indira Gandhi National Open University (IGNOU) also started PhD in Nursing
2010	Faculty of Nursing Sciences, Baba Farid University of Health Sciences, Faridkot, Punjab, started PhD in Nursing
2010	First research project sponsored by Department of Science and Technology (DST) and Indian Council of Medical Research (ICMR) was started at National Institute of Nursing Education, PGIMER, Chandigarh
2012	First research project sponsored by Department of Biotechnology (DBT) was started at National Institute of Nursing Education, PGIMER, Chandigarh
2014	Started PhD at National Institute of Nursing Education, PGIMER, Chandigarh
2015	Nursing Research Society of India (NRSI) started Post-Doctoral Fellowship to promote research in the field of Nursing
2020	Nurses played a significant role in caring for patients during the COVID-19 pandemic, highlighting the importance of nursing research in improving health care outcomes.
2021	The use of Artificial Intelligence (AI) in nursing research gained prominence, including the use of machine learning algorithms to predict patient outcomes, identifying potential health risks, and improving nursing practices.
2023	Clinical Nursing Research Society of India (CNRS)-North Zone initiated Annual All India Nursing Research Award Program for Nursing students to encourage nursing researches by PhD, PG and UG Nursing students in India.

Rapid development of nursing research has been seen in India over the last decade. Focus is placed on the development of evidence-based practices with a strong emphasis on systematic reviews. Conferences and workshops on nursing research are regularly held. Indian nurses have started and contributed as editors of popular national and international journals, providing a platform for nursing researchers to publish their work.

CHARACTERISTICS OF GOOD RESEARCH

Certain characteristics have been attributed to nursing research. These are discussed as follows:

- **Empirical:** Research is a systematic and critical investigation of phenomenon of interest. Empirical research is based on measurements that can be accurately and precisely obtained. Quantitative research is based on numerical data and is easier to scientifically prove. Qualitative research, on the other hand, is based on people's opinions and experiences, making it more susceptible to bias.
- **Credible:** Credibility in research requires a believable and trustworthy source of information and the use of best practices. Secondary data may save time, but its reliability is questionable as it may have been



manipulated and is therefore less credible for use in research. Using only secondary data when primary data can be collected is not considered credible.

- **Analytical:** Research is conducted to find out answers to the pertinent questions and to solve the problems. Regardless of the type of study (historical, descriptive, experimental or case study), a systematic and analytical approach is used to gather data. The data is collected using the five human senses (sight, sound, smell, taste, and touch) either directly or indirectly.
- **Critical:** A critical approach in research means being able to evaluate information objectively, using logical and systematic reasoning to assess its validity, reliability, and significance. This requires accurate observations, objective analysis and interpretation, and description of the collected data.
- **Methodical:** Research is conducted methodically without any bias using logical method and procedures. It includes identification of a problem to be investigated; carefully designing the measurements and procedures; collection and logical analysis of the data; and formulation of conclusions regarding the problem being investigated. Methodical approach is essential for research. Each step should follow a logical sequence. Research requires patience and unhurried activity.
- **Generalizable:** Generalizability refers to the ability of the results from a research study to be applied to a larger group or population. This means that the findings from a smaller sample should accurately reflect the characteristics of the larger population. By generalizing the results, researchers can make conclusions that go beyond just the sample they studied and apply the results to a broader group or population.
- **Reliable:** Reliability refers to the consistency of results from a research study, instrument, tool, or procedure. If the same study is repeated multiple times with the same population and methods, and it produces similar results, then it is considered to be reliable. For example, if a study finds that parental separation negatively affects a child's academic performance, the reliability of the study would be high if the same result is found in another sample taken from a similar population. Reliability is also used to describe the accuracy of research instruments, such as surveys or tests. Using valid and reliable measures help to ensure the quality of patient care.
- **Expertise:** The researcher must be adequately prepared and trained to undertake the activity of research.

QUALITIES OF A GOOD RESEARCHER

Research has become an integral part of various disciplines. In Nursing education, even at the diploma level, students are introduced to the basics of research through classroom teaching. However, to carry out a reliable and meaningful study, a person must meet certain minimum requirements.

- **Research-oriented:** Researchers should have an open mind and critical thinking approach to identify and solve research problems.
- **Competent:** Researchers should be dedicated, hard-working, and knowledgeable in the nursing research process.
- **Focused:** Researchers should have a clear vision, stable thinking, and integrity in their work.
- **Resourceful:** Researchers must be resourceful, inventive and creative. They should have an ability to transform their research question into a reliable protocol.
- **Honest:** They must be accurate and honest at all levels of research process. Misinterpretation or falsification of data may have very serious consequences. These may deprive patients of the correct diagnosis and the appropriate treatment. The researcher must take care of plagiarism while writing.
- **Knowledgeable:** Researchers should have a thorough understanding of their field of investigation and basic statistical principles.



- **Team spirit:** Research usually requires the contribution of more than one person. Research often requires collaboration, so researchers should have strong teamwork skills.
- **Verbal and written communication competency:** An important step of conducting research is dissemination of findings. Effective communication of research findings, through writing and presentations, is crucial and requires strong verbal and written communication skills.

TYPES OF RESEARCH

Research can be classified either based on its approach (quantitative or qualitative) or based on the purpose of conducting research (basic or applied research). The detailed classification and explanation of the types and designs are discussed in the Chapter 8.

Based on Approach

- **Quantitative research:** This type of research involves collecting numerical data and using statistical methods to analyze it. The focus is on testing hypotheses and generating generalizable findings.

Example

A study to determine the effectiveness of a new pain management protocol on postoperative pain in surgical patients. The researcher would collect numerical data on the pain scores of patients before and after the intervention, and analyze the data using statistical methods to determine the effectiveness of the new protocol.

- **Qualitative research:** This type of research focuses on understanding the experiences, perspectives, and views of individuals. It involves collecting non-numerical data, such as interviews, observations, and focus groups, and using interpretive and inductive methods to analyze it.

Example

A study to explore the experiences and perceptions of cancer patients regarding their pain management. The researcher would collect non-numerical data through in-depth interviews, observations or focus groups, and use interpretive methods to analyze the data to gain an understanding of the patients' experiences and perceptions.

- **Mixed methods research:** This type of research combines both quantitative and qualitative methods, using both numerical and non-numerical data. The aim is to combine the strengths of both approaches to provide a more comprehensive understanding of the research problem.

Example

A study to examine the effectiveness of a new nursing intervention on reducing anxiety in patients undergoing surgery. The researcher would collect both numerical data, such as anxiety scores on a standardized scale, and non-numerical data, such as patient interviews or focus groups, to provide a more comprehensive understanding of the intervention's effectiveness and to gain a deeper understanding of patients' experiences and perceptions.

Based on Purpose

- **Basic research:** Basic research, also known as pure or fundamental research, is a type of research that aims to increase understanding of a phenomenon, without immediate practical applications. In the field of nursing, basic research may be conducted to gain a better understanding of a particular health condition or disease process, or to explore the underlying mechanisms of a nursing intervention.

Example

A basic research study in nursing could involve investigating the physiological and psychological changes that occur in patients with depression. The study could collect data on patients' brain activity, hormone levels, and symptoms of depression, and then use statistical methods to analyze the data. The goal of the study would be to increase our understanding of the underlying causes of depression, and to identify potential targets for future interventions.

- **Applied research:** It is a type of research that is focused on solving practical problems and improving the quality of life. In nursing, applied research is conducted to improve the health outcomes of patients, enhance the quality of care, and improve the overall functioning of the health care system.

Example

A nursing researcher may conduct a study to investigate the effectiveness of a new pain management protocol for postoperative patients. This type of research aims to address a specific, practical problem and determine the best solution to improve patient outcomes. In this study, the researcher would collect numerical data (such as patient pain scores) and use statistical methods to analyze the data, with the goal of informing the implementation of the new pain management protocol in clinical practice.

- **Translational research:** It refers to the process of converting basic scientific findings into practical applications for health care and clinical settings.

Example

A study to investigate the effectiveness and safety of the negative pressure wound therapy (NPWT) device for treating wounds in patients with diabetes. The NPWT device is developed through basic research. The goal of the applied research would be to determine the best practices for using the negative pressure wound therapy device in a clinical setting and to provide evidence to support its use in wound care for patients with diabetes. The findings from this study could then be used to guide clinical practice and improve patient outcomes.

SCOPE AND AREAS OF NURSING RESEARCH

The scope of nursing research is extensive and encompasses various aspects of the nursing field. It seeks to answer questions and address problems related to nursing practice, including prevention, treatment, and rehabilitation. Additionally, nursing research also covers the preparation of nursing personnel and practitioners. Furthermore, it covers the challenges faced by nurses in their day-to-day practice, education, and administration. Overall, nursing research aims to contribute to the advancement of the nursing profession and improve patient care. The scope of nursing research in different areas of nursing are described below.

Nursing Practice

The scope of research in clinical nursing practice is broad and includes a wide range of topics and issues related to patient care and outcomes. The goal of clinical nursing research is to improve patient care and outcomes, enhance the body of knowledge, and inform health care policies and practices. It includes studies on patient diagnosis, treatment and management, assessment of health outcomes, patient education and satisfaction, nursing interventions, and the development and evaluation of new treatments and technologies. Clinical nursing research also explores the effectiveness of different nursing interventions and strategies for improving patient outcomes, as well as the impact of various health care systems, policies, and procedures on patient care. Additionally, it includes studies on the experiences of patients and families, as well as the

experiences of nursing staff, and their role in the health care delivery system. The goal of clinical nursing research is to improve patient care and outcomes, enhance the nursing profession, and inform health care policies and practices.

Here are some common areas of research in the field of nursing practice which are as follows:

- Patient safety and quality care delivery
- Promotion, prevention, and restoration of health
- Developing and testing new nursing interventions
- Development and implementation of clinical practices
- Patient education and self-management
- Palliative and end-of-life care
- Mental health and wellness
- Chronic illness management
- Use of advanced technologies in nursing practice

Nursing Education

Nursing research in education aims to improve teaching and learning processes through evaluating the effectiveness of various teaching methods and technologies. The advancements in technology over the period of time have led to the emergence of new and innovative teaching methods, the effectiveness of which can be compared to traditional methods.

In order to produce a well-educated and efficient team of nursing educators and researchers, it is crucial to develop and implement innovative models of nursing education. This will ensure that the nursing profession continues to evolve and meet the changing demands of society. In the Indian context, these efforts are necessary to meet the growing needs of the public and produce a highly skilled team of nursing professionals. The development of new models of nursing education should be given top priority along with the assessment of clinical competence to ensure the continued advancement of nursing research in India.

Nursing Administration and Management

Nursing administration is an important area in the field of nursing and there are many challenges, issues and problems that require solution through research. Some common areas of research in nursing administration include:

- **Quality improvement:** Research focuses on improving the quality of care and patient outcomes through the implementation of evidence-based practices, continuous quality improvement initiatives, and data-driven decision-making.
- **Staff management/workforce management:** This area of research focuses on issues related to staffing, scheduling, and productivity, including the recruitment and retention of nurses and other health care professionals.
- **Financial management:** Research focuses on financial management and cost containment, including issues related to budgeting, billing and reimbursement, and the effective use of resources.
- **Patient satisfaction:** Research focuses on evaluating patient satisfaction with care and the health care experience.
- **Health information technology:** Research focuses on the use of technology in nursing administration, including the implementation and use of electronic health records, telehealth, and other digital health tools.



- **Organizational culture:** Research focuses on the culture of health care organizations, including issues related to leadership, teamwork, and workplace culture, and the impact of these factors on patient outcomes and quality of care.
- **Regulatory compliance:** Research focuses on the compliance of health care organizations with regulatory requirements, including issues related to patient privacy and confidentiality, as well as state and federal regulations.

GAPS AND CHALLENGES IN NURSING RESEARCH

Nursing research plays a crucial role in improving patient care and advancing the nursing profession. By conducting research studies, nurses can gather valuable information and make discoveries that can have a positive impact on health care and the lives of patients. Although there has been a growing focus on nursing research in recent years, India still lags behind the developed countries in terms of the level of research conducted and its impact. However, the increasing emphasis on research in nursing programs and clinical settings is a positive step forward and suggests that the quality and quantity of nursing research will continue to improve in the future.

Nurses are the backbone of the health care system, as they are often the first line of care for patients. In addition to performing routine tasks such as monitoring vital signs and administering medication, they have the potential to make significant contributions to improving health care and reducing health disparities. Nurses are well-positioned to drive change in the nursing profession and improve nursing practices. Despite this, there has been a persistent challenge in connecting nursing research with clinical practice.

Barriers in Conducting Nursing Research

A number of barriers have been identified that prevent them from conducting, participating or implementing the research. Some of these barriers are as follows:

- **Deficient knowledge and training regarding research:** Nurses who lack training and knowledge in research methods may be less likely to participate in research and may be intimidated by the process. They may not be familiar with research designs, statistical analysis, and ethical considerations in research.
- **Misconceptions regarding research:** Some nurses may view research as a complex, time-consuming process that is not relevant to their practice. They may believe that research is only for academicians and not for practicing nurses.
- **Negative attitudes toward research:** Some nurses may hold a negative view of research because of prior negative experiences or misconceptions about the purpose of research. They may believe that research is not relevant to their practice or is a waste of time.
- **More patient workloads:** Nurses often have a heavy workload and are expected to provide care for multiple patients at the same time. They may find it difficult to take time out for conducting research or to prioritize research amidst their other responsibilities.
- **Lack of administrative/organizational support:** Nursing research may not be a priority for health care organizations and hospitals. They may not allocate resources or provide support for nurses to conduct research, leading to barriers in conducting research.
- **Lack of ability to change traditional practices:** Traditional nursing practices may be resistant to change. Nurses may find it difficult to challenge established beliefs and practices, even if the research supports a different approach.

- **Considering research not a priority:** Nurses may view research as a low priority in comparison to the more immediate needs of patient care.
- **No incentive for the researcher:** In some cases, there may not be any financial or professional incentives for nurses who participate in research. This may discourage nurses from participating in research.

CONCEPT OF EVIDENCE-BASED PRACTICE

Evidence-based practice (EBP) is an approach to health care that uses the best available evidence to inform decision-making about patient care. This approach involves integrating clinical expertise, patient values, and the best available research evidence to make decisions about patient care. EBP is a systematic approach to clinical decision-making that involves critically appraising and synthesizing the best available research evidence with clinical expertise and patient preferences. The goal of EBP is to provide patients with the most effective and efficient treatments and care, based on the best available evidence.

Nursing research is essential to generate scientific knowledge for use in clinical practice. One of the major goals of nursing research is to provide evidence-based nursing care. The nursing care based on sound scientific research and best available evidence is the most favorable approach for ensuring quality care for the patients. EBP is rapidly evolving in all health care disciplines in the developed countries.

Definitions and Meaning of Evidence-Based Practice

Evidence-based practice is “the conduct of health care according to the principle that all interventions should be based on the best currently available scientific evidence” (Shorten A, 1997). **Evidence-based nursing (EBN)** is a type of evidence-based health care. It involves identifying solid research findings and implementing them in nursing practices. Evidence-based nursing is an integration of the best evidence available, nursing expertise, and the values and preferences of the individuals, families and communities who are served.

Evidence-based nursing is the “conscientious, explicit and judicious use of theory-derived, research-based information in making decisions about care delivery to individuals or groups of patients and in consideration of individual needs and preferences.”

—Ingersoll G, 2000

Evidence-based nursing is “an ongoing process by which evidence, nursing theory and the practitioners’ clinical expertise are critically evaluated and considered, in conjunction with patient involvement, to provide delivery of optimum nursing care for the individual.”

—Scott K, 2009

Evidence-Based Practice versus Research Utilization

Health care providers can often confuse EBP with research utilization, even though they are related but distinct concepts in nursing. EBP refers to the process of using the best available evidence, along with clinical expertise and patient preferences, to guide clinical decision-making and improve patient outcomes. Research utilization, on the other hand, refers specifically to the process of using research findings in clinical practice. Figure 1.2 and Table 1.5 illustrate the difference between EBP pathway and research utilization pathway.

Needs and Purposes of Evidence-Based Practice in Nursing

Evidence-based practice in nursing is aimed at improving patient outcomes, enhancing the quality of care, increasing patient satisfaction, reducing health care costs, and advancing the nursing profession.

- **Improve patient outcomes:** EBP is designed to help nurses provide the most effective and appropriate care to their patients, based on the best available evidence. By using evidence-based interventions, nurses

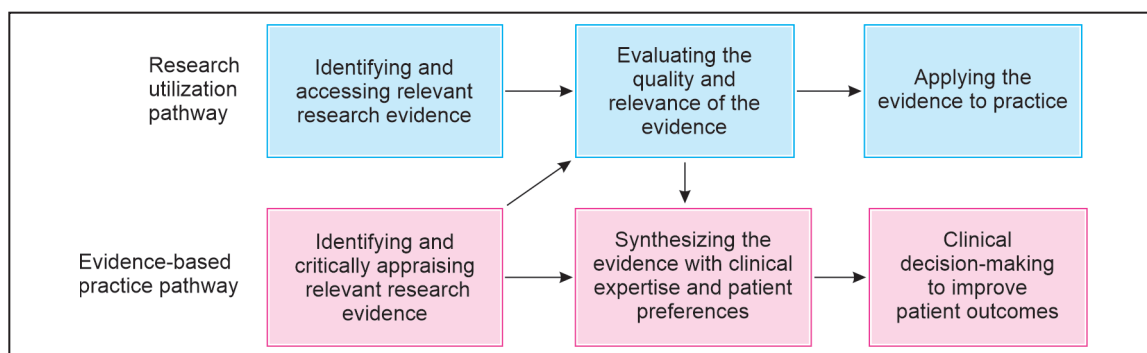


Figure 1.2: The differences of evidence-based practice pathway and research utilization pathway

Table 1.5 Differences between evidence-based practice and research utilization pathway

Criteria	Evidence-based practice (EBP)	Research utilization
Definition	A process of using the best available evidence, along with clinical expertise and patient preferences, to guide clinical decision-making and improve patient outcomes.	A process of using research findings in clinical practice.
Focus	Broad decision-making process that integrates research evidence with clinical expertise and patient preferences.	Specific process of applying research evidence in practice.
Components	Best available evidence, clinical expertise, and patient preferences.	Research evidence only.
Purpose	Improve patient outcomes by providing the most effective and appropriate care.	Incorporate research findings into practice.
Outcome	Improved patient outcomes and quality of care.	Integration of research evidence into practice.
Applicability	Applicable to all areas of nursing practice.	Applicable to research findings only.

can improve patient outcomes, such as reducing complications, improving quality of life, and enhancing overall health and well-being.

- **Enhance quality of care:** EBP helps to ensure that nurses are providing the highest quality care possible by using the most up-to-date and accurate evidence to inform their clinical decisions. This can lead to improved safety, effectiveness, and efficiency in health care delivery.
- **Increase patient satisfaction:** EBP emphasizes the importance of patient-centered care, taking into account patient preferences, values, and beliefs. By involving patients in their own care decisions, nurses can improve patient satisfaction and overall health care experience.
- **Reduce health care costs:** By using evidence-based interventions, nurses can optimize health care resources, reduce waste, and minimize unnecessary treatments and procedures. This can lead to cost savings for patients, health care organizations, and the health care system as a whole.
- **Advance the nursing profession:** EBP promotes the use of scientific evidence to guide nursing practice, which can enhance the credibility and legitimacy of the nursing profession. By continually updating their knowledge and skills, nurses can contribute to the ongoing development and refinement of evidence-based nursing practice.

By using the best available evidence to inform their clinical decisions, nurses can provide the most effective and appropriate care to their patients, improved patient safety, effectiveness, and efficiency, and optimize health care resources.

The eventual aim of EBP is to provide the patient with the highest quality and most cost-effective nursing care to patients. EBP is increasingly being recognized as an essential component of health care, and health care organizations are increasingly implementing EBP frameworks and processes to ensure that their clinical decisions are evidence-based. Hence, it is essential for health care providers to have the skill to provide evidence-based care to their patients.

Steps of Process of Evidence-Based Practice

The process of evidence-based practice (EBP) starts with cultivating a spirit of inquiry, which is essential for nurses to question and seek out the best evidence to inform their clinical decision-making. Evidence-based practice (EBP) involves a series of distinct steps as describe below:

Step 1—Asking a clinical question: Asking a clinical question is the first step in the evidence-based practice process. It involves identifying a clinical problem or issue and formulating a focused and answerable question. Clinical questions can arise from various sources such as patient care issues, health care provider's experience, current guidelines and protocols or gaps in the existing literature.

The question should be structured using a well-defined framework, such as the Patient/Problem, Intervention, Comparison, and Outcome (PICO) format, to ensure that it is clear and concise. PICO is a framework used for developing a clinical question in evidence-based practice.

For example:

Problem question: Does the use of hand hygiene education for patients and health care workers decrease hospital-acquired infections (HAIs) in adult intensive care units (ICUs)?

P: Adult patients and health care workers in ICU

I: Hand hygiene education

C: Hand hygiene education vs No education or other types of education

O: Decrease in HAIs

The question should also be relevant to the clinical context and the available evidence. Asking a well-formulated question is essential for conducting a thorough and effective literature search, which is the next step in the evidence-based practice process.

Step 2—Review of the literature for relevant evidences: After formulating the clinical question, the next crucial step is to search, review and gather research evidence. It is essential to search for high quality and high-level evidence, such as randomized controlled trials (RCTs), systematic reviews, and meta-analyzes. These types of evidence are considered the most reliable in providing conclusive answers to clinical questions.

During the review process, it is necessary to rigorously analyze and synthesize the results from independent quantitative and qualitative studies. This integrative review helps in determining the current knowledge for the chosen research question and locating the most relevant facts to answer it.

It is important to search for reliable sources of evidence, such as Cochrane reviews, MEDLINE, CINAHL, PsycINFO, ERIC, etc. These sources provide access to a vast pool of literature, and using the PICO format to identify keywords or phrases can aid in finding relevant articles in various research databases.

When conducting a literature review for EBP, it is important to consider the correctness of the evidence. In rapidly changing health care field, newer studies may provide more relevant and accurate information. It is recommended to limit the search to studies published within the last 5 years unless a specific older study is of particular relevance.

Hierarchy of Evidence

Levels of evidence in descending order from the highest level of evidence to the lowest (Fig. 1.3).

Level I: Evidence from systematic reviews or meta-analyses of randomized controlled trials (RCTs) or evidence-based clinical practice guidelines based on systematic reviews of RCTs

Level II: Evidence from single randomized controlled trials (RCTs) or randomized clinical trials.

Level III: Evidence from nonrandomized controlled trials/Quasi experimental research

Level IV: Evidence from case-control studies and cohort studies

Level V: Evidence from systematic reviews of descriptive and qualitative studies

Level VI: Evidence from a single descriptive or qualitative study.

Level VII: Expert opinion, reports of expert committees or consensus statements

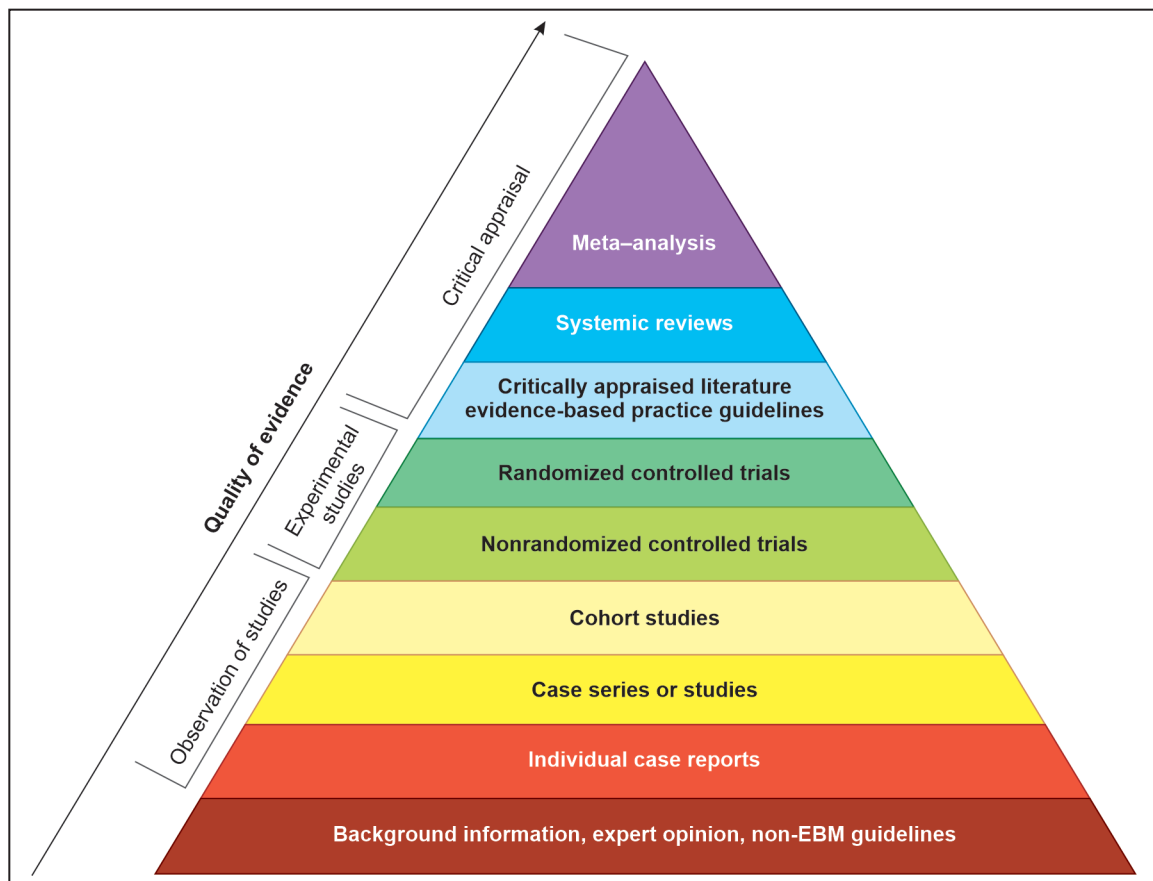


Figure 1.3: Hierarchy of evidence pyramid

Source: The above image is based on the EBM Page Generator (2006) from Dartmouth College and Yale University and the Coursera MOOC "Understanding Clinical Research: Behind the Statistics" (2016).

Step 3—Critical appraisal of the evidence: The next step is to critically evaluate the evidence found in the literature search to determine their validity, reliability, and applicability to the clinical question. It involves evaluating the worthiness of the research by assessing its authenticity, results, and applicability.

Authenticity includes whether the research methodology was accurate, appropriate, and adequate.

Results of the study assess whether the intervention worked and its impact on outcome variables.

Applicability assesses the feasibility, cost-effectiveness, and patient values and preferences.

After evaluating all the studies, the results are combined to make a decision if they have identical or related conclusions. Conducting a thorough critical appraisal of studies ensures that the best evidence is used in making clinical decisions.

Step 4—Combining the evidence with clinical expertise, patient preferences and values: Once the evidence has been appraised and synthesized, the next step in EBP is to combine it with clinical expertise, patient preferences, and values. This step involves integrating the available evidence with the nurses' own knowledge and skills to make informed clinical decisions that are tailored to the individual patient's unique circumstances, values, and preferences. Patient preferences and values are particularly important in EBP, as they provide insight into the patient's goals and expectations for their care, which can guide treatment decisions. For example, a study may suggest a particular treatment approach, but a nurse may need to consider the patient's cultural background, lifestyle, and personal values to determine whether the treatment is appropriate for that individual.

Step 5—Evaluating the outcome of the practice decision: The final step is to evaluate the outcomes of the recommended treatment or practice to determine its effectiveness and make adjustments as needed. After implementing EBP, it is important to monitor and evaluate any changes in outcomes, both in terms of process and outcomes. Evaluation data should be gathered over a period of 6–12 months to assess the effect of the intervention properly. The positive effects can be incorporated into practice, while negative outcomes can be reviewed to determine how to address them.

Steps of the process of EBP have been explained with an example clinical question in Table 1.6.

Table 1.6 Steps of process of evidence-based practice with an example

Steps	Example for "In patients with type 2 diabetes, does regular exercise improve glycemic control?"
Step 1: Asking a clinical question	What is the impact of regular exercise on glycemic control in patients with type II diabetes?
Step 2: Review of the literature for relevant evidences	- A search was conducted on PubMed, Cochrane Library, and CINAHL using keywords "type 2 diabetes", "exercise", and "glycemic control". - Several relevant studies were identified, including a randomized controlled trial, a meta-analysis, and a systematic review.
Step 3: Critical appraisal of the evidence	The identified studies were critically appraised for their quality, relevance, and applicability. The randomized controlled trial was found to be of high quality and directly relevant to the clinical question. The meta-analysis and systematic review were also of high quality and provided additional support for the effectiveness of exercise in improving glycemic control in patients with type II diabetes.
Step 4: Combining the evidence with clinical expertise, patient preferences and values	The evidence was combined with the clinical expertise of the health care team and the preferences and values of the patients to develop a plan for implementing regular exercise as a part of the treatment for type 2 diabetes. The plan was tailored to the individual patient's needs and goals.
Step 5: Evaluating the outcome of the practice decision	- The outcomes of the practice decision were monitored and evaluated over a period of 6 months. Patients who adhered to the exercise plan showed a significant improvement in glycemic control compared to those who did not exercise regularly. - The positive outcomes were incorporated into the practice and the exercise plan was modified for ongoing use.

Barriers in Evidence-Based Practice

Despite its potential benefits, there are several barriers that hinder the implementation of EBP in nursing and other health care disciplines. Barriers to EBP in nursing can hinder the implementation of best practices and lead to suboptimal patient care. These barriers can vary from individual factors such as lack of knowledge and skills, to organizational factors such as limited resources and lack of support from management. The barriers to implement evidence-based practice in nursing include:

- **Lack of knowledge:** A lack of knowledge or understanding about the research methodologies, benefits of EBP, how to find and evaluate evidence, and how to apply evidence to practice can be a significant barrier for nurses.
- **Resistance to change:** Resistance to change is a common barrier in health care settings and can prevent nurses from adopting new practices or approaches, even when evidence supports their effectiveness.
- **Limited access to research:** Limited access to research can make it difficult for nurses to find and evaluate the latest evidence-based practices. This can be due to a lack of resources, including time and funding, or limited access to relevant databases and journals.
- **Lack of time:** Time constraints can make it difficult for nurses to incorporate EBP into their practice. Nurses often have limited time for professional development or to review and apply research findings to their practice due to their workload.
- **Limited continuing education programs:** Limited availability or access to continuing education programs can prevent nurses from keeping up with the latest research and evidence-based practices.
- **Lack of resources:** A lack of resources, including staffing, technology, and funding, can hinder the implementation of evidence-based practices.
- **Organizational barriers:** Organizational barriers refer to factors within the health care system that may hinder the implementation of evidence-based practice. These include lack of support from management, lack of resources, conflicting priorities, and resistance to change. The culture of the organization, such as the attitudes and beliefs of staff toward EBP, also plays a significant role in determining its success.

Identifying and addressing these barriers is essential for promoting the use of evidence-based practices in nursing and improving patient outcomes.

SUMMARY

- **Meaning and definition of research:** Research is defined as a systematic and systematic process of collecting and analyzing information to expand knowledge and solve problems.
- **Methods of acquiring knowledge:** The chapter discussed structured and unstructured methods of acquiring knowledge.
- **Problem-solving:** Research is a systematic approach to problem-solving that involves identifying, defining, and solving problems.
- **Scientific methods:** The scientific method involves a systematic approach to solving problems and includes steps such as observation, hypothesis formation, experimentation, and data analysis.
- **Needs and purposes of research:** Research is conducted to expand knowledge, solve problems, and improve practice.
- **Importance and significance of nursing research:** Nursing research is important because it provides EBP, improves patient outcomes, and contributes to the advancement of the nursing profession.

- **Historical developments in nursing research:** The chapter discussed the evolution of nursing research, including early developments, the emergence of nursing as a profession, and the current state of nursing research nationally and internationally.
- **Characteristics of good research and qualities of a researcher:** Good research is characterized by its systematic and systematic approach, rigor, reliability, validity, and objectivity. A good researcher is characterized by qualities such as curiosity, critical thinking, integrity, and perseverance.
- **Types of research:** The chapter briefly described different types of research, including qualitative research, quantitative research, mixed methods research, and action research.
- **Scope of nursing research:** The scope of nursing research encompasses a wide range of topics, including patient care, health promotion, disease prevention, and the organization and delivery of health care services.
- **EBP in nursing:** The concept, purpose, steps of process of EBP, level of evidence and barriers of evidence.

ASSESS YOURSELF

Long Answer Questions

1. What do you mean by nursing research? Discuss it.
2. Research is much concerned with proper fact finding, analysis and evaluation. Do you agree with this statement? Give reasons in support of your answer.
3. Explain the purposes and goals for conducting nursing research with examples from nursing education, nursing service, and nursing administration.
4. Discuss the historical aspects of research in India.
5. Discuss the qualities of a good researcher.
6. How will you differentiate research process from problem-solving process? Discuss with an example.
7. Discuss the major steps of research process.

Short Answer Questions

1. Define all the key terms given at the beginning of the chapter.
2. Write a short note on the ethical aspects of research.
3. Write about various types of hypotheses.
4. Write a short note on scope of nursing research.
5. What are the characteristics of a good research?

Multiple Choice Questions

1. A nurse who reads research articles and incorporates research findings into clinical practice is a:
 - a. Consumer
 - b. Primary investigator
 - c. Co-investigator
 - d. Collaborator
2. Contribution of Florence Nightingale to nursing research is:
 - a. Case study approach
 - b. Conceptual Framework for research
 - c. Data collection and analysis
 - d. Qualitative research method
3. Feasibility of a research study is determined by examining:
 - a. Investigator's credibility
 - b. Availability of subjects
 - c. Importance of research problem
 - d. Previous research evidences



4. The most important contribution to research in health by Florence Nightingale was:
 - a. Development of nursing theory in Notes on Nursing.
 - b. Compilation of data on soldiers' morbidity and mortality.
 - c. Study of the best way to acquire provisions.
 - d. Experimenting with the wound care techniques.
5. Determine which of the following statement conveys the empirical nature of research:
 - a. The research is conducted in controlled situations.
 - b. Research has been carried out following meticulous steps.
 - c. The results of the research yielded favorable results.
 - d. The researcher was able to generalize the findings to a large group of population.
6. As a professional, a nurse can do research for varied reasons, except:
 - a. Professional advancement
 - b. To validate the results of new nursing modalities.
 - c. For financial gains
 - d. To improve nursing care
7. Who is the first nurse researcher?
 - a. Martha Rogers
 - b. Dorethea Orem
 - c. Florence Nightingale
 - d. Sr. Callista Roy
8. Which of the following is not the purpose of pilot study?
 - a. Tool refinement
 - b. Fine tune the data collection process
 - c. Help in sample size estimation
 - d. Drawing final inferences
9. Identify the correct sequence of data collection.
 - a. Contact, Inform, Consent, Collect
 - b. Contact, Consent, Inform, Collect
 - c. Inform, Contact, Consent, Collect
 - d. Contact, Inform, Collect, Consent

Answer Key

1. a 2. c 3. b 4. b 5. d 6. c 7. c
8. d 9. a

BIBLIOGRAPHY

- Abdellah FG, Levine E. *Better patient care through nursing research*. New York: Macmillan; 1965.
- Barnes Fred P. *Research for the practitioner in Education*. Washington DC. National Association of Elementary School Principles. NEA; 1964. p. 13.
- Benner, P. *From Novice to Expert: Excellence and Power in Clinical Nursing Practice*. Menlo Park, CA: Addison-Wesley; 1984.
- Broton D, Kumar S, Brown LP, et al. A randomized clinical trial of early hospital discharge and home follow-up of very-low-birth-weight infants. *NEJM*. 1986;315:934–9.
- Burnard P. *The sixth sense*. *Nursing Times*. 1985;85(50):52–3.
- Burns N, Grove S. *The Practice of Nursing Research: Conduct, Critique, and Utilization*. 4th ed. Philadelphia: W.B. Saunders Company; 2011.



Overview of Research Process

LEARNING OBJECTIVES

After the completion of the chapter, the readers will be able to:

- Define some common terminologies related to nursing research.
- Differentiate between quantitative and qualitative research process.
- Enumerate different phases and steps of quantitative research process.
- Explain different steps of qualitative research process.

CHAPTER OUTLINE

- Introduction
- Research Process
- Quantitative Research Process
- Qualitative Research Process
- Key Differences Between the Quantitative and Qualitative Research Process

KEY TERMS

Abstract: A concise summary of a research study. The structured abstract has been written under the headings Introduction, Methodology, Results and Discussion.

Accessible population: Refers to the group of individuals or objects who meets the inclusion criteria and are available and reachable for a researcher to study.

Assumptions: Assumptions refer to the underlying beliefs or viewpoints that the researcher holds about the research that may not necessarily be proven.

Conceptual framework: Conceptual framework is a visual or written representation of the problem being studied, the variables of interest, and the relationships between variables.

Confounding variables: Confounding variables independently affect both the independent and dependent variables. They influence the relationship between the independent and dependent variables, making it difficult to accurately measure the true cause-and-effect relationship.

Contd...



Control: Control refers to the steps taken by researchers to minimize or eliminate the effects of extraneous or confounding variables on the outcome of the study. Control can be achieved in several ways, including through the use of control groups, randomization, standardization of procedures and measures, and statistical techniques.

Data analysis: Refers to the process of systematically examining and interpreting data in order to extract meaningful insights and draw conclusions from the results.

Data: Data refers to the raw information that is collected and analyzed in a research study. Data can be quantitative or qualitative.

Delimitations: Delimitations are the boundaries set to the research study before commencing it. Delimitations can include factors such as the population or sample size, the geographical area or time period, research methods used or the measures being studied.

Dependent variable: Dependent variable is the outcome of interest that is affected by the changes in the independent variable. It is a variable that is measured or observed by the researcher to determine if it is affected by the independent variable.

Descriptive statistics: Descriptive statistics are used to summarize and describe the numerical data obtained from populations and samples.

External validity: Refers to the degree to which the results of a research study can be generalized to other populations, settings, and conditions beyond the study itself (outside the study).

Extraneous variables: Extraneous variables are variables that are not part of the study but may affect the outcome of an experiment. They produce an association between the independent and dependent variables that is untrue, meaning the variables are not causally related.

Independent variable: A variable that is manipulated or changed by the researcher to observe its effects on another variable.

Inferential statistics: It involves using sample data to make inferences or predictions about a larger population, using probability theory and statistical models.

Internal validity: Refers to the degree to which a research study accurately establishes a cause-and-effect relationship between the independent and dependent variables, while minimizing the influence of confounding variables.

Limitations: Weakness in a study that are not under control of the researcher. These are factors that may have affected the validity and reliability of the research findings.

Literature review: Literature review is a comprehensive and systematic examination of the available research literature on a specific topic or research problem.

Manipulation: Manipulation refers to the intentionally changing or controlling one or more independent variables in order to observe their effects on a dependent variable.

Manuscript: A manuscript refers to a written or typed document that presents the results and findings of a research study. It typically follows the format of introduction, methodology, results, discussion and conclusion.

Nonprobability sampling: A sampling technique in which individuals or objects are selected for inclusion in the sample based on nonrandom criteria, such as convenience, availability, or the researcher's judgment. Individuals in the population do not have an equal chance of being selected for the sample.

Null hypothesis: It is a statement that predicts no statistically significant difference or relationship between the variables of a study. It is also called statistical hypothesis.

Objectives: An objective is a statement in specific and measurable terms that describes what is intended to be achieved by the end of the research.

Operational definition: Operational definition is a clear and specific description of a variable or concept that is being studied in a research study. It defines the variable or concept in terms of the specific operations or procedures used to measure or manipulate it in the study.

Pilot study: It is a small-scale preliminary study that is conducted before the main research with the aim of testing the feasibility of implementing research methods, tools and procedures.

Population: It refers to the entire group of individuals or objects that a researcher wants to study.

Probability sampling: Sampling approach in which every individual or object in a population has an equal chance of being selected for inclusion in the sample.

Contd...

Problem statement: A research problem statement is a clear and concise description of the issues or gap in knowledge that the research aims to address.

Qualitative data: It is non-numerical and requires interpretive analysis. For example, attitude, beliefs, experience, etc.

Quantitative data: It is numerical and can be measured and analyzed using statistical methods. For example, height, weight, etc.

Reliability: It refers to the degree to which a research tool or instrument consistently measures the construct over repeated administrations or measurements.

Research approach: A research approach is the overall strategy or plan that guides the research process, providing a framework for the collection, analysis, and interpretation of data. The research approach is often categorized as either quantitative, qualitative, or mixed methods, depending on the nature of the data and the objectives of the study.

Research design: A research design is a detailed plan with specific methods and procedures to be used in conducting a research study. It serves as a blueprint for the collection, measurement, and analysis of data with the aim to ensure that the study produces reliable and valid results.

Research hypothesis: It is a statement of prediction about the expected relationship between the variables in a research study.

Research proposal: A detailed written description of a proposed research study. This serves as a roadmap for the research project to convince stakeholders, such as Ethics Committee, Academic Committees, or funding agencies.

Sample: Refers to a subset of individuals or objects taken from the population that is used to represent the larger group.

Sampling technique: Refers to the methods used to select a representative subset of individuals or objects from a population.

Sociodemographic variables: Sociodemographic variables are demographic characteristics of the participants in a study, such as age, gender, race, education, and income.

Study setting: Refers to the physical or virtual location where the research study takes place, such as a laboratory, a clinic, a school, or an online platform.

Target population: Refers to the specific group of individuals or objects that a researcher is interested in studying and from which the findings of the study are intended to be generalized.

Tool validity: Tool or instrument validity refers to the degree to which a tool or instrument used in a research study accurately measures the construct it is intended to measure.

Variable: A variable is a characteristic, attribute, or property that can take on different values or measurements within a study. For example, height, weight, etc.

INTRODUCTION

This chapter serves as a foundation for students to understand the various steps involved in conducting a research study. The overview includes basic research terms and discussion of the steps involved in the quantitative and qualitative research process, and the importance of following ethical guidelines.

RESEARCH PROCESS

Research is a systematic process that involves a series of steps to collect and analyze data in order to answer research questions. Research process involves a series of sequential steps that a researcher follows to collect, analyze, and interpret data in order to derive meaningful insights and conclusions about a particular phenomenon or topic of interest.

Both quantitative and qualitative research processes aim to systematically gather information on a phenomenon of interest, however, the steps and method of quantitative and qualitative research process differs.

QUANTITATIVE RESEARCH PROCESS

The quantitative research process involves a systematic approach that includes a series of steps organized under five major phases Table 2.1:

1. Conceptual phase
2. Design and planning phase
3. Empirical phase
4. Analytic phase
5. Dissemination phase

Phase I: Conceptual Phase

Identify and Formulate Research Question or Problem

Identifying a research question or problem is the first step in conducting a research study. This can be a challenging task as it involves selecting an appropriate topic that is interesting, feasible, and significant to the nursing profession. The researcher should engage in activities such as thinking, theorizing, and decision-making to ensure that the chosen topic is robust, engaging, and enjoyable.

The problem statement can be presented in either statement or question format and should clearly identify the population of interest and the variables being studied. A well-written statement should meet the following criteria:

- It should identify the key variables.
- Should have variables that is measurable.
- Describe the nature of the population being studied.
- Guide the reader and researcher throughout the study.

The research question can be framed using the FINER criteria, which includes being Feasible, Interesting, Novel, Ethical, and Relevant. The PICOT model is a useful guide for formulating research questions for

Table 2.1 Phases of quantitative research including series of steps

Phases	Steps
Conceptual phase	• Identify and formulate research question or problem • Formulate study objectives • Review the literature • Develop conceptual framework • Formulate hypotheses/assumptions
Design and planning phase	• Select research approach and design • Specify the population and sampling method • Develop or select tools for data collection • Obtain ethical approvals and ensure participant rights • Conduct a pilot study
Empirical phase	• Select the sample • Collect data • Prepare data for analysis
Analytic phase	• Analyze data using statistical methods • Interpret results and draw conclusions
Dissemination phase	• Disseminate the research findings

randomized controlled trials, which includes identifying the Population, Intervention, Comparison, Outcome, and Time.

Formulate Study Objectives

Aims and objectives play a crucial role in providing a clear direction to the research process and ensuring that the study stays focused on the topic under investigation. Both aims and objectives must be clearly stated to avoid any deviations from the research question. Aims refer to the broad goal of the research, which represents the overall purpose of the study. On the other hand, objectives refer to the specific steps taken to achieve the aims, illustrating how the research will accomplish its goals.

Objectives are presented in a statement format, outlining the measurable outcomes of the study and how it will address the specific research question. Effective research requires setting objectives that are SMART - Specific, Measurable, Achievable, Relevant, and Time-bound.

S	Specific	Clearly defined and focus on a particular aspect of the research question
M	Measurable	Quantifiable and provide a way to measure variable
A	Achievable	Realistic and feasible given the resources available to the researcher
R	Relevant	Directly related to the research question and are necessary to achieve the research goal
T	Time-bound	Have a specific timeline or deadline for completion

Review of the Literature

A review of literature is a critical aspect of the research process that should be conducted at various stages, including before selecting a research topic, during the planning stage, and during the discussion phase. There are four primary reasons for reviewing the literature which are as follows:

1. Avoiding duplication of previous studies
2. Generating ideas
3. Identifying research strategies and procedures
4. Discussing similar studies

Before selecting a research topic, a thorough review of the relevant literature should be conducted to determine the amount of available literature related to the potential study and to identify any gaps or areas for further investigation. This helps in narrowing down the research problem and making it more focused.

During the planning stage, the review of literature helps researchers in developing a clear research question, identifying appropriate research methods, and selecting appropriate data collection instruments. Additionally, it enables researchers to gain a comprehensive understanding of the existing knowledge on the topic and identify gaps that need further investigation.

During the discussion phase, the review of literature is critical in contextualizing the research findings within the existing knowledge and identifying areas where the research contributes to the existing body of knowledge. In addition, it may help in generating new research questions for future investigation.

Develop Conceptual Framework

Conceptual framework is an essential component of nursing research that involves the development of a visual or written representation of concepts related to the research problem or question. It serves as a tool



for organizing and clarifying the researcher's understanding of the research problem and guides the research process by providing a structure for the study's design, data collection, and analysis.

In nursing research, the conceptual framework typically includes key concepts and relationships between them, which are based on existing nursing theories, models, or frameworks. The conceptual framework is developed from the literature review, research questions, or hypotheses and helps to guide the research process by providing a structure for organizing and analyzing data, leading to a more rigorous and high-quality research. Researchers can develop their own conceptual framework based on their research questions or hypotheses.

Theories or theoretical frameworks can be embedded in a conceptual framework in nursing research. For example, a nursing theory can be used as a foundation for developing the conceptual framework, and the concepts within the theory can be incorporated into the framework.

Formulate Hypotheses/Assumptions

A hypothesis is a tentative statement that predicts a relationship between two or more variables that is testable through scientific research. Hypothesis is a crucial and vital aspect of scientific research. A well-formulated hypothesis guides the research process by suggesting a relationship between variables and providing a basis for testing through empirical research.

The formulation of a hypothesis requires careful consideration of existing knowledge, observations, and theories, and it should be based on a clear understanding of the research problem or question. By formulating a hypothesis, researchers can develop testable predictions, design studies, and collect data to investigate the proposed relationship between variables.

For example, consider the research statement, "The effect of nurse-led smoking cessation counseling on smoking rates among patients with COPD." The researcher could propose a relationship between nurse-led smoking cessation counseling and smoking rates in patients with COPD, such as: "Patients with COPD who receive nurse-led smoking cessation counseling will have a lower rate of smoking compared to those who do not receive counseling."

Assumptions in research refer to the underlying beliefs or viewpoints that the researcher holds about the research topic, methodology, or data that may not necessarily be proven. An example of an assumption statement could be "the sample of patients with COPD who participate in the study is representative of the larger population of patients with COPD who smoke". Explicitly stating the assumption can help to clarify the scope and limitations of the study and provide direction for the researcher.

Phase II: Design and Planning Phase

Select Research Approach and Design

Choosing an appropriate research approach and design is one of the most important steps in the research process. The research approach refers to the general perspective or strategy that will be used to conduct the study. There are two main research approaches: quantitative and qualitative. The approach determines the type of data that will be collected and the methods that will be used to analyze the data.

The research design refers to the specific plan or blueprint for carrying out the research. It provides a 'Road map' for all aspects of the research study. The study design specifies the key elements of the research

study, including who will be studied, what variables will be measured, when the study will be conducted, where the study will take place, and how the data will be collected and analyzed.

There are various research designs, including experimental, quasi-experimental, nonexperimental, and qualitative designs. The appropriate research approach and design should be selected based on the research question and the nature of the research problem. For example, if the research question involves examining the effectiveness of a new nursing intervention, a quantitative experimental design may be appropriate. On the other hand, if the research question involves exploring the experiences of patients with a chronic illness, a qualitative design may be more appropriate.

Specify the Population and Sampling Method

Identifying the population to be studied and selecting an appropriate sampling method is a crucial step in the research process. The population refers to the complete set of individuals or objects that possess some similar characteristics of interest to the researcher. The target population is the group of individuals who meet the inclusion and exclusion criteria and to whom the findings of the study will be generalized. The accessible population is the group that is actually reachable or available for the study.

For example, in a study on the effectiveness of a new medication for patients with diabetes, the population would be all patients with diabetes who meet the study criteria. The target population would be a subgroup of these patients who meet specific criteria, such as age or disease severity, and to whom the study findings will be generalized. The accessible population would be the group of patients with diabetes who are available and willing to participate in the study.

It is practically impossible to study the entire population, so a representative sample is selected using various sampling techniques. Designing an appropriate sampling method is important as it determines the representativeness of the sample and the generalizability of the findings. Sampling involves selecting a subgroup of the population to be studied. Sampling techniques are broadly classified as probability and nonprobability techniques. In probability sampling, each member of the population has an equal chance of being selected for the study. In nonprobability sampling, the sample is chosen purposively or conveniently, meaning that the participants are selected based on availability or convenience, rather than by chance.

Develop or Select Tools for Data Collection

Developing appropriate tools or selecting standardized tools for data collection is an essential step in the research process. Tools for data collection can take the form of questionnaires, interview schedules, observation checklists, or other methods depending on the selected data collection methods. Researchers should review existing literature to determine if there are already available instruments that can be used to measure the research variables. If an existing instrument is used, permission must be sought from the author and the instrument's reliability and validity must be established. If an appropriate instrument is not available, researchers may have to develop a new instrument, which requires consultation with experts to establish content validity and establish reliability.

For experimental research, the researcher needs to develop protocols for the study, which includes the various steps of the protocol, specific equipment or intervention to be used, who will administer the intervention, how frequently, and for how long the treatment will last. The goal of a well-developed protocol is to ensure that all subjects in the experimental group are exposed to the same type of intervention.

Obtain Ethical Approvals and Ensure Participant Rights

Ethical considerations are a crucial aspect of medical and nursing research, which involves a systematic inquiry into the principles of right or wrong conduct, virtue or vice, and good and evil as they relate to conduct morals. Ethics are the norms for conduct that distinguish between acceptable and unacceptable behavior, and govern a person's actions.

Majority of the nursing research is conducted on human beings. So, their rights must be well thought out by the researcher. Prior permission for their voluntarily participation in the study must be sought from each subject. They should be informed regarding the study. Those who are willing to participate should sign the consent form. Permission to carry out the study should also be obtained from the Institution Ethics Committee. Failure to follow the ethical principles during research can lead to harm to the subjects, whether human or animal, as well as to the public and the researchers themselves.

Conduct a Pilot Study

The pilot study is a small-scale version of the study, also known as a trial run, which helps in minimizing the problems in final data collection and obtaining reliable results. Conducting a pilot study is an important step in the research process to ensure that the research plan is feasible and will work smoothly. It involves examining the use of instruments, data collection procedures, sample availability, data analysis approaches, and any necessary modifications to the methodology. After conducting the pilot study, the research plan is reviewed, and necessary revisions are made to the instruments and methodology. In some cases, another pilot study may be conducted to further improve the feasibility and reliability of the study.

Phase III: Empirical Phase

Select the Sample

Selecting a sample from the population is an important step in research. It is not feasible to study the entire population due to time, cost, and logistical constraints. Therefore, researchers use an appropriate sampling technique, as specified in the planning phase, to select a representative subset of the population that can be studied.

Collect Data

Data collection involves collecting pieces of information during the study. Although difficult, it is considered the most exciting part of the research process. Once the sample is selected, the researcher must determine what data needs to be collected, how it will be collected, who will collect it, where it will be collected, and when it will be collected. If more than one investigator is involved in the data collection process, then all group members should be trained on the method of data collection to achieve uniformity. The steps involved in data collection are as follows:

1. Contacting the subjects
2. Informing them about the study
3. Obtaining signed consent forms
4. Enrolling them in the study
5. Collecting the data, and thanking the subjects

During the data collection process, unexpected problems may arise, and the researcher may need to make alterations while implementing the written proposal as closely as possible.

Prepare Data for Analysis

Preferably, data preparation for analysis should be done side by side during the process of data collection. All the questionnaires should be checked for their completeness. The data should be properly coded and then entered into the appropriate statistical application/package. The dummy tables should be ready, so that the analyzed data can be entered in these tables.

Phase IV: Analytic Phase

Analyze Data Using Statistical Methods

Analysis of data enables the researcher to make sense of the collected data and draw conclusions based on the findings. In this step, a coded master data sheet is analyzed using appropriate descriptive or inferential statistics. Descriptive statistics are used to summarize and describe the basic features of the data, such as mean, standard deviation, and range. Inferential statistics, on the other hand, are used to test hypotheses and draw conclusions about the population based on the sample data. Statistical softwares/packages such as SPSS, STATA, EpiInfo and R Software are commonly used for the data analysis.

Interpret Results and Draw Conclusions

Once the data has been analyzed using appropriate statistical methods, the researcher needs to interpret the results in a meaningful way based on the objectives. The interpretation involves making sense of the data, identifying patterns, and drawing conclusions based on the findings. The results should be compared to the research objectives and hypothesis to determine if they support or contradict them. The interpretation also involves discussing any limitations of the study and making recommendations for future research. The interpretation of results should provide a clear and concise summary of the findings and their relevance to the research objectives.

Phase V: Dissemination Phase

Disseminate the Research Findings

Dissemination in research refers to the process of sharing the research findings with the broader scientific community. Researchers must share their findings with colleagues and stakeholders through formal or informal, written or verbal communication modes. These include publishing articles in journals, presenting papers and posters at conferences, and participating in continuing education programs. Dissemination is crucial to ensure that the study contributes to building a body of knowledge and improving practices.

QUALITATIVE RESEARCH PROCESS

Qualitative research is a systematic approach to explore and understand the meaning and experiences of people. It focuses on examining subjective experiences, perspectives, and behaviors by collecting and analyzing



non-numerical data, such as words, images, and observations. Qualitative research aims to develop a deep and rich understanding of a phenomenon or a context and to generate new theories and insights.

The steps of conducting qualitative research are as follows:

1. Identify the Research Problem and Formulate Research Question(s)

This step involves identifying a problem or gap in knowledge that needs to be addressed, and formulating research questions that will guide the study. Qualitative research often begins with a general topic or area of interest that the researcher wishes to explore. The topic may be broad or general in nature, and the research problem may be identified through observation, personal experience, or a review of the literature. Qualitative research questions are often open-ended and exploratory in nature and aim to understand a phenomenon from the perspective of those experiencing it.

2. Formulate Broad Study Objectives

The study objectives should be aligned with the research questions and should help guide the research design and data collection methods. While qualitative research objectives may not need to be as specific or measurable as in quantitative research, it is still important to ensure that they are clear, focused, and aligned with the research questions.

3. Conduct a Thorough Literature Review

This step involves conducting a comprehensive review of relevant literature related to the research problem and questions. The literature review helps to identify existing knowledge and research on the topic, as well as any gaps or areas where further research is needed. It also helps to establish the theoretical framework and conceptual basis for the study.

4. Select a Research Design

Research design that is appropriate for the research question, objectives and context should be selected. Qualitative research offers a range of approaches and designs, including:

- **Grounded theory approach:** This approach involves developing a theory or explanation based on the data collected, rather than testing a pre-existing theory or hypothesis.
- **Phenomenological design:** This approach aims to understand the subjective or lived experiences and perceptions of individuals, often through in-depth interviews.
- **Ethnographical design:** This approach involves studying a particular culture or social group, often through observation and participation in their daily lives.
- **Historical research:** This approach involves studying past events, often using archival sources such as documents and artifacts.
- **Case study:** This approach involves in-depth exploration of a particular case or situation, often using multiple data sources such as interviews, documents, and observations.
- **Action research:** This approach involves collaborative and participatory research, often with a focus on social change or improvement.



5. Entry into the Research Setting

Entry into the research setting refers to the process of gaining access to the setting or community where the research will take place. This step involves identifying the research setting, or the physical or social context in which the research will take place. In qualitative research, the setting is often an important aspect of the research, as it provides the context for the experiences and perspectives of participants.

6. Determine the Study Population and Select a Sample

This step involves identifying the study population, or the group of individuals or entities that the researcher wishes to study and selecting a sample from that population. In qualitative research, participants are often selected purposively, based on their experience of the phenomenon under study. The goal is to obtain rich and detailed information from participants about their lived experiences, societal practices, cultures, and narrative accounts. The sample size in qualitative research is usually smaller compared to quantitative research, typically ranging from a few to 30 participants, depending on the research question and objectives.

7. Address Ethical Considerations

This step involves identifying and addressing any ethical issues that may arise in the research process, such as ensuring informed consent from participants, protecting participant confidentiality and privacy, minimizing harm and distress, and ensuring that the research is conducted in a fair and respectful manner. In qualitative research, ethical considerations may be especially important due to the often personal and sensitive nature of the data collected.

8. Develop or Select Tools for Data Collection

This step involves developing or selecting appropriate tools and methods for collecting data from the participants. Qualitative research often uses methods such as interviews, focus groups, observations, and document analysis to collect data. The researcher should choose tools and methods that are appropriate for the research question and objectives, and that will allow for the collection of rich and detailed data. Tools may include self-developed interview guides, observation protocols, or adapting existing ones to fit the research context.

9. Collect Data

In qualitative research, the data collection process is often the most important, challenging and time-consuming part of the research. Researchers may need to spend significant amounts of time building rapport with participants, gaining their trust, and creating a comfortable and safe environment for data collection. The data collection process is also often interactive and flexible, allowing participants to share their experiences and perspectives in their own words.

10. Prepare Data for Analysis

Preparing data for analysis in qualitative research involves organizing and managing the data in a way that makes it easier to analyze and interpret. This step typically involves a series of procedures such as transcription, cleaning and organizing data, coding, categorizing, comparing, and laddering.

11. Analyze and Interpret Data

The researcher should carefully review and interpret the data to identify patterns, themes, and relationships, and should use their own perspectives and experiences to inform the interpretation. In contrast to quantitative research, which often involves statistical analysis of numerical data, qualitative research involves a more interpretive and subjective approach to analyzing and interpreting the data.

12. Disseminate Research Findings

Dissemination involves sharing the results of the research with others, through academic publications, presentations, or other forms of communication. The researcher should ensure that the findings are communicated accurately and appropriately, and that ethical considerations are addressed in the dissemination process.

KEY DIFFERENCES BETWEEN THE QUANTITATIVE AND QUALITATIVE RESEARCH PROCESS

While both qualitative and quantitative research share some similarities in terms of their research process, there are significant differences between the two approaches (Table 2.2).

Table 2.2 Differences between quantitative and qualitative research process

Key differences	Qualitative research	Quantitative research
Research questions	Exploratory and open-ended	Specific hypotheses to test
Tools for data collection	Open-ended questions, observations, and interviews	Structured questionnaires, surveys, and experiments
Data analysis	Themes, patterns, and interpretations	Statistical analysis and hypothesis testing
Sampling technique and sample size	Often nonrepresentative and smaller size	Representative and larger size
Researcher's role	Active involvement in research process	Objective and detached approach
Data (information collected)	Verbatim	Numerical

SUMMARY

- Research process involves a series of sequential steps that a researcher follows to collect, analyze, and interpret data in order to derive meaningful insights and conclusions about a particular phenomenon or topic of interest.
- The quantitative research process involves a systematic approach that includes a series of steps organized under five major phases that includes conceptual phase, design and planning phase, empirical phase, analytic phase and dissemination phase
- Qualitative research is a systematic approach to explore and understand the meaning and experiences of people. It aims to develop a deep and rich understanding of a phenomenon or a context and to generate new theories and insights.
- While both qualitative and quantitative research share some similarities in terms of their research process, there are significant differences between the two approaches.

ASSESS YOURSELF

Long Answer Questions

1. Differentiate between quantitative and qualitative research problems in terms of:
 - Nature of the research questions
 - Development of research problem statement
 - Formulating the hypothesis
 - Review of literature
 - Research tools
2. Discuss the dissemination phase of quantitative research process.
3. Discuss operational definition with appropriate examples.
4. Discuss narrative research with examples.

Short Answer Questions

1. Write the full form of SMART.
2. Write the name of steps of the empirical phase.

Multiple Choice Questions

1. In which of the following research approaches generalizing of findings is difficult?
 - a. Quantitative research
 - b. Qualitative research
 - c. Mixed research
 - d. Methodological research
2. Which of the following best describes quantitative research?
 - a. Collection of non-numerical data
 - b. Attempt to confirm the researcher's hypotheses
 - c. Research that is exploratory
 - d. Research that attempts to generate a new theory
3. A variable that is presumed to cause a change in another variable is called a(n):
 - a. Categorical variable
 - b. Dependent variable
 - c. Independent variable
 - d. Intervening variable
4. Which of the followings is NOT TRUE about qualitative research?
 - a. It is typically used when a great deal is already known about the topic of interest
 - b. It relies on the collection of non-numerical data such as words and pictures
 - c. It is used to generate hypotheses and develop theory about phenomena in the world
 - d. It uses the inductive scientific method
5. The strongest evidence for causality comes from which of the following research methods?
 - a. Experimental
 - b. Causal-comparative
 - c. Correlational
 - d. Ethnography
6. In PICOT format, C stands for:
 - a. Control
 - b. Comparison
 - c. Continuity
 - d. Comprehensive
7. The research participants are described in detail in which section of the research plan?
 - a. Introduction
 - b. Methodology
 - c. Data analysis
 - d. Discussion
8. In which of the following type of research, literature review should not be conducted in the beginning?
 - a. Phenomenological research
 - b. Grounded theory research
 - c. Ethnographic research
 - d. Historical research

9. The feasibility of a research study should be considered in light of:
- Cost and time required to conduct the study
 - Skills required for a researcher
 - Potential ethical concerns
 - All of these

Answer Key

1. b 2. b 3. c 4. a 5. a 6. b 7. b
 8. b 9. d

BIBLIOGRAPHY

- Abbott P. Why do we Need to Review Literature? *Nurse Researcher* 1993; 1(1): 14-22.
- Burns N, Grove S. *The Practice of Nursing Research: Conduct, Critique, and Utilization*. (4th ed.), 2001, Philadelphia: W.B. Saunders Company.
- Dempsey PA, Dempsey AD. *Using Nursing Research: Process, Critical Evaluation, and Utilization*. 5th ed., 2000, Philadelphia: Lippincott Williams and Wilkins.
- Downs FS. Hitching the Research Wagon to Theory (editorial). *Nursing Research* 1994; 45:195.
- Fisher CG, Wood KB. Introduction to and Techniques of Evidence based Medicine. *Spine* 2007;32 (Suppl):S66-72.
- Hanacek J. Phases of Research Process, HYPERLINK "http://www.academia.edu/6430105/4Phases_of_research_process". Accessed on 5/3/2019.
- Hulley S, Cummings S, Browner W, et al. *Designing clinical research*. 3rd ed. Philadelphia (PA): Lippincott Williams and Wilkins; 2007.
- Leedy PD, Ormrod JE. (2010). *Practical Research: Planning and Design*, Ninth Edition. NYC: Merrill. Assumptions
- Nieswiadomy RM. *Foundations of Nursing Research*. 5th ed., 2008, Dorling Kindersley, New Delhi, India.
- Roberts K, Taylor B. *Nursing Research Process: An Australian Perspective*. 2nd ed., 2002. Nelson Australia Pty Limited.
- Sackett D, Strauss S, Richardson W, et al. *Evidence-based Medicine: How to Practice and Teach Evidence-based Medicine*. 2nd ed. Edinburgh (UK): Churchill Livingstone; 2000.
- Sousa VD, Driessnack M, Mendes IAC. An Overview of Research Designs Relevant to Nursing: Part 1: Quantitative Research Designs. *Rev Latino-am Enfermagem*, 2007, maio/junho; 15(3): 503-7.
- Stommel M, Wills CE. *Clinical Research: Concepts and Principles for Advanced Practice Nurses*. Philadelphia: Lippincott Williams and Wilkins. 2004.
- Timmins F, McCabe C. How to Conduct an Effective Literature Search. *Nursing Standard* 2005; 20(11): 41-47
- Tulman L, Fawcett J. Lessons Learnt from a Pilot Study of a Behavioral Correlates of Functional Status in Women with Breast Cancer. *Nursing Research* 1996; 45: 356-58.

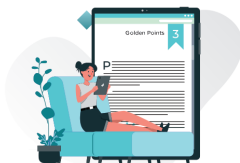
Congratulations!!

You have completed the CHAPTER thoroughly,
 now it's time to assess your knowledge and learn
 more through **My Phygital Book**



Scan the QR Code
 to Download the App

Nursing NextLive
 The Next Level of Nursing Education
 CBS Phygital Books > **Nursing Research**
 and Statistics **PHYGITAL**



My Phygital Book
 Listen, Learn & Practice

Reading is not enough, Now **Listen, Learn & Practice** Every Chapter

Golden Points

Get One Liners of
 Chapter summary in the
 PODCAST form

Solved Exercises

Subjective and objective exercises
 given in book with their solutions
 to evaluate and assess the
 complete chapter knowledge

MCQs

Chapter-wise extra MCQs
 in the form of Practice test
 to give in-depth concept clarity



Ethics in Nursing Research

LEARNING OBJECTIVES

After the completion of the chapter, the readers will be able to:

- Discuss the development of ethical code.
- State the role of Institute Ethics Committee in research.
- Identify the role of Informed consent in research.
- List the components of informed consent form.
- Differentiate between Adverse Event Monitoring and Data and Safety Monitoring Board.
- Describe Right to Information (RTI) in research.
- Explain trial event monitoring.

CHAPTER OUTLINE

- Introduction
- History of Development of Ethical Code for Research
- Definition
- Purpose of Ethics in Nursing Research
- Fundamental Ethical Principles in Nursing Research
- Ethical Guidelines for Biomedical and Health Research (ICMR, 2017)
- Informed Consent
- Institutional Ethics Committee
- RTI in Research
- Ethical Responsibilities of a Researcher

KEY TERMS

Accountability: The ethical obligation of individuals and organizations to take responsibility for their actions and decisions in nursing research.

Adverse event monitoring: The systematic process of identifying, reporting, and evaluating unexpected or harmful events that may occur during the course of a research study.

Autonomy: Respecting the rights of individuals to make their own informed decisions and choices regarding participation in research studies.

Contd...

Beneficence: The ethical principle of promoting the well-being and welfare of research participants, ensuring that potential benefits outweigh potential harms.

Compliance: Adherence to established ethical guidelines, regulations, and protocols while conducting nursing research.

Confidentiality: Safeguarding the privacy and confidentiality of research participants' personal information and data.

Data and safety monitoring board: An independent committee responsible for reviewing and overseeing the safety and integrity of a research study, especially in clinical trials.

Ethical code: A set of ethical principles and standards that guide the conduct of nurses and researchers in their professional practice and research endeavors.

Ethics: The study of moral principles and values that govern human behavior and decision-making in nursing research.

Indian Council of Medical Research (ICMR): A prominent research organization in India that provides ethical guidelines and oversight for medical and health care research.

Informed consent: The process of providing research participants with comprehensive information about a study's purpose, risks, and benefits, enabling them to make voluntary and informed decisions about participation.

Institution ethics committee: An independent body responsible for reviewing and approving the ethical aspects of research proposals and monitoring ongoing research within an institution.

Justice: Ensuring fairness and equitable distribution of benefits and burdens in research, without discrimination or bias.

Nonexploitation: The ethical principle of protecting research participants from harm, exploitation, or undue influence during the research process.

Nonmaleficence: The ethical obligation to do no harm and prevent harm to research participants, emphasizing their safety and well-being.

Privacy: Safeguarding individuals' personal information and ensuring their right to control access to their data during nursing research.

Transparency: The practice of openly sharing research methods, findings, and potential conflicts of interest to maintain integrity and trust in research.

Voluntariness: Ensuring that participation in research is entirely voluntary, without coercion or pressure, and that individuals can withdraw at any time without consequences.

INTRODUCTION

Ethics is "a systematic inquiry into the principles of right or wrong conduct, of virtue or vice, and of good and evil as they relate to conduct morals". Ethics plays a fundamental role in guiding individuals' behavior and actions. Ethics are thus defined as, "the norms for conduct that distinguish between acceptable and unacceptable behavior".

Ethical principles guide behavior in various fields, including health care and nursing. In fact, ethics is a crucial and integral part of medical and nursing research. These ethical norms have been established to ensure that researchers adhere to both scientific and ethical guidelines. One essential mechanism in the process of research ethics is the Institutional Ethics Committee (IEC), which serves as a means to oversee and regulate research activities. The practice of applying ethical principles to scientific research is commonly referred to as "research ethics".

Ensuring ethics in research is of paramount importance in the context of health care and nursing research for several compelling reasons. Firstly, research in these fields directly involves human subjects, often vulnerable patients who rely on the medical and nursing professions for their well-being. Ethical guidelines

safeguard the rights, dignity, and safety of these individuals, ensuring that they are not subjected to harm or exploitation during the research process. Secondly, ethical research practices foster trust and credibility within the health care and nursing communities. Health care providers, patients, and the public must have confidence in the integrity of research findings to make informed decisions about treatment, policy, and practice. Thirdly, ethical research contributes to the advancement of medical and nursing knowledge by upholding the standards of rigor and accuracy. Without ethical oversight, there is a risk of unreliable or biased research, which could potentially lead to incorrect clinical practices and adverse patient outcomes.

The infamous Tuskegee Syphilis Study: In the past, failure of researchers to follow these norms has resulted in harm to the participants and society. A notorious and highly unethical research study was conducted by the US Public Health Service (PHS) in Macon County, Alabama, starting in the 1930s and lasting until the early 1970s. The study aimed to observe the natural progression of syphilis in African American men. However, what made this study unethical and infamous was the fact that participants were deliberately left untreated even after effective treatment (penicillin) became available in the 1940s. These men were not informed about their diagnosis or the available treatment options, and they were deceived into thinking they were receiving medical care when, in reality, they were not. The study continued for decades, leading to severe health consequences and even deaths among the participants who were denied treatment. It wasn't until the early 1970s, when the study was exposed by investigative journalists and public outrage grew, that the study was finally terminated.

The Tuskegee Syphilis Study has since become a symbol of unethical medical research and a catalyst for the development of modern research ethics guidelines, including the establishment of Institutional Review Boards (IRBs) to ensure the protection of human research subjects.

HISTORY OF DEVELOPMENT OF ETHICAL CODE FOR RESEARCH

The journey of developing ethical rules for research has a significant history. It all began during the Nuremberg Trial for Nazi war criminals in 1946–47 when German physicians were accused of conducting cruel experiments on camp inmates. To hold these doctors accountable, the Nuremberg Code, which laid out ethical guidelines for human research, was created in 1947. This was a crucial step as it marked the first international statement on this matter.

Another milestone came in 1964 with the Helsinki Declaration, crafted by the World Medical Association. It outlined ethical principles for biomedical research. Then, in 1979, the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research introduced the Belmont Report, emphasizing fundamental ethical principles. These guidelines laid the groundwork for more consistent and stringent ethical regulations.

In India, the Indian Council of Medical Research issued the “Policy Statement on Ethical Considerations involved in Research on Human Subjects” in 1980, focusing on the welfare of clinical research participants. Additionally, in 1983, the Council for International Organizations of Medical Sciences (CIOMS) and the World Health Organization (WHO) proposed international ethical guidelines. More recent documents include “The International Declaration on Human Gene Data” in 2003 and the “Universal Declaration on Bioethics and Human Rights” in 2005.

In 1968, the American Nurses Association (ANA) developed guidelines for nurses in practice, education, and research, which were updated in 1975 and 1985. They were initially called “Human Rights Guidelines for Nurses in Clinical and Other Research” and later became “Ethical Guidelines in the Conduct, Dissemination, and Implementation of Nursing Research” in 1995.

DEFINITION

Ethics in nursing research can be defined as the set of moral principles and guidelines that govern the conduct of research involving human participants in the field of nursing. These principles aim to ensure the protection, well-being, and rights of research participants while promoting the integrity, transparency, and credibility of the research process.

PURPOSE OF ETHICS IN NURSING RESEARCH

The purpose of ethics in nursing research is crucial as it guides the systematic examination of patient care issues, contributing to the development of evidence-based nursing practices that prioritize patient well-being. Ethical considerations are essential in all scientific activities, especially those involving human subjects or impacting society and the environment.

Research ethics aims to strike a balance between the needs of research and the protection of participants. It is important to adhere to ethical norms in research for fulfilling the following needs:

- **Protecting participants and vulnerable populations:** Ethical norms ensure the safety of study participants, including vulnerable groups, shielding them from potential harm due to research interventions.
- **Preventing exploitation:** Ethical guidelines prevent any form of exploitation, such as coercion, manipulation, or compromising the voluntariness of participation.
- **Respecting dignity, privacy, and confidentiality:** Ethical principles mandate the utmost respect for participants' dignity, privacy, and confidentiality throughout the research process.
- **Balancing risk and benefit:** Research ethics involves assessing the risk-benefit ratio for participants, ensuring that potential harm is justified by the benefits to science and society.
- **Ensuring autonomy:** Ethical norms uphold participants' autonomy, allowing them to freely consent or decline participation and withdraw from a study without pressure or consequences.

FUNDAMENTAL ETHICAL PRINCIPLES IN NURSING RESEARCH

Ethical principles in nursing research are the moral guidelines that researchers must follow to protect the rights and welfare of human participants. The four fundamental principles of research include the principles of beneficence, nonmaleficence, justice and autonomy.

Principle of Beneficence

- Researchers have an ethical duty to prioritize the well-being and best interests of research participants. This means that every research decision and action should be aimed at promoting welfare and benefiting the individuals involved.
- To adhere to the principle of beneficence, researchers must ensure that the potential benefits of the research clearly outweigh any potential risks or harms. The goal is to maximize the positive outcomes for participants while minimizing any negative consequences.
- For example, a nurse researcher is conducting a clinical trial to evaluate the effectiveness of a new pain management technique for postoperative patients. To ensure the beneficence, the researcher carefully selects participants who have recently undergone surgery and are experiencing postoperative pain. This selection aligns with the best interests of the participants, as they may benefit from improved pain management.

Principle of Nonmaleficence (To Do No Harm)

- Researchers have an ethical obligation to make every effort to avoid causing harm to research participants. This includes preventing physical, psychological, emotional, or any other form of harm that could result from their participation in the research.
- To adhere to the principle of nonmaleficence, researchers must take proactive steps to minimize the risks associated with the research. This involves identifying potential risks and implementing measures to prevent them, ensuring that participants are not exposed to unnecessary complications.
- Researchers should take all possible measures to protect participants from harm and should be prepared to address any adverse events or unforeseen risks that may arise during the research.
- For example, a nurse researcher is conducting a clinical trial to evaluate the effectiveness of a new pain management technique for postoperative patients. The researcher closely monitors participants to ensure their safety and well-being. Any adverse events or unexpected side effects are promptly addressed, demonstrating a commitment to minimize or do no harm.

Principle of Justice

- Researchers have an ethical duty to ensure that participants are treated fairly throughout all aspects of the research process. This means that all individuals who meet the study's inclusion criteria should have an equal opportunity to participate, without favoritism or discrimination.
- Equitable access implies that researchers should not select participants based on personal characteristics, such as race, gender, age, socioeconomic status, or any other attributes unrelated to the research objectives.
- Researchers must avoid any practices that may lead to the exclusion or mistreatment of certain groups or individuals.
- For example, a nurse researcher is conducting a study that aims to determine whether a novel pain management technique can improve recovery outcomes for postoperative patients. In this study, the researcher avoids any discriminatory criteria that could exclude certain groups avoided in the participant enrollment process. Inclusion criteria are set to ensure that individuals from diverse backgrounds, including different age groups, genders, ethnicities, and socioeconomic statuses, have equal access to participation.

Principle of Autonomy and Respect for Human Dignity

- The Principle of Autonomy and Respect for Human Dignity is a fundamental ethical guideline in research that emphasizes the rights and autonomy of research participants.
- Researchers must provide participants with full information about the study, including the risks and benefits, before obtaining their consent. Participants have the right to make their own decisions about whether or not to participate in research.
- Participants also have the right to withdraw from the research at any point without facing adverse consequences or penalties. Researchers must inform participants about this right during the informed consent process.
- Respecting human dignity means treating participants with respect, fairness, and acknowledging their intrinsic worth. Researchers must avoid any actions that might demean or devalue participants.
- Protecting the participant's privacy, maintaining confidentiality, and ensuring that their well-being and rights are maintained throughout the research process.



Table 3.1 Example for application of ethical principles in nursing research

Research statement	
Title: Examining the Impact of Virtual Reality Therapy on Pain Management in Pediatric Oncology Patients	
Research objective: To investigate the effectiveness of virtual reality therapy in alleviating pain and improving the quality of life for pediatric oncology patients undergoing chemotherapy.	
Incorporating Ethical Principles:	
Ethical principle	Description and application in the research
Beneficence	- The research aims to maximize benefits for pediatric oncology patients by exploring an innovative approach to pain management. - The research includes regular pain assessments and adjustments to the virtual reality interventions to ensure they are effective in minimizing pain and discomfort.
Nonmaleficence	- Stringent safety protocols are in place to prevent any adverse effects or harm from the virtual reality therapy. - Continuous monitoring of patients during virtual reality sessions allows for immediate intervention if any distress or discomfort arises.
Justice	- Participants are selected for the study based on objective criteria related to their medical condition, pain levels, and age. - The research aims to include a diverse group of pediatric oncology patients to ensure equitable representation. - Access to virtual reality therapy is provided to all eligible participants, regardless of personal characteristics or biases.
Autonomy	- Informed consent is obtained from the parents or legal guardians of pediatric patients, while assent is obtained from patients capable of understanding the research. - Detailed information about the study, including potential benefits and risks, is provided to all participants and their families. - Participants have the autonomy to withdraw from the research at any point without affecting their ongoing medical care.

- For example, a nurse researcher obtains the informed consent after explaining the content of participant information sheet and allows the participant to decide whether to participate in the study or not. This ensures that the participant's autonomy is upheld.

Table 3.1 describes how all of these ethical principles are followed in nursing with an example problem statement.

ETHICAL GUIDELINES FOR BIOMEDICAL AND HEALTH RESEARCH (ICMR, 2017)

The four basic ethical principles discussed above have been expanded into 12 general principles. National Ethical Guidelines for Biomedical and Health Research (2017) published by Indian Council of Medical Research (ICMR) discussed these 12 general principles described as follows:

- Principle of essentiality** whereby after due consideration of all alternatives in the light of existing knowledge, the use of human participants is considered to be essential for the proposed research. This should be duly vetted by an ethics committee (EC) independent of the proposed research.
- Principle of voluntariness** whereby respect for the right of the participant to agree or not to agree to participate in research, or to withdraw from research at any time, is paramount. The informed consent process ensures that participants' rights are safeguarded.



3. **Principle of nonexploitation** whereby research participants are equitably selected so that the benefits and burdens of the research are distributed fairly and without arbitrariness or discrimination. Sufficient safeguards to protect vulnerable groups should be ensured.
4. **Principle of social responsibility** whereby the research is planned and conducted so as to avoid creation or deepening of social and historic divisions or in any way disturbing social harmony in community relationships.
5. **Principle of ensuring privacy and confidentiality** whereby to maintain privacy of the potential participant, her/his identity and records are kept confidential and access is limited to only those authorized. However, under certain circumstances (suicidal ideation, homicidal tendency, HIV positive status, when required by court of law, etc.), privacy of the information can be breached in consultation with the EC for valid scientific or legal reasons as the right to life of an individual supersedes the right to privacy of the research participant.
6. **Principle of risk minimization** whereby due care is taken by all stakeholders (including but not limited to researchers, ECs, sponsors, regulators) at all stages of the research to ensure that the risks are minimized and appropriate care and compensation is given, if any harm occurs.
7. **Principle of professional competence** whereby the research is planned, conducted, evaluated and monitored throughout by persons who are competent and have the appropriate and relevant qualification, experience and/or training.
8. **Principle of maximization of benefit** whereby due care is taken to design and conduct the research in such a way as to directly or indirectly maximize the benefits to the research participants and/or to the society.
9. **Principle of institutional arrangements** whereby institutions where the research is being conducted, have policies for appropriate research governance and take the responsibility to facilitate research by providing required infrastructure, manpower, funds and training opportunities.
10. **Principle of transparency and accountability** whereby the research plan and outcomes emanating from the research are brought into the public domain through registries, reports and scientific and other publications while safeguarding the right to privacy of the participants. Stakeholders involved in research should disclose any existing conflict of interest and manage it appropriately. The research should be conducted in a fair, honest, impartial and transparent manner to guarantee accountability. Related records, data and notes should be retained for the required period for possible external scrutiny/audit.
11. **Principle of totality of responsibility** whereby all stakeholders involved in research are responsible for their actions. The professional, social and moral responsibilities compliant with ethical guidelines and related regulations are binding on all stakeholders directly or indirectly.
12. **Principle of environmental protection** whereby researchers are accountable for ensuring protection of the environment and resources at all stages of the research, in compliance with existing guidelines and regulations.

INFORMED CONSENT

Informed consent is a fundamental ethical principle in the research process. It means people should get comprehensive information about a study's purpose, procedures, potential risks, and benefits. This serves as a protective shield for the individuals, upholding their autonomy and ensuring their ability to make informed choices about participation. Informed consent is not merely a procedural formality in research; rather, it represents a commitment to ethical research practices.

Process of Obtaining Informed Consent

- The process of obtaining informed consent in research typically involves two key documents: The Participant Information Sheet (PIS) and the Participant Informed Consent Form (PICF). These documents work together to ensure that potential research participants are fully informed about the study and voluntarily agree to participate.
- The informed consent document (ICD), which includes patient/participant information sheet (PIS) and informed consent form (ICF), should have the required elements (Box 3.1) and should be reviewed and approved by the Ethics Committee before enrolment of participants.
- For all biomedical and health research involving human participants, it is the primary responsibility of the researcher to obtain the written, informed consent of the prospective participant or legally acceptable/authorized representative (LAR). In case of an individual who is not capable of giving informed consent, the consent of the LAR should be obtained. If a participant or LAR is illiterate, a literate impartial witness should also be present during the informed consent process.
- In certain circumstances, audio/audio-visual recording of the informed consent process may be required, for example, in certain clinical trials as notified by Central Drugs Standard Control Organisation (CDSCO).
- Verbal/oral consent/waiver of consent/re-consent may be obtained under certain conditions after due consideration and approval by the Ethics Committee.

BOX 3.1 Essential elements and additional elements of informed consent (ICMR guidelines)

Essential elements

- Statement mentioning that it is research
- Purpose and methods of the research in simple language
- Expected duration of the participation and frequency of contact with estimated number of participants to be enrolled, types of data collection and methods.
- Benefits to the participant, community or others that might reasonably be expected as an outcome of research
- Any foreseeable risks, discomfort or inconvenience to the participant resulting from participation in the study
- Extent to which confidentiality of records could be maintained, such as the limits to which the researcher would be able to safeguard confidentiality and the anticipated consequences of breach of confidentiality
- Payment/reimbursement for participation and incidental expenses depending on the type of study
- Free treatment and/or compensation of participants for research-related injury and/or harm
- Freedom of the individual to participate and/or withdraw from research at any time without penalty or loss of benefits to which the participant would otherwise be entitled
- The identity of the research team and contact persons with addresses and phone numbers (for example, PI/Co PI for queries related to the research and Chairperson/Member Secretary/or helpline for appeal against violations of ethical principles and human rights)

Additional elements

- Any alternative treatment or intervention that might be as advantageous to the participant as the ones to which he/she is going to be subjected.
- If there is a possibility that the research could lead to any stigmatizing condition, for example HIV and genetic disorders, provision for pretest- and post-test counseling
- Insurance coverage, if any, for research-related or other adverse events
- Foreseeable extent of information on possible current and future uses of the biological material (sample) and of the data to be generated from the research

Source: Informed consent process. ICMR National Ethical Guidelines for Biomedical Research, 2017.

Participant Information Sheet (PIS)

- The PIS is the initial document that is provided to potential research participants. It serves as an informational tool to convey essential details about the research study in a clear and understandable manner.
- The PIS typically includes information such as the study's purpose, procedures, risks, benefits, confidentiality, contact information, and the voluntary nature of participation. Participants receive the PIS to review and gain an understanding of the study before making a decision about whether or not to participate.
- Essential elements and additional elements that need to be included in the participant information sheet have been described in Box 3.2.

Participant Informed Consent Form (PICF)

- A Participant Informed Consent Form (PICF) is a legal and ethical document used in research studies, particularly in medical and clinical research, to formally obtain informed consent from individuals who are willing to participate in a research study.
- The purpose of the PICF is to ensure that potential participants fully understand the nature of the study, its procedures, potential risks and benefits, and their rights and responsibilities as research subjects.
- Informed consent protects the individual's autonomy to freely choose whether or not to participate in the research. The process involves three components:
 - i. Providing relevant information to potential participants.
 - ii. Ensuring the information is comprehended by them.
 - iii. Assuring voluntariness of participation.
- Informed consent should explain medical terminology in simple terms and be in a language that the participant understands.
- A sample Participant Information Sheet and Participant Informed Consent Form (PICF) have been provided in Box 3.2.

Electronic/Online Consent

In recent years, data collection through online forms has become increasingly common. Electronic media can be used to provide information as in the written informed consent document, which can be administered and documented using electronic informed consent systems. These are electronic processes that use various, and possibly multiple, electronic formats such as text, graphics, audio, video, podcasts or interactive websites to explain information related to a study and to document informed assent/consent from a participant or LAR.

The process of electronic consent, electronic materials, method of documentation (including electronic/digital signatures), methods used to maintain privacy of participants, confidentiality, and security of the information as well as data use policies at the research site must be reviewed and approved by the EC prior to commencement of research.

Online consent may be obtained, for example, in research involving sensitive data such as unsafe sex, high risk behavior, use of contraceptives (condoms, oral pills), or emergency contraceptive pills among unmarried females in India etc. Investigators must ensure that privacy of the participant and confidentiality of related data is maintained. (ICMR Ethical Guidelines, 2017).



BOX 3.2 Sample participant information sheet and participant informed consent form

Participant Information Sheet (PIS)

Title of the study/Project: A study to evaluate the effectiveness of a call reminder system on medication adherence among patients with mental disorders.

I. **Principal investigator:** Dr Muthuvenkatachalam S., Asst. Professor, Dept. of Psychiatric Nursing, IHBAS, Delhi.

II. **Co-investigators: (if any)**

1. _____

2. _____

We are conducting a study to evaluate the effectiveness of a call reminder system in improving the medication adherence among patients with mental disorders attending OPD of IHBAS.

- III. **Methods of study:** Participants will be enrolled into either intervention or control group. Participants in the intervention group will be explained about the medication regimen and the importance of compliance with medication regimen. In addition to this, they receive a call reminder to take their medication in time as per their prescription schedule. The participants in the control group will be explained about the medication regimen and the importance of compliance with medication regimen during enrolment but they do not receive any call reminder. One to one interview will be conducted at 1 month and 3-month interval when they visit OPD Pharmacy for follow-up medication to gather data related to medication adherence.
- IV. **Expected duration of study participation:** Total duration of approximately 5 minutes each to fill the questionnaire during enrollment and follow-ups.
- V. **Potential risks and discomforts:** There is no potential risk associated with this study.
- VI. **Confidentiality:** The data collected from the participants will be kept confidential and will be used only for research purposes.
- VII. **Provision of free treatment for research-related injury:** Not applicable in this study since there is no potential risk associated with the study.
- VIII. **Alternatives to participation:** You are free not to participate in the study or to withdraw from the study at any time without penalty or loss of benefits.
- IX. **Financial consideration:** Neither you will be charged nor awarded incentives for inclusion in the study.
- X. **Contacts:** If you have any further questions, please contact (provide following contact details).

Name: _____

Designation: _____

Address of Affiliated Institute: _____

Tel No.: _____

Contd...



PARTICIPANT INFORMED CONSENT FORM (PICF)

Protocol/Study number: _____

Participant identification number for this trial: _____

Title of project: A Study to Evaluate the Effectiveness of a Call Reminder System on Medication Adherence among Patients with Mental Disorders.

Name of Principal Investigator: Dr Muthuvenkatachalam S. Tel.No (s). _____

The contents of the information sheet that was provided have been read carefully by me/explained in detail to me, in a language that I comprehend, and I have fully understood the contents. I confirm that I have had the opportunity to ask questions.

The nature and purpose of the study and its potential risks/benefits and expected duration of the study, and other relevant details of the study have been explained to me in detail. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal right being affected.

I understand that the information collected about me from my participation in this research and sections of any of my medical notes may be looked at by responsible individuals from IHBAS. I give permission to these individuals to access my records.

I agree to take part in the above study.

Date: _____

(Signatures/Left Thumb Impression) _____

Place: _____

Name of the Participant: _____

Son/Daughter/Spouse of: _____

Complete postal address: _____

This is to certify that the above consent has been obtained in my presence.

Date: _____

Signatures of the Principal Investigator _____
Place: _____

1. Witness

Signatures

Name: _____

Address: _____

NB Three copies should be made, for (1) Patient, (2) Researcher, (3) Institution

Waiver of Informed Consent

Obtaining informed consent is a fundamental responsibility of the researcher in biomedical research, and it is mandatory in most cases. However, the researcher can apply to the EC for a waiver of consent if the research involves less than minimal risk to participants and the waiver will not adversely affect the rights and welfare of the study participants. ICMR National Ethical Guidelines for biomedical and health research involving human participants (2017) specify the conditions under which the Ethics Committee (EC) may grant a waiver of informed consent. The conditions are as follows:

- Research cannot practically be carried out without the waiver and the waiver is scientifically justified.
- Retrospective studies, where the participants are de-identified or cannot be contacted.
- Research on anonymized biological samples/data.
- Certain types of public health studies/surveillance programs/program evaluation studies.
- Research on data available in the public domain; or
- Research during humanitarian emergencies and disasters, when the participant may not be in a position to give consent. Attempt should be made to obtain the participant's consent at the earliest.

The waiver of informed consent can be given in the following instances:

- Research is done on publicly available information, documents, records, reviews, archival materials or third party interviews.
- When study is done on anonymous biological samples from deceased individuals, left over samples, cell lines, DNA or RNA from institutions, etc.

INSTITUTIONAL ETHICS COMMITTEE

An Institutional Ethics Committee (IEC) is a critical component in research and health care institutions. It is referred to by different names in other countries as IEC, Review Board (IRB), Ethics Review Board (ERB) and Research Ethics Board (REB). Its primary responsibility is to ensure ethical standards are upheld in research involving human subjects. The major responsibility of IECs is to protect the rights, safety and well-being of the research participants.

The IEC conducts meetings for reviewing the research proposals and gives suggestions to the investigators to make their research ethical before approving them. The committee achieves its aims by following ethical reviewing of procedures. It is mandatory that all research institutes must have an appropriately constituted IEC. The proposals involving human participants should be approved by IEC prior to the commencement of the project. The IEC also has the responsibility of regularly monitoring the cleared projects to ensure compliance to ethical principles.

The committees work in accordance with the international guidelines or the Standard Operating Procedures (SOP) of the WHO and National Ethical Guidelines for biomedical research of the ICMR, 2017.

Composition of an Institutional Ethics Committee

Any IEC usually comprises 8–12 members from different disciplines and sectors of health. The two hallmarks of the committee are independence and competence. To maintain the independence of committee, the chairman is appointed from outside the institution. The secretary is from the Institution itself. Other members can be medical/nonmedical, scientific/nonscientific persons. The composition of committee members is shown in Box 3.3.

BOX 3.3 The composition of committee members

- Chairperson
- Basic medical science experts (1–2)
- Clinicians (1–2)
- Legal expert (1)
- Social scientist or nongovernmental voluntary agency representative (NGO) (1)
- Philosopher or ethicist (1)
- Lay person (1) and
- Secretary

Quorum Requirements

Minimum of five members will be required to compose a quorum for the meeting.

As per revised Schedule Y of Drugs and Cosmetics Act, 1940 (amended in 2005), IEC approving drug trials should have in the quorum at least one representative from the following groups:

1. Pharmacologist
2. Clinician
3. Legal expert
4. Social scientist or representative of NGO or philosopher or ethicist
5. Lay person.

If required, subject experts can be invited for their views, for example, a pediatrician, a cardiologist etc.

Review Procedures

The committee has to evaluate and justify the associated risks to the study participants. It also has to assess the expected benefits. It must also ensure the adequacy of documentation for privacy, confidentiality and legal issues. Depending on the risk involved to the participants, the IEC categorize them into three types. The criterion for grouping protocols into 3 heads is the “minimum risk” involved in research. Harm or discomfort not greater than encountered in routine physical or psychological examinations or tests is defined as “minimum risk”. The three categories are stated below.

1. **Exemption from review:** Study protocols that present less than minimal risk fall under this category. For example, research on educational practices like effectiveness or comparison among instructional techniques/strategies.
2. **Expedited review:** The proposals that are at minimal risk to study participants are subjected to this kind of review. Some of the conditions in which this reviewing is done are:
 - Clinical studies involving already approved drugs and medical devices.
 - Any report of minor Adverse Event (AE) or unexpected Adverse Drug Reaction (ADR).
 - Research involving clinical materials (data, records, or specimens) that have been collected for nonresearch purposes.
 - When a full review of the research is not possible like in case of emergency situations (serious outbreaks or disasters)
3. **Full review:** Those researches that show more than minimal risk, and do not qualify for exempted or expedited review are subjected to full review. The projects that involve vulnerable population are also reviewed fully.



- **Submission of application:** A complete application form in prescribed format along with study protocol must be submitted for IEC reviewing.

The protocol should include:

- The title of study with signature of Principal Investigator (PI) and coinvestigators.
- Research objectives and rationale of study.
- Qualification and experience of investigators.
- Inclusion and exclusion criteria for entry of participants.
- Precise description of methodology.
- Plan to withhold standard treatment in the course of research.
- Plan for statistical analysis.
- Procedure for obtaining informed consent with sample of patient information sheet and informed consent forms.
- Safety of the intervention or drug or vaccine to be tested.
- For research involving more than minimal risk, an account of management of such risk or injury.
- Proposed compensation in case of research related and unrelated injury/illness.
- All other relevant documents related to the study protocol like investigator's brochure for trial on drugs/devices/vaccines/herbal remedies and statement of relevant regulatory clearances.
- Agreement to comply with national and international Good Clinical Practices (GCP) protocols for clinical trials.
- Details of Funding agency/Sponsor.
- In case of international collaborations, the details about foreign collaborators and documents for review of Health Ministry's Screening Committee (HMSC) or appropriate Committees under other agencies/authority like Drug Controller General of India (DCGI)
- For exchange of biological material in international collaborative study, an MoU/Material Transfer Agreement between the collaborating partners.
- A statement on conflict-of-interest (COI), if any.

Decision-Making Process

The IEC must provide complete and adequate review of the research proposals submitted to them. The following points should be kept in mind while doing so:

- The board must make a consensus decision. The Secretary communicates in writing the decision to the PI.
- If any member of IEC has her/his own proposal for review, then she/he should withdraw from the committee when their project is being discussed.
- A negative decision (e.g., a rejection of research protocol) must have a clearly defined reason supporting it.
- The IEC should order for discontinuing the trial if the goals of the trial are achieved midway or unequivocal results are obtained.
- Notification of premature termination of study along with the reason and result summary conducted till date must be provided.
- In the following cases, the matter must be brought to the attention of IEC:
 - Any changes to the original approved protocol with proper justification.
 - Remedial steps taken to tackle unexpected or serious adverse events.
 - Any new information that can influence the conduct of the study.
- Minutes of the meeting should be signed by the Chairperson and the designated member of the committee.

Review Process and Monitoring

It is advisable to conduct formal meetings for ethical reviewing instead of circulating the proposals. The committee should meet frequently and the decisions must not be kept pending for >3–6 months, as defined in the SOP. The ongoing research may be periodically reviewed and monitored.

Record Keeping by IEC

The documents and other communications related to IEC must be properly preserved as per the institute procedures. During access and retrieval procedures, strict confidentiality is to be maintained. Participants and other related information must be stored for 5 years or more (including microfilms, CDs and Video recordings).

Responsibilities of Ethics Committees

- During review, determine whether the prospective participants for a particular research are vulnerable.
- Examine whether inclusion/exclusion of the vulnerable population is justified.
- Ensure that COI does not increase harm or lessen benefits to the participants.
- Carefully determine the benefits and risks to the participants and advise risk minimization strategies wherever possible.
- Suggest additional safeguards, such as more frequent review and monitoring, including site visits.
- Only the full committee should do initial and continuing review of such proposals. It is desirable to have empowered representatives from the specific populations during deliberations.
- ECs have special responsibilities when research is conducted on participants who are suffering from mental illness and/or cognitive impairment. They should exercise caution and require researchers to justify cases for exceptions to the usual requirements of participation or essentiality of departure from the guidelines governing research. ECs should ensure that these exceptions are as minimal as possible and are clearly spelt out in the ICD.
- ECs should have SOPs for handling proposals involving vulnerable populations.

Adverse Event Monitoring

Adverse event monitoring involves monitoring and reporting of adverse event or unanticipated problems arising during the research trials (both ethical and unethical) to the ethical committee of the institute to prevent harm to participants or others. Any unfavorable changes in current health states of participants must be documented. Incident, experience or outcome that may harm the participants (physical, psychological, economical or social) are also to be reported. In fact, the protocol must outline how adverse events will be defined, documented and monitored. Allocation of responsibility in case of adverse event and its management must be predefined in the study protocol before submitting it to the Ethics Committee. It must have a financial plan (compensation) in case of any adverse event.

Unexpected adverse event or injuries from trials should be reported to the sponsor by the investigators within 24 hours and to the ethics committee within 7 days. This enables the authorities to stop the trial or withdraw the drugs immediately. All other less serious events must be filed within 14 days.

Data and Safety Monitoring Board

Data and safety monitoring board (DSMB) is an independent committee. It is established by the sponsor to regularly assess the study for scientific and ethical integrity. This is achieved by reviewing and evaluating data and reports periodically. It provides recommendations to the sponsor regarding study modification, suspension, or termination.

The DSMB is also known by other names like Monitoring Committee (MC), Data Monitoring Committee (DMC), Data and Ethics Monitoring Committee (DEMC), Independent Data Monitoring Committee (IDMC), Safety Monitoring Committee, and Study Monitoring Committee.

The monitoring by a DSMB is not required by all clinical studies. The need for establishing a separate DSMB is decided by the ethics committee or study sponsors. It is required only for complex or pivotal researches. The interim data analysis safeguards the study participants.

It is important for studies that intend to save lives and prevent serious disease progression or adverse health outcome. For example, in case of randomized controlled studies which evaluate safety and effectiveness of a new intervention with reduced severe morbidity or mortality as outcome; earlier studies of a high-risk intervention or the ones involving vulnerable populations, etc.

Functions of DSMB

- DSMB preserves the integrity of the study and/or protects the rights and welfare of research participants.
- It reviews the complete protocol including informed consent, investigator's brochure, relevant literature, and other related documents.
- It assesses and evaluates the safety and efficacy of the study, and reviews reports on Serious Adverse Events (SAEs).
- It gives recommendations on dosages, duration, eligibility criteria, sample size, etc.

RTI IN RESEARCH

Right to Information Act 2005, gives a citizen the right to seek information from public authority or any one held under its control. It mandates timely response to citizen requests for government information. It is the duty of the state to provide such information. RTI in research empowers the citizens to ask for any information or detail regarding the trial. They can ask for the selection criteria, procedure or methodology, expenses, insurance claims, etc. Anyone can ask regarding the remuneration and selection criteria of staff working in the research projects.

It is the responsibility of the principal investigator to give a transparent and detailed reply. No information is hidden from the public or the person who has filed the RTI.

The RTI in research is a tool that helps to keep a check on the quality of research and also curbs unethical research practices.

ETHICAL RESPONSIBILITIES OF A RESEARCHER

- Recognize the vulnerability of the participant and ensure additional safeguards are in place for their protection. Justify inclusion/exclusion of vulnerable populations in the study.
- COI issues must be addressed.

- Have well-defined procedures (SOPs) to ensure a balanced benefit-risk ratio.
- Ensure that prospective participants are competent to give informed consent.
- Take consent of the LAR when a prospective participant lacks the capacity to consent.
- Respect dissent from the participant.
- Seek permission of the appropriate authorities where relevant, such as for institutionalized individuals, tribal communities, etc.
- Research should be conducted within the purview of existing relevant guidelines/regulations.

SUMMARY

- Ethics in nursing research can be defined as the set of moral principles and guidelines that govern the conduct of research involving human participants in the field of nursing.
- The purposes of ethics in nursing research are to safeguard the well-being of participants, including vulnerable populations, prevent exploitation, respect dignity and privacy, balance risk and benefit, and uphold participant autonomy while guiding evidence-based nursing practices.
- The four fundamental ethical principles in nursing research are beneficence (prioritizing participant well-being), nonmaleficence (preventing harm), justice (ensuring fairness in participant treatment), and autonomy and respect for human dignity (upholding participant rights, informed consent, and privacy).
- The Participant Information Sheet (PIS) serves as an initial, clear, and understandable document that informs potential research participants about essential study details, while the Participant Informed Consent Form (PICF) is a legally and ethically vital document used in research to ensure participants fully understand the study, their rights, and their choice to participate.
- Electronic/online consent utilizes digital formats for informed consent while maintaining ethical and security standards, and waivers of informed consent can be granted in biomedical research under specified conditions to balance participant protection and research feasibility.
- An Institutional Ethics Committee (IEC) is a vital body responsible for upholding ethical standards, safeguarding the rights and well-being of research participants, and ensuring the ethical review and approval of research proposals involving human subjects in accordance with international guidelines and national ethical standards.

ASSESS YOURSELF

Long Answer Questions

1. What are ethics? Explain the need to have ethics in nursing research.
2. Give a brief account of the development history of the ethical guidelines.
3. State the principles of research ethics and how these relate to the rights of research participants.
4. Describe the role of IEC.
5. What do you understand by the term informed consent? What are its basic elements?

Short Answer Questions

1. Write briefly about debriefing and consent form.
2. Write briefly about Data and Safety Monitoring Board (DSMB).
3. What is adverse event monitoring?



Multiple Choice Questions

- The Nuremberg Code (ethical guidelines for conducting research) was developed as a result of:
 - World War I
 - World War II
 - Cold War
 - Iraq-US-War
- Which one is not the fundamental guiding principle of ethics?
 - Respect for patient and their autonomy
 - Maleficence
 - Beneficence
 - Justice
- Right to Information Act came into existence in which year?
 - 1985
 - 1999
 - 2001
 - 2005
- Which of the following is not required in consent form?
 - Address of researcher
 - Name of researcher
 - Phone no. of the researcher
 - Income of the researcher
- Which of the following is not eligible to become a member of IEC?
 - Lay person
 - Philosopher
 - Member of Parliament
 - Legal expert
- What is the minimum number of members to comprise an optimum quorum for the IEC meeting?
 - 3
 - 4
 - 5
 - 7
- Which of the following is true about ethics?
 - Ethics do not relate to nursing
 - Ethics are always related to law of the land
 - Ethics are framed by Rajya Sabha
 - Ethics reflect our morals
- Which of the following conduct of nurses is unethical?
 - She takes informed consent of a blind patient
 - She does not tell exact diagnosis to cancer patient
 - She also offers treatment to the control group in a drug trial
 - She keeps the subject's information confidential
- Ethics norms are framed to fulfill which of the following?
 - To promote values essential to collaborative work
 - To save researcher from enquiry
 - To document fabricated data
 - To save on time of researcher
- The study protocol for submission to IEC does not include which of the following?
 - The title of study with signature of Principal Investigator (PI) and Co-investigators
 - Research objectives and rationale of study
 - Plan for statistical analysis
 - Name of the subjects/research participants

Answer Key

1. b	2. d	3. d	4. d	5. c	6. c	7. d
8. c	9. a	10. d				

BIBLIOGRAPHY

- All India Institute of Medical Sciences. Institute Ethics Committee (Human Studies) Standard Operating Procedures. Bhubaneswar: 2012-2013 Available at: www.aiims.edu/en/component/content/category/101-medicine.html.
- Antipuesto DJ. Ethical Principles. [online] Available from: <http://nursingcrib.com/nursing-notes-reviewer/fundamentals-of-nursing/ethical-principles>. [Accessed 2011]
- Burns N, Grove SK. *Understanding Nursing Research – Building an Evidence Based Practice*. 4th edition Saunders Elsevier Publishing; 2011.
- Caplan AL Twenty years after. *The legacy of the Tuskegee syphilis study*. *Hastings Center Report*. 1992;22(6):29.
- Chair Douglas P Olsen. *Ethical Considerations in International Nursing Research: a report from the International Centre for Nursing Ethics*. *Nurs Ethics*. 2003;10: 122-137.
- Council for International Organizations of Medical Sciences (CIOMS). *International Ethical Guidelines for Biomedical Research Involving Human Subjects*. Geneva: 2002.
- Daniel K An Assessment of Ethical Issues in Social and Science Research, *International Journal of Psychology and Behavioral Sciences*. 2013;3(2):41-8.
- Declaration of Helsinki. [online] Available from <http://www.wma.net/en/30publications/10policies/b3/index.html> [Accessed]
- Ethics and Its Impact on Nursing. *Study Mode.com*. [online] Available from <http://www.studymode.com/essays/Ethics-And-Its-Impact-On-Nursing-1843193.html>.
- Indian Council of Medical Research. *Ethical Guidelines for Biomedical Research on Human Participants*. New Delhi:2006. [online] Available from: icmr.nic.in/ethical_guidelines.pdf.
- Kapil U Update on vitamin A-related deaths in Assam, India. *Am J Clin Nutr*. 2004;80:1082-83.
- Marcus. *Ethics and Nursing - Values and Ethics in Nursing*. [online] Available from: <https://www.scribd.com/doc/6352416/Ethics-and-Nursing>. [Accessed 2008]
- National Committee for Ethics in Social Science Research in Health. *Ethical Guidelines for Social Science Research*. Mumbai. [online] 2000 Available from; [http://www.dt.mahidol.ac.th/division/th_Research_Ethic_Promotion_Unit/images/data/The % 20 India % 20 National % 20 Committee % 20 for % 20 Ethic % 20 in % 20 Social % 20 Science % 20 Res. pdf](http://www.dt.mahidol.ac.th/division/th_Research_Ethic_Promotion_Unit/images/data/The%20India%20National%20Committee%20for%20Ethic%20in%20Social%20Science%20Res.pdf)
- Nieswiadomy R M. *Foundations of Nursing Research*. 5th ed. Pearson education publication; 2008.
- Orb A, Eisenhauer L, Wynaden D. *Ethics in Qualitative Research* *Journal of Nursing Scholarship*. 2001; 33(1):93-6.
- Resnik D B. *What is Ethics in Research and Why is it Important?* 2011 [online] Available from: <http://www.niehs.nih.gov/research/resources/bioethics/whatis/>
- Roberts K, Taylor, BJ. *Nursing Research Processes: An Australian Perspective*. 2nd edition. Nelson Australian Pty Limited; 2002.
- *The Nuremberg Code. Trials of War Criminals before the Nuremberg Military Tribunals under Control Council Law No. 10*, Washington DC: US Government Printing Office. 1949;2: 181-2.
- United States Office of Human Subject Research [online] Available from <http://ohsr.od.nih.gov/mpa/belmont.php3>. [Accessed 2016]
- University of Minnesota's Center for Bioethics. *A Guide to Research Ethics*. [online] Available from: www.bioethics.umn.edu [Accessed 2003]
- World Health Organization. *Operational Guidelines for the Establishment and Functioning of Data and Safety Monitoring Boards TDR/GEN/Guidelines/05.1*. Geneva. [online] Available from osp.od.nih.gov/.../default/files/resources/operational-guidelines.pdf [Accessed 2005]
- World Health Organization. *Standards and Operational Guidance for Ethics Review of Health-Related Research with Human Participants*; 2011.



Research Problem

LEARNING OBJECTIVES

After the completion of the chapter, the readers will be able to:

- Define research problems.
- Enlist the sources of research problem.
- List down the criteria to select a good research problem.
- Explain the steps of formulating research problem.
- Define variable.
- Elaborate different types of variables in research.
- Differentiate between operational definition and conceptual definition.
- Differentiate between aims and objectives.
- Explain different types of objectives.

CHAPTER OUTLINE

• Introduction	• Formulating the Research Problem
• Definitions	• Elements of Problem Statement
• Identification of Research Problem	• Identification of Variables
• Sources of Research Problem	• Operational Definitions
• Criteria to Select Good Research Problem	• Research Objectives

KEY TERMS

Aim: A broad and overarching statement that describes the overall purpose or intention of a research study.

Conceptual definition: A clear and comprehensive explanation of a research variable's meaning and theoretical underpinnings within the context of the study.

Confounding variable: A type of extraneous variable that is related to both the independent and dependent variables, making it challenging to determine the true cause-and-effect relationship.

Contd...

Demographic variable: A type of independent variable that includes characteristics such as age, gender, ethnicity, and education level, often used to describe study participants.

Dependent variable: The variable that is measured or observed to assess the effects of the independent variable; it is the outcome of interest in a study.

Elements of a research problem: The key components that define a research problem, including the phenomenon of interest, the population or sample, and the research context or setting.

Extraneous variable: Variables other than the independent variable that can influence the dependent variable and need to be controlled or accounted for in a study.

General objective: A statement that outlines the primary goal or outcome a researcher hopes to achieve in a study.

Independent variable: The variable that is manipulated or controlled by the researcher to assess its impact on the dependent variable.

Multivariate study: A research study that examines the relationship between two or more independent variables single or multiple explores complex interactions among variables.

Objective: Specific, measurable, and attainable sub-goals or outcomes that contribute to achieving the general objective of a research study.

Operational definition: A precise and measurable definition of a research variable that specifies how it will be observed, measured, or manipulated in the study.

Problem statement: A concise and clear description of the research problem that outlines its scope, significance, and relevance to the field of study.

Qualitative variables: Variables that represent qualities, characteristics, or attributes and are typically categorized into distinct groups or categories.

Quantitative variables: Variables that are expressed in numerical terms and can be quantified or measured using numerical values.

Research problem: A specific issue or concern that serves as the foundation for a research study, typically formulated as a question or statement to be investigated.

Secondary objective: Additional objectives that support and complement the achievement of the general objective in a research study.

Specific objective: Highly focused and detailed objectives that define the precise tasks or actions to be accomplished in a research study.

Univariate study: A research study that examines the relationship between a single independent variable and a single dependent variable.

Variables: Factors or characteristics that can be measured, observed, or manipulated in a research study.

INTRODUCTION

The process of identifying and formulating a research problem is a first and foundational step in the research process. It involves recognizing a gap in existing knowledge or a real-world challenge that requires investigation. This phase demands critical thinking, literature review, and a clear understanding of the current state of the phenomena under study. For beginners, this phase of the research process often proves to be one of the most challenging tasks.

Research problem is a question that an investigator wants to solve through research. From the researcher's perspective, many factors/requisites are to be taken into consideration while selecting a research problem. These may include knowledge level of a researcher, skill, interest, motivation, proficiency, enthusiasm, and creativeness etc with respect to the topic of inquiry. It is generally thought that many high-quality studies are those where enough time was spent for selection of a research problem.

This chapter discusses the statement, elements and sources of a research problem, factors to be considered while selecting a research problem, and the criteria to evaluate a research problem, etc. The format for writing a problem statement will also be discussed. It will also elaborate upon the types of variables, operational definitions, and writing research objectives with appropriate examples.

DEFINITIONS

Research Problem

According to Kerlinger (1964), “A *problem is an interrogative sentence or statement that asks what relation exists between two or more variables. The answer to question will provide what is having sought in the research.*”

R.S. Woodworth defines problem as “a situation for which we have no ready and successful response by nature or by previous acquired habit. We must find out what to do”, i.e., the solution can be found out only after an investigation.

A research problem is a specific question or issue that a researcher seeks to answer or address through their research. The research problem can be about something that is already known, or it can be about something that is not yet known or a gap in knowledge that needs to be filled. The research problem should be specific, focused, and important. It should also be feasible to investigate with the resources available to the researcher. Indeed, a research problem serves as the driving force that motivates a researcher to initiate a study.

Problem Statement/Statement of the Problem

While the terms “research problem” and “problem statement” are often seen as identical, they do have different meanings in the context of research. A research problem is a broader issue or question that needs investigation, while a problem statement is a concise description of the specific challenge or question that the researcher aims to address within that research problem.

A problem statement in research is a concise and specific statement that identifies the issue or problem which the research project aims to address. A well-constructed problem statement not only highlights the significance of the research but also provides direction for formulating research questions, objectives, and hypotheses. The core of the research proposal revolves around the problem statement. There should be a good alignment between the topic and the statement of the problem.

Sometimes problem statement and the purposes of a study are considered identical. However, these two are different. Problem statement of a study is about ‘what’ will be observed by the investigator, however, the purpose of the study includes ‘why’ the study will be carried out.

IDENTIFICATION OF RESEARCH PROBLEM

Identification and formulation of a research problem is the first and foremost step in the research process. Usually, a researcher selects a broad topic/area of research and then narrows down to a specific research statement of the problem. The step of identification and formulating research problem is often challenging and time consuming.

Research problems can originate from several sources. The best research problems are those that are interesting to the researcher, that are important to the field, and that are feasible to investigate.

SOURCES OF RESEARCH PROBLEM

Research problems can originate from several sources. It is very important to get the right problem in terms of relevance, significance and feasibility. The researchers can identify the appropriate nursing research problem from several sources. However, the following are certain important sources which could be helpful in identifying a research problem (Fig. 4.1).

- Personal experience:** Research questions often begin with researchers' own curiosity and ideas, driven by day-to-day personal experiences, interactions and observations. This could be a great source of identifying the research problem. For example, a researcher noticed a concerning trend that the individuals with mental illness are frequently subjected to mistreatment and stigma within the community. This observation motivated the researcher to study the factors contributing to the stigma surrounding mental health issues.
- Clinical experience:** Nurses working directly with patients often encounter situations that raise questions or highlight challenges in patient care. The problems of the patients/caregivers in the hospital could be a source of idea. These experiences, gained through hands-on interactions with patients, can spark curiosity about the effectiveness of current practices, the impact of specific interventions, or the underlying causes of certain health conditions. For example, a researcher observed inconsistent hand hygiene practices among staff in the ward. This experience prompted the nurse researcher to develop a research problem

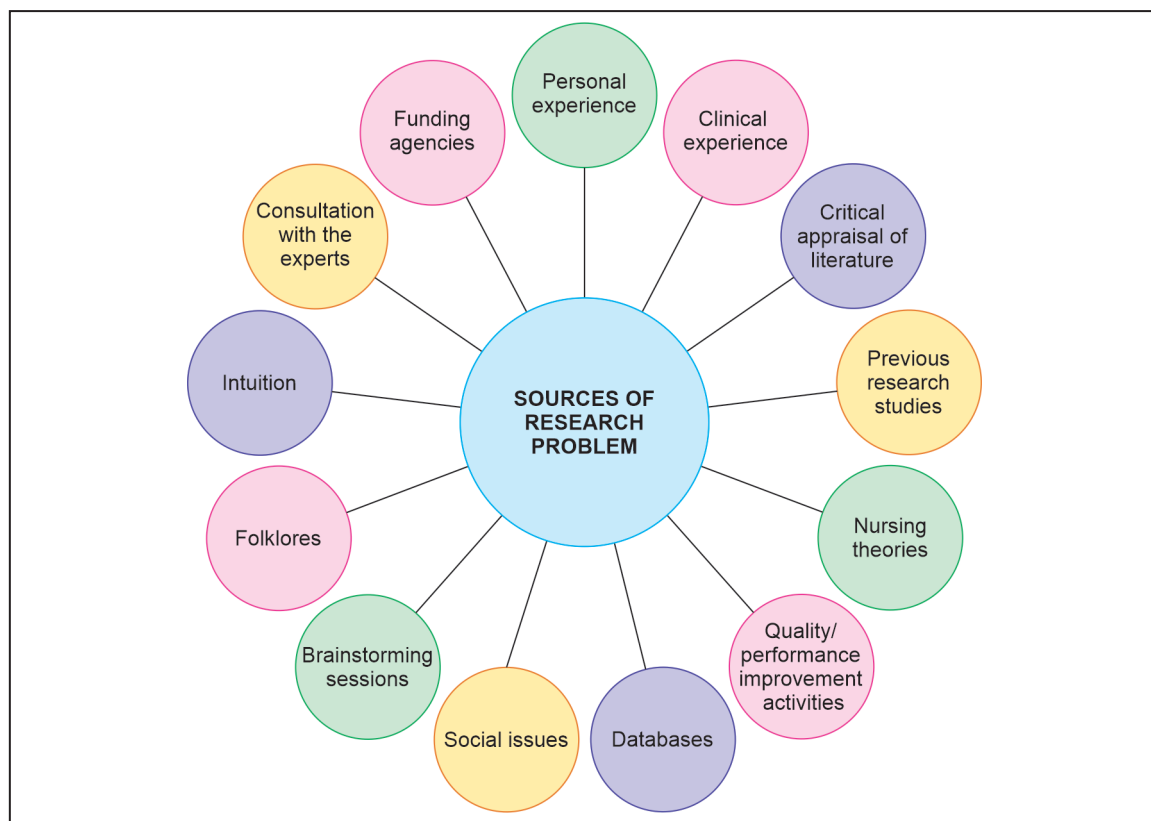


Figure 4.1: Sources of research problem

focused on improving hand hygiene compliance in health care settings, aiming to enhance patient safety and infection control practices.

- **Critical appraisal of literature:** Another valuable source of research problems stems from the critical appraisal of existing literature. Researchers often explore published studies, articles, and research findings in their field. Through this process, they may identify gaps, inconsistencies, or unresolved questions in the current body of knowledge. By critically evaluating the strengths and limitations of previous research, researchers can pinpoint areas that require further investigation. For example, after carefully studying existing research, a nurse researcher noticed that there's a gap in understanding how the nurse-patient ratio affects patient safety in hospitals. This prompted the researcher to study the impact of nurse-patient ratio on patient safety and quality of patient care.
- **Previous research studies:** Almost every published and unpublished study ends with the recommendations for the future research studies. These may suggest areas for further study. Replication of a study on a new population and in a new setting could be another good source. Literature review can even help to narrow down the selected problem. For example, a published research paper on preventing pressure ulcers by repositioning patients every 2 hours proposed that it might be beneficial to conduct a new study with less frequent repositioning intervals to enhance patient comfort. This provides a basis for a new research problem.
- **Nursing theories:** Nursing or other health theories are another source of research problems. Research is a process of theory development and/or testing. Already existing theories must be tested in the real world through the formulation of research problems and hypotheses. Theories hypothesize that there are certain relationships between concepts, and these can be tested using research techniques. The theory may predict a certain outcome and it is necessary to test the theory to see if it is applicable in practice. *For example*, Orem's Self-Care Deficit theory suggests that individuals need to engage in self-care to maintain their health. Research can involve testing this theory in real-world scenarios by investigating whether patients who actively participate in self-care routines experience better health outcomes compared to those who do not.

However, very few nursing research projects operate at the level of testing theory. Majority of them use the theory as a framework for organizing the research.

- **Quality/performance improvement activities:** Quality and performance improvement activities can serve as a valuable source of research problems. By examining the challenges and opportunities identified through quality improvement initiatives, researchers can pinpoint research questions that address real-world issues and contribute to enhancing overall performance and outcomes. For example, through the analysis of quality improvement data, the research problem could emerge as "To what extent do nurses' attitude and perception toward hand hygiene practices impact their compliance, and how can interventions be tailored to address these factors?"
- **Databases:** Databases serve as potential sources of research problems by providing a wealth of information from various studies. Researchers can explore existing data to identify gaps, contradictions, or areas that require further investigation. Databases can offer insights into emerging trends, helping researchers identify topics that are relevant and timely for further study.
- **Social issues:** Social issues serve as significant sources of research problems. These are often highlighted in various media platforms such as newspapers, magazines, TV, film, and social media. For instance, with the aging population and the trend toward smaller families, a study could investigate the challenges faced by the elderly. Similarly, pressing social issues in health care like HIV/AIDS, female feticide, sexual harassment, domestic violence, and gender equality offer valuable research opportunities to address real-world concerns and contribute to positive societal change.

- **Brainstorming sessions:** Brainstorming sessions can generate valuable research problems through collaborative idea-sharing. Experts coming together to discuss specific topics can uncover new perspectives and areas worth investigating. For example, a brainstorming session among nurses, researchers, and nursing faculty might reveal pressing research priorities that aim to enhance patient care and health care practices.
- **Folklores:** Folklores are the common beliefs or practices within the society. These viewpoints could be right or wrong. This can serve as intriguing sources of research problems. For example, traditional remedies for common illnesses based on folklore could be investigated through scientific research to gain a clearer understanding of their validity and contribute to evidence-based health care practices.
- **Intuition:** Intuition, or a gut feeling, can be an unconventional yet valuable source of research problems. Researchers' instincts about certain phenomena can spark curiosity and lead to meaningful investigations. For instance, a nurse's intuition about a potential link between certain patient behaviors and their health outcomes might inspire a study exploring this relationship.
- **Consultation with the experts:** The experts with sound knowledge and experience of their respective fields can be resourceful in suggesting researchable problems. These experts can offer insightful perspectives and recommendations that contribute to the selection of meaningful and feasible research topics. This includes research guides/supervisor of doctoral research.
- **Funding agencies:** Many government and nongovernment organizations often announce call for research proposals on their websites and sometimes in the newspaper. These opportunities can serve as potential sources for identifying research problems that align with priorities and interests of these organizations. Department of Science and Technology (DST), Department of Biotechnology (DBT), Indian Council of Medical Research (ICMR), Indian Council of Social Science Research (ICSSR), etc. are some of such agencies.

CRITERIA TO SELECT GOOD RESEARCH PROBLEM

Selecting a good research problem is a crucial step in the research process. A well-chosen research problem forms the foundation of a successful research project. Here are some criteria to consider while selecting a good research problem.

- **Significance to nursing:** It's important to consider how the problem contributes to the field of nursing and health care. The research problem should have the potential to improve nursing practice, education, or administration. A research problem that is significant to nursing profession aims to address one or more of the following:
 - Improves patient care and outcome.
 - Improves the standards of nursing practice.
 - Fills knowledge gaps in nursing.
 - Promotes evidence-based practice.
 - Promotes nursing leadership and advocacy.
 - Develops the nursing education.
- **Relevance:** The research problem should be relevant to the field of study and address a current or emerging issue. It should contribute to advancing knowledge, solving practical problems, or filling a gap in the existing literature.
- **Originality:** Each research problem should be innovative and exclusive in itself. Research problem that is unique and innovative offers a new perspective on an existing issue. It is the prime responsibility of a researcher that an original research problem is selected in order to expand the existing body of knowledge. Moreover, novelty is nowadays a major evaluation criterion for assessing the research worthiness of a problem.



- **Researcher's interest:** Choosing a research problem according to the interest and passion of the researcher is an important criterion. This will help to maintain enthusiasm for the project throughout the research process.
- **Researcher's expertise:** The competency and skills possessed by the researcher should match the complexity and requirements of the chosen research problem. Opting for a problem that aligns with the researcher's capabilities enhances the likelihood of conducting a successful study and producing meaningful outcomes.
- **Feasibility:** One should also consider the feasibility of carrying out the research study in terms of resources, time, money, availability of sample, cooperation from others and organizational support.
 - **Resources:** One should have sufficient resources to carry out the project. Resources include manpower, laboratory equipment, software tools, access to databases, and materials needed for data collection.
 - **Time:** Time is a critical consideration. Research projects have specific timelines that encompass planning, data collection, analysis and writing. The available time must align with the complexity of the research problem. A project that requires extensive data collection and analysis might need a longer timeframe compared to a smaller-scale study.
 - **Money:** Virtually every project has some cost attached to it. Financial considerations are integral to research feasibility. Expenses could include participant compensation, travel costs, purchasing materials or software licenses, and any fees associated with data collection. Having a budget and securing funding, if needed, ensure that the research can be conducted without financial deterrents.
 - **Availability of sample:** Availability of an appropriate sample is crucial for gathering representative data and drawing meaningful conclusions. Given that nursing research frequently involves human subjects as participants, a significant challenge arises in finding individuals who meet the inclusion criteria and are willing to participate in the study. Also, consider factors such as the size of the sample, its accessibility, and its relevance to the research question.
 - **Cooperation:** All studies require support and cooperation from the stakeholders such as the study setting, colleagues, administrators, and research participants. This has to be ensured by the researcher at the time of planning for the study to avoid unnecessary hurdles in the later stage.
 - **Organizational support:** The organizational and administrative support encompasses various aspects such as time allocation, financial resources and provision of materials. The psychological support by the administrator may even be very helpful and powerful motivating factor for a researcher.
- **Ethical issues:** Ethical consideration is an important criterion while selecting research problem. The research problem chosen by the researcher should reflect commitment to ethical conduct throughout the research process. The ethical committee closely examines the research proposals for potential violation of ethical principles.
- **Researchable:** Researchable problem is one that is solvable effectively through systematic research methods. For a problem to be considered researchable, it should enable researchers to gather relevant data and draw conclusions based on evidence. For example, if a researcher selects a research problem to assess the effectiveness of spiritual belief on recovery of patients in health care setting, it's challenging to empirically prove the role of spiritual belief in patient outcomes.
- **Legitimacy:** The problem chosen should be grounded in sound academic principles, aligning with established theories, methodologies, and accepted practices within the field. This ensures that the research is well-founded and contributes meaningfully to the body of knowledge in a credible manner. A research problem should avoid reflecting a moral standpoint, especially in areas laden with values like religion, politics, or ethics. For example, questions such as "Should nurses assist with euthanasia?" aren't suitable research topics as they address moral queries better suited to ethical debates than research.

FORMULATING THE RESEARCH PROBLEM

It generally begins with the identification of a general problem area of interest to the researcher. This is followed by subsequent narrowing down the topic of inquiry to a very specific problem to be investigated. The flow of steps of formulating research problem statement along with an example has been depicted in Table 4.1.

1. Selecting the Research Topic

The first step of formulating research problem is to choose a broad subject area from real-world problems, personal experience, previous research, literatures, and theories. Significance of the chosen topic to the nursing profession is identified.

2. Reviewing the Relevant Literature

Reviewing existing literature related to the selected topic helps the researcher to understand what is known and what is not known about the topic. Research gaps, trends and existing research questions are identified. “Whys” and “How’s” surrounding the topic are explored.

3. Narrowing Down the Research Topic (Delimitation of the Problem)

The initial topic is fined into a more focused research question. This step adds precision to the research study. Specific aspects or angles to explore the topic are considered. The researcher ensures that the research problem is researchable and specific.

4. Evaluating the Research Problem

Once the research problem is clearly defined, the researcher must evaluate the research problem for its significance, relevance, researchability and feasibility. Feasibility should be evaluated in terms of availability

Table 4.1 Funding agencies for research

The agencies which help in funding the students in India are:

- Indian Council of Medical Research (ICMR)
- Indian Council of Social Science Research (ICSSR)
- Public Health Research Initiative (PHRI)
- University Grants Commission (UGC)
- All India Council for Technical Education (AICTE)
- Council of Scientific and Industrial Research (CSIR)
- Defence Research and Development Organization (DRDO)
- Department of Biotechnology (DBT)
- Department of Science and Technology (DST)
- Department of Scientific and Industrial Research (DSIR)
- Department of Education (DOE)
- Indian National Science Academy (INSA)

International funding agencies are:

- International Foundation for Science
- Third World Academy of Sciences (TWAS)
- Third World Network of Scientific Organizations

Table 4.2 Step wise example of formulation of research problem statement

Steps	Example
1. Selecting the Research Topic	A researcher decided to explore nursing care needs of elderly population in institutional settings. Broad topic: Nursing care needs of elderly population in institutional settings.
2. Reviewing the Relevant Literature	Studies, articles and reports on nursing care needs of elderly in institutional settings are reviewed
3. Narrowing Down the Research Topic (Delimitation of the problem)	Nursing care needs of elderly is a very broad area. The researcher delimits the research topic to a specific topic "Evaluating the Effectiveness of Fall Prevention Strategies for Elderly Patients in institutional settings"
4. Evaluating the Research Problem	The researchability and feasibility to conduct the study are evaluated. Study settings, availability of study participants and other resources available to conduct the study are assessed.
5. Formulating the Final Problem	The final research statement can be formulated as follows: Declarative format: "To evaluate the effectiveness of fall prevention strategies on reducing the incidence of falls among elderly clients in institutional settings" Interrogative format: "How does the implementation of fall prevention strategies impact the reduction of falls among elderly clients in institutional settings?"

of resources, manpower, time, cost, cooperation, administrative support, and ethical issues. Guidelines for evaluation of research problem have been described in Table 4.2.

5. Formulating the Final Problem

The researcher formulates a clear and concise research problem statement after careful evaluation of the research problem. The statement should accurately reflect the primary focus and purpose of the study.

A problem statement can be presented in either declarative or interrogative format, each offering a distinct approach to framing the research issue:

Declarative format:

- In this format, the problem is stated as a declaration or assertion.
- It provides a straightforward and direct statement of the issue.
- Often used when the problem is well-defined and the focus is on addressing the issue.
- Example: "A study to evaluate the effectiveness of implementation of hand hygiene protocols in health care settings on incidence of hospital-acquired infections."

Interrogative format:

- In this format, the problem is posed as a question.
- It engages the reader by prompting them to think about the research question.
- Commonly used when the problem requires exploration and inquiry.
- Example: "How does the implementation of hand hygiene protocols impact the incidence of hospital-acquired infections in health care settings?"

Guidelines for Evaluation of a Research Problems (Table 4.3)

Table 4.3 Criteria for evaluation of a research problem

S.no.	Criteria	Yes/No
1	Is the research problem interesting?	
2	Significance of the problem	
2 (a)	Is the problem aligned with current trends in nursing?	
2 (b)	Does the research problem hold significance for the nursing profession?	
2 (c)	Will patients, nurses or the health care community benefit from the generated evidence?	
2 (d)	Will the findings contribute to improving nursing practices?	
3	Feasibility/practicality of the study	
3 (a)	Is there sufficient time available to complete the research?	
3 (b)	Will participants be available during data collection?	
3 (c)	Are there any budgetary or other facility-related constraints for conducting the study?	
3 (d)	Will the researcher get necessary cooperation and support to complete the research?	
3 (e)	Are appropriate methodology and resources, including suitable measuring instruments, available?	
3 (f)	Is there sufficient manpower available to conduct the research?	
4	Researchability of the problem	
4 (a)	Is the problem researchable through the collection and analysis of real-world data?	
4 (b)	Is the chosen approach suitable for investigating the problem?	
5	Ethical considerations	
5 (a)	Does the study involve human subjects?	
5 (b)	Are there potential risks to the physical or mental well-being of the subjects?	
5 (c)	Will the researcher be able to obtain informed consent from the participants?	
6	Statement of the problem	
6 (a)	Is the problem statement concise and clearly written?	
6 (b)	Does the statement include study variables and the target population?	

ELEMENTS OF PROBLEM STATEMENT

Elements of quantitative and qualitative problem statements are described in Table 4.4 with examples.


Table 4.4 Examples of problem statements and its elements

Example statement	Elements of problem statement explained
Quantitative problem statement: "A experimental study to examine the effects of a mindfulness-based intervention on reducing stress levels among employees in a corporate work environment."	Type of Study: An experimental study Quantitative Terms: examine, effects Independent Variable: mindfulness-based intervention Dependent Variable: stress levels Control and/or Mediating Variable: Not applicable in this study. Research Setting: corporate work environment Participants/Population: corporate employees
Qualitative problem statement: A phenomenological study to explore the lived experiences of caregivers providing care for individuals with Alzheimer's disease in home settings.	Type of Study: A phenomenological study Qualitative Words: explore, lived experiences Central Phenomenon: caregivers providing care for individuals with Alzheimer's disease Participants: caregivers Research Setting: home settings

Guidelines for writing quantitative and qualitative problem statements are as follows:

Quantitative Problem Statement

- Use a single sentence.
- Start with type of study "An experimental study to" Or "A descriptive study on"
- Use quantitative terms such as 'compare' 'assess' 'measure', etc.
- Independent variable (1st position in sentence)
- Dependent variable (2nd position in sentence)
- Control and/or mediating variable (3rd position in sentence)
- The research setting
- Participants/population

Qualitative Problem Statement

- Use a single sentence.
- Start with a statement such as, "A study on lived experience of" Or "An ethnographic study on....."
- The central phenomenon
- A statement identifying the type of qualitative design
- Use qualitative words such as "explore", "discover", "understand",
- The participants
- The research setting

IDENTIFICATION OF VARIABLES

A variable, as the name suggests, is something that varies. Variables are characteristics, qualities, quantities, or properties that can vary and are studied or measured. Variables are the factors or elements that researchers aim to investigate, understand, and analyse in order to draw meaningful conclusions from their research study. For example, blood pressure, pulse rate, anxiety level, and degree of pain are all characteristics of people

that vary from individual to individual. Variables can be controlled or manipulated. They differ in the role they are given in research and in the type of measures that can be applied to them.

Example

Study: A researcher is investigating how two different methods of teaching (Video Vs demonstration) a procedure to second-year nursing students affect their performance in inserting a nasogastric tube.

Variables: In this study, the grade level (second year) remains the same for everyone - it's a constant condition. However, after teaching methods are applied, each student's performance in inserting NG tube is measured. Since all students will not perform identically, their scores will vary. These varying scores are what we call variables.

Types of Variables (Fig. 4.2)

1. **Research variables:** Research variables are integral components of any scientific investigation, forming the building blocks upon which hypothesis is tested and conclusions are drawn. However, the term 'Research variable' is often used when the variables are observed in natural setting without any manipulation as in descriptive, exploratory and qualitative research. In these types of research, the primary objective is to observe and understand the variables.

Example

In a research study titled 'A study to assess the nutritional habits and dietary preferences of adolescent school students in a selected high school', 'nutritional habits' and 'dietary preferences' are research variables as they are observed in a natural setting without any manipulation.

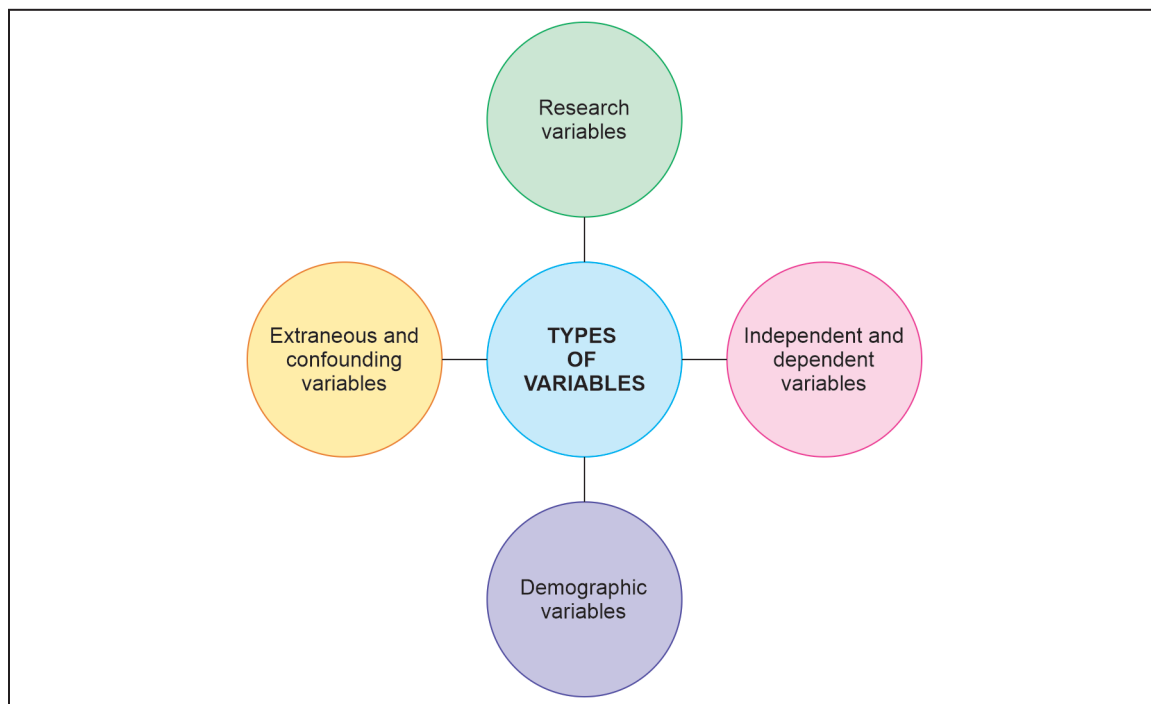


Figure 4.2: Types of variables

2. **Independent and dependent variables:** Researchers often examine how one variable affects another variable. In this context, the variables are classified as independent and dependent variables. These are observed in experimental and correlational research studies.

- **Independent variable:** It is a variable that is intentionally manipulated or changed by the researcher to observe its effects on another variable. It is a variable that is believed to have an effect on the outcome of interest, which is the dependent variable. The independent variable serves as the cause or condition under investigation. Researchers change or manipulate the independent variable deliberately to observe its potential effect on the dependent variable. In controlled experimental settings, researchers assign participants to different groups, each experiencing a unique level or type of the independent variable.
- **Dependent variable:** Dependent variable is the outcome of interest that is affected by the changes in the independent variable. It is a variable that is measured or observed by the researcher to determine if it is affected by the independent variable. This interrelationship between independent and dependent variable establishes a cause-and-effect relationship within the study.

Example

In a study to investigate the effect of mindful meditation on postsurgical pain among patients – who underwent abdominal surgery, the mindful meditation is the independent variable, while the postsurgical pain level reported by patients is the dependent variable.

3. **Demographic variables:** Nursing and health care research often involves a human participants. Hence, it is essential to gather comprehensive data regarding the characteristics of the study population (participants). Demographic variables are the characteristics of a population, such as age, gender, race, ethnicity, income, education, and marital status. These variables are often used in research to describe the sample population and to control confounding factors.
4. **Extraneous and confounding variables:** Extraneous and confounding variables are both factors that can affect the results of a research study (Fig. 4.3).
- **Extraneous variables:** An extraneous variable is any variable outside the experimental design that has the potential to affect the dependent variable. Extraneous variables are not part of the study but may affect the dependent variables. They produce an association between the independent and dependent variables that is untrue, meaning the variables are not causally related.
 - **Confounding variables:** The word 'confound' means 'to confuse'. Confounding variables independently affect both the independent and dependent variables. They influence the relationship between the independent and dependent variables, making it difficult to accurately measure the true cause-and-effect relationship. Confounding variable makes it a challenge to isolate the true influence of independent variable on the dependent variable (Fig. 4.3).

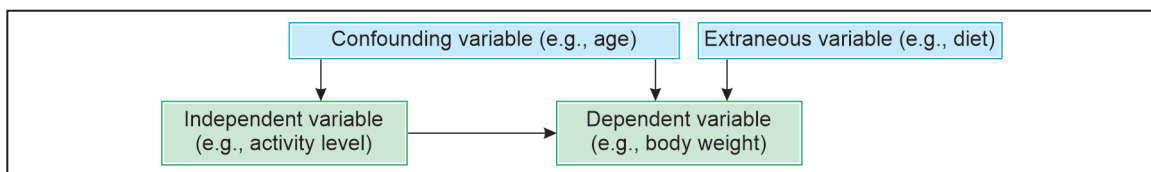


Figure 4.3: Confounding variable versus extraneous variable



Example

Study: 'A study to investigate the effect of activity level on body weight among adults'

Independent variable (IV): Activity level

Dependent variable (DV): body weight

Extraneous variable: Diet preference

Confounding variable: Age

Role of extraneous variable: Participants in the study may have varying dietary habits. Diet preference of an individual (eg. veg vs non-veg; low-calorie vs high calorie) could lead to differences in calorie intake and nutritional choices, which in turn could affect body weight (DV), irrespective of their activity levels (IV). This extraneous variable can introduce variability in body weight outcomes, complicating the interpretation of the relationship between activity level (IV) and body weight (DV).

Role of confounding variable: Age can be a confounding variable in this scenario as it could be related to both activity levels and body weight. Different age groups may engage in varying levels of physical activity. Younger adult participants might be more active due to higher energy levels than older adults. Age can also influence body weight due to metabolic changes with age. Due to the confounding effect of age, it becomes challenging to ascertain whether changes in body weight are due to the varying activity levels or the differences in age.

Univariate versus Multivariate Study

- **Univariate study:** A univariate study focuses on studying a single variable. In this type of study, researchers examine the distribution, characteristics, and patterns of variation within a single variable. Univariate studies are often used to describe the characteristics of a particular phenomenon without considering relationships with other variables. For example, a study that analyzes the distribution of blood pressure readings among elderly people is a univariate study. The focus is solely on understanding the distribution of a single variable (blood pressure) without considering other factors.
- **Bivariate study:** A bivariate study involves the analysis of the relationship between two variables. Researchers explore how changes in one variable affect another variable. Bivariate studies aim to uncover associations, correlations, or cause-and-effect relationship between two variables. At least two variables are included in correlational and interventional research. For example, a correlational study to assess the relationship between physical activity and body weight is a bivariate study.
- **Multivariate study:** A multivariate study expands the analysis to include three or more variables simultaneously. Researchers investigate the complex interactions and relationships among multiple variables, accounting for potential confounding effects and interactions. For example, an exploratory study to determine the factors influencing academic performance of nursing students may include variables such as study habits, sleep patterns and socioeconomic status. This multivariate study aims to understand how these variables collectively contribute to academic outcomes.

Quantitative versus Qualitative Variables

- **Quantitative variables:** Quantitative variables, also known as numerical variables, are those that can be measured and expressed as numerical values. These variables represent quantities with meaningful intervals between the values. They can be further categorized into two types:
 1. **Continuous variables:** Continuous variables can take any value within a specific range and can have infinite possible values. They are typically measured using instruments with fine scales. Examples include height (165.5 cm), weight (61.5 kg), temperature (98.6°F), and age.

2. **Discrete variables:** Discrete variables can only take distinct, separate values, often integers. There are no intermediate values between these distinct points. Examples include the number of children in a family, the count of medical visits or the number of items purchased.
- **Qualitative variables:** Qualitative variables, also known as categorical variables, represent characteristics or qualities that cannot be measured numerically. They are often expressed using categories or labels. Qualitative variables can be further classified into two types:
 1. **Nominal variables:** Nominal variables have categories without any inherent order or hierarchy. They are used for labeling and classification. Examples include gender, ethnicity and types of medical conditions.
 2. **Ordinal variables:** Ordinal variables have categories with a natural order or ranking. However, the intervals between the categories may not be equal or meaningful. Examples include education levels (e.g., high school, bachelor's degree, master's degree), Likert scale responses and socioeconomic status.

Examples of quantitative and qualitative research problem statement and identification of variables have been provided in Tables 4.5 and 4.6.

Table 4.5 Examples of quantitative research problem statement and identification of variables

Type of study	Example of research problem statement	Identification of variables
Descriptive	A descriptive study on prevalence of eating disorders among adolescent girls studying in selected colleges in Delhi.	Research variable: Prevalence of eating disorders
Comparative	A comparative study on professional values among clinical nurses and nursing faculties of a tertiary care teaching hospital.	Research variable: Professional values.
Explorative	An explorative study on the factors and barriers influencing the screening tests for cervical cancer among menopausal women in selected areas.	Research variable: Factors and barriers influencing the screening tests for cervical cancer
Correlational (case control study)	Risk of drug-induced liver injury in critically ill children: A case-control study	Predictor variable: Critically ill children Outcome variable: Drug-induced liver injury
Correlational (prospective cohort study)	Cardiovascular risks and outcomes in COVID-19 survivors: A prospective cohort study	Predictor variable: COVID-19 infection Outcome variable: Cardiovascular risks and outcomes
Experimental	Effect of exercise therapy for pregnancy-related low-back pain among antenatal mothers: A randomized controlled trial	Independent variable: Exercise therapy Dependent variable: Pregnancy-related low-back pain
Quasi-experimental	Effect of breastfeeding support program on breastfeeding duration and exclusivity: A quasi-experimental study.	Independent variable: Breastfeeding support program Dependent variable: Breastfeeding duration and exclusivity.

Table 4.6 Example of qualitative research problem statement and identification of variables

Type of study	Example of research problem statement	Identification of variables
Phenomenological	The lived experiences of nurses caring for patients with Covid-19: A phenomenological study.	Research variable: Lived experiences of nurses caring for Covid patients.
Ethnographical	Communication culture in nursing care of patients with cancer: An ethnographic study	Research variable: Communication culture in cancer nursing care
Grounded theory	A caring leadership model in nursing: A ground theory approach	Research variable: Caring leadership
Case study	A case study of accessibility and utilization of Health and Wellness Centers (HWCs) in Rural community.	Research variable: Accessibility and utilization of HWCs.
Historical research	Exploring the role of nursing pioneers in advancing public health: A historical investigation	Research variable: Role of nursing pioneers in advancement of public health.
Action research	A study on practicability of specialist nurse practitioner role implementation structures and processes in a tertiary care hospital.	Research variable: Practicability of specialist nurse practitioner role implementation structures and processes

OPERATIONAL DEFINITIONS

Operational definitions are clear and concise statements that describe how a concept or variable will be measured or observed in a research study. Operational definitions are crucial in research because they provide clear, specific, and measurable descriptions of key variables and concepts. These definitions ensure that researchers and readers have a common understanding of what is being studied, allowing for accurate data collection and analysis.

Conceptual versus Operational Definition

- **Conceptual definition** provides a broad, abstract and theoretical understanding of a concept or variable. It explains the concept's meaning in general terms, often relying on established theories and literature. Conceptual definitions are primarily concerned with understanding and explaining the essence or nature of a concept.
- **Operational definition**, on the other hand, is specific, concrete and focused on how a concept or variable will be measured, observed or manipulated in a particular study. Operational definitions translate abstract concepts into observable and measurable terms. They are used to define precisely how a concept will be assessed or applied in a study.

Table 4.7 shows comparison of conceptual and operational definitions in research.

Examples of conceptual and operational definitions of 'nursing competence'

Conceptual definition: Nursing competence represents the comprehensive knowledge, skills, judgment, and ethical principles that underpin a nurse's ability to provide safe, effective and compassionate patient care.

Operational definition: In this research study, nursing competence refers to the score obtained by registered nurses on Holistic Nurse Competence Scale (HNCS) which includes five domains such as general aptitude, staff education and management, Ethical practice, provision of nursing care and professional development as components. A higher score indicates higher levels of nursing competence.

Table 4.7 Comparison of conceptual and operational definitions in research

Aspect	Conceptual definition	Operational definition
Nature and purpose	Broad, abstract, theoretical understanding	Specific, practical guidelines
Level of abstraction	High level of abstraction	Lower level of abstraction
Use in research phases	Theoretical and introductory phase	Empirical data-gathering phase
Applicability	Applicable across various contexts	Study-specific and context-dependent
Scope	Broad and general	Specific and measurable
Examples	Defines the essence of a concept	Specifies how a concept will be measured or applied in a study

Characteristics of Operational Definition

- **Clarity:** Operational definitions must be clear and unambiguous, leaving no scope for misinterpretation. They should provide explicit details on how a variable or concept will be assessed, measured or manipulated.
- **Measurability:** Operational definitions should specify a method or criterion that allows for the quantification or observation of the variable or concept. This ensures that it can be measured objectively.
- **Specificity:** Operational definitions should be specific and detailed, outlining the exact procedures, instruments or criteria to be used.
- **Reproducibility:** Operational definitions should be constructed in a way that allows other researchers to replicate the same measurements or observations using the provided guidelines.
- **Consistency with research objectives:** Operational definitions should align with the research objectives and hypotheses. They should support the research questions being investigated.
- **Validity:** Operational definitions should effectively measure what they intend to measure, ensuring validity.
- **Reliability:** Operational definitions should result in consistent measurements or observations when applied repeatedly. They should minimize errors and inconsistencies.
- **Empirical Basis:** Operational definitions should be based on empirical evidence and established research methods. They should reflect a sound and evidence-based approach to measurement.
- **Feasibility:** Operational definitions should consider the feasibility of data collection or assessment within the constraints of the research study, including available resources and time.

RESEARCH OBJECTIVES

Research is a systematic investigation aimed at solving a problem. It follows a structured research process, and setting clear objectives is a crucial step in this process. Objectives outline the specific actions a researcher will take to achieve the research goal. They summarize what the study aims to accomplish, such as identifying relationships or differences between variables. Typically, objectives focus on how to measure variables or describe them, aligning with the research problem. Well-defined objectives provide a clear path for the researcher to follow throughout the study.

Aims

The aims of a research statement broadly outline what the researcher intends to achieve by undertaking a research project. In other words, aims are the broad statements of the desired outcomes. These are also called

the general purpose of the research study. Aims focus on long-term, intended outcomes. These emphasize what is to be accomplished. Generally, a research study may have more than one aim. Each aim may have several objectives associated with it. Aim is a much broader aspect than objective.

Objectives

Following the establishment of the aims, researcher needs to formulate the objectives of the study. A research study may include a number of objectives consistent with an aim. Objectives are subsidiary to aims and emphasize how aims are to be accomplished.

Research objectives are specific, measurable, and time-bound statements that articulate the precise goals and tasks a researcher intends to achieve within a research study. These objectives provide clear guidance on what needs to be done to accomplish the broader aims of the research project. Research objectives typically define the scope of the study and serve as a roadmap for conducting research activities, data collection, analysis, and ultimately, reaching meaningful conclusions.

Key characteristics of research objectives include: (SMART – Specific, Measurable, Achievable, Relevance, Time-bound)

- **Specific:** Research objectives are detailed and focused, highlighting the specific actions or outcomes to be achieved.
- **Measurable:** Objectives are formulated in a way that allows for measurement, ensuring that progress can be assessed quantitatively or qualitatively.
- **Achievable:** Research objectives are realistic and attainable within the constraints of the study, including available resources and time.
- **Relevance:** Objectives are aligned with the research problem, aims, and questions, ensuring they directly contribute to addressing the central issues of research.
- **Time-bound:** Objectives are framed within a specific timeframe, indicating when the tasks or goals should be completed.

Types of Research Objectives

The objectives can be broadly categorized into general and specific objectives:

- **General objectives:** General objectives are broad statements that describe the overarching goals of a research study. They provide a perspective on what the research intends to achieve in general terms. These are usually fewer in number.
- **Specific objectives:** The general objectives can be broken down into small logically connected components to form specific objectives. Specific objectives in research are detailed, focused, and measurable statements that outline the specific tasks, actions, or outcomes the researcher intends to achieve within a research study. Specific objectives provide a clear roadmap for conducting research activities, data collection, analysis, and ultimately, reaching meaningful conclusions. The general objective is achieved by accomplishing all the specific objectives. The specific objectives are more in number.

Example of general and specific objectives

Research statement: Effect of exercise therapy for pregnancy-related low-back pain among antenatal mothers: A randomized controlled trial.

General objectives: To investigate the effectiveness of exercise therapy in alleviating pregnancy-related low-back pain among antenatal mothers.

Contd...



Specific objectives:

- To assess the baseline pain levels and functional limitations associated with low-back pain in antenatal mothers.
- To develop a structured exercise therapy program as per the needs and safety of pregnant women.
- To randomly assign antenatal mothers with low-back pain to either the exercise therapy group or a control group.
- To implement the exercise therapy program for the intervention group.
- To measure changes in pain intensity in the exercise therapy group compared to the control group.

The research objectives can also be categorized into primary and secondary objectives:

- **Primary objectives:** Primary objectives are the main goals of a research study. They are the questions that the study is designed to answer. Primary objectives are typically more specific and measurable than secondary objectives. E.g., To determine the effectiveness of massage therapy on back pain.
- **Secondary objectives:** Secondary objectives are additional goals that may be addressed by the study, but they are not the primary focus. Secondary objectives can be more general and exploratory. E.g., To assess the acceptability of massage therapy by patients.

Example of primary and secondary objectives

Research statement: A descriptive study on prevalence of eating disorders among adolescent girls studying in selected colleges in Delhi.

Primary objective: To determine the prevalence of eating disorders among adolescent girls enrolled in selected colleges in Delhi.

Secondary objectives:

- To assess the various types of eating disorders present among adolescent girls in the selected colleges.
- To examine the sociodemographic factors associated with the prevalence of eating disorders in this population.
- To investigate the psychological and emotional factors contributing to the development of eating disorders in adolescent girls.
- To explore the dietary and lifestyle habits of adolescent girls and their potential connection to eating disorders.
- To identify the awareness levels among adolescent girls regarding eating disorders and their available resources for seeking help or support.

Guidelines for Stating the Objectives

The following guidelines must be taken care of while stating the objectives of a research study:

- The objectives should be written briefly and concisely.
- The objectives should be specific and well-defined.
- They should cover various aspects of the research problem and its contributing factors in a coherent way and in a logical sequence.
- The objectives are clearly phrased in the operational terms, specifying exactly what researcher is going to do, where, and for what purpose.
- The objectives should be realistic and achievable with available resources.

Starting research objectives with action verbs is a good practice. Action verbs make the objectives more explicit, indicating a clear action or task that needs to be performed to achieve the objective.

Examples of action verbs used in research objectives have been listed in Table 4.8.

Table 4.8 Verbs to be used and avoided while writing objectives

Verbs to be used	Verbs to be avoided
Analyze, Apply, Arrange, Ascertain, Assess, Categorize, Classify, Compare, Construct, Contrast, Create, Defend, Describe, Determine, Develop, Distinguish, Employ, Evaluate, Examine, Explain, Explore, Formulate, Identify, Illustrate, Integrate, Interpret, Investigate, List, Measure, Organize, Prepare, Predict, Propose, Recall, Relate, Report, Restate, Review, Solve, Sort, Test, Translate, Use, Validate.	Know, understand, really understand, fully appreciate, internalize, to grasp the significance of, to have an awareness of, etc.

Commonly used action verbs in qualitative and quantitative research have been listed in Table 4.9.

Table 4.9 Commonly used action verbs in qualitative and quantitative research

Quantitative research	Qualitative research
Assess	Assess
Compare	Describe
Determine	Develop
Detect	Discover
Describe	Explain
Examine	Explore
Find out	Express
Identify	Validate
Investigate	Record
Measure	Reflect
Predict	Summarize
Test	Synthesize

SUMMARY

- The process of identifying and formulating a research problem is a first and foundational step in the research process.
- A research problem is a broader issue or question that needs investigation, while a problem statement is a concise description of the specific challenge or question that the researcher aims to address within that research problem.
- Research problems in nursing can be sourced from personal experiences, clinical encounters, critical literature appraisal, previous research recommendations, nursing theories, quality improvement initiatives, databases, social issues, brainstorming sessions, folklore, intuition, expert consultations, and funding agencies.
- Selecting a good research problem in nursing involves considering its significance to the field, relevance, originality, the researcher's interest and expertise, feasibility in terms of resources and time, ethical considerations, researchability, and legitimacy within established academic principles.
- Formulating a research problem involves a series of steps, including selecting a broad topic, reviewing relevant literature, narrowing down the research topic, evaluating its significance and feasibility, and ultimately creating a clear and concise research problem statement, which can be presented declaratively or interrogatively.

- Guidelines for constructing problem statements in quantitative and qualitative research specify the elements to include, such as the type of study, use of specific terms, identification of variables, research setting, and participants, tailored to the respective research approach.
- Variables are characteristics, qualities, quantities, or properties that can vary and are studied or measured. Variables can be classified into different types such as research, independent, dependent, demographic, extraneous, and confounding variables, each serving specific roles in the research process.
- Operational definitions in research are precise, concrete statements that describe how variables or concepts will be measured or observed, ensuring clarity, measurability, specificity, reproducibility, alignment with research objectives, validity, reliability, an empirical basis, and feasibility.
- Research objectives are specific, measurable, and time-bound statements that outline the precise goals and tasks a researcher intends to achieve within a study. Research objectives are classified into general and specific objectives as well as primary and secondary objectives.

ASSESS YOURSELF

Long Answer Questions

1. Define the term research problem and identify five characteristics of good research problems.
2. List the characteristics of researchable and nonresearchable problems. Identify examples of each.
3. Discuss the phases of formulating a problem for research in nursing.
4. Discuss why the selection of the problem for a research study is one of the most important steps in the research process.
5. Discuss factors to be considered while selecting a research topic.

Short Answer Questions

1. Identify four common sources of research problems.
2. Discuss the elements of a research problem.
3. State the criteria for evaluating a quantitative research problem.

Multiple Choice Questions

1. PICO means _____.
 - a. Population, intervention, comparison, outcome
 - b. Prevalence, incidence, cohort, observation
 - c. Polio, influenza, chickenpox, ovulation
 - d. Patient, injection, catheterization, operation
2. Discrepancy between what is known and what ought to be known is described as:
 - a. Research results
 - b. Research gap
 - c. Research objective
 - d. Research findings
3. Which of the following usually refers to the independent variables in doing research?
 - a. Results
 - b. Cause
 - c. Output
 - d. Effect
4. The dependent variable is:
 - a. A stimulus or activity that is varied by the researcher.
 - b. The quality, property, or characteristic identified in the problem
 - c. A characteristic or element of the human subjects involved in the study
 - d. The response or outcome that the researcher wants to understand

5. Which of the following is TRUE?
 - a. Problem statement is why study is being done
 - b. Research purpose is what will be examined in the study
 - c. Research questions provide greater focus to research
 - d. Research feasibility ignores the money aspect
6. Which of the following is correct guideline for writing research statement of an experimental research?
 - a. Independent variable first, dependent second
 - b. Dependent variable first, independent second
 - c. Use only independent variable
 - d. Use only dependent variable.
7. Identify the independent variable in the following hypothesis: "Cancer patients who receive music therapy complain less frequently of pain and require less pain medication than cancer patients not receiving music therapy."
 - a. Cancer patients
 - b. Complaints of pain
 - c. Pain medication use
 - d. Music therapy
8. The initial and one of the most significant steps in conducting the research process is:
 - a. Defining the research variables
 - b. Identifying the research problem
 - c. Stating the research purposes
 - d. Determining the feasibility of the study
9. Which of the following is not the element of a research statement?
 - a. Research design
 - b. Research instrument
 - c. Population
 - d. Time
10. Problem identification in the research process would be equivalent to which step in the nursing process?
 - a. Nursing assessment
 - b. Planning
 - c. Implementation
 - d. Evaluation

Answer Key

1. a	2. b	3. b	4. d	5. c	6. a	7. d
8. b	9. b	10. a				

BIBLIOGRAPHY

- Drucker PF. HYPERLINK "<http://www.goodreads.com/work/quotes/2086954>"Essential Drucker: Management, the Individual and Society. [online] Available from HYPERLINK "<http://www.goodreads.com/quotes/18976-management-is-doing-things-right-leadership-is-doing-the-right.%20Accessed%20on%2027/12/2014>"<http://www.goodreads.com/quotes/18976-management-is-doing-things-right-leadership-is-doing-the-right.%20Accessed%20on%2027/12/2014>" [Accessed December, 2014].
- Elements of a research problem. [online] Available from HYPERLINK "<http://universalteacher.com/1/elements-of-a-research-problem/>"<http://universalteacher.com/1/elements-of-a-research-problem/>. [Accessed April 2016].
- Hanacek J. Phases of research process. [online] Available from HYPERLINK "http://www.academia.edu/6430105/4Phases_of_research_process.%20Accessed%20on%2015/9/2014"[www.academia.edu/6430105/4 Phases_of_research_process.](http://www.academia.edu/6430105/4Phases_of_research_process.%20Accessed%20on%2015/9/2014) [Accessed September, 2014].
- Nilesiadomy RM. Foundations of Nursing Research. 5th edition. New Delhi: Dorling Kindersley; 2008.
- Polit DF, Beck CT. Nursing Research: Principles and Methods. 7th edition. Philadelphia: Lippincott Williams & Wilkins; 2004.
- Roberts K, Taylor B. Nursing Research Process: An Australian Perspective. 2nd edition. Singapore: Thompson, Nelson Australia Pty Limited; 2002.



Hypothesis and Assumption

LEARNING OBJECTIVES

After the completion of the chapter, the readers will be able to:

- Define hypothesis.
- Enlist the importance of hypothesis in research.
- List down the characteristics of hypothesis.
- Explain the sources of hypothesis.
- Describe various types of hypothesis.
- Define assumptions.
- Explain the types of assumptions.
- Differentiate between hypothesis and assumptions.
- Differentiate between limitations and delimitations of research study.

CHAPTER OUTLINE

• Hypothesis	• Delimitations
• Assumption	• Limitations

KEY TERMS

Associative hypothesis: A hypothesis that suggests a correlation or association between variables, without implying causation.

Assumptions: Assumptions are underlying beliefs, conditions, or propositions that are taken for granted and considered true without direct evidence, serving as the foundation for research design and hypotheses.

Causal hypothesis: A hypothesis that proposes a cause-and-effect relationship between variables, implying that changes in one variable will result in changes in another.

Complex hypothesis: A complex hypothesis predicts the relationship between more than two variables.

Contd...

Directional hypothesis: A hypothesis that predicts the specific direction of the relationship between variables, indicating whether one variable will increase or decrease in response to the changes in another.

Empirical testing: The process of conducting research to collect data and evidence in order to evaluate and test hypotheses, thereby validating or refuting them.

Hypothesis: A hypothesis is a tentative and testable statement that suggests a potential relationship between two or more variables in research.

Nondirectional hypothesis: A hypothesis that does not specify the direction of the relationship between variables, only suggesting that a relationship exists without indicating whether one variable will increase or decrease as a result.

Null hypothesis: A statement that suggests no significant relationship or effect between variables, often used as a basis for statistical hypothesis testing.

Research hypothesis: A hypothesis formulated for the purpose of testing and investigation, typically stating the expected relationship between variables based on existing knowledge or theories.

Simple hypothesis: A hypothesis that proposes a specific and straightforward relationship between two variables.

HYPOTHESIS

A hypothesis in research is a testable and verifiable statement that predicts a relationship between two or more variables. The primary purpose of a hypothesis is to guide and structure the research process, allowing researchers to make predictions and draw conclusions based on empirical evidence. It is important to note that a hypothesis is not a fact. It is simply a prediction that a researcher is making about the answer to the research question. The purpose of research is to test the hypothesis and to see if it is supported by the data.

A well-formulated hypothesis includes a clear and testable statement that states the expected relationship between specific variables, identifies the target population or sample under study, and predicts the anticipated outcome or result, providing a concise roadmap for empirical research. Typically, researchers begin their inquiry with broad research questions or problems and subsequently construct hypotheses that provide specific predictions or expectations aligned with those research questions.

Hypotheses are standard features of quantitative research to predict relationship between two or more variables but are not explicitly stated in descriptive and explorative research studies. In quantitative research, hypotheses guide the research process, including the selection of data collection methods, the design of experiments or surveys, and the application of statistical tests to analyze data. Hypotheses are not typically formulated in qualitative research; instead, hypotheses often emerge as outcomes of qualitative research.

Definitions

"A hypothesis is a prediction, almost always involving a predicted relationship between two or more variables."

—Polit and Beck, 2017

A hypothesis is a specific, testable prediction about what you expect to happen in your study.

—APA Dictionary of Psychology (2nd Edition), APA, 2015

A hypothesis is a tentative statement about the relationship between two or more variables.

—Borg, GAV, 1983

Importance of Hypothesis in Research

Hypothesis holds significant importance in the scientific inquiry process. A well-formulated hypothesis helps to ensure that the research is focused, rigorous, and relevant to the field of study. The importance of hypothesis in research can be described as follows:

- **Focused approach:** Hypotheses help to focus the research. They provide a specific and measurable goal for the research, which helps to keep the research on track.
- **Empirical testing:** Hypotheses are fundamental to the scientific method. They allow researchers to empirically test ideas and theories, ensuring that conclusions are based on evidence rather than speculation.
- **Rigor and reliability:** The presence of hypotheses in research promotes scientific rigor and reliability. Researchers reduce the potential for bias and errors in their studies by making predictions and systematically testing them.
- **Theory development:** Hypotheses play a role in theory development and refinement. When hypotheses are tested and confirmed through empirical evidence, they contribute to the development and validation of scientific theories.
- **Advancing knowledge:** Hypothesis helps generate new ideas. Hypothesis is a driving force behind the advancement of knowledge in science including nursing. Whether hypotheses are supported or refuted, they contribute to a deeper understanding of phenomena.
- **Problem solving:** In applied research, hypotheses help address specific problems or questions. They guide research efforts aimed at finding solutions to practical issues in areas like medicine, engineering, and social policy.
- **Communication:** Hypothesis help the researchers to communicate their goals, expectations, and findings to the scientific community and the broader public. They provide a structured way to convey research intentions and outcomes.

Characteristics of Good Hypothesis

A good hypothesis in research has several key characteristics that make it effective and valuable for guiding scientific investigations. These characteristics include:

- **Testability:** A good hypothesis is formulated in a way that allows it to be tested empirically. The hypothesis should propose a testable relationship or effect between the independent and dependent variables. It should predict how changes in the independent variable will impact the dependent variable. This prediction provides the basis for empirical testing.
- **Specificity:** A hypothesis should be clear, specific, and focused on the variables and relationship under investigation. Vague or ambiguous hypotheses can lead to confusion and imprecise results.
- **Falsifiability:** A good hypothesis is capable of being proven false based on empirical evidence. It is not merely an assertion but a statement that can be challenged through research. Falsifiability is a key criterion in the scientific method.
- **Relevance:** Hypotheses should directly relate to the research question or problem being addressed. They should align with the objectives of the study and the existing body of knowledge in the field.
- **Clarity:** A well-constructed hypothesis is expressed clearly and concisely. It avoids jargon and complex language, making it easily understandable to both researchers and readers.
- **Measurability:** Hypotheses should involve variables that can be measured or observed. This ensures that data can be collected to test the hypothesis effectively. The variables should also be defined clearly.



- **Logical consistency:** A hypothesis should be logically consistent with existing theories or knowledge in the field. It should not contradict well-established principles or facts.
- **Predictiveness:** Hypotheses make predictions about the expected outcomes or relationships between variables. These predictions should be specific and based on the researcher's understanding of the topic.
- **Rationale:** A good hypothesis is supported by a rationale or background information that explains why the hypothesis is being proposed. It should be grounded in existing literature or empirical observations.
- **Simplicity:** While hypotheses should be specific, they should also be kept as simple as possible. Overly complex hypotheses can be difficult to test and may introduce unnecessary complications into the research design.
- **Economical:** A good hypothesis is formulated with economy in mind. This means that it should be framed in a way that allows researchers to conduct the research efficiently and cost-effectively.
- **Availability of resources:** Researchers must take into account the availability of techniques, technology, equipment, and resources needed to test the hypothesis.
- **Revisability:** Hypotheses should be open to revision based on new evidence or findings. Researchers should be willing to adapt their hypotheses if the data do not support their initial predictions.
- **Independence:** In cases where multiple hypotheses are formulated, they should be independent of each other. This ensures that each hypothesis addresses a distinct aspect of the research question.

Sources of Hypotheses

Hypotheses are not merely a guess. They are based on existing knowledge and theory, and they are made with the intention of being tested. Hypotheses in research can arise from various sources, and they often result from a combination of factors and sources. Some common sources of hypotheses include (Fig. 5.1):

- **Existing theories and frameworks:** Many hypotheses are grounded in existing scientific theories. Researchers may build on established theories or models to formulate hypotheses that test specific aspects or predictions derived from those theories. For example, Orem's Self-Care Deficit Nursing Theory emphasizes the importance of self-care and self-care agency in maintaining and promoting health. The hypothesis can be derived from this theory, "Elderly diabetic patients with higher levels of self-care ability will experience fewer hospital readmissions within six months of their initial discharge."
- **Literature review:** A thorough review of previous research findings in the existing literature can generate hypotheses. For example, in a descriptive study, researchers have found that a significant portion of the student population experiences poor sleep quality, also identifies that a high proportion of students use smartphones and laptops before bedtime. A researcher can formulate hypothesis with these and findings as, "Frequent use of electronic devices before bedtime is associated with poor sleep quality in college students."
- **Personal experiences and observations:** Personal observations or experiences can lead to the generation of hypotheses. Researchers may notice patterns, trends, or anomalies in their surroundings or daily life, sparking ideas for research questions and hypotheses.
- **Research questions:** Hypotheses often originate from broader research questions. Researchers start with a general question and then formulate hypotheses that provide specific predictions or expectations related to that question.
- **Exploratory research findings:** Qualitative or exploratory research, which involves open-ended data collection and analysis, may lead to the emergence of hypotheses. Initial findings from exploratory research can inspire hypotheses for further investigation. For example, in a qualitative exploratory study, researchers reported that the nurses frequently mention challenges related to the usability of electronic health record (EHR) systems in the pediatric setting. Based on the insights from this exploratory research,

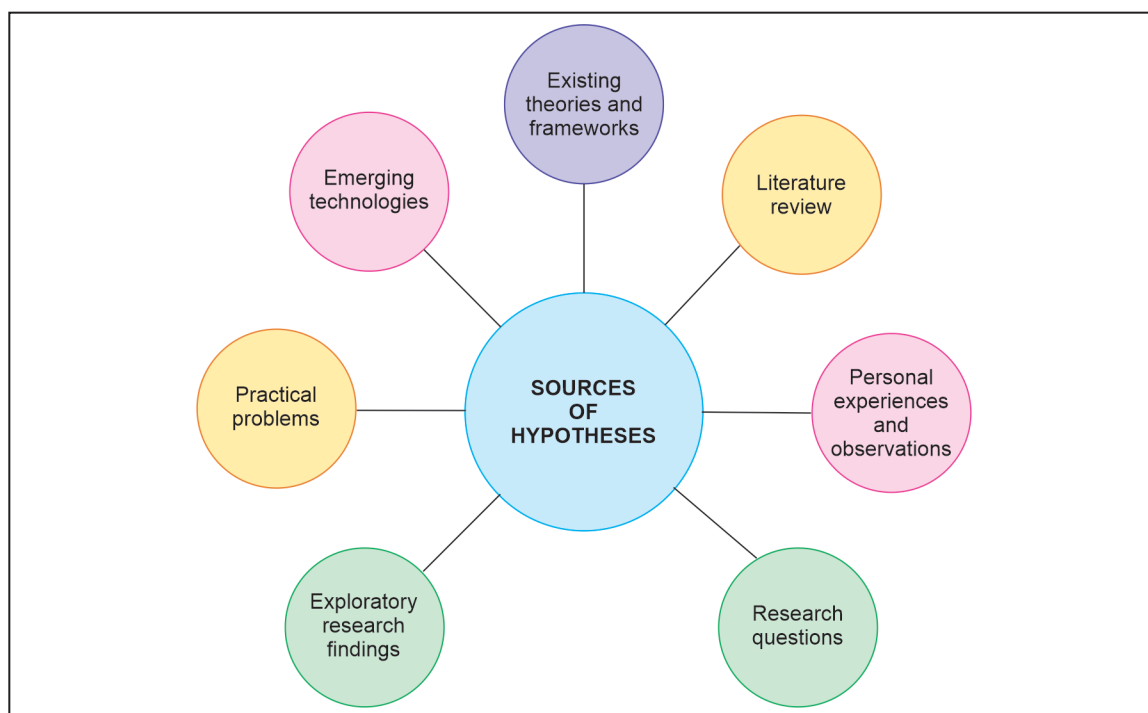


Figure 5.1: Sources of hypotheses

a researcher can formulate hypothesis as, “Implementation of a user-centered EHR system tailored specifically for pediatric care will lead to improved efficiency in patient charting compared to the current EHR system.”

- **Practical problems:** Real-world problems or practical challenges in various domains may trigger hypotheses. Researchers may seek solutions or explanations for these problems through systematic investigation.
- **Emerging technologies:** Advances in technology may open new research possibilities. Researchers may formulate hypotheses to explore the effects or implications of these technologies on various aspects of society or science. For example, advances in Artificial Intelligence (AI)-driven simulators in nursing education may trigger the researcher to formulate hypothesis as, “Integration of AI-driven patient simulators will lead to more effective clinical skills acquisition among nursing students compared to traditional simulation methods.”

Types of Hypotheses

Simple and Complex Hypotheses

- **Simple hypothesis:** A simple hypothesis predicts the relationship between two variables. For example, aerobic exercise is effective in decreasing blood pressure among prehypertensive patients. It presents a clear and specific relationship between two variables: Aerobic exercise (independent variable) and blood pressure (dependent variable).

- **Complex hypothesis:** A complex hypothesis predicts the relationship between more than two variables. For example, aerobic exercise is more effective in reducing blood pressure in prehypertensive adults than in prehypertensive elderly. In this complex hypothesis, 'Aerobic exercise' is an independent variable, 'blood pressure' is a dependent variable and 'age' is a moderator variable.

Associative and Causal Hypotheses

- **Associative hypothesis:** An associative hypothesis predicts the relationship between two variables in their natural setting without any manipulation. It identifies a connection or correlation between variables but does not imply causation. For example, "increased hours of television watching are associated with higher body mass index (BMI) scores in school-aged children." This hypothesis indicates a relationship between two variables (television watching hours and BMI scores) without implying causation but suggesting that they are linked in some way.
- **Causal hypothesis:** A causal hypothesis explains a cause-and-effect relationship between two or more independent and dependent variables. It implies that changes in the independent variable(s) directly lead to changes in the dependent variable(s). For example, "the prevalence of ventilator-associated pneumonia is lower among patients receiving oral care using betadine compared to patients receiving oral care using hydrogen peroxide." In this, researchers are not just identifying an association but suggesting that the type of oral care (independent variable) directly influences the occurrence of ventilator-associated pneumonia (dependent variable).

Directional and Nondirectional Hypotheses

- **Directional hypothesis:** It not only specifies the existence of relationship between variables but also specifies the direction of relationship between the variables. The direction of relationship can be positive and negative. For example, "Nurses with higher knowledge regarding organ donation will exhibit a positive attitude toward organ donation." This hypothesis specifies the existence of a relationship between nurses' knowledge regarding organ donation and their attitude toward it, with the direction of the relationship being positive (i.e., higher knowledge is expected to result in a positive attitude).
- **Nondirectional hypothesis:** A nondirectional hypothesis focuses solely on the existence of a relationship between variables but does not make specific predictions about the direction of that relationship. For example, "there is a relationship between knowledge and attitude regarding organ donation among nurses." The hypothesis indicates the existence of a relationship between two variables (knowledge and attitude) without specifying the expected direction of that relationship.

Null Hypothesis and Research Hypothesis

The null hypothesis (H_0) and the research hypothesis (H_1) are two opposing statements about the relationship between two variables.

- **Null hypothesis (H_0):** The null hypothesis is also known as statistical hypothesis. It states that there is no relationship, effect, or difference between variables in a study. The null hypothesis is tested by collecting data and conducting statistical analysis. If the data does not support the null hypothesis, then the research hypothesis (alternative hypothesis) is supported. It is a fundamental principle in hypothesis testing that



the null hypothesis (H_0) cannot be proven to be true. Instead, the goal of hypothesis testing is to assess whether the data provides sufficient evidence to reject the null hypothesis or not.

For example, there is no relationship between regular aerobic exercise and weight loss among overweight adults.

- **Research hypothesis (H_1):** Research hypothesis is also known as alternative hypothesis. It states that there is relationship between two variables. When null hypothesis is rejected, research hypothesis is accepted. For example, regular aerobic exercise leads to weight loss among overweight adults.

It is important to note that directional hypotheses are used when researchers have a specific expectation about the direction of the relationship between variables. This can make the research more focused and increase statistical power. Nondirectional hypotheses are more conservative and versatile. They do not make a specific directional prediction and are suitable when researchers are exploring a relationship without strong prior expectations.

Components of Research Hypothesis

A well-structured research hypothesis includes the following four essential components:

1. **Independent variable:** The independent variable is the factor or condition that the researcher manipulates or examines to assess its impact on the dependent variable. It represents the presumed cause or predictor in the hypothesis. For example, in a study examining the effect of Foot Reflexology on blood pressure, the *foot reflexology* is the independent variable.
2. **Dependent variable:** The dependent variable is the outcome or response that the researcher measures to assess the impact of the independent variable. It represents the presumed effect or outcome of interest in the hypothesis. In the example mentioned earlier, *blood pressure* is the dependent variable.
3. **Relationship between independent and dependent variable:** This component specifies the relationship between the independent and dependent variables. It may be positive or negative or sometimes direction unspecified. For example, a hypothesis might state that, "Foot reflexology therapy leads to a decrease in blood pressure among prehypertensive patients," predicting a decreased blood pressure with foot reflexology. It is negative directional hypothesis.
4. **Sample population being studied:** The hypothesis should clearly define the target population or sample to which the hypothesis applies. It answers the question of who the study intends to and investigates and generalizes the findings to. In the given example, prehypertensive patients are the sample population.

Example of a hypothesis and its components is as follows:

Example of a hypothesis and its components

Hypothesis: Patients with COPD who receive education on proper inhaler technique will demonstrate improved lung function and reduced hospitalization rates compared to those who do not receive this education.

Four Components of this hypothesis:

1. Independent variable: Education on proper inhaler technique
2. Dependent variable: Lung function and hospitalization
3. Relationship between independent and dependent variable: Predicting improved lung function and reduced hospitalization among COPD patients who receive education compare to those who do not receive education.
4. Sample being studied: Patients with COPD.

Note: The significance level, often denoted as alpha (α), is a critical aspect of the research process and hypothesis testing. However, it is not typically included as a component within the formal statement of a hypothesis. Instead, it is part of the research methodology and statistical analysis plan.



Formulating Hypothesis

Developing hypotheses is an important aspect of quantitative research, where the relationship between independent and dependent variables is examined systematically. There is no standard formula to develop a well-structured hypothesis. Researchers often use inductive and deductive reasoning to derive hypotheses from existing theories and frameworks.

The research hypothesis is formulated during the planning phase of the research process. The steps involved in developing a well-structured hypothesis are as follows:

1. **Identification of the research problem and question:** The research problem or question to be investigated is clearly identified at the outset, providing the foundational context for hypothesis development.
2. **Review of existing literature:** A comprehensive review of existing literature and research within the relevant field is conducted. This step aims to gain an understanding of the current state of knowledge and pinpoints any gaps or areas requiring further investigation.
3. **Selection of variables:** Independent and dependent variables are identified for the study. The independent variable, subject to manipulation or study, is chosen to observe its impact on the dependent variable.
4. **Specification of direction:** A decision is made regarding the nature of the hypothesis, whether it will be directional or nondirectional. A directional hypothesis predicts the specific direction of the relationship between variables (positive or negative), whereas a nondirectional hypothesis predicts a relationship without specifying direction.
5. **Formulation of a clear statement:** A clear, concise, and empirically testable statement is crafted to express the hypothesis. Hypothesis should be stated in a declarative form.
6. **Specification of the target population:** The population or sample to which the hypothesis pertains is precisely defined, providing clarity regarding the scope and generalizability of the findings.
7. **Determination of the level of significance:** The level of significance (alpha) for the hypothesis is established, determining the threshold for statistical significance during analysis.
8. **Ensuring clarity and simplicity:** The hypothesis is maintained in a clear and straightforward statement concentrating on a specific prediction or relationship. Complexity is avoided to prevent confusion.
9. **Review and refinement:** A final review of the hypothesis is conducted to ensure its alignment with the research goals and objectives. Adjustments are made as needed to enhance clarity and precision.

Examples of well-structured hypothesis are as follows:

Examples of well-structured hypothesis

- The use of a nurse-led telehealth intervention for patients with chronic diseases will result in a significant improvement in medication adherence compared to standard care.
- There will be a significant difference in the mean pain scores between patients receiving standard pain management and those receiving an enhanced pain management protocol following orthopedic surgery.
- Quality of nurse-patient communication in a hospital setting will be positively correlated with patient satisfaction scores of post-surgical patients in a selected post-operative ward.
- There will be a significant association between the level of nursing staff education and the competency level of nursing staff working in the intensive care units.

ASSUMPTION

Assumptions in research refer to the underlying beliefs or principles that guide the study. Assumptions are accepted as true without requiring proof or evidence within the context of a specific study. These assumptions serve as foundational elements upon which a research study is built. While assumptions are not proven facts,

researchers use them as premises to guide their research design, data collection, and data analysis. For example, imagine a researcher wants to study the impact of a new teaching method on students' academic performance in mathematics. Researcher assumes a 'homogeneous student background', drawing from their knowledge that students of same grade will have same level of understanding, even though variations may exist.

Definitions

Assumptions are statements that are considered to be true or taken for granted, even though they have not been proved scientifically.

In other words, assumptions are statements that are accepted as true without scientific proof and form the basis for the research study.

In other words, assumptions are principles that are accepted as true based on logic, often at the onset of a research study, even though they may not have been proven within the scope of the study.

Assumption versus Hypothesis

Assumption and hypothesis are both fundamental concepts in research, but they serve different purposes and are used at different stages of the research process. Assumptions and hypotheses are terms that are sometimes confused, but they have distinct meanings and purposes in research (Table 5.1).

Uses of Assumptions in Research

Assumptions in research serve several important purposes:

- **Foundation for research design:** Assumptions help establish the foundational elements upon which a research study is built. They provide a starting point for designing the study, including the choice of variables, research methods, and data collection procedures.
- **Research planning:** Assumptions help researchers determine the scope of their study, the target population, and the appropriate research methods.

Table 5.1 Comparison of assumption and hypothesis in research

Aspect	Assumptions	Hypotheses
Definition	A statement that is taken for granted or considered true, even though it has not been scientifically tested	A specific prediction about the relationship between two or more variables
Basis	Often implicit and not always stated	Explicitly formulated and stated
Purpose	Provide foundational starting points in research	Guide empirical testing
Testing	Not scientifically tested within the scope of study	Directly tested through research study
Formation Timing	Made before research begins	Developed after literature review
Examples	• The sample is the true representation of the population under study (or) • The participants in this study will provide accurate and truthful responses in the surveys	• There is a positive relationship between X and Y (or) • Group A will perform better than Group B

- **Hypothesis development:** Assumptions often lead to the formulation of research hypotheses. Researchers make certain assumptions about the relationships between variables, and these assumptions are then tested through the research process.
- **Risk assessment:** Stating assumptions help researchers identify potential risks and limitations, enabling them to assess and reduce bias or error.
- **Interpretation of results:** When analyzing research results, researchers consider whether the assumptions held true and how any deviations from these assumptions might impact the interpretation of findings. For example, the assumption that survey participants will provide truthful responses, i.e., fundamental. If this assumption proves to be false and participants are not truthful in their responses, the study's results and conclusions may be inaccurate and unreliable.
- **Communication:** Transparently stating assumptions and communicating to readers enhance the credibility and transparency of the research.
- **Discussion and implications:** In the discussion section of research paper, researchers may reflect on the validity of their assumptions and consider how they affect the study's implications and generalizability.

Types of Assumptions

Assumptions in research can take on various forms and serve different purposes. They are as follows:

- **Universal assumptions:** These are fundamental beliefs or principles that are generally accepted as true across different contexts or disciplines. For example, the assumption that gravity exists, is a universal assumption.
- **Theoretical assumptions:** These assumptions are based on existing theories or models in a particular field of study. Researchers often build their hypotheses and methodologies on these theoretical assumptions. For example, in a study investigating patient satisfaction, a theoretical assumption could be drawn from Maslow's Hierarchy of Needs, assuming that higher levels of patient satisfaction are correlated with meeting higher-level needs like esteem and self-actualization.
- **Methodological assumptions:** These relate to the methods used in research. They include assumptions about data collection (e.g., surveys assume respondents provide accurate information), sampling (e.g., random sampling assumes representativeness), and analysis (e.g., statistical assumptions like normal distribution).
- **Prescriptive assumptions:** Prescriptive assumptions suggest how things should be or what should happen. They are normative in nature and often guide decision-making. For example, an assumption that health care should be accessible to all citizens is prescriptive.
- **Research study assumptions:** These are specific to a particular research study and pertain to the conditions, variables, or methods used in that study. For example, in a survey-based study, an assumption might be that participants will answer truthfully.
- **Warranted assumptions:** Warranted assumptions are those that have some basis or evidence supporting their validity. Researchers can provide reasons or justifications for these assumptions based on prior research or logical reasoning. For example, "Administering pain relief medication in the prescribed dosage will alleviate patient's pain." This assumption is warranted based on previous research and medical knowledge.
- **Unwarranted assumptions:** Conversely, unwarranted assumptions lack a solid foundation or justification. They are often made without sufficient evidence or without considering alternative possibilities. Researchers should be cautious of unwarranted assumptions as they can introduce bias or errors into a study. For example, "Patients from a certain socioeconomic background always respond better to a particular treatment."



BOX 5.1 Commonly unstated assumptions in nursing and health care research (Williams MA, 1980)¹

- People want to assume control of their own health problems.
- Stress should be avoided.
- People are aware of the experiences that most affect their life choices.
- Health is a priority for most people.
- People in underserved areas feel underserved.
- Most measurable attitudes are held strongly enough to direct behavior.
- Health professionals view health care in a different manner than the lay persons.
- Human biological and chemical factors show less variation than cultural and social factors.
- The nursing process is the best way of conceptualizing nursing practice.
- Statistically significant differences relate to the variable or variables under consideration.
- People operate based on cognitive information.
- Increased knowledge about an event lowers anxiety about the event.
- Receipt of health care at home is preferable to receipt of care in an institution.

¹Williams, MA (1980). Editorial: Assumptions in Research. Research in Nursing and Health, 3, 47–48.

Examples of Assumptions: (Stated and Unstated)

In research studies, not all the assumptions are explicitly stated in the research proposal, paper or report. Stated assumptions are those that are explicitly mentioned by the researchers in their research proposals, papers, or reports. Unstated assumptions (implicit), on the other hand, are those beliefs or conditions that are not explicitly mentioned by the researchers in their work.

Some of the important stated assumptions in nursing research which lay foundation for the study are as follows:

- The study participants are true representatives of the population under study.
- The instruments used to collect data are valid and accurately measure the variables of interest.
- The participants will adhere to prescribed treatment plans and medication regimens.
- The study participants will respond truthfully to the items of the questionnaire.

Some of the commonly unstated (implicit or indirectly stated) assumptions in published nursing and health care research papers as uncovered by Williams MA (1980) are listed in Box 5.1.

DELIMITATIONS

Delimitation in research refers to the specific boundaries or limitations that researchers set on their studies. Delimitations define the scope of the research and help clarify what aspects of a topic will be included or excluded from the study. These constraints are set intentionally and are often established at the beginning of the research project. Delimitations are crucial because they provide context for the study and ensure that research remains focused and manageable.

Concept of Delimitations

- Delimitations are typically characteristics or aspects of the study that researchers identify as relevant to their research goals. These may include geographic boundaries, time frames, population characteristics, specific measurement methods, variables, access and availability, language and cultural boundaries.

- Unlike limitations that may arise naturally during the research process (such as unexpected data collection issues), delimitations are imposed by the researcher. They are predetermined choices made to shape the study according to the research objectives.
- Delimitations are characteristics or parameters identified by the researchers in order to focus their investigations and achieve specific research objectives.
- Delimitations are used to define the controlled range or scope of a research study. By specifying what will be included and excluded from the study, researchers ensure that their investigation remains manageable and focused.
- Delimitations must be mentioned in the research study in order to provide transparency, clarity, and context to both researchers and readers.

Types of Delimitations

There are several types of delimitations in research studies. These delimitations help researchers establish the boundaries and scope of their study. Some important types of delimitations in research and their significance as follows (Table 5.2):

- **Theoretical delimitations:** Researchers may limit their study to a specific theoretical framework or perspective, excluding alternative theories.
- **Methodological delimitations:** Methodological delimitations pertain to the methods, techniques, and procedures used in a research study. They focus on constraints or boundaries related to data collection, analysis, and overall research methodology.
- **Geographical delimitations:** Researchers may limit their study to a specific geographic area, such as a particular city, state, or country. This helps in focusing the research within a manageable region.
- **Temporal delimitations:** Temporal delimitations involve restricting the study to a specific time frame. Researchers may choose to study a particular historical period or limit data collection to a certain timeframe.
- **Resource delimitations:** Limitations in terms of time, budget, or available resources can also be a type of delimitation. Researchers must work within these constraints when conducting their studies.
- **Population delimitations:** This type of delimitation defines the specific group or population under investigation. Researchers may choose to study a particular age group, gender, or demographic subset.

Table 5.2 Types of delimitation and examples

Types of delimitation	Delimitation statement
Theoretical delimitation	This study is confined to the Health Belief Model framework.
Methodological delimitation	Data collection is limited to structured surveys, excluding interviews.
Geographical delimitation	The research focuses on nurses working in urban hospitals only.
Temporal delimitation	Data analysis is based on records from the last 5 years.
Resource delimitation	Limited funding restricts the study to a single health care facility.
Population delimitation	The study only includes adult patients aged 18–65.
Sample size delimitation	Data collection is limited to 150 participants.
Scope of variables delimitation	The study examines only nurse-patient communication aspects.
Ethical delimitation	Pediatric patients are excluded due to ethical considerations.

- **Sample size delimitations:** Researchers often set boundaries on the size of their sample to make the research more feasible. This can involve choosing a specific number of participants or setting minimum and maximum limits.
- **Scope of variables delimitations:** Researchers may narrow down the variables they are investigating, focusing on specific aspects of a broader concept. For example, in a study on education, researchers might delimit the scope to only examine teaching methods.
- **Ethical delimitations:** Ethical considerations can lead to delimitations, such as excluding certain sensitive topics or populations to ensure ethical research practices.

Uses of Delimitations

Delimitations in research serve several important purposes, helping researchers clarify the scope and boundaries of their study. These include:

- **Scope definition:** Delimitations help researchers define the specific boundaries and extent of their study.
- **Research focus:** Delimitations narrow down the research focus to the most relevant aspects. Researchers can concentrate their efforts and resources on the core elements of their study, which enhance the quality of their research.
- **Manageability:** Researchers can work within defined parameters, making it feasible to collect and analyze data effectively.
- **Reduced complexity:** Researchers can avoid unnecessary complications by excluding certain variables or aspects that are not central to their study.
- **Relevance:** Delimitations ensure that the research remains relevant to the research question or problem. Researchers can stay aligned with their primary objectives.
- **Resource allocation:** By specifying delimitations, researchers can allocate their resources, such as time, budget, and personnel, more efficiently.
- **Clarity for readers:** Delimitations provide transparency to readers, helping them understand the study's boundaries.
- **Comparability:** Delimitations make research more comparable. When researchers clearly define what is included and excluded, it becomes easier for other researchers to replicate or build upon the study.
- **Ethical considerations:** Delimitations can also serve ethical purposes. They help researchers ensure that their study respects ethical principles, such as informed consent and confidentiality, within the defined scope.
- **Research rigor:** Adhering to the predefined boundaries enhances the study's validity and reliability.

Writing Delimitations

Writing a clear and effective delimitation statement is essential in research to specify the boundaries and scope of your study. While writing delimitation, the researcher must:

- Identify the characteristics that need to be delimited.
- State the delimitation in clear and specific terms.
- Brief why these delimitations are made.
- Use formal and academic language.
- Make sure that the delimitation is consistent with rest of the research proposal.



LIMITATIONS

Limitations in research refer to the constraints, weaknesses, or shortcomings that researchers encounter during the course of their study. These limitations can arise during data collection, analysis, or interpretation. Limitations are often cannot be controlled by the researcher as it may occur while the study is in progress such as malfunctioning of the equipment and drop out of the study participants. Identifying and addressing limitations is a crucial part of research, as it helps ensure the transparency, credibility, and reliability of the study's findings.

Some common limitations that researchers may encounter in their studies includes:

- **Attrition:** Attrition occurs when participants drop out or are lost to follow-up during a study. It can lead to reduced sample sizes and biased results.
- **Sampling bias:** Sampling bias occurs when the sample selected for the study is not representative of the larger population, leading to results that may not be generalizable.
- **Data collection issues:** These issues encompass difficulties in collecting accurate and complete data, such as errors in measurement, missing data, unreliable instruments or equipment breakdown.
- **Resource constraints:** Limited resources, including budget, time, and access to participants or equipment, can restrict the scope and scale of a study.
- **Selection bias:** Selection bias arises when certain groups of participants are more likely to be included in the study, leading to unrepresentative samples.
- **Response bias:** Response bias occurs when participants provide inaccurate or socially desirable responses, skewing the data.
- **Measurement instruments:** Issues related to the reliability and validity of measurement tools can affect the quality of data collected.
- **Researcher bias:** Researcher bias, also known as experimenter bias, happens when the researcher's own beliefs or expectations influence the study's outcomes.
- **Generalizability:** This limitation arises when study findings cannot be applied to broader populations or contexts due to specific sample characteristics or study conditions.
- **Time constraints:** Limited time for data collection and analysis may prevent researchers from conducting more comprehensive investigations.
- **Ethical constraints:** Ethical considerations, such as restrictions on the use of human or animal subjects, can limit the scope of research.
- **Availability of data:** Researchers may face limitations in accessing relevant data sources, which can affect the comprehensiveness of their study.
- **Conflict of interest:** Conflicts of interest, financial or otherwise, can potentially bias study outcomes or the interpretation of results.

Importance of Stating Limitations in Research Papers/Reports

Stating limitations in research papers or reports is of paramount importance for several reasons:

- **Transparency and credibility:** Acknowledging limitations demonstrates transparency in the research process. It allows readers to assess the study's reliability and the potential impact of constraints on the results, enhancing the paper's credibility.
- **Contextual understanding:** Limitations provide context for interpreting the findings. Readers can better understand the scope of the study and any constraints that may have affected the results.
- **Generalizability:** Researchers often have specific target populations or conditions in mind. By stating limitations, they clarify the boundaries within which the study's conclusions can be applied, helping readers assess the generalizability of the findings.



- **Future research:** Identifying limitations can point to areas for future research. Researchers can suggest ways to address or lessen these limitations, opening avenues for further investigation.
- **Avoiding misinterpretation:** Clear disclosure of constraints helps prevent misinterpretation. Without acknowledging limitations, readers may overinterpret the findings or make unwarranted extrapolations.
- **Methodological improvements:** Stating limitations encourages methodological rigor. Researchers are motivated to improve their study designs and data collection techniques in response to identified constraints.
- **Peer review:** Journal reviewers and fellow researchers assess the validity and significance of a study partly based on its limitations. Addressing limitations appropriately can improve the chances of publication.
- **Ethical considerations:** Ethical constraints, such as participant privacy or resource limitations, should be transparently stated to ensure ethical research conduct.
- **Minimizing bias:** Openly discussing limitations minimizes the risk of bias, both unintentional and intentional. It demonstrates a commitment to unbiased reporting.
- **Enhancing trust:** Ultimately, stating limitations fosters trust in the research community. It signals that the study has been conducted with integrity and that researchers are accountable for their work.

SUMMARY

- Hypotheses in research are testable and verifiable statements predicting relationships between variables, guiding and structuring research, and aiming to be supported by empirical evidence.
- Characteristics of a good hypothesis include testability, specificity, falsifiability, relevance, clarity, measurability, logical consistency, predictiveness, rationale, simplicity, economy, resource availability, revisability, and independence.
- Hypothesis holds significant importance in the scientific inquiry process. A well-formulated hypothesis helps to ensure that the research is focused, rigorous, and relevant to the field of study.
- Hypotheses can be sourced from existing theories, literature reviews, personal experiences, research questions, exploratory findings, practical problems, and emerging technologies. They are grounded in existing knowledge and theory, with the intention of being tested through research.
- Types of hypotheses in research include simple (predicting a relationship between two variables) and complex (predicting relationships involving more than two variables), associative (indicating a connection between variables without implying causation) and causal (explaining cause-and-effect relationships), and directional (specifying the expected direction of the relationship) and nondirectional (indicating a relationship without specifying its direction).
- The null hypothesis (H_0) suggests no relationship or effect, while the research hypothesis (H_1) proposes a specific relationship between variables. Hypothesis testing involves collecting data to either reject the null hypothesis in favor of the research hypothesis or fail to find sufficient evidence to do so.
- A well-structured research hypothesis (H_1) includes four essential components: the independent variable (cause), dependent variable (effect), the specified relationship between them, and the defined sample population under study.
- To formulate a well-structured hypothesis in quantitative research, researchers follow a systematic process that includes identifying the research problem, reviewing existing literature, selecting variables, specifying direction (if applicable), crafting a clear statement, defining the target population, setting the level of significance, and ensuring clarity and simplicity in the hypothesis statement.
- Assumptions in research are foundational beliefs or principles that guide a study and are accepted as true without requiring scientific proof within the context of that study.

- Assumptions serve various purposes in research, including shaping research design, hypothesis development, risk assessment, and interpretation of results.
- Types of assumptions include universal, theoretical, methodological, prescriptive, research study-specific, warranted, and unwarranted assumptions, each serving a distinct role in the research process.
- Delimitations in research are intentional constraints or boundaries set by researchers to define the scope of their study, including factors like theoretical frameworks, methodology, geography, time frames, resource limitations, and population characteristics.
- Delimitations serve the crucial functions of focusing research efforts, ensuring clarity, managing complexity, enhancing research relevance, and facilitating resource allocation while providing transparency to readers and aligning with ethical considerations.
- Limitations in research refer to constraints and weaknesses that researchers encounter during their studies, such as attrition, sampling bias, data collection issues, and resource constraints. Identifying and addressing these limitations is crucial for research transparency and credibility.
- Stating limitations in research papers or reports is essential to enhance transparency, provide context for interpreting findings, guide future research, avoid misinterpretation, and demonstrate ethical research conduct, ultimately fostering trust in the research community.

ASSESS YOURSELF

Long Answer Questions

1. What is hypothesis? Explain different types of hypothesis.
2. What are assumptions and their applicability in research?

Short Answer Questions

1. What are delimitations and limitations in research?
2. Enumerate the differences between hypothesis and assumptions.
3. What are the elements of well-formulated hypothesis?

Multiple Choice Questions

1. A formal tentative statement about the expected relationship between two or more variables under the study is:
 - a. Hypothesis
 - b. Variable
 - c. Delimitation
 - d. Assumption
2. Assumption and delimitation are identified in which stage of research process?
 - a. Planning
 - b. Implementing
 - c. Writing report
 - d. Critiquing
3. Which scientific method focuses on testing hypotheses developed from theories?
 - a. Deductive method
 - b. Inductive method
 - c. Hypothesis method
 - d. Pattern method
4. Identify the type of hypothesis from the following statement: "The lower the blood sugar level, the lesser is the risk of infection among diabetic patients."
 - a. Simple, associative
 - b. Simple, causal
 - c. Causal, null
 - d. Causal, directional

5. Identify the type of hypothesis from the following statement: "Emotional well-being is influenced by the self-esteem, degree of social support and financial status in women breast cancer survivors."
 - a. Simple, research
 - b. Simple, directional
 - c. Complex, nondirectional
 - d. Complex, directional
6. Hypotheses are often generated as the data are collected, interpreted, and analyzed in which type of research studies?
 - a. Quantitative research studies
 - b. Qualitative research studies
 - c. Prospective cohort studies
 - d. Comparative studies
7. Which of the following is not true for hypothesis?
 - a. It is a prediction of relationship between variables
 - b. It is the researcher's anticipation regarding the study
 - c. A hypothesis is a tentative generalization
 - d. It cannot be tested
8. Realistic expectation which is something that we believe to be true is:
 - a. Hypothesis
 - b. Conceptual framework
 - c. Assumption
 - d. Concepts
9. Which of the following term describes the boundaries that the researcher has set for the study?
 - a. Assumption
 - b. Hypothesis
 - c. Conceptual framework
 - d. Delimitation
10. Which of the following term describes the shortcomings of research that is found at the end of the research process?
 - a. Demerits
 - b. Critique
 - c. Limitation
 - d. Delimitation

Answer Key

1. a	2. a	3. a	4. a	5. c	6. b	7. d
8. c	9. d	10. c				

BIBLIOGRAPHY

- Hanacek J. Phases of research process. [online] Available from HYPERLINK "http://www.academia.edu/6430105/4Phases_of_research_process.%20Accessed%20on%2015/9/2014"www.academia.edu/6430105/4 Phases_of_research_process. [Accessed September, 2014].
- Polit DF, Beck CT. Nursing Research: Principles and Methods. 7th edition. Philadelphia: Lippincott Williams & Wilkins; 2004.
- Roberts K, Taylor B. Nursing Research Process: An Australian Perspective. 2nd edition. Singapore: Thompson, Nelson Australia Pty Limited; 2002.
- Xaquín S, Perez-sindin Lopez. How to turn your research idea into a research question. [online] Available from <http://xaperezsindin.com/2012/10/31/how-to-turn-your-research-question-into-your-research-objectives/>. [Assessed June 7, 2015].



Literature Review

LEARNING OBJECTIVES

After the completion of the chapter, the readers will be able to:

- Define literature review.
- Enlist the importance of literature review.
- Explain the types of literature review.
- Elaborate sources of literature review.
- List down the steps of literature review.
- Discuss the importance of annotated bibliography.

CHAPTER OUTLINE

• Introduction	• Steps of Literature Review
• Meaning and Definition of Literature Review	• Important Points to be Considered While Writing Literature Review
• Importance and Purposes of Literature Review	• Annotated Bibliography
• Types of Literature Review	• Components of Annotated Bibliography
• Sources of Literature Review	

KEY TERMS

Cochrane library: A comprehensive online resource that contains systematic reviews, meta-analyses, and other evidence-based health care information, particularly focused on clinical trials and interventions.

Cochrane reviews: In-depth systematic reviews and summaries of research studies and clinical trials available within the Cochrane Library, known for their rigorous methodology and evidence synthesis.

Cumulative Index to Nursing and Allied Health Literature (CINAHL): A specialized database that focuses on nursing, allied health, and health care literature, making it a valuable resource for nursing research and practice.

DynaMed: An evidence-based clinical decision support tool that provides health care professionals with access to up-to-date medical information and clinical guidelines.

Contd...

EBSCO: Short for Elton B. Stephens Company. It is an online research database that provides access to a wide range of academic and scholarly journals, articles, and other publications across various disciplines.

Medical Literature Analysis and Retrieval System (MEDLARS): A system developed by the National Library of Medicine (NLM) for indexing and retrieving biomedical and health care literature, including PubMed.

OVID: A platform that provides access to a variety of databases, journals, and resources in the fields of medicine, health care, and other academic disciplines.

Primary source of literature: Original research studies, reports, or documents that provide firsthand information and data on a particular topic or research question.

Proquest: An online database that offers access to a diverse collection of academic journals, magazines, newspapers, and other sources spanning multiple fields of study.

PsycINFO: A specialized database that focuses on psychology and related fields, offering access to a wide range of research articles, books, and other resources in the realm of psychology and behavioral sciences.

PubMed: A widely used and freely accessible database for biomedical and life sciences literature, containing a vast collection of research articles, clinical studies, and other publications.

Secondary source of literature: Sources that summarize, analyze, or interpret information or research findings from primary sources, such as review articles, textbooks, and literature reviews.

Scopus: An interdisciplinary abstract and citation database that covers a broad range of academic disciplines, offering access to research articles, conference papers, and citation analysis tools.

INTRODUCTION

The review of literature, often referred to as the literature review, is a fundamental component of the research process and scholarly writing. It is an important step in the research process. Literature review serves as the starting point for any investigation, offering a comprehensive overview of existing knowledge, theories, and research related to a specific topic or research question. Once the researcher has identified a potential research problem, the next step is to review the related literature. This involves an objective, thorough summary and critical analysis of the relevant available research as well as non-research literature on the topic being studied. It provides the researcher with the opportunity to determine how much pertinent material is available concerning the potential study; what all has been done by others regarding a particular topic of interest. All the scholarly articles, books, and other sources relevant to a particular issue are reviewed appropriately.

The purpose of literature reviews is to have a general idea of significant literature published on a topic. Literature reviews not only provide context and depth to the study but also play a crucial role in shaping research objectives and methodologies. In the current chapter, various aspects of literature review, i.e., the purpose, importance, sources, methods, etc. are discussed.

MEANING AND DEFINITION OF LITERATURE REVIEW

A literature review is a systematic and critical examination of scholarly literature, research studies, books, articles, and other sources relevant to a specific research topic, question, or area of study. It serves the purpose of providing a comprehensive overview of the existing knowledge, theories, concepts, and findings related to the chosen subject. A literature review not only summarizes the key findings and arguments of these sources but also evaluates their quality, methodology, and relevance. It identifies trends, gaps, contradictions, and areas where further research is needed, helping to inform the development of research objectives and hypotheses.

“A literature review is a systematic, explicit, and reproducible means for identifying, evaluating, and interpreting the relevant body of knowledge related to a particular topic.”

—Arlene Fink, 2014

“A literature review is an account of what has been published on a topic by accredited scholars and researchers.”

—Taylor D, 2001

“A literature review is a structured and critical appraisal of the existing knowledge on a particular topic.”

—Hart, 1998

Literature review serves as a tool that may involve documenting and summarizing relevant facts in an annotated bibliography format, offering concise insights into existing literature, or engaging in critical analysis of research methodologies, strengths, weaknesses, and contributions. This flexibility allows researchers to customize the literature review to their specific research objectives, whether it is to provide a comprehensive overview of existing knowledge or to critically evaluate the existing body of literature in their field of study.

IMPORTANCE AND PURPOSES OF LITERATURE REVIEW

A research literature review is a systematic, explicit and reproducible method for identifying, evaluating, and synthesizing the existing body of completed and recorded work produced by researchers, scholars, and practitioners.

Understanding the literature on the research topic will prevent the researcher from repeating previous errors, or redoing work which has already been done. It will also give an insight into aspects of the topic which might be worthy of exploration and future research.

A literature review serves many important purposes in research. These are elaborated as follows:

- **Familiarizing with existing research:** The primary purpose of a literature review is to familiarize the reader with the current state of research on the topic. This familiarity allows the researcher to position their study within the context of existing literature, facilitating a clear understanding of where their work fits and helping to avoid duplication of previous studies.
- **Identifying research directions:** A literature review not only informs the researcher about existing studies but also sparks ideas for potential future research directions. It can inspire researchers to develop new insights or formulate novel research questions based on gaps or limitations identified in previous work.
- **Highlighting research gaps:** It serves as a tool to identify gaps in the existing research, shedding light on areas where further investigation is needed.
- **Refining research focus:** A literature review helps researchers narrow down the scope of their study by enabling them to select specific aspects of the topic that are most relevant and beneficial to their research objectives.
- **Learning from past methodologies:** Researchers can gather insights from previous studies in terms of research strategies, methodologies, design, and even the use of measuring instruments.
- **Facilitating comparative analysis:** A well-conducted literature review acts as a guide for comparing the results and findings of the current study with those of earlier research.
- **Identifying replication needs:** It aids in determining whether there is a need to replicate a study in a different setting or with a different population, which can validate and extend the findings of previous research.
- **Revealing research limitations:** A literature review also highlights the limitations and flaws in previous research studies, enabling researchers to be mindful of potential challenges they may encounter in their own work.

- **Gaining research experience:** Researchers can learn from the experiences of others documented in the literature, helping them avoid common mistakes and navigate research challenges effectively.
- **Promoting critical thinking:** A literature review provides an opportunity for researchers to critically evaluate and analyze the existing research.
- **Fostering interdisciplinary insights:** A comprehensive literature review can offer insights from related disciplines or fields of study, encouraging interdisciplinary perspectives and enriching the depth of the research.
- **Supporting theoretical frameworks:** A literature review helps researchers identify and adopt appropriate theoretical frameworks that have proven effective in similar studies, strengthening the conceptual foundation of their research.

TYPES OF LITERATURE REVIEW

Literature reviews can be categorized based on their purpose and methods used. Some common types of literature review include:

- **Narrative (or traditional) literature review:** This is the most common type of literature review. It involves identifying and summarizing the key findings of relevant studies on a particular topic. Narrative literature reviews can be used to:
 - Provide an overview of the existing research on a topic.
 - Identify gaps in the literature.
 - Develop a theoretical framework for a new study.
 - Support the findings of a new study.
- **Systematic review:** A systematic review is a comprehensive and systematic synthesis of existing research on a specific research question. Systematic reviews follow a structured and predefined protocol for searching, selecting, and analyzing literature. They use explicit criteria to include or exclude studies and employ rigorous methods to assess and synthesize the evidence. Systematic reviews are often used to inform evidence-based practice and policy.
- **Meta-analysis:** A meta-analysis is a type of systematic review that uses statistical methods to combine data from multiple studies, applying statistical techniques to calculate effect sizes and provide a more robust and quantitative understanding of the research question. Meta-analyses are often used to produce quantitative estimates of the effects of an intervention or to identify factors that are associated with a particular outcome.
- **Meta-synthesis:** A meta-synthesis is a type of systematic review that is used to synthesize the findings of qualitative studies. Meta-syntheses are often used to develop new theories or conceptual models.
- **Integrated review:** Integrated reviews combine findings from diverse types of research studies (e.g., both qualitative and quantitative) to provide a more holistic view of the topic. Integrated reviews are often used when researchers want to bring together and analyze both qualitative and quantitative research to gain a comprehensive understanding of the topic.
- **Scoping review:** A scoping review is a type of literature review that is used to map the existing literature on a broad topic, often to identify gaps in research or inform the development of a research agenda. It is a relatively new type of literature review, and it is often used to assess the feasibility of conducting a systematic review.
- **Critical review:** Critical reviews focus on assessing the strengths and weaknesses of the research, including the study design, methodology, and the credibility of findings. They aim to provide a comprehensive evaluation of the literature's reliability.

- **Policy reviews:** Policy reviews examine and synthesize literature relevant to a specific policy or practice issue. They are often conducted to inform policy decisions by summarizing research findings that have direct implications for policy development or implementation.
- **Historical review:** Historical reviews focus on the chronological evolution of ideas, theories, and research in a particular field, providing insights into how knowledge has evolved over time.

SOURCES OF LITERATURE REVIEW

A literature review can be conducted using two sources: primary sources and secondary sources (Table 6.1).

Primary Sources

Primary sources are reports authored by the original researchers of a study, offering firsthand information or ideas derived directly from their own research work. For example, original research articles in peer-reviewed journals serve as primary sources as they present the authors' firsthand accounts of their research.

The primary source is a report written by the original researchers of a study. It provides first-hand information or ideas obtained from the original material. For example, original research articles published in a journal represent the primary source of information as the authors of these studies have provided a first-hand report of their own research. Primary sources include the following:

- **Original research articles:** Research articles published in peer-reviewed journals, conference proceedings, or as theses and dissertations are primary sources. They present firsthand data, methodologies, findings, and conclusions on a specific research question or topic.
- **Surveys and questionnaires:** Data collected through surveys, questionnaires, or interviews directly from participants are primary sources.
- **Observations:** Researchers may collect data through direct observations in the field or laboratory. Observational data forms primary sources, providing raw information on phenomena or behaviors.
- **Archival materials:** In historical research, primary sources often include documents, manuscripts, letters, diaries, and other records from the past that provide firsthand accounts and historical context.

Secondary Sources

Secondary sources refer to materials that provide interpretations, summaries, or analyzes of original research and data conducted by others. Secondary sources are created by someone other than the original researcher with an aim to present or critique the information derived from primary sources. Secondary sources of

Table 6.1 Example for primary and secondary source of literature review

Context: A researcher is carrying out literature review on experiences of ICU nurses working with COVID-19 patients.

Example:

Primary source	Bergman L, Falk AC, Wolf A, Larsson IM. Registered nurses' experiences of working in the intensive care unit during the COVID-19 pandemic. Nurs Crit Care. 2021 Nov;26(6):467-475.
Secondary source	Nikbakht Nasrabadi A, Abbasi S, Mardani A, Maleki M, Vlaisavljevic Z. Experiences of intensive care unit nurses working with COVID-19 patients: A systematic review and meta-synthesis of qualitative studies. Front Public Health. 2022 Nov 15;10:1034624.

literature review include summaries and comments about original research papers (primary sources), including systematic reviews, meta-analyses, meta-syntheses, and other forms of scholarly critiques. These secondary sources provide valuable insights, analyses, and background of the primary research conducted by others. Researchers often turn to these secondary sources to access synthesized information and expert interpretations.

Access to sources of literature: Both primary and secondary sources of literatures can be accessed through either print sources or electronic sources as described as follows:

- **Printed sources:** Some of the printed sources of literature includes (Fig. 6.1):
 - **Books:** Scholarly books, monographs, and edited volumes that provide in-depth analysis and discussions of research, theories, and concepts within the field of study.
 - **Peer-reviewed journals:** Printed copies of peer-reviewed journals containing research articles, reviews, and scholarly commentary on various topics within the field. These can often be found in university libraries.
 - **Conference proceedings:** Printed collections of research papers are presented at academic conferences. They provide insights into the latest research trends and findings within a specific discipline.
 - **Magazines and periodicals:** While not typically used for scholarly literature reviews, certain magazines and periodicals may contain articles of interest or relevant information on specific topics.
 - **Theses and dissertations:** Graduate theses and doctoral dissertations, which are often available in print format, can serve as valuable sources of research information.

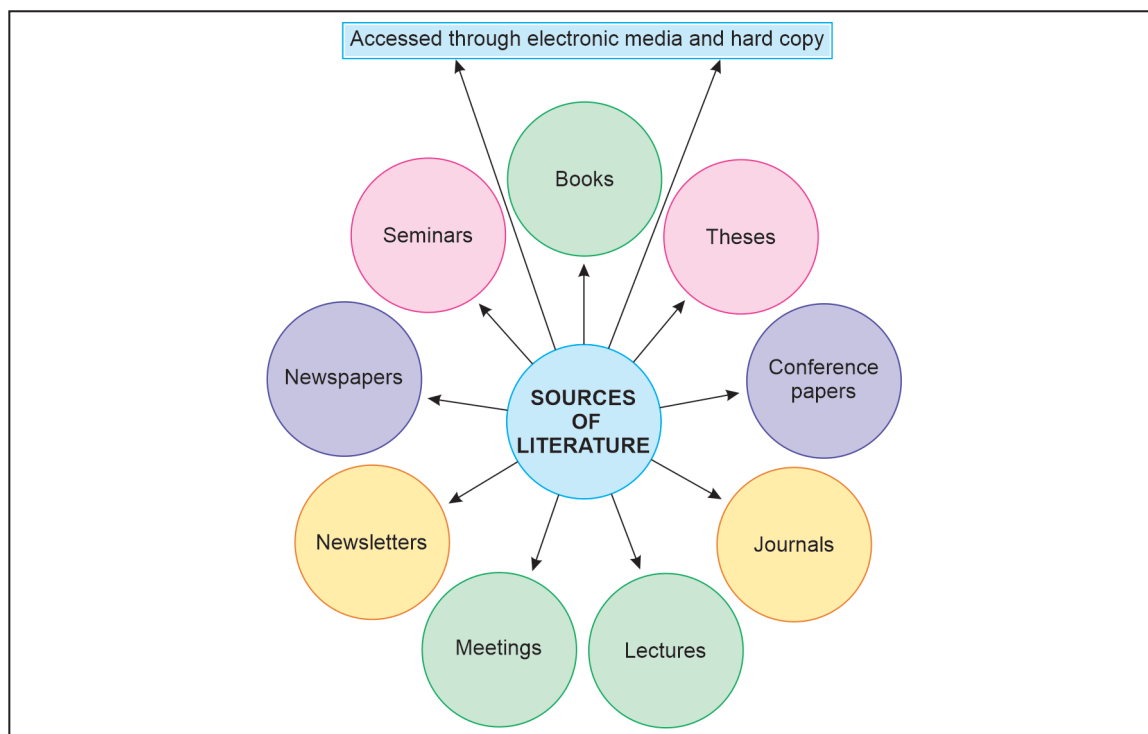


Figure 6.1: Sources of literature



- **Newspapers:** While not commonly used for academic literature reviews, newspapers can provide historical context and information on current events related to a research topic.
- **Reports and manuals:** Printed reports, technical manuals, and institutional publications may contain relevant research findings or data, particularly in specialized fields.
- **Encyclopedias and reference books:** Printed encyclopedias and reference works offer concise explanations and summaries of topics, providing foundational knowledge for literature reviews.

Some important international nursing journals

- International Journal of Nursing Studies
- Journal of Advanced Nursing
- Nursing Research
- Nursing Outlook
- Worldviews on Evidence-Based Nursing
- Journal of Clinical Nursing
- International Nursing Review
- Nurse Education Today
- Journal of Nursing Management
- Intensive and Critical Care Nursing
- Applied Nursing Research
- Nurse Education in Practice
- Journal of Family Nursing
- Nursing in Critical Care
- Journal of Psychiatric and Mental Health Nursing

Some important national nursing journals

- The Nursing Journal of India
- Indian Journal of Psychiatric Nursing
- Indian Journal of Continuing Nursing Education
- Indian Journal of Nursing and Midwifery
- Indian Journal of Nursing Studies

- **Electronic sources:** Electronic sources include a wide range of online databases, repositories, and platforms that host an extensive range of scholarly materials, offering researchers unprecedented access to research articles, studies, and resources spanning various disciplines. In this digital landscape, the electronic sources not only facilitate the exploration of existing literature but also serve as critical tools for evidence-based inquiry, enriching the literature review process with the latest advancements and insights from the global researchers' community.

Electronic sources make it easy for scholars to explore the latest research. Electronic sources encompass both search engines and specialized databases, each serving distinct purposes.

- **Search engines** like Google (www.google.com), Yahoo Search (search.yahoo.com), MSN Search (www.msn.com) and AI powered Bing (www.bing.com) are designed for broad, general-purpose internet searches. They are ideal for conducting preliminary research and gaining a broad understanding of a topic or issue. Search engines index an extensive range of web content, including websites, news articles, blogs, images, videos, and more. They provide a comprehensive overview of information available on the World Wide Web.
- **Databases** are specialized repositories that focus on specific disciplines or subject areas. Examples include PubMed (www.pubmed.gov) for health care and Medline for medical research. Databases primarily consist of peer-reviewed research articles, conference papers, and academic publications.

This ensures the quality and reliability of the information retrieved. Information in databases is structured and organized with specific fields and categories. Researchers can perform advanced searches, utilizing controlled vocabulary, to precisely locate relevant materials.

- ◆ **CINAHL (Cumulative index to nursing and allied health literature):** CINAHL is a comprehensive database of nursing and health-related literature. It provides access to over 7.6 million records, including articles, books, conference proceedings, and dissertations from over 3800 journals. The database covers a wide range of topics, including nursing, medicine, health care, and allied health fields.
- ◆ **MEDLINE (Medical literature analysis and retrieval system online):** MEDLINE is a vast database that covers biomedical and life sciences literature. It includes a wide range of medical and health care research articles. One of the interfaces for searching the MEDLINE literature database is PubMed (www.pubmed.gov), which is provided by the National Library of Medicine (NLM) and used by publishers to submit content to the NLM.
- ◆ **PubMed:** PubMed is a free and widely-used database that provides access to a vast collection of biomedical literature, including MEDLINE content. It's a valuable resource for health care research.
- ◆ **Cochrane library:** The Cochrane Library (www.cochranelibrary.com) is a collection of databases that contain high-quality, independent evidence to inform health care decision-making. The Cochrane Library includes the following databases:
 - ❖ Cochrane Database of Systematic Reviews (CDSR)
 - ❖ Cochrane Central Register of Controlled Trials (CENTRAL)
 - ❖ Cochrane Methodology Register
 - ❖ Cochrane Clinical Answers
- ◆ **British nursing index:** The British Nursing Index (BNI) is a bibliographic database that indexes the most popular English language nursing journals published primarily in the UK, with a small selection of titles from the US and Australia. It can be accessed from www.proquest.com.
- ◆ **ProQuest:** ProQuest is a multidisciplinary database that includes a diverse range of academic disciplines, offering access to dissertations, theses, and scholarly articles.
- ◆ **MedlinePlus:** While it primarily serves as a consumer health resource, MedlinePlus can also be used for literature searches to find reliable health information.
- ◆ **Nursing and health sciences databases:** These databases may include specific resources tailored to nursing and health sciences research, providing access to research articles, conference proceedings, and more.
- ◆ **ERIC (Education resources information center):** ERIC focuses on education-related literature, making it a key resource for education and educational research.
- ◆ **Web of science:** Web of Science is an interdisciplinary database covering a wide range of academic subjects, making it useful for cross-disciplinary research.
- ◆ **PsycINFO:** PsycINFO is a database that contains abstracts of literature related to psychology. Produced by the American Psychological Association (APA), PsycINFO covers a wide range of materials, including journal articles, books, and dissertations.
- ◆ **Scopus:** Scopus is a multidisciplinary database that covers scientific, technical, medical, and social sciences research.
- ◆ **Embase:** Embase specializes in biomedical and pharmacological literature, providing access to a range of health care research articles.

Table 6.2 Name and website URLs of some important nursing journals

Name of the Journal	URL address to access
The American Journal of Nursing	https://journals.lww.com/ajnonline/pages/default.aspx
American Nurse	https://www.myamericannurse.com/
Critical Care Nurse	https://www.wgu.edu/career-guide/health-care/critical-care-nurse-career.html
Emergency Nurse	https://www.rasmussen.edu/degrees/nursing/blog/emergency-nursing/
Geriatric Nursing	https://explorehealthcareers.org/career/geriatrics/geriatric-staff-nurse/
Intensive and Critical Care Nursing	https://www.sciencedirect.com/journal/intensive-and-critical-care-nursing
International Journal of Nursing Studies	https://www.sciencedirect.com/journal/international-journal-of-nursing-studies
International Nursing Review	https://onlinelibrary.wiley.com/journal/14667657
Journal for Nurse Practitioners	https://www.npjournals.org/
Journal of Advanced Nursing	https://onlinelibrary.wiley.com/journal/13652648
Journal of Clinical Nursing	https://onlinelibrary.wiley.com/journal/13652702
Journal of Nursing Education Today	https://www.sciencedirect.com/journal/nurse-education-today
Journal of Nursing Management	https://onlinelibrary.wiley.com/journal/13652834
Nurse Education in Practice	https://www.sciencedirect.com/journal/nurse-education-in-practice
Nursing Outlook	https://www.nursingoutlook.org/
Nursing Research	https://journals.lww.com/nursingresearchonline/pages/default.aspx
Oncology Nursing Forum	https://www.ons.org/onf
Worldviews on Evidence-Based Nursing	https://sigmapubs.onlinelibrary.wiley.com/journal/17416787

- ◆ **EBSCO:** EBSCO is a popular database provider that offers a wide range of academic databases and tools for researchers, librarians, and students.
- ◆ **Etoh:** Etoh, which stands for Essential Evidence Topics in Health, is a resource for evidence-based health care research.
- ◆ **Radix:** Radix is a database that offers access to nursing and allied health research materials.
- ◆ **Online journals:** The name and website URLs of some important nursing journals are provided in Table 6.2.

STEPS OF LITERATURE REVIEW

Literature review is a systematic and organized process which involves the following steps as illustrated in Figure 6.2.

1. **Defining the research question and identifying the key terms:** The first step in conducting a literature review involves clearly defining the research question or problem statement. This question serves as the guiding principle for the review. Additionally, identifying key terms and concepts related to the research question is essential. Boolean operators such as AND, OR, and NOT can be used to combine keywords

and create more precise search queries. An example of research question and appropriate keywords are given in Table 6.3.

2. **Identifying and evaluating relevant sources:**

Identifying and evaluating sources is a crucial task to ensure that the literature review includes high-quality and relevant materials. Scholarly sources, such as peer-reviewed journal articles, books, and reputable reports, should be selected. Assessing the credibility of each source involves considering author qualifications, journal status, recency of publication and methodology. Reputable journals and publishers have established quality control processes and editorial standards that enhance the credibility of the work published in their journals.

It is essential to ensure that the journal has undergone peer review because peer-reviewed articles are subjected to evaluation by experts in the field, which adds a layer of quality assurance. Recently published sources (published within the last 5–10 years) should be prioritized to ensure the review incorporates the latest nursing research and practices since nursing is a fast-evolving field. The relevant literature sources related to nursing has been discussed earlier in this chapter.

3. **Searching the literature:** After selecting relevant sources, the next crucial step is to identify a structured approach to searching for appropriate information. Manually searching for printed journals was the standard practice until the digital revolution and advancements transformed the literature review process, making it significantly more efficient. Here, both the manual and digital methods and some key databases used in nursing research are discussed.

- **Manual searching of printed journals:** Manual searching of printed journals involved physically accessing and browsing through printed volumes of journals in libraries. Researchers would rely on bibliographic indices or indexes to locate specific articles. Bibliographic indices, such as the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Index Medicus (Medline), and others, provided structured listings of articles, often organized by subject, author, or keyword. Researchers would consult these indices to identify relevant articles and then locate the physical journals in libraries.

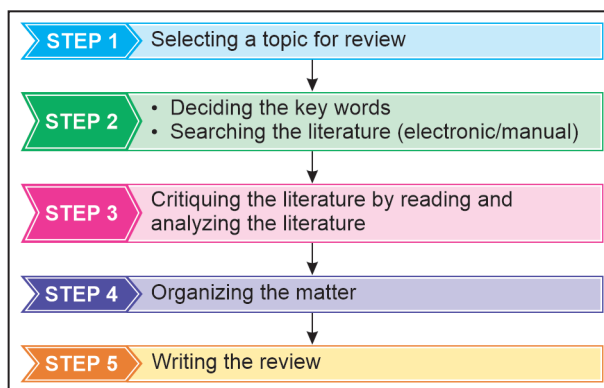


Figure 6.2: Steps of literature review

Table 6.3 Identification of keywords from research problem statement

Research problem	Example of appropriate key terms for search
A study to assess the impact of telemedicine on health care access and patient outcomes in rural communities requires assessment.	• Telemedicine and Rural health care • Rural health care and Health care access • Telemedicine and patient outcomes • Telemedicine effectiveness and rural health care
The effectiveness of mindfulness-based stress reduction therapy on the psychological well-being of cancer patients undergoing chemotherapy.	• Mindfulness-based stress reduction and Psychological well-being and Cancer patients • Mindfulness-based stress reduction and Chemotherapy



- **Digital and online databases:** The advent of digital technology and the internet revolutionized the literature review process, making it faster and more accessible. Digital databases and search engines allowed researchers to search and retrieve a vast amount of literature from their computers. Careful and appropriate use of keywords is crucial for effective literature search using online databases.
 - ◆ **Spelling of keywords:** When searching for literature in databases, it is important to be aware of the different spellings of certain terms in British and American English. For example, the spelling of “anaemia” is “anaemia” in British, while the American spelling is “anemia”. If the journal is of American origin, it may not locate the key term anaemia. So, it is recommended to use both spelling ‘anemia’ and ‘anaemia’ in the query with Boolean operator ‘OR’ (anaemia OR anemia). This will locate the article if it has the keyword either ‘anemia’ or ‘anaemia’.
 - ◆ **MESH terms:** MESH (Medical Subject Headings) terms are a controlled vocabulary used to index biomedical and life sciences articles. Using MESH terms enhances the precision of the literature search. The MESH Browser is a dedicated tool provided by the National Library of Medicine (NLM) for exploring MESH terms. MESH terms in search can be incorporated while searching articles in PubMed.
 - ◆ **Boolean operators:** Boolean operators such as AND, OR, and NOT can be used to combine keywords and create more precise search queries. By strategically using Boolean operators and keywords, the researchers can efficiently find relevant literature. For example (Fig. 6.3),
AND: Use AND to retrieve articles that contain both keywords. For example, “anaemia AND treatment” will retrieve article that contain both of these keywords.
OR: Use OR to retrieve articles that contain either or both the keywords. For example, “anaemia OR iron deficiency” will retrieve articles that contain either ‘anaemia’ or ‘iron deficiency’ or both the terms.
NOT: Use NOT to exclude keywords from the search results. For example, “anaemia NOT sickle cell” will retrieve articles that contain the keyword “anaemia” but not the keyword “sickle cell”.
 - ◆ **Truncation to broaden search:** Truncation is a technique that allows the researcher to broaden the search by including variations of a keyword. To truncate a keyword, a wildcard character * is used at the end of the keyword. For example, truncating the keyword “Nurse” to “Nurs*” will return results that contain the following keywords: nurse, nursing, nurses, nursing care, etc.
 - ◆ **Field tags for narrowing search:** The strategic use of “field tags” is a valuable technique to enhance search accuracy and reduce the likelihood of irrelevant search results. Field tags are specialized operators or codes used within database search queries to designate a particular field

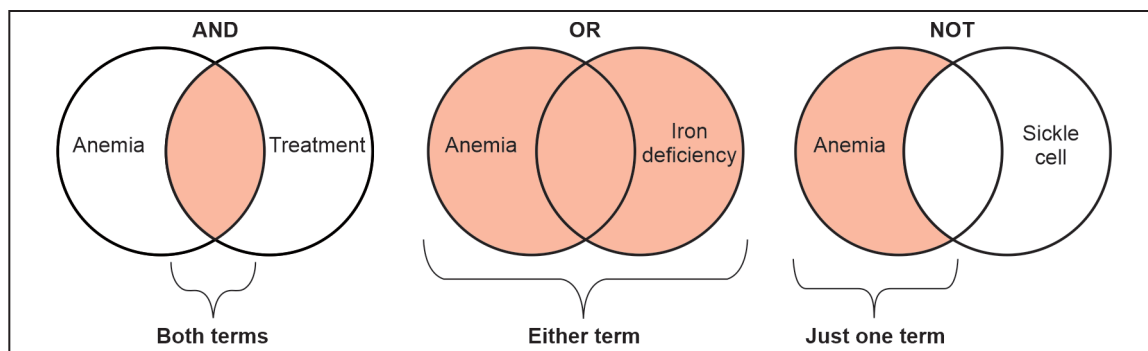


Figure 6.3: Boolean operators and their purpose

Table 6.4 Field tag codes with examples

Field tags [code]	Search area	Example
[TI]	Title field: Within the title of articles	"nursing interventions [TI]" will retrieve articles where "nursing interventions" appears in the title.
[AB]	Abstract field: Abstract section of articles	"nursing assessment [AB]" will retrieve articles where "nursing assessment" appears in the abstract.
[AU]	Author field: Articles by a specific author	"Kumar [AU]" will yield articles authored by individuals with the last name Kumar.
[TIAB]	Journal field: Title AND Abstract	"Cancer [TIAB]" will yield articles where cancer appears in the title as well as abstract.

or section of a database record where the search term should be located. Use of field tags with example is illustrated in Table 6.4.

Field tags can be used in combination with Boolean operators also. For example, mobile phones [TI] AND cancer [TI] will return articles where both 'mobile phones' and 'cancer' appears in the title.

- ◆ **Filters for narrowing search:** The databases have various filters to narrow down search results. Filters are useful for specifying criteria that help the researcher to find the most relevant articles. The common filters used are publication date, language, age and sex of subjects, journal categories, etc. In PubMed, the filter options are provided on the left side of the window that can be applied after the initial search using keywords.
4. **Analyzing and synthesizing literature review:** Once the relevant literature is retrieved through the search, a thorough review of the literature sources is conducted, and pertinent information that addresses the research question is meticulously extracted. Key findings, methodologies, and any pertinent statistical data are documented to facilitate effective organization of the material. Detailed notes are maintained to ensure a thorough and structured approach to the literature review process.
One of the commonly used methods of analyzing and synthesizing a literature review is PQRS system. The PQRS system in the context of literature review refers to the Preview, Question, Read, and Summarize method. This approach is used to systematically review and analyze literature for research purposes.
 - **Preview:** This step involves getting an initial overview of the literature. It includes looking at titles, abstracts, and keywords to quickly assess whether a source is relevant to the research.
 - **Question:** Research questions or objectives are formulated based on the goals of the literature review. Researchers define what they aim to learn from the literature and identify the gaps they intend to address. These questions serve as the compass that guides the review process.
 - **Read:** In this phase, the selected source content is thoroughly read and analyzed. Attention is paid to key findings, methodologies, and evidence that support or refute the research questions.
 - **Summarize:** The main points, key findings, and relevant information from each source are summarized and organized to identify trends, themes, and insights.
 5. **Writing the literature review:** After the analysis and synthesis of the literature have been successfully completed, the next important step is to draft the literature review itself, ensuring that it is presented in a well-structured and reader-friendly manner. The approaches of organizing the literature review depends on nature of the research question, the available sources, and the goals of the review. Different approaches of organizing literature review are presented in Table 6.5.

Table 6.5 Approaches of organizing literature review

Approaches	Description
Thematic organization	- Organizes literature by key themes, topics, or concepts. - Group sources based on shared thematic elements. - Suitable for addressing different aspects or dimensions of the research question.
Chronological organization	- Organizes literature by publication date. - Presents sources in a historical or time-based sequence. - Useful for tracing the evolution of research in a specific field.
Theoretical versus methodological organization	- Distinguishes sources based on their theoretical framework or research methods. - Separates literature by the underlying theories or methodologies employed by researchers. - Helpful when examining the relationship between theory and empirical research.
Theoretical versus empirical organization	- Separates sources based on their theoretical nature or empirical research focus. - Groups literature by whether it primarily contributes theoretical concepts or empirical data. - Useful for discussions that involve both theoretical foundations and practical findings.
Geographical organization	- This approach organizes the literature based on geographical regions or locations. - It is commonly used in studies involving geographic or regional differences, such as in studies of environmental issues or cultural practices.
Problem-cause-solution organization	- Suitable for reviews focused on addressing problems and proposing solutions. - It organizes the literature into sections that discuss the problem, the underlying causes, and potential solutions or interventions.
Conceptual framework organization	- This approach structures the literature review around a specific conceptual framework or theoretical model. - It helps to demonstrate how various studies fit within a particular theoretical perspective.

Much like research papers, literature reviews adhere to a structured format that typically comprises three fundamental elements: Introduction or Background Information, body of review, and conclusion.

- i. **Introduction or background information:** This section sets the stage for the literature review by providing context and background information about the topic under investigation. It should introduce the research question or objective, explain the significance of the review, and outline the scope and organization of the subsequent discussion.
 - ◆ Begin by introducing the broader context in which the research question or problem statement exists. Explain why the topic is important and relevant within the field of study.
 - ◆ Clearly state the research question or objective. This should be a concise and focused statement that is aimed to address through the literature review.
 - ◆ Discuss the significance of the research question. Explain why it matters, what gaps it aims to fill, and how it contributes to existing knowledge in the field.
 - ◆ Outline the scope of the literature review. Define the boundaries of the investigation, such as the time frame or specific subtopics to be covered.
- ii. **Body of the review:** The body of the literature review constitutes the main content and discussion of sources. This is where the researcher examines and critically analyze and synthesize the reviewed literature. The body of review comprises:
 - ◆ **Thematic or chronological organization:** Decide whether to organize the body thematically (by key themes or topics) or chronologically (by publication date). Choose the approach that best suits the research question.

- ◆ **Critical analysis:** For each source, provide a summary of key findings, methodologies, and main arguments. Analyze how each source contributes to answering the research question.
 - ◆ **Synthesis:** Identify common themes, patterns, or trends emerging from the reviewed literature. Highlight connections and discrepancies between different sources.
 - ◆ **Integration:** Show how each source fits into the broader discussion. Discuss how the literature collectively informs the research question.
- iii. **Conclusion:** The conclusion section brings the literature review to a close by summarizing the key findings, themes, and insights that have emerged from the reviewed sources. The essential components of conclusion section comprises:
- ◆ **Summarize key findings:** Provide a concise summary of the main findings, themes, and insights that have emerged from the reviewed literature.
 - ◆ **Highlight contributions:** Emphasize the contributions of the literature to the research question. Discuss how it has advanced understanding or identified areas that require further exploration.
 - ◆ **Address gaps or limitations:** Mention any gaps or limitations in the existing literature that the research aims to address or explore further.
 - ◆ **Recommendations (if applicable):** If the review suggests actionable recommendations, propose them in the context of the research question.

To simplify the writing of literature review, a summary table of all the reviews can be prepared to have a quick look at the reviewed literature. A format of the same has been shown in Table 6.6. As such, it is not a standard format. The headings of the columns may be modified as per the choice of the researchers.

- iv. **Citing the sources properly:** Proper citation is fundamental in academic writing to give credit to the original authors and to avoid plagiarism. Ensuring accurate citation of all sources referenced in the literature review is essential.

Key considerations for citing sources properly in a literature review include the following:

- ◆ **Choose the appropriate citation style:** Adhering to the citation style recommended by the institution or publisher, such as APA, MLA, or Chicago, is necessary.
 - ◆ **Include all relevant information:** When citing a source, include all the necessary information to help readers locate the original work. This typically includes the author's name(s), publication date, title of the work, source (journal, book, website, etc.), and page numbers (if applicable).
 - ◆ **In-text citations:** In-text citations are used to acknowledge a source within the body of the literature review. They typically include the author's name and publication year in parentheses. For example: (Kumar, 2020).
- **Reference list or bibliography:** Compile a comprehensive reference list or bibliography at the end of the literature review. This list should include full details for each source that are cited, following the citation style guidelines.

Table 6.6 Sample summary table for literature review

Author/yr/Place	Sample size	Type of study	Outcome variable	Result
Mann et al. (1995), New York	66	Cross-sectional study	Assistive device use by home-based elderly persons with arthritis	Respondents had inadequate information on assistive devices and expressed need for additional devices such as magnifiers, grab bars, jar openers and hearing aids, etc.



- **Be consistent:** Consistency in citation style is crucial. Use the same citation style consistently throughout the literature review.
- **Use quotation marks:** When directly quoting text from a source, enclose the quoted material in quotation marks and provide the page number in the citation.
- **Paraphrasing and summarizing:** When paraphrasing or summarizing ideas from a source, proper citation is still required, even if the author's exact words are not used. This acknowledges the source of the ideas.
- **Electronic and online sources:** For online sources, provide the URL or DOI (Digital Object Identifier) where applicable.
- **Citation management tools:** Consider using citation management software like Zotero, EndNote, or Mendeley to help organize and format the citations according to the chosen style. (Reference style and citations are discussed in detail in Chapter 11).

IMPORTANT POINTS TO BE CONSIDERED WHILE WRITING LITERATURE REVIEW

Certain important points while writing literature review are discussed as follows:

- **Avoid long paragraphs:** Use concise paragraphs to enhance readability and focus on a single idea per paragraph.
- **Grammar and punctuation:** Ensure the correct use of grammar and punctuation to maintain writing clarity and professionalism.
- **Be specific:** Provide specific details when discussing methodologies, important results, and significant findings from the literature to enhance precision.
- **Flow and cohesion:** Maintain a coherent flow between paragraphs, ensuring that each paragraph naturally leads to the next for better comprehension.
- **Relevance to objectives:** Align the literature review with the study's objectives to establish its purpose within the research context.
- **Focus on sources of evidence:** Emphasize the quality and credibility of the sources of reference in the review.
- **Identify research gaps:** Identify gaps in previous research that the study aims to address, highlighting the unique contribution it offers.
- **Abbreviation usage:** Minimize the use of discipline-specific abbreviations to prevent confusion, especially for readers outside the field.
- **Be selective:** Focus on relevant and current topics directly related to the research question or problem statement.
- **Provide evidence:** Substantiate the claims and arguments with credible evidence from reputable sources in the literature.
- **Account for contrary evidence:** Acknowledge and address contradictory findings or viewpoints within the reviewed literature to provide a balanced perspective.
- **Critical analysis:** Provide a critical analysis of the literature, evaluating the strengths and weaknesses of the studies reviewed.
- **Reference citations:** Properly cite all sources of reference in the literature review to give credit to original authors and avoid plagiarism.
- **Citation consistency:** Ensure all sources cited in the text are correctly listed in the reference list, adhering to the prescribed citation style.

- **Effective organization:** Structure the literature review logically, using clear headings and subheadings to guide readers through the review's flow.
- **Use own language:** Summarize and interpret the literature in own words while maintaining accuracy and clarity.
- **Clarity of argument:** Present a clear and coherent argument that guides the reader through the literature review.

ANNOTATED BIBLIOGRAPHY

An annotated bibliography is a valuable tool in the research process that provides a concise summary and critical evaluation of sources such as books, articles, reports, and other documents. An annotated bibliography provides information regarding the research that has been done on a given topic. It is an alphabetic list of the citations to books, articles, and documents. Each citation is followed by a brief, descriptive and evaluative paragraph usually of about 150 words is called the annotation.

The purpose of the annotation is to notify the readers of the relevance, accuracy, and quality of the sources cited. Sometimes, the students get confused between the annotation and the abstract. In fact, an abstract is the descriptive summary of a journal article. It is often found at the beginning of the article. Though annotation is also the summary of an article or of any other document, but it is more descriptive and critical. It exposes the author's point of view, clarity and appropriateness of expression, authority, etc.

COMPONENTS OF ANNOTATED BIBLIOGRAPHY

An annotated bibliography typically consists of the following components for each source entry:

- **Citation:** Begin with the full citation of the source in the appropriate citation style (e.g., APA, MLA, Chicago). This includes the author(s), title, publication date, publisher, and any other relevant bibliographic information.
- **Annotation:** The annotation component of an annotated bibliography provides a summary and critical evaluation of the source. It includes several key elements:
 - Author background.
 - The central theme of focus.
 - Strengths and weaknesses of the source, considering factors such as the author's qualifications, research methodology, potential biases, and overall reliability.
 - The research methodology used in the source.
 - Description of how it contributes to the understanding of the research topic or supports the research objectives.
 - Mentioning of the intended audience of the source. Is it written for scholars, professionals, students, or a general audience?

Purposes of Writing Annotated Bibliography

Annotated bibliography serves the following purposes:

- **Summary:** It provides concise summaries of each source's content, helping readers quickly understand the source's main ideas, arguments, and findings.
- **Evaluation:** It assesses the quality, credibility, and relevance of each source, allowing researchers to determine the suitability of sources for their research.

- **Organization:** Annotated bibliographies help researchers organize and categorize their sources, facilitating the identification of patterns, trends, and gaps in the literature.
- **Research planning:** They assist in planning research projects by identifying key sources and their potential contributions to the research topic.
- **Citation aid:** Annotated bibliographies offer complete citation information for each source, aiding researchers in correctly citing and referencing their sources in academic work.

Types of Annotated Bibliography

Annotations can take different forms, and there are two primary types of annotated bibliographies:

1. **Descriptive or Informative Annotated Bibliography:** In a descriptive or informative annotated bibliography, the annotations summarize the main points, arguments, and content of the source. These annotations provide a concise overview of the source's key ideas, methodology, findings, and any significant contributions. The primary goal of this type of annotation is to inform the reader about the content of the source without offering a critical evaluation or analysis. It is often used when the reader simply needs a clear understanding of what the source is about.
2. **Analytical or critical annotated bibliography:** In an analytical or critical annotated bibliography, the annotations not only summarize the source but also critically evaluate it. These annotations assess the source's strengths and weaknesses, its relevance to the research topic, the credibility of the author, and the quality of the evidence or arguments presented. Critical annotations may discuss the source's methodology, biases, and potential limitations. The primary goal of this type of annotation is to help the reader assess the source's value and relevance to their research and to provide a critical perspective on the source.

The choice between a descriptive and analytical annotation depends on the purpose of the annotated bibliography and the needs of the reader. A descriptive annotation may be more appropriate when the goal is to provide a straightforward summary of sources, while an analytical annotation is useful when the reader requires a deeper understanding and evaluation of the sources. Researchers often use a combination of both types in an annotated bibliography to provide a well-rounded overview of the literature on a particular topic.

Steps of Writing Annotated Bibliography

The seven-step process of writing annotated bibliography is described as follows:

1. **Search for literature:**
 - Begin by conducting thorough research on the chosen topic. Utilize academic databases, library catalogs, and search engines to locate relevant books, articles, and documents.
 - Record the bibliographic information for each source, including author(s), title, publication date, and other pertinent details.
2. **Critical review of literature:**
 - After locating potential sources, one should briefly examine and review each source. One should skim through the contents to gain a sense of the source's content and its relevance to the research.
 - Pay attention to elements such as the abstract, introduction, conclusion, and any headings or subheadings to identify the focus of each source.
3. **Selection of sources:**
 - Choose sources that offer a range of perspectives and insights on the research topic including diverse sources that contribute to a more comprehensive understanding of the subject matter.
 - Consider including works that represent different time periods, geographic locations, methodologies, and viewpoints to present a well-rounded bibliography.



4. **Citation:**

- Properly cite each source using the appropriate citation style (e.g., APA, MLA, Chicago). Ensure adherence to specific formatting guidelines for the chosen style.
- Include all necessary bibliographic details, such as author(s), title, publication date, publisher, and page numbers.

5. **Writing annotations:**

- Write concise annotations for each source. Annotations typically consist of a few sentences to a paragraph and serve as summaries and evaluations of the sources.
- Summarize the central theme, scope, and primary arguments or findings of each source. Highlight key points related to the research topic.
- Provide critical insights or commentary on the sources. Evaluate their credibility, objectivity, and relevance to the research.
- If applicable, compare or contrast each source with others in the bibliography. Note any unique contributions or perspectives they offer.

6. **Formatting and organization:**

- Format the annotated bibliography according to the specific requirements of the assignment or the chosen citation style.
- Organize the sources alphabetically by the author's last name (or by title if there is no author) within the annotated bibliography.

7. **Proofreading and revision:**

- Carefully proofread and revise the annotated bibliography to ensure clarity, coherence, and correctness. Check for any spelling or grammatical errors.

Sample of an annotated bibliography using the APA format for citation of a journal article is shown in Box 6.1.

BOX 6.1 Annotated bibliography using APA format

Kaur, S., Singh, A., Dhillon, M.S., Tewari, M.K., Walia, I. (2011, 2012). Point prevalence of bedsore among the admitted patients in a tertiary care hospital. *Journal of the Academy of Hospital Administration*, 23(1), 24(2), Jan-June and July-Dec, 18–24.

The authors are nursing faculties, research scholars at National Institute of Nursing Education, PGIMER, Chandigarh and they have undertaken this study to estimate the point prevalence of bedsore and to assess the functional dependence in the activity of daily life amongst the admitted patients in a tertiary care hospital. The mean ADL score was 1.30 ± 1.74 with the range of 0–6. 62.2% had <1.30 score. Half of the subjects were completely dependent for bathing and dressing. The overall prevalence of 10% was increased by 2.3% reported in a study conducted in 1998 in the same institution. Though high prevalence (41%) and incidence (33%) of bedsore has been reported from other countries, however, in the present study, none of the patients was found to be having bedsore from intensive care units. The authors have reported that majority of the patients with bedsore admitted in various wards were admitted through emergency. Tarpey et al. have also reported a high proportion of patients admitted through the emergency department at risk for pressure ulcer development. It has been concluded that there is a need to develop strategies for reduction and prevention of bedsores in hospital.

SUMMARY

- A literature review is a systematic and critical examination of scholarly literature, research studies, books, articles, and other relevant sources related to a research topic. It not only summarizes key findings but also evaluates their quality, methodology, and relevance.
- Literature reviews play a pivotal role in research by familiarizing researchers with existing work, preventing duplication, and inspiring new research directions.
- Literature reviews identify gaps, refine research focus, and promote critical thinking. Furthermore, literature reviews offer insights into research methodologies, limitations, and areas needing further exploration, fostering a comprehensive understanding of the chosen topic.
- Literature reviews vary based on their purpose and methods. Common types include narrative reviews, systematic reviews, meta-analyses, meta-syntheses, integrated reviews, scoping reviews, critical reviews, policy reviews, and historical reviews.
- Literature reviews draw from two main sources—primary and secondary sources. Primary sources encompass original research articles, surveys, observations, and archival materials authored by the researchers who conducted the study, providing firsthand data and findings. Secondary sources, on the other hand, offer interpretations, summaries, or critiques of primary research, such as systematic reviews, meta-analyses, and scholarly commentaries.
- Printed sources for literature reviews include books, peer-reviewed journals, conference proceedings, magazines, theses, dissertations, newspapers, reports, manuals, encyclopaedias, and reference books.
- Electronic sources are an essential component of modern literature reviews, offering researchers access to a vast array of digital materials. These sources encompass search engines like Google for broad internet searches, specialized databases such as PubMed and CINAHL for discipline-specific research, and online platforms like ProQuest and Web of Science for multidisciplinary academic resources.
- The steps of conducting a literature review encompass defining the research question and identifying key terms, selecting and evaluating relevant sources, conducting comprehensive literature searches using appropriate tools and techniques, analyzing and synthesizing the literature, and finally, writing the review in a structured format and citation of the review.
- An annotated bibliography is a tool used in research that provides a concise summary and critical evaluation of sources, including books, articles, and reports.
- There are two primary types of annotated bibliographies: descriptive (providing a summary of the source) and analytical (offering a critical evaluation of the source). The choice between them depends on the intended purpose and the reader's needs.
- The process of creating an annotated bibliography involves searching for literature, critically reviewing potential sources, selecting diverse and relevant sources, citing them correctly, writing concise annotations, formatting and organizing the bibliography, and proofreading and revising for clarity and correctness.

ASSESS YOURSELF

Long Answer Questions

1. Explain the difference between a primary and secondary source of literature. Why are primary sources more reliable?
2. Discuss five major sources of literature.
3. Discuss five major online sources of literature.

4. Discuss the importance and the use of a careful search of the literature.
5. Write the critical review of an article.

Short Answer Questions

1. What is the meaning of the term 'review of literature'?
2. Write the important considerations while writing literature review.
3. How will you critically review the literature?

Multiple Choice Questions

1. Which of the following is considered to be the highest quality type of literature?
 - a. Research articles in a peer-reviewed journal
 - b. Secondary sources
 - c. Books.
 - d. Research reports in a conference proceedings.
2. The most useful abstracting index for nursing literature is:
 - a. ERIC
 - b. CINAHL
 - c. Pubmed
 - d. Psych INFO
3. Which portion of the research report should capture MeSH?
 - a. Title
 - b. Abstract
 - c. Conclusion
 - d. Recommendations
4. In a peer-reviewed journal, the articles are published on the basis of:
 - a. Subjective discretion of the editors
 - b. Number of authors listed
 - c. Sincerity of the authors listed
 - d. Comments of the reviewers
5. Which of the following is the criteria of primary source of literature?
 - a. Systematic review published in a peer reviewed journal
 - b. Record based data
 - c. Original articles published in a journal
 - d. Meta analysis data published in a journal
6. Which of the following is NOT a purpose of literature review?
 - a. Avoid duplication of previous studies
 - b. Help researchers to copy results of previous studies
 - c. Help to narrow down the topic of proposed study
 - d. Facilitate researchers to discuss their results
7. A critical aspect of beginning a database search for relevant literature on a topic of interest involves identifying:
 - a. Reference management software
 - b. Electronic journals
 - c. Keywords
 - d. Existing knowledge
8. Which among the following article published in a peer reviewed journal is considered the highest level of evidence?
 - a. Meta analysis of RCTs
 - b. Findings of Single RCT
 - c. Systematic review of observational studies
 - d. Expert's opinion/comment about published paper
9. Which of the following is NOT TRUE of the Cochrane library?
 - a. It provides data on RCTs
 - b. It focuses only on studies in Western countries
 - c. It is a collection of databases
 - d. It represents the highest level of evidences for health care decision making

10. Which of the following is NOT true of pubmed search using boolean operators.
- Search query "Depression AND Therapy" will retrieve articles that contain either "Depression" or "Therapy" or both
 - Search Query "Migraine OR Headache" will retrieve articles that contain either "Migraine" or "Headache"
 - Search query "Depression AND Therapy" will only retrieve articles that contain both terms in the content
 - Search query "Depression NOT Anorexia" will retrieve articles that contain the term depression but exclude the term anorexia

Answer Key

1. a 2. b 3. b 4. d 5. c 6. b 7. c
8. a 9. b 10. a

BIBLIOGRAPHY

- Abbott P. Why do we need to review literature? *Nurse Researcher*. 1993;1(1):14-22.
- Brink P, Wood M. Basic steps in planning research. Jones and Bartlett; 1994. p. 2.
- Burns N, Grove S. *The Practice of Nursing Research: Conduct, Critique, and Utilization*. 4th edition. Philadelphia: W.B. Saunders Company; 2001.
- Burns N, Grove SK. *The practice of nursing research: Conduct, critique and Utilization*. 5th edition. St. Louis, MO: Elsevier Saunders; 2005.
- Dempsey PA, Dempsey AD. *Using Nursing Research: Process, Critical Evaluation, and Utilization*. 5th edition. Philadelphia. Lippincott Williams and Wilkins; 2000.
- EBSCO Information Services [online] Available from https://en.wikipedia.org/wiki/EBSCO_Information_Services [Accessed April 14, 2016].
- Nieswiadomy RM. *Foundations of Nursing Research*. 5th edition. New Delhi: Dorling Kindersley; 2008.
- Polit DF, Beck CT. *Nursing Research: Principles and Methods*. Philadelphia: Lippincott Williams & Wilkins; 2003.
- Polit DF, Beck CT. *Nursing research: Principles and methods*. 7th edition. Philadelphia: Lippincott Williams & Wilkins; 2004.
- ProQuest. [online] Available form <https://en.wikipedia.org/wiki/ProQuest>. [Accessed April 14, 2016]
- Roberts K, Taylor B. *Nursing Research Process: An Australian Perspective*. 2nd edition. Singapore: Thompson, Nelson Australia Pty Limited; 2002.
- Timmins F, McCabe C. How to conduct an effective literature search. *Nursing Standard*. 2005;20(11): 41-7.



Assess Yourself
Every Step Counts

It's time to do self-assessment. Are you ready for the competition!

Mini Test (Topic-wise) 6 Tests based on important topics of the respective subjects	Semester-wise Test (All semester subject) 2 Tests based on all the subjects of particular semester	Mega Grand Test (All subject) 2 Tests based on all the UG subjects (1 Test from Target High book)



Scan the QR Code to Download the App

Nursing NextLive
The Next Level of Nursing Education
CBS Phygitall Books >
Nursing Research and Statistics PHYGITALL





Theoretical and Conceptual Framework in Nursing Research

LEARNING OBJECTIVES

After the completion of the chapter, the readers will be able to:

- Define concept, construct, theory, model, conceptual models and conceptual framework.
- Discuss importance of using theories and models in nursing.
- Distinguish between theoretical and conceptual framework.
- Identify the steps of developing conceptual framework.

CHAPTER OUTLINE

• Introduction	• Building Blocks of Theories
• Terminologies	• Application of Theory in Nursing Research
• Models and Conceptual Models in Nursing	• Use of Theories in Developing Conceptual Framework
• Classification of Nursing Theories	• Theoretical and Conceptual Framework

KEY TERMS

Concepts: Fundamental ideas or mental representations that represent a class of objects, events, or phenomena, serving as building blocks for understanding and discussing various aspects of a subject or topic.

Construct: An abstract concept that is deliberately created or defined by researchers to represent a complex idea or theoretical concept in a way that can be measured or studied empirically.

Conceptual framework: A theoretical structure or model that provides a systematic and organized way of understanding, explaining, and interpreting relationships between concepts or variables in a research study or within a specific field.

Models: Simplified representations of real-world phenomena or systems, often using diagrams, equations, or other visual aids to illustrate the relationships and interactions between various components or variables.

Theories: Comprehensive and systematic explanations or sets of principles that aim to provide a deep understanding of complex phenomena, guiding research and helping to make predictions and connections within a specific field of study.

Theoretical framework: A broader theoretical perspective or foundation that underpins a research study or guides research questions, helping to situate the study within existing theories and providing a basis for understanding and interpreting research findings.

INTRODUCTION

Research depends on the relationships among these concepts. The process of putting these concepts on paper and connecting them to reveal interrelations and outcomes is called a conceptual framework. This framework is a crucial tool in research, guiding the way by providing a structured map of ideas and their connections.

Since research involves the explanation of complex phenomena, there is a need to simplify or reduce its complexities by introducing the variables that can be measured. This is where the idea of putting things into focus comes into play, i.e., the building of a conceptual framework. The conceptual framework works like a map that sets the direction of research. Conceptual framework is the abstract representation, related with the goals of a research projects. It is essential to focus attention on the already existing theories and research that is relevant to current plans of study. It informs and supports the concepts, expectations, assumptions, beliefs and theories of research.

A conceptual framework in research is a theoretical structure or model that provides a logical and systematic foundation for a study. It serves as a blueprint for the research process, helping researchers organize their thoughts, define key concepts, and develop hypotheses or research questions. The conceptual framework is a critical component of research because it helps researchers establish a clear understanding of the relationships among variables and concepts being studied.

TERMINOLOGIES

During the construct of conceptual framework, researcher comes across few terminologies. It is very important to understand these terminologies. These terms include concepts, constructs, theories, models, conceptual models and conceptual frameworks in nursing.

Concepts

A concept is an idea, often abstract, that we grasp to form beliefs and knowledge about the world. It originates from the Latin word “conceptum” meaning something conceived. Concepts are the building blocks of thoughts and play a role in learning, memory, inference, categorization, and decision-making. Concept can also be referred to as an outcome of a revolution of the idea which already exists. There are three ways to understand the concepts. They are: (1) the mental representations, (2) abilities and (3) senses. As per mental representations, the concepts are entities present in our brain, as per abilities the concepts are related to the abilities of mental state, and as per senses they are the abstract objects.

Constructs

The meaning of word “construct” is to make or create. The term “construct” refers to a characteristic or trait that is being examined. Constructs are like building blocks in theories, helping us understand and describe phenomena. They are crucial for explaining the “how” and “why” of a phenomenon. Constructs can apply to people like gender or age, physical attributes (e.g., height or weight), or ideas (e.g., self-esteem or racism).

Constructs should always be clear and explicit in research. This allows for operational definitions, criticism, comparisons, and testing. Constructs can be directly measured like height or weight, or indirectly like intelligence or happiness. Indirect constructs are based on observations but are not directly observable. For example, depression can be assessed using a scale with multiple items, and the scores indicate the level of depression. Constructs serve as convenient labels for grouping similar behaviors. They help researchers classify and communicate observations effectively.



Theories

The word theory is originated from Greek word “*theorein*” which meant to look upon, to observe, to consider, to contemplate. A theory is a systematic attempt to explain observed phenomena, answering questions like why people commit crimes, how media influence us or why individuals believe in God.

More formally, a theory is a coherent set of general propositions, used as principles of explanations of the apparent relationship of certain observed phenomena. A theory is a systematically organized body of knowledge applicable in a relatively wide variety of circumstances, especially a system of assumptions, accepted principles, and rules of procedure devised to analyze, predict, or otherwise explain the nature or behavior of a specified set of phenomena.

All theories are mental models of the perceived reality. The functions of theory are to describe, explain, predict, or control human phenomena in a variety of contexts.

Theories typically fall into two categories: Those focused on understanding and those emphasizing explanation and prediction. A valid theory must meet four criteria:

1. Clear conceptual definitions
2. Defined domain limitations
3. Establishment of relationships, and
4. The ability to make predictions.

The functions of theories can be descriptive, analytical, explanatory, and sometimes prescriptive. A scientific theory must be consistent with the facts, otherwise it is mere fiction. Theories can be verified by experiments or by methodological observation. Usually, theories focus on one selected aspect of a phenomenon under consideration. This means that several or even many theories can be constructed dealing with the same phenomenon.

Theory versus Hypothesis

The terms theory and hypothesis are often used interchangeably in nonacademic settings. However, in scholarly research, especially in experiments, they have distinct meanings.

- A theory is a well-established and widely accepted principle used to explain aspects of the natural world. It is based on repeated observations, testing, and includes facts, laws, predictions, and accepted assumptions.
- A hypothesis, on the other hand, is a specific, testable prediction about what researchers expect to happen in a study. It is a sort of educated guess that needs testing to confirm or refute.

The characteristics of theory and hypothesis in the context of research are described in Table 7.1.

Table 7.1 Comparison of theory and hypothesis

Aspect	Theory	Hypothesis
Definition	A well-established principle explaining an aspect of the natural world.	A specific, testable prediction about expected study outcomes.
Development	Developed through repeated observation, testing, and incorporation of facts, laws, predictions, and accepted assumptions.	A speculative guess that requires testing to confirm or refute.
Predictive scope	Predicts events in a broad, general context.	Makes a specific prediction about a specified set of circumstances.
Testing and acceptance	Extensively tested and widely accepted among scholars.	Yet to be tested; its validity is yet to be determined.

Models

A model is a representation of reality, like scaled-down model cars or airplanes that help us understand and analyze objects. Models can also depict complex concepts, such as economic systems, health beliefs, or the experience of grief and bereavement. In nursing, models serve as depictions of what nursing is, its objectives, and the various components that can be dissected, analyzed, and comprehended. Nursing encompasses complex elements, leading to the development of multiple models, each offering a unique perspective on nursing and guiding nursing practice. Therefore, a nursing model can be described as a visual or conceptual representation of nursing itself. There are two types of models: (1) Schematic and statistical models, along with (2) Conceptual models.

Schematic and Statistical Models

Schematic models: Graphical representations of phenomenon are depicted by the schematic models in both qualitative and quantitative studies. These models feature the use of boxes, arrows and an array of other symbols to represent concepts and linkages.

Statistical models: Quantitative studies use these models. Quantitative nature of relationship among variables is expressed by use of symbols. The symbols can only present the probability of a certain behavior with the occurrence of other phenomenon.

Conceptual Models

The conceptual models also play an important role in advancing scientific inquiry similar to theory. They provide a way to explain phenomena or interconnected phenomena, offering a less formal approach than theories. Additionally, these models can articulate assumptions and philosophical viewpoints, representing worldviews about processes and their nature.

Conceptual models consist of a set of abstract concepts along with propositions that describe these concepts, express their relationships, or outline the fundamental assumptions of the model. Conceptual models consist of abstract and general concepts, expressed uniquely for each model. These concepts and propositions are less abstract than those in a metaparadigm, which inspires the conceptual model. Conceptual models help to organize knowledge within a field, define its focus, and guide observation and interpretation.

Comparison of theory versus model has been given in the Box 7.1.

BOX 7.1 Theory versus model

Theories are general and abstract ideas that explain how things work. Models are specific and concrete ways of showing how things are or should be. Models can come from theories, but they can also come from observations or experiences. For example, one theory is that the environment affects the health of patients. One model is that nurses should consider five environmental factors (For example—fresh air, pure water, efficient drainage, cleanliness/sanitation and light/direct sunlight) in their practice

MODELS AND CONCEPTUAL MODELS IN NURSING

In nursing, conceptual models created by nursing theorists are a distinct body of knowledge that defines the profession. These models were developed to establish a unique nursing knowledge base, showcasing the profession's specific concerns and purpose. They serve as a hallmark of the nursing profession, emphasizing its professional status. These conceptual models also play a crucial role in guiding nursing practice and education. They provide a framework for nurses to better understand and address the complex and ever-evolving health care needs of patients.

Central Concepts of all Nursing Models

The central concepts of all nursing models include the person, environment, health and nursing.

- Person—the recipient of nursing actions
- Environment—the recipient's specific surroundings
- Health—the wellness or illness state of the recipient
- Nursing—actions taken by nurses on behalf of or in conjunction with a recipient

The early theorists drew substantially on other disciplines to develop their ideas and to give their model a different perspective. For example, Neuman (1995) drew extensively on systems theories in thinking about people as a system that strives for stability. Illness is therefore a stressor which can destabilize an individual, and people then need help from nurses to regain stability.

Peplau (1988) drew on psychological theories to conceptualize nursing as an interpersonal process to help patients with mental health problems. In doing so, she contributed to the recognition of the therapeutic potential of nursing.

CLASSIFICATION OF NURSING THEORIES

The nursing theories can be classified on the basis of levels, philosophical assumptions and functions as given here.

Depending on Levels

- **Metatheory:** It identifies specific phenomena through abstract concepts. It is also referred to as “theory of theories”. Its focus is on generating knowledge and theory development, philosophical issues, methodological issues of nursing theory and developing criteria for analysis and evaluating nursing theory.
 - Example of metatheory—J Dickoff and P James's theory of theories.
- **Grand theory:** This theory provides a conceptual framework with the key concepts. It is the third level of nursing theory. It emphasizes a global viewpoint with a broad perspective of nursing practice, and a distinct nursing perspective of nursing phenomenon. Fawcett (1995) defined Grand Theories as the broadest in scope, less abstract than conceptual models but composed of general concepts still relatively abstract, and the relationships cannot be tested empirically. Examples include:
 - **Florence Nightingale's environmental theory (mid-19th century):** This theory, developed in the mid-19th century, emphasized the role of the environment in patient care and is often considered the foundational theory of modern nursing.

- **Hildegard Peplau's interpersonal relations theory (mid-20th century):** This theory, developed in the mid-20th century, focuses on the nurse-patient relationship and the therapeutic nature of interpersonal interactions in nursing.
- **Dorothea Orem's self-care theory (1971):** This theory, introduced in 1971, centers on the concept of self-care and individuals' ability to meet their own health-related needs.
- **Betty Neuman's systems model (1972):** This model, introduced in 1972, views individuals as dynamic systems influenced by various stressors and emphasizes a holistic approach to nursing care.
- **Madeleine Leininger's cultural care theory (1985):** This theory, developed in 1985, underscores the importance of cultural competence in nursing and culturally congruent care.
- **Martha Rogers' science of unitary human beings (1970s–1980s):** This theory, developed in the 1970s and 1980s, proposes that humans are holistic and indivisible from their environment, emphasizing interconnectedness.
- **Jean Watson's theory of human caring (1979):** This theory, introduced in 1979, emphasizes the significance of caring in nursing and the transpersonal nature of the nurse-patient relationship.

In addition, Grand theories may provide the foundation for a mid-range theory. For example, the mid-range theory of “self-care deficit” (2001) evolved from Orem's (1971) Grand theory of “self-care”.

- **Middle-range theory:** This is more precise and only analyzes a particular situation with a limited number of variables. Middle-range theories, the second level of nursing theories, are moderately abstract, inclusive, organized within a limited scope; have a limited number of variables, which are testable in a direct manner. Middle-range nursing theories are narrower in scope than grand nursing theories and offer an effective bridge between grand nursing theories and nursing practice. They present concepts and propositions at a lower level of abstraction and hold great promise for increasing theory-based research and nursing practice strategies. It focuses on concepts of pain, grief, hope, comfort, and quality of life. Examples of middle-range theories in nursing are:
 - Orem's self-care deficit theory
 - Rogers' theory of accelerating change
 - Roy's theory of the person as an adaptive system
 - King's theory of goal attainment.
- **Micro-range theories/Practice theories:** Micro-range theories, often referred to as practice theories, are focused on specific, practical, and context-specific aspects of a particular event, phenomenon, or practice. These theories typically involve one or two key concepts and provide a framework for understanding and guiding actions in a specific context. They are often used in fields like health care, education, and social work to inform and improve professional practice. These theories are often narrower in scope and deal with smaller-scale social, psychological, or behavioral phenomena. Examples include:
 - Evidence-based clinical guidelines
 - Theory of breastfeeding (Nelson, 2006)
 - Theory of health promotion for preterm infants (Mefford, 2004)
 - Praxis theory of suffering (Morse, 2001, 2005)
 - Theory of postpartum depression (Beck, 1993)
 - Lean six sigma managerial approach

Based on the Philosophical Underpinnings of the Theories

- **Needs theories:** These theories are based on the fulfillments of needs of patients.
Examples: Theories of Henderson, Abdellah, and Orem.



- **Interaction theories:** These theories deal in relationships of nurses with patients. These are criticized for largely ignoring the medical model of health and not attending to basic physical needs.
Examples: King's Orlando, Peplau, Travelbee, Weidenbach.
- **Outcome theories:** These theories deal with the outcome of nursing care.
Examples: Johnson, Roy, Levine, Rogers.
- **Humanistic theories:** These theories emphasize a person's capacity for self-actualization, uniqueness of the individual. Carl Rogers' major contribution to nursing practice is the understanding that each client is a unique individual.

Depending on Functions

- **Descriptive theories:** These theories aim to identify and describe the properties and workings of a particular aspect of nursing or a discipline. For example, the theory of interpersonal relationships by Peplau (1952, 1987, 1989) focuses on understanding and explaining how relationships impact nursing practice.
- **Explanatory theories:** These theories delve deeper into how properties and factors relate to one another within the nursing discipline. For instance, the theory of human caring by Watson (1979, 1985, 1992) explores the intricate relationships between caring behaviors and their effects on patient well-being.
- **Predictive theories:** These theories go a step further by calculating and forecasting the relationships between properties and their occurrences in nursing. The theory of Deliberative Nursing Process by Orlando (1961, 1972) aims to predict how nurses can deliberate and make decisions in their practice.
- **Prescriptive Theories:** These theories identify the specific conditions or circumstances under which certain relationships occur within nursing. For example, Wiedenbach's theory, "The Helping Art of Clinical Nursing", outlines the conditions and strategies for providing effective clinical care.

Apart from nursing theories, the nursing researchers also use the theories from other disciplines as well. Some examples of other theories that are commonly used by a nurse researcher are depicted in Box 7.2.

BOX 7.2 Theories from other disciplines

Social learning theory: Bandura (1986); Rotter (1954)
Adult learning theory: Knowles (1980)
Role theory: Mead (1934)
State-trait anxiety: Spielberger (1972)
Stress: Selye (1976)
Helplessness: Seligman (1975)

Cognitive dissonance: Festinger (1957)
Developmental theory: Piaget (1926); Freud (1938); Erikson (1950); Havighurst (1952)
Health belief: Becker (1955)
Attitudes: Fishbein and Ajzen (1975)
Gate control: Melzack and Wall (1983)

Motivation: Maslow (1970)
Crisis: Caplan (1964)
Relaxation: Benson (1975)
Pain: Melzack and Wall (1983)
Body image: Schilder (1952)
Job satisfaction: Herzberg (1966)

Family theory: Minuchin (1974); Duvall (1977)
Family communication: Satir (1967)
Coping: Lazarus and Folkman (1984)
Moral reasoning: Kohlberg (1978)
Change theory: Lewin (1951)
Health behaviors: Becker (1985)



BUILDING BLOCKS OF THEORIES

The building blocks of nursing theories include various components and elements that form the foundation of these theories. These include:

- **Concepts:** Concepts are fundamental elements or ideas within nursing theories. They represent abstract or concrete notions that help describe, categorize, or explain aspects of nursing practice, patient care, and health. Abstract concepts in nursing theories are broader, theoretical ideas that are not easily measured or observed directly, while concrete concepts are specific, tangible elements that can be directly assessed and quantified in the context of patient care. For example:
 - Abstract concept—vital signs (nonspecific; not measurable)
 - Concrete concept—pulse rate (specific; measurable)
- **Constructs:** Constructs are more complex concepts that are developed for a specific nursing theory or research purpose. They often involve a set of related concepts that help define a particular aspect of nursing practice or phenomenon. For example, a construct like “patient satisfaction” may be used to explore and measure how satisfied patients are with their health care experience.
- **Conceptual definitions:** Conceptual definitions provide precise explanations of concepts or constructs within the context of a nursing theory. They help clarify the meaning and scope of these elements in the theory.
- **Relational statements:** Relational statements describe the relationships between concepts or constructs in a nursing theory. They articulate how these elements are interconnected and influence each other. For example, effective communication (concept) between health care providers (concept) leads to improved patient outcomes (concept). This statement illustrates how these concepts are interrelated in the context of patient care.
- **Conceptual models:** Conceptual models are visual representations or diagrams that illustrate the structure and connections between concepts, constructs, and relational statements in a nursing theory. They help visualize the theory’s framework.
- **Assumptions:** Assumptions are foundational statements or propositions accepted as true within the context of a nursing theory. They serve as starting points for theory development and guide the direction of research and practice.

APPLICATION OF THEORY IN NURSING RESEARCH

The application of theory in nursing research is crucial for guiding and enhancing the quality of studies conducted by nursing students. Theories serve as a foundation upon which research questions are built and provide a framework for designing and conducting research. The applications of theories in nursing research in different stages of research process are as follows:

- **Selecting a nursing theory:** The process of applying theory in nursing research begins with the careful selection of a theory that closely aligns with the research topic. The choice of theory should reflect the phenomenon under investigation and the objectives of the study.
- **Formulating research questions and hypotheses:** Once a theory is chosen, it serves as a guiding framework for formulating research questions and hypotheses. Research questions should be rooted in the theoretical foundations of the selected theory.
- **Study design and variables:** Theories aid in shaping the study design and identifying relevant variables. The theoretical framework helps researchers define the study’s parameters and specify which variables to measure.

- **Data collection and analysis:** The chosen theory informs the process of data collection and analysis. Researchers align their data collection tools and instruments with the theory, ensuring that data collection captures the relevant aspects of the phenomenon.
- **Interpreting findings:** Theoretical frameworks provide a lens through which research findings can be interpreted. Researchers explore how their results align with or challenge the assumptions and relationships proposed by the theory.
- **Generalization and application:** Findings from nursing research guided by theory can often be generalized to broader nursing practice contexts.
- **Theory testing and development:** Research conducted within a theoretical framework contributes to theory testing and development.
- **Contributions to nursing knowledge:** By applying theory in research, nurse researchers contribute to the advancement of nursing knowledge. Their studies build upon existing theories, enriching the body of nursing literature and expanding the understanding of nursing practice.

USE OF THEORIES IN DEVELOPING CONCEPTUAL FRAMEWORK

The use of theories plays an essential role in developing a conceptual framework for research.

- **Guiding framework:** Theories serve as a guiding framework upon which the conceptual framework is built. Researchers select a relevant theory that aligns with their research problem and objectives.
- **Identifying key concepts:** Theoretical frameworks help in identifying the key concepts or variables that are essential to the research. The chosen theory provides a foundation for understanding which elements are relevant to the study.
- **Relationships and propositions:** Theories provide insights into how concepts or variables are related and interact with each other. They offer propositions or hypotheses about these relationships, which inform the development of the conceptual framework.
- **Framework structure:** Theoretical frameworks influence the structure and organization of the conceptual framework. The selected theory helps in determining how the identified concepts or variables should be arranged logically within the framework.
- **Operational definitions:** Theories assist in creating operational definitions for concepts or variables. They guide researchers in specifying how these elements will be measured or observed in the actual research study.
- **Conceptual clarity:** The use of theories ensures conceptual clarity by grounding the framework in established knowledge and concepts. This clarity is vital for understanding and communicating the research's theoretical foundation.
- **Testing and validation:** Theoretical frameworks provide a basis for testing and validation. Researchers can use the theory's propositions to formulate hypotheses and conduct empirical studies to validate the framework.
- **Interpretation:** Theories facilitate the interpretation of research findings within a broader theoretical context. Researchers can analyze their results in light of the chosen theory, helping to draw meaningful conclusions.

THEORETICAL AND CONCEPTUAL FRAMEWORK

Theoretical and conceptual frameworks are essential components of research studies, but they serve distinct purposes.

Theoretical Frameworks

The theoretical framework is a structure that outlines and explains the theories or established principles that underpin the research. It provides a broad perspective and establishes the foundation on which the study is built. It guides the researcher in understanding the existing body of knowledge related to the research topic. This knowledge comes from established theories and concepts within a particular field or discipline.

Example for use of theoretical framework in research

Wells JS (2015) studied adherence to intravenous chemotherapy among African-American and Caucasian women with early-stage breast cancer. Researchers used the Health Decision Model (HDM) as their theoretical framework. The HDM is a modified version of the Health Belief Model, incorporating aspects of patient preferences alongside the Health Belief Model elements. This model consists of six interconnected factors that help predict a person's adherence to a health decision, including sociodemographic, social interactions, experience, knowledge, general and specific health beliefs, and patient preferences. The study used the HDM to explore factors influencing chemotherapy adherence in breast cancer patients, using sociodemographic, social interactions, knowledge, personal experience, and specific health beliefs as predictors.

The study's results were analyzed within the context of this theoretical framework. They found that factors such as treatment delays, health insurance, depression, and symptom severity were predictors of chemotherapy initiation, which could inform clinical interventions. These findings contribute to the existing body of literature on cancer nursing.

Conceptual Framework

A conceptual framework is a structured and organized system of interconnected concepts and ideas that provide a foundation for understanding and exploring a specific research problem. The conceptual framework is a visual or written tool that outlines the specific concepts, variables, and relationships to be studied in a research project. It is more focused and practical than a theoretical framework. The term "conceptual framework" refers to an organization of concepts that provides a focus for inquiry.

The simplified equation "Conceptual framework = Concept + Framework" conveys the essence of what a conceptual framework is: it is a structure that incorporates key concepts to provide a framework for understanding and exploring a specific topic or problem.

Definition

Conceptual framework is a group of concepts that are broadly defined and systematically organized to provide a focus, a rationale, and a tool for the integration and interpretation of information.

—Mosby's medical dictionary, 2018

A conceptual model has two important components: one deals with the concepts or forming of concepts and is known as conceptual, and the other focuses on the underlying structure, known as the framework. A conceptual framework is like a blueprint for research, helping researchers organize and compare their ideas, plans, and findings with existing theories. It is not something found but rather something created—a set of interrelated theories. This framework provides the foundation for various theories, such as communication or systems theory.

A conceptual framework is a method of showing and explaining the main ideas and how they relate to each other. It can be a picture or a set of rules. It helps to organize and understand the topic. A good conceptual



framework is simple, realistic, and easy to use. A conceptual framework is used in research to guide what data to collect and how to analyze it. It is based on the goal of the research project. A conceptual framework is not the same as the real world, but it represents some aspects of it.

Conceptual framework is used to limit the scope of the relevant data by focusing on specific variables and defining the specific viewpoint (framework) that the researcher will take in analyzing and interpreting the data to be gathered. It also facilitates the understanding of concepts and variables according to given definitions and builds new knowledge by validating or challenging theoretical assumptions.

The conceptual framework can fit in both quantitative and qualitative research. In quantitative research, it helps to identify and measure the concepts and how they affect each other. A quantitative conceptual framework helps to know how things work in reality and what causes or influences what. This helps to predict how one thing is related to another thing. In qualitative research, conceptual framework helps to explore and understand the concepts and how they relate to each other. A qualitative conceptual framework helps to learn more about the meanings and experiences of the people involved in the research.

Features of Conceptual Frameworks

Conceptual frameworks are important tools for research, as they help to organize and understand complex ideas, theories, or concepts. Some features of conceptual frameworks are:

- **Based on a literature review:** Conceptual frameworks are developed based on a thorough review of existing literature and studies related to the topic under investigation. This review helps researchers understand the current state of knowledge and identify gaps or areas in need of further exploration.
- **Incorporate assumptions, concepts, and propositions:** Conceptual frameworks include a set of assumptions, key concepts, and propositions that collectively create a theoretical framework for comprehending and explaining the phenomenon being studied. These elements provide the foundation for the research.
- **Illustrate expected relationships:** Conceptual frameworks visually or conceptually illustrate the expected relationships between the variables, characteristics, or properties that are the focus of the research. They help researchers conceptualize how different elements are interconnected and influence each other.
- **Written or visual representation:** Conceptual frameworks can be presented in written form, such as in a research proposal or scholarly article, or they can be visual, often in the form of diagrams or models. Visual representations make it easier to grasp complex relationships.
- **Scope definition and research questions:** Conceptual frameworks define the scope of the study by specifying what aspects of the phenomenon will be investigated. They also set out the research questions or hypotheses that the study aims to address, providing clear research objectives.
- **Guide data collection and analysis:** Conceptual frameworks play a crucial role in guiding the data collection and analysis process. They help researchers identify which variables or factors are relevant and what kind of data should be collected. Additionally, they provide a structure for analyzing and interpreting the data collected.
- **Evaluate and interpret results:** Throughout the research process, conceptual frameworks assist researchers in evaluating and interpreting their results. They enable researchers to relate their findings back to the theoretical framework and the expected relationships between variables, helping to draw meaningful conclusions.



Purposes of Conceptual Framework in Research

Conceptual frameworks serve several important purposes in research, providing structure and clarity to the study. The key purposes of conceptual framework in research are:

- **Organizing ideas and concepts:** Conceptual frameworks help researchers organize their thoughts, ideas, and concepts related to the research topic. They provide a structured way to think about and approach complex phenomena.
- **Defining the scope of the study:** A conceptual framework delineates the boundaries and scope of the research. It specifies what aspects of the phenomenon will be explored and what will be excluded, ensuring focus and clarity.
- **Theoretical foundation:** Conceptual frameworks are built on existing theories or models. They serve as a theoretical foundation for the study, anchoring it in established knowledge and research.
- **Guiding research questions and hypotheses:** Researchers use conceptual frameworks to formulate research questions and hypotheses. The framework helps shape these inquiries, ensuring they are relevant and theoretically grounded.
- **Providing a structure for data collection:** Conceptual frameworks guide the selection of variables, data collection methods, and instruments. Researchers align their data collection efforts with the concepts and constructs defined in the framework.
- **Illustrating expected relationships:** They illustrate the expected relationships between variables or the characteristics being studied. Conceptual frameworks provide a visual representation of how different elements are connected.
- **Data interpretation:** Conceptual frameworks assist in interpreting research findings. Researchers use the framework to make sense of the data, identifying patterns and relationships in line with the framework's concepts.
- **Theory development and refinement:** In some cases, research conducted within a conceptual framework can contribute to theory development or refinement. Researchers may validate or adapt existing theories based on empirical evidence.
- **Communication and replication:** Conceptual frameworks help researchers communicate their research methods and findings clearly to others. They also facilitate replication studies, allowing other researchers to replicate and verify the research.
- **Contributing to knowledge:** Research conducted within a conceptual framework contributes to the growth of knowledge in a particular field. It builds upon existing theories, enriches the literature, and advances understanding.
- **Identifying limitations:** Conceptual frameworks help researchers identify the limitations of their study. By specifying the scope and boundaries of the research, they highlight what the study does not cover.

Difference between Conceptual Framework and Theoretical Framework

There are two types of terminologies found in literature: (1) Conceptual framework and (2) Theoretical framework; often they are used interchangeably. Henceforth, it is important to understand difference between two. A conceptual framework is the researcher's idea on how the research problem will be explored. It is further designed on the theoretical framework, which lies on a much broader scale of resolution. The difference between conceptual and theoretical framework is described in Table 7.2.

Table 7.2 Difference between conceptual and theoretical framework

Aspect	Theoretical framework	Conceptual framework
Scope	Broader, based on established theories.	Specific and focused on research problem.
Purpose	Provides a general explanation.	Guides how the research is conducted.
Relationships	Describes broader relationships in a phenomenon.	Defines specific relationships between variables.
Example	Distraction during painful procedures reduces pain.	Showing cartoon films to children during IV cannula insertion to reduce pain perception.
Variables	Typically focuses on general concepts.	Identifies and specifies variables for the study.
Statistical treatment	Not directly tied to statistical analysis.	Guides the statistical analysis of the study's variables.
Example	Distraction during painful procedures reduces pain.	Showing cartoon films to children during insertion of IV cannula to reduce pain perception

Developing the Conceptual Framework

At the start of any research study, it is important to consider relevant theory underpinning the knowledge base of the phenomenon to be researched. By addressing simple questions, the researcher can begin to develop a loosely structured conceptual framework to guide them. The following questions have been adapted from Slevin and Basford (1999):

- What do I know about the phenomenon that I want to study?
- What types of knowledge are available to me (empirical, nonempirical, tacit, intuitive, moral or ethical)?
- What theory will best guide my nursing practice?
- Is this theory proven through theory-linked research?
- What other theories are relevant to this practice?
- How can I apply these theories and findings in practice?

In considering these questions and critically appraising the literature, the quantity of information that emerges can be cumbersome, and it is often unclear whether it can be brought together to build something meaningful, esthetically pleasing and scientifically sound. To address this, researchers consider many constructs or permutations—amalgamations, definitive properties, relationship differentials, knowledge derivatives and practice outcomes and effects. This search for theoretical understanding and its translation into meaningful practice is what is done when developing a conceptual research framework. This framework must have a clear practice outcome, if it is to be of clinical relevance.

Steps of Developing Conceptual Framework

The development of a conceptual framework typically involves the following steps (Fig. 7.1):

1. **Identify the research problem:** Clearly define the research problem or topic that the conceptual framework aims to address. This could be a gap in existing knowledge or a specific question that needs to be answered.

2. **Conduct a literature review to gather information:** Review existing literature and relevant research studies to understand the existing knowledge and theories related to the research problem. This step helps in identifying the key concepts, variables, and relationships that will be included in the conceptual framework.
3. **Identify key concepts and variables:** Determine the main concepts and variables that are relevant to the research problem. These may be abstract ideas, constructs, or specific factors that are important to the study.
4. **Development of a logical construct:** Create a logical construct that outlines the logical organization and arrangement of the key concepts and variables in the conceptual framework. This step establishes the overall structure and framework for the research.
5. **Determine the relationships:** Based on the literature review and theoretical underpinnings, establish the relationships between the identified concepts and variables. This involves specifying how the variables relate to each other and form a coherent framework.
6. **Define operational definitions:** Provide clear and concise definitions for each concept and variable in the framework. Operational definitions explain how the variables will be measured or observed in the actual research study.
7. **Test and refine the framework:** Once the initial conceptual framework is developed, it may need to be tested and refined. This is done by collecting data and analyzing it to assess the validity and reliability of the framework. Adjustments or modifications can be made based on the findings.
8. **Finalize the conceptual framework:** After testing and refining, finalize the conceptual framework by incorporating any necessary revisions. The framework should accurately represent the relationships between the identified concepts and variables.

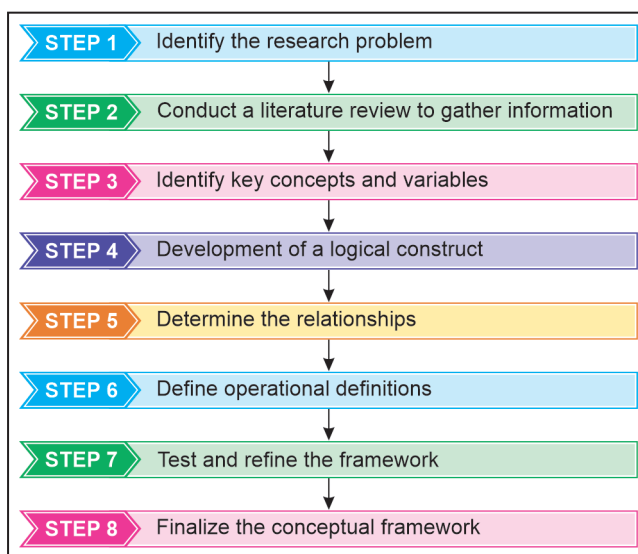


Figure 7.1: Steps of developing conceptual framework

Instructions for Writing Conceptual Framework (Jody Hanson)

There is no universal rule or procedure to draw a conceptual framework. Keep the conceptual framework simple with minimum data but to get the maximum understanding while viewing it. Here is another set of instructions for writing conceptual framework by Jody Hanson.

- Identify the research statement and write it in a circle in the middle of a piece of paper. Draw lines away from the center and make circles to record secondary ideas. Use colored pencils they help to articulate thoughts and ideas.
- Create a different diagram—a spider or a hierarchy—if the first does not suit nursing research purpose. The shape is of secondary concern; important in generating the ideas for the conceptual framework.
- Highlight the gaps, connections and contradictions in conceptual framework. Leave it alone for a while and then revisit the design to see if it suits nursing research project or it needs to add additional material.



BOX 7.3 Use of online tools in drawing conceptual framework

With the emergence of online tools, researchers now have the means to craft visually engaging and informative conceptual frameworks. These frameworks not only enhance comprehension but also simplify the process of sharing and collaboration, which is particularly crucial when multiple researchers are involved in a study.

Several online platforms cater to the needs of researchers seeking to create and share conceptual frameworks. Some important online tools are described here:

Lucidchart: <https://lucid.app/>

Lucidchart offers a user-friendly interface for crafting diagrams and frameworks. Its collaborative features enable researchers to work together seamlessly.

Creately: <https://creately.com/>

Creately provides a platform for creating visually compelling diagrams, flowcharts, and frameworks. Its library of templates accelerates the framework design process.

- Review the ethical regulations of nursing research and make sure conceptual framework fits within the guidelines.
- Discuss with experts in the field to review conceptual framework. An experienced researcher may be able to identify points you missed in your conceptual framework and make suggestions on how you could improve it.

Use of online tools in drawing conceptual framework has been given in Box 7.3.

Examples of Conceptual Framework

Example 1: A Quasi-experimental study to assess the effectiveness of self-care instructional module for patient undergoing open abdominal hysterectomy on postoperative recovery outcomes

The conceptual framework is based on Orem's self-care theory. It is an interactional model, which provides a framework of education and support that is provided to the patients so that they develop effective self-care behavior and engage themselves in self-care. The theory is comprised of three related parts:

1. Theory of self-care.
 2. Theory of self-care deficit.
 3. Theory of nursing system.
1. **Theory of self-care:** This includes self-care, self-care agencies, therapeutic self-care demand, and self-care requisites. The activities carried out by individuals to maintain their own health is **self-care**, whereas acquired ability to perform the self-care is **self-care agency**. The self-care agency is affected by conditioning factors, which are basic to every individual such as age, gender, health care system, family system and so on. The ability to engage in self-care develops daily through the process of learning, intellectual curiosity, experience, teaching and assistance aid in the development of self-care agency. The **therapeutic self-care demand** is the overall self-care actions performed for some duration to meet self-care by using valid methods and set of actions. The self-care helps to achieve three requisites: (1) *Universal self-care requisites*, (2) *Developmental self-care requisites* and (3) *Health deviation self-care requisites*. If there is inadequacy, the individual will fail to maintain self-care. *Universal self-care requisites* are associated with life process and are required for the maintenance of human structure, integrity and functioning. These are the requisites related to activities of daily living. The *developmental self-care requisites* are associated with the adaption to the developmental changes in life such as change in body,



new job, retirement, etc. *Health deviation self-care requisites* are required in conditions of deviation from normal health such as a state of illness. Once the need is identified, the nurse has to select required nursing systems to provide care: wholly compensatory, partly compensatory or supportive and educative system.

2. **Theory of self-care deficit:** This theory specifies when the nursing care is needed. The prompt, adequate and appropriate nursing assessment helps to reveal **self-care deficits**. This can be achieved by acting, guiding, supporting, and teaching the others.
3. **Theory of nursing system:** This theory describes how the identified needs will be met by the patient himself, by nurse, or by both. Orem's identifies three systems of nursing system to meet the need; wholly compensatory, partly compensatory/supportive and supportive education. The Figure 7.2 shows how the main five components of Orem's theory are used to make a flexible conceptual model.

In present study, the patient undergoing open abdominal hysterectomy is self-care agency. The surgery affects the patient's self-care ability postoperatively. Therapeutic self-care demand is need to learn about the postoperative regimen in order to improve their postoperative recovery outcomes. Nursing activities based on the theory of Orem focuses on self-care deficiency. In order to overcome this deficiency, self-care instructional module was prepared for patient undergoing open abdominal hysterectomy. Patients admitted for the surgery were educated during preoperative period through self-care instructional module, which included deep breathing exercises, active and passive exercises, ambulation, wound care, diet, personal hygiene, and prevention of postoperative complications. Therefore, that patient can perform self-care during postoperative period and improve postoperative recovery outcomes.

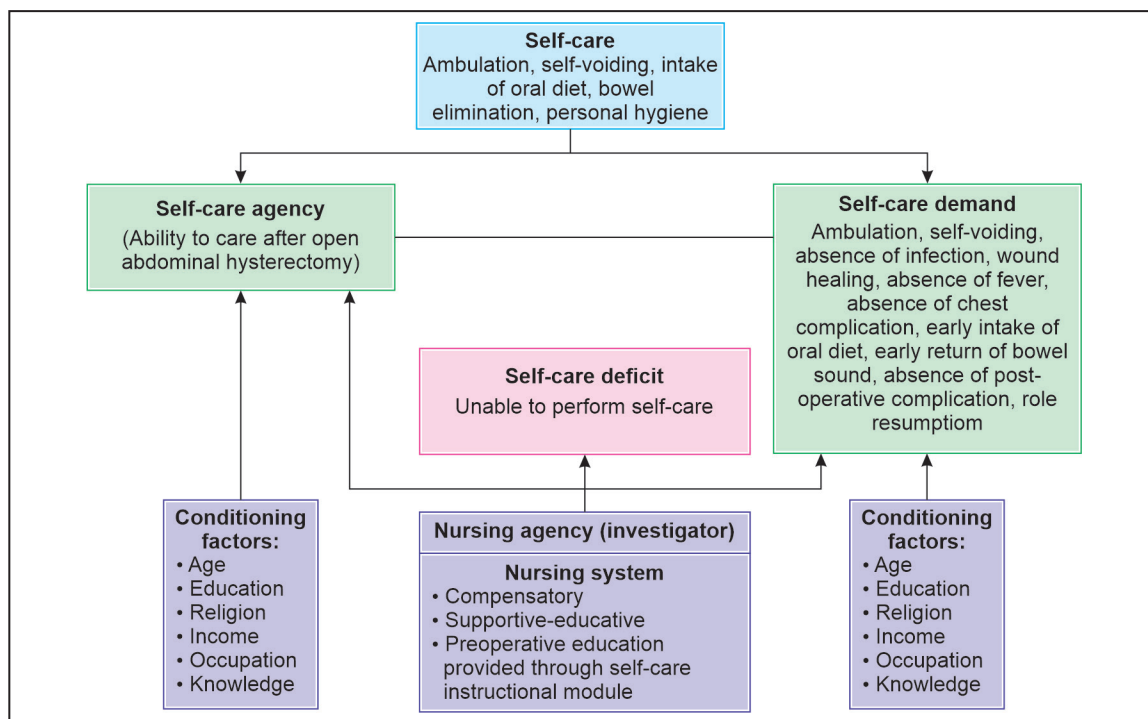


Figure 7.2: Conceptual framework based on Orem's self-care theory

The self-care instructional module can enhance their postoperative recovery or the self-care agency. It helps in meeting the self-care demands or requisites, early ambulation, self-voiding, absence of infection, early wound healing, absence of fever, prevention of chest complications, initiating intake of oral diet, return of bowel sound, prevention of postoperative complication, return to work, and role resumption. In this way, the preoperative teaching can help the patients undergoing open abdominal hysterectomy to perform self-care, assume their role, and return to normal. Nurses' actions are partially compensated by providing educational support to patient during preoperative period (Fig. 7.2).

Example 2: An experimental study to evaluate the effectiveness of topical application of honey on oral mucosa of children for the treatment of chemotherapy-induced oral mucositis

Conceptual framework of the study was based on "Betty Neuman's Nursing Intervention Concept". Betty Neuman systems model is unique system based on perspective that provides a unifying focus for approaching a wide range of nursing concerns. The model is dynamic because it is based on the client's continuous relationship to environmental stress factors, which have a potential for causing a reaction, or obvious symptomatic reaction to stress, or could affect reconstitution following treatment of stress reaction. Betty Neuman explained four major interacting concepts in her theory such as person or client system in which reaction occurs, health or wellness, environment which have stressors, and nursing in which interventions are provided.

In the given study, only two attributes as stressors, i.e., chemotherapy drugs and nursing interventions, i.e., topical application of honey on oral mucosa were studied. Chemotherapy drugs act as stressors in client system (children) who are undergoing chemotherapy treatment.

If the stressor attacks on flexible line of defense, causes low immunity and increases the susceptibility to occur oral mucositis. If stressor attacks on normal line of defense, causes grade I and II oral mucositis and if attacks on line of resistance, causes more than grade II of oral mucositis. In present study, only I and II grade oral mucositis are included. So, the reaction may occur in the form of oral mucositis manifested as inflammation, soreness, erythema, ulceration and dysphagia. The secondary intervention as topical application of honey on oral mucosa was provided as nursing action. The effect was checked as reconstitution such as cure of oral mucositis (Fig. 7.3).

Sometimes one theory does not clarify the relationship between different variables of study. In that condition, researcher needs to take help of another theory. So, conceptual framework can be based on two or more theories. Example 2, explains the use of two theories while making conceptual framework, i.e., Goal Attainment Theory and "Transaction Process Model" by Imogene M King in 1981 and the "Gate Control Theory of pain" by Ronald Melzack and Patrick Wall in 1962.

Example 3: An operational study to develop skills of caregivers in providing colostomy care to neonates with anorectal malformation

The conceptual framework of the given study is based on **Bertalanffy's General System Theory** model which was given by Ludwig Von Bertalanffy (1969).

System: According to Bertalanffy, "A system is a group of elements that interact with one another in order to achieve a goal." Systems can be open or closed. All living systems are open, so there is a continuous exchange of matter, energy or information. In open systems, there are varying degrees of interaction with environment from which the system receives input and gives back output in the form of matter, energy and information.

In present study, system includes development of protocol on colostomy care for neonates with anorectal malformation by investigator, and operationalizing it among the caregivers of neonates for promotion of their skills in providing colostomy care. Here elements of system are caregivers and protocol on colostomy care.

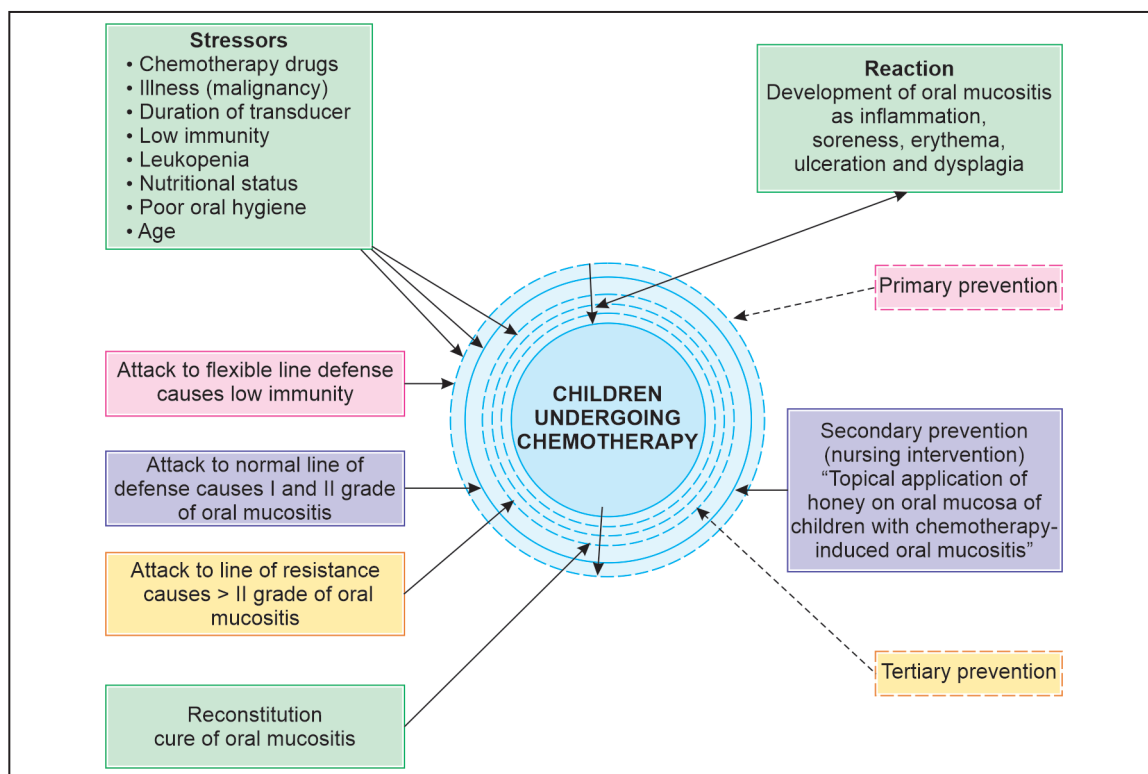


Figure 7.3: Conceptual framework based on Betty Neuman's concept of nursing interventions

Input: A matter, energy, information, and individual's effort that enter into a system is called input. In the present study, the input is gathering information about colostomy care, development of protocol on colostomy care in the form of Instructional booklet for the caregivers for home care.

Throughput: It is the process of transferring the information entered in the system into useful terms. It is the process by which information received in the system is utilized and it further leads to formation of the product. It may be utilized by system itself or can be transferred to the environment. In this research study, throughput is operationalizing the system. It includes assessment of skills in caregivers regarding colostomy care and difficulties they may come across with the neonates of anorectal malformation. It further refers to facilitate the environment for development of skills of caregivers in providing colostomy care to neonates with anorectal malformation. It includes communicating and motivating the caregivers of neonates to follow the protocol guidelines for promotion of skill development, in care of neonates with colostomy. The skills of caregivers in providing colostomy care to neonates with anorectal malformation are developed by demonstration and return demonstration till they were fully skilled.

Output: Output is the end product of the system. In this research study, the output is the success or failure of operationalized system for development of skills of caregivers in providing colostomy care to neonates with anorectal malformation.

Feedback: Feedback is the process by which the system continuously monitors itself and the environment for information to guide the operation. In the present study, feedback will be given to input as well as to the throughput of the system.

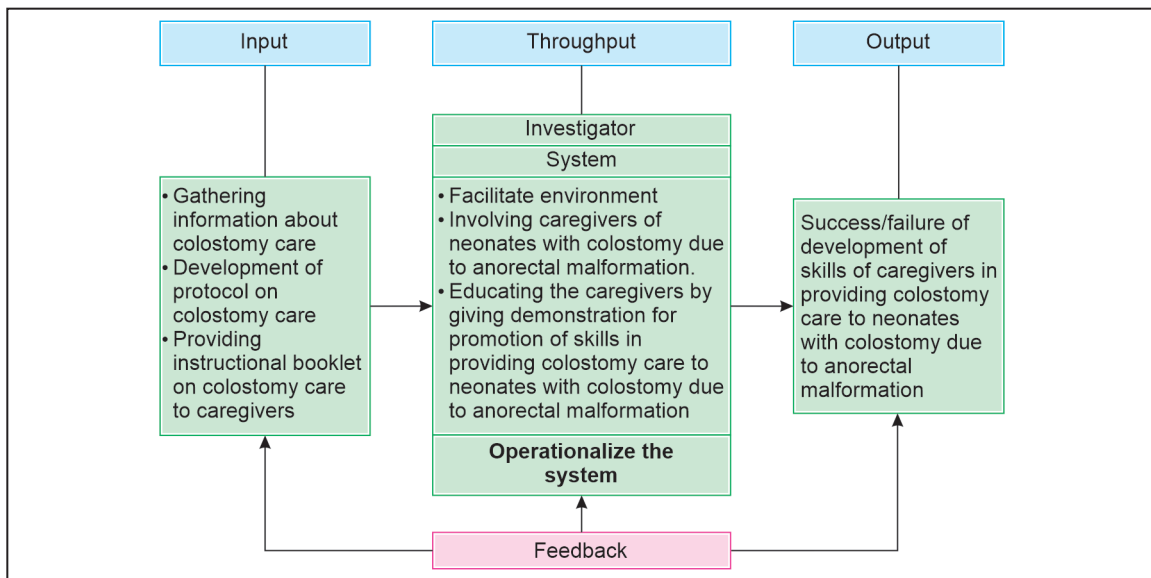


Figure 7.4: Conceptual framework based on general system theory

Feedback to the input will be given in the form of recommendations, after implementing protocol on colostomy care. Recommendations will include positive/negative results of development of skills, areas that need improvement and modifications, if needed in the system (Fig. 7.4).

SUMMARY

- Concepts are fundamental, often abstract, ideas that form the basis of our beliefs and knowledge about the world. They play a crucial role in learning, memory, categorization, and decision-making. Concepts can be understood through mental representations, abilities, and senses.
- Constructs are characteristics or traits examined in research. They serve as building blocks in theories, explaining the “how” and “why” of phenomena. Constructs can be directly or indirectly.
- Theories are systematic attempts to explain observed phenomena and answer questions about the world. They provide a framework of principles, assumptions, and rules to analyze, predict, or explain specific phenomena. The functions of theories include description, explanation, prediction, and sometimes prescription.
- Models are representations of reality used to understand and analyze objects or complex concepts. In nursing, models depict what nursing is, its objectives, and its components. There are two types: (1) Schematic and (2) Statistical models. Conceptual models are less formal than theories but articulate assumptions and worldviews, helping organize knowledge within a field.
- Nursing theories can be classified by levels, including metatheory, grand theory, middle-range theory, and micro-theories, each serving distinct purposes in nursing practice and research.
- Philosophical underpinnings categorize nursing theories into needs theories, interaction theories, outcome theories, and humanistic theories, reflecting different perspectives on patient care.
- Nursing theories also vary by function, encompassing descriptive, explanatory, predictive, and prescriptive theories, offering diverse ways to analyze, understand, and apply nursing concepts in practice.

- The building blocks of nursing theories encompass concepts, constructs, conceptual definitions, relational statements, conceptual models, and assumptions, which collectively form the foundational elements of these theories.
- The theoretical framework is a structure that outlines and explains the theories or established principles that underpin the research. It provides a broad perspective and establishes the foundation on which the study is built.
- Conceptual framework is a group of concepts that are broadly defined and systematically organized to provide a focus, a rationale, and a tool for the integration and interpretation of information.
- The steps of developing a conceptual framework involve identifying the research problem, conducting a literature review, identifying key concepts and variables, creating a logical construct, determining relationships, defining operational definitions, testing and refining the framework, and finalizing it to represent the relationships within the research problem.

ASSESS YOURSELF

Long Answer Questions

1. Explain conceptual framework in context to nursing research.
2. Define conceptual framework. Describe the related terminology.
3. Define theory and explain the use of theories in developing conceptual framework.
4. Describe the process of selecting and developing a conceptual framework.

Short Answer Questions

1. Define concepts.
2. Define framework.
3. Define constructs.

Multiple Choice Questions

1. Important aspect of scientific theory is that it is:
 - a. Based on preexisting facts
 - b. Testable
 - c. Formulated prior to research
 - d. Derived from issues
2. Inductive theories are based on conclusion drawn by:
 - a. Testing theories
 - b. Moving from general to specific
 - c. Moving from specific to general
 - d. General observations
3. Scientific method based on testing hypotheses it is:
 - a. Hypothesis method
 - b. Inductive method
 - c. Deductive method
 - d. Pattern method
4. The theoretical frameworks are supported by:
 - a. Theories
 - b. Idea and general principles
 - c. Observation
 - d. Hypothesis and assumptions
5. Development of conceptual framework in qualitative research is mainly:
 - a. Before literature review
 - b. During literature review
 - c. Before data analysis
 - d. After data analysis

6. The concept “operationalization” refers to:
 - a. Identifying the importance of the concept
 - b. Identifying the relationship between that concept and others
 - c. Deciding how to measure the concept
 - d. Defining the concept theoretically
7. The attributes are:
 - a. Concepts expressed in words
 - b. Pre-existing ideas
 - c. Issues from research
 - d. Situations
8. The constructs are building blocks of which of the following:
 - a. Theories
 - b. Hypothesis
 - c. Assumptions
 - d. General observations
9. Which of the following is grand theory in nursing:
 - a. Rogers’ theory of accelerating change
 - b. Orem’s theory of “self-care”
 - c. King’s theory of goal attainment
 - d. Theory of breastfeeding
10. Nursing research can be based on:
 - a. Only nursing theories
 - b. Theories from other disciplines
 - c. Both a and b
 - d. None of these

Answer Key

1. b	2. c	3. c	4. a	5. d	6. c	7. a
8. a	9. b	10. c				

BIBLIOGRAPHY

- Babak T. 10 tips on developing a conceptual framework in quantitative studies. [online] <http://www.itsnotyouitsyourdata.com/stuck-in-the-middle/10-tips-on-developing-a-conceptual-framework-in-quantitative-studies/> [Accessed June 6, 2023].
- Bhatti A, Kaur R, Venkdhakshmi, Sikka P.A Quasi-experimental study to assess the effectiveness of self-care Instructional module for patient undergoing open abdominal Hysterectomy on postoperative recovery outcomes at Gynae ward, PGIMER, Chandigarh 2014-16. An unpublished MSc Nursing thesis submitted to PGIMER, Chandigarh 2016.
- Concept. In Wikipedia, The Free Encyclopedia. [online] Available from <https://en.wikipedia.org/w/index.php?title=Concept&oldid=717966250>. [Accessed May 1, 2016].
- Concepts. Stanford Encyclopedia of Philosophy. [online] Available from <http://plato.stanford.edu/entries/concepts/Bib> [Accessed June 5, 2016].
- Conceptual framework. (2016, April 16). In Wikipedia, The Free Encyclopedia. [online] Available from https://en.wikipedia.org/w/index.php?title=Conceptual_framework&oldid=715561139 [Accessed April 26, 2016].
- Conceptual framework. (n.d.) Miller-Keane Encyclopedia and Dictionary of Medicine, Nursing, and Allied Health. 7th edition. (2003). [online] Available from <http://medical-dictionary.thefreedictionary.com/conceptual+framework> [Accessed April 26, 2016].
- Conceptual framework. Medical Dictionary for the Health Professions and Nursing. [online] Available from <http://medical-dictionary.thefreedictionary.com/conceptual+framework> [Accessed April 26, 2016].
- Conceptual framework. Miller-Keane Encyclopedia and Dictionary of Medicine, Nursing, and Allied Health. 7th edition. [online] Available from <http://medical-dictionary.thefreedictionary.com/conceptual+framework> [Accessed April 26, 2016].
- Conceptual framework. Mosby's Medical Dictionary, 8th edition. [online] Available from <http://medical-dictionary.thefreedictionary.com/conceptual+framework> [Accessed April 26, 2016].



- Conceptual Framework; What Do You Think Is Going On? [online] Available from http://www.sagepub.com/sites/default/files/upm-binaries/48274_ch_3.pdf [Accessed June 4, 2016].
- Concets. Dictionay.com. [online] Available from <http://www.dictionary.com/browse/concept> [Accessed 2023]
- "Construct." Merriam-Webster.com. Merriam-Webster, n.d. Web. 1 May 2016.
- Constructs in quantitative research. [online] Available from <http://dissertation.laerd.com/constructs-in-quantitative-research.php> [Accessed June 2, 2016].
- Eresourcebehavioral and social sciences, Objective Measurement of Subjective Phenomena. [online] Available form: http://www.esourceresearch.org/Portals/0/Uploads/Documents/Public/Widaman_FullChapter.pdf [Accessed June 7, 2016].
- Hanson J. How to Write a Conceptual Framework for Nursing Research. [online] Available from http://www.ehow.com/how_7488679_write-conceptual-framework-nursing-research.html. [Accessed June 4, 2016].
- King IM, Fawcett J. The Language of Nursing Theory and Metatheory. Cited by Barbara Bates Center for the Study of the History of Nursing at the University of Pennsylvania. [online] Available from <http://library.lmunet.edu/c.php?g=262933&dp=1756475> [Accessed June 6, 2016].
- Masters K. Framework for professional nursing practice. [online] Available from <https://googledrive.com/.Nursing-Theories-Framework-Professional-Practice-519G>. [Accessed June 3, 2016].
- Murphy F, Williams A, Pridmore JA. Nursing models and contemporary nursing 1: their development, uses and limitations. *Nursing Times*; 106: 23. early [online] Available from <http://www.nursingtimes.net/roles/practice-nurses/nursing-models-and-contemporary-nursing-1-their-development-uses-and-limitations-/5015918.fullarticle> [Accessed May 25, 2016].
- Nursing Theories: An Overview. Nursing theories: a companion to nursing theories and models. [online] Available at http://currentnursing.com/nursing_theory/nursing_theories_overview.html. [Accessed May 28, 2016].
- Polit DF, Beck CT. *Nursing Research: Principles and Methods*. Developing a conceptual context. P:114-36.
- Risaw L, Narang K, Bharti B, et al. A randomized controlled trial to assess the effect of distraction by flippits on behavioral response to pain in children of age group 4 to 6 years during blood sampling in Advanced Pediatric Centre, PGIMER, Chandigarh 2014-16. An unpublished MSc Nursing thesis submitted to PGIMER, Chandigarh 2016.
- Sagar S, Kaur S, Rao KL, Ghai S. An Operational study to develop skills of caregivers in providing Colostomy care to neonates with Anorectal malformation, admitted in NSICU, Advanced pediatric Centre, Post Graduate Institute Of Medical Education and Research, Chandigarh, 2014-16. An unpublished MSc Nursing thesis submitted to PGIMER, Chandigarh 2016.
- Sinclair M. Editorial: A guide to understanding theoretical and conceptual frameworks. *Evidence Based Midwifery*. 2007;5(2):39 [online] Available from <http://www.doctoralmidwiferysociety.org/portals/c8d3e3f8-9c01-4bf5-abd9-3fd6b4c510ae/marleneeditorialtheoreticlaframework.pdf> [Accessed June 10, 2016].
- Singh R, Sharma S, Madhi B. Observational blind study to evaluate the effectiveness of topical application of honey on oral mucosa of children for the treatment of chemotherapy induced oral mucositis at APC, PGIMER, Chandigarh, 2014-16. An unpublished MSc Nursing thesis submitted to PGIMER, Chandigarh 2016.
- Slevin O, Basford L. *Theory and practice of nursing: an integrated approach to caring practice (second edition)*. Stanley Thornes: Cheltenham cited by Sinclair M. (2007) Editorial: A guide to understanding theoretical and conceptual frameworks. *Evidence Based Midwifery* 1999;5(2):39. [online] Available from <http://www.doctoralmidwiferysociety.org/portals/c8d3e3f8-9c01-4bf5-abd9-3fd6b4c510ae/marleneeditorialtheoreticlaframework.pdf> [Accessed June 6, 2016].
- Sunday CE. The role of theory in research. [online] Available from: <https://www.uwc.ac.za/Students/Postgraduate/Documents/The%2520role%2520of%2520theory%2520in%2520research.pdf+andcd=1andhl=enandct=clnkandgl=in> [Accessed June 8, 2016].
- Swanson RA. *Theory Building in Applied Disciplines*. San Francisco, CA: Berrett-Koehler Publishers; 2013. [online] Available from <http://libguides.usc.edu/writingguide/theoreticalframework>. [Accessed June 4, 2016].
- Theory. Online Etymology Dictionary. [online] Available from <http://www.etymonline.com/index.php?term=theory>. [Accessed June 2, 2016].
- Wells JS, Strickland OL, Dalton JA, et al: Adherence to intravenous chemotherapy in African American and white women with early-stage breast cancer. *Cancer Nurs* 2015;38:89-98.



Research Approaches and Designs

LEARNING OBJECTIVES

After the completion of the chapter, the readers will be able to:

- Define the concept research approach and design.
- Enumerate the types of research.
- Distinguish between basic and applied research.
- Differentiate quantitative and qualitative research.
- Describe the types of quantitative, qualitative and mixed method research designs.
- Discuss the types of quasi-experimental and true experimental design.
- Describe the types of qualitative research designs.
- Enumerate the essential characteristics of experimental research.
- Discuss the internal and external validity of the experimental designs.
- Identify various threats to internal and external validity.

CHAPTER OUTLINE

• Introduction	• Characteristics of a Good Research Design
• Definitions	• Selection of Research Design
• Research Approaches and Designs	• Validity of Research Designs
• Key Elements of Research Designs	• Types of Research Designs

KEY TERMS

Action research: A research approach that involves active participation and collaboration with stakeholders to identify and address problems within a specific context.

Applied research: Research conducted to address specific practical problems or issues and provide solutions to real-world problems.

Basic research: Research focused on gaining a fundamental understanding of phenomena without immediate practical applications in mind.

Contd...

Case study: An in-depth examination of a single individual, group, or entity to gain insights and understanding of a specific situation or phenomenon.

Cross-sectional research: Research that collects data from participants at a single point in time to analyze and compare various variables.

Descriptive research: Research that aims to describe and document the characteristics and features of a phenomenon or population.

Ethnographic research: An approach that involves immersing researchers in the culture and context of a specific group to understand their behavior and social dynamics.

Evaluation research: Research conducted to assess the effectiveness or impact of programs, interventions, or policies.

Experimental mortality: The loss of participants during an experiment, which can affect the validity of the results.

Experimental research: Research that involves manipulating one or more variables to determine their causal effects on outcomes.

Explanatory research: Research aimed at explaining why certain phenomena occur, typically building on existing theories.

Exploratory research: Preliminary research conducted to gain a better understanding of a topic or generate hypotheses for further investigation.

External validity: The extent to which research findings can be generalized to other populations or settings.

Formative research: Research conducted to inform the development or improvement of programs, products, or interventions.

Grounded theory research: An approach that seeks to generate theories and concepts based on empirical data collected during research.

Hawthorne effect: A phenomenon where individuals modify their behavior when they are aware they are being observed or studied.

Historical research: Research that examines past events, trends, or conditions to understand their impact and relevance.

History: External events or factors that can influence the outcomes of a research study.

Internal validity: The extent to which a research study accurately measures the effect of the independent variable on the dependent variable.

Longitudinal research: Research that collects data from the same participants over an extended period to track changes or trends.

Maturation effect: Changes in participants overtime that can affect the outcomes of a study.

Meta-analysis: A statistical technique that combines and analyzes the results of multiple studies on a particular topic to draw more robust conclusions.

Methodological research: Research focused on the development and evaluation of research methods and techniques.

Nonexperimental: Research that does not involve manipulating variables and lacks a control group.

Operational research: Research that uses mathematical models and analytical methods to solve complex decision-making problems.

Outcome research: Research focused on measuring the effects or outcomes of an intervention or treatment.

Phenomenological research: Research aimed at exploring and understanding individuals' subjective experiences and perceptions.

Prospective research: Research that follows participants forward in time to observe and record events as they occur.

Qualitative research: Research that emphasizes understanding and interpreting social phenomena through non-numerical data such as interviews, observations, and textual analysis.

Quantitative research: Research that relies on numerical data and statistical analysis to draw conclusions and make predictions.

Quasi-experimental research: Research that lacks full experimental control but still attempts to establish causal relationships between variables.

Randomization: The process of randomly assigning participants to different groups or conditions in an experiment.

Randomized block design: A research design that involves grouping participants based on specific characteristics before randomization.

Contd...

Randomized Controlled Trial (RCT): A type of experimental research that uses randomization to assess the effectiveness of interventions or treatments.

Regression threat: A statistical issue where participants' scores tend to regress toward the mean in repeated measurements, potentially affecting research outcomes.

Retrospective research: Research that examines past events, data, or records to understand their significance or causes.

Selection effect: A bias that occurs when participants in different groups are not equivalent at the beginning of a study.

Testing effect: A phenomenon where taking a pretest influences participants' performance on a post-test.

INTRODUCTION

The terms “research approach” and “research design” are often used interchangeably. The research design is the detailed plan to answer the research questions that have been proposed for the study. It is the framework that provides a detailed blueprint of how the research will be carried out, what tools and technique will be used, and how the data will be analyzed. It is a description of methodology of the study that includes research approaches, variables, population and sample, sampling methods, data collection method and analysis.

In nursing sciences, the term “research approach” generally refers to whether the research study adopts quantitative, qualitative, or mixed method (combination of both) approach. Quantitative research approach is primarily categorized into experimental and nonexperimental designs with various distinct designs under each category. The qualitative research includes phenomenological, grounded theory, ethnographic, historical, action research and case study methods.

The current chapter introduces the student to the commonly used research designs under quantitative and qualitative research approaches along with appropriate examples.

DEFINITIONS

Research design is a plan aimed at answering a specific research question.

—Saunders et al. (2012)

Research design is the heart of the research process which constitutes the approach, study setting, sampling techniques, sample size, tools and methods of data collection and analysis of data to answer the research questions.

Research design can be defined as *a conceptual structure within which research will likely be done.*

A research design is a blueprint of the research for collection, measurement and analysis of data.

RESEARCH APPROACHES AND DESIGNS

Research approach deals with the way how to get the answers for a problem. It is the method, plan, or procedure to conduct the research. There are three types of research approaches: Qualitative, quantitative, and mixed method. Qualitative and quantitative research approaches differ basically in some major areas, including their objectives; types of questions posed; types of data collection methods used; types of data produced; and degree of flexibility in study design.

Qualitative research is an approach for exploring and in-depth understanding of social phenomena within their natural setting. Qualitative data relies on direct and lived experiences of human beings. On the

contrary, the quantitative research focuses on numerical or quantifiable data. It examines the relationship among variables, which can be quantified or measured by using certain instruments. It is an approach for testing objective theories by examining the relationship among variables. Table 8.1 depicts the differentiation of quantitative and qualitative approaches.

Mixed method research is an approach that involves collecting both quantitative and qualitative data. It integrates the two forms of data and use distinct designs that may involve philosophical assumptions and theoretical frameworks. Combination of qualitative and quantitative approaches is likely to provide more understanding of a research problem.

The **research design** is considered the blueprint of a study. It is a detailed outline of how an investigation will take place. It can be thought of as an outline detailing with what will be done and how this will be accomplished. Just as a builder first make a sketch of a particular type of building before obtaining permits; and works out a schedule for ordering the materials, similarly a researcher needs to develop a research design as per the type of a research study. The key aspects of a research design include the research methodology, participant/sample, assignment of subjects to different groups, the instruments, data collection procedures, statistical analysis, etc.

Table 8.1 Comparison of quantitative and qualitative research study

Characteristic	Quantitative research study	Qualitative research study
Objectives	- To seek precise measurement and quantify variation - To predict causal relationships - To describe quantifiable characteristics of a population. E.g., age, male: female ratio, etc.	- To explore and understand phenomena - To gain in-depth understanding of specific issues - To describe individual experiences - To define group norms
Data obtained	Numerical and measurable data	- Mainly textual (words, pictures, audio, video) - Data can be observed but not measured
Application	Tests theory/hypothesis	Develops theory/hypothesis
Characteristic of design	Fixed and predetermined prior to the study	Flexible and evolving as study progresses
Sample	Use large sample size	Use small sample
Tools	Preselected, close-ended questionnaires and rating scales	Open-ended questions guided with flexible sequencing
Data analysis	- Descriptive and inferential statistics - Deductive method	- Narrative description - Inductive method
Type of reasoning	Deductive reasoning (moving from general to specific)	Inductive reasoning (moving from specific to general)
Flexibility in study design	Fixed. Participants' response does not affect the sequence	Relatively flexible. Participants' response affects the sequence
Characteristics of findings	Precise and narrow	Comprehensive or expansive

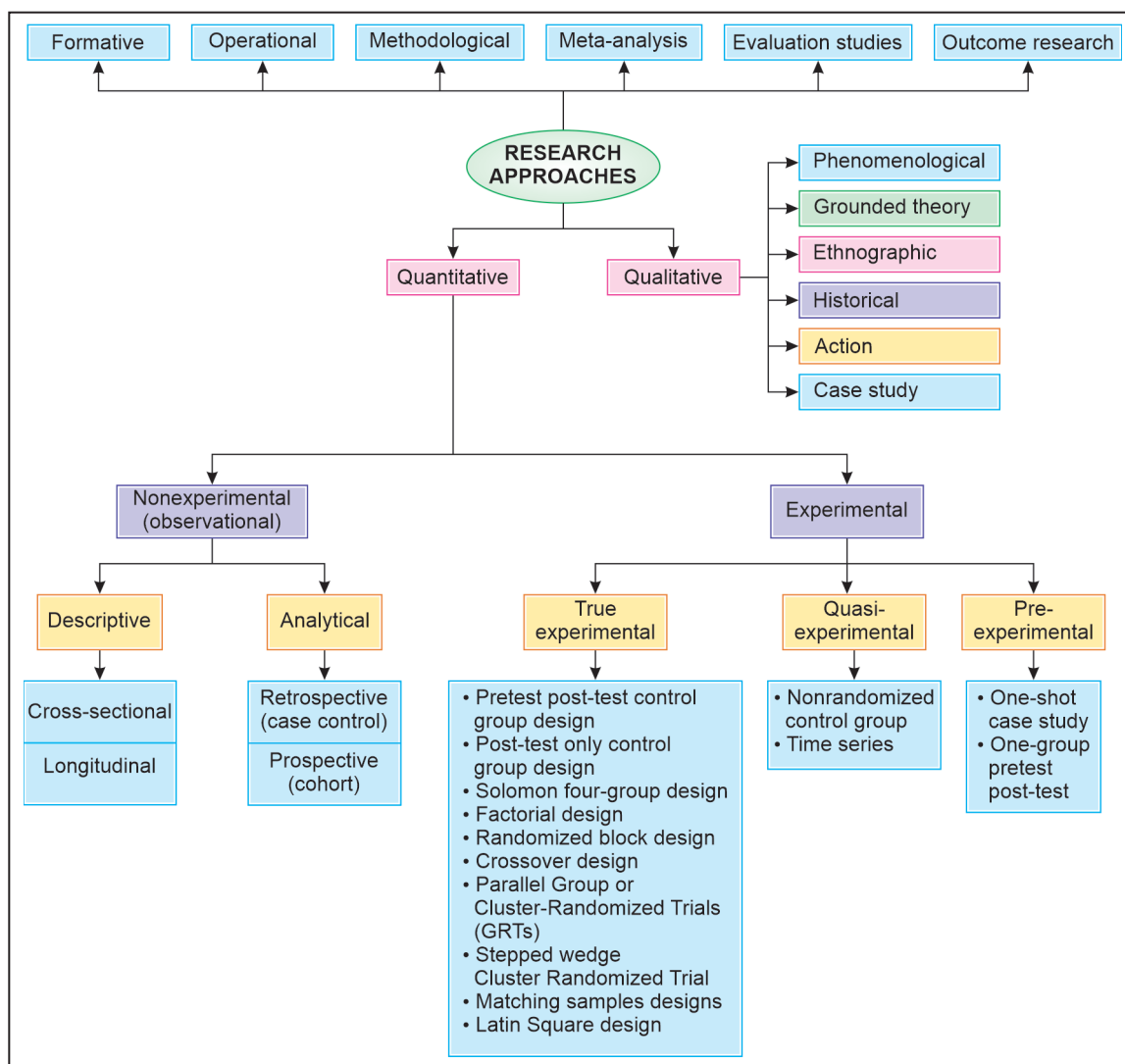


Figure 8.1: Research approaches and designs

Figure 8.1 shows the various types of research designs under qualitative and quantitative research approaches.

KEY ELEMENTS OF RESEARCH DESIGNS

The framework of research techniques, tools and methods to answer research questions is called research design. The term “methodology” is often interchangeably used as research design. The elements of research design include the approach, variables, population and sample, sampling technique, setting, tools and methods of data collection, method of data analysis, and timeline for completion (Fig. 8.2).

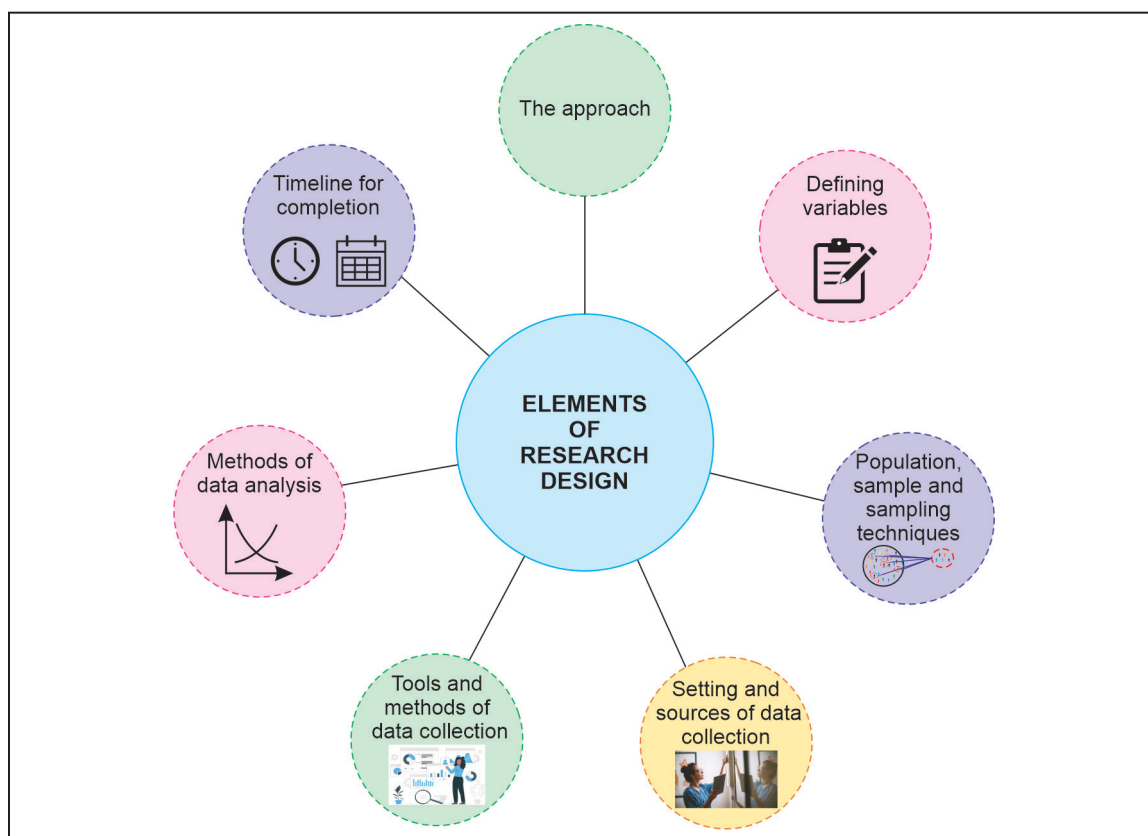


Figure 8.2: Elements of research design

The Approach

The approach describes the plan to investigate the research question either *quantitatively* (structured and measurable) or *qualitatively* (unstructured and nonmeasurable). Some researchers use combination of both quantitative and qualitative methods to answer the research question which is known as *mixed method research*. The research approach directs the researcher to decide the variables under the study, choose the appropriate tools to measure or describe the variables.

The nature of the phenomenon under study determines the research approach. For example, if the researcher wants to study the effect of a diet plan on weight gain of patients, then the research approach should be quantitative as the outcome variable (weight) is measurable (quantitative). On the other hand, if the researcher wants to study the parenting experiences of a working women, then the approach should be qualitative as the outcome variable (experience) is not measurable but describable.

Defining Variables

Variables are the basic units of the information studied and interpreted in research studies. While designing quantitative research, it is important to identify and define variables. Identification of independent and dependent variables is essential in experimental research. Researchers measure, analyze, and interpret the values to make sense. Variables are operationally defined during the planning stage of a quantitative research study. In qualitative research, the researchers investigate, explore, describe and categorize the variables.

Population, Sample and Sampling Techniques

The outcome of the research design should apply to a population and not just the sample. The research design is aimed at drawing conclusion about the entire group (population) through studying a small sample. Research design provides the researcher with the framework for the population, sample and sampling technique. For example, in an experimental research design, a researcher is directed to choose a probability sampling technique to draw sample and randomly allocate the sample into control and experimental group. This enhances the validity of the finding and generalizability.

Setting and Sources of Data Collection

Describing the study setting or location where the research takes place is an essential component of research design. For example, a study could take place in a selected ward of a hospital, a laboratory, a school or in a community setting depending on the population under study.

Tools and Methods of Data Collection

Research design describes the tools and methods of data collection that are appropriate to answer the research question. For example, if the researcher is studying the infection control practices of nurses, then the observational checklist may be the suitable data collection tool.

Methods of Data Analysis

Description of methods of data analysis is an important component of research design. Specific methods of data analysis in accordance with the objectives of the research objectives guide the researcher to collect appropriate data, i.e., continuous, categorical or qualitative data. Without a properly planned data analysis methods the researcher may end up collecting data that is irrelevant and difficult to analyze to answer the research questions.

Timeline for Completion

Timelines are essential to any research projects. The research design describes the timeline from initiation to completion of research study. It is helpful in organizing the research work that needs to be done and holds the researchers accountable for completing the research work. It is also helpful in budgeting.

CHARACTERISTICS OF A GOOD RESEARCH DESIGN

In nursing research, designing a research study is very complex as it most often involves human as a subject; and selection of a method and logical plan does not always guarantee a reliable result. Every research design has its own strengths and weaknesses, however, a good research design is likely to minimize bias and maximize the reliability of the outcome.

A good research design must possess the following four characteristics:

1. **Objectivity:** The essence of objectivity is to conduct research free from researcher's biases. The bias in the research can be caused by several reasons which are not always controllable by the researcher. Objectivity can be achieved by having an objective measuring instrument, robust method of data collection and scoring of the responses.



2. **Reliability:** Reliability in research refers to how consistently a method measures something. A method is considered reliable if the given method consistently produces the same result under the same circumstances. Threats to reliability in research include researcher or observer error, environmental changes, and participant changes.
3. **Validity:** The conclusions drawn from research are only useful if they are valid. Validity of a research design refers to the extent to which results represent reality.
4. **Generalizability:** Generalizability is a measure of how useful the results of a study are for a broader group of people or situations. In other words, how the findings from a sample are useful for the population from which the sample is drawn.

SELECTION OF RESEARCH DESIGN

There are certain general criteria and some specific criteria for selecting a research design. The general points are discussed as follows. The specific points which can assist the researcher in identifying the most suitable quantitative research design have been given in Box 8.1.

Factors Affecting Selection of Research Design

Some of the important factors that influence the selection of research design have been discussed as follows:

- **Research problem and research questions:** The nature of the research problem is the primary factor in deciding the research design. It depends on the variable under study. Researchers select the research design that is suitable to answer the research question.
For example, if the researcher interest is to evaluate the effectiveness of a newly developed intervention on pain management, then he/she would choose one of the experimental designs (quantitative design). The researcher may choose a qualitative research design if the research question is to assess the experiences of patients who recovered after being hospitalized with severe COVID.
- **Aims and purpose of the study:** Researchers conduct research to find answers to questions, explore the unknown, predict future trends, describe past events, explain phenomena and relationships between variables. So, the purpose of a research design determines what type of research design will be chosen. For example, a researcher investigating whether exercise helps people lose weight might use one of the experimental designs (quantitative design).
- **Knowledge, skills and experience of the researcher:** Researchers tend to select those research designs that they feel most competent and are most comfortable with. Researchers' experience in the field, training and specialization influence their selection of research design because they avoid designs that may be unfamiliar, difficult or overly complicated.

BOX 8.1 Choosing and justifying the quantitative research design

- Whether the researcher is concerned with relationship between variables or comparing the difference between variables?
- Will the independent variables be manipulated?
- Is there any control group?
- Will the subjects be randomly assigned?
- Which design is feasible and best controls for threats to internal validity?
- Which design was used by previous similar studies?
- Are there any limitations reported related to the use of research design?

For example, a researcher with lack of skills in in-depth interview may avoid qualitative research design and select quantitative research by quantifying the variables by using questionnaires or scales. On the other hand, those who enjoy writing literary essays or conducting personal interviews may select qualitative designs.

- **Researcher's interest:** Researchers' own interest also influences the choice of research design. A researcher who is interested in technical, scientific writing, statistics, and computer statistical programs would most likely select the quantitative design.
- **Availability of subjects/participants:** The availability of study participants also influences the selection of the research design. The qualitative research study can be conducted on few subjects; however, a greater number of participants are required for the quantitative research study.
- **Ethical concerns:** When designing research, it is essential to incorporate ethical and legal principles. This includes minimizing the risk of harm, obtaining informed consent, protecting anonymity and confidentiality, avoiding misleading practices and providing right to withdraw from research. The obligation of the researcher to strictly follow these principles may limit the choice of research design. For example, a researcher wants to study the effect of sleep deprivation on quality of life of children. Though the problem is suitable for experimental research, the researcher cannot choose experimental research because it is unethical and harmful to restrict sleep hours of children for the experimental purpose. So, the researcher may choose an observational design to study the effect of sleep on quality of life.
- **Time:** Selection of research designs is influenced by the amount of time available to conduct the study. Longitudinal studies require a longer period of time, while cross-sectional research can be conducted in a shorter period.
- **Resources:** Selection of research design is influenced by the availability of resources for the research study. Money, manpower, equipment/tools, and facilities are some of the major resources required to conduct a research study. The constraints on any of these resources may result in choosing a less suitable research design than a more suitable design which consumes more resources. For example, a researcher wants to study the effect of a nurse-led stress management program on quality of life of diabetic patients. A randomized control trial is a gold standard for this study, but it requires random allocation of subjects into control and experimental groups. Limited resources may force the researcher to choose a quasi-experimental design.
- **Control over extraneous variables:** The selection of research design depends on whether or not the control over extraneous variable is required for the study. If required, the researcher selects a randomized controlled study because randomization ensures that the expected extraneous variables are almost identical in control and experimental groups. So, the extraneous variable is controlled.
- **Research utilization:** The researchers' choice of research design depends on how they want their users to benefit from their research results. For example, if a researcher wants to develop a nursing care protocol to prevent pressure ulcers in bedridden patients, then a true experimental design would be the best choice to test the protocol.

VALIDITY OF RESEARCH DESIGNS

The validity of a research study has two domains: Internal and external validity. These are the important criteria to determine the credibility, trustworthiness, and reliability of the research findings. The best research designs are those with high levels of internal and external validity.

Internal Validity

Internal validity refers to the degree of confidence to which the cause-and-effect relationship is not influenced by the other factors or variables, i.e., the intervention (independent variable) has caused the result (dependent variable). This means the variation in the dependent variable is due to the independent variable and not due to any other factors such as methodological error, sampling, or measurement error. Internal validity is a prime consideration for any research study that assesses the effects of an intervention. Internal validity answers the question of whether the independent variable is responsible for the variation in the dependent variable or whether other factors have caused that variation.

For example, to assess the effect of honey on the prevention of mucositis among the patients undergoing chemotherapy, the researcher would want to be sure that the less incidence of mucositis is due to the intervention and not some other factors that came into effect during the study, e.g., the introduction of some other drug.

Internal validity is relevant only when the researchers are trying to link a cause and an effect. It is not appropriate in observational or descriptive studies that just report the findings of the study.

Threats to Internal Validity

The controlled or experimental design facilitates the researcher to control a threats to internal and external validity. The degree of control exerted over the potential extraneous variables determines the level of internal validity. Threats to internal validity are the factors other than the independent variable that influence the dependent variable. Controlling the possible confounding variables minimizes the potential for an alternative explanation for treatment effects and provides more confidence that effects are due to the independent variable. Most of the threats to internal validity are found in single group studies. One of the ways to minimize these threats is to add a control group with random allocation.

Eight major threats to internal validity have been identified. These are history, maturation, testing effect, selection effect, attrition, instrumentation threat, measurements threats, and regression effect. These are described with examples in Table 8.2. These should be controlled to limit their effect on the experimental conditions.

Table 8.2 Threats to internal validity

Threats to internal validity	Description	Example
1. History	- History becomes a threat when any unexpected events that occur during the study change the conditions of the study and influence the dependent variable. - History is a threat more likely for the one-group design and less likely for the two-group design study. In two-group design, the history threat occurs for both control and experimental groups, so it is unlikely that the difference between the two groups will be due to the history event.	A researcher is studying the effect of an educational intervention on the use of contraceptives. During the study, the Government started a major mass media television campaign about contraception. This could affect the attitude of the subjects. Thus, the results could be attributed to the television campaign and not exclusively to the educational intervention.

Contd...



Threats to internal validity	Description	Example
2. Maturation	- Maturation threat occurs when a normal developmental process (maturation) with passage of time influences the dependent variable. These developmental changes may be biological or psychological in nature. These changes may partly or completely affect the dependent variable, thereby causing threat to internal validity. Both history and maturation are important in longitudinal studies due to the length of time, it takes to complete the study. There are more chances of maturation threat in studies where children are the subjects because of the rapid physical, mental and social growth in childhood. - Maturation threat can be reduced by having shorter intervals between observations during follow-up. It is again a threat for the one group design. It is not a threat to the two-group design, assuming that participants in both groups mature at the similar pace.	- In a study to assess effect of a meditation techniques on cognitive skills of children, the reported increase in cognitive skills may be due to the normal development of child rather than due to the intervention (meditation technique). - Conversely, in elderly population, there can be more rapid deterioration of physical characteristics which negatively impact the dependent variable during the study.
3. Testing effect	This threat may happen when changes in test scores take place not because of the intervention but rather because of repeated testing. This is of particular concern when researchers administer identical pretests and post-tests. The subjects may do better in the post-test because they learn how to take the test or perform better by taking the pretest. It is again a threat to the one-group design wherein it can be avoided by having a different set of post-tests, however, it may lead to instrumentation threat. It is not a threat to the two-group design, because both the groups are exposed to the pretest, so the difference between groups may not be due to testing effect.	A researcher wants to assess the effect of an educational intervention on use of inhaler amongst the asthmatic patients. The plan is to test the knowledge score both before and after the intervention. Exposure to pretest items may stimulate them to learn more about the use of inhaler, which may positively impact the post-test scores. So, the resulted difference in post-test scores may be partially due to testing effect.
4. Selection effects	It refers to selection or assignment of study participants into control and experimental groups. If the subjects are selected randomly, all have an equal chance of being included in treatment or control groups, and the groups will be comparable. The self-selection of the subjects into experimental and comparison groups, or if the subjects are allowed to choose the group they want to enter, the groups may be unequal. Hence, the comparison becomes invalid. This effect could be avoided by random allocation of the subjects to the control and experimental group. Selection is not a threat for the one-group design, but it is a threat for the two group design.	If the nurses are asked to volunteer to experimental group to improve the job satisfaction, the experimental group will have more engaged and committed participants than that of control group. This will show higher satisfaction level in experimental groups.

Contd...

Threats to internal validity	Description	Example
5. Attrition	It is also called experimental mortality, withdrawals, dropouts, or mortality threat. Experimental mortality does not mean death of the subjects during study. It is the loss of subjects from the study due to any reason. The study participants may withdraw themselves during the study. If the drop out of the subjects is due to intervention effect (not a coincidence), it can threaten the internal validity.	A researcher is studying the effect of a modified duty shift timings on job satisfaction of nurses. Certainly, dissatisfied nurses tend to resign their job during the study. The average job satisfaction score in the post-test will improve, not because of the intervention but because the dissatisfied nurses have already quit their job and not participated in the post-test.
6. Changes related to instrumentation	The reliability of the instrument used for the measurement of variables may affect the internal validity of the study. Instrumentation error occurs when results are due to an error in the calibration of an instrument rather than true experimental effect. Change of instruments during the course of research may pose a threat to internal validity. This can be avoided by calibrating the instruments prior to the data collection, checking at regular intervals, and using the same instrument throughout the research study.	A researcher starts data collection with a mercurial sphygmomanometer and changed to a digital sphygmomanometer after some time. This may threaten the reliability of the measurement; hence, causing threat to internal validity.
7. Changes related to measurements	If there are more than one data collector and they are not trained prior to the data collection regarding certain measurement and there are no written guidelines regarding the procedure, everyone will be doing it on their own. It could influence the results of the study. This could be controlled by training all the data collectors and testing them until they achieve the inter-rater reliability to a set standard.	In an experimental study assessing blood pressure, untrained collectors might use varied techniques, affecting the reliability of the measurements.
8. Regression effect	Normally, when a group of subjects are given the same test several times, there is a tendency for their scores to move closer to the mean (i.e., regress). The selected subjects may even be having extreme (low or high) scores. The extreme (low or high) scores tend to be closer to the mean in the post-test assessment than the pretest assessment. Regression threat occurs when the researcher misinterprets this change as an interventional effect.	In a study to assess the effect of a structured teaching program on knowledge regarding biomedical waste disposal among nurses, the nurses who scored extremely lower score in the pretest will show higher gain in the post-test than the nurses who already scored average or above average in the pretest. It is possible for someone who scored 10 out of 50 in the pretest to score 30 out of 50 in the post-test (20 point gain) whereas it is very difficult for someone who scored 30 out of 50 in pretest to improve 20 points in the post-test.

External Validity

External validity refers to the extent to which the findings of a study from a sample can be generalized (applied) to a larger population. External validity helps to answer the question: Can the research findings be applied to the “real world”? If the research findings of a study are applicable to other people, settings, time, and situations, then the external validity is very high. Sampling technique is an important determinant of external validity. The sample selected should be the true representative of the population to achieve high external validity. Thus, random sampling methods are essential to improve *external validity* and random allocation/assignment is essential to improve the *internal validity*. If subjects are not sampled randomly from the population, the results may be generalizable only to that portion of the population from which the sample was taken.

Threats to External Validity

The factors within a research study that reduce the generalizability are known as threats to external validity. The main threats to external validity are: Sampling bias; Hawthorne effect (observation effect); Experimenter effect; Reactive effect of the pretest; Novelty effect; People, place and time.

- **Sampling bias:** Sampling bias occurs when some members of population have more chances to be selected for the study than others. Sampling bias limits the generalizability of the study findings to a larger population because the sample is not the true representation of the all the members of the population. Probability sampling reduces any selection bias by giving everyone an equal chance to participate in the study.
- **Hawthorne effect (observation effect):** People behave differently when they know that they are being observed (Hawthorne effect). It is a big dilemma for the researchers, because it is unethical to observe the people without their knowledge. But if they know that they are being observed, they may become more conscious and may behave differently, thus producing the invalid data. The only way to overcome this problem, aside from deception, is to use unobtrusive observation.
- **Experimenter effect:** The researcher consciously or unconsciously may affect the result. For example, if the researcher becomes aware in between the study that one intervention is better than the other, she/he may promote that particular treatment for the better results of the study. The researcher may also have a vested interest in the outcome of their intervention. It may also influence the results of the study. Sometimes certain behaviors of the researchers, e.g., their facial expressions, clothing, age, gender, body build, etc. may influence the ways in which respondents respond to the research questions. To overcome this, the investigator should be blind to the interventions being tried in the study.
- **Reactive effect of the pretests:** A pretests might enhance the responsiveness of the subjects to the experimental variables. For example, if the researcher administers a pretests to establish a baseline before introducing an intervention, subject sensitization may occur. This means that the subjects have become knowledgeable about the procedure used for the research. This may influence their participation as well as the post-test results. The subjects may not respond to the intervention in the same manner if they had not received a pretests.
- **Novelty effect:** Novelty effects pose a threat to the external validity of a research study because it is difficult to determine if the results are due to the treatment itself or simply the novelty of the treatment. Since anything different makes a difference, a treatment may work because it is innovative, and the subjects may respond to the uniqueness of it rather than the actual treatment itself. The opposite may also occur due to the uniqueness of the new treatment. Either way novelty poses threat to the external validity of a research study.

- People, place and time:** People, places and time are considered to major threats to external validity because the results of the study may be affected due to unusual type of people included in the study or the study conducted at unusual setting or at an unusual time. For example, if a researcher is interested in studying the quality of life of nurses working in mental health units and recruited sample from a government hospital, the findings may not be generalizable to all nurses because the results may not reflect the reality as the nurses working in private sector may have different set of problems like unsatisfactory salary, lack of job security etc. Similarly, a study on effectiveness of tobacco cessation program at a time when Government has initiated a mass campaign on tobacco cessation and imposed some restrictions on tobacco selling may influence the outcome of the study.

TYPES OF RESEARCH DESIGNS

Classification of research designs and terminology used to describe the designs vary across disciplines. There is no one standard classification of research designs. However, for the practical purposes, the research designs can be classified into three major categories:

1. Quantitative research designs
2. Qualitative research designs
3. Mixed method research designs

1. Quantitative Research Designs

Quantitative research mostly centers on numerical data. The study variable is numerically measured. These data are analyzed using statistical methods.

The quantitative research designs are broadly classified into experimental and nonexperimental research designs. Experimental designs involve manipulation of independent variables. They are used to measure whether one treatment has a better effect than another. For example, quantitative designs might answer research questions such as, “Is treatment A better than treatment B”? The three major types of experimental designs are true experimental designs, Quasi-experimental designs, and pre-experimental.

Nonexperimental research designs (Table 8.3) are observational, and results are intended to be descriptive. For example, a research study to explore the factors influencing drug compliance among mentally ill patients is nonexperimental because there is no manipulation of variables involved in the study. The study reports only the characteristics of the population. The nonexperimental research designs are further divided into descriptive and analytical research designs. The descriptive designs include the cross-sectional and longitudinal; and the analytical designs comprise retrospective (case control) and prospective (cohort) designs.

Experimental Research Designs

Experimental research designs are the methods that investigate the interaction between independent and dependent variables after manipulating independent variables. It is a scientific method to establish the cause-effect relationship between variables. In other words, the researcher seeks to determine the effect of a specific intervention on the outcome. The researcher assesses this by providing a specific intervention/treatment to one group and withholding it from another and then determine how both groups scored on the outcome variables. These are the most scientifically sophisticated and powerful designs.

In experimental research, the researcher plays an active role in manipulation of independent variable through treatment/intervention, controlling extraneous variables and measurement of dependent variables. In general, the steps followed in conducting experimental research are given in Table 8.4.

**Table 8.3** Quantitative research designs

Type		Description
Experimental	True experimental	Pretest post-test control group design
		Participants undergo a pretest, receive an experimental treatment, and then take a post-test. The control group provides a baseline for comparison.
		Post-test only control group design
		Similar to the pretest post-test design, but without the pretest. This design is effective in situations where a pretest may influence the study outcomes.
		Solomon four, group design
		Combines elements of pretest post-test design and post-test design only control group designs. Includes two experimental and two control groups to examine the effects of pretesting on study outcomes.
		Factorial design
		Multiple independent variables are manipulated simultaneously to understand their individual and combined effects on the dependent variable.
		Randomized block design
		Participants are grouped into blocks based on specific characteristics and then randomly assigned to different experimental conditions within those blocks. Helps control for confounding variables.
		Cross over design
		Participants experience multiple experimental conditions in a random order, with a washout period between conditions. Common in clinical trials, particularly when testing the effectiveness of different treatments.
		Parallel group or Cluster-Randomized Trials (GRTs)
		Group of participants or clusters are randomly assigned to different interventions. Practical when individual randomization is challenging.
		Stepped Wedge Cluster-Randomized Trial
		Interventions are sequentially introduced to different clusters overtime, allowing researchers to assess effects gradually.
		Matching samples designs
		Participants are matched based on specific characteristics before being assigned to different groups. Helps control for confounding variables.
		Latin square design
		Commonly used in experimental settings where researchers manipulate multiple factors, ensuring each level of each factor appears once in every row and column.
	Quasi-experimental Design	Nonrandomized control group
		Participants are assigned to groups without randomization, useful when randomization is impractical or ethically challenging.
		Time series designs
		Data is collected at multiple of time before, during, and after an intervention, allowing researchers to observe trends and changes overtime.

Contd...

Type			Description
Non-experimental design	Pre-experimental design	One-shot case study	A single group is observed after an intervention, providing a snapshot of outcomes without a comparison group.
		One group pretest-post-test design	Participants undergo a pretest, receive an intervention, and then take a post-test. A straightforward design is lacking a control group for comparison.
	Descriptive	Cross-sectional	Data is collected from participants at a single point in time, providing a snapshot of a population's characteristics.
		Longitudinal	Data is collected from the same participants over an extended period, allowing researchers to examine changes and developments overtime.
	Analytical	Retrospective (Case-control)	Involves comparing individuals with a specific outcome (cases) to those without the outcome (controls) based on past events or conditions.
		Prospective (cohort)	Participants are followed overtime to assess the development of a particular outcome. Useful for studying the incidence of diseases or events.

Table 8.4 Steps followed in conducting experimental research

Steps	Example
STEP 1 Identify the problem	Increased incidences of pressure ulcers are observed in neuro ICU.
STEP 2 Formulate research questions that need to be answered	Whether application of preventive silicone dressings to the sacrum and heels reduces the incidences of pressure ulcers?
STEP 3 Formulate hypothesis	There will be less incidence of pressure ulcer among patients who received preventive silicone dressings than that of patient who received routine care.
STEP 4 Select sample	Patients admitted in neuro ICU are selected for the study using total enumeration sampling method.
STEP 5 Allocate sample into experimental and control group (if applicable)	Selected sample (patients) is randomly allocated into control (routine care) and experimental (silicone dressings + routine care) group.
STEP 6 Gather data	Incidence of pressure ulcer is recorded over next 6 months.
STEP 7 Analyze the data to test hypothesis	The data is analyzed to test the hypothesis.
STEP 8 Interpretation of results	The application of silicone dressings, in addition to routine care, in neuro intensive care unit patients is effective in preventing pressure ulcers at the heels and sacrum.

The experimental research designs are further classified into:

- True experimental research designs
- Quasi-experimental research designs
- Pre-experimental research designs

True Experimental Research Designs

True experimental research design is the most accurate form of experimental design. This method is often termed Randomized Controlled Trial (RCT) in biomedical research. In this method, the researchers have complete control over the extraneous variables. Hence, they can conclude that the change in dependent variable is due to the effect of independent variable.

The true experimental approach is the most powerful design for testing hypothesis of causal relationship among the variables. The primary purpose of true experimental research is to investigate the effect of an independent variable(s) on the dependent variables(s) to determine the existence of a cause-and-effect relationships between the variables. The basic structure of true experimental research design has been illustrated in Figure 8.3. This may vary from design to design as the hybrid designs use combination of basic designs to improve the control over the variables.

Essential characteristics of true experimental design: The **three essential characteristics** of an experimental design are manipulation, control and randomization.

1. **Manipulation:** Experimental manipulation is a process by which researchers intentionally change, modify, or influence the independent variable. Manipulation is a conscious and purposeful act by the researcher to modify the independent variable (cause) and observe the effect of manipulation on the dependent variable (effect). In other words, manipulation of a variable occurs when the researcher controls the movement of these variables.

Example 1: A researcher is conducting a study to examine the effect of application of cold pack on the skin before injection of vaccine on pain level at the time of injection. Providing cold pack application to children in experimental group and withholding for children in control group are considered manipulations of independent variables. The effect of the manipulated independent variable (cold pack application) is observed on the dependent variable (pain level at the time of injection).

Independent variable: Application of cold pack

Dependant variable: Pain level at the time of vaccination injection.

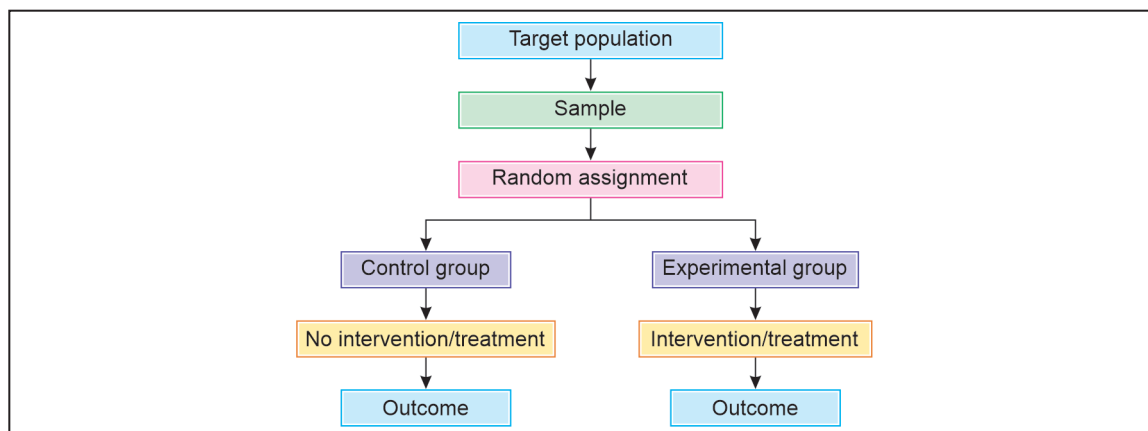


Figure 8.3: Basic structure of true experimental research design/RCTs

Example 2: In another example, a researcher is conducting a study to evaluate the effectiveness of an hourly position change on the prevention of pressure ulcer among patients admitted in neuro ICU. In this example, hourly position change is an independent variable, which is manipulated (changed) by the researcher and is used as an intervention for the experimental group, while the control group receives a routine 2 hourly position change. This provides an opportunity to the researcher to modify the independent variable (frequency of position change) to observe its effect on dependent variable (pressure ulcer).

Independent variable: Hourly position change

Dependant variable: Incidence of pressure ulcer

2. **Control:** Control is an essential component of true experimental designs. Control is used to prevent outside factors (extraneous variables) from influencing the study outcome (dependent variable). True experimental research design involves highly controlled experimental procedures in an effort to minimize errors and increase the confidence that the manipulation of independent variable caused the change in dependent variable (outcome).

There are several ways to control extraneous variables in experimental designs. Use of control group, random allocation of subjects into control and experimental groups and standardized procedure are the ways to attain control in a true experimental research study.

A **control group** is created to estimate the counterfactual, i.e., what would have happened if an intervention/treatment had not been implemented. A control group is identical to experimental group in all means except for the difference that the control group does not receive experimental treatment or any intervention. Outcome of the experimental group is compared with the outcome of the control group which isolates the effect of independent variable on the dependent variable. In nursing research, often it is not practical to withhold treatment/intervention for control group; hence, the control group receives conventional/routine treatment, and the outcome is compared with the experimental treatment. Different types of control groups that can be used in experimental nursing research are given in the Table 8.5.

Table 8.5 Types of control groups

Types of control groups	Description	Example
Standard method of care	The control group receives conventional routine care (existing treatment), while the experimental group is introduced with a new treatment/intervention.	A researcher wants to assess the effectiveness of silicone mattress in prevention of pressure ulcer, where conventional sponge mattress is used as control.
Alternative intervention	Participants in control group receive other alternative treatment which is already tested to be effective.	A researcher wants to assess the effectiveness of negative pressure wound therapy (NPWT) with instillation, where the standard negative pressure wound therapy is used as control. Here, the experimental group receives instillation in addition to NPWT.
A placebo or pseudo intervention control group	Placebo is an inactive substance or intervention that looks similar and given the same way as the treatment/intervention being tested. Here, the control group receives a placebo or pseudo-intervention.	It is often difficult to construct a pseudo-intervention in nursing research with no therapeutic effect.

Contd...

Types of control groups	Description	Example
Wait-listed control group	The subjects in control group also receive treatment but the treatment is delayed for the control group until the effect of intervention is compared between experimental and control group.	A nurse researcher wants to assess the effect of Cognitive Behavior therapy (CBT) on stress level among abused elderly. The subjects in experimental group receive CBT before post-test. However, the subjects in control group also receive CBT but only after the post-test.
Different doses/ intensities of intervention	The subjects in experimental group receive higher dose or more intensive and longer intervention than control group.	A researcher wants to assess the effect of abdominal massage therapy on constipation among patients with chronic constipation. Here, the subjects in experimental group receive abdominal massage for 20 minutes duration, whereas the control group subjects receive for 10 minutes duration.

In addition, the control of effects of extraneous variables on the dependent variable can be ensured by adopting one or more of the following measures, i.e., **matching, counterbalancing, and establishing homogeneity by statistical test.**

- **Matching** is a conscious “matching” of the subjects’ characteristics in both the groups. It is a weak but a common method of control over the extraneous variables. In matching, the researcher identifies one or more extraneous variables to be controlled which are supposed to have effect on dependent variable. As the subjects are recruited for one of the treatment groups, the researcher tries to find subjects for the other group similar to the subjects of the first group based on the specific matching variable as planned. These matching variables could be the age, sex, habitat, etc.

For example, if age and gender are the matching variables of interest in a two study groups, and if a 50-years-old woman is recruited for the first group, the researcher would try to find another woman aged 50 years for the second group.

- **Counterbalancing:** This is another way to exert control over extraneous variables. Counterbalancing is used in which the researcher is concerned that the order in which the treatment or interventions are administered may influence the study results. It attempts to achieve control by entering all subjects into all treatments.

For example, there are two interventions, A and B, to be tested. The subjects are divided into two groups and one group is treated with treatment A followed by treatment B, and the other group with treatment B followed by treatment A (Fig. 8.4).

- **Establishing homogeneity by statistical tests:** To ensure homogeneity of the demographic characteristics among two groups under study, a chi-square test may be applied on the frequency distribution of selected characteristics in two groups. So, here the two groups are matched statistically, however, in “matching”, both the groups are matched consciously or purposely.

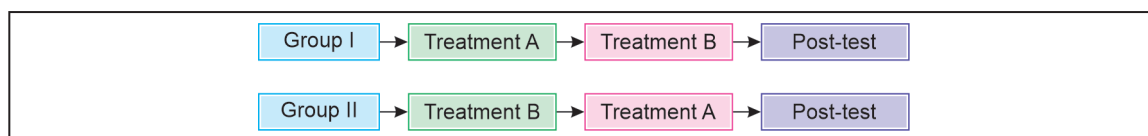


Figure 8.4: Counterbalancing



Standardization of procedure refers to experimental control and is essential to attain control in true experimental designs. This includes standardization of treatment administration, instruction to participants, and measurement of variables. These parameters must be held in constant to have complete control over the experimental variables. This is as important as having the control group in a true experimental research.

For example, a nurse researcher wants to assess the effectiveness of a new diet plan on haemoglobin level of antenatal women. Apart from having the control group with random allocation, it is important to standardize the diet plan, meal timings, and control of caffeine intake etc. Failing to control these variables at constant will threat the internal validity of the study outcome.

3. **Randomization:** Randomization is a process of randomly assigning participants (subjects) into treatment/experimental and control groups. The random assignment of the subjects eliminates the chances of selection bias and confounding bias. Randomization ensures that every subject has an equal chance of being assigned to experimental or control group on a random basis, thereby eliminating selection bias. Randomization is based upon the assumption that since subjects were randomly allocated to experimental and control groups, the characteristics of the subjects are equally distributed in both the groups. This eliminates the influence of confounding variable on the dependent variable. In other words, the influence of confounding variables will be similar in both the groups, thereby eliminating the confounding bias. Randomization is used in true experimental research design/RCT to minimize the threat of internal validity of the study and to eliminate the effect of extraneous variables on dependent variables.

Randomization versus random sampling: Randomization is often confused with random sampling techniques. However, randomization differs from random sampling. Random sampling (also known as probability sampling) is a method of selecting members (subjects) from the population to be included in the study. In contrast, randomization or random assignment is a method of allocating the sample participants (subjects) into control and experimental groups (Fig. 8.5).

In randomization, even participants selected through convenient sampling (nonprobability sampling) can be randomly assigned into control and treatment groups. The majority of RCTs in clinical settings are conducted with convenient sampling. After sampling, participants are randomly allocated into control and experimental groups.

Methods of randomization: Random assignment of the subjects may be done with simple flipping of a coin for each subject; with the coin landing on its “head” can be included in one group and with the “tail”

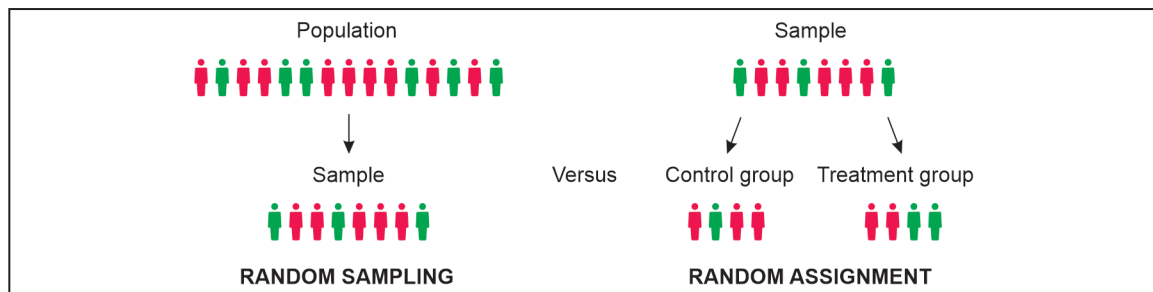


Figure 8.5: Random sampling versus random assignment

to another group. Another possible method is to write the name of the group (experimental or control) on slips of paper and put the slips into a bowl and then draw the lots. Accordingly, the subjects can be included in the respective group.

The most commonly used randomization method in clinical research is the use of sealed opaque envelope system. In this, randomly generated treatment allocations are given to clinicians in opaque envelopes. Once a participant has consented to enter a clinical trial, an envelope is opened, and the participant is then offered the allocated treatment regimen.

A random table may also be used to facilitate the randomization process. In this method, blind-folded subjects choose a number from a table of number horizontally (row) or vertically (columns), till a requisite number is reached for both experimental and control groups. Computer generated random numbers may also be used for the random assignment of the subjects.

A good randomization method must be: (i) simple to implement, (ii) balanced enough to allocate equal number of participants to different groups, and (iii) unpredictable, so that neither the investigator nor the participant should be able to predict their treatment allocation.

Simple randomization may result in unbalanced group sizes if the sample size is small ($n < 300$). There is only 37% probability of having similar group sizes when the sample size is $n = 40$. However, the probability increases to 91% when the sample size is $n = 300$. So, it is recommended to use simple randomization method when the total number of samples is > 100 .

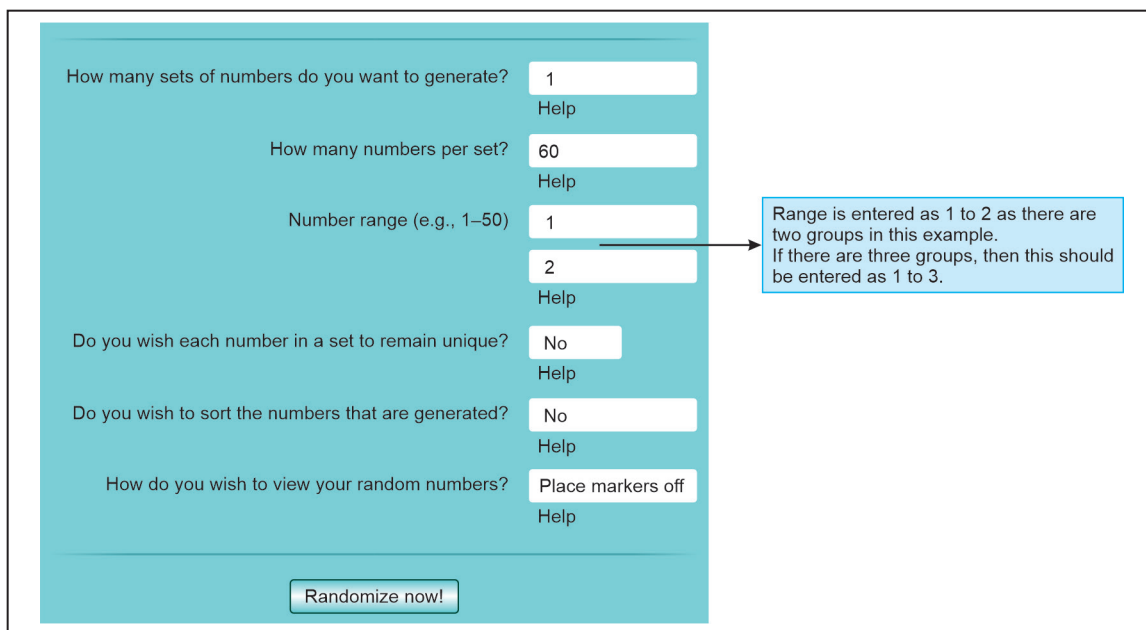
The common methods of randomization used in true experimental research are as follows:

- **Simple randomization:** Randomization based on a single sequence of random assignment is known as simple randomization. It is easiest and most basic approach that ensures unpredictability of treatment assignment. Simple randomization can be carried out in several ways.
 - ◆ **Flip of a coin:** It is the most common and basic method of simple randomization. The side of the coin (heads-control, tails-experimental) determines the assignment of the subject to control or experimental group. This method may result in unequal number of participants among groups, particularly with a small sample size.
 - ◆ **Shuffle a deck of cards:** A card is drawn at random from a well shuffled pack of cards. If an even numbered card is picked, then the subject is assigned to experimental group and in case of odd number, subject is assigned to control group.
 - ◆ **Throwing a dice:** Throwing a single dice can fall in six ways. The subject is assigned to the experimental group if the dice number comes 3 or below, and assigned to the control group if it comes above 3.
 - ◆ A random number table (Random table is given in annexure) or a computer-generated random table (<https://www.randomizer.org/>) may be used for random assignment of subjects into control and treatment groups. Random assignment using the random number table is simple, convenient and reliable; however, today, online random number generators and software programs have replaced random tables.

Exercise 1: You are a nursing researcher testing the effectiveness of back massage on labor pain. You have a list of 60 participants who consented to participate in the study. These 60 subjects need to be randomly assigned into control and treatment groups.

Step 1: Navigate to <https://www.randomizer.org/>

Step 2: Enter the details as given in the figure (this varies depending on the sample size and number of treatment groups)



Step 3: The system generates a set of random number as follows:

1 Set of 60 numbers
Range: From 1 to 2
Set #1
2,2,2,2,1,2,2,2,1,2,2,2,1,1,2,1,1,1,1,2,1,2,1,2,1,2,1,2,2,2,1,1,2,2,2,2,2,1,
2,2,1,1,1,1,2,1,1,1,1,1,2,1,2,1,2

Step 4: You now have a list assigning each volunteer to either control (1) or experimental group (2). 29 subjects have been assigned to control group and 31 subjects have been assigned to experimental group.

- **Block randomization:** The problem with the simple randomization method is that it may result in unequal number of participants among groups (as seen in exercise 1). The block randomization method is designed to randomize subjects into groups in equal numbers. This method is used to maintain a balance in sample sizes across groups overtime. Block randomization works by randomizing participants within each block. Blocks are small and predetermined, which keeps the number of subjects in each group similar at all times. The block size is determined as a multiple of the number of groups. For example, with two treatment groups, the block size would be 4, 6 or 8. Generally, smaller block sizes lead to more balanced groups than larger block sizes. However, a small block size increases the risk of bias and allocation may be predictable, especially if the allocation is open. With block randomization, balanced sample size among groups may be achieved, however, the groups may not be equally distributed in terms of certain covariates. For example, one group may have more subjects with comorbidities (e.g., cancer, diabetes, hypertension, etc.) that may affect the results of the clinical trial. Therefore, it is important to balance these covariates to avoid threat to the internal validity of the study.



Example 1: In a study with two treatment arms (A and B). The block size should be at least $\times 2$ of the number of treatment groups. In this case, the block size could be $2 \times 2 = 4$. The six possible combinations for each block of 4 subjects are as follows:

(1) AABB, (2) ABBA, (3) BBAA, (4) BAAB, (5) ABAB, (6) BABA for each block of 4 subjects, randomly pick up one combination and assign the treatments (A or B) to those 4 subjects in the sequence specified by the combination.

Block randomization may also be performed using free online resources. Random block sizes can be used to minimize the risk of bias.

Example 2: You are a nursing researcher testing the effectiveness of back massage on labor pain. You have a list of 40 participants who consented to participate in the study. These 40 subjects need to be assigned randomly into control and treatment groups using block randomization method with a random block size, i.e., 4, 6 and 8.

Step 1: Navigate to <https://www.sealedenvelope.com/simple-randomizer/v1/lists>

Step 2: Enter the details as given in the figure (this varies depending on the sample size, number of treatment groups and block size)

CREATE A RANDOMISATION LIST

Use this tool to create a blocked randomisation list for your trial. The generated lists are suitable for use with our [simple randomisation service](#). Unsure about block sizes? Use our [simulation tool](#) to help you decide.

Create a list

Seed:
179601667365878
Seed for random number generator

Treatment groups
Group A, Group B
A comma separated list of treatments

Block sizes
4, 6, 8
A comma separated list of block sizes — must be multiples of the number of treatments

List length
40

Stratification factors (optional)
Age group: under 30, 30 or over
name: category 1, category 2, ...

☐ Generate unique randomisation code?

Create list Download as CSV

Help

Seed
This value is used to initialise our [pseudo-random number generator](#). The same list will be always be created provided you specify the same seed and other parameters *.

Treatment groups
A comma separated list of treatments. For unequal allocation duplicate the treatment name, e.g.

Group A, Group A, Group B

for a 2:1 allocation ratio.

Block sizes
A comma separated list of block sizes. The sizes must be multiples of the number of treatments. Use our [simulation tool](#) to help you decide on suitable sizes.

List length
The minimum number of rows to generate. The generated list may be slightly longer than this because of the need to fill blocks.

Important! If you are using stratification, you must make sure that the list is long enough to cover the maximum number of randomisations you expect to perform within any stratum.

The safest option is to set the list length to **sample size x number of strata**.



Step 3: The website generates a set of random numbers as follows:

CREATE A RANDOMISATION LIST

Use this tool to create a blocked randomisation list for your trial. The generated lists are suitable for use with our simple randomisation service. Unsure about block sizes? Use our [simulation tool](#) to help you decide.

Create a list

Seed:

Seed for random number generator

Treatment groups

A comma separated list of treatments

Block sizes

A comma separated list of block sizes — must be multiples of the number of treatments

List length

Stratification factors (optional)
 +
name: category 1, category 2, ...

☐ Generate unique randomisation code?

Your list

Seed: 82784773690424
Block sizes: 4, 6, 8
Actual list length: 50
block identifier, block size, sequence within block, treatment

1, 4, 1, Group A
1, 4, 2, Group A
1, 4, 3, Group B
1, 4, 4, Group B
2, 6, 1, Group B
2, 6, 2, Group B
2, 6, 3, Group B
2, 6, 4, Group A
2, 6, 5, Group A
2, 6, 6, Group A
3, 4, 1, Group A
3, 4, 2, Group B
3, 4, 3, Group B
3, 4, 4, Group A
4, 4, 1, Group B
4, 4, 2, Group A
4, 4, 3, Group B
4, 4, 4, Group A
5, 6, 1, Group B
5, 6, 2, Group B
5, 6, 3, Group B
5, 6, 4, Group A
5, 6, 5, Group A
5, 6, 6, Group A
6, 4, 1, Group B
6, 4, 2, Group A
6, 4, 3, Group A
6, 4, 4, Group B
7, 6, 1, Group B
7, 6, 2, Group A
7, 6, 3, Group A
7, 6, 4, Group B
7, 6, 5, Group B
7, 6, 6, Group A
8, 8, 1, Group A
8, 8, 2, Group B
8, 8, 3, Group B

How to cite this tool

Sealed Envelope Ltd. 2022. Create a blocked randomisation list. [Online] Available from: <https://www.sealedenvelope.com/simple-randomiser/v1/lists> [Accessed 2 Jan 2024].

Reference

Pocock SJ. Clinical Trials: A Practical Approach. Wiley; 1983.

The website generated randomization list has divided subjects into 3 blocks of 8 subjects each and 2 blocks of 6 subjects each. Subjects in each block were assigned to Group A or B randomly, thereby balancing the number of participants in both groups.

- **Stratified randomization:** Stratified randomization is designed to overcome the disadvantages of block randomization in which there are chances of heterogeneity among experimental groups. Stratified randomization prevents imbalance between treatment groups for the confounding factors that influence the dependent variable (outcome). The steps of stratified randomization are as follows:
 - ◆ Identify the confounding variables which are likely to influence the treatment outcome (dependent variable). For example, age and gender.
 - ◆ Separate strata are constructed based on the identified confounding variables. For example, since age and gender are important risk factors for Catheter-Associated Urinary Tract Infection (CAUTI), it affects the effect of nurse-led interventional package to prevent CAUTI. Thus, subjects are first assigned into the following four strata based on age and gender combination, i.e.:
 - i. Male, age <60
 - ii. Male, age ≥60
 - iii. Female, age <60
 - iv. Female, age ≥60
 - ◆ Once all the subjects have been assigned to respective strata, permuted block randomization is used within each stratum to ensure balance. Use of simple randomization to allocated subjects from each strata to treatment groups may lead to unbalanced groups.

Stratified randomization is a useful technique in clinical trials with small sample size to ensure equal distribution of participants among groups in terms of numbers and covariates. Identification of baseline characteristics of participants is essential to construct strata which is a challenging task in health care research.

- **Covariate adaptive randomization:** In clinical trials, balanced allocation of covariates is an essential component to ensure valid treatment comparisons. Covariate adaptive randomization or 'minimization' has advantage over stratified randomization in achieving balance over many covariates when the sample size is small to medium. Covariate-adaptive randomization procedure is intended to balance the allocations of two treatments across a identified set of covariates without compromising randomness. In this method, a new participant is sequentially assigned to a particular treatment group based on specific baseline characteristic of the participant and previous assignment of participants. Case-by-case decision on group assignment is made based on the previous participant group assignments. It is an act of balancing the confounding covariates in each treatment group.

Allocation concealment: Allocation concealment is a technique used to prevent selection bias in RCTs. The allocation sequence is concealed from those who assign participants to treatment groups, until assignment occurs. Therefore, it prevents researchers from knowing what is the next sequence of allocation and influencing which participants are assigned to the intervention or control group. Two steps are involved in the generation of random numbers: first, a random sequence is generated; second, this random sequence is concealed from the researcher who is responsible for assigning subjects into treatment groups. The researcher who is allocating participants to treatment groups is provided with randomly generated treatment allocations in a sealed opaque envelope. Once a participant is consented to enter a trial, an envelope is opened and the participant is offered the allocated treatment. Allocation concealment is different from blinding. Allocation concealment eliminates selection and ensures that the treatment to be allocated is not known before the participant entered into the study. By contrast, blinding ensures participants and investigators are not aware of which group a participant is allocated to after random allocation occurs.

Table 8.6 illustrates the different types of blind trials in research.

Table 8.6 Type of blind trials

Type of blind trial	Awareness about treatment of stakeholders involved in research study		
	Participants 	Researchers 	Data analysis 
Open trial	Aware 	Aware 	Aware 
Single blind trial	Blinded 	Aware 	Aware 
Double blind trial	Blinded 	Blinded 	Blinded 
Triple blind trial	Blinded 	Blinded 	Blinded 

Table 8.7 describes different types of bias along with description and intervention.

Table 8.7 Types of bias in experimental research along with description and intervention

Types of bias	Description	Intervention
Selection bias	Systematic differences in baseline characteristics between groups (lack of homogeneity) due to allocation without randomization	- Random allocation of subjects - Allocation concealment
Response bias	The tendency of study participants to give inaccurate, even false answers to self-reported questionnaire.	A well-structured, neutrally-worded questionnaire minimizes the response bias
Recall bias	Caused by inaccurate and incomplete recollection of events by study participants.	- Reduce recall period as much as possible - Choosing appropriate data collection method
Performance bias	It happens when one group of subjects in an experiment gets more attention and care from researchers than another group.	Blinding of researchers
Detection bias/ Ascertainment bias	Systematic bias in the assessment of outcome measures by researchers or study participants for one group of subjects.	Blinding of outcome assessors
Attrition bias	Withdrawal of participants from study results in attrition bias. Less interested or sick patients are more likely to withdraw from study, thus introducing bias in outcome.	- Intensive follow-up - Intention-to-treat analysis.
Reporting bias	Publication bias: The journals are more likely to publish positive results than negative results. Outcome report bias: It occurs when researchers intentionally report only a subset of original recorded outcomes.	The funnel plot method is used to assess the potential role of publication bias.



Blinding: Blinding or 'masking' is the process that prevents parties (participant or researcher or both) involved in a research study from knowing which treatment was given to which group. Blinding is an act of withholding information about the treatment assignment from people involved in the trial from the time of group assignment until the experiment is complete. Blinding is used in RCT to minimize detection and performance bias. The following are the types of blind trials.

- **Open trial:** There is no blinding process in open trial. The research participants, researchers and the data analysts are aware of the treatment allocation details; hence, there is a chance of performance and detection bias in this type of trial.
- **Single-blind trial:** The researcher knows which treatment or intervention the participant is receiving but the participants do not know whether they are receiving the intervention or placebo. This will control the placebo effect.
- **Double-blind trial:** In this method, neither the researcher nor the study participants are informed about the treatment details. This method will prevent both placebo effect and performance effect. Therefore, double-blind trials are preferred method of clinical trials.
- **Triple-blind trial:** In this method, the treatment allocation details are withheld from participants, the researcher and the individuals who measure the outcome and analyze the data. Therefore, placebo bias, measurement bias and performance bias are eliminated.

Use of placebo in true experimental research: Some people feel better just from the perception of receiving new treatment; this is known as the placebo effect. Due to the positive perception, the participants in experimental group may produce some placebo effect. So, researchers use placebos in control group to determine if any difference between groups are due to the new treatment or the participants' perception (placebo effect). Placebo is an inactive substance or intervention that looks similar and given the same way as the treatment/intervention being tested. Placebo is commonly used in clinical trials. However, it is challenging task to design a placebo to match with nursing interventions. So, placebo controlled RCTs in nursing research are uncommon. The new interventions are often compared with the existing routine care practices.

Types of True Experimental Research Designs

The various true experimental research designs include:

1. Pretest post-test control group design
2. Post-test only control group design
3. Solomon four-group design
4. Factorial design
5. Randomized block design
6. Cross over design
7. Parallel Group or Cluster-Randomized Trials (CRTs)
8. Stepped wedge cluster randomized trial
9. Matching samples designs
10. Latin square design

BOX 8.2 Symbols used in experimental designs

- R: Random allocation to the groups
- O: Observation or measurements
- E: Experimental group
- C: Control group
- X: Exposure of the group to the experimental variable (Intervention)

These have been elaborated as follows. All the experimental designs are shown diagrammatically using certain symbols. This method was developed by Campbell and Stanley (1966). These symbols are shown in Box 8.2.

1. **Pretest post-test control group design:** This design uses a control group to determine whether the treatment/intervention makes a difference. This design has a control group, intervention, pretest and post-test. This is also known as classic experimental design. In this design, subjects are randomly assigned to either the experimental or control group. Following the pretest in both the groups, the treatment is carried out on experimental group only. After treatment, observation of dependent variable is made in both the groups to examine the effect of the manipulation of independent variable, i.e., the intervention on dependent variable. This design can be presented as shown in Figure 8.6.

The schematic presentation of the pretest post-test control group design has been presented in Figure 8.7. The schematic representation of the design will be used henceforth to illustrate the research design.

For example, “A study on the effect of an orientation program on the anxiety level of patients undergoing radiotherapy for first time” (Harpreet et al. 2014).

The patients were randomly assigned into intervention and control groups by computer generated randomization. In intervention group, orientation program was used as an intervention for the patients before they underwent radiotherapy. However, in control group, routine care was provided. Anxiety was

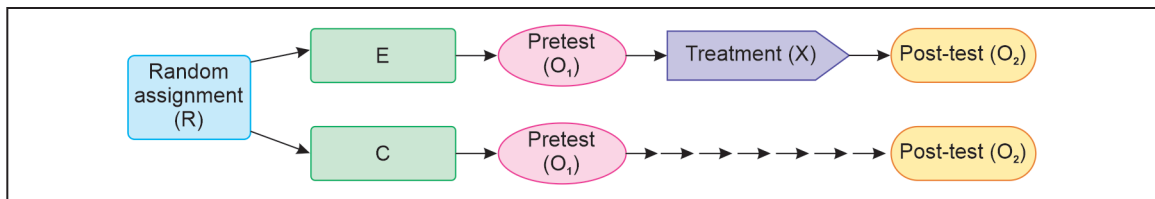


Figure 8.6: Pretest post-test control group design

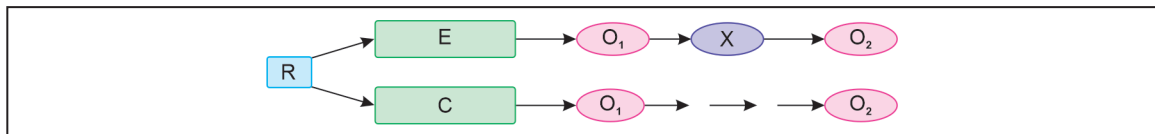


Figure 8.7: Schematic presentation of pretest post-test control group design

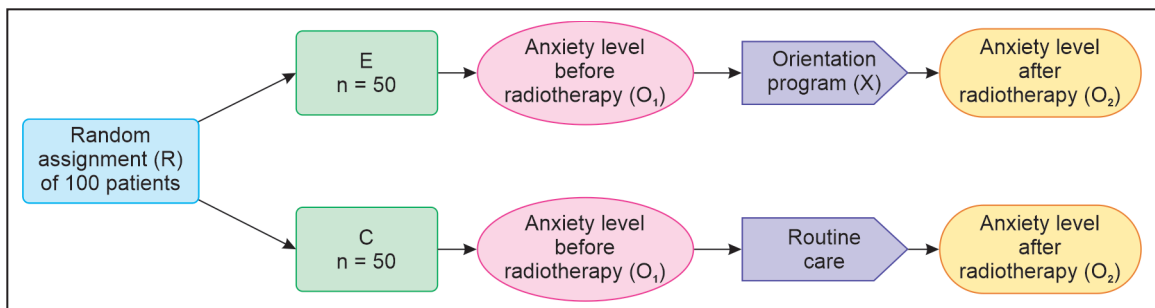


Figure 8.8: Schematic diagram of pretest post-test control group design

assessed in both the groups, before and immediate after radiotherapy using a 4-point, seventeen items anxiety assessment scale. Figure 8.8 illustrates the above study with a schematic diagram.

2. **Post-test only control group design (Fig. 8.9):** This design is often used in situations when a pretest of the subjects is not possible or desirable. It is composed of two randomly assigned groups - experimental and control groups. Both the groups are not tested before the introduction of an intervention. The treatment is implemented in the experimental group only. Post-test observations are made in both the groups.

Example 1: To study the effect of abdominal massage on bowel movements among patients diagnosed with postoperative constipation.

Example 2: To study the effect of negative pressure wound therapy for surgical wounds on wound healing by primary closure.

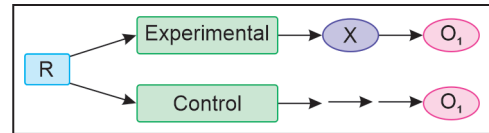


Figure 8.9: Post-test only control design

In both above examples, pretesting is not possible, so post-test only design is appropriate to test the effectiveness of the intervention.

3. **Solomon four-group design (Fig. 8.10):** Solomon four-group design is a hybrid research design which is formed by combining the features of the pretest post-test design and the post-test only design.

As the name suggests, the Solomon four group design has four groups: two experimental groups and two control groups. One control and experimental group undergoes pretest and post-test and another control and experimental group undergoes only post-test. Participants are randomly assigned to one of the four following groups.

1. Experimental group-I with pretest and post-test assessment
2. Experimental group-II with only post-test assessment
3. Control group-I with pretest and post-test assessment
4. Control group-II with post-test only assessment

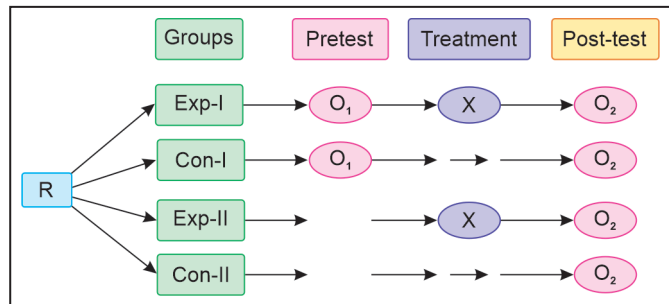


Figure 8.10: Schematic diagram of Solomon four-group design

It is illustrated as follows:

Only the participants in Experimental group-I and Experimental group-II receive the intervention/treatment. Participants in Experimental group-I and Control group-I receive pretest and post-test, whereas participants in Experimental group-II and Control group-II receive only post-test. The outcome (dependent variable) is assessed simultaneously across all the four groups.

The Solomon four-group design has a distinct advantage of controlling threat to both the internal validity (cause-and-effect relationship) and external validity (generalizability). This design was developed to control threats to internal validity such as bias and confounders and external validity such as pretest sensitization or reactive effect which is not controlled by a standard pretest post-test control group design.

For example, in a study to assess the effectiveness of a tobacco cessation program among young adults, introduction of pretest may sensitize the participants and make them more responsive to the tobacco cessation program. However, the study results are meant to be generalized to the general population who have not received any pretest. So, the effect of intervention (tobacco cessation program) on the general population will be different than the one found in the study. This leads to poor generalizability of the

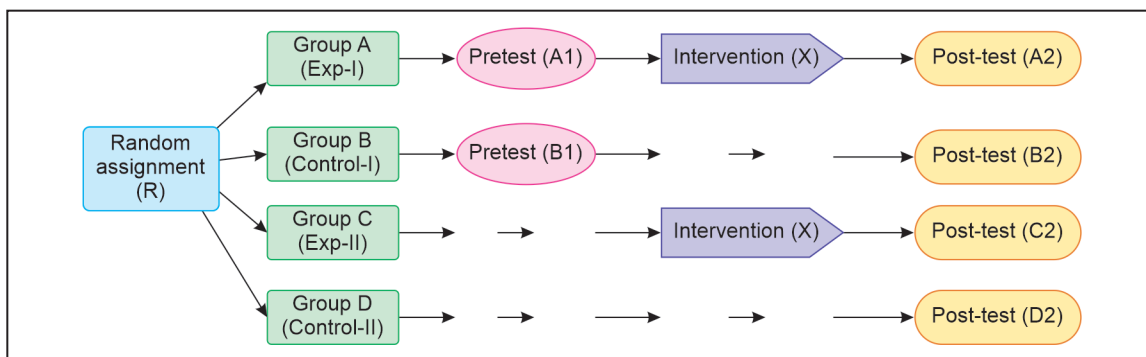


Figure 8.11: Solomon four group design

study findings. Solomon four-group design controls the threat to external validity by determining the pretest effect on the outcome.

The following example is used to explain how the Solomon four-group design compares the result. Groups named as A and C are experimental groups; B and D are control groups (Fig. 8.11).

The pretest sensitivity or reactive effect is assessed in three steps:

Step 1: The difference between A2 and C2 = the effect of pretest on the post-test in the presence of intervention. The difference between A2 and C2 determines the interaction effect of pretest on the intervention. If A2 and C2 differ significantly, it means that the pretest had an effect on the intervention and that the experiment is flawed (lacks generalizability).

Step 2: The difference between B2 and D2 determines the effect of the pretest on the post-test independently (without intervention). If B2 and D2 differ significantly, it means the pretesting has influenced the post-test (lacks internal validity).

Step 3: Compare the result of step 1 and step 2 (i.e., difference between A2-C2 and B2-D2). A difference between quantities of step 1 and step 2 means that the effect of the pretest on the post-test is different in presence of intervention, i.e. there is an interaction between pretest and intervention.

Solomon four-group design is one of the benchmarks in sociological and educational research. This design can be effectively used in nursing education research studies to control the pretest sensitivity, but unfortunately, it is less commonly used because of the need for larger sample size and complex statistical analysis methods.

Example, Chang et al. (2014) 21 conducted an RCT to assess the effect of an asynchronous e-learning curriculum on the knowledge level of medical residents. The Solomon four-group design was used. Block randomization was done to assign each participant to any of the four groups. The group A received the pretest followed by access to the e-learning modules which was followed by the post-test. While group B was pretested at beginning of rotation and post-tested at end without receiving any access to e-learning module. The group C was given access to e-learning and post-test was done, however, pretesting was not done. Lastly, group D was post-tested only, there was neither pretest nor intervention. The results of the study revealed no pretest sensitization while use of e-learning modules improved the knowledge significantly.

4. **Factorial design:** Factorial design involves measuring the effect of two or more independent variables on a dependent variable. In other words, the researcher manipulates two or more independent variables simultaneously to observe their effects on the dependent variables. This design is particularly useful when there are more than two independent variables to be tested.

For example, a researcher wants to test the effectiveness of two psychosocial therapies and two pharmacological interventions on tobacco cessation amongst tobacco users. In this example, we have two factors: Type of psychosocial therapy and type of pharmacological therapy.

Factor 1 (psychosocial intervention): Two levels—Brief intervention (α_1) and motivational counseling (α_2)

Factor 2 (Pharmacological intervention): Two levels—nicotine gum (β_1) and nicotine patch (β_2).

There will be four cells to which the subjects will be randomly assigned. This is called 2×2 factorial design because there are two factors with two levels of treatment (Fig. 8.12). Data is collected for all possible combinations of the levels of two factors of interest. For example, participants assigned to the $\alpha_1\beta_1$ cell (Fig. 8.12) will receive brief intervention and nicotine gum therapy.

Type of pharmacological therapy	Type of psychosocial therapy	
	Brief intervention (β_1)	Motivational counseling (β_2)
Nicotine gum (α_1)	$\alpha_1\beta_1$	$\alpha_1\beta_2$
Nicotine patch (α_2)	$\alpha_2\beta_1$	$\alpha_2\beta_2$

Figure 8.12: Factorial design

Figure 8.12 depicts a 2×2 factorial design for the above example which can help the researcher to test multiple hypotheses, by manipulating more than one independent variable. In this study, the subjects shall be assigned to one of the four arms:

- The first group ($\alpha_1 \beta_1$) will receive nicotine gum and brief intervention.
- The second group ($\alpha_1 \beta_2$) will receive nicotine gum with motivational counseling.
- The third group ($\alpha_2 \beta_1$) will receive nicotine patch with brief intervention.
- The fourth group ($\alpha_2 \beta_2$) will receive nicotine patch with motivational counseling.

The researcher shall test various research questions with this design:

- Is nicotine gum beneficial in tobacco cessation than nicotine patch?
- Is brief intervention more effective than motivational counseling in tobacco cessation?
- Is brief intervention with nicotine gum effective in tobacco cessation compared to brief intervention with nicotine patch?
- Is the motivational counseling with nicotine gum effective in tobacco cessation compared to motivational counseling with nicotine patch?

Thus, the design shall test the main effect of using a nicotine gum and nicotine patch—the main effect of the type of counseling used. The superiority of the design lies in the fact that it shall assess the interaction effects of type of pharmacological therapy and type of psychosocial therapy used.

- Randomized block design:** This is a simple method to reduce the variability among the treatment groups by a more homogeneous combination of the subjects through randomized block design. Randomized block design divides study participants into groups or blocks (subgroups) of equal size based on certain characteristics, and then randomly assigns the treatment to participants in each block. Randomized block design is used to block the effect of an uninterested variable (confounding variable) on the outcome variable, e.g., male and female. This is particularly useful method to control confounding variables when the sample size is small because if the subjects are allocated randomly using simple randomization without using randomized block design, then there is high probability that the confounding variable (gender) gets unevenly distributed among treatment groups.

Example 1: A researcher wants to study the effectiveness of a physical training program on activities of daily living among dementia patients. The physical capability varies between male and female gender

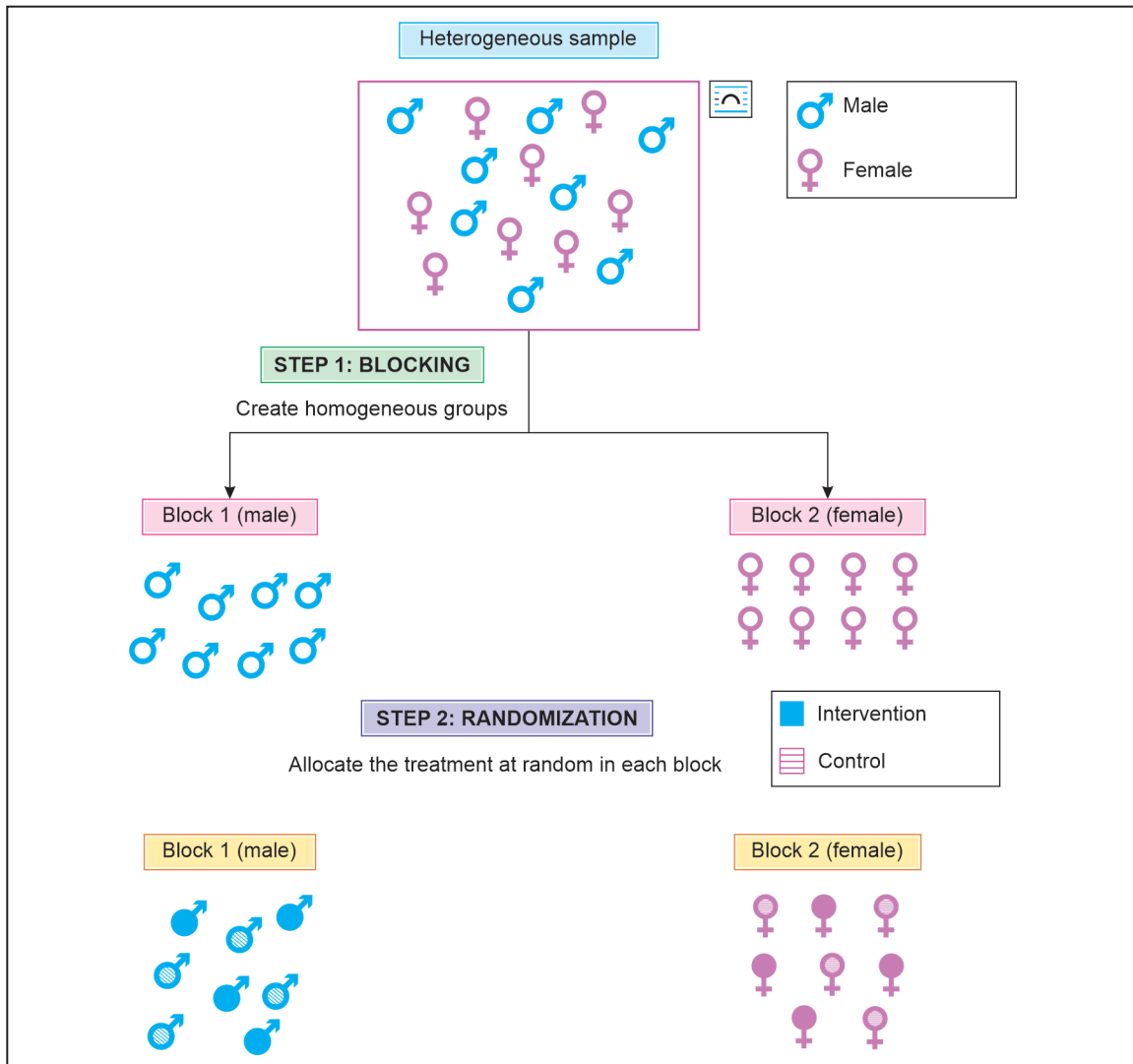


Figure 8.13: Steps of randomized block design (Example 1)

which may affect the outcome of the study. So, the researcher decides to create blocks based on gender to control its effect on outcome variable. The participants are divided into blocks of male and female and then the treatment (physical training program) is allocated randomly within each block (Fig. 8.13).

Example 2: A researcher wants to study the effectiveness of two different massage therapies (massage with kinesthetic stimulation vs massage therapy alone) on weight gain in preterm infants. In this example, the gestational age of preterm babies varies to a great extent which may influence the outcome. So, the researcher decides to divide the preterm infants to blocks (subgroups) based on gestational age: 27–29 weeks, 30–32 weeks and 33–35 weeks. Here, the gestational age is the blocking variable. Then, the intervention (massage with kinesthetic stimulation or massage therapy alone) is randomly allocated to the infants within each block (Fig. 8.14).

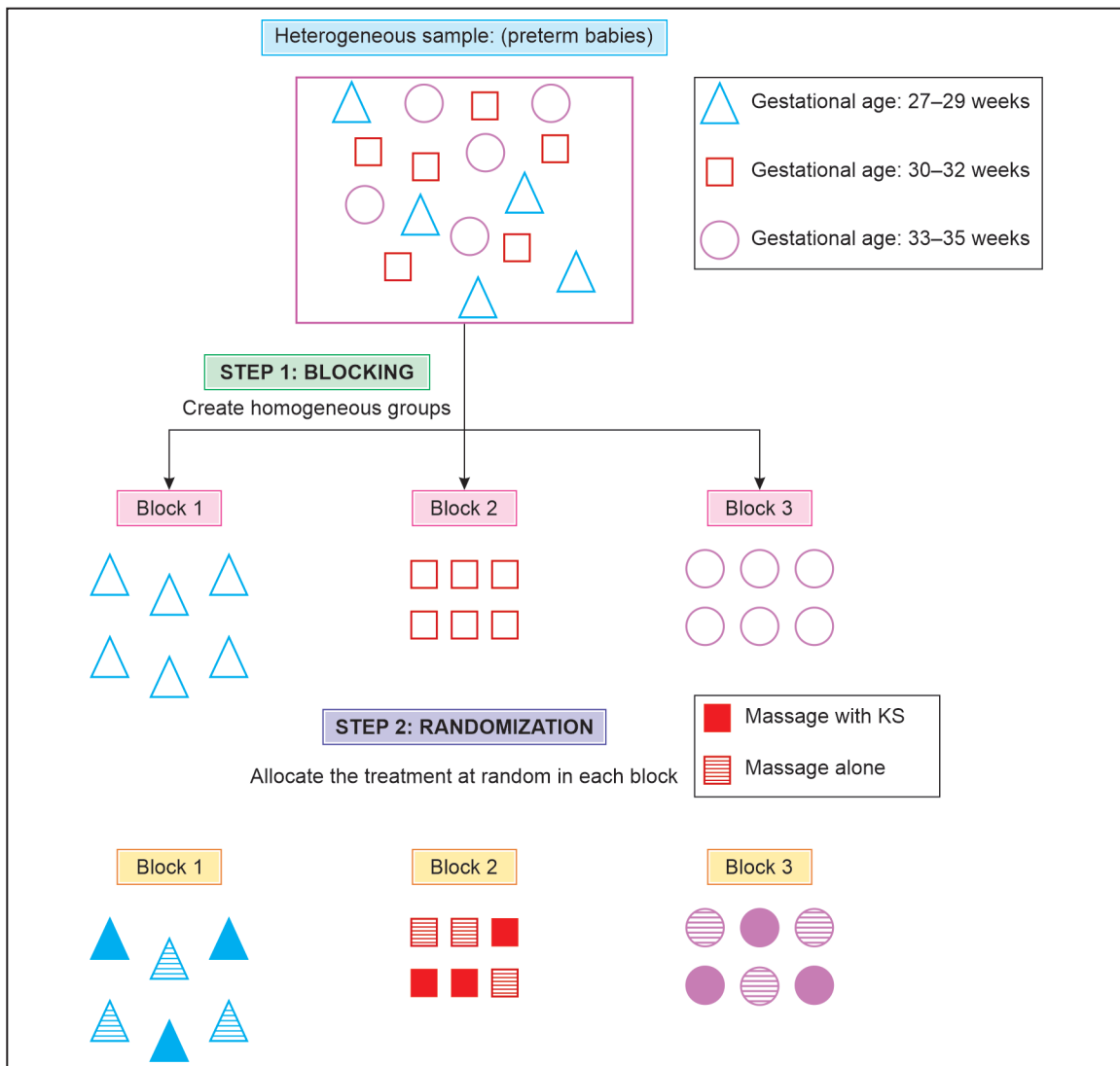


Figure 8.14: Steps of randomized block design (Example 2)

6. **Cross over design:** It is also known as counterbalanced/repeated measure design. In cross over design, the study participants are exposed to more than one treatment. The study subjects receive different interventions during the different time period (phases). Here, the subjects cross over from one intervention to another intervention during the course of the research, so that the subjects serve as their own control. In other words, control is achieved by assigning all subjects into all treatments. This design is more efficient in establishing the highest possible similarity among subjects exposed to different conditions where groups compared obviously have equal distribution of characteristics. Sometimes this design is not effective because when subjects are exposed to two different conditions, their responses of the second condition may be influenced by their experience in the first condition, a phenomenon known as carryover effect. So, a washout period (a time between two interventions) may be necessary until the effect of the first treatment subsides.

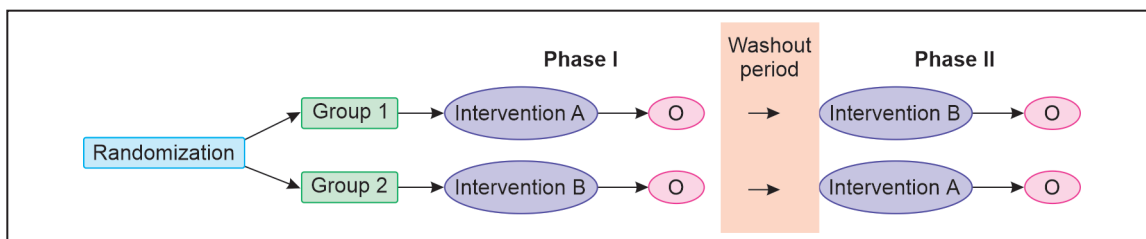


Figure 8.15: Presentation of cross over design

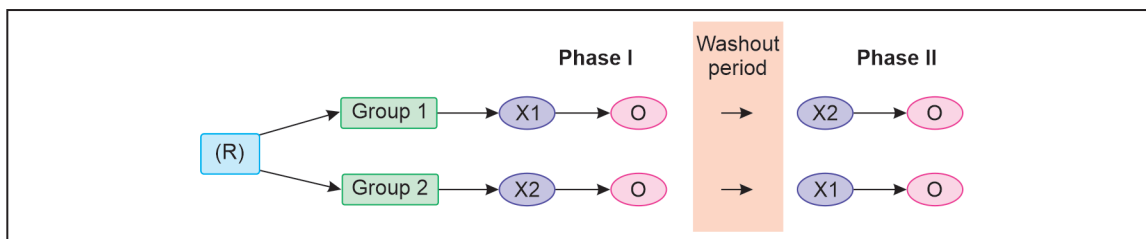


Figure 8.16: Schematic presentation of cross over design

This design can be presented as shown in Figures 8.15 and 8.16.

For example, a study was carried out to assess the effect of music therapy on level of anxiety, intensity of pain perception and opioid demand, at the time of dressing change among burn patients. A cross over design was employed. The subjects in the Group 1 were assigned into the control group during their first dressing change which was assessed on the first day. Then, the same subjects formed the experimental group on the third day during their next dressing change. Conversely, the subjects in Group 2 were assigned into experimental conditions on the first day and control on the third at the time of dressing change. Assessment of level of anxiety, intensity of pain perception and opioid demand during dressing change among the study subjects was carried out during both the controlled and experimental observations.

In certain textbooks the cross over design has been discussed under quasi experimental design. However, it should be included in the true experimental research designs, because the three requisites of an experimental design, i.e., manipulation, control and randomization, are being fulfilled in this design.

7. **Parallel group or cluster-randomized trials (CRTs):** This is one of the commonly used designs in public health. The units of assignment (cluster) can be hospitals, wards, schools, workplaces, or entire communities, with patients, students, or employees as the unit of observation. The entire cluster is randomized into either control or experimental group. This design is appropriate when the intervention is delivered in a group setting, involves manipulation of the social or physical environment, or cannot be delivered to individual participants without risk of contamination. Although it is not commonly used in nursing research at the moment, there is great potential in conducting parallel Cluster-Randomized Trials (CRTs) because the focus of interest in nursing research is often a group of patients or a larger community; and educational interventions are easy to implement at group level than individual level. It is also useful in testing newly developed nursing care protocols at different settings.

For example, a researcher wants to study the effect of educational intervention on quality of life of elderly living in old age homes. Here, it is difficult to deliver the intervention at individual level and there is a chance of contamination effect. So, each old age home enrolled in the study is a cluster (unit) and the clusters are randomly assigned to either control or experimental group. All the consented old age home

Clusters	Baseline	Phase 1	Phase 2	Phase 3	Phase 4
Cluster 1	Control	Intervention	Intervention	Intervention	Intervention
Cluster 2	Control	Control	Intervention	Intervention	Intervention
Cluster 3	Control	Control	Control	Intervention	Intervention
Cluster 4	Control	Control	Control	Control	Intervention

 Intervention
  Control

Figure 8.17: Schematic presentation of stepped wedge cluster randomized trial

residents are the unit of observation. However, the power and generalizability of the CRTs are lower than that of individually randomized trials.

8. **Stepped wedge cluster-randomized trial:** The stepped wedge cluster randomized trial is a new study design that is increasingly being used to evaluate care delivery interventions. During the initial phase of the study, the clusters are not exposed to the intervention. Following that, one cluster (or a group of clusters) is randomly crossed from control to intervention group. This process is repeated until all the clusters move into intervention group. Each cluster is observed in control as well as experimental conditions which provides better comparisons. This design may be used effectively in nursing research to evaluate the effect of newly introduced care protocols, infection control protocols where multiple settings can be involved in the trial as clusters. This design can be presented as shown in Figure 8.17.
9. **Matching samples designs:** In this design, the researcher attempts to match the subjects in both the experimental and control groups. The various characteristics/variables for matching could be age, gender, height, weight, etc. or could be any one as per the type of proposed research study. A major problem with this design is that the investigator needs to have a large pool of sample to match both the experimental and control groups as per the selected variables.

For example, a male participant can be matched with another male. While matching age, it can further reduce the sample size. Eventually, the sample size will be further reduced while matching both the groups as per the selected variables. Thus, we need to have fairly large sample size to allocate treatment using matching samples.

10. **Latin square design:** Latin square design allows the researcher to control two blocking variables simultaneously. In other words, this design controls two sources of nuisance factors. Latin square is an arrangement of 'n' elements in a $n \times n$ square array in a way that each symbol occurs once in each row and each column (Fig. 8.18). Similarly, in latin square design each treatment/intervention is employed once in each row and each column.

		Columns			
Rows	A	B	C	D	
	B	D	A	C	
	C	A	D	B	
	D	C	B	A	

Figure 8.18: Latin square (4 × 4)

In this design, the number of treatments is equal to the number of rows and columns, so that it create a latin square. This provides an opportunity to employ each of the treatment in each column and each row. This design is primarily used in agriculture research where the plots are divided into $n \times n$ squares (latin square) and plants are tested for yields in each plot. This ensures that each variety of seed is planted



in each row and each column in order to control the variability of the soil in the field such as direction, moisture, etc.

This design can be used in nursing and health care research. For example, a public health nurse wanted to test the effectiveness of four different high-protein diet plans on weight gain of malnourished children. Here, the children are divided into four different appetite categories and four different weight categories (4×4). The four different high-protein diets are labelled as A, B, C and D. This design can be illustrated as shown in Figure 8.19.

In this example, each category of children receives each type of diet once because each of the diet plan is employed once in each column and each row. This design provides an opportunity to the researcher to control the effect of two nuisance factors (i.e., baseline weight and appetite) on the outcome variable (weight gain).

		Appetite category			
Weight category		1	2	3	4
	i	A	B	C	D
	ii	B	D	A	C
	iii	C	A	D	B
	iv	D	C	B	A

Figure 8.19: Latin square design (4×4)

Advantages of experimental research design:

- Experimental research designs are the most powerful methods to establish the causal relationship between variables.
- These designs provide the highest quality evidence regarding the effects of specific interventions.
- There is better extent of purity in observation as the study is conducted under controlled environment.
- Conditions that are not found in natural setting can be created in experimental setting in a short period of time that may take years to naturally occur (therefore very useful in genetic studies).
- Because the study is carried out in experimental setting, the problems of real life situations and the personal problems of the researcher are eliminated.
- The environment in which the research takes place can often be carefully controlled. Thus, it is easier to estimate the true effect of the variable of interest on the outcome of interest.

Disadvantages of experimental research design: Though there are number of benefits of experimental research design, it has certain limitations also. These are:

- Sometimes, there could be a problem if the subjects themselves have the discretion about participation in the treatment.
- If the experiment is conducted in the lab, and the intervention is being carried out by the person other than the researcher himself, then it may be difficult to determine that if the subjects in the experimental group have actually received the intervention.
- In experimental studies conducted in natural settings like a hospital or community, it may not be possible to impose control over extraneous variables.
- Experiments are often more impractical when the effect of independent variable may require a lengthy period of time before it can emerge as a response on the criterion measures.
- It is very difficult to obtain permission from the participants.
- Because the size of the sample is kept small especially studies involving humans, the representativeness of the findings of such study is questionable.
- Experimental situation may not relate to the real world.
- It may be unethical or impossible to randomly assign people to group, e.g., deliberately depriving the children off the sleep.

Quasi-experimental Research Designs

Quasi-experimental designs can be used when a researcher cannot design a true experimental study because of certain constraints like selection of subjects or the study settings. It is also known as nonrandomized controlled trial in biomedical research. In Latin, the word quasi means “almost”. These designs are so called because they do not meet the standards set for experimental groups.

In Quasi-experimental designs, there is always manipulation of the independent variable to observe the effects on the dependent variables but lacks the key element: Randomization. In the absence of random assignment, it is not possible to control the extraneous variables in an experiment. Most of the nursing research are of Quasi-experimental research because it is more feasible, practical, less expensive and sometimes randomization deemed unethical (e.g., effectiveness of hand hygiene).

The various types of Quasi-experimental designs include:

1. Nonrandomized (nonequivalent) control group design
 2. Nonequivalent control group post-test only design
 3. Time series design (interrupted time series design)
 4. Time series nonequivalent control group design
 5. Time series with multiple institution of treatment
 6. Time series with intensified treatment, and
 7. Time series with withdrawn and reinstituted treatment
1. **Nonrandomized (nonequivalent) control group design:** The nonrandomized control group design and the nonequivalent control group design are similar. This design is similar to the pretest post-test control group design except that there is no randomization. The study participants are allotted to either experimental or control group without randomization. Hence, the control group is known as nonequivalent control group. First, the pretest assessment of dependent variable is carried out in both the groups. Then the experimental group receives intervention/treatment. The control group will not receive any intervention or receive some alternative intervention (placebo or routine care). Later, post-test assessment is carried out on both the groups. This is the most common design of the quasi-experimental research design especially in nursing research. This design is presented as shown in Figure 8.20.

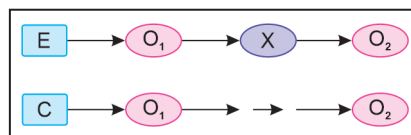


Figure 8.20: Nonrandomized (nonequivalent) control group design

For example, Hye-Ju Lee et al. (2021) conducted a Quasi nonequivalent control group study to investigate the effect of the comprehensive oral care program on oral health status and symptoms in head and neck cancer (HNC) patients undergoing radiotherapy. As randomization was not possible, the researcher assigned 61 study participants into control (30) and experimental group (31) without randomization. Baseline oral health and quality of life was assessed in both groups. Both groups were given oral health education at baseline, immediate postradiotherapy, 3 months and 6 months after radiotherapy. In addition, the experimental group received fluoride varnish application and fluoride mouth rinsing. The oral health and QoL was again assessed after 6 months of radiotherapy in both the groups.

In the above example, there was a manipulation but no randomization or control. However, the researcher tried to compensate the absence of randomization and control by giving oral health education to both the groups to achieve some equivalence between groups.

2. **Nonequivalent control group post-test only design:** Nonequivalent control group post-test only design is similar to the nonequivalent control group pretest/post-test design except that it has only post-test. There is no pretest. Thus, any difference between the two groups prior to the study is not known. This is also called the static group comparison study. This design is particularly useful in situation where neither randomization nor pretesting is possible. For example, a study on effectiveness of Hydrogel dressings on wound management of burn injuries. This design can be schematically presented as shown in Figure 8.21.

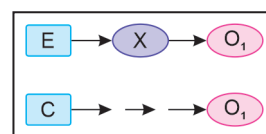


Figure 8.21: Post-test only design

3. **Time series design:** Time series designs are also referred as the trend designs in which repeated observations are made on dependent variable before and after the treatment on one group of subjects. This is also known as *interrupted time series design*. A time series design is one in which the researcher makes several measurements both before and after the intervention. This helps to measure any variation in the data that is dependent on time, so that the maturation effect is controlled.

Firstly, time series design effectively rules out the threat of maturation, testing and regression. Maturation is ruled out as it is imperative to assume that the maturational changes are gradual, not abrupt and sporadic. Secondly, if there are any testing effects, they would be evident in the initial set of observations which are made before the true intervention is performed. Thirdly, like the testing effects the regression to mean effect shall also come into sight in initial set of observations. This design is diagrammed as depicted in Figure 8.22.

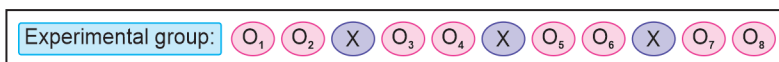


Figure 8.22: Time series design

O_1 to O_4 are the four preintervention data collection on four different instances, X represents the intervention and O_5 to O_8 represent the postintervention observations.

Let us take the example of “effect of an education intervention on the indices of asthma morbidity (number of hospitalizations, number of emergency visits, number of asthma attack, etc.) amongst the patients suffering with bronchial asthma. After establishing the diagnosis, we can follow up the patients on monthly basis and can have four observations. This will be followed by implementation of the educational intervention. Again, these enrolled patients can be followed up over a period of time. On each visit, the outcome variable (the indices of asthma morbidity) can be recorded.

4. **Time series nonequivalent control group design:** The researcher also has an option of keeping a control group concurrent to an experimental group, thus employing a time series with nonequivalent control group design. It is the combination of time series design and the nonequivalent control group design. This design is shown in Figure 8.23.

This can be explained by the above said example on asthma by having another group as control in which there will be no intervention, however, the frequency of the follow-up visits will be same in both the groups.

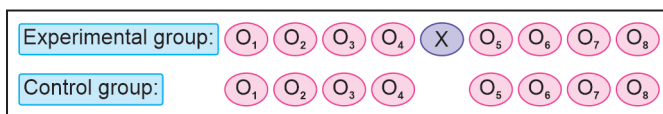


Figure 8.23: Time series nonequivalent control group design

For example, Lai et al. studied the effectiveness of a ‘Facebook-assisted teaching method’ on knowledge and attitudes about ‘Cervical cancer prevention and human papillomavirus (HPV) vaccination intention’ among female adolescent students. The quasi-experimental time series design was used in the study. Participants were recruited using purposive sampling into control group and an experimental group followed by pretesting three times O_1 , O_2 and O_3 over a period of time. Thereafter, both the groups were delivered lecture, on cancer prevention. The experimental group received 6 hours facebook-assisted discussion sessions while control group had in person discussions after class. The post-tests (O_4 , O_5 and O_6) was conducted on both the groups over a period of time. Time series is the only design to furnish a continuous record of fluctuations in the experimental variables over the entire course of the program.

5. **Time series with multiple institution of treatment:** Time series with multiple institution of treatment is a type of quasi-experimental design in which the investigator implements intervention multiple times in between a series of observations. For example, in previously mentioned study on effectiveness of educational program on the indices of asthma morbidity, the multiple institutions of the intervention could be educating the patients after every two follow ups (Fig. 8.24).

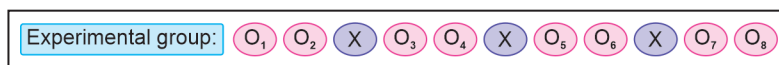


Figure 8.24: Schematic diagram for time series with multiple institution of treatment

6. **Time series with intensified treatment:** Time series with intensified treatment design involves strengthening of the intervention overtime. In other words, the intervention will be intensified as the study progresses. For example, a researcher wanted to study the effect of tactile stimulation on the growth and development of neonates. The researcher may start with tactile stimulation for 5 minutes a day and increases the duration to 10 minutes and 15 minutes as the study proceeds. This helps the researcher to assess the dose response relationship (Fig. 8.25).

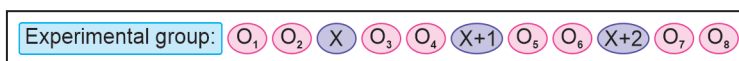


Figure 8.25: Schematic diagram for time series with intensified treatment

In another example, a researcher intends to study the impact of a new drug on glycemic control among diabetic patients. Two readings of HbA1c are taken before initiating a drug, then two readings after initiating a drug. Now the researcher increases the dose and further makes two sets of observations and thereafter a further dose is increased, and observations are made.

7. **Time series with withdrawn and reinstituted treatment:** Time series with withdrawn and reinstituted treatment design involves instituting the intervention at one point of time and then withdrawing the intervention at a later point, again with reinstitution of the intervention. This enables the researcher to observe the changes in dependent variable when the intervention is withdrawn and reintroduce again after some time period (Fig. 8.26).

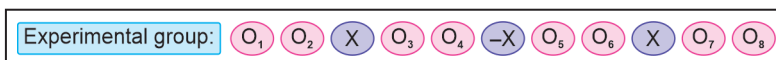


Figure 8.26: Time series with withdrawn and reinstituted treatment

For example, in a study to assess the effectiveness of a App-based personal coach on weight reduction, two observations on weight are made prior to the intervention, then the intervention is introduced and two more observations on weight are made. Thereafter, the App-based personal coach is withdrawn and further two observations are made. And lastly, the intervention is reintroduced again and observations are made post intervention.

Advantages of quasi-experimental research design:

- Most practical and feasible research design especially in nursing.
- Less expensive and time consuming than true experimental studies.
- Involves real world problems and practicable solutions for the problems.
- Resources needed for experimentation are also reduced.
- Enables comparison with other groups.

Disadvantages of quasi-experimental research design:

- It provides comparatively weaker evidence of cause-and-effect relationship.
- There is no control over the confounding variables so that there is a threat to the internal validity
- Due to no randomization, there is high risk for selection bias which affects the study outcome.
- There is no mechanism to prevent researchers' personal bias get involved in the study.
- Unexpected factors might affect the results.

Pre-experimental Research Designs

Pre-experimental research designs are weak in structure and control. In fact, these designs have little value and are not considered rigorous enough for the purpose of a study. The two common types of pre-experimental research designs are (1) One shot Case Study and, (2) One Group Pretest-Post.

1. **One shot case study:** In this design, there is no pretest, the subjects are given some type of intervention, and then the post-test is conducted. Like all other experimental designs, the goal is to determine if the intervention had any effect on the outcome. Without a comparison group, it is impossible to determine if the outcome scores are any higher than they would have been without the treatment. And, without any pretests scores, it is impossible to determine if any change within the group itself has taken place (Fig. 8.27).
2. **One group pretest/post-test design:** It is one of the simplest types of quasi-experimental research design. It measures what has happened to the experimental group based on the way it was before the start of the intervention (pretest state) and the differences achieved at the end of the intervention. (Fig. 8.28). It is very weak design as there is no control group neither there is any randomization. An example of pretest/post-test design is as follows:

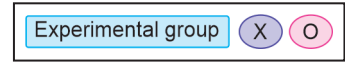


Figure 8.27: One shot case study



Figure 8.28: One group pretest/post design

Example: One group pretest/post-test design

"A quasi-experimental study was conducted to assess the effect of 'foot massage and reflexology' on physiological parameters, i.e., systolic and diastolic blood pressure, heart rate and oxygen saturation of critically ill patients in intensive care units. 60 patients were enrolled in the study. A protocol on the procedure of 'foot massage and reflexology' was developed. An observation checklist was used to record the various parameters. Controlled observations for all the physiological parameters under study were recorded for the first 3 days in the morning as well as in the evening hours with the total of six observations. Then, for the next 3 days, the procedure of 'foot massage and reflexology' was implemented on the same patients. All the physiological parameters were recorded just before and after the implementation of protocol on each day in the morning as well as in the evening hours".

In this study, the random assignment of the subjects is missing.

Nonexperimental Research Designs

Nonexperimental research designs are purely observational, and the results are descriptive. The researcher gathers data as it naturally occurs and explains the phenomena exactly as it is. The variables are neither manipulated nor controlled. The researcher is a passive agent who observes, measures, and describes a phenomenon as it occurs or exists.

Much of the research that has been done in nursing domain is nonexperimental because of difficulty in controlling the variables in humans. Another reason to use nonexperimental research is that in some cases, it is unethical to randomly assign individuals to different exposures. For example, if we want to study the health effects of smoking, it will not be ethical to randomly assign individuals to either a smoking or a nonsmoking group. The better and ethical way to conduct such study with a group of smokers and a group of nonsmokers is to compare the current health status between both the groups or follow both the groups to study long-term effects of smoking on health.

Data gathered and analyzed from nonexperimental studies help in hypothesis formulation which can be tested using true experimental designs. For example, nonexperimental studies establishing that there is a relationship between playing video games and aggressive behavior can be complemented by experimental studies to test the causal relationship between the two variables.

Table 8.8 Classification of nonexperimental—quantitative study based on objective

Types of study	Description
Descriptive	This study design is used to describe a phenomenon or documents its characteristics; focuses on what is happening, or how much of it has happened, rather than why it is happening.
Predictive (correlational)	This study design is used to predict the variable of interest using information from other variables (called predictors).
Explanatory	This study design is used to explain how some phenomenon works or why it operates and explores causal relationships between variables.
Classification based on time dimension	
Retrospective	Looks back in time. Data collected are used to make comparisons between the past and the present for the cases in the data set, e.g., case control study.
Cross-sectional	Looks at a single point in time or relatively brief time. The data collected are directly applied to each case at that single time period and comparisons are made across the variables of interest, e.g., correlational study and surveys, etc.
Prospective or longitudinal study	Looks at more than one time point; data collected makes comparisons across time, e.g., cohort studies and panel studies.

Nonexperimental studies may be classified based on either the objective of the study or the time frame of the data collection (Table 8.8).

Classification based on time dimension could be seen as answers to the following questions: Were the data collected at a single time point in the present, or in the future, or were already existing data explored? You can think of them as representing the past (retrospective), present (cross-sectional), and future (prospective) with respect to timing of data collection. Furthermore, if we combine the two classifications, the time dimension studies can be utilized according to the primary research objective (Table 8.9).

Descriptive Studies

The descriptive studies attempt to describe the characteristics of a population, a phenomenon, situation or a problem under study. Descriptive studies are usually concerned with describing the population with respect to important variables like how prevalent the phenomenon is, how often the phenomenon does occur, and what are the characteristics of the phenomenon, etc. In this type of research study, the researchers observe, count, describe, and classify the phenomenon under study.

Key features of descriptive studies:

- No manipulation of variables involved in descriptive studies. It just reports the phenomena as it occurs in a natural setting.

Table 8.9 Types of study obtained after crossing research objective and time dimension study design

Research design	Retrospective	Cross-sectional	Prospective
Descriptive	Retrospective, descriptive study	Cross-sectional, descriptive study	Prospective, descriptive study
Predictive	Retrospective, predictive study	Cross-sectional, predictive study	Prospective, predictive study
Explanatory	Retrospective, explanatory study	Cross-sectional, explanatory study	Prospective explanatory study

- Descriptive studies are designed to gather more information about a field of enquiry.
- Descriptive studies provide an accurate interpretation of characteristics of a particular individual situation, or group.
- Descriptive studies are a means of discovering new meaning, describing what exists, determining the frequency with which something occurs and categorize the information.
- Descriptive studies provide information for protocol development for nursing practices and theory development.
- Data gathered and analyzed in descriptive studies generate hypothesis which can open the door for experimental studies.

Descriptive Designs

There are two basic descriptive designs:

1. Univariate descriptive design
 - Cross-sectional descriptive study
 - Longitudinal descriptive study
2. Comparative descriptive design

Univariate descriptive design

- **Cross-sectional descriptive study:** It is also called the prevalence study or the one-shot study. This is the simplest form of an observational study. In these types of studies, the data is gathered from the subjects at one point of time, the result of which are generalized to the whole of the population provided the sampling has been done through probability sampling method. They are designed to look at how things are now, without any sense of whether there is a history or trend at work. An example of cross-sectional study is as follows:

Example: Cross-sectional study

“A cross-sectional study was undertaken to estimate the point prevalence of bed sore and to assess the functional dependence in the activities of daily life amongst the admitted patients in a tertiary care hospital. 751 patients were studied from various units of the hospital. Ten percent (74) patients were found to be having bed sore in different stages. Mean age (years) of the patients was 40.39 ± 19.38 years. Most (86.5%) of the patients were admitted through emergency. Maximum patients (33.3%) with bed sore were from neurosurgical ward and orthopedic unit (30%). Sacrum was the most common site of development of bed sores for all the four stages; 16% patients had more than one ulcer. It was concluded that ten percent prevalence of bed sore indicates the need to improve the quality of care in the hospital.”

- **Longitudinal descriptive study:** The longitudinal studies involve data collection at multiple points of time, i.e., data are collected from the same subjects at different points of times. It is also known as prospective study, incidence study, forward looking study. Longitudinal studies may take the form of a Trend study, i.e., it looks at population characteristics overtime, e.g., the absenteeism rates amongst the health care workers can be studied during the course of a year. Similarly, a follow-up study can be conducted to assess the level of empathy amongst the nursing students from the start till the end of training period. The data may be collected at the end of each completion year of the training.
Longitudinal studies are more difficult to organize and conduct and are more time consuming than the cross-sectional studies. There could be overlapping of longitudinal studies and the prospective/cohort study because of the nature of both the types of studies.

Comparative descriptive study: Comparative descriptive study design describes variation groups in a population without any manipulation. The primary goal of these designs is to compare two or more groups on a selected variable of interest. For example, knowledge regarding home management of diarrhea among rural

and urban mothers of under five children. Here, the rural and urban mothers form a group and the knowledge regarding home management of diarrhea is compared between these groups.

Types of Cross-Sectional Research Designs

There are other types of cross-sectional research design namely correlational research, survey design, and exploratory design.

1. **Correlational research:** Correlational research is a type of nonexperimental research in which the researcher measures two variables and assesses the statistical relationship (i.e., the correlation) between them. The defining feature of correlational research is that the two variables are measured—neither one is manipulated. The direction and strength of the association or relationship between two variables are determined through correlational studies.

For example, we want to study the relationship between weight and blood cholesterol levels. We measure weight and cholesterol levels in each individual and then perform a statistical test to measure the strength and direction of the linear relationship or correlation between the two variables. The strength of the association is measured by a statistical measure called correlation coefficient.

The **direction** of a relationship between two factors is stated as being positive or negative. The **strength** of a relationship between two factors is described by the value of the correlation coefficient r , with values closer to $r = \pm 1.0$ indicating a stronger relationship between two factors. The value of the correlation coefficient ranges from -1 to $+1$. The negative values represent negative correlation while positive values signify a positive correlation.

+1.00 = Perfect positive correlation

0.00 = No relationship

-1.00 = Perfect negative correlation

The direction and strength of correlation can be readily identified in a graph called a **scatterplot**. To construct a scatterplot, we plot each pair of values, called data points along X and Y-axis, to see whether a pattern emerges. A positive correlation means that the values of one factor move along with the values of the second factor in the same direction, i.e., with an increase in the value of the first factor, values of the second factor also increase and vice versa. A negative correlation indicates that the values of two factors, change in opposite directions, meaning that as values of one factor increase, values of the second factor decrease (Fig. 8.29).

The most commonly used formula for computing r is the Pearson correlation coefficient, which is used to determine the strength and direction of the relationship between two factors on an interval or a ratio scale of measurement.

Example: Suppose you want to look at the correlation between two variables namely distance to the health facility and time taken to initiate tuberculosis treatment. We, therefore, carry out a study to record both the variables in a sample of respondents. Then we calculate the correlation coefficient to study the relationship between the two variables and plot a scatterplot to demonstrate the relationship (Fig. 8.30).

2. **Survey design:** It is one of the most commonly used nonexperimental research designs to describe a population of interest by administering a survey or questionnaire to the participants. Survey design involves the collection of information from a sample of individuals through their responses to questions, which can be administered face to face, through e-mails, telephone calls, internet, etc. A survey or a

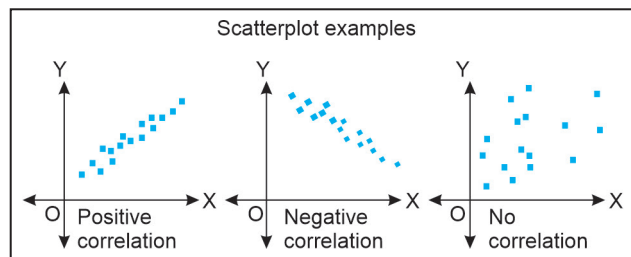


Figure 8.29: Scatter plots showing correlation

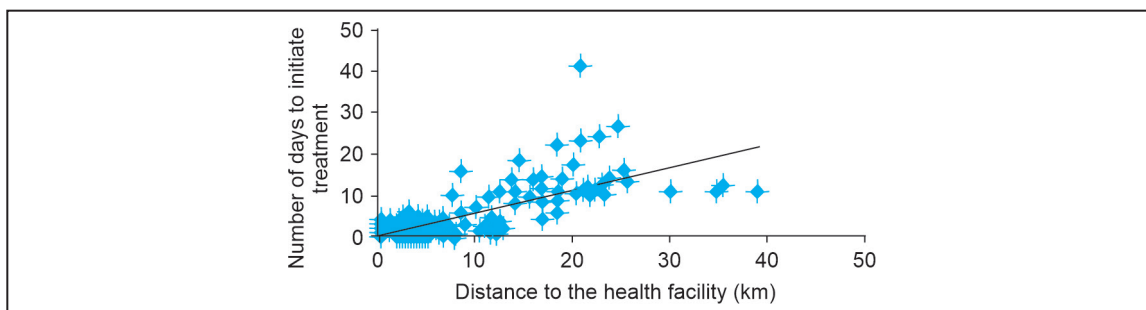


Figure 8.30: Correlation between distance to health facility and number of days to initiate tuberculosis treatment

questionnaire is a common measurement tool used in the behavioral sciences and public health. Surveys are efficient because many variables can be measured without substantially increasing the time or cost. Survey studies may be descriptive, comparative, explorative or correlational. There are three types of questions or statements that can be included in a survey: open-ended items, partially open-ended items, and restricted items (This is explained in detail in Chapter 10).

Main features of survey research:

- Survey research involves collecting data from a predefined group of respondents to collect information and gain insights into various topics of interest.
- Survey research provides information to make critical decisions on policy making.
- Survey research is generally cost effective and easy to conduct.
- Survey research has the flexibility to conduct either through face-to-face interview, telephonically, via email or using online forms, example, Survey monkey, google forms, etc.
- It facilitates gather data from large and diversified sample in short time.

Characteristics of a good survey research project:

- A specific research question and objective.
- Carefully designed and well written questions with appropriate response options.
- A well-designed and implemented representative sampling method.

Risk of errors in survey design:

For a survey to give out appropriate results, it must minimize the risk of two types of error:

1. **Errors of observation:** Poor measurement of cases that are surveyed.
2. **Errors of nonobservation:** Omission of cases that should be surveyed. There are three sources of errors of nonobservation:
 - i. Inadequate coverage of the population due to a poor sampling frame.
 - ii. The process of random sampling can result in sampling error.
 - iii. Non-response: When individuals refuse to respond or cannot be contacted because they might have some common characteristics related to the research question.

Some examples of surveys include: National Family Health Survey (NFHS), District Level Household Survey, Coverage Evaluation Survey, Global Adult Tobacco Survey, etc.

The NFHS is a nationally representative household survey. Four rounds of the survey have been conducted since the first survey in 1992–93. The latest survey was conducted in 2015–16. The survey provides state and national information for India on various sociodemographic and health indicators such as infant and child mortality, the practice of family planning, maternal and child health, reproductive health, nutrition, anemia, utilization and quality of health and family planning services. These national

surveys were carried out to provide essential data on health and family welfare to the Ministry of Health and Family Welfare and other agencies for policy making and program purposes and to provide information on important emerging health issues and its sociodemographic correlates.

3. **Exploratory research design:** Exploratory research design is used to investigate a problem or phenomena that is not clearly defined. It is conducted for the purpose of better understanding of the existing problem. Exploratory studies are primarily qualitative as they are often conducted with open-ended questions to understand the phenomena. However, it is also being conducted in quantitative forms using standardized scales. For example, Patra BN et al., has conducted an exploratory study on self-stigma in patients with major depressive disorder. The stigma of the depressed patients was assessed using the stigma, the Discrimination and Stigma Scale -12.

Types of Longitudinal or Follow-up Studies

Cohort Study: Cohort study is a particular form of longitudinal study that takes cohort (which shares defining characteristics) as a sample. It is a type of epidemiological study in which, the researcher selects a group of exposed individuals and a group of unexposed individuals in a nonrandom manner, from a study population, which is initially disease free. After the selection, both groups are followed to compare the incidence of the disease. If a positive association exists between the exposure and the disease, we expect the incidence of disease in the exposed group to be greater than the incidence of disease in the unexposed group.

There are two types of cohort studies: prospective and retrospective (or historical) cohorts. Prospective cohort studies follow a cohort into the future for a health outcome (Fig. 8.31). Retrospective cohort studies track the cohort back in time for exposure information after the disease/outcome has occurred (Fig. 8.32). Both types of cohort studies are also known as longitudinal or follow-up studies (Table 8.10).

Example: Suppose we want to study the association between levels of physical activity and coronary artery disease (CAD) (Table 8.11). We defined a cohort, measured the levels of physical activity (exposure) in the population and divided the population into two groups based on the levels of physical activity into low and high levels. Among the cohort, some developed CAD while some did not develop the disease.

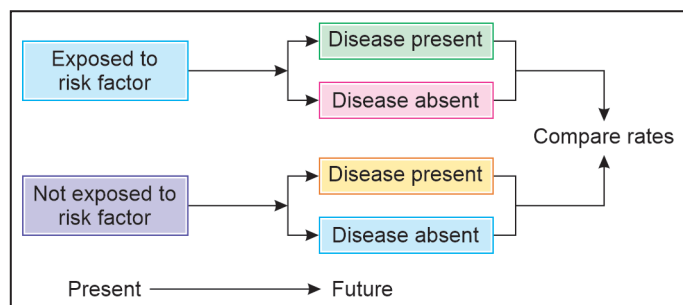


Figure 8.31: Schematic presentation of prospective cohort study design

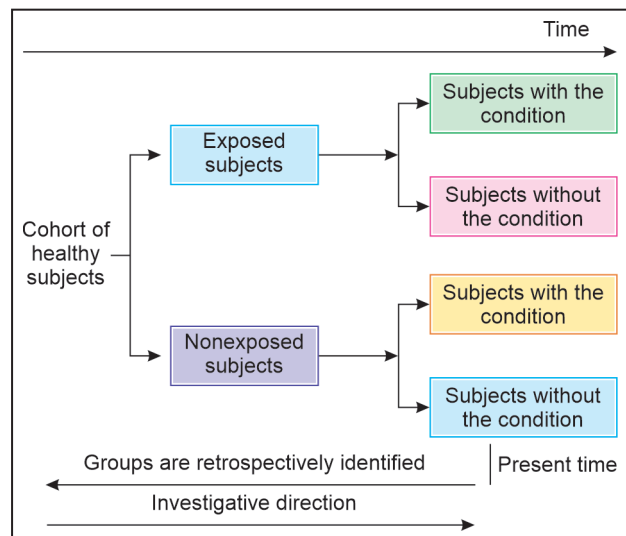


Figure 8.32: Schematic presentation of retrospective cohort study design

Table 8.10 Cohort study design

The observed data will be tabulated as follows to calculate incidence rate and risk ratio.

	Cases (with disease)	Controls (without disease)	Total
Exposed	a	b	a + b
Not exposed	c	d	c + d

a – exposed and developed disease

b – exposed and not developed disease

c – not exposed and developed disease

d – not exposed and not developed disease

Incidence of disease in exposed (proportions are those at risk) = $a/(a + b)$

Incidence of disease in unexposed (proportions of those at risk) = $c/(c + d)$

Risk ratio is defined as the ratio of the risk of developing disease in the exposed group to the risk of developing disease in the unexposed group.

$$\text{Risk ratio} = \frac{a/(a + b)}{c/(c + d)}$$

Table 8.11 Cohort design to study the association between levels of physical activity and coronary artery disease (CAD)

Levels	Developed CAD	Did not develop CAD	Total
Low levels of physical activity	84	2916	3000
High levels of physical activity	87	6913	7000

The proportion of exposed (low levels of physical activity) who developed CAD is 84/3000. The proportion of the diseased (CAD) among unexposed (high levels of physical activity) is 87/7000. Accordingly, we see that proportion of CAD in exposed was higher than the proportion of the diseased among unexposed.

Incidence of CAD in exposed (proportions are those at risk) = $84/3000 = 0.028$

Incidence of disease in unexposed (proportions of those at risk) = $87/7000 = 0.012$

$$\text{Risk ratio} = \frac{0.028}{0.012} = 2.33$$

Interpretation: A risk ratio greater than 1.0 indicates a positive association, or increased risk for developing a disease. Risk ratio 2.33 means the exposed group (low levels of physical activity) has 2.33 times the risk of having CAD compared to the unexposed (high levels of physical activity).

Potential biases in a cohort study

Bias in assessment of outcome: If the person who is assessing the outcome is aware of the exposure status of the subject and the hypothesis being tested, then he may be biased in judging the disease or outcome status. This problem can be addressed by masking the person who is carrying out the outcome assessment to the exposure status of the subjects. Method of assessing the outcome (such as investigation to diagnose a disease) can also introduce bias in the study.

Biases from nonresponse and loss to follow up: Loss to follow up can be a serious problem in a prospective study.

Retrospective or Case-Control Study Design

Retrospective (Retro = looking at the past) or a case control study design means to start from a disease or outcome in the present and going back in time to link it with a presumed cause or exposure in the past.

Research direction is backward in time. Data is collected through record reviews or asking subjects about the information exposure, behavior or instances which occurred in the past that will explain the research question or hypothesis. To understand further, suppose we need to assess the relationship between the exposure and a disease, a group of subjects with disease or outcome (cases) and another group of subjects without the disease or outcome (controls) are selected. Then we determine the proportion of cases and controls who were exposed and what proportion were not (Fig. 8.33).

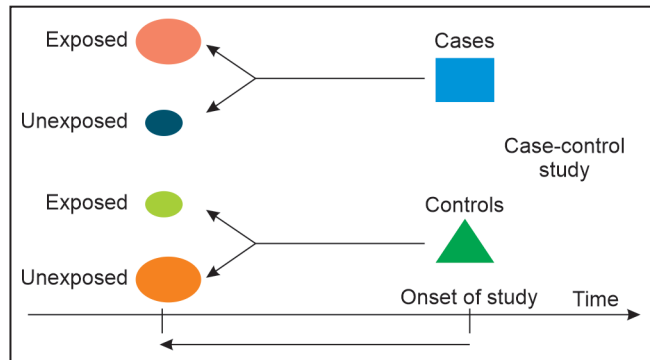


Figure 8.33: Schematic diagram of case-control study

Table 8.12 shows a hypothetical scenario of a case-control study.

Selection of cases: Cases can be selected from a variety of sources, including hospital patients, clinics, etc. If cases are selected from a single hospital or clinic, risk factors or exposure identified might be unique to that hospital because of referral patterns or other factors thus raising the issue of generalizability. If the study is carried out in a tertiary hospital only, then the risk factors identified might be related to severely ill patients only.

Selection of controls: Controls may be selected from the community or from the hospital. In hospitals, they may be selected among patients admitted for diseases other than the disease of interest in the study. In community, controls may be selected from several sources such as voter list, school rosters, resident in the neighborhood sometimes referred to as “neighborhood controls”. An alternate method for selecting controls is to use random digit dialing. Another approach for control selection is the “best friend control” in which, the case is asked about the name of a best friend who is likely to participate in the study. Such a control may likely to be similar to the case in age and other demographic and social characteristics. For the studies conducted on genetics, spouse or sibling controls can be used.

Example: 100 patients were screened for lung cancer who visited hospital for lung-related disease. 20 patients were found to have developed lung cancer (cases) and 80 patients had no lung cancer (controls). Now, the clinicians collected data regarding the smoking history and the data is placed in the Table 8.13.

Proportion of exposed cases = $15/20 = 0.75$

Proportion of exposed controls = $30/80 = 0.38$

Table 8.12 Case control design

	Cases (with disease)	Controls (without disease)
Exposed	a	b
Not exposed	c	d
Proportion of exposed	$a/(a + c)$	$b/(b + d)$

a – Cases who were exposed to risk factor

b – Controls who were exposed to risk factor

c – Cases who were not exposed to risk factor

d – Controls who were not exposed to risk factor

We expect the proportion of cases who were exposed, i.e., $a/(a + c)$, to be greater than the proportion of the controls who were exposed, i.e., $b/(b + d)$

Table 8.13 Example of a case control design

	Cases (Lung cancer)	Controls (No lung cancer)
Exposed (smoker)	15	30
Not exposed (non-smoker)	5	50

Risk ratio is defined as the ratio of the risk of developing disease in the exposed group to the risk of developing disease in the unexposed group.

$$\begin{aligned}\text{Odds ratio (OR)} &= (a \times d) / (c \times b) \\ &= (15 \times 50) / (5 \times 30) \\ &= 5\end{aligned}$$

Interpretation: The odds ratio indicates how much higher the odds of exposure are among case-patients than among controls. In this example, the OR = 5 means the odds of being a smoker (exposure) were 5 times higher among cancer patients (cases).

Potential Biases in a Case Control Study

In a case-control study, exposure assessment errors can arise from three common sources of bias:

- **Recall bias:** The exposure and outcome have already occurred in case control study. So, there is a possibility of differential reporting of exposure information between cases and controls based on their disease status.
- **Observer bias:** The investigator's awareness of whether a participant is a case or a control may inadvertently affect the collection and interpretation of exposure data, introducing bias into the study.
- **Selection Bias:** Selection bias is a possibility as inherent in case-control studies, where it gives rise to noncomparability between cases and controls.

Note: Retrospective cohort studies are NOT the same as case-control studies. The retrospective cohort study inspects individuals by their exposure status (from the past to present). But case control study inspects individuals by outcome/ disease status (present to past).

Table 8.14 shows major differences between a cohort and case-control study.

Table 8.14 Comparison between prospective and retrospective study designs

Characteristics	Prospective cohort study	Retrospective or case-control study
Outcome measurements	Incidence of diseased among exposed and incidence of diseased among nonexposed	Proportion of cases exposed, and proportion of controls exposed
Measures of risk	Relative risk	Odds ratio
Temporal relationship	Easy to establish	Hard to establish
Multiple associations	Possible to study associations of an exposure with multiple diseases	Possible to study associations of a disease with several exposures
Time required	Takes a long time because of the need to follow-up subjects	Relatively short
Cost	Expensive	Relatively inexpensive
Potential bias	Outcome assessment bias; follow-up bias	Exposure assessment bias
Best, if applied for issue	Rare 'exposures'	Rare diseases

Panel study: Panel study is a type of longitudinal study in which the study population is followed regularly at specified intervals over a long period, often many years. The key feature of panel studies is that they collect repeated measures of the same set of variables from the same sample at different points in time. A panel study collects data from the same person overtime, thereby providing the best form of research design for determining temporal association, i.e., **cause and effect in time**. However, a panel study is difficult and expensive to implement due to attrition with each wave of data collected from the panel of subjects.

Other Types of Research Design

There are certain research designs which do not come under experimental, Quasi-experimental or nonexperimental research designs. These are discussed under, “Other types of research designs”. These include formative research, operational research, methodological research, meta-analysis, evaluation mixed method research and outcome research.

Formative Research

Formative research uses quantitative and qualitative methods to provide information for the researchers to plan and implement interventional programs. Formative research can be an effective means of obtaining an information when particular information for planning that study is unavailable from the literature or the investigator’s experience. Formative research is conducted before an intervention is developed or implemented to collect detailed information about the people for whom, and the context in which, interventions will be designed as given in the following example:

Example: Formative research

Gittelsohn et al. (1998) has developed a school obesity prevention program for American Indians’. The study used formative research to develop the program. Paired child interviews, child food sorting interviews, focus groups and interview with caregivers, focus groups with teachers, interviews with teachers and food service workers, and direct observation methods were used to obtain information from the target population and the stakeholder involved. The formative research helped the researchers to identify a set of priority behaviors as the primary focus of the intervention strategy, appropriate foods for intervention and educational approaches. The developed program found to be effective and demonstrated positive changes in dietary and cognitive behavior.

Formative research outcome helps to develop the interventions which are:

- Specific to the needs of the target population
- Culturally and geographically appropriate
- Acceptable to the target population
- Feasible to implement
- Helps in improving the relationship between clients and agencies.

Formative research has its roots in applied anthropology, sociology, social marketing, and educational psychology. It can be applied at all levels of behavioral interventions, whether clinic based (individual or group interventions), school based, community based, or population based. In conclusion, the formative research is an information gathering process to develop acceptable interventional programs which are specific and appropriate to the need of the people.

Operational Research (OR)

Operational research is different from clinical and epidemiological research. Operational research is a systematic approach to solve problems. From a health program perspective, operational research is defined as the search for strategies and interventions that enhance the quality and effectiveness of the program. C W Churchman who is considered one of the pioneers of operational research defined it as, “The application of scientific methods, techniques and tools to problems involving the operations of a system so as to provide those in control of the system with optimum solutions to problems.”

A global meeting held in Geneva to develop the framework of OR, defined the scope of OR in context to public health as, “Any research producing practically usable knowledge (evidence, or finding) which can improve program implementation regardless of the type of research falls within the boundaries of OR.

The procedure to be followed in the operational research, generally involves the following major phases:

- Formulating the problem
- Constructing an intervention
- Operationalizing the intervention
- Testing the intervention and its solution (updating the model)
- Finally implementing the intervention

An example of OR is as follows:

Example: Operational research in oncology nursing

“Nurses are involved both in the preparation and administration of chemotherapy drugs. While preparing or administering cytotoxic drugs, there are possibilities of spillage, which pose exposure not only to the person handling the drugs but also to others in the unit. To prevent this exposure, “Chemotherapy Spill Kit (CSK)” has been recommended by all leading oncology nursing agencies. In the current study, operationalization of ‘CSK’ was done to assess its use among nurses employed in chemotherapy administration areas at a tertiary care hospital for one month. The study was conducted in four phases:

1. **Preparation phase** in which kit consisting of two parts—**personal protection part** and **spill management part** was prepared.
2. **Information dissemination and demonstration phase** in which the nurses were demonstrated the use of CSK.
3. **Placement phase** in which Kit was placed in all the research settings for use.
4. **Observation phase** in which the subjects were observed for the usage of ‘CSK’.

Twenty two subjects posted in the chemotherapy administration areas were observed for one month. All the subjects used personal protection part of the kit and 17 subjects who experienced spills, used spill management part also. Total 43 small cytotoxic spillages were experienced. Various problems expressed with the personal protection part of ‘CSK’ were, feeling suffocation with use of mask, feeling hot with disposable cap and all goggle users had problems of headache and blurred vision with goggles. Subjects who used spill management part expressed difficulty in using dissecting forceps and also verbalized that spill cleaning is time consuming. However, as the usage of the ‘CSK’ progressed among the subjects, the satisfaction to the usage of various parts of ‘CSK’ increased significantly from follow-up 1 to follow-up 2 ($p < .0001$). Hence, the usage of ‘CSK’ was recommended while chemotherapy administration.”

Methodological research: Any study that describes or analyzes methods (design, conduct, analysis, or reporting) in published or unpublished literature is methodological research. The objective of the methodological research is to describe or analyze methods in primary and secondary studies.



The scope of methodological research is broad and includes topics as diverse as:

- Research question formation
- Research instrument/questionnaire development and standardization
- Adherence to reporting guidelines
- Consistency in reporting
- Approaches to study analyzes
- Investigating the credibility of analyzes

However, in nursing research, the term methodological research is often used in exchange with tool development and standardization studies. It is concerned with the development, testing, and evaluation of research instruments, and interventions, etc. This type of research study is conducted in various phases.

Phase 1: Preparation phase: Preparing the preliminary draft of the tool based on literature review.

Phase 2: Validation phase (face and content validity): Selection of Delphi panel (Modifications as per suggestions).

Phase 3: Checking feasibility.

Phase 4: Checking the psychometric properties of the tool.

Phase 5: Final draft of the tool.

An example of methodological research study is shown as follows:

Example of methodological research study in nursing

- A study was carried out to develop a 'Nursing Checklist' for receiving patients in ICUs of a tertiary care hospital.
- Using methodological study design, the study was carried out in total five phases.
 - i. **1st phase**, a blueprint of the checklist was prepared after identifying the needs and an exhaustive review of literature.
 - ii. **2nd phase**, face and content validity of the nursing checklist was established with Delphi technique.
 - iii. **3rd phase**, feasibility of the checklist was checked by conducting a pilot study
 - iv. **4th phase**, checklist was implemented on 30 subjects in ICUs of a tertiary care hospital.
 - v. **Final draft** of the Nursing checklist had 12 main steps with 105 items. The checklist was found to be feasible after conducting pilot study. Statistical analysis revealed that the checklist is valid and reliable, and it can be applied in daily practice and in the clinical research context.

Systematic Review and Meta-Analysis

Systematic review and meta-analysis are a type of research study that combines the results of multiple previous studies to get a more comprehensive understanding of a specific topic. In a systematic review, the researchers identify and assess all relevant studies on a particular topic using a systematic and transparent process. A systematic review is a comprehensive and systematic summary of the existing research on a specific topic, using a predefined protocol to identify, select, and critically appraise relevant studies.

A meta-analysis is a type of systematic review that uses statistical methods to combine the results of multiple studies to provide a more precise estimate of the overall effect of a specific intervention or treatment. So, while all meta-analyzes are systematic reviews, but not all systematic reviews involve a meta-analysis. These studies are useful for providing a high level of evidence in support of a particular intervention or treatment (Fig. 8.34).

Meta-Analysis

Meta-analysis is a statistical method used to synthesize and summarize the results of multiple independent studies on a specific topic to answer research question. It involves combining and analyzing the data from several studies to estimate a pooled effect size and to identify sources of variability and heterogeneity among the studies. Meta-analyses are commonly used in nursing research to synthesize the results of multiple studies on a specific topic and to generate more robust and reliable evidence for practice.

For example, in a meta-analysis to evaluate the effectiveness of a specific patient education intervention on blood glucose control in patients with type 2 diabetes, the researcher would collect data from multiple studies that have investigated the similar intervention, and would pool and analyze the data to estimate the overall effect of the intervention on blood glucose control. The meta-analysis would also identify sources of variability in the results across the different studies, such as differences in patient populations, study designs, and intervention delivery methods. This information can provide insights into the best practices for patient education interventions in diabetes care and help to inform clinical decision making.

The steps involved in conducting a meta-analysis are as follows:

1. **Formulate a clear research question:** Define a specific research question that will guide the selection of studies to be included in the meta-analysis. The PICO (patient/population, intervention, comparison, and outcome) framework (Box 8.3) is used to help identify the key elements of a clinical question and to facilitate the development of a focused and well-defined research question.

Example: What is the effect of a multidisciplinary care intervention on patient outcomes in hospitalized older adults? (The same example is used to explain the remaining steps of meta-analysis).

2. **Conduct a comprehensive literature search:** Search multiple databases and relevant sources to identify all eligible studies that address the research question.

Example: Search multiple databases, such as CINAHL, PubMed, and Cochrane Library, to identify all eligible studies that have investigated the effect of a multidisciplinary care intervention on patient outcomes in hospitalized older adults.

3. **Study selection:** Evaluate the eligibility of each study based on predefined inclusion and exclusion criteria and select the studies to be included in the meta-analysis. PRISMA (preferred reporting items for systematic reviews and meta-analyses) framework provides standard guidelines for selection of studies.

Example: Evaluate the eligibility of each study based on inclusion criteria such as: (a) Randomized controlled trials, (b) Patients over 65 years of age, and (c) Studies conducted in a hospital setting. Exclusion criteria could include: (a) Studies not conducted in English, (b) Studies with <50 participants, and (c) Studies that did not use a multidisciplinary care intervention.

4. **Data extraction:** Extract relevant data from each included study, including sample size, effect size, and other relevant statistics.

Example: Extract relevant data from each eligible study, including sample size, patient outcomes (such as length of hospital stay and readmission rates), and other relevant statistics.

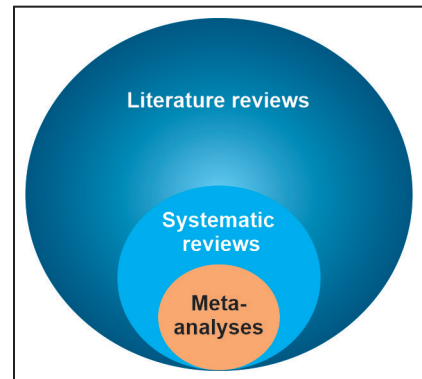


Figure 8.34: Literature review, systematic review and meta-analysis: a comparison

- Quality assessment:** Assess the quality of each included study to determine the risk of bias and to identify any potential sources of heterogeneity.
Example: Assess the quality of each eligible study using tools such as the Cochrane Risk of Bias tool to determine the risk of bias and to identify any potential sources of heterogeneity.
- Data synthesis:** Combine the data from each study to calculate a weighted average effect size and to test for heterogeneity among the studies.
Example: Combine the data from each study to calculate a weighted average effect size, and to test for heterogeneity among the studies using a random-effects model.
- Interpretation of results:** Interpret the results of meta-analysis, including the overall effect size, variability among studies, and any potential sources of heterogeneity.
Example: Interpret the results of meta-analysis, including the overall effect size of the multidisciplinary care intervention on patient outcomes, variability among studies, and any potential sources of heterogeneity.
- Draw conclusions and make recommendations:** Draw conclusions based on the results of the meta-analysis and make recommendations for future research and practice.
Example: Draw conclusions based on the results of meta-analysis, such as “the multidisciplinary care intervention is effective in reducing length of hospital stay and readmission rates in hospitalized older adults,” and make recommendations for future research and practice, such as “further research is needed to determine the optimal components of a multidisciplinary care intervention.”
- Report the findings:** Report the findings of the meta-analysis in a clear and concise manner, including a detailed description of the methods and results, and a critical appraisal of the limitations and strengths of the analysis. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (Box 8.3) provides a set of standardized guidelines for reporting the methods used in a meta-analysis, including selection of studies.
Example: Report the findings of the meta-analysis in a clear and concise manner, including a detailed description of the methods and results, a critical appraisal of the limitations and strengths of the analysis, and a discussion of the implications for nursing practice.

Forest plots: Forest plots are a commonly used visual representation of the results of a meta-analysis. The plot displays the results of each individual study, as well as, the combined results of the meta-analysis, and provides

BOX 8.3 PICO and PRISMA framework

PICO: Is a framework used to formulate a well-structured clinical research question. PICO stands for:

- **Patient/Population:** The group of individuals being studied.
- **Intervention:** The treatment, exposure, or exposure of interest.
- **Comparison:** The alternative to the intervention.
- **Outcome:** The end result or effect being studied.

The PICO framework is used to help identify the key elements of a clinical question and to facilitate the development of a focused and well-defined research question. By using the PICO framework, researchers can ensure that their research question is relevant, feasible, and likely to yield meaningful results.

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA): PRISMA is a reporting guideline for systematic reviews and meta-analyses. It provides a set of standardized items for reporting the methods and results of a meta-analysis, including the study selection process, data extraction and synthesis, and interpretation of results. The use of the PRISMA framework helps to increase the transparency and reproducibility of systematic reviews and meta-analyses.

a visual summary of the overall effect size and also the level of heterogeneity between studies. A forest plot typically includes the following elements:

- **Study IDs:** The IDs of each study included in the meta-analysis are listed on the left-hand side of the plot.
- **Effect size:** The effect size of each study is represented by a square, with the size of the square proportional to the weight of the study in the meta-analysis.
- **95% confidence interval (CI):** The 95% CI is represented by a horizontal line extending from the left and right sides of the square, with the length of the line representing the level of uncertainty around the effect size.
- **Combined effect size:** The combined effect size of the meta-analysis is represented by a diamond, with the size of the diamond proportional to the weight of the combined effect in the analysis.
- **Heterogeneity:** The level of heterogeneity between studies is represented by a horizontal line extending from the diamond, with the length of the line representing the level of variability in the results between studies. I-square (I^2) in a meta-analysis forest plot is a statistical measure used to assess the degree of heterogeneity or variability among the studies included in the analysis. It quantifies the proportion of total variation in study estimates that is due to the between-study differences, rather than chance. I-square values range from 0% to 100%.

I-square (I^2) Value	Interpretation
0%–25%	Low heterogeneity
25%–50%	Moderate heterogeneity
Over 50%	High heterogeneity

The forest plot provides a clear and visual representation of the results of the meta-analysis, allowing for easy interpretation of the overall effect size, the level of heterogeneity, and the distribution of results across studies. The plot is a valuable tool for summarizing the results of a meta-analysis and communicating the results to a wider audience.

Interpreting forest plot diagram: Interpreting a forest plot diagram in meta-analysis involves understanding the graphical representation of the study-specific effect sizes and their overall summary. For example, Figure 8.35 provides visual summary of meta-analysis that compared the effect of Diclofenac (treatment) and placebo therapy in pain.

- In this diagram, each row in the forest plot represents an individual study included in the meta-analysis.
- The vertical line at the center of the forest plot represents the line of no effect (null hypothesis). Effect sizes to the right of the line indicate a positive effect, while those to the left indicate a negative effect.
- Each study is represented by a point estimate, often a square or circle, positioned along the vertical axis.

Horizontal lines (error bars) extend from the point estimate, representing the confidence interval (CI) for the effect size in each study. The longer the line, the wider the CI, indicating greater uncertainty.

- The position of each study's point estimate (often represented by a square or circle) along the horizontal axis indicates the effect size of that study.
- At the bottom of the forest plot, there is often a diamond shape. The center of the diamond represents the overall or summary effect size across all studies. The width of the diamond indicates the confidence interval for the overall effect size. A wider diamond suggests greater uncertainty in the summary estimate.
- Some forest plots include a heterogeneity statistic, such as I^2 , which quantifies the percentage of variability across studies due to true heterogeneity rather than chance.

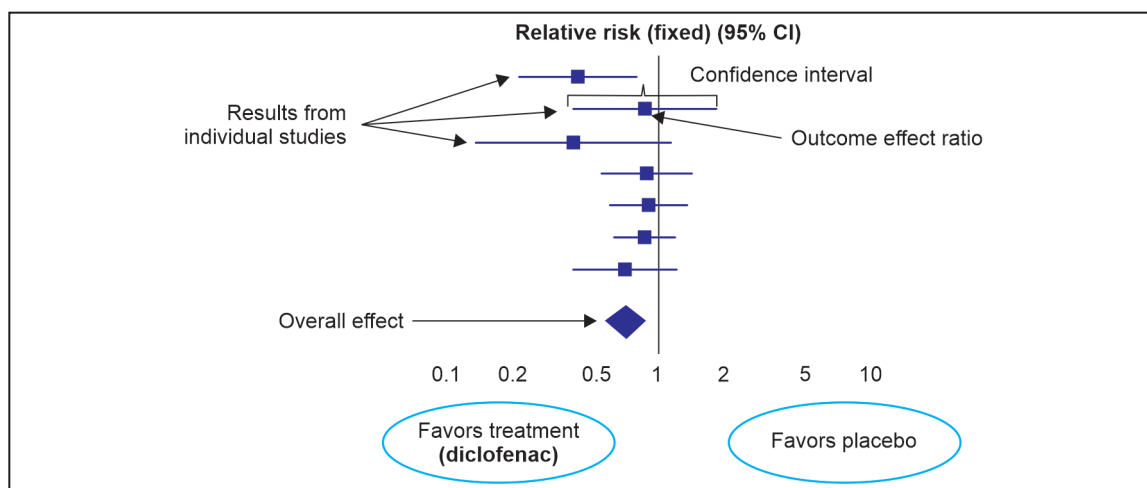


Figure 8.35: Forest plot diagram

Evaluation Research Design

It is also known as program evaluation. Evaluation research attempts to determine the overall effectiveness of a program or to know which part of a program are working well or to know how the participants are responding to the methods or conditions. In contrast with experimental research, generalizability is often not a priority for the evaluation research. Evaluation research provides essential data for decision making and helps to determine whether the intervention should be accepted, rejected, or modified in the given setting.

This is one of the common research methods used in nursing research, however, those studies are often classified as 'quasi-experimental or pre-experimental' categories instead of 'evaluation research'. For example, study to assess effectiveness of teaching module or structured education program, etc.

Some of the most common evaluation (research) questions are:

- Whether a program/intervention caused change in participants' or others' behavior, in physical or social conditions, health or development outcomes, or other indicators of success?
- What components of the program or intervention were responsible for the change?
- What are the inadvertent effects of an intervention, and how did they influence the outcomes?

An example of evaluation research in nursing is shown as follows:

Example: Evaluation research design

Study title: Effectiveness of a short-structured training program on knowledge of health care providers and program managers involved in Maternal and Child Health programmes in Odisha, India: A quality improvement study

Vikas Bhatia et al. evaluated the effectiveness of training program on knowledge related to new interventions proposed under India Newborn Action Plan (INAP) and Integrated Action Plan against Pneumonia and Diarrhea (IAPPD) among health care providers and program managers involved in MCH programmes. This quality improvement study used preevaluation and postevaluation design. The study was conducted in 17 districts of Odisha, India. Intervention was a short-structured (8 hours) training delivered to 127 batches with expected participation of 30 trainees in each batch. Study results revealed significant improvement in knowledge for majority of the components.

This is an example of a program evaluation study that attempted to determine the effectiveness of program on different domains of knowledge.

Outcome Research

Outcome research is a branch of public health research. It focuses on the end results of the health care services on the health and well-being of the people. It is concerned with the effectiveness of public-health interventions and health services. The outcome is frequently focused on the affected individual in terms of quality of life, cost-effectiveness, people's experiences, health status and disease burden, etc. The findings of outcome studies have a major impact on the provision of health care and the development of health policy. The nurse researchers should also understand the processes of outcome research while providing care to the patients.

Example of outcome research

Study Title: The effect of Self-Help Groups on access to maternal health services: evidence from rural India.

Saha S et al. analyzed the entire dataset from the third national District Level Household Survey from 601 districts in India to assess the impact of the presence of SHGs on maternal health service uptake. The primary predictor variable was presence of a SHG in the village and the outcome variables were: Institutional delivery; feeding newborns colostrum; knowledge about family planning methods; and ever used family planning. Study findings revealed that respondents from villages with a SHG were 19% more likely to have delivered in an institution, 8% more likely to have fed newborns colostrum, have knowledge and utilized family planning products and services. The study concludes that the presence of SHGs in a village is associated with higher knowledge of family planning and maternal health service uptake in rural India. The outcome of the study will be helpful for the policy makers in public health to improve maternal health services.

2. Qualitative Research Designs

The interest of qualitative research in the nursing discipline began in late 1970s. It is one of the data collection and interpretation methods in research studies. Quantitative research collects numerical data, while qualitative research collects verbatim. Qualitative research studies help us to understand the experience, attitude, behavior, belief, and interactions of people. In the initial time, it is used in the psychological studies when the researcher found it difficult to explain human behaviors in numerical form. It involves asking a broad question and collecting data in the form of words, images, video, etc. So, in qualitative research no numerical data is collected, but quotes of people are collected and then interpreted.

The objective of qualitative research is to obtain in depth insight of the situation that is being researched. Eg: asking the lived experiences of the patients who have been weaned off from the ventilator. The integration of qualitative and quantitative study is gaining more popularity across the disciplines as it strengthens the interventional studies by enhancing the user involvement.

In a nutshell qualitative research studies are useful for developing or expanding the existing knowledge and to study a new situation or phenomenon.

Features of Qualitative Research

Qualitative research has simultaneously evolved in several disciplines, with particular contribution from social sciences. It is more concerned with understanding why people behave as they do—their knowledge, attitudes, beliefs, fears, and so on. Some examples are as follows:

- Why is it that people continue to smoke when the evidence about its harmful effects are well known?
- Why do people not take the medicine prescribed for them even though they know it is good for their health?

When used along with quantitative methods, qualitative research can facilitate us to interpret and better understand a given situation.

The main features of qualitative research are depicted in Figure 8.36.

Exploratory: Exploration is the essential feature of qualitative research. Though it is primarily exploratory in nature, it can also offer explanations of certain phenomena or events. Qualitative research techniques intend to answer the questions about the 'what', 'how' or 'why' of a phenomenon rather than 'how many' or 'how much', which are answered by quantitative methods. The results are thus obtained in words, rather than numbers through qualitative data analysis. Qualitative research, hence, makes use of non-numeric information to explore attitudes and experiences of an individual or a group. Therefore, it produces findings that are not obtained by statistical procedures or other quantitative means.

Inductive: The inductive approach involves generating meaning from the data collected to identify patterns and the relationships amongst the concepts. In qualitative research the researcher is open to the ideas which comes out after collecting the information from the participants. The purpose of qualitative research is to develop concepts, generate hypothesis, develop theories rather than testing it.

Interactive: In qualitative research, there is a close interaction between the researcher and the participants. Intense researcher involvement is one of the features of qualitative study. The researchers sometimes become themselves the instrument of data collection.

Holistic: In qualitative research, there is a more emphasis on holistic description of the phenomenon under study. The participants can respond more elaborately and in greater details which help to understand whole about the phenomenon under study.

Flexible: Qualitative research designs are one of the most flexible research designs especially during the process of data collection. Using open-ended questions, participants are free to respond in their own words. These questions may not be worded in exactly the same way with each participant. The responses from the participants affect how and which questions to be asked next. So, there is a better comparison of the information amongst the participants.

Emergingt/evolving design: In qualitative studies there is no predetermined designs. Research designs emerge as data collection progresses.

Triangulation: Use of various methods of data collection or getting data from different sources are the features of qualitative research. This helps to get comprehensive information about a phenomenon by combining

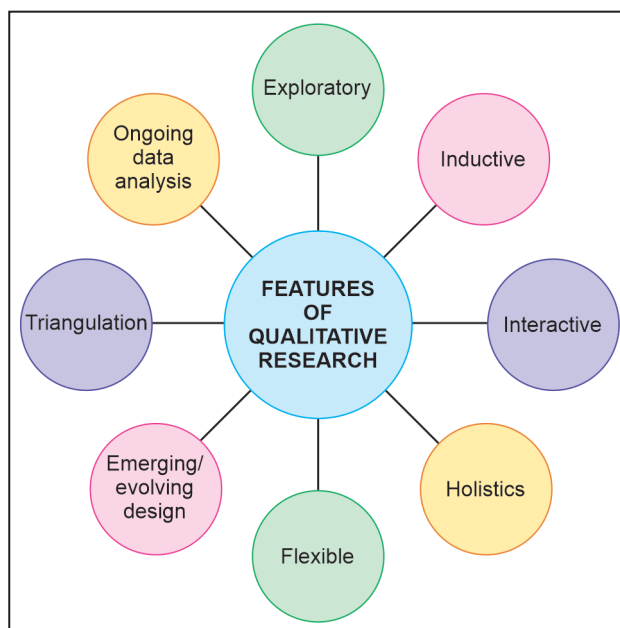


Figure 8.36: Features of qualitative research

information from different sources or tool. Types of triangulations include method triangulation, investigator triangulation, theory triangulation, and data source triangulation.

Ongoing data analysis: Data analysis is an ongoing process and is done every time after collecting data to find out what is coming out of it and also to find out areas which need further exploration.

Steps of Qualitative Research (Table 8.15)

Table 8.15 Steps of qualitative research

Sl. no.	Step	Description
1	Identify the research problem	Identify or select a question related to any phenomenon or area where the researcher wants to explore or want to know more.
2	Select the research setting and participants	Identify the people who have experienced the phenomenon of your interest and also identify the setting where we can conduct the data collection.
3	Collect data using data collection tool	Collect data from the research participants. In qualitative studies data collection start with broad opening questions.
4	Analyze the collected data to find out recurring theme.	Data analysis is an ongoing step in qualitative research process. Analyze the collected data and find out the themes emerging out of it.
5	Review of literature	This step will help the researcher to gain further insight into the area of study.
6	Collect further data until no new themes emerges (data saturation)	Collect further data from the participants by tightening the research questions and by asking more specific questions. This data collection will continue until no new theme emerges, i.e., data saturation obtained.
7	Summarize the findings	Once the data collection is completed find out the themes coming out of it and summarize the findings of the study.
8	Communicate the findings	Communicate the findings of your study to others.

Types of Qualitative Studies (Table 8.16)

1. Phenomenological research
2. Ethnographic research
3. Grounded theory research
4. Historical research
5. Action research
6. Case study method.

1. Phenomenological Research

Phenomenological studies are used to explain or illustrate the lived experience of people about the phenomenon under study. It focuses on individuals' elucidation of their experience about a particular

Table 8.16 Qualitative research designs

Types of qualitative design	Description	Example
Phenomenological	Focuses on exploring and understanding lived experiences and the essence of phenomena as described by individuals. Involves in-depth interviews and analysis to uncover underlying meanings.	"Exploring the Lived Experience of Nurses Caring for Patients with Chronic Pain"
Grounded Theory	Aims to develop a theory grounded in the data collected rather than testing preexisting theories. Involves systematic coding and constant comparison to derive concepts and categories.	"Unveiling the Process of Adaptation: A Grounded Theory Study on Family Dynamics in Coping with Alzheimer's Disease"
Ethnographic	Involves immersive fieldwork to understand and describe the culture and behaviors of a specific group or community. Often includes participant observations and interviews.	"Navigating Cultural Transition: An Ethnographic Exploration of Immigrant Women's Experiences in Healthcare Settings"
Historical	Examines past events, contexts, or social phenomena to understand their impact on the present. Involves archival research, document analysis, and interviews with key informants.	"The Evolution of Mental Health Nursing Practices: A Historical Analysis of Policy Changes and Patient Care Approaches"
Action Research	Integrates the research with practical action to address real-world problems collaboratively. Involves a cyclical process of planning, acting, observing, and reflecting to drive positive change.	"Enhancing Nurse-Physician Collaboration: A Participatory Action Research Approach in a Hospital Setting"
Case study	In-depth exploration of a specific instance, event, or phenomenon. Utilizes multiple data sources, such as interviews, observations, and documents, to provide a comprehensive understanding.	"Evaluating the Impact of Palliative Care Interventions: A Case Study of a Hospice Program in a Rural Community"

phenomenon and the ways in which they express these. The researcher's task is to illustrate the phenomena as experienced and articulated by the individuals. Phenomenological research involves gathering "deep" information and perceptions from the people through inductive (moving from specific observations/data to broader generalizations and theories), qualitative methods such as interviews, discussions, and observations, and then representing that information from the perspective of the research participant.

So, the goal of a qualitative phenomenological research is to describe a "lived experience" of a phenomenon. As this is a qualitative description of data, its analysis is quite different from the traditional or quantitative methods of research.

Phenomenologists focus on describing what all participants have in common as they experience a phenomenon. This method differs from other qualitative approaches as the basic purpose of phenomenology is to replace individual experiences with a universal description of a phenomenon. The phenomenon here is



an “object” of human experience. This human experience may be a phenomenon such as insomnia, being left out, undergoing coronary artery bypass surgery or the experience of being on ventilator.

If the researcher has his/her own ideas about the experience being studied, then those ideas are ‘bracketed out’ (kept aside for the time being until the participants’ perspectives of their experiences are understood). The researcher asks these individuals to describe their experiences regarding a particular phenomenon they have experienced and collects data (e.g., through in-depth interviews) from them. A composite description of the experiences for all the individuals is developed. This description consists of “what” they experienced and “how” they experienced it.

The three processes that must occur in phenomenological research include that:

1. A person must communicate an experience with the researcher.
2. The researcher must translate the communicated experience into an understanding of the person’s experience.
3. The researcher communicates his/her understanding to the audience in writing so that the members of this audience can then relate their understanding of this information to the past and future experiences.

For an example to understand the above-mentioned steps, if researcher interested in exploring the experiences of a group of people hospitalized due to corona.

1. Hospitalized people due to corona are interviewed and asked to narrate their hospital experience and how they felt being away from home. Their experiences are studied which include their perceptions, misconceptions, feelings, desires, actions, and their thoughts about hospitalization due to corona. So, while carrying out the study, researcher try to comprehend this experience of participants.
2. These interviews are then transcribed (and translated, where needed). In field, the raw data is collected as notes, audio or video recordings. This data then needs to be transformed into written text format for the purpose of analysis. This transformation of data from field notes or audio/video recordings into organized text format is known as transcription.
3. The data is analyzed by extracting ‘significant statements or quotes’ from the transcribed interviews. The significant statements are then transformed into ‘clusters of meanings’ as per the statement under the specific psychological and phenomenological concepts. Finally, these transformations are grouped together to make a general description of the experience or themes. Then the findings will be communicated to the audience.

Example

Lived experience of nurses offering maternal and new-born services amidst of COVID-19 second wave in a selected tertiary care hospital, New Delhi.

2. Ethnographic Research

Ethnography is an approach that focuses on gathering the information by observing the interactions of people of a particular culture group in their ordinary day to day settings.

It relies on the collection of data in the natural environment. Ethnographers are interested in how the behavior of individuals is influenced or mediated by culture or social group in which they live. The prominence in ethnography is on studying an entire culture. The most common ethnographic data collection method is participant observation, although nonparticipant observation, in-depth interviews and focus group discussions can also be used.

Hammersley states, “The task of ethnographers is to document the culture, the perspectives, and practices, of the people in these settings. The aim is to ‘get inside’ the way each group of people sees the world.”

The biggest advantage of ethnographic research is direct access to real action, places, and situations. Rice and Ezzy have suggested that, through ethnography, behaviors of the patients can be understood. This can be used to treat them through means that fit their needs. The benefits of ethnography research are understanding the social and cultural backgrounds of the patients and how health behaviors differ across groups.

In such a study, the researcher becomes a participant observer. The researcher gets engrossed in the day-to-day lives of the people. The ethnographer engages in gathering information through observations or through one-to-one interviews with the members of the group. The ethnographer locates key informants. The key informants are the individuals who provide valuable insights into the group. He/she can also guide the researcher regarding information and contact in the local community. The researcher focuses on behavior, language, and interactions of the community.

In an ethnographic study there is no preset limit of what will be observed and no real end point. Themes or perspectives do analysis. An attempt is then made to determine the pervasive patterns such as life cycles, events and cultural themes. However, ethnography has several challenges:

- The researcher needs to have basic knowledge in cultural anthropology and the meanings of social cultural systems.
- Ethnography is a time-consuming research approach. The time taken to collect data is lengthy. The researcher is required to spend lot of time in the field—ranging from months to years.
- The technique of writing is different as compared to the traditional style of scientific writing. This may limit the audience and may be challenging for some authors.
- There is a chance for the researcher to “go native” (i.e., adapting the culture of the study participants), which may pose challenges in completing the study.

Types of ethnographic research

1. **Macro-ethnography:** This type of studies will be performed to know broad aspect of the culture.
2. **Micro-ethnography:** This type of studies will be performed to study a narrow aspect of the culture.

According to LeCompte and Schensul following are the characteristic features of ethnographic studies:

- Carried out in natural setting and not in an artificial setting.
- Researcher has intimate interaction with the participants.
- It shows the actual interaction and behavior of the people.
- It collects in-depth, interactive, inductive, and recursive data to develop theory on local culture and practice.
- Using culture of the community as the focus to interpret study findings.

Example of ethnographic research

In a study conducted by Bandhopadhyay in the state of West Bengal in 1990s, maternal and childcare practices were explored. High maternal and infant mortality rates were a grave concern at that time as the primary health care programs were unable to address this issue. The study was conducted at four sites in the state. The researcher spent nearly four months at each site and stayed with the local community. The manager of the Agricultural Research Center introduced the researcher to the gatekeepers of the community, i.e., the village head and other key persons who introduced the researcher to the villagers. Data collection focused on observation of the daily life of the community. In addition, In-depth Interviews and focus group discussions were also conducted. The study revealed that there was a strong influence of culture and tradition related to pregnancy, delivery, and childbirth and for seeking treatment of infants. People used more than one system for seeking care depending upon cost, time and perceived effectiveness. There was some degree of distrust with the local reproductive health services. The author concluded that in order to reduce maternal mortality, these factors need to be addressed in addition to improving access to health care.

3. Grounded Theory Research

Grounded theory research is a type of qualitative research method in which a theory is build up from the data. This is in contrast to quantitative research, where often the data are used to generate or test a hypothesis (or theory). Glaser and Strauss originally developed it in the 1960s. The purpose of grounded theory is to develop theory about a phenomenon of interest. However, this theory needs to be grounded or rooted in observation. Hence, it is termed grounded theory.

Grounded theory is thus an inductive approach in nature. This means that it moves from the specific to the more general. The research begins with the raising of generative questions which help to guide the research. As the researcher begins to gather data, core theoretical concept(s) are identified. The process of grounded theory involves several key strategies like coding, memoing and interactive diagrams.

Coding: It is the process for categorizing the qualitative data and for describing the details of these categories. Open coding is conducted in the beginning. Some initial categories are developed by examining the data in minute details. Later, one moves to more selective coding where systematic coding is done with respect to a core concept.

Memoing: It is the process for recording the thoughts and ideas of the researcher as they evolve throughout the research study. It may be in the form of extensive marginal notes and comments. These memos tend to be very open initially while later on they focus on the core concept.

Integrative diagrams: These are used to compile all the details together so that the data makes sense with respect to the emerging theory. The diagrams can be any form of graphics like concept maps or directed graphs or even simple cartoons that can act as summarizing devices. This integrative work is best done in group sessions where different members of the research team can interact and share ideas to increase insight.

Eventually a conceptually dense theory is formed as new observations lead to new linkages. The researcher develops a matrix that elucidates the social, historical, and economic conditions influencing the phenomenon under study. Grounded theory does not have a clearly distinguished point for ending a study. The task ends when the researcher decides to quit. This process results in a theory, written by the researchers close to a specific problem or population of people.

Sources of data collection in grounded theory can be done by participant-observation, formal and informal interview, case studies, documents such as diary, newspaper, art work, etc.

Example of grounded theory is as follows:

Example of grounded theory

Example of grounded theory D'Souza and Sequeira conducted a case study to explore quality of service in a tertiary care health organization in Mangalore, Karnataka. Purposive sampling included 45 patients in the age group of 18–65 years. The study used the grounded theory for patient's perspective of service quality. This exploration facilitated to formulate a hypothesis. A descriptive approach was used to test the specific hypothesis. The grounded theory identified service quality dimensions through open coding, axial coding and selective coding. The analysis was conducted for the assessment of overall service quality by 'doctors', 'quality of care,' 'nursing quality of care' and 'operative quality of care'. The study indicated the need to improve care in the organization. The study also highlighted that service attributes related to this dimension required management attention to improve the quality of care.

4. Historical Research

It is a type of qualitative research that examines and analyzes data related to a past events to arrive at an account of what has happened in the past. Much of the time in conducting historical research is engaged in



the process of gathering, reading, and comprehending the material collected, and then writing the manuscript from the data collected.

Historical research helps us to understand certain event happened in the past and its effect on present and future.

The steps in conducting historical research

1. Identification of the research topic and formulation of the research problem or question.
2. Data collection or review of literature
3. Evaluation of the materials
4. Data synthesis
5. Report preparation or preparation of the narrative exposition

Sources of information for conducting historical research

- Information extracted from documents, records, photographs, and relics. Documents and records include written or printed materials such as diaries, newspapers, photos, year books, reports, census reports, etc.
- Oral histories are another very useful type of information. An oral history is obtained when you interview a person who has had direct or indirect experience with knowledge of the chosen topic.
- Relics are also a valuable source of information. These include articles of clothing, buildings, books, maps or any other object that might provide useful information about the past.

Types of sources of information in historical research

The sources of information in historical research can be classified as follows:

Primary sources: These are the fragments from the past. Primary sources are the materials that come from the same era as the topic or event being studied. They are often first-hand accounts of what happened in the time period that historians are studying.

For example, old book, witness report, newspaper, journal, personal diaries, documents such as court proceedings, etc.

Secondary sources: These are the information about the past event created by a person who did not witness the event. Rather they are arguments/interpretations about the past that emerge from an immersion in and are built upon a foundation of primary sources. For example, books and articles produced by historians.

Tertiary sources: Tertiary sources are exclusively from secondary sources. In tertiary sources piece of information related to the event from various secondary sources will collect together and present together.

Example for historical research

Although there are many examples of historical research in the field of health and medicine, historical studies of unethical research are important as they have contributed toward present values and ethics in research. Some of the important cases include the Nazi experiment, the Stanley Milgram's experiment, and the Tuskegee Syphilis study. These studies led to the creation of the Belmont Report and an Institutional Review Board (IRB) was formed to protect human subjects involved in research. In 1932, the Tuskegee Syphilis Study was a 40-year project administered by US Public Health Service in Macon County, Alabama.

Tuskegee Syphilis Study was initially started as a 6-year project which went up to 40 years. The American Government promised free treatment for 400 male patients of syphilis. The study sample was made up of poor African American men who were told that they had "bad blood". These men did not receive standard treatment for syphilis even when penicillin was available in 1947, during the study. The men in the study were not informed of the research design and its risks to them. The participants were never given a choice to leave the study. The study's unethical features remained unknown, until 1972 when Jean Heller, a writer and journalist broke the story. Her article "Syphilis Victims in the US Study Went Untreated for 40 Years" was published on July 26, 1972 in the New York Times.

Contd...

By this time, over one hundred of the infected men died and others suffered from serious syphilis-related conditions. This initiated a research into the Tuskegee study. This historical research, oral history and other documents were the source of information. In 1973, a lawsuit was filed on behalf of the study participants and their families. In 1974, a \$10 million out-of-court settlement was reached. As part of the settlement, the U.S. government promised to give lifetime medical benefits and burial services to all living participants. The Tuskegee Health Benefit Program (THBP) was established to provide these services.

5. Action Research

Action research is an inquiry or research related to the focused efforts to improve the quality of practice. It is a research strategy aimed at tackling real-world problems in participatory and collaborative way. It is typically planned and carried out by practitioners who analyze the data to improve their own practice. As its name implies, action research is planned to achieve both action and research. It is conducted in situations where it is desired to bring about an action in the form of change, and develop an understanding which informs the change. Kurt Lewin coined the term 'action research'.

As described by Lewin, "It is a type of comparative research on the conditions and effects of various forms of social action, and research leading to social action." (Lewin 1946, reproduced in Lewin 1948: 202–3)

In simple words, action research is "learning by doing"—a group of people identify a problem, do something to resolve it, see how successful their efforts were, and if not satisfied, try again.

Action research is typically cyclic. It alternates between action and critical reflection. The reflection consists first of analyzing what has already happened in previous steps, and then of planning what next step to take.

Quality improvement studies are the example for action research.

Steps of action research (Fig. 8.37)

Following are the steps involved in conducting action research:

1. **Plan:** Develop a plan of critically informed action to improve what is already happening.
2. **Act:** To implement the plan.
3. **Observe:** Observe the effects of the critically informed action in the context in which it occurs.
4. **Reflect:** Reflect on these effects as the basis for further planning, subsequent critically informed action.

Key features of action research

- **Participatory character:** It involves collaboration or dialogue with others to identify the issues and to collect and analyze data. The participants are required to perceive a need for change. They are also required to be willing to play an active part in research and change process.
- **Democracy:** Participants are seen as equals with the researcher and are consulted about the action process and methods of evaluation.
- It focuses on a particular situation, usually social and is a deliberate intervention into the functioning. Thus, contributes to both social science knowledge and local change.

Action research is thus 'research with the people' rather than 'research on the people' to accomplish the twin goal, it requires the active collaboration of researcher and client. It thus stresses on the importance of colearning as a primary aspect of the research process.

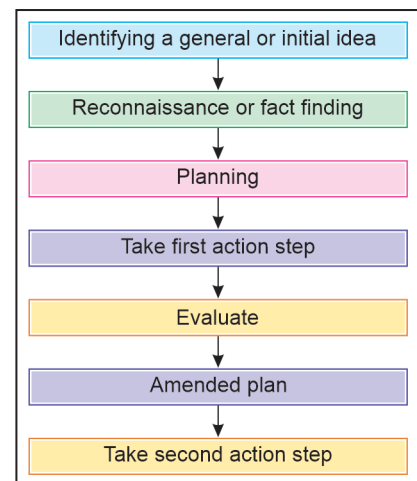


Figure 8.37: Steps of action research

The main purpose of action research is to solve practical problems by the application of scientific methods. Action research is used in real situations, rather than in contrived, experimental studies. Its primary focus is on solving real problems. It can, however, be used by social scientists for preliminary or pilot research. Thus, it is of use especially when the situation is too ambiguous to frame a precise research question. Mostly, though, in accordance with its principles, it is chosen when circumstances require flexibility. This typically includes the involvement of the people in the research.

Action research approach is commonly used in community work, but it has also been employed in facilitating change in health services.

Example of action research is as follows:

Example of action research

A 5-year action research project was initiated to develop confidence amongst nurses in caring for patients with HIV disease in West India. A 10-day educational program was organized to develop individual and partnership action plans focusing on bringing about changes in nursing practice within well-defined fields of action. Following implementation of their action plans, participants reassembled 12 months later for a follow-up workshop to discuss their progress and describe those factors that either helped or hindered them in achieving their objectives. They then developed new action plans for the next 12-month period. Action plans frequently focused on infection control, primary prevention, curriculum development in preregistration nursing programs and in-service nursing education. The majority of participants reported significant achievements in realizing their action-plan objectives. Data analysis revealed that the change intervention itself, together with multidisciplinary support from colleagues, the senior status of the participant, and anticipating and attending the follow-up workshop, all positively correlated with achievement. The lack of personal authority and resistance from managers were the two major factors negatively correlated with achievement.

6. Case Study Method

Case study involves analysis of persons, events, decisions, periods, policies or other systems that are studied holistically by one or the other method. A case study could involve a single person, an organization or an institution. It could also be an extended approach tracing events involving several people.

Case study research approach has a good scope in the field of health care and social sciences. Case study approach could describe and analyze the health care services, evaluate a particular service delivery and effectiveness of a program as in pilot studies.

For example, a case study may be conducted to develop a new service such as a hospital discharge liaison scheme in a locality. Another example can be setting up of an outreach teenage health service as an alternative to general practice based teenage clinics. This might be evaluated in terms of input, impact on the health of teenagers locally and the development of collaborative links with other groups involved in promoting teenage health.

One of the criticisms aimed at case study research is that the case under study is not necessarily representative of similar cases therefore, the results of the research cannot be generalized. However, case study and other qualitative approaches are not aimed at (statistical) generalizability, but the inferences derived from a case study in one setting may be applicable or useful in other similar settings—a concept called ‘transferability’. Hence, there are different qualitative research approaches that are helpful in obtaining information about the values, opinions, behaviors, and social contexts of particular populations. Qualitative methods provide an emic perspective and are gaining importance in the field of health research.

3. Mixed Method Research Designs

Mixed method research designs involve using both qualitative and quantitative methods in a single study to understand a research problem. This approach allows researchers to gain a more comprehensive understanding of the research question by combining the strengths of both methods. The use of a mixed method research design is preferred when the combination of both quantitative and qualitative data offers a more comprehensive understanding of the research issue, compared to using only one of the methods.

Qualitative methods are used to gather in-depth information about participants' experiences and perspectives, while quantitative methods are used to test hypotheses and examine relationships between variables. Mixed method designs can take several forms, including concurrent, sequential, and embedded. The choice of design depends on the research question and the goals of the study.

The uses of mixed method research designs include the following:

- **Enhancing understanding:** By combining qualitative and quantitative methods, mixed methods research can provide a more comprehensive understanding of a phenomenon.
- **Data triangulation:** Using multiple methods to study the same topic helps to increase the validity and reliability of the findings.
- **Addressing complexity:** Some research questions are complex and may require multiple perspectives to fully understand. Mixed methods research can help to address these questions.
- **Complementary strengths:** Qualitative and quantitative methods have different strengths and limitations, and mixed methods research allows researchers to leverage these strengths to address research questions more effectively.
- **Bridging the gap:** Mixed methods research can help to bridge the gap between quantitative and qualitative research traditions, leading to increased collaboration and integration between these fields.
- **Addressing limitations:** Using a mixed methods approach can help to address limitations of either quantitative or qualitative methods alone.

Steps of Conducting Mixed Method Research

The general steps involved in conducting mixed method research are shown in Table 8.17 and explained here as well.

1. **Identify the research question:** The first step is to identify a research question that can benefit from both quantitative and qualitative data.
2. **Feasibility assessment:** Determine if a mixed methods research design is feasible and appropriate for the research question. Consider factors such as time, budget, resources, and the research question's complexity.
3. **Identify the rationale for using mixed method design:** The rationale should explain why a mixed methods design is necessary for the study and how it will contribute to a more comprehensive understanding of the research question.
4. **Determine the appropriate research design:** There are several types of mixed method research design. Choose the design that best fits the research question.
5. **Determine the data collection strategy:** Determine the data collection strategy that will be used to collect both qualitative and quantitative data. Consider the research question and the feasibility of collecting both types of data.

6. **Collect data:** Collect both quantitative and qualitative data through appropriate methods such as surveys, interviews, or focus groups.
7. **Analyze data:** Analyze the quantitative and qualitative data separately or concurrently using appropriate methods such as statistical analysis or thematic analysis.
8. **Write the report:** Write the report as one or two-phase study, presenting the quantitative and qualitative findings separately or integrating the findings into a comprehensive narrative.

Table 8.17 A research example to explain the steps of mixed method research design

Step of mixed method research	Example
Identify the research question	The research questions for the study might include: • “What are the factors influencing the adoption of telemedicine by patients with chronic conditions and how does it impact their health care outcomes?” • This research question is suitable for a mixed methods design because it involves exploring both qualitative factors that may influence telemedicine adoption (such as patient beliefs and attitudes) as well as quantitative health care outcomes (such as hospitalization rates or medication adherence).
Feasibility assessment	The feasibility assessment involves considering the time, budget, resources, ethical considerations, and availability of an appropriate sample of participants, and determining whether a mixed methods design is feasible and appropriate for answering the research question.
Identify the rationale for using mixed method design	The rationale for using a mixed methods design could be that a quantitative approach would provide numerical data on health care outcomes while a qualitative approach would allow for an exploration of patient experiences, attitudes, and beliefs, ultimately providing a more comprehensive understanding of the complex factors involved in telemedicine adoption and its impact on health care outcomes. The combination of quantitative and qualitative method can complement each other to provide better understanding.
Determine the appropriate research design	A concurrent triangulation mixed methods design could be used for this research question. This design involves collecting both quantitative and qualitative data simultaneously, analyzing each data set separately, and then comparing and integrating the results to gain a deeper understanding of the research question.
Determine the data collection strategy	• The quantitative data could be collected using a cross-sectional survey questionnaire, which can be administered to a large sample of patients with chronic conditions to collect numerical data on their telemedicine adoption and health care outcomes. • On the other hand, the qualitative data could be collected using in-depth interviews with a subset of the patients who have agreed to participate in the study.
Collect data	Collection of data using the survey method (quantitative) and in-depth interviews (qualitative)
Analyze data	The data analysis process could involve analyzing the quantitative data using statistical software (e.g., SPSS, STATA, etc). A theme analysis of qualitative data can be performed using softwares such as NVivo or ATLAS.ti
Write the report	Writing the report could involve presenting the findings from both the quantitative and qualitative data, interpreting the results, and making recommendations for practice and future research.

Legends used in mixed method research designs:

Notation used	Description
QUAN	Primarily driven by quantitatively data collection
QUAL	Primarily drive by qualitative data collection
quan	Quantitative data
qual	Qualitative data
+	Indicates that quantitative and qualitative data are collected simultaneously (concurrently)
→	Indicates sequential form of data collection
()	Indicates that one form of data collection is embedded within another larger design
C	Quantitative data collection
Q	Qualitative data collection
C+Q	Concurrent data collection
Q → C	Sequential data collection, where qualitative data collected first
C → Q	Sequential data collection, where quantitative data collected first

Types of Mixed Method Research Designs

There are four major types of mixed method research designs:

1. The convergent parallel design
2. The explanatory sequential design
3. The exploratory sequential design
4. The embedded design

The Convergent Parallel Design

Convergent parallel design is a mixed methods research design that involves the simultaneous collection and analysis of both quantitative and qualitative data (Fig. 8.38). This approach allows researchers to converge or combine data from different sources to gain a more complete understanding of the research topic. Researchers collect quantitative data through surveys, experiments, or other statistical methods, as well as qualitative data through interviews, focus groups, or observations. The data are analyzed separately using appropriate methods for each type of data, and then the results are compared and integrated to draw conclusions about the research question.

The researcher collects both quantitative and qualitative data concurrently. The two types of data are analyzed independently using relevant analytical methods. Subsequently, the outcome of the two analyzes are merged and integrated during the interpretation phase to yield a comprehensive understanding of the research problem. This is further explained using the following nursing research example.

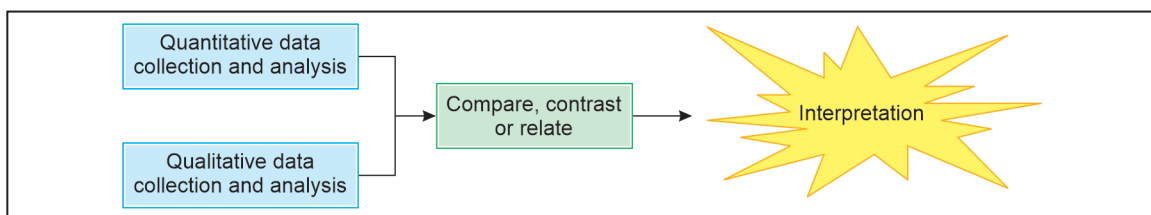


Figure 8.38: Schematic diagram of convergent parallel design

Example

A nursing researcher is interested in studying the effectiveness of a new pain management intervention for postoperative patients. In this study, the quantitative aspect of the study could involve collecting numerical data on patients' pain levels before and after the intervention using standardized pain assessment tools. This data could be analyzed using statistical methods to determine if the intervention has a significant effect on reducing pain levels. The qualitative aspect of the study could involve conducting interviews with patients to gather their perceptions of the intervention, including their experiences with pain and the effectiveness of the intervention in managing their pain. The qualitative data could be analyzed using thematic analysis to identify common themes and patterns in the patients' experiences.

The results of the quantitative and qualitative analyzes could then be compared and integrated to provide a comprehensive understanding of the effectiveness of the pain management intervention. By using a convergent parallel design, the study could provide more robust evidence on the effectiveness of the intervention by triangulating findings from both quantitative and qualitative data sources.

The Explanatory Sequential Design

The explanatory sequential design is a research design that involves the collection and analysis of two types of data sets in sequence, with the first phase involving the collection and analysis of quantitative data, followed by a second phase that involves the collection and analysis of qualitative data. This approach is used when the investigator seeks to follow up the quantitative results with qualitative data.

The initial quantitative phase serves to test hypotheses or to explore relationships among variables, and the results are used to develop or refine a theory. The subsequent qualitative phase seeks to further explain or elaborate on the quantitative findings by exploring the experiences, perspectives, or meanings associated with the data.

While the sequence of the approach remains constant, the primary focus of the study may be either quantitative data or qualitative data (or both equally) depending on the research question and objectives (Fig. 8.39).

Example of an explanatory sequential design in nursing research

In a study to assess the impact of a new discharge education program on patients with heart failure, the initial quantitative phase involves collecting numerical data to test whether the new discharge education program has a significant effect on clinical outcomes such as readmission rates and medication adherence. The quantitative findings provide a preliminary explanation of the relationship between the intervention and the outcomes. The subsequent qualitative phase involves collecting data on patients' experiences and perspectives to further explain or elaborate on the quantitative findings. The qualitative data may reveal additional factors that contribute to the outcomes, such as patients' understanding of heart failure, their perceived barriers to self-care, and their satisfaction with the education program. The qualitative findings serve to deepen the understanding of the quantitative data and may lead to the development of new theories or hypotheses.

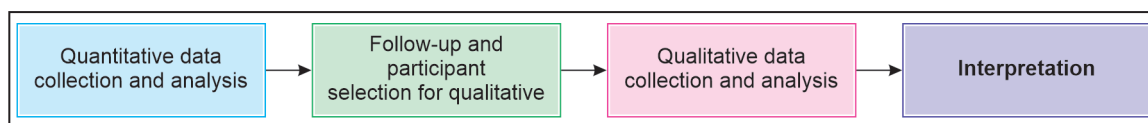


Figure 8.39: Schematic diagram of explanatory sequential design

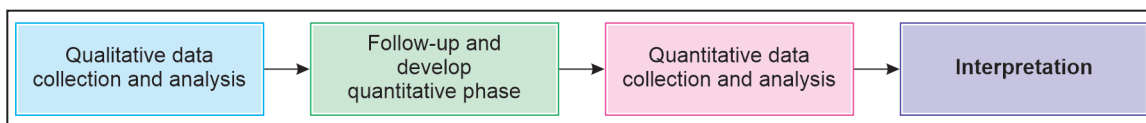


Figure 8.40: Schematic diagram of exploratory sequential design

The Exploratory Sequential Design

In this design, the researcher collects and analyzes qualitative data followed by quantitative data. The strength of this approach is that it allows the initial qualitative phase to build the subsequent quantitative phase by informing the research questions, variables, instruments, and/or typology (Figs 8.40 and 8.41).

The qualitative results are used to specify the research questions and variables that will be explored in the subsequent quantitative phase. The results of qualitative phase may also be used to develop an instrument/tool for data collection or to generate a typology to classify and analyze the data.

This approach enables the researcher to explore complex research questions and gain deeper insights into the underlying mechanisms and factors that contribute to the outcomes being studied.

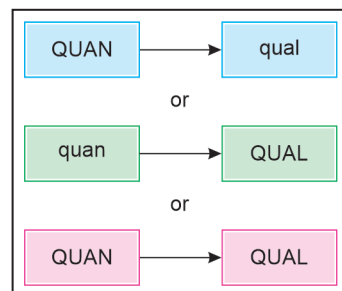


Figure 8.41: Different approaches in explanatory sequential design

Example of an exploratory sequential design in nursing research

- Study title: A study to determine factors influencing the decision-making process of nurses in end-of-life care.
- In the qualitative phase, the researcher may conduct interviews or focus groups with nurses to explore their experiences and perspectives regarding end-of-life care. The qualitative data collected may help the researcher to identify common themes, patterns, and factors that influence nurses' decision-making processes in end-of-life care.
- Based on the results of the qualitative phase, the researcher can use this information to inform the development of a quantitative survey instrument to measure the frequency of various factors that influence nurses' decision-making processes in end-of-life care.
- The results of the quantitative phase could then be used to further validate the themes and patterns identified in the qualitative phase, as well as to identify potential areas for intervention to improve end-of-life care.
- By using an exploratory sequential design, the researcher can gain a deeper understanding of the complex factors that influence nurses' decision-making processes in end-of-life care, and ultimately, improve the quality of care provided to patients and their families

The Embedded Design

In this design, the researcher collects and analyzes both quantitative and qualitative data within a traditional quantitative research design or qualitative research design. The embedded approach can take different forms, depending on how the two methods are combined (Fig. 8.42). For example, the qualitative method may be embedded within the quantitative method, or viceversa. Alternatively, both methods may be embedded within a larger study design, where each method is used to address a different aspect of the research question.

One common example of embedded mixed methods research is the use of qualitative interviews or focus groups to help explain or interpret the results of a quantitative survey. In this case, the survey provides



Figure 8.42: Schematic diagram of embedded mixed method design

the quantitative data, while the interviews or focus groups provide additional insights into the participants' attitudes, experiences, or perceptions related to the survey topic.

There are two types of embedded research models: embedded experimental model and embedded correlational model.

Embedded experimental model: In this model, qualitative data collection is embedded with an experimental research design to provide a more comprehensive understanding of the research question. The qualitative method is embedded to provide an in-depth understanding of the mechanisms behind the observed effects of the experimental manipulation.

Qualitative data collection may occur before, during, or after the intervention in the embedded experimental model. The timing of data collection depends on the research question, design, and intervention. The qualitative data that is collected before can also be used to inform the design of the experimental study.

- **Preintervention data collection:** Qualitative data collection may occur before the intervention to provide insight into the context and participants' perspectives, which can inform the design of the intervention.
- **During intervention data collection:** Qualitative data collection may occur during the intervention to understand the participants' experiences and perceptions of the intervention as it is being implemented.
- **Postintervention data collection:** Qualitative data collection may occur after the intervention to explore the participants' experiences and outcomes related to the intervention.

Embedded correlational model: This model combines correlational (quantitative) and noncorrelational (qualitative) methods. When a researcher uses a correlational design to investigate the relationship between two or more variables, the qualitative method is embedded to provide a deeper understanding of the nature of the correlation and to explore the reasons behind the correlation. The qualitative data can also be used to identify potential confounding variables and to refine the design of the correlational study.

Example of an explanatory sequential design in nursing research

A researcher embedded the qualitative focusgroup interview of nurses and patients in a correlational study to investigate correlation between nursing workload and patient satisfaction to explore their perceptions of the workload and how it affects patient satisfaction.

Each of these designs has its own strengths and limitations, and the choice of design depends on the research question, the goals of the study, and the resources available. It is also possible to have a hybrid design, which combines elements of different designs.

Advantages and Disadvantages of Mixed Method Research Designs

Advantages

- Mixed method research helps to address research questions that cannot be answered by either qualitative or quantitative methods alone.
- Mixed method designs allow researchers to combine the strengths of both qualitative and quantitative methods, providing a more comprehensive understanding of the research problem.
- **Triangulation:** The use of multiple methods to collect data can help to triangulate the findings, increasing the validity and reliability of the research. Triangulation involves the use of multiple methods to study a phenomenon, which can help to offset the limitations of any one method.
- Offers flexibility in research design by allowing researchers to adjust the mix of qualitative and quantitative data collection methods depending on the research question and context.
- Embedded designs can be valuable tool to plan an intervention, sampling process and understand the patient's experiences.



- By embedding qualitative data collection within an interventional study, researchers can gain a more comprehensive understanding of the intervention's impact.
- Sequential mixed methods contribute for tool development and taxonomy or classification development in nursing.
- Mixed method designs can be particularly useful in applied research, where there is a need to translate research findings into practice. The combination of qualitative and quantitative data can provide a more practical and actionable understanding of the research question.

Disadvantages

- **Complexity:** Mixed method research can be more complex, challenging and require expertise in both methods.
- **Time and resources:** Mixed method research requires more time, resources and cost. This limits the feasibility of the research
- **Integration issues:** Integrating quantitative and qualitative data can be challenging and requires careful consideration to ensure that the data are compatible and meaningful. There is also a need for specialized software and expertise in data analyzes.
- **Bias:** There is a risk of bias in mixed method research designs if the researcher has a preferred method or perspective that influences the design, implementation, or analysis.
- **Limited generalizability:** Mixed method research designs may have limited generalizability, as they often involve a smaller sample size than purely quantitative research designs.

SUMMARY

- Research approach deals with the way how to get the answers for a problem. It is the method, plan, or procedure to conduct the research.
- Research design is the heart of the research process which constitutes the approach, study setting, sampling techniques, sample size, tools and methods of data collection and analysis of data to answer the research questions.
- The elements of research design include the approach, variables, population and sample, sampling technique, setting, tools and methods of data collection, method of data analysis, and timeline for completion.
- The validity of a research study has two domains: Internal and External Validity. These are the important criteria to determine the credibility, trustworthiness, and reliability of the research findings. The best research designs are those with high levels of internal and external validity.
- There is no one standard classification of research designs. However, for the practical purposes, the research designs can be classified into three major categories: Quantitative research designs, Qualitative research designs, Mixed method research designs.
- The quantitative research focuses on numerical or quantifiable data. It examines the relationship among variables, which can be quantified or measured by using certain instruments.
- Experimental research designs are the methods investigate the interaction between independent and dependent variables after manipulating independent variables. It is a scientific method to establish the cause and effect relationship between variables.
- True experimental research design is the most accurate form of experimental design. The three essential characteristics of an experimental design are manipulation, control and randomization.
- Quasi experimental designs can be used when a researcher cannot design a true experimental study because of certain constraints like selection of subjects or the study settings. It is also known as nonrandomized controlled trial in biomedical research.

- Nonexperimental research designs are purely observational, and the results are descriptive. The researcher gathers data as it naturally occurs and explains the phenomena exactly as it is. The variables are neither manipulated nor controlled.
- A systematic review and meta-analysis are a type of research study that combines the results of multiple previous studies to get a more comprehensive understanding of a specific topic. A meta-analysis is a type of systematic review that uses statistical methods to combine the results of multiple studies to provide a more precise estimate of the overall effect of a specific intervention or treatment.
- Qualitative research is an approach for exploring and in-depth understanding of social phenomena within their natural setting. It relies on direct and lived experiences of human beings as a data.
- Mixed methods research is an approach that involves collecting both quantitative and qualitative data. It integrates the two forms of data and use distinct designs that may involve philosophical assumptions and theoretical frameworks combination.

ASSESS YOURSELF

Long Answer Questions

1. Discuss the key elements of research designs.
2. Explain the true experimental research designs with examples.
3. Explain nonexperimental research designs with examples.
4. Discuss the types of qualitative research designs.

Short Answer Questions

1. Write notes on:
 - a. Difference between quantitative and qualitative research.
 - b. Essential elements of true experimental designs.
 - c. Comparison between prospective and retrospective study design.
 - d. Meta-analysis.
 - e. Randomized block design.

Multiple Choice Questions

1. A blueprint for the conduction of study is:
 - a. Pilot study
 - b. Research hypothesis
 - c. Research design
 - d. Data collection tool
2. A researcher investigates the effect of foot massage on sleep quality of patients. This study would be described as:
 - a. Applied research
 - b. Basic research
 - c. Grounded theory approach
 - d. Phenomenological research
3. Which of the following research uses statistical methods to make generalizations?
 - a. Phenomenological research
 - b. Ethnographical research
 - c. Quantitative research
 - d. Qualitative research
4. Which of these designs is used to estimate the prevalence of osteoporosis?
 - a. Cross-sectional
 - b. Quasi-experimental
 - c. Cross over
 - d. Factorial

5. The primary objective of an experimental research is to detect the effect produced by:
 - a. Extraneous variable
 - b. Confounding variable
 - c. Independent variable
 - d. Dependent variable
6. Examining cause and effect relationship between variables under highly controlled conditions is:
 - a. Correlational research
 - b. Experimental research
 - c. Descriptive research
 - d. Quasi-experimental research
7. The mandatory criteria for a pre-experimental research design is to have only one of the following characteristics _____.
 - a. Control
 - b. Manipulation
 - c. Randomization
 - d. Matching
8. Crossover research design is a type of:
 - a. Quasi-experimental research design
 - b. True experimental research design
 - c. Descriptive design
 - d. Pre-experimental design
9. A qualitative research design which examines human experiences through the descriptions provided by the people involved is called:
 - a. Phenomenological research
 - b. Ethnographic research
 - c. Grounded theory
 - d. Historical research
10. All the following are qualitative research methods; except:
 - a. Phenomenology
 - b. Ethnography
 - c. Grounded theory
 - d. Correlation
11. All of the following are the characteristics of qualitative research; except:
 - a. Used to develop theory
 - b. It is holistic
 - c. Uses the reduction reasoning
 - d. Subjective
12. Quantitative research is a process to:
 - a. Describe lived experiences of people
 - b. Develop theories and hypothesis
 - c. Evaluate theories and hypothesis
 - d. Obtain feelings and beliefs of the people
13. The method that focuses on description and interpretation of cultural behavior is referred to as:
 - a. Phenomenology
 - b. Ethnography
 - c. Grounded theory
 - d. Symbolic interactionism
14. Which of the following features are considered as critical in qualitative research?
 - a. Collecting data with the help of standardized research tools.
 - b. Design sampling with probability sample techniques.
 - c. Collecting data with bottom-up empirical evidence.
 - d. Gathering data with top-down schematic evidence.

Answer Key

1. c	2. a	3. c	4. a	5. c	6. b	7. b
8. b	9. a	10. d	11. c	12. c	13. b	14. c



BIBLIOGRAPHY

- Bandhopadhyay M. Tackling complexities in understanding the social determinants of health: The contribution of ethnographic research. *BMC. Public Health* 2011;11 (Suppl 5):S6
- Bhatia V, Singh AK, Giri PP, Sahoo DP. Effectiveness of a short-structured training programme on knowledge of health care providers and programme managers involved in maternal and child health programmes in Odisha, India: a quality improvement study. *BMJ Open*. 2021 Aug 17;11(8):e040841. doi: 10.1136/bmjopen-2020-040841. PMID: 34404694; PMCID: PMC8372814.
- Bricki N and Green J. A Guide to using Qualitative Research Methodology. *Medecins Sans Frontieres*. 2007. Available online at: www.fieldresearch.msf.org. Accessed on 2.10.14
- Centers for Disease Control and Prevention. US Public Health Service Syphilis Study at Tuskegee. Available online at: www.cdc.gov/Tuskegee/timeline.htm.
- D'Souza SC, Sequeira AH. Measuring the Customer-Perceived Service Quality in Health Care Organization: A Case Study. *Journal of Health Management* 2012; (14): 127-41
- Gay LR. *Educational Research*. 5th ed. 1996, Upper Saddle River, NJ: Prentice-Hall, Inc.
- Gittelsohn J, Evans M, Helitzer D, Anliker J, Story M, Metcalfe L, et al. Formative research in a school-based obesity prevention program for Native American school children (Pathways) *Health Education Research*. 1998;13:251–265.
- Glaser BG and Strauss AL. The discovery of grounded theory. In *Strategies for Qualitative Research*. Aldine Publication, Chicago. 1967.
- Glaser BG and Strauss AL. The discovery of grounded theory. In *Strategies for Qualitative Research*. Aldine Publication, Chicago. 1967.
- Glaser BG and Strauss AL. The discovery of grounded theory. In *Strategies for Qualitative Research*. Aldine Publication, Chicago. 1967.
- Goodson L, Vassar M. An overview of ethnography in health care and medical education research. *J Educ Eval Health Prof*. 2011;8:4. doi: 10.3352/jeehp.2011.8.4. Epub 2011 Apr 25. PMID: 21637319; PMCID: PMC3100516.
- Morgan M, Read R, Ogden J. *Sociology and Psychology in Public Health*. In *Oxford Textbook of Public Health*. 5th Ed. Oxford University Press. 2009
- National Institute of Health and Family Welfare Public Health Education and Research Consortium Network & Partnership. Rapid Appraisal for Health interventions (RAHI) Phase I (2007) and Phase II (2008). Supported by UNFPA. Available online at www.nihfw.org/PHEC Accessed on 25.12.14
- National Institute of Health and Family Welfare Public Health Education and Research Consortium Network & Partnership. Rapid Appraisal for Health interventions (RAHI) Phase I (2007) and Phase II (2008). Supported by UNFPA. Available online at www.nihfw.org/PHEC Accessed on 25.12.14
- O'Brien, R. Overview of the Methodological Approach of Action Research. In Roberto Richardson (Ed.), *Theory and Practice of Action Research*. João Pessoa, Brazil. (English version) 2001. Available: <http://www.web.ca/robrien/papers/arfinal.htm>. Accessed on 29.9.14
- Patra BN, Patil V, Balhara YPS, Khandelwal SK. Self-stigma in patients with major depressive disorder: An exploratory study from India. *Ind J Soc Psychiatry*. 2022 Feb;68(1):147-154. doi: 10.1177/0020764020975811
- Pratt RJ, Pellowe CM, Juvekar SK, Potdar NS, Weston AJ, Joykutty A, et al. Kaleidoscope: A 5-year action research project to develop nursing confidence in caring for patients with HIV disease in west India. *Int Nurs Rev* 2001; 48 (3): 164-73.
- Rice PL, Ezzy D. *Qualitative research methods: A health focus*. Oxford: Oxford University Press; 1999. p. 291
- Saha S, Annear PL, Pathak S. The effect of Self-Help Groups on access to maternal health services: evidence from rural India. *Int J Equity Health*. 2013 May 28;12:36. doi: 10.1186/1475-9276-12-36. PMID: 23714337; PMCID: PMC3673812.
- Smith MK. Kurt Lewin, groups, experiential learning and action research'. *The encyclopedia of informal education*; 2001. Available online at: <http://www.infed.org/thinkers/etlewin.htm> Accessed on 25.9.14
- Thomas G, Krantz J, Ramirez R. *Action Based Modes of Inquiry and the Host-Researcher Relationship*. Consultation 5.3 (Fall 1986): 161
- Yin, RK. *Case study research: Design and methods*. 5th ed. 2014 Thousand Oaks CA: Sage.



Sampling Techniques in Nursing Research

LEARNING OBJECTIVES

After the completion of the chapter, the readers will be able to:

- Define the terminology related to sample and sampling technique.
- Enumerate the steps of sampling process.
- Understand the importance of sampling in research.
- Appreciate the different sampling techniques in research.
- Discuss the merits and demerits of various sampling methods.
- Choose an appropriate sampling method.
- Use the table of random number including the computer-generated random number table.
- Discuss the characteristics of a good sample.
- Discuss the calculation of sample size.

CHAPTER OUTLINE

• Introduction	• Characteristics of a Good Sample
• Sampling Process	• Advantages of Sampling
• Sampling Error	• Disadvantages of Sampling
• Sampling Techniques	• Sample Size Calculation
• Factors Affecting Sampling Process	

KEY TERMS

Accidental sampling: Selecting individuals who are readily available or easy to reach for the study.

Accessible population: The portion of the population that the researcher can reach out and study.

Cluster sampling: Dividing the population into clusters and randomly selecting entire clusters for inclusion in the sample.

Convenience sampling: Choosing participants based on their easy accessibility and proximity to the researcher.

Contd...

Disproportionate stratified sampling: Unequal representation of different strata in the sample to address specific research needs.

Judgmental sampling: It is also known as purposive sampling in nursing research. It refers to handpicking participants based on the researcher's judgment or expertise in the field.

Multistage cluster sampling: A complex sampling method where the population is divided into clusters, then clusters are randomly selected, and finally, individuals within the chosen clusters are sampled.

Nonprobability sampling: Sampling methods that do not rely on random selection.

Probability sampling: Sampling methods where each member of the population has a known and non-zero chance of being included.

Proportional sampling: Ensuring that the proportion of different subgroups in the sample reflects the proportion in the population.

Quota sampling: Ensuring the representation of different subgroups in the sample to match their proportion in the population.

Random sampling: Each member of the population has an equal chance of being selected for the sample.

Sampling frame: A list or source from which the sample is drawn.

Sampling interval: The fixed interval used to select individuals in systematic random sampling.

Sampling unit: The individual element or group that is selected in the sampling process.

Sequential sampling: A continuous sampling process where the sample size is not predetermined.

Simple random sampling: Every member of the population has an equal chance of being selected and each selection is independent.

Snowball technique: In this, initial participants refer additional participants to the study.

Stratified random sampling: Dividing the population into strata and then randomly selecting individuals from each stratum.

Systematic random sampling: Selecting every Kth individual from a list after selecting a random starting point.

Target population: The entire group that the researcher is interested in studying.

Volunteer sampling: Participants self-select into a study by volunteering.

INTRODUCTION

Sampling is a part of our daily life. Frequently, we decide about certain things after checking a small portion, which is a sample of entire available amount of that thing. For example, while cooking rice, to see whether the rice is cooked or not, we never see each grain of rice. We assess only a sample of rice grain by its texture and firmness to determine its the cooked or the uncooked status. Similarly, we check a small sample of tea to decide about its quality.

Similar is the concept of sampling in research. Researchers typically cannot observe every individual within the population they aim to study due to various constraints such as a lack of time, money, and issues related to accessibility. Therefore, they study a sample of people to make inferences about the population.

Sampling is considered a crucial stage in research process. It is a vital part of research methodology. The quality of sample can have a profound impact on the outcome of a study. Poor sampling technique may compromise the research findings. Thus, the researcher must use a sampling technique that ensures a sample reflecting the characteristics of study population most accurately. Thus, Sampling in nursing research goes beyond merely choosing a subset of individuals; it involves making informed decisions that reflect the diverse patient populations encountered in clinical practice, thereby enhancing the relevance and applicability of research outcomes in the field of health care. Practically, all decisions regarding the study are based on data from the sample. Additionally, an appropriate sampling strategy makes the study more manageable.

Therefore, understanding the concept, techniques, and methodology of sampling is crucial for researchers. This chapter discusses various known sampling techniques falling within both probability and nonprobability sampling strategies, defining various terms related to the sampling process at the appropriate places.

SAMPLING PROCESS

Sampling is a statistical process that involves selecting a subset of a population to make observations and statistical inferences. Sampling allows researchers to conduct studies about a large group by using a small portion of the population.

Before discussing various sampling techniques, it is important for the researchers to understand the sampling process. It basically involves the steps a researcher should follow to choose a sample. These are outlined in Figures 9.1 and 9.2.

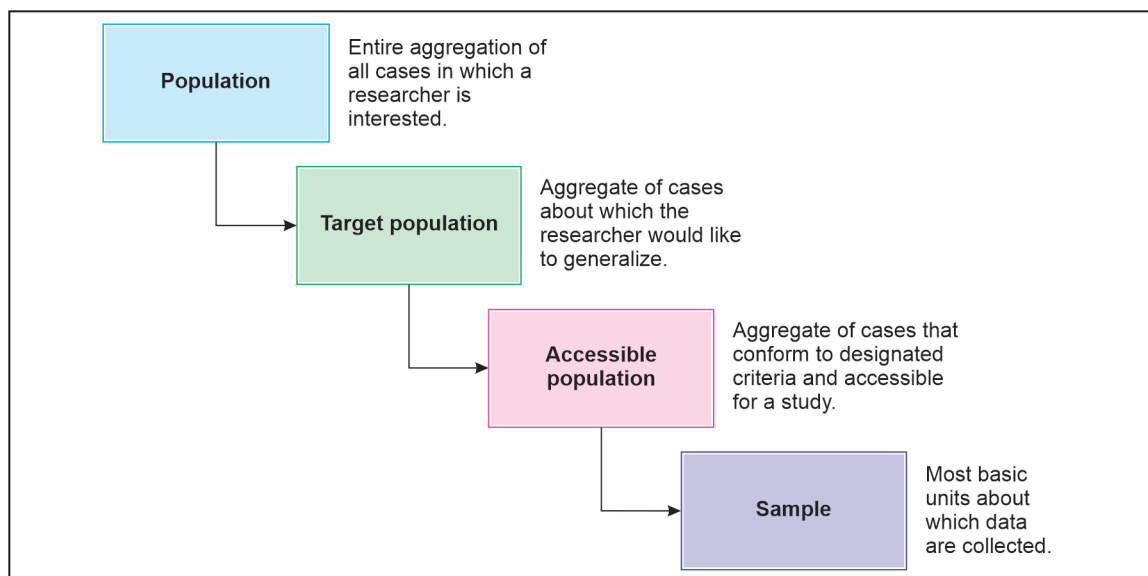


Figure 9.1: Schematic diagram of sampling

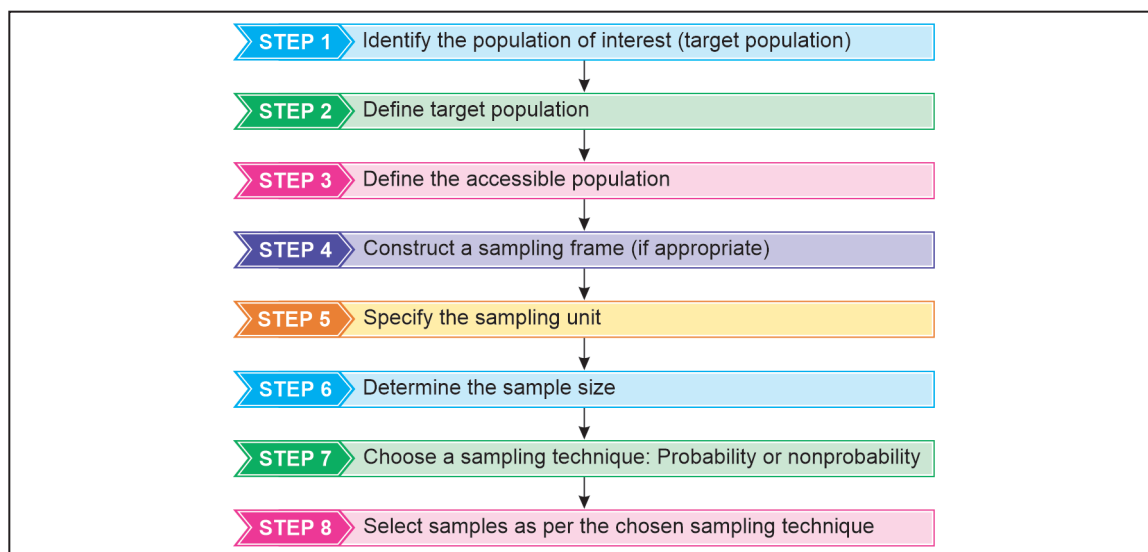


Figure 9.2: Sampling process



Step 1: Identify the Population of Interest (Target Population)

In research, the term “population” refers to a group of individuals, items, or elements that share specific common characteristics or attributes that a researcher is interested in studying. This population represents the entire group that is the subject of the research. It can encompass a wide range of entities, including people, animals, objects (e.g., syringes), procedures, hospitals, places, locations, or even abstract concepts, depending on the research focus.

The population is composed of two groups, i.e., the **Target population** and the **Accessible population**.

The **Target population** encompasses the entire group of people or objects to which the study findings are intended to be generalized and who meet the researcher’s specified eligibility criteria. The eligibility criteria are the criteria defined by the researcher to determine who will or will not be included in the study. For example, target population of a study could include all school-age children with asthma, all lactating women with breast engorgement, or all low birth weight infants.

However, it is usually not possible to include the entire target population in the study because of various constraints like manpower, time, money, etc. Additionally, members of the population might be geographically dispersed or unwilling to participate. Therefore, a portion of the population that is practically accessible to the researcher needs to be selected. This subset is referred to as the **Accessible population** and may be restricted to a region, state, city, country, or institution. Samples are drawn from the accessible population, and generalizations are made to the target population. In the above said examples, the accessible population in each case could include, all school-age children with asthma treated in the allergy clinic at the Advanced Pediatric Center, AIIMS, New Delhi, all lactating women residing in a particular community area, or all low birth weight infants admitted to the neonatal ICUs of AIIMS, New Delhi.

Consider a scenario where one is keen to know the prevalence/incidence of hospital acquired infections among the patients admitted in all the wards of hospital in a month. It may be difficult to study all the admitted patients. But it may be relatively easier to study a sample of patients in few wards. The inference drawn from this data can represent the prevalence of hospital-acquired infections among the patients in general.

Step 2: Construct a Sampling Frame (If Appropriate)

Once the definition of accessible population is clear, the researcher should prepare the **sampling frame**. It is the list of all the members of the population from which the sample is taken. It might be tremendously large if population is national or international in nature. A sampling frame is not as large as the population, but it is still a big group of people. It may not be possible to study every single unit of the accessible population, so the researcher needs to draw the sample from the sampling frame using some techniques, which is the next step of the sampling process. For example, if the study is to be conducted on nurses of hospital, then list of all the nurses working in that hospital and fulfilling the inclusion and exclusion criteria will be the sampling frame. An ideal sampling frame enlists the names of its elements only once. The choice of the sampling frame should ideally represent the target population to ensure that findings from the sample can be generalized to the broader group of interest.

An example of target population versus sampling frame has been given as follows:

Target population versus sampling frame—an example

- If a nursing researcher is interested in understanding the health care needs of elderly patients residing in old age homes in India, the target population would be all the elderly individuals (aged 60 years and older) residing in old age homes in India.
- In this case, the sampling frame might be a list of elderly persons aged 60 and older who are currently staying at a selected old age home facility in a specific city.
- In this example, the target population is all elderly individuals residing in old age home in India, but the sampling frame is limited to the elderly patients at a particular old age home in a specific city.

Table 9.1 Sampling frame of the study conducted on elderly patients in old age home

Sl. no.	Name of resident	Sl. no.	Name of resident	Sl. no.	Name of resident	Sl. no.	Name of resident
1.	Ram	11.	Bhagwan Das	21.	Om Prakash	31.	Govind
2.	Sushila	12.	Vimla	22.	Sheela	32.	Tarawati
3.	Rameshwar	13.	Mohan Lal	23.	Krishan Kumar	33.	Subhash Chandra
4.	Leela	14.	Kamla	24.	Laxmi	34.	Prabha
5.	Shyam Sunder	15.	Jagdish	25.	Rajendra Prasad	35.	Omkar
6.	Kanta Devi	16.	Sudha	26.	Gayatri	36.	Kamini
7.	Hari Prasad	17.	Dhanraj	27.	Mahesh	37.	Raghunath
8.	Savitri	18.	Shakuntala	28.	Sumitra	38.	Santosh
9.	Gopal	19.	Suraj	29.	Madan Mohan	39.	Mohini
10.	Saraswati	20.	Indira	30.	Meenakshi	40.	Baldev

The sampling frame of the study conducted on elderly patients in old age home has been given in Table 9.1.

Step 3: Specify the Sampling Unit

The sampling unit is a fundamental component that consists of a single element or a cluster of elements drawn from the population for inclusion in the sample. It is the fundamental building block for creating a sample, and it represents the individual or group that researchers gather data from or perform procedures on during the study. For example, in a survey of households, the sampling unit could be an individual household. In a study of students, the sampling unit could be an individual student. In more complex situations, such as health care research, the sampling unit could be a specific health care facility or even a patient. The inclusion and exclusion criteria for selecting the sampling unit are typically defined by the researcher based on the objectives of the study.

For example, consider a study on nurses working in tertiary care hospital. The sampling unit might be the individual nurse, and the unit of inquiry could be the specific information or data collected from each nurse, such as their work hours, job role, or patient interaction patterns (Fig. 9.3).

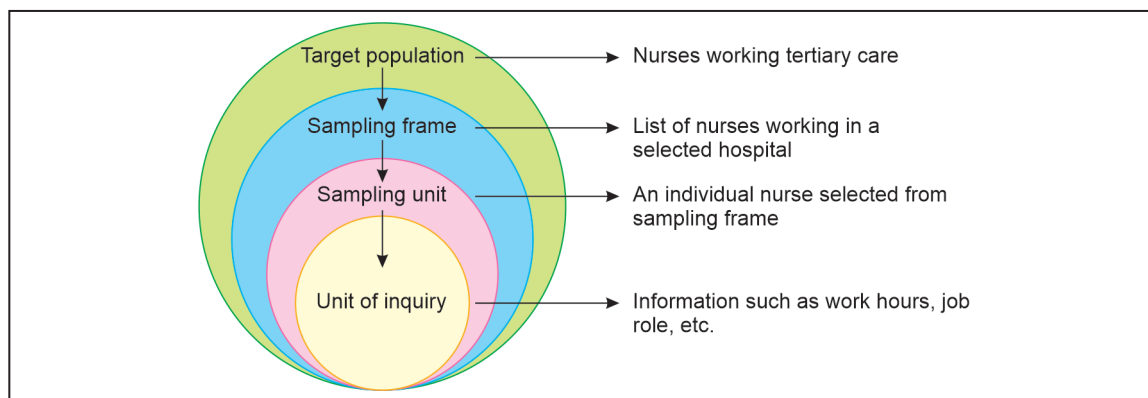


Figure 9.3: Target population and unit of inquiry

Step 4: Determine the Sample Size

The sample size plays an important role in the process of sampling.

The total no. of subjects/units/observations in the sample constitutes the sample size of the study. It is represented by n . In contrast, N refers to the total number of units in the entire target population or **population size**. The ratio of n/N is called **sampling fraction**.

Perhaps, the most important question that concerns the researcher is the **adequate** number of units for inclusion in the sample. In general, calculation of exact sample size is very difficult in every study and one can only get an approximation. It varies in different research settings. In fact, larger sample size leads to more precision in the results.

It is very important to have an accurate sample size. If it is too large, it may waste time, resources or money. On the other hand, too small a sample size may lead to inaccurate results. So, determining the appropriate sample size is an important step in conducting any research study. Sample size calculation is discussed in detail later in this chapter.

Step 5: Choose a Sampling Technique: Probability or Nonprobability

Sampling involves selecting individuals, events, behaviors or elements for a study, with the sampling method defining the specific technique used. The choice of sampling method is influenced by the objectives of the study, the availability of the financial resources, time constraints, and the nature of the research problem. Essentially, there are two methods for selecting a sample from a sampling frame: (1) Probability (random) or (2) Nonprobability (nonrandom). Each of these techniques has its own advantages and disadvantages, which will be discussed in the subsequent section of this chapter.

Step 6: Select Samples as per the Chosen Sampling Technique

Once the population, sampling frame, sampling method, and sample size are determined, this step marks the final phase in the sampling process. It involves putting the sampling plan into action to select the necessary sample for the study. The actual selection of the sample elements takes place in this stage, and it is crucial for the researcher to adhere to the established guidelines for smooth execution of the research.

A sample is a representative subset of the population, defined as the portion of the population from which elements (individuals or objects) are chosen for participation in a research study. Individuals within the sample are often referred to as subjects or participants. In simpler terms, the sample is a scientifically selected group that is considered to possess all the characteristics of the population it represents.

For example, if the goal is to determine how many nurses in a hospital adhere to universal precautions when caring for patients, it might be impractical to observe all the nurses in the hospital. Instead, a sample consisting of nurses from randomly chosen wards can be observed, and they will represent all the nurses in the hospital (Fig. 9.4).

The choice of the sample depends primarily on the study's objectives. Selecting the appropriate sample, determining the correct sample size, and applying the suitable sampling technique are critical factors in the success of a research study.

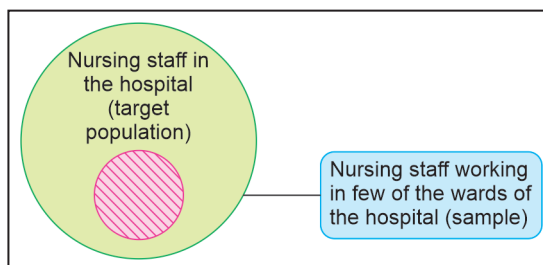


Figure 9.4: Concept of population and sampling

SAMPLING ERROR

Sampling error refers to the discrepancy between the characteristics, traits, behaviors, qualities, or figures observed in a selected sample and the true parameters of the entire population. It is difference between the population mean and the sample mean. It is given that a sample represents only a subset of the entire population; there may be a chance for difference between the sample and the population.

In this instances, where the sample is not truly representative of the entire population, the results obtained from the sample are likely to deviate from those that would be derived from the entire population. Consequently, when interpreting results, it is crucial to consider the presence of sampling error, particularly in probability sampling methods where it can be estimated. Nonprobability sampling methods lack a reliable means of estimating sampling error.

The magnitude of sampling error is influenced by factors such as the sample size, the type of sampling method employed, and the variability within the population. Optimal minimization of sampling error occurs when a representative sample is randomly selected using a probability method and when the sample size is increased. It is important to note, however, that complete elimination of sampling error is practically unattainable. This form of error is sometimes referred to as a chance or standard error.

Strategies to Prevent Sampling Errors in Nursing Research

- Definition of the population of interest:** It involves clearly specifying the population or subgroup, such as patients, nurses, or health care settings, that is intended to be studied. For example, the population of interest could be defined as ‘female patients aged 50–65 with a history of diabetes.’ This specific definition helps researchers shape their research question, sampling methods, and data analysis to address issues relevant to this group.
- Probability sampling:** Probability sampling minimizes the risk of selection bias, where certain individuals or groups are systematically over-represented or under-represented in the sample. This ensures that the sample is more likely to be a true reflection of the population. The randomness of the selection process contributes to the statistical validity of the findings, making it more likely that the study accurately reflects the population’s characteristics.
- Sample size calculation:** The appropriate sample size should be determined through power calculations or statistical software. An adequate sample size is associated with the reduction of both type I and type II errors and the enhancement of result precision.
- Ensuring representativeness:** The population should be represented accurately in the sample by considering variables like age, gender, ethnicity, socioeconomic status, and other relevant factors. The use of convenience sampling, which may lead to biased results, should be avoided.
- Randomization:** In controlled experiments or clinical trials, the random allocation of participants to various treatment groups is essential. This practice serves to eliminate selection bias, enhancing the overall reliability and validity of the study’s findings.
- Sample size impact:** The minimization of sampling errors is achieved by increasing the sample size. But practically sampling error cannot be completely eliminated. Sampling error is sometimes referred to as chance or standard error. Larger samples result in the reduction of sampling process errors and bring the study closer to the characteristics of the entire population, thereby decreasing sampling errors (Fig. 9.5).

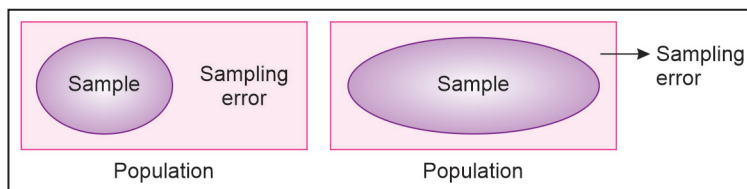


Figure 9.5: Sample and sampling error

- **Stratification:** When subgroups are present within the study's population, it is necessary to employ stratified sampling to ensure the proper representation of each subgroup in the sample.
- **Consideration for peer review:** It is advisable to undergo peer review or seek consultation from a statistician to validate the appropriateness of sampling methods and to minimize potential errors in the research process.

By implementing these strategies, you can reduce the risk of sampling errors in nursing research and increase the validity and reliability of your study's findings.

SAMPLING TECHNIQUES

In order to obtain the sample, it is necessary to use a systematic procedure for its selection. “**Sampling** is the procedure of selecting a representative subset of a population with the aim of discerning the characteristics of the entire population.” Sampling involves the selection of an unbiased or random sample from the population to gain insights into the target population.

The two main types of sampling techniques (Fig. 9.6) are as follows:

1. Probability sampling technique
2. Nonprobability sampling technique

1. Probability Sampling Technique

The probability sampling technique ensures that each element, individual, or unit in the population has an equal chance of being selected as a sample. This approach allows for the generation of an unbiased estimate of the population, aiming to closely resemble the characteristics of the entire population. The probability sample is typically chosen randomly from the population. When every element in the population has the same probability of selection, it is known as an “equal probability of selection” (EPS) design. Such designs are also termed “self-weighting” because all sampled units are assigned the same weight.

Advantages of Probability Sampling Technique

- The probability sampling technique makes valid generalization to the population from which the samples are drawn.
- Probability samples are usually more representative, i.e., they have higher external validity because of less bias.
- More accuracy of sample is there.

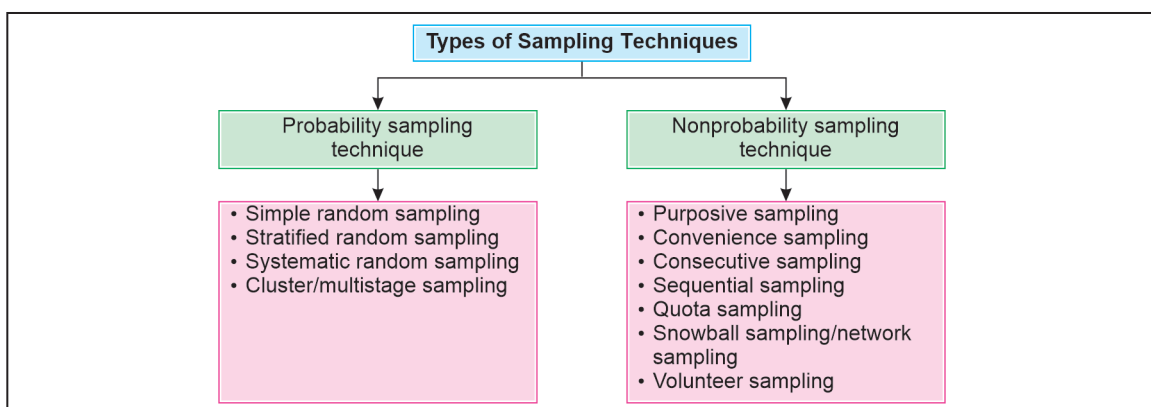


Figure 9.6: Types of sampling techniques

Disadvantages of Probability Sampling Technique

- There is no guarantee of generalization.
- It only allows the researcher to estimate the chance that any given population element will be included in the study.

Types of Probability Sampling Technique

There are basically four types of probability sampling techniques: (1) Simple random sampling (SRS), (2) Systematic random sampling, (3) Stratified random sampling, and (4) Cluster/Multistage sampling (Fig. 9.7).

1. Simple Random Sampling

It is the simplest form of **probability sampling** (Box 9.1). In this method, each individual/subject/unit is chosen randomly and entirely by chance, such that each individual has the **same probability** of being chosen at any stage during the sampling process. Each subset of k individuals has the same probability of being chosen for the sample as any other subset of k individuals. This **minimizes** bias (Fig. 9.8).

To randomly choose the sample, the researchers can make use of a **lottery method**, **table of random numbers**, **computer-generated random number table**, etc. They continue choosing elements at random according to the selected method until the predetermined sample size is attained. Sampling is done without replacement to avoid the occurrence of a unit being sampled more than once.

- **Lottery method:** In the **lottery method**, all items in the sampling frame are numbered on separate slips of paper of identical size and shape. These slips are then folded and mixed up in a bowl. A blindfold selection is then made of the number of slips required to constitute the desired sample size. For example, if we want to take a sample of 10 persons out of a population of 100, then write the names of the 100 persons on separate slips of paper, fold these slips, mix them thoroughly and then make a blindfold selection of 10 slips. In the same way, if we want to know the status of cleanliness of wards in a hospital, all the wards can be assigned a number and their numbered slips can be put in a bowl. The researcher then picks up the slips randomly to choose the wards. Similarly, to know the prevalence of anemia among nurses, they can be selected randomly to estimate their Hb levels.

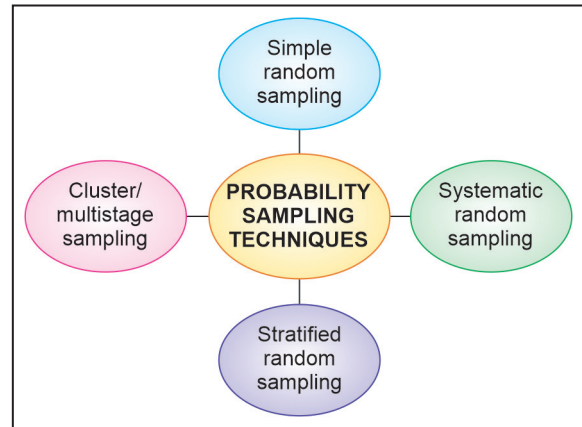


Figure 9.7: Probability sampling techniques

BOX 9.1 Steps of simple random sampling technique

1. Define the target population.
2. Develop a sampling frame.
3. Assign a unique number to each element in the frame.
4. Determine the sample size.
5. Randomly select the targeted number of population elements.

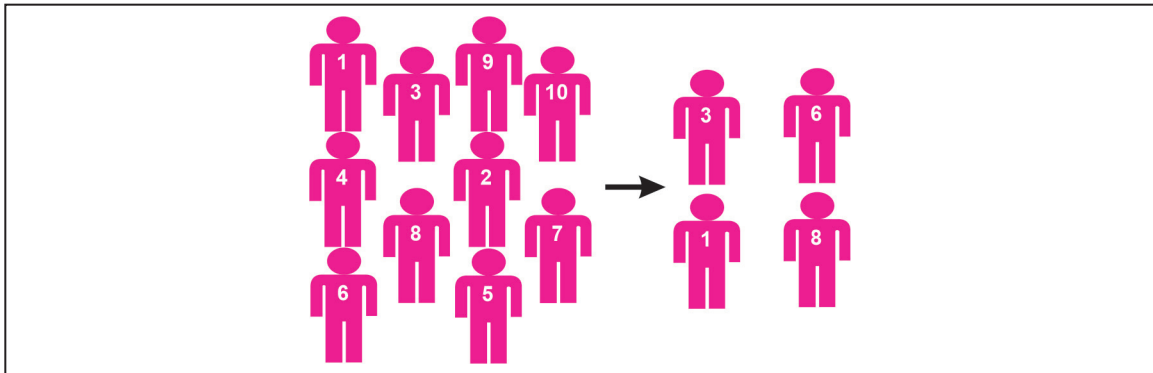


Figure 9.8: Simple random sampling

- **Random number table:** A **random number table** consists of 6 columns of 2 or more digit nonrepeatable numbers (Annexure). The researcher, with eyes closed, then points to any number within the random number table and moves in any systematic fashion (up, down and sideways) to select the correct number of potential participants.
- **Computer-generated random number table:** Figure 9.9A shows the screenshot of Stat Trek's random number generator. The columns we need to fill to generate the random number table are the "minimum" value; "maximum" value (should be more than the required random numbers); "allowing or preventing the duplicate entries" in the generated table; and the "Seed". "The seed is a number that controls whether the Random Number Generator produces a new set of random numbers or repeats a particular sequence of random numbers. If the text box labeled "Seed" is blank, the Random Number Generator will produce a *different* set of random numbers each time a random number table is created. On the other hand, if some number is entered in the "Seed" text box, the Random Number Generator will produce a set of random numbers based on the value of the Seed. Each time a random number table is created, the Random Number Generator will produce the *same* set of random numbers, until the Seed value is changed."

- Enter a value in each of the first three text boxes
- Indicate whether duplicate entries are allowed in the table
- Click the **calculate** button to create a table of random numbers

Note: The seed value is optional. Leave it blank to generate a new set of numbers. Use it to repeat a previously-generated set of numbers

How many random numbers?	100
Minimum value	01
Maximum value	120
Allow duplicate entries	False
Seed (optional)	1

Calculate

Figure 9.9A: Screenshot showing Stat Trek's random number generator



100 Random Numbers																			
067	113	062	007	020	054	001	068	015	082	028	056	089	002	036	069	103	016	049	083
116	030	008	085	042	118	075	032	108	065	022	099	055	012	045	079	112	026	102	059
010	109	087	044	120	077	034	110	046	024	101	057	014	091	047	004	081	038	114	093
071	006	104	105	111	040	018	117	095	073	003	052	058	107	063	119	048	097	115	050
061	051	098	027	041	090	033	096	025	039	088	053	031	094	023	037	086	100	029	043

Specs: This table of 100 random numbers was produced according to the following specifications:
Numbers were randomly selected from within the range of 1 to 120. Duplicate numbers were not allowed. Table entries were selected using a seed value of 1. This table was generated on 7/6/2015.

Figure 9.9B: Computer-generated random number table

For example, if we want to have a random number for a sample size of 100, we can set the minimum value equal to 01 and the maximum value equal to 120, the Random Number Generator will produce a table consisting of random arrangements of the numbers in the range of 01 to 120 as shown in Figure 9.9B.

For a large sample, a random number table or computer-generated table of random number can be used. However, the oldest and most popular is the lottery method.

Advantages of Simple Random Sampling Techniques

The benefits of SRS can be obtained when the target population size is small, homogeneous, and the sampling frame is clearly defined.

- It is one of the easiest ways of doing sampling.
- **Representativeness:** Since every member of the population has an equal chance of being selected, the sample is more likely to accurately represent the population's characteristics.
- **Unbiased:** It minimizes selection bias, making the results more reliable.
- **Statistical validity:** Simple random sampling allows generalization of findings to the population which is a major advantage because such generalizations are more likely to be considered to have external validity.
- There is no bias in the selection of sample as the sample is selected randomly.
- The sample is highly representative of the population being studied.

Disadvantages of Simple Random Sampling Techniques

- **Sampling frame:** Ensuring that the sampling frame is complete and up-to-date can be challenging, as it may not always accurately reflect the entire population.
- **Resource intensive:** If the population is extensive, the process of creating a sampling frame and selecting the sample can be resource-intensive and time-consuming.
- **Small sample sizes:** In smaller populations, simple random sampling may not be practical because it may result in small sample sizes.

- **Randomization:** The process of randomization should be carried out with care to avoid any bias in the selection process.
- A complete and up-to-date list of the whole population units (sampling frame) is required.
- An unbiased random selection of individuals is very important.
- This method is prone to sampling error because the randomness of the selection may result in a sample that does not reflect the composition of the population. This may result in over or under-representation of the sample.
- It is costly and tedious, since it requires constructing a complete sampling frame.

2. Systematic Random Sampling Technique

It is a method of choosing a random sample from a larger population.

As the name signifies, it involves arranging the study population according to some ordering scheme. The subjects are randomly selected from the population at a fixed interval that is predetermined by the researcher. This fixed interval is called the sampling interval (Box 9.2).

Sampling interval (K) = Population size (N)/Sample size (n)

For example, if we want to take 10% nurses for some study out of a total of 200 nurses, we would select every 10th nurse. To calculate the sampling interval, divide the population (200 nurses) by the required sample size (20 nurses), take every 10th nurse. The start must be random to prevent the bias.

Sampling interval = $200/20 = 10$

Diagrammatic representation of systematic sampling technique is shown in Figure 9.10.

Population size: 27; Sample size: 9; K: 3.

BOX 9.2 Steps of systematic random sampling technique

1. Define the target population.
2. Determine the desired sample size.
3. Develop a sampling frame.
4. Determine the number of elements in the sampling frame.
5. Calculate the sampling interval.
6. Randomly select a number from the sampling frame.
7. Then take every Kth number as per the sampling interval until the desired sample size is reached or the sampling frame is exhausted.

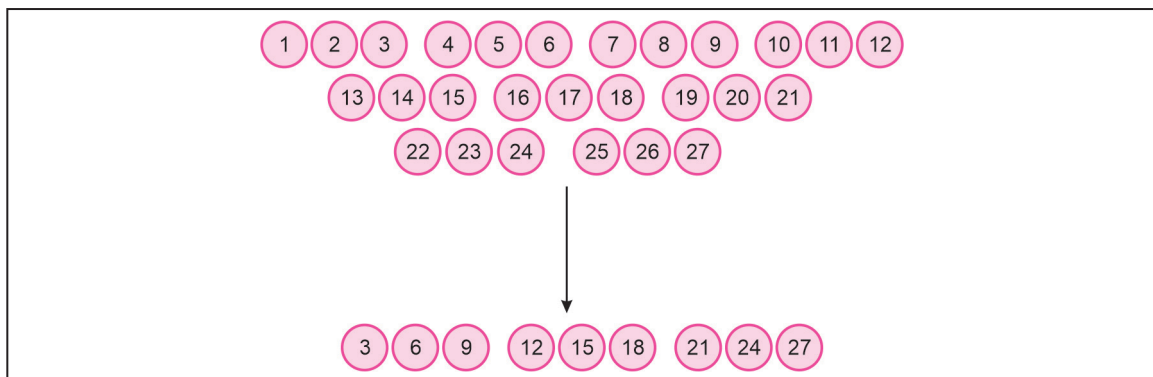


Figure 9.10: Systematic random sampling

If in the first round, somehow the researcher is not able to complete the required sample size, then for the next round, the sampling interval can be reduced. For example, if initially the sampling interval was 10, then it can be decreased to 8 or 6 as per the requirement.

Advantages of Systematic Random Sampling Technique

- **Representativeness:** Systematic sampling ensures that every element in the population has an equal chance of being included. This can lead to a more representative sample compared to simple random sampling.
- **Ease of implementation:** It is relatively straightforward to implement systematic sampling, especially when you have a clear list of the population.
- **Efficiency:** Systematic sampling is often more efficient than simple random sampling, as it requires less time and resources to select the sample.
- **Regular pattern:** Systematic sampling has a regular pattern that may be easier to manage and analyze.

Disadvantages of Systematic Random Sampling Technique

- It may not be possible to select the required sample size if the population is too small.
- Samples may be biased if ordering of population in the beginning is not random.
- In each case, the researcher needs to find out the sampling interval before proceeding further.
- All the members of the population do not have an equal chance of being selected.

3. Stratified Random Sampling Technique

Stratification is the process of grouping the members of the population into homogeneous group before sampling. This sampling technique is used when there is lot of variation of subpopulation or groups. Then it is recommended to sample each group/subpopulation independently to get accurate results or for representation of the population. Stratified sampling techniques are generally used when the population is heterogeneous, or dissimilar, where certain homogeneous, or similar, subpopulations can be isolated (strata). Stratification is basically to divide the population into different strata or into homogeneous subgroups before sampling. These strata or categories may be the age, sex, educational background, occupation, ethnicity, etc. depending upon their importance in the study. But utmost care should be taken that each subgroup is different from other and one unit is assigned to only one stratum. Then from each subgroup/stratum, elements are selected randomly as in random or systematic sampling technique (Fig. 9.11).

The sample is drawn from each subgroup in proportion to the number of members/units in each group.

Here is how you can use stratified random sampling with types in nursing research:

- **Identify your population:** Start by defining the entire population you want to study. This might include patients, nurses, or health care facilities, depending on your research focus.

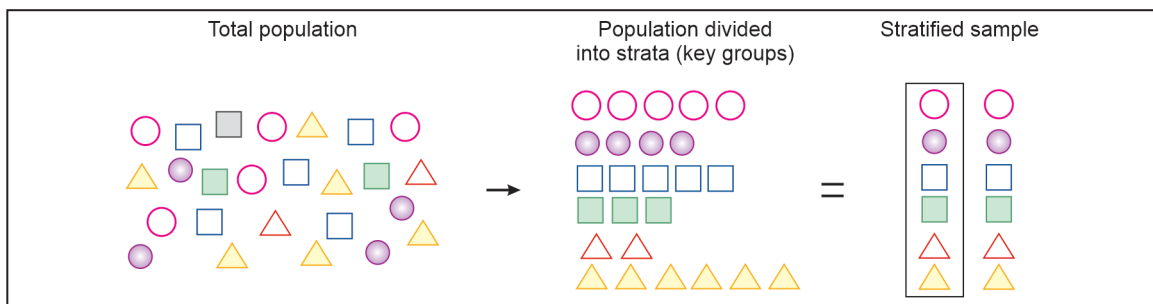


Figure 9.11: Stratified random sampling
(Source: www.formyschoolstuff.com)

- **Define types or subgroups:** Determine the different types or subgroups within your population that you want to study. For instance, in nursing research, you might have different types of patients (e.g., pediatric, adult, geriatric), different nursing units (e.g., medical-surgical, intensive care, emergency), or different health care facilities (e.g., hospitals, clinics, nursing homes).
- **Stratification:** Divide your population into these distinct subgroups (strata). Each stratum should be mutually exclusive, and individuals or elements should belong to only one stratum. This division helps ensure that each type or subgroup is adequately represented in the sample.
- **Random sampling:** Within each stratum, use a random sampling technique to select a sample of individuals or elements. You can use various randomization methods, such as random number generators, to select participants from each stratum. The sample size within each stratum should be proportional to the size of the stratum relative to the overall population.
- **Combine samples:** Once you have selected samples from each stratum, combine them to create your final research sample. This sample will be stratified and representative of the entire population.

Types of Stratified Random Sampling (Fig. 9.12)

Proportionate Sampling

Definition: In proportionate sampling, the sample size for each stratum is determined in proportion to its size within the overall population. In other words, each stratum's size in the sample reflects its size in the population. This means larger strata get larger samples, and smaller strata get smaller samples.

Example: If you are conducting research on patients in a hospital and have three strata—(1) Pediatric, (2) Adult, and (3) Geriatric patients, and they make up 20%, 50%, and 30% of the total patient population, respectively, you would take a sample where 20% of the patients are pediatric, 50% are adult, and 30% are geriatric.

Disproportionate Sampling

Definition: In disproportionate stratification, the sample size of each stratum does not have to be proportionate to the population size of the stratum. This means that two or more strata will have different sampling fractions. Thus, difference between proportionate and disproportionate stratified random sampling is their sampling fractions only. In the context of stratified sampling, sampling fraction is the ratio of the sample size to the size of the stratum.

Example: Consider that in an institution there are 200 nursing students, 150 dental students and 100 medical students, and the researcher wants to have equal number of students, i.e., 50 students to be included in the study. So, as per the disproportionate random sampling technique, the researcher will randomly select 50 students by having different sampling fraction for each category.

If the researcher takes the same proportion from each stratum, the sample will have elements of each stratum in the same proportion as in population, this is called proportionate stratified sample. For example, suppose a study is to be conducted on nursing students with a population of 200 BSc Nursing students and

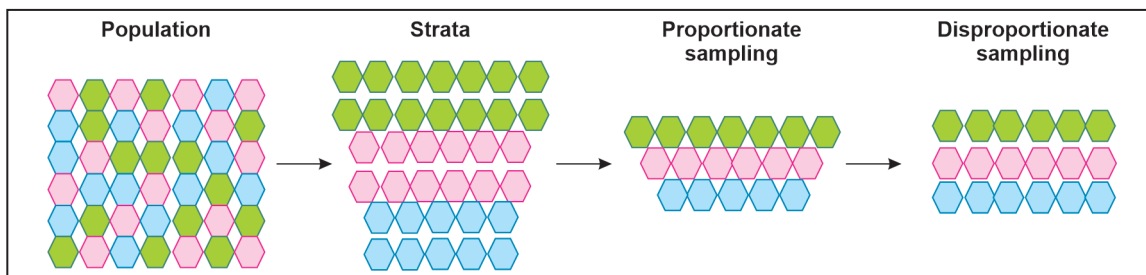


Figure 9.12: Proportionate and disproportionate sampling



BOX 9.3 Steps of stratified random sampling technique

1. Define the target population.
2. Identify stratification variable(s) and determine the number of strata to be used.
3. Develop a sampling frame that includes information on the stratification variables for each element.
4. Divide the sampling frame into strata to create a sampling frame for each stratum.
5. Assign a unique number to each element.
6. Determine the sample size for each stratum.
7. Randomly select the targeted number of elements from each stratum.

100 of MSc Nursing students. So, the total sample will be 300 nursing students. The proportionate sample size in case of BSc Nursing students will be $200/300$, and for MSc it will be $100/300$. The important thing to remember in this technique is to use the same sampling fraction for each stratum regardless of the differences in population size of the strata. In disproportionate sampling, the different strata will have different sampling fractions.

The steps of stratified sampling technique have been given in Box 9.3.

Advantages of Stratified Random Sampling Technique

- It provides more accuracy than simple random technique.
- It gives more accuracy of the representation of population.
- The researcher can learn about the relationship that exists among the chosen strata.

Disadvantages of Stratified Random Sampling Technique

- Need to have information of whole of the population.
- It is time-consuming and costly method as it has several steps in drawing the sample.
- The data analysis is little tedious as the number and size of strata population is to be considered.
- Stratified characteristics need to be known in advance.
- The precision of this design is highly dependent on the sampling fraction allocation by the researcher. If the researcher commits mistakes in allotting sampling fractions, a stratum may either be over-represented or under-represented which will result in skewed results.

4. Cluster Sampling (Multistage Sampling) Technique

Cluster sampling is a sampling technique often used when it is difficult or impractical to survey every individual in a large population. Here, the population is divided into groups or clusters, and a random sample of these clusters is selected for the study. These can be naturally occurring group of elements such as schools, hospitals or health areas (Box 9.4).

It is usually used when sampling has to be done on large geographic area and researcher cannot get a complete list of members of the population but can get the list of groups or clusters of the population.

BOX 9.4 Steps of cluster sampling technique

1. Define the target population.
2. Determine the desired sample size.
3. Develop a sampling frame of clusters of the target population.
4. Estimate the average number of population per cluster.
5. Determine the number of clusters to be selected.
6. Randomly select the targeted number of clusters.

Then random sampling is done in these groups or clusters. The cluster is the unit of sampling. Then, from the selected cluster, either each member can be studied or the sample can be chosen systematically or randomly (Figs 9.13 and 9.14).

The cluster sampling can be **single stage sampling**, **two stage sampling** or **multistage sampling**. In **single stage**, all the elements from each selected cluster are studied. In **two stage**, random sampling technique is used to select few elements from the clusters. **Multistage** sampling technique involves selecting a sample in two or more successive stages.

Example 1: If a researcher wants to conduct a study on nursing supervisors working in hospitals of a particular state. Then first randomly select a percentage of hospitals of the state which will be the clusters. Then survey each nursing supervisor of the selected hospital. This will be a single stage sampling technique. If the study is to be conducted on staff nurses of various hospitals of a district, then after randomly selecting the hospital, the nurses in the selected hospitals will also be selected randomly because it may not be possible for each staff nurse to be included in the study. Likewise, it will be a multistage sampling technique.

The cluster is the unit of sampling. Cluster sampling is useful where we cannot get lists of the whole population.

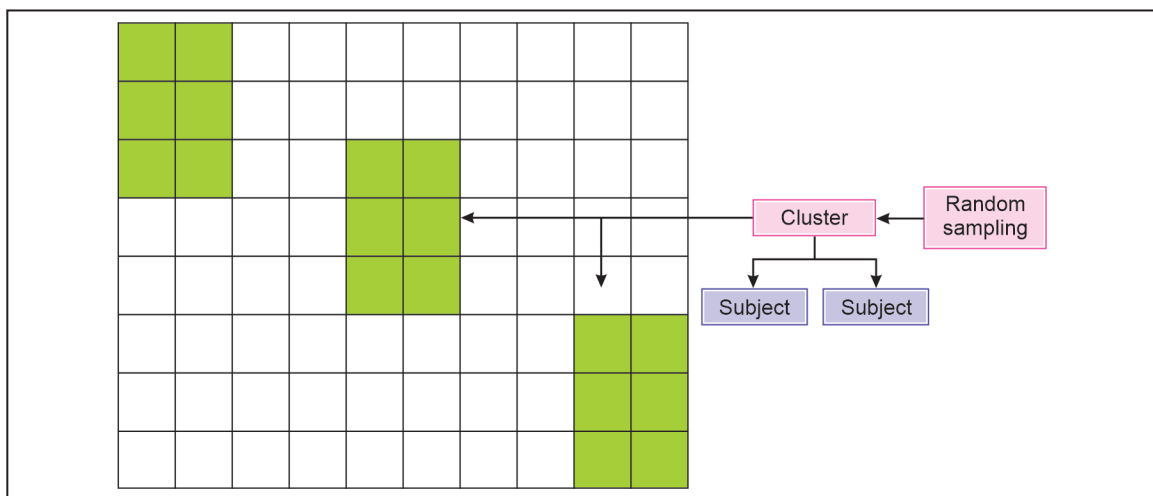


Figure 9.13: Cluster sampling

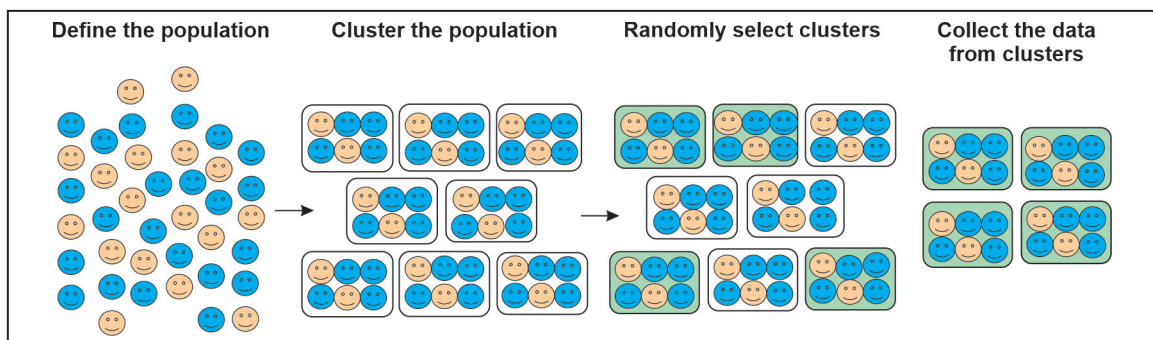


Figure 9.14: Cluster sampling process

Example 2:

- **Population and clusters:** Consider a scenario where you are conducting a study on medication adherence among diabetic patients in a large city. The entire population of diabetic patients in the city is your target population. However, it is not feasible to collect data from all of them due to logistical constraints.
- **Cluster selection:** Instead of selecting individuals randomly from the entire population, you choose to employ cluster sampling. First, you divide the city into clusters based on a natural grouping, such as health care facilities. Each cluster represents a subgroup of the population.
- **Random cluster selection:** Next, you randomly select a subset of these clusters for your study. Let's say you randomly select 5 out of the 20 health care facilities that offer diabetes care services in the city.
- **Data collection within clusters:** Within each selected cluster (i.e., health care facility), you collect data from all diabetic patients. This could involve surveys, interviews, or medical record reviews to assess medication adherence. In this way, you get a representative sample of diabetic patients from these clusters.
- **Analysis:** Once the data is collected, you can analyze it to draw conclusions about medication adherence among diabetic patients in the entire city. Statistical techniques can be applied to account for the cluster sampling design and calculate population-level estimates.

Let's say you have randomly selected five health care facilities in the city, and within each of these facilities, you collect data from diabetic patients regarding their medication adherence. After analyzing the data, you find that the average medication adherence rate in these five facilities is 75%.

Now, you can use statistical techniques to extrapolate this finding to the entire city's population of diabetic patients. With appropriate calculations and statistical methods, you can estimate the overall medication adherence rate for all diabetic patients in the city.

Advantages of Cluster Sampling Technique

- It is economical, as clustering can reduce travel and administrative costs.
- Sampling frame (listing of all the elements in the target population) is not required.
- It is more convenient especially when the population is large and more dispersed.
- Also suitable for survey of institutions.

Disadvantages of Cluster Sampling Technique

- This technique is **the least representative** of the population.
- There is a chance of having an **over-represented or under-represented** cluster which can skew the results of the study.
- There is also a possibility of high **sampling error** which is brought by the limited clusters included in the sample leaving off a significant proportion of the population unsampled.

The differences between random sampling and randomization is given in the Box 9.5.

BOX 9.5 Random sampling versus randomization

Confusion can arise between random sampling and randomization in research methodologies. To clarify:

Random sampling is a method of selecting subjects from a population with each individual having an equal chance of being included. This process ensures the formation of a representative sample for a study. On the other hand, **Randomization** is a procedure within the experimental phase where selected participants are allocated randomly to different treatment groups or conditions. It ensures that any observed effects are likely due to the treatment rather than pre-existing differences between groups. Even if, the initial sample was drawn using nonprobability sampling, randomization can be done to minimize biases.

In simple words, random sampling is an initial step of selecting subjects while randomization is the process of allocating selected subjects into different treatment groups.

2. Nonprobability Sampling Technique

In **nonprobability sampling technique**, elements or members of the population **do not** have an equal chance of being chosen in the study. It involves the selection of elements based on assumptions regarding the **population of interest**, which forms the criteria for selection. **This method is used when the population parameters are either unknown or not possible to individually identify. Hence, because the selection of elements is nonrandom**, nonprobability sampling does not allow the estimation of sampling errors. It restricts generalization. In a general sense, it is an umbrella term, which includes any sample that does not conform to the requirements of a probability sampling.

These conditions give rise to:

- Exclusion bias.
- Placing limits on how much information a sample can provide about the population.
- Information about the relationship between sample and population is limited.
- The sample chosen may not represent the whole population.

It is usually done by the researcher in case studies, pilot studies, qualitative research, accidental sampling, quota sampling, and purposive sampling and for hypothesis development. This sampling method is usually employed in studies that are not interested in the parameters of the entire population.

Advantages of Nonprobability Sampling Technique

- Sample can be chosen conveniently.
- Cost-effective.

Disadvantages of Nonprobability Sampling Technique

Though it is simple and easy sampling technique, it has certain disadvantages:

- It is likely that some combinations of individuals are more selected than others.
- Some individuals may have absolutely no chance of being selected.
- Sample is less representative of the population because we do not know which members of the population have a chance to be included in the sample.
- Cannot generalize the findings to whole of the population.

Types of Nonprobability Sampling Technique

There are five main types of nonprobability sampling techniques, i.e.: (1) Convenience sampling, (2) Quota sampling, (3) Purposive sampling, (4) Snowball sampling, and (5) Sequential sampling (Fig. 9.15).

Convenience Sampling

Convenience sampling, also referred to as **accidental sampling**, is a nonprobability sampling technique where subjects are selected because of their convenient in **accessibility and proximity** to the researcher (Fig. 9.16).

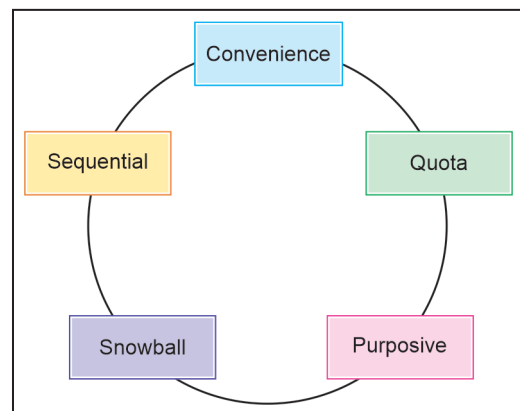


Figure 9.15: Nonprobability sampling technique

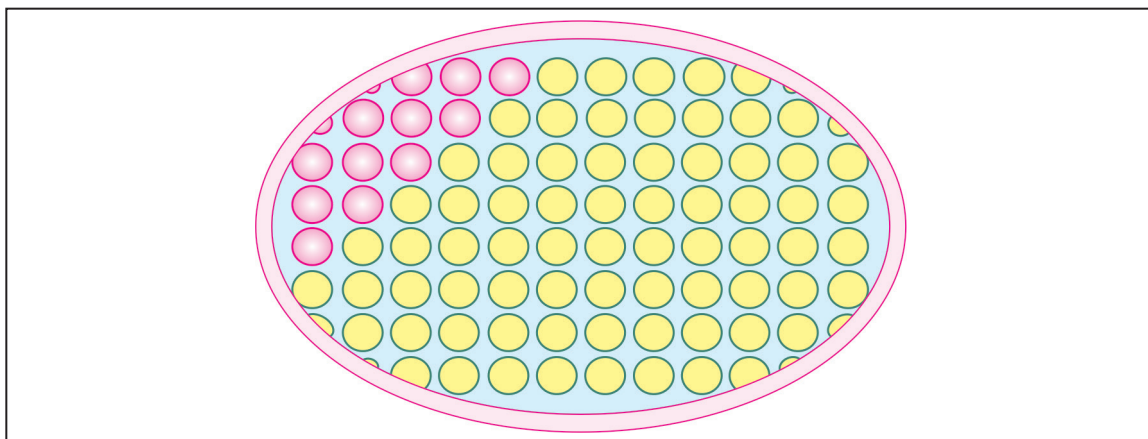


Figure 9.16: Convenience sampling technique

A convenience sample is one that uses any available elements of the population that meet the criteria to enter the study. It is **the most commonly used** of all sampling techniques. Many researchers prefer this sampling technique because it is fast, inexpensive, easy and the subjects are readily available. Conducting a research study on the students of researcher's own college is an example of convenience sampling.

Advantages of Convenience Sampling Technique

- Convenience sampling technique can be used in pilot studies, because it allows the researcher to acquire the basic data and trends regarding his study.
- This sampling technique is also useful in documenting that a particular quality of a substance or phenomenon occurs within a given sample.
- It is economical and saves time.
- The sample has easy accessibility.

Disadvantages of Convenience Sampling Technique

- There are more chances of having sampling bias.
- Generalization of the findings to the entire population is another limitation. Since the sample is not representative of the population, the results of the study cannot talk for the entire population. It results in a low external validity of the study.

Quota Sampling

Quota sampling is similar to stratified random sampling. The first step in both the methods involves dividing the population into homogeneous strata and then selecting sample elements from each of these strata. The difference lies in selecting the potential subjects from these strata. Stratified random sampling involves a random sampling method of obtaining sample members whereas quota sampling obtains members through convenience samples (Box 9.6).

Quota sampling is used in research in which it is desirable to access different subgroups of the population. To ensure that the sample does not become over loaded with subjects having certain characteristics, the researcher specifies a percentage for the inclusion of subjects in the sample so that the sample is proportionate to the characteristics of the population.



BOX 9.6 Steps of quota sampling

- Divide the population into exclusive subgroups. Identify the proportions of these subgroups in the population. This same proportion will be applied in the sampling process.
- Select subjects from the various subgroups while taking into consideration the proportions noted in the previous step which ensures that the sample is representative of the entire population as far as possible.

For example, we want to conduct a research study on awareness of bedside nurses regarding organ donation working in ten general wards of a hospital. The total nurses including both male and female working in these areas are 400. We need to include 30 nurses including 20 females and 10 males from each area. We would keep on including the subjects who fulfill the inclusion criteria until the quota (30 subjects: 20 females and 10 males) in one particular unit is completed before moving to the next one.

Advantages of Quota Sampling Technique

- Quota sampling is useful when time is limited.
- It allows the researchers to sample a subgroup that is of great interest to the study. If a study aims to investigate a trait or a characteristic of a certain subgroup, this type of sampling is the ideal technique.
- It also allows the researchers to observe relationships between subgroups. In some studies, traits of a certain subgroup interact with other traits of another subgroup. In such cases, it is also necessary for the researcher to use this type of sampling technique.
- It is a cost-effective method of sampling.
- It also allows the researcher to study traits and characteristics that are noted for each subgroup.

Disadvantages of Quota Sampling Technique

- It may not be representative of the population because only the selected traits of the population are taken into account in forming the subgroups.
- There may be skewed or biased representation of a particular trait in the process of sampling the subgroups.
- The researcher selects the respondents based on availability rather than on their suitability to the study.
- The quota reflects the population in terms of superficial characteristics.

Snowball Sampling

Snowball sampling is also known as **nominated sampling, network sampling or link tracing sampling. This technique is used by researchers to locate the potential subjects when they are difficult to trace out.**

In this technique, subjects are asked to provide referrals to other study subjects. Thus, the sample grows like a snowball. So, it works like chain referral. Following the enrollment of the first subject in the study, the researchers ask him/her regarding the accessibility or availability of some other individual with the similar problem. The researchers then enroll the nominated subjects and continue in the same way until they obtain sufficient number of subjects.

Snowball sampling is quite suitable to use when members of a population are hidden and difficult to locate. For example, it is difficult to locate the bedridden patients in the community settings. So, snowball technique can be used in carrying out some interventional study on these patients.

Types of Snowball Sampling Technique

1. Linear snowball sampling
2. Exponential nondiscriminative snowball sampling
3. Exponential discriminative snowball sampling



1. **Linear snowball sampling:** One subject is giving reference for the second one and so on (Fig. 9.17).
2. **Exponential nondiscriminative snowball sampling:** One subject is giving reference for another two and then these two subjects for another four and so on (Fig. 9.18).
3. **Exponential discriminative snowball sampling:** One subject is giving reference for another two, of which only one is active and gives reference for another two, of which again only one is active, and so on (Fig. 9.19).

Advantages of Snowball Sampling Technique

- It facilitates the researcher to reach the subjects that are difficult to sample using some other sampling techniques.
- It is quite simple and cost-efficient to make use of this method.
- Not much planning is required.
- This sampling technique is also cost-effective from manpower point of view as compared to other sampling techniques.

Disadvantages of Snowball Sampling Technique

- The researchers rely mainly on the information provided by the previous subjects. So, they have modest control over the sampling method.
- The sample may not be representative of the population.
- More chance of sampling bias is there.
- Snowball sampling can produce varied and inaccurate results.

In snowball sampling technique, the previous subjects suggest the name of the other people that they are aware of. So, they may share the same traits and characteristics. Thus, it is possible that the sample the researcher will obtain is only a small subgroup of the entire population.

Purposive Sampling

Purposive sampling is also called subjective or judgmental sampling technique. It is a nonprobability sampling technique in which the researcher himself purposively chooses certain subjects which to his judgment are best representatives of the universe. Here the selection is deliberate and based on own idea of the researcher about the sample units. The researcher sets up certain criteria thought to be representative of the target population and deliberately selects subjects according to these criteria. For example, a study was carried out to see the effect of video vs. live demonstration on nasogastric tube insertion on the skill of nursing students. Purposively BSc Nursing 2nd year students were selected for this study because the students learn this procedure in 2nd year only.

Advantages of Purposive Sampling Technique

- It is cost-effective and less time-consuming.
- It prevents unnecessary and irrelevant items entering into the sample.
- It gives better results if the researcher is unbiased and has the capacity of keen observation and sound judgment.

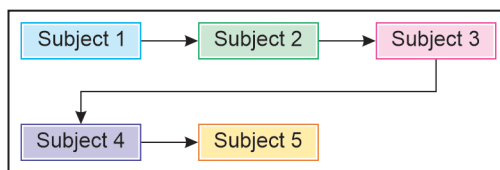


Figure 9.17: Linear snowball sampling

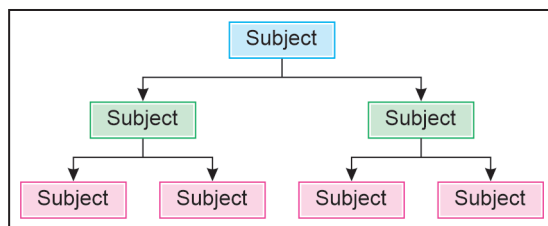


Figure 9.18: Exponential nondiscriminative snowball sampling

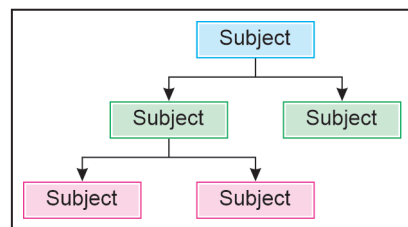


Figure 9.19: Exponential discriminative snowball sampling

Disadvantages of Purposive Sampling Technique

- There is enough scope for bias as the sample is purposely selected by the researcher.
- Equal chance for all the items to be included in the study is not there.
- Less degree of accuracy is there.

Sequential Sampling Technique

In this method, the researcher selects a single or a small group of subjects in each time interval, conducts the study, analyzes the results, and attempts to draw inferences. If necessary, the researcher then selects another group of subjects and repeats the process. This approach provides the researcher with numerous opportunities to fine-tune research methods and gain valuable insights into the ongoing study. The researcher can collect an unlimited number of subjects before ultimately deciding whether to accept the null or alternative hypothesis.

Advantages of Sequential Sampling Technique

The various advantages of sequential sampling technique include:

- There is no limitation on the sample size; it can vary from relatively small to excessively large based on the researcher's decision-making.
- The sampling schedule is highly flexible. The second group of subjects can only be obtained after conducting the experiment with the initial group.
- This method allows the researchers to refine their research methods and results. Due to the repetitive nature of this sampling approach, minor changes and adjustments can be made during the initial stages of the study to correct and perfect the research method.
- There is a minimal effort required on the part of the researcher when employing this sampling technique. It is less expensive, less time-consuming and requires fewer manpower resources.

Disadvantages of Sequential Sampling Technique

The various disadvantages of sequential sampling technique include:

- The sample is hardly representative of the entire population. Its only hope of approaching representativeness is when the researcher chooses to use a very large sample size significant enough to represent a big fraction of the entire population.
- It lacks randomness.

The results cannot be used to draw conclusions and interpretations pertaining to the entire population.

A brief summary of probability and nonprobability sampling technique along with their advantages and disadvantages is depicted in Table 9.2.

FACTORS AFFECTING SAMPLING PROCESS

A number of factors decide whether to choose probability or nonprobability sampling method. These are enlisted as follows:

- Study objective and hypothesis
- Type of study design
- Nature and quality of sampling frame
- Sampling technique
- Accuracy of requirement of study results
- Ethical concern
- Time, cost and operational issues
- Need for generalizability over other population
- Attrition rate and accessibility of study subjects.



Table 9.2 Sampling techniques: Advantages and disadvantages

Technique	When to use it	Advantages	Disadvantages
Simple random	When the population members are similar to one another on important variables. Sampling frame is available	• Every member is given equal opportunities of being selected • Highly representative if all subjects participate • Ensures a high degree of representativeness	• It is not possible without a complete list of all the members of population • Time-consuming and tedious
Systematic	When the population members are similar to one another on important variables. No sampling frame is there	• Very simple to use • Evenly sampled population • Ensures a high degree of representativeness	Less random than simple random sampling
Stratified random	When the population is heterogeneous and contains several different groups, some of which are related to the topic of the study	• Can ensure that specific groups are represented, even proportionally, in the sample(s) (e.g., by age), by selecting individuals from strata list • Ensures a high degree of representativeness of all the strata	• More complex, requires greater effort than simple random • Strata must be carefully defined • Time-consuming and tedious
Cluster (Multistage)	When the population consists of units rather than individuals	• Possible to select randomly when no single list of population members exists, but local lists do	
		• Can make up probability sample by random at stages and within groups • Possible to select random sample when population lists are very localized	• Possibly, members of units are different from one another, decreasing the techniques' effectiveness • Complex, combines limitations of cluster and stratified random sampling
Convenience, Accidental, Volunteer	When the members of the population are convenient to sample	• Inexpensive way of ensuring sufficient numbers of a study • Convenient	• Degree of generalizability and inference of the entire population is questionable • Can be highly unrepresentative • Low external validity of the study
Quota	When strata are present and stratified sampling is not possible	• Ensures selection of adequate numbers of subjects with appropriate characteristics • Ensures some degree of representativeness of all the strata in the population	• Not possible to prove that the sample is representative of designated population • Degree of generalizability is questionable

Contd...



Technique	When to use it	Advantages	Disadvantages
Snowball	Subjects are difficult to locate	• Possible to include members of groups where no lists or identifiable clusters even exist (e.g., drug abusers, rare disease) • Cheap, simple and cost-efficient • Needs little planning and fewer workforce	No way of knowing whether the sample is representative of the population
Purposive	Subjects fulfilling certain criteria as set by researcher	Ensures balance of group sizes when multiple groups are to be selected	Samples are not easily defensible as being representative of populations due to potential subjectivity of researcher
Sequential	Neither sample size nor the time frame of data collection is fixed initially	• Researcher gets many chances to refine the methods • Repeated observations will give better insight into the study	• Very difficult and time-consuming to conduct the study • Very less representativeness

Source: Black TR. Doing quantitative research in the social sciences: An integrated approach to research design, measurement, and statistics. Thousand Oaks, CA: SAGE Publications, Inc. 1999. p. 118.

CHARACTERISTICS OF A GOOD SAMPLE

A good sample is one which fulfills all or a few of the following characteristics:

- **It should be representative:** At the time of selecting a sampling technique by the researcher, the basic assumption is that the samples so selected out of the population are the best representative of the population under study. Thus, good samples are those which accurately represent the population. Probability sampling technique yields representative samples.
- **It should be accurate:** Accuracy is defined as the degree to which bias is absent from the sample. An accurate sample is one which exactly represents the population. It is free from any influence that causes any differences between sample value and population value.
- **It should be of appropriate size:** A good sample must be adequate in size and reliable. The sample size should be such that the inferences drawn from the sample are accurate to a given level of confidence to represent the entire population under study. The size of sample depends on number of factors like the type of study, homogeneity or heterogeneity of the population. In quantitative study, a large sample size is required; however, the qualitative studies can be conducted even on a small sample size. If the population is homogeneous then a small sample will represent the behavior of entire universe. On the other hand, if the population is heterogeneous in nature then samples are to be chosen from each heterogeneous unit.

Remember that big is good, but appropriate is better.

ADVANTAGES OF SAMPLING

- Census studies or complete enumerations are usually not possible. So, sampling is the only practical study option available.
- If sampling is done in a correct manner it is much more convenient and efficient as the population to be studied is significantly reduced.



- It cuts the cost of the study drastically thus opening up avenues of improving the study outcome by better use of finances.
- Trained personnel can carry out the entire task as the units of inquiry are significantly less.

DISADVANTAGES OF SAMPLING

Even though it is the only practical approach in most cases, sometimes it is not the approach as it has certain disadvantages as listed below:

- Sampling fluctuation is a factor that requires caution because no matter how carefully samples are chosen, variability exists between two different samples.
- In certain situations, particularly in clinical trials, including some individuals and excluding others from the sample can be challenging.
- Sometimes, however, it is essential to include the complete population in a survey. For example, in census reports depicting population trends, sex ratios, expenditure reports of an organization, etc.

SAMPLE SIZE CALCULATION

Sample Size in Quantitative Research

Basic Concepts of Sample Size Calculation

Several key statistical concepts are involved in sample size calculation. A researcher needs to have the following information to calculate sample size:

- **Null and alternative hypotheses:** It is essential for experimental studies. The null hypothesis signifies no observed difference, set for rejection. It is always accompanied by an alternative hypothesis indicating a significant difference. Clear definition of the null hypothesis is crucial.
- **Significance level (α):** It denoted by α , it represents the probability of rejecting a truly true null hypothesis (Type I error). Commonly set at 5% ($\alpha = 0.05$) or sometimes at 1% ($\alpha = 0.001$) for biomedical research, with corresponding confidence intervals (CI) of 95% and 99%.
- **Study power ($1 - \beta$):** It refers to the probability of detecting a significant difference when it exists. In clinical trials, a power of 80% or greater is often considered appropriate, minimizing the risk of false negative results.
- **Expected effect size:** It represents the magnitude of the relationship between variables in the population. Calculated difference between effects of intervention and control groups. Estimations often drawn from pilot studies or existing data.
- **Underlying event rate:** The prevalence or underlying event rate in the population is a crucial factor in sample size calculation. It informs researchers about the baseline occurrence of the condition under study. For example, in the investigation of the association between smoking and lung cancer, knowledge of the prevalence rate for lung cancer in the study population is essential.
- **Margin of error/precision:** A random sampling error indicating the likelihood of sample results varying from the population. For example, a 30% prevalence with a 5% margin of error implies a range of 25% to 35% in the population.
- **Standard deviation (SD) in the population:** Anticipating population variance is crucial in sample size calculation. Homogeneous populations require smaller sample sizes due to reduced variance. For example, when investigating the impact of yoga therapy on weight loss, the participant's weight range varies from 50 kg to 120 kg. This results in larger SD or variance and subsequently higher sample size.

- **One-tail and two-tail inferential statistical tests:** Choice of one-tail or two-tail depends on study objectives. One-tail tests suffice when certain about the direction of the effect. Two-tail tests are prudent when uncertain about the effect's direction.

Sample size estimation of two commonly used research designs, i.e. descriptive studies (cross-sectional) and experimental studies, are discussed below with example.

Sample Size Estimation for Descriptive Studies (Cross-Sectional)

In cross-sectional studies aimed at estimating a population parameter, sample size calculation involves the prevalence of a particular characteristic or the mean value of a quantitative variable.

The formula for sample size (n) in a cross-sectional study is:

$$n = \frac{Z^2 \times P \times (1 - P)}{d^2}$$

where:

- Z is the Z-score corresponding to the desired confidence level (e.g., 1.96 for 95% confidence).
- P is the estimated prevalence or proportion in the population.
- d is the precision or margin of error.

Example calculation:

Let us say a researcher is conducting a cross-sectional study to estimate the prevalence of diabetes in a community. The researcher wants 95% confidence level ($Z = 1.96$), and estimated prevalence (based on previous study or pilot study) is around 30% ($P = 0.3$). The researcher wants a margin of error of 5% ($d = 0.05$).

Let us apply the values into the formula:

$$\begin{aligned} n &= \frac{Z^2 \times P \times (1 - P)}{d^2} \\ n &= \frac{(1.96)^2 \times 0.3 \times (1 - 0.3)}{(0.05)^2} \\ n &= \frac{3.8416 \times 0.21}{0.0025} \\ n &= \frac{0.807936}{0.0025} \\ n &\approx 323 \end{aligned}$$

Therefore, a sample size of approximately 323 individuals is needed for the cross-sectional study to estimate the prevalence with a 95% confidence level and a 5% margin of error.

Sample Size Estimation for Experimental Studies

In experimental studies, determining the sample size is crucial for ensuring the study's statistical power and reliability. The formula for sample size (n) in an experimental study is given below:

$$n = \frac{2 \times (Z_{\alpha/2} + Z_{\beta})^2 \times \sigma^2}{d^2}$$

where:

- $Z_{\alpha/2}$ is the Z-score corresponding to the desired significance level (α).
- Z_{β} is the Z-score corresponding to the desired power ($1 - \beta$).
- σ is the population standard deviation.
- d is the effect size or the minimum difference you want to detect.

Example calculation

Suppose a researcher is conducting an experimental research to compare the effectiveness of two teaching methods on exam scores. The researcher wants a significance level of 0.05 ($Z_{\alpha/2} = 1.96$), a power of 0.80 ($Z_{\beta} = 0.84$), and expects a standard deviation of 10. Researcher aims to detect a minimum difference of 5 points in exam scores.

Note: For 80% power $Z_{0.80} = 0.84$; For 90% power $Z_{0.90} = 1.282$

Let us apply the values into the formula,

$$\begin{aligned}
 n &= \frac{2 \times (Z_{\alpha/2} + Z_{\beta})^2 \times \sigma^2}{d^2} \\
 n &= \frac{2 \times (1.96 + 0.84)^2 \times (10)^2}{5^2} \\
 n &= \frac{2 \times (2.80)^2 \times 100}{25} \\
 n &= \frac{2 \times 7.84 \times 100}{25} \\
 n &= \frac{1568}{25} \\
 n &= 62.72
 \end{aligned}$$

Therefore, a sample size of approximately 63 participants per group is needed for the above study to achieve a significance level of 0.05, a power of 0.80, and to detect a minimum difference of 5 points in exam scores.

Sample Size Estimation Using Online Tools

Several online tools are available to estimate the sample size for research. These tools can be helpful for researchers who are not familiar with statistical formulas or who need a quick and easy way to determine the appropriate sample size for their study.

Study design	Web URL to calculate sample size
Descriptive study (survey)	https://www.calculator.net/sample-size-calculator.html
Experimental study	https://clincalc.com/stats/samplesize.aspx
All types of studies	https://sample-size.net/all-calculators-on-this-site/

Open the URL and fill the required parameters and get the sample size. Calculate the attrition-adjusted sample size by adding 10% of the initial sample size to account for attrition. For example, if the calculated sample size is 40, then add 4 (10% of 40) to arrive at the final sample size of 44.

Sample Size in Qualitative Research

The qualitative researches are not much concerned about the sample size. The information is collected from the subjects till the researcher reaches saturation or there is redundancy of data. In other words, the researcher conducts the interviews of the subjects till no new concepts of information emerge. That is, the concepts, themes, etc. begin to be redundant.

SUMMARY

- Sampling is a statistical process that involves selecting a subset of a population to make observations and statistical inferences. Sampling allows researchers to conduct studies about a large group by using a small portion of the population.
- The population is composed of two groups, i.e., the Target population and the Accessible population. The Target population encompasses the entire group of people or objects to which the study findings are intended to be generalized and who meet the researcher's specified eligibility criteria.
- A sample refers to a subset of individuals or elements selected from a larger population for the purpose of studying and making inferences about that population.
- Sampling error refers to the discrepancy between the characteristics, traits, behaviors, qualities, or figures observed in a selected sample and the true parameters of the entire population. It is the difference between the population mean and the sample mean.
- There are two broad types of sampling methods, including probability sampling (where each member of the population has an equal chance of being selected) and non-probability sampling (where the selection is based on researcher's choice and specific criteria).
- The decision regarding the size of sample is determined primarily by the considerations such as the degree of precision required, the type of sampling procedure used, the homogeneity of the population, cost and convenience.

ASSESS YOURSELF

Long Answer Questions

1. Discuss reasons why a researcher might decide to use a sampling technique rather than to collect data from the entire population.
2. Explain the difference between probability and nonprobability sampling.
3. Discuss the probability sampling techniques with examples.
4. Discuss the nonprobability sampling techniques with examples.
5. Discuss the characteristics of a good sample.
6. Differentiate between quota sampling and stratified random sampling technique.

Short Answer Questions

Write short note on the following:

1. Population
2. Sampling error
3. Sequential sampling
4. Sampling frame
5. Sample size

Multiple Choice Questions

1. Whole group of people or objects to which the researcher wishes to generalize the study findings and which meet a set of criteria of interest to researcher is known as:
 - a. Subset of population
 - b. Sample population
 - c. Target population
 - d. Accessible population
2. Which of the following is NOT true of probability sampling technique?
 - a. Each unit has an equal chance of selection
 - b. Generate unbiased estimation of population
 - c. Produce a sample that resembles population as closely as possible
 - d. Avoids use of sampling frame
3. Which of the following is NOT true of simple random sampling technique?
 - a. Prone to sampling error
 - b. It is costly technique
 - c. Needs complete sampling frame
 - d. Leads to classification error
4. Which is TRUE of the stratified random sampling technique as compared to simple random sampling (SRS)?
 - a. It is used for homogeneous population
 - b. It is less accurate than simple random sampling
 - c. It is time-consuming
 - d. Its analysis is easier than simple random sampling
5. Which of the following is NOT true of nonrandom sampling technique?
 - a. It can generalize fully to whole population
 - b. It is less representative of the population than SRS
 - c. It reflects biased sampling
 - d. It can lead to exclusion bias
6. A sample in which each element has an equal likelihood of inclusion is a:
 - a. Biased sample
 - b. Snowball sample
 - c. Probability sample
 - d. Quota sample
7. A sample which involves a random start and then proceeds with every Kth element from then onward is:
 - a. Simple random sampling
 - b. Stratified random sampling
 - c. Systematic sampling
 - d. Snowball sampling
8. In which of the following nonrandom sampling techniques does the research asks the research participants to identify other potential research participants?
 - a. Snowball
 - b. Convenience
 - c. Purposive
 - d. Quota
9. Which of the following sampling methods is the best way to select a group of people for a study if one is interested in generalizing it to the larger population?
 - a. Convenience sampling
 - b. Quota sampling
 - c. Purposive sampling
 - d. Random sampling
10. Which of the following is NOT a form of nonprobability sampling?
 - a. Snowball sampling
 - b. Convenience sampling
 - c. Quota sampling
 - d. Systematic sampling

Answer Key

1. c	2. d	3. d	4. c	5. a	6. c	7. c
8. a	9. d	10. d				

BIBLIOGRAPHY

- Black TR. *Doing quantitative research in the social sciences: An integrated approach to research design, measurement, and statistics*. Thousand Oaks, CA: SAGE Publications, Inc. 1999. p. 118)
- Dempsey PA, Dempsey AD. *Using Nursing Research: Process, Critical Evaluation, and Utilization*. 5th edition. Philadelphia: Lippincott Williams and Wilkins; 2000.
- Jekel JF, Katz DL, Elmore JG, Wild D. *Epidemiology, biostatistics, and preventive medicine*. 3rd edition. Saunders Elsevier; 2007.
- Kelsey JL, Whittemore AS, Evans AS, et al. *Methods in Observational Epidemiology*. 2nd edition, New York: Oxford University Press; 1996.
- Nieswiadomy RM. *Foundations of Nursing Research*. 5th edition. New Delhi: Dorling Kindersley; 2008.
- Nursing Research Society of India. *Nursing Research and Statistics*. 1st edition. New Delhi: Dorling Kindersley; 2013.
- Rao KV. *Biostatistics: A manual of Statistical methods for use in Health, Nutrition and Anthropology*. 2nd edition. New Delhi: Jaypee Brothers; 2007.
- Roberts K, Taylor B. *Nursing Research Process: An Australian Perspective*. 2nd edition. Singapore: Thompson, Nelson Australia Pty Limited; 2002.
- Thompson SK. *Sampling*. 2nd edition. New York: Jossey Bass; 2002.

High Yield Topics

Revise on the Go

Get Topic-wise Selective **Images & Tables** with their description for LMR and Quick reference, based on the topics of University examination



Scan the QR Code to Download the App

Nursing NextLive
The Next Level of Nursing Education
CBS Phygit Books >
Nursing Research and Statistics PHYGITAL



Tools and Techniques of Data Collection

LEARNING OBJECTIVES

After the completion of the chapter, the readers will be able to:

- Enumerate the methods used in data collection for quantitative research.
- Enumerate the methods used in data collection for qualitative research.
- Discuss the importance of observation as a data collection method.
- Discuss the importance of interview as a data collection method.
- Discuss the significance of questionnaire as a data collection method.
- Discuss the methods of administration of a questionnaire tool.
- Determine the needs for physiological data collection methods.
- Explain the projective and Q sort methods of data collection.
- Appreciate the record analysis as a method of data collection.
- Construct the in-depth interview guide.
- Understand the conduction of focus group discussion.

CHAPTER OUTLINE

• Introduction	• Methods and Tools of Data Collection
• Concept of Data Collection	• Pilot Study
• Sources of Data	• Process of Data Collection
• Selecting a Data Collection Method and Tool	

KEY TERMS

Controlled observation: Systematic data collection in a controlled environment.

Covert observation: Secretly observing subjects without their knowledge.

Delphi technique: A structured method for obtaining consensus and expert opinions on complex or uncertain topics by using multiple rounds of anonymous questionnaires and feedback to reach a collective decision or consensus among a panel of experts.

Contd...

Focus group discussion: A qualitative research method involving group discussions to explore opinions and experiences.

In-depth interview: A one-on-one conversation to gather detailed information.

Interview method: Gathering data through direct questioning and conversation.

Interview schedule: A structured set of questions used in interviews.

In vitro: Experiments conducted on samples removed from participants. Eg. Blood chemistry

In vivo: Data collected directly from participants in real-time. Eg. Blood pressure

Nonparticipant observation: It involves observing subjects without direct involvement, allowing researchers to maintain a more objective standpoint in the study.

Observation: It is a systematic data collection method, utilizes visual or auditory means to gather information, providing a structured approach to studying behaviors or phenomena.

Overt observation: It is characterized by observable data collection where subjects are aware that they are being observed, offering transparency in the research process.

Projective technique: It is a psychological assessment method employing open-ended stimuli to elicit responses, often revealing subconscious thoughts or feelings.

Participant observation: It entails researchers actively participating in the activities that are being studied, offering an immersive understanding of the subject.

Physiological measures: It involve the collection of data from physiological indicators such as heart rate, providing insight into physiological responses.

Q sort: It is a method for sorting and ranking subjective data, allowing researchers to analyze and categorize participants' perspectives.

Questionnaire method: It employs a set of written questions for data collection, facilitating standardized responses and quantitative analysis.

Record analysis: It involves examining existing records for research purposes, utilizing pre-existing data sources to draw conclusions.

Semi-structured interview: It is a method that combines guided and open-ended questions, providing flexibility while maintaining some structure.

Structured interview: A standardized approach with predetermined questions, ensuring consistency and comparability across interviews.

Telephone interview: Data collection through phone conversations, offering a convenient method for remote or widespread participation.

Uncontrolled observation: It entails data collection in natural, unregulated settings, capturing real-world behaviors without interference.

Unstructured observation: An unscheduled and spontaneous data collection, allowing for flexibility and adaptability in the research process.

Unstructured interview: It involves conversations without a fixed set of questions, enabling a more conversational and open exchange of information.

Vignettes: Short scenarios used in research to gather responses or opinions, providing a controlled context for participants to express their views.

INTRODUCTION

The data collection phase in research is a dynamic interaction between researchers and participants, facilitated by specialized instruments or tools. These tools can take various forms, such as interview schedules, questionnaires, observation checklists, or machinery, and they play a pivotal role in data collection. A well-chosen, validated instrument ensures precise measurements, a crucial element in research. It is essential for researchers to carefully plan their data collection techniques and select appropriate tools to guarantee the accuracy of their data, enabling subsequent analysis. It is very common to confuse between tools and methods/techniques of data collection. To clarify, tools are the instruments used to measure the research concept, while

methods or techniques represent the means by which data is gathered using these specific tools. For instance, an interview is a technique, and the interview schedule (questionnaire) is the corresponding tool. Likewise, observation is a technique, and observation checklists are the tools employed. The current chapter presents various tools and techniques of data collection.

CONCEPT OF DATA COLLECTION

Data (singular datum) are distinct pieces of information that is collected, observed, or created for the purposes of analysis to generate the results of a study and to reach at some conclusion. Data refers to raw, unprocessed facts, figures, or information that can be in the form of numbers, text, images, or other types of representations. Data can be collected and stored for various purposes, including analysis, interpretation, and decision-making. Data form the foundation for testing the hypotheses formulated in a research study. When data are processed, organized, structured, presented and interpreted in a given context to determine their true *meaning*, they are called **information**.

Data collection is the systematic process by which the researchers gather information from various sources in order to address their research questions. In any type of study, ensuring accurate data collection is essential to maintain the research's integrity and reliability. Employing a structured data collection process is vital for defining, ensuring accuracy, and preserving the truthfulness of the collected data, leading to valid findings. Incorrect or distorted data can not only waste resources but also misguide other researchers down unproductive paths. Therefore, researchers must decide what, when, who, how, and where data will be collected to carry out a successful data collection process:

- **What:** Deciding what specific data points, variables, or information to collect is fundamental.
- **When:** Determining the timing for data collection is crucial.
- **Who:** Identifying the individuals or groups responsible for data collection is essential.
- **How:** Defining the methods and techniques for data collection is important.
- **Where:** Selecting the appropriate locations or settings for data collection is a vital decision.

SOURCES OF DATA

There are two types of data: Primary and Secondary data.

1. Primary Data

Primary data refers to information collected directly from respondents, units of observation, or from the field under the direct control and supervision of an investigator. This data is original and gathered specifically for a particular research purpose. Primary data is typically fresh, unprocessed, and collected for the first time, making it valuable for both current and future studies. It can be acquired using various methods, including quantitative and qualitative approaches such as personal interviews, mail surveys, self-administered questionnaires, telephone interviews, fax, email, web-based surveys, mechanical observation, simulation, focus group discussions, in-depth interviews, human observation, and case studies, among others. This type of data is essential for research and analysis, as it offers unique and firsthand insights into the subject of study.

2. Secondary Data

Secondary data refers to information that has been previously gathered and recorded by someone else for a different study or research purpose. This data has typically undergone statistical analysis in the context of its



original project. Using secondary data involves fewer costs, less time, and less effort compared to collecting primary data. Essentially, it is the reuse of existing data. For example, the government conducts large-scale surveys like the National Family Health Surveys (NFHS) to collect information on various variables from a significant sample size. Initially, this data is primary for the government. However, when it is published or made available to the public and used for other research, it becomes secondary data for those researchers. Analyzing secondary data is valuable in fields like marketing and health research and can sometimes sufficiently address research questions, making the collection of new primary data unnecessary. Secondary data may either be published or unpublished data. Researcher must be very careful in using secondary data, because the data available may sometimes be unsuitable.

The examples of primary and secondary sources of data are depicted in Table 10.1.

Table 10.1 Primary and secondary sources of data

Source type	Description
I. Primary sources: Data collected directly for a specific research purpose.	
Surveys	Questionnaires or interviews with respondents.
Observations	Directly witnessing and recording events or phenomena.
Interviews	One-on-one or group discussions with participants.
Experiments	Controlled tests to gather data under specific conditions.
Case studies	In-depth examination of a single or small number of cases.
Focus groups	Group discussions to explore opinions and perceptions.
Personal diaries	Self-recorded daily experiences or observations.
II. Secondary sources: Data collected by others for different purposes.	
Published records	Data available in publicly accessible sources.
Books	Information published in books and textbooks.
Journals	Data published in academic and research journals.
Government reports	Official reports and publications from government agencies.
Newspapers	Data reported in newspapers and periodicals.
Magazines	Information published in magazines and trade publications.
Websites	Data available on the internet and online resources.
Databases	Structured collections of data, often from research or government sources.
Unpublished records	Data that may not be widely accessible.
Theses and dissertations	Graduate-level research documents.
Internal reports	Reports and data collected within organizations.
Personal correspondence	Letters, emails, and personal communications.
Archival materials	Historical documents, records, and artifacts.

Comparison of advantages and disadvantages of primary and secondary data is given in Table 10.2.

Table 10.2 Advantages and disadvantage of primary and secondary data

Aspect	Primary Data	Secondary Data
Advantages	- Targeted data collection allows for specific research needs. - Researchers have greater control over data quality. - Data interpretation tends to be more accurate. - Efficient spending for information tailored to research. - Addresses specific research issues effectively.	- Ease of access to existing data sources. - Lower cost and time requirements for acquisition.
Disadvantages	- High cost and resource-intensive data collection. - Time-consuming, often requiring longer data collection.	- Doubtful quality of research if sources are unreliable. - Data may not align precisely with the researcher's needs.

SELECTING A DATA COLLECTION METHOD AND TOOL

The tools of data collection depend on the nature of research approach, the research questions, and the need for precision. The researcher may use more than one tool to gather the data. For example, in a study on "Assessment of knowledge, attitude, and practices of nursing personnel regarding hepatitis" the researcher can use a questionnaire to assess their knowledge, a rating scale to appraise their attitude, and a checklist to evaluate their practices.

The selection of an appropriate data collection method in research is a critical decision that can significantly impact the quality and relevance of the data collected. Several factors influence the choice of a data collection method:

- **Research objectives:** The specific goals and research questions of the study play a fundamental role in selecting the data collection method. Researchers should align the method with the objectives to ensure that the collected data address the research's core questions.
- **Nature of the data:** The type of data needed, such as quantitative (numeric) or qualitative (descriptive), influences the choice of method. For instance, surveys and experiments are often used for quantitative data, while interviews and observations are common for qualitative data.
- **Research design:** The overall research design, including the study's structure, time frame, and scope, will guide the selection of a data collection method. Cross-sectional studies may require different methods than longitudinal or case studies.
- **Resources:** Considerations of time, budget, and personnel available for data collection play a significant role. Some methods are more resource-intensive than others, and practical constraints may limit options.
- **Sampling strategy:** The sampling approach (e.g., random, stratified, convenience sampling) can influence the choice of data collection method. For example, surveys are commonly used when a large, diverse sample is required.
- **Participant characteristics:** The characteristics of the participants or subjects, such as age, language, literacy, and cultural background, can determine the suitability of certain data collection methods. Some methods may require adaptation to be culturally sensitive or age appropriate.
- **Ethical considerations:** Ethical factors, including informed consent, privacy, and potential harm to participants, guide the choice of data collection methods. For example, sensitive topics may require more anonymous methods.

- **Availability of existing data:** The existence of relevant secondary data can influence whether to collect new primary data. Researchers may choose to utilize existing data sources to save time and resources.
- **Validity and reliability:** Researchers must assess the validity (accuracy) and reliability (consistency) of data collection methods. The chosen method should have demonstrated validity and reliability for the type of data being collected.
- **Data analysis and interpretation:** Considerations for how the data will be analyzed and interpreted should guide the choice of the data collection method. Certain methods may produce data that is more amenable to specific analytical techniques.
- **Practical considerations:** Practical aspects, such as the availability of equipment and technology, as well as the expertise of the research team, can affect the selection of the data collection method.

METHODS AND TOOLS OF DATA COLLECTION

The methods or techniques of data collection encompass the strategies guiding data collection, while tools for data collection are the concrete resources used within these methods to carry out the data collection process.

- **Methods of data collection:** Methods or techniques of data collection refer to the systematic and overarching approaches used to gather information in a research study. They encompass the general strategy or framework for data collection, guiding how data will be obtained from participants or sources.
- **Tools for data collection:** Tools for data collection are the instruments or materials used to facilitate and execute the data collection process within a chosen method or technique. These tools can be physical or digital and are essential for practical data gathering.

The summary of classification of data collection methods and tools is depicted in Table 10.3.

Table 10.3 Methods and tools of data collection

Methods or techniques	Tools for data collection
Interview	• Interview schedule or guide • Audio recording equipment • Transcription software
Self-report (questioning)	• Questionnaires • Surveys • Self-administered forms • Attitude scales
Observation	• Observation checklist • Rating scales • Field notes • Anecdotes • Video recording equipment • Closed Circuit Television (CCTV)
Biophysiological measurements • <i>In-vivo</i> (within living organism)	• Electrocardiogram (ECG) machines • Blood pressure monitors • EEG (Electroencephalogram) devices • Pulse oximetry
• <i>In-vitro</i> (outside the living organism)	• Blood chemistry • Urinalysis • DNA sequencing
Other methods	• Projective technique (Rorschach inkblot test) • Q-sort cards • Vignettes

Interview Method

The conversation among more than one people (interviewer/and interviewee) where questions are asked by the interviewer is to obtain information from the interviewee is known as an interview.

The interview method of data collection is a versatile and widely used approach in the field of research. It involves direct interaction between a researcher and a participant or respondent, where questions are posed and answers are provided. This method allows researchers to gain valuable insights, perspectives, and in-depth information from individuals, making it a powerful tool for qualitative and quantitative research.

Interviews can take various forms, including structured, semi-structured, and unstructured, and can be conducted in person, over the phone, or through digital platforms. The interview process not only provides researchers with the opportunity to collect data but also allows them to build rapport, clarify responses, and explore topics in a dynamic and interactive manner.

Methods of Conducting Interview

Face-to-face Interview

The face-to-face interview method is a widely used and effective approach to collecting data in various fields of research. In this method, researchers engage in direct, in-person interactions with participants or respondents. Face-to-face interviews offer a structured and controlled environment for data collection, ensuring accurate information during screening questions and in-depth exploration of research topics. Interviewers have the chance to capture not only verbal responses but also the interviewee's emotions and behaviors. The quality of data collected often depends on the interviewer's skills, making it a method that requires careful planning and execution. Face-to-face interviews are valued for their reliability and depth, making them a common choice for researchers seeking comprehensive and high-quality data.

The merits and demerits of face-to-face interview method:

Merits	Demerits
• Allows for in-depth exploration of research topics • Controlled environment • Ensures accurate information during screening (Eg. Gender, age and race, etc.) • Captures interviewee's emotions and nonverbal responses	• Consume lots of resources • Time consuming • Interviewees may provide socially desirable responses • Geographical limitations to travel distances • Interviewer dependency • Can be time-consuming and consume lot of resources

Telephonic Interview

When it is not possible to contact the respondent directly, then an interview can be conducted through telephone. Researchers interact with respondents over the phone, bridging geographical gaps and streamlining the interview process. The interviewer should practice using the data collection instrument several times before actually talking to the potential respondents. The interviewer should maintain a respectful and nonconfrontational approach when dealing with the interviewee's responses. It is essential to avoid engaging in arguments or pressuring respondents to answer questions. The replies of the respondent can be recorded without any embarrassment to the respondents.



The merits and demerits of telephonic interview method

Merits	Demerits
• Cost-effective and budget friendly • Flexible scheduling at the convenience of the respondents • Respondents may feel more anonymous • Convenient for interviewers to record responses without embarrassment to respondents	• Limited to individuals with telephone access • Reduced nonverbal cues • Not suitable for extensive surveys • Respondents may be cautious of unsolicited phone calls

Online Interview

In an online interview, researchers engage with respondents through various computer-mediated communication tools such as email, instant messaging, or video chat platforms like Google meet, Zoom or Skype. Online interviews can be conducted synchronously, where real-time interactions occur, or asynchronously, where participants respond at their own convenience. Online interviews can be conducted in a group setting or on a one-to-one basis. The interviews can be structured or unstructured.

The merits and demerits of online interview method

Merits	Demerits
• Access to diverse, worldwide audience • Cost-efficiency • Flexible real-time or delayed interactions • Efficient data gathering and storage	• Researcher and respondents need computer skills • Privacy and security concerns • Limited nonverbal cues

Types of Interview

Interview methods encompass a range of approaches, including structured interviews, semi-structured interviews, unstructured interviews, in-depth interviews, and focus group interviews (also known as focus group discussions). Table 10.4 depicts the types of interviews and its uses in research.

Table 10.4 Types of interviews for data collection and its uses

Interview methods	Description	Use
Structured Interview	• Standardized format with predetermined questions. • Closed-ended questions.	Commonly used in surveys and quantitative research to ensure consistency in responses.
Semi-Structured Interview	• Combines structure with flexibility. • Starts with core questions but allows probing.	Often used in qualitative and mixed-methods research for detailed exploration while maintaining some consistency.
Unstructured Interview	• Free-flowing conversation without a set script. • Open-ended questions.	Valuable in qualitative research for in-depth exploration and participant expression.
In-Depth Interview	• Extensive, one-on-one discussion. • Explores specific topics in detail.	Used for gaining comprehensive insights into complex or sensitive subjects.
Focus Group Interview (Focus Group Discussion)	• Involves a group discussion led by a moderator. • Interaction among participants encouraged.	Commonly used in program development, exploring health care provider perspectives, exploration patient experiences, etc.

Structured Interview

A structured interview is a standardized method of data collection where predetermined questions are asked in a consistent order to all participants, ensuring uniformity in data gathering and facilitating quantitative analysis. In this approach, the interviewer follows a set list of prepared questions, and respondents are expected to select precoded or predecided response options. Structured interviews are typically conducted face-to-face or *via* telephone, utilizing identical questions to gather data, and the question sequence is predetermined.

Characteristics of Structured Interviews

- Each respondent is asked the same series of questions.
- Questions are predetermined and often have a limited set of response options.
- There is minimal room for variation in responses, and open-ended questions are infrequent.
- Questioning is standardized, maintaining consistent order and phrasing across interviews.
- The interviewer assumes a neutral role, appearing casual and friendly, without interjecting personal opinions.
- Self-administered questionnaires fall under the category of structured interviews.

When to Use a Structured Interview

Structured interviews are used in the following situations:

- **Quantitative research:**
 - When aiming to collect standardized, comparable data from participants.
 - In studies where statistical analysis and numerical comparison of responses are crucial.
- **Large-scale surveys:**
 - For research projects involve a large number of participants.
 - The consistency in questioning and response coding is essential for statistical analysis.
- **Objective measurement:**
 - When the research focuses on specific, measurable behaviors, attitudes, or characteristics.
 - In situations where precise and standardized data are needed for clear comparisons.
- **Cross-cultural research:** When conducting research across different cultures or languages, using a standardized set of questions can help to ensure consistency in data collection.
- **To minimize interviewer bias:** When there is a need to reduce the potential influence of the interviewer's personal biases on the data.
- **To ensure reliability:** When aiming for high reliability in data collection, especially when the multiple interviewers are involved.

Recording Interviews

Structured interview data can be collected and recorded through various methods, including paper-based and self-reporting (mail or face-to-face), telephone interviews where the interviewer records participants' responses, and web-based self-reporting.

Merits	Demerits
• Structured interviews eliminates the need to establish rapport between interviewer and interviewee. • They yield consistent data that allows for meaningful comparisons across multiple respondents. • Ensures objectivity, comparability, and reliability.	• Lack of flexibility • Potential for superficial responses • Difficulty in complex topics • Interviewer-participant dynamics • Overemphasis on quantification • Inability to capture context • Potential for social desirability bias • Applicability to diverse populations • Neglect of unforeseen factors

Semi-structured Interviews

In semi-structured interview, the questions are both structured and open-ended which are prepared in the form of an interview guide. Semi-structured interviews are a flexible data collection method where researchers have a set of core questions but also the freedom to explore additional topics and follow the respondent's lead, allowing for more in-depth and distinct responses. Unlike structured interviews, they provide room for open-ended discussion and are often used in qualitative research to capture rich, detailed information.

Characteristics of Semi-structured Interviews

- The interview is a formal engagement between the interviewer and respondents.
- The interviewer uses an 'interview guide'—a list of questions and topics to cover, often in a specific order.
- During semi-structured interviews, the interviewer follows a guide but can also explore related topics as needed.

When to Use Semi-structured Interviews

Semi-structured interviews find application in various research contexts:

- Ideal for exploratory research because it allows flexible exploration of novel topics.
- Well-suited for intricate and evolving subjects, adapting to the complexities of the research area.
- Effective in comprehensive understanding of the studied phenomenon.
- Cultural sensitivity—crucial in studies involving participants from varied backgrounds.
- Holistic understanding—provides a comprehensive grasp of the research topic.
- Well-suited for continuous exploration overtime, allowing for the in-depth analysis of changes and trends.

Recording Semi-structured Interviews

Typically, the interviewer uses a paper-based guide. Since semi-structured interviews often involve open-ended questions and discussions that may deviate, it is advisable to record and later transcribe the interviews for analysis.

Merits	Demerits
• Allows flexibility in questioning • Facilitates in-depth exploration • Enhanced participant comfort • Accommodate cultural sensitivity • Provides holistic understanding of the phenomena under study	• Can be more time-consuming compared to structured interviews • Analysis challenges in terms of standardization and objectivity • Potential for bias may impact responses, affecting the reliability of data • Success relies on the interviewer's training and ability • Limited generalization

Unstructured Interview

An unstructured interview is more like a discussion and takes more time than a structured interview. In this approach, the researcher starts with a general set of questions to elicit information from the respondents. The conversation then evolves as the researcher uses the respondents' answers to delve deeper into the topic, adding more questions along the way. Unstructured interviews are commonly conducted face-to-face, with respondents encouraged to share their thoughts and revisit the main subject. Recording the conversation is crucial to capture all the data, and prior consent from respondents is sought for recording.

Characteristics of Unstructured Interviews

- The interview is a formal arrangement with a scheduled time for conversation, recognized as an interview by both parties.
- The interviewer has a clear focus and goal for the interview but lacks a structured guide.

- Questions are typically open-ended, offering little control over respondents' responses.
- Ethnographic, in-depth interviews are often unstructured and may include oral history, creative interviews, and postmodern interviews.

When to Use Unstructured Interviews

Unstructured interviews are recommended when the researcher has gained enough understanding of a setting and topic to have a clear agenda, yet remains open to revising their understanding based on respondents' input. Due to their unstructured nature, speaking with informants on multiple occasions is beneficial.

Recording Unstructured Interviews

Given the open-ended nature, it is best to tape-record unstructured interviews and later transcribe them for analysis. This allows the interviewer to focus on interaction. Alternatively, a note-taker can be present during the interview if recording is not feasible.

Benefits	Demerits
Unstructured interviews are invaluable for gaining insight into a culture, experience, or setting that has not been fully understood. They allow researchers to focus on specific topics of interest and may serve as a preliminary step toward developing more structured interview guides or surveys.	• Interviewer requires a great deal of knowledge and skill in order to analyze the data. • Analysis will be difficult—data collected cannot be compared. • Data interpretation based on researcher's perception and subjective feelings. • Time-consuming.

In-depth Interview

In-depth interview (IDI) is one of the most common methods of data collection in qualitative studies. It is used to explore the respondent's own perceptions and opinions in detail. This method is used in topics where very little is known, and it is important to gain an in-depth understanding. In-depth interviews are particularly useful when sensitive topics are being explored. During IDIs, the person being interviewed is considered the expert and the interviewer is considered the student. One or more repeat visits may also be required if some gaps are there in the information gathered.

While conducting interviews, the researchers engage with the participants by posing questions in a neutral manner. The researcher listens attentively to the responses of the participants and asks the leading questions and also probes based on those responses. The interviewer needs to be skillful in regard to the communication skills and the ability to bond culturally.

Characteristics of in-depth Interview

- In-depth interviews involve open-ended questions that allow respondents to provide detailed, narrative responses.
- Used in qualitative research.
- They are exploratory and seek to delve deeply into the respondent's experiences, thoughts, and emotions.
- In-depth interviews are highly flexible, allowing interviewers to adapt their questions and follow the respondent's lead.
- They yield rich and detailed qualitative data, providing insights.
- They tend to be time-consuming due to the depth of data collected.

Conducting an in-depth Interview

Certain important steps should be followed while conducting the interview. These are as follows:

1. Greet the participant in a friendly manner
2. Establish good rapport with him/her



3. Briefly describe all the steps of the interview process like taking informed consent, the questions and recording of the interview
4. Obtain informed consent from the participant
5. Turn on the tape-recorder and make sure that it is in working condition
6. Conduct the interview as per the interview guide
7. At the end of the question-asking phase of the interview, give the participant the opportunity to ask questions
8. Turn off the tape-recorder and thank the participant.

After the Interview

- Check the tape to see if the interview was recorded completely. If it was not, expand the hand written notes immediately.
- Make sure all materials are labeled and a number is given to the interview.
- Assemble all the materials and double-check that all the forms are completed and that all materials are appropriately labeled.
- Transcribe the notes as soon as possible after each interview, preferably within 24 hours, while the memory is still fresh.

The process of carrying out the interview almost remains the same as for the structured interview. The difference here is that there is no need to record the conversation. Whole of the information is recorded on the interview schedule itself at the time of conducting the interview.

Focus Group Interview/Discussion

Focus group discussion (FGD) is another most common method of collecting data in qualitative **studies**. It is a carefully planned discussion to obtain perceptions regarding a defined area of interest. Such group discussions are useful for issues that are readily discussed in groups if all members of the group share the same experience. For example, the problems faced by the nurses while working in the acute care psychiatric ward. For conducting a FGD, people from similar backgrounds or experiences are gathered to discuss a specific topic of interest. For example, if one wants to conduct FGD to assess the problems of the nurses while working in the acute care psychiatric ward, it will be better that the group constitutes only of the nurses working in those areas only. There should be 6–10 participants in FGD. Fewer participants tend to result in inadequate discussion. The researcher may use purposive sampling technique, because the participants who are experts and are vocal should be included in FGD. The group participants should have certain common characteristics related to the topic of discussion. One should aim to have a homogenous group. Homogeneity may be in terms of age, sex, ethnicity, experiences, etc. Having a homogenous group of participants is important as it reduces bias.

Characteristics of Focus Group Discussion

- **Group dynamics:** FGDs involve a small group of homogenous participants (typically 6–10)
- **Moderated conversation:** A skilled moderator leads the discussion, ensuring that relevant topics are explored.
- **Generates qualitative data:** FGDs generate qualitative data, focusing on the narrative and opinions of participants.
- **Examine complex issues:** They are particularly useful for examining complex health care issues, uncovering challenges in patient care, or exploring the perspectives of both health care professionals and patients.
- **Group reflection:** FGDs encourage group reflection, allowing participants to share their thoughts, experiences, and concerns.
- **Data triangulation:** FGDs can complement other data collection methods, such as surveys or individual interviews, enabling researchers to triangulate their findings.



Mertis of Focus Group Discussions

- **Rich data:** FGDs generate rich, qualitative data by capturing participants' diverse perspectives and experiences.
- **Group dynamics:** Group interactions often stimulate deeper insights and foster discussions that may not occur in one-on-one interviews.
- **Idea generation:** FGDs are excellent for idea generation and brainstorming, making them valuable for exploring innovative solutions and strategies.
- **Exploring complex issues:** They are well-suited for investigating complex health care and nursing-related issues.
- **Contextual understanding:** FGDs provide a contextual understanding of health care practices and patient experiences.
- **Time efficiency:** Researchers can collect data from multiple participants in a single session, making FGDs relatively time-efficient compared to individual interviews.
- **Hypothesis development:** Can be used to develop hypothesis for further research.
- Do not require participants to be literate.

Demerits of Focus Group Discussions

- **Limited generalizability:** Findings from FGDs may not be easily generalized to larger populations due to the specific nature of the group and their experiences.
- **Lack of privacy:** Lack of privacy and anonymity for the participants.
- **Moderator influence:** The moderator's skills and style can influence the direction and depth of discussions, potentially introducing bias.
- **Data analysis complexity:** Qualitative data from FGDs can be challenging to analyze and interpret.
- **Potential for dominant voices:** In some cases, dominant participants may overshadow quieter voices, leading to an imbalance in contributions.
- **Resource-intensive:** Organizing and conducting FGDs can be resource-intensive, including costs associated with logistics, transcription, and analysis.
- **Time constraints:** Scheduling and coordinating FGDs with participants can be challenging, especially when working with busy health care professionals.

Steps in Conducting Focus Group Discussions

The process of utilizing FGDs to study a problem involves several key steps. The extent to which these steps need to be followed may vary depending on the training and experience of those involved in data collection. The steps of conducting FGD is described in Table 10.5.

Advantages and Disadvantages of Interview Method

Advantages of Interview Method

- It can be used even if the respondent does not have adequate level of education.
- The complete information could be collected.
- If respondents face any difficulty in understanding any part of questionnaire then the data collector can facilitate them and thus increasing the likelihood of useful responses.
- It permits face-to-face contact with the respondents.
- It provides opportunity to explore topics in depth.
- It allows the interviewer to experience the affective as well as cognitive aspects of responses.

Table 10.5 Steps of conducting focus group discussions

Steps	Description
Preparation	
Define topic and objectives	- Define and clarify discussion concepts. - Present a set of issues for the group's consideration. - The moderator improvises comments and questions within the guideline framework. - Use open-ended questions to prompt valuable insights from participants.
Selecting study Participant	- After understanding the topics, define participant characteristics. - Ensure common characteristics in groups related to the research issue. - Create separate groups for diverse perspectives (e.g., men, women, age groups). - Select participants using purposive or convenience sampling. - Send invitations a few days in advance, outlining the FGD's purpose.
Choosing setting and physical arrangements	- The FGD should be conducted in a relaxed, permissive, nonthreatening environment which is free from distractions and is acceptable to all the members of the group. - Arrange chairs in a circle for open discussion. - Ensure a quiet, well-lit, disturbance-free environment. - Choose a neutral setting for free expression. - Avoid locations with potential biases, like a health center.
Conducting the Session	
Moderator and recorder	- One member of the research team should take on the role of a 'facilitator' or 'moderator' for the focus group, while another should serve as the 'recorder'. Moderator's Functions: The moderator should not act as an expert on the topic. Their role is to stimulate and support discussion. Moderator should: - Introduce the session, themselves, and the recorder. - Introduce the participants, either by name or by asking them to introduce themselves in an engaging manner. - Put participants at ease and explain the purpose of the FGD, the type of information needed, and how it will be utilized. - Encourage discussion with enthusiasm, liveliness, and a touch of humor. - Formulate questions and ensure a variety of participants express their views. - Encourage involvement by avoiding a question-and-answer format. - Use techniques like seeking clarification, reorienting the discussion when necessary, and involving reluctant participants. - Direct questions back to the group, asking for their thoughts or what they would do. - Control the timing of the meeting subtly, maintaining interest by skillfully guiding the discussion from one topic to another.
Summarizing and thanking participants	- At the end of the meeting, the facilitator should summarize the main issues, confirm agreement, and invite additional comments. - Express gratitude to the participants, emphasizing the value of their contributions. - Be attentive to any additional insights shared after the meeting, as they may provide valuable information that would otherwise remain undisclosed.

- It allows the interviewer to be flexible in administering interview to particular individuals or in particular circumstances.
- It helps in generating more valid and complete information.
- The interviewer can clarify the points or questions which are unclear to the interviewee.

Disadvantages of Interview Method

- It is an expensive and time consuming as the researcher has to approach the respondents personally.
- It is difficult to collect data or likely to get more negative responses regarding sensitive issues.
- The quality of data collected through this method is highly dependent on the data collector.
- Need well-qualified, highly trained interviewers.
- Interviewee may distort information through recall error, selective perceptions, and desire to please the interviewer.
- Flexibility can result in inconsistencies across the interviews.
- Volume of information may be very large, thus may be difficult to transcribe and reduce the data.
- Sometimes difficult to contact the respondents.
- It may be inaccurate in terms of getting the numerical data.

Interviewing Process

The process of interviewing research participants typically involves following steps:

1. **Preparation for interview**
 - The appointment needs to be fixed by the researcher as per the convenience of the participants.
 - The interviewer's appearance and clothing should align with professional standards, reflecting respect for the participants.
 - The interviewer must be familiar with the interview schedule and questionnaire before starting interview.
2. **Pre-interview introduction**
 - The participants are introduced to the researcher, initiating a formal introduction by the researcher himself.
 - In-depth information about the research is provided to the participants.
3. **Carrying the interview forward**
 - The interview is initiated with a careful start, ensuring only one question is posed at a time.
 - Participants are attentively listened to, and ample time is given for responses.
 - No signs of surprise are exhibited, maintaining a neutral and unbiased attitude throughout.
 - Additional questions are posed to extract comprehensive information.
 - The interview process is conducted deliberately without any sense of hurry.
4. **Recording the interview**
 - An appropriate device is selected for recording, ensuring clarity and precision.
 - For written records, shorthand may be used to capture essential details.
5. **Closing the interview**
 - The interview is concluded formally, expressing gratitude to the participants.
 - Any further clarification or information needed is addressed at the conclusion.

Questionnaire Method

A questionnaire is a structured instrument or tool used for collecting data and information from participants or respondents. It typically consists of a series of questions, both open-ended and closed-ended, designed to gather specific data related to the research objectives.

Questionnaire method is one of the most common methods of data collection in research. The questionnaire consists of a set of questions, and it is designed according to aims and objectives of the research. Well-prepared questionnaires allow for easy interpretation and analysis. On the other hand, poorly developed questionnaires may cost more in time and effort and prevent the investigator from achieving the purpose of the study. Answers/responses to these questions given by respondents are collected either by self administered method or interview method.



Type of Questions

Primarily there are two types of questions: Open-ended and the closed-ended questions. Various types of closed-ended questions include dichotomous, multiple choice, cafeteria questions and scale response questions. Types of questions are depicted in Figure 10.1.

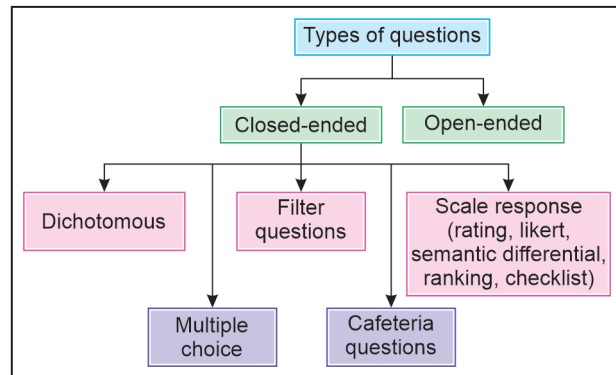


Figure 10.1: Types of questions

1. Open-ended Questions

Open-ended questions allow respondents to provide answers in their own words, free from any specific suggestions by the interviewer. They reveal what is most important to the respondent without imposing any constraints. These questions do not limit respondents to predetermined options and instead seek their personal thoughts and feelings. For example, a question like, “What is your favorite dish, and why do you like it?” is open-ended because it encourages respondents to express their opinions without restrictions.

Open-ended questions often begin with words like “Why”, “How”, and “What”, prompting respondents to provide comprehensive responses rather than simple “yes” or “no” answers. These questions are designed to gather insights and depth of understanding, making them valuable tools for qualitative research.

Open-ended questions often begin with words like “Why”, “How”, and “What”, prompting respondents to provide comprehensive responses rather than simple “yes” or “no” answers. These questions are designed to gather insights and depth of understanding, making them valuable tools for qualitative research.

Characteristics of Open-ended Questions

- Encourage respondents to provide responses in their own words.
- Do not impose predetermined answer options.
- Begin with words like “Why”, “How”, and “What”.
- Seek comprehensive and detailed responses.
- Elicit insights and depth of understanding.
- Primarily used in qualitative research to explore perspectives.
- May result in responses with varying levels of articulation.
- Potential for irrelevant or extraneous information in responses.
- Data analysis can be more intricate and demanding due to unstructured responses.

2. Close-ended Questions

Closed-ended questions are structured to offer respondents a selection of predefined categories to choose from, ensuring greater consistency in the responses. For example:

What is your marital status? Single/married/divorced/separated/widowed.

The respondent can pick from any of the options given after the question.

Closed-ended questions are easier to code and analyze. These are also useful for comparing responses across different groups. However, they come with their limitations. In some cases, the provided answer choices may not encompass all possible responses, potentially forces respondents to select options that do not accurately reflect their status. These types of questions do not permit expression of exact shades of opinion.

Types of Closed-ended Questions

- **Dichotomous questions:** A dichotomous question is a type of closed-ended question that provides two distinct response options, such as “Yes/No” or “Male/Female” format. Dichotomous questions are designed to elicit binary, either-or responses from respondents.

Example:

Q. Have you ever been hospitalized?

A. Yes

B. No



- **Forced-choice questions:** A forced-choice question eliminates the possibility of a neutral response by excluding options such as “Undecided”, “No opinion”, “Can not say”, “Do not know”, “Maybe”, and “Not applicable”. Respondents are compelled to make a selection among two or more provided options or statements. A forced-choice question ensures that the respondent provides a specific answer so that the researchers have more relevant data to analyze.

Example:

Q. Please provide an opinion that best describes your experience during the hospital stay?

- a. Had a positive and satisfactory experience.
 - b. Encountered challenges but overall had a positive experience.
 - c. Experienced difficulties and had a challenging stay.
- **Multiple choice questions (MCQs):** Multiple choice questions (MCQs) are commonly utilized in surveys and assessments due to their objectivity and ease of analysis. An MCQ typically consists of a stem, which can be a complete or incomplete statement or a question, providing the context for the question. Each question has only one correct answer. The three other options are distracters and should be homogenous.

Example:

Q. Which vital sign is commonly measured using a stethoscope and sphygmomanometer?

- A. Body temperature
 - B. Heart rate
 - C. Blood pressure
 - D. Respiratory rate
- **Cafeteria questions:** Cafeteria questions, often referred to as “cafeteria-style questions,” are a variation of multiple-choice questions used in surveys and questionnaires. In these questions, respondents are presented with a list of response options and are asked to select the response that best aligns with their views or preferences.

Example:

Q. Please select your preferred method for receiving nursing education materials:

- A. In-person workshops
 - B. Online webinars
 - C. Printed manuals
 - D. Interactive e-learning modules
 - E. Other (please specify)
- **Filter questions (contingency questions):** In this the questions asked depend on the response from a previous question. Sometimes there could be multiple filter questions in order to direct the respondents to the correct subsequent questions. These can confuse the respondents and may discourage them from continuing with filling up the questionnaire. For two level jumps, a graphic (arrow and box) can be used has shown below.

Example:

Have you ever smoked Bidi?

- Yes
- No

If yes, since how many years you are smoking:

- <1 year
- 1–2 years
- 3–4 years
- 5–6 years
- >6 years

- **Rank order questions:** Rank order questions are a type of survey or questionnaire questions that ask respondents to rank a set of items or options in a specific order of preference or importance. These questions are often used to understand the relative significance or priority of different elements within a list.

In a nursing research context, a rank order question could be used to assess the importance of various patient care activities, clinical practices, or nursing skills.

Example:

Q. Please rank the following patient care activities in order of their importance, with 1 being the most important and 5 being the least important:

- Administering medications
 - Conducting patient assessments
 - Providing patient education
 - Ensuring infection control measures
 - Monitoring vital signs
- **Matrix questions:** Matrix questions are a type of survey or questionnaire question that is used to gather responses on multiple related items in a tabular format. Matrix questions include multiple questions, and identical response categories are assigned. Questions are listed in rows and the response categories are listed in columns forming a matrix as shown in the example below.

Example:

Q. Please rate your satisfaction with the following aspects of your nursing care during your hospital stay by checking the appropriate below sample:

Matrix questions to assess satisfaction of patients regarding nursing care during hospital stay

Aspect	Excellent	Very good	Good	Fair	Poor
Communication with nursing staff					
Response time to call buttons					
Clarity of medication instructions					
Cleanliness of your room					
Assistance with personal needs					

- **Rating scale questions:** It is also known as the Likert scale questions. This scale is use to measure the intensity of agreement or disagreement with a statement. Respondents are asked to select a point on the scale, such as from “Strongly Disagree” to “Strongly Agree”.

Example:

Q. The use of telehealth technologies has significantly improved patient care and outcomes during the COVID-19 pandemic

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

- **Checklist questions:** Respondents select items from a list to indicate what applies to them. It is often used in demographic data collection.

Example:

Q. Please select all the types of recreational activities you enjoy:

- ☐ Hiking
- ☐ Swimming
- ☐ Cycling
- ☐ Yoga
- ☐ Cooking
- ☐ Painting
- ☐ Playing a musical instrument
- ☐ Watching movies

Development of a Questionnaire

A questionnaire is one of the most commonly used tools of data collection. It contains questions that the respondents are asked to answer in writing. It is a measurement instrument for assessing an individual's level of knowledge, attitudes, beliefs, ideas, opinions, behavior, feelings, perception or attributes, etc. In simple terms questionnaire is a set of questions.

General Guidelines for Designing a Good Questionnaire

Developing a questionnaire is a crucial step in collecting data for research, surveys, or assessments. A well-designed questionnaire ensures that the researcher obtains the information accurately and effectively. Following are some guidelines to create an effective and well-structured questionnaire:

- **Define the objectives:** Clearly define the research objectives to ensure that the information being sought is specific, and the research questions or hypotheses are guided by them.
- **Participant characteristics:** The characteristics of the study participants, such as age, gender, education, and other relevant factors, should be identified. The questions should be tailored to their background and expectations.
- **Start with clear instructions:** The questionnaire should start with a clear instructions to the respondent.
- **Clarity and conciseness:** Questions should be written in a clear, concise manner, avoiding jargon, technical terms, or ambiguous language. Each question should convey a single, specific idea.
- **Neutral language:** Leading or biased language that might influence respondents' answers should be avoided. The questions should be kept neutral and objective.
- **Chose the right question types:** The most appropriate question types for research objectives should be selected. Common types include open-ended questions, close-ended questions (e.g., multiple-choice, Likert scale), and checklist questions.
- **Avoid double-barrelled questions:** Each question should address a single issue, and the combination of two questions into one should be avoided to prevent confusion among respondents.
- **Sequence of questions:** Consideration of question sequence is important. Starting with easy and nonsensitive questions before moving to more complex or personal ones should be taken into account. The logical flow of the questionnaire should be considered.
- **Response options:** Clear and comprehensive response options should be provided for close-ended questions, covering all possible answers without overlap.
- **Pretesting of the questionnaire:** A pretest or pilot study with a small group of individuals should be conducted to identify issues with the questions, response format, or overall flow. Feedback should be used to make improvements.
- **Brevity should be maintained:** Long questionnaires can lead to respondent fatigue and dropouts, so the questionnaire should be kept as brief as possible while still obtaining the necessary data. Irrelevant or redundant questions should be avoided.
- **Double negatives should be avoided:** The use of double negatives or complex sentence structures should be refrained from. Questions should be straightforward and should not require respondents to decipher negatives.
- **Consideration of skip logic:** If the questionnaire has branching logic, skip patterns should be set up so that respondents are directed to relevant questions based on their previous answers.
- **Reliability and validity should be tested:** The reliability and validity of the questionnaire should be assessed. Reliability ensures that the questionnaire yields consistent results, and validity ensures that it measures what it is supposed to.

- **Ethical and privacy concerns:** Ethical standards should be adhered to, and respondents should be informed about the purpose of the survey, how their data will be used, and how their privacy will be protected.
- **Review and revisions:** The questionnaire should be reviewed for clarity, structure, and flow. Revisions should be made as necessary to ensure that the questions align with objectives and will provide valuable data.
- **Formatting:** The questionnaire should be finalized and formatted for distribution, whether for paper surveys, online surveys, or in-person interviews.

Steps Involved in Development of Questionnaire

The process of developing a questionnaire typically involves several stages. The steps involved are depicted in Figure 10.2.

1. **Determination of required information:** To develop an effective questionnaire, researchers must first establish a clear understanding of the information they require. This entails defining the purpose and objectives of their study. They should determine what specific knowledge is necessary and the reasons behind its necessity. Additionally, it is crucial to anticipate the outcomes that the questionnaire will yield.
2. **Consideration of the target respondents:** Consideration of the age, education level, cultural bias, and language barrier of the target respondents from whom data will be collected is done. Accordingly, the language and the difficulty level of the questions will be adjusted.
3. **Utilization of the data collection method to reach the respondent:** Decision on which data collection methods, such as Mail, Telephone, Personal (face-to-face) interview, Web-based, etc., will be employed to reach the target respondents is made. The instructions to fill up the questionnaire may vary accordingly.
4. **Decision on the content of the questions:** A thorough literature review is conducted before starting to develop the questionnaire. This will facilitate the decision on the contents of the questionnaire.

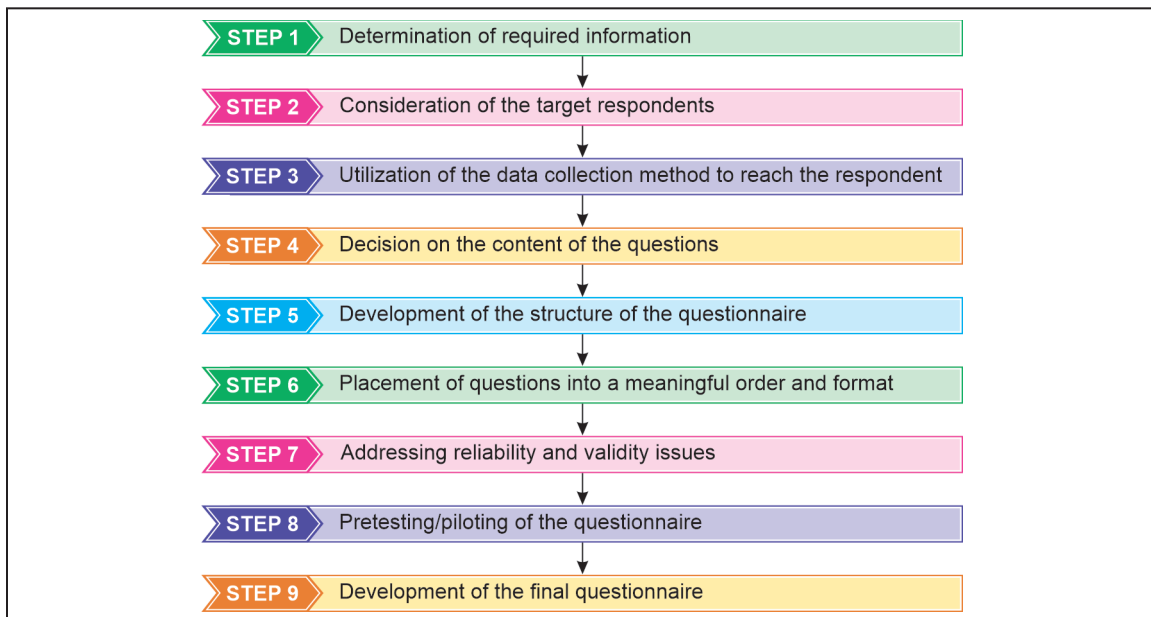


Figure 10.2: Steps of questionnaire development



The questionnaire is kept as short and concise as possible. More people are likely to answer a shorter questionnaire. Questions that answer the research question are included. A questionnaire is not an opportunity to collect all kinds of information about the respondents. Redundant questions are avoided, as this would irritate and frustrate the respondents. The type of questions about attitudes, beliefs, attributes, or behavior is decided.

5. **Development of the structure of the questionnaire:** Decision on whether to have closed or open-ended questions is made. Broad question areas are defined. Planning is done on how the questions should be worded. Consideration is given to the ease of reading, keeping the lowest person in mind. The wording of the questions is also kept to the point.
6. **Placement of questions into a meaningful order and format:** Questions are placed in sequence in a logical fashion, progressing from one area of questioning to the next. Check is done to ensure that all the questions are relevant to all the respondents. The easy questions are placed at the beginning and the relatively difficult or sensitive questions are put toward the end.
7. **Addressing reliability and validity issues:** The validity and reliability of the newly developed questionnaire are established using appropriate methods. Various methods to ascertain the validity and reliability are elaborated in the next chapter.
8. **Pretesting/piloting of the questionnaire:** A group of participants (about 5–10) are asked to take the questionnaire. Their feedback is collected on aspects such as the questionnaire's ease of understanding, any confusing questions, ease of access (especially important for online questionnaires), appropriate time for questionnaire completion, comfort level of respondents while answering the questions, and any suggestions for questionnaire improvements.
9. **Development of the final questionnaire:** The final questionnaire must look good and read clearly. All the pages are numbered. Font size is kept clear and legible. Adequate instructions on how to complete or skip the questions if any are included. The questionnaire is always proofread for spelling, grammar, and punctuation errors.

Pretesting of the Questionnaire

A well-designed questionnaire should meet the objectives of the research and be able to obtain complete and accurate information as far as possible. Pre and pilot testing of questionnaire is not only important, but is mandatory. It should be conducted to correct any problem/deficiency in the questionnaire before it is administered to the study subjects. It can help determine the strength and weaknesses regarding correct understanding of the questionnaire, wording of items, adequacy of responses, any regional differences, etc. It also confirms if the filter questions and skip patterns are adequate. In case of a multi centric study the pilot testing is a must in all centers.

There are two types of pretests, i.e., participating and undeclared.

1. **Participating pretests:** In this the researcher informs the respondents that the pretest is just a practice run. After filling out the questionnaire, the researcher conducts an interview with the respondents. They are asked to explain their views regarding the questionnaire, wording, order, the difficulty level, or any other relevant information. This kind of pretest will help the researcher to determine whether the questionnaire is understandable.
2. **Undeclared pretest:** In this the researcher does not inform the respondents that it is a pretest. The respondents are asked to fill up the questionnaire just as conducting the final data collection. This type of pretest allows the researcher to check the choice of analysis.

If there is a need to conduct more than one pretest, it is always better to go for a participatory pretest first, then an undeclared test.

Methods of Administration of a Questionnaire Tool

This is an issue which affects the cost and response rates. It also influences which questions can be asked and in what format. There are four methods to administer the questionnaire.

1. **Researcher administered:** This involves the administration of the questionnaire by the trained researcher. Interviewing is done in a face-to-face encounter. Data is collected in a nonthreatening environment, i.e., the respondent is relaxed. The advantages of this method are that no items are omitted, questions can be repeated if not answered well and no mistakes occur as the researcher himself is asking the questions. To collect data the researcher can train the data collectors. Data from nonliterate people can be collected. Certain disadvantages associated with this method are that it is time and cost intensive and there could be manpower issues also.
2. **Self-administered:** In this method interviewer may or may not be present when the questionnaire is being administered. The most common example is mail survey where the respondents read the letter of instruction and fill out the questionnaire. The other type is giving questionnaire to a group of respondents in the presence of interviewer. For example, distributing the tool to all the students of a class at one point of time. The presence of interviewer can ensure high completion rate. The advantages of this method are that it requires less cost and can be done for a wide population group at one time. The disadvantages are that the respondents may not follow the sequence and the completion rate may be less. The respondents may face trouble in following the instructions especially in the mail survey. In fact, it cannot be ensured who is actually filling up the questionnaire.
3. **Telephone interview:** An alternative to meeting subjects personally is to interview them on phone. The major advantage is in terms of saving of manpower, cost and time. However, at the same time there is selection bias as it rules out all those who do not have phones in their homes, though, now-a-days, this problem can be sorted out as everyone is having mobile phones. Surveys using telephone directories as sampling frame may under represent the poor people.
4. **Using internet:** This method involves sending the questionnaire through e-mail to the respondents. The questionnaire may be sent as a soft copy along with complete instructions to fill it up. The advantage of this method is that it is quite cost-effective as with one click we can send the questionnaire to hundreds of people. However, there is again a selection bias because everyone may not be having access to the system. Many respondents may not respond back to the mail.

Advantages and Disadvantages of Questionnaire

Advantages of Questionnaire

- It offers greater anonymity.
- It is easy and economical.
- There is no bias of data collector.
- It is a good method to collect data regarding sensitive issues like sexual behavior, drug usage, etc.
- Large amounts of information can be collected from a large number of people in a short period of time.
- Can be carried out by the researcher or by any number of people with limited effect to its validity and reliability.
- The results of the questionnaires can usually be quickly and easily quantified by either a researcher or through the use of a software package.
- Can be analyzed more objectively than other forms of research.

Disadvantages of Questionnaire

- There is more chance of getting incomplete information from the respondents.
- If respondents face any difficulty in understating any part of questionnaire then the quality of data may suffer.
- Respondents may take help of others to fill up the questionnaire and that will distort the information obtained.
- Dropout rates likely to be high especially for the mailed questionnaire and data collected may suffer from nonrespondent bias.
- It cannot be used if respondent does not have adequate level of education.
- People may read each question differently and therefore reply based on their own interpretation of the questions.
- Lengthy questionnaire may add on to the printing price.

Composite Scales/Attitude Scales

Composite scales, often referred to as attitude scales, are a measurement tool used in research and surveys to assess people's attitudes, opinions, or perceptions toward a particular subject or topic. These scales are designed to measure abstract concepts that are not directly observable, such as attitudes, beliefs, or feelings.

Composite scales are so named because they are constructed by combining or "composing" multiple items or statements to form a single overall score or measurement for a specific construct or attribute. Each item contributes to the overall assessment, and the final score represents a composite or summary of the individual's responses to those items, i.e., each response is given a value and the responses for the entire scale are totaled to obtain a single score. These items, often referred to as scale items or scale questions, are carefully selected and designed to collectively represent the underlying construct being measured, such as an attitude, belief, or perception.

There are several types or forms of composite scales commonly used in research. These include:

- Likert scales
- Semantic differential scales
- Thurstone scales
- Guttman scales
- Visual analogue scale

Likert Scale

A Likert scale is a widely used scale that measures the intensity of an individual's attitudes, opinions, beliefs, or feelings toward a particular topic or statement. It is named after its creator, Rensis Likert, who introduced this scaling method in 1932. A Likert scale typically presents a series of statements or items to respondents, who are asked to indicate their level of agreement or disagreement with each statement. Respondents use a range of response options, typically including:

• Strongly disagree	• Agree
• Disagree	• Strongly agree
• Neutral	

The number of response options may vary from five to seven. Most of the time, it is the odd number scale. The even numbered response scale is called Forced-Choice Scale. In the odd numbered choices, the subjects may respond to the middle choice and thus, appear to be neutral choosing neither high nor low ratings.



Definitions

- **Likert scale:** A Likert scale is a composite measurement scale used in surveys and questionnaires to measure the attitudes, opinions, perceptions, or feelings of individuals toward a particular subject or statement.
- **Likert scale item:** A single statement or question in a Likert scale survey that respondents evaluate using the available response options.
- **Likert scale response:** The choice or rating given by respondents to a Likert scale item, indicating their level of agreement or disagreement.
- **Summated score:** The total score achieved by adding up or averaging the responses to multiple Likert scale items, providing an overall assessment of the construct being measured.

Uses of Likert Scale

- **Measuring attitudes:** Likert scales used to measure the attitudes, feelings, and values on a structured scale.
- **Quantifying the qualitative variables:** They are used to quantitatively measure the qualitative aspects of people such as feelings and values.
- **Assessing opinions and perceptions:** Likert scale measures the strength and direction of opinions.
- **Gathering consumer feedback:** In health care system, Likert scales are used to assess patient feedback and preferences.

Scoring of Likert Scale

Scoring of a Likert scale involves assigning numerical values to respondents' selected responses for each item or statement on the scale. The scoring process allows the researcher to calculate an overall score that represents the respondent's attitude or perception toward the construct being measured.

How to Score a Likert Scale

- **Assign numerical values:** Each response category on the Likert scale is assigned a numerical value, typically starting from 1 (e.g., "Strongly Disagree") and incrementing by one for each subsequent category. For negatively worded statements, the response values are scored in reverse order. For example, in a 5-point Likert scale (Table 10.6). Positively worded items are scored as
 - Strongly disagree = 1
 - Disagree = 2
 - Neutral = 3
 - Agree = 4
 - Strongly agree = 5
 Negatively worded items are scored as:
 - Strongly disagree = 5
 - Disagree = 4
 - Neutral = 3
 - Agree = 2
 - Strongly agree = 1
- **Calculate item scores:** For each item or statement on the Likert scale, record the respondent's selected response by matching it to the corresponding numerical value. Repeat this process for all items.
- **Sum or average item scores:** To calculate an overall score for the respondent, sum the item scores across all the items in the Likert scale. Alternatively, you can calculate the average (mean) of the item scores. Summation is more common, but averaging may be preferred in some cases.



Table 10.6 Example of a 5-point Likert scale to assess the acceptability of nursing care protocol among nurses

Sl. no.	Statements	Always (5)	Most of the time (4)	Sometimes (3)	Rarely (2)	Never (1)
1.	Do you think the protocol is helpful in planning care of stroke patients?					
2.	Do you think it is really beneficial?					
3.	Do you think it helps in preventing errors in work?					
4.	Do you think it helps to systematize nursing care?					

- **Interpret the score:** The overall score represents the respondent's attitude or perception toward the construct being measured. A higher score indicates a more positive or agreeable attitude, while a lower score reflects a more negative or disagreeable attitude. The midpoint (e.g., "Neutral") typically has a neutral score (e.g., 3 in a 5-point scale).
- **Data analysis:** Analyze the scores using appropriate statistical methods, such as calculating means, medians, and standard deviations, conducting hypothesis tests, and comparing scores across groups or time points.

Characteristics of Likert Scale

Likert scales have several distinctive characteristics that make them a valuable tool for measuring attitudes, opinions, and perceptions:

- **Ordered categories:** Likert scales present respondents with a set of ordered response categories, typically ranging from "Strongly Disagree" to "Strongly Agree" or a similar progression. These categories provide a structured framework for expressing the intensity of agreement or disagreement.
- **Multiple items:** Likert scales consist of multiple items or statements, each representing a different aspect of the construct under investigation. This multi-item approach allows for a comprehensive assessment.
- **Neutral or midpoint:** Likert scales typically include a neutral or midpoint category, such as "Neutral" or "Neither Agree nor Disagree", allowing respondents to express neutrality when appropriate.
- **Balanced design:** Likert scales are designed to balance the number of positive and negative items, ensuring that the scale accurately captures both agreement and disagreement with the statements.
- **Psychometric properties:** Likert scales are developed with attention to psychometric properties, including reliability and validity, to ensure that they measure the intended construct consistently and accurately.
- **Ease of use:** They are user-friendly and easy to understand, making them accessible to a wide range of respondents, including those with varying levels of education and familiarity with surveys.
- **Versatility:** Likert scales can be adapted to measure a wide array of constructs, including attitudes, opinions, feelings, and behaviors, in diverse fields and research contexts.
- **Comparability:** The standardized nature of Likert scales allows for comparisons between respondents, groups, or over time, making them suitable for various research designs.
- **Numeric values:** Responses on a Likert scale are assigned numerical values, usually ranging from 1 to 5, 1 to 7, or another numeric range. This numeric representation facilitates quantitative analysis.
- **Quantitative analysis:** Likert scale data can be analyzed quantitatively, enabling statistical analysis, hypothesis testing, and the generation of numerical summaries and statistics.

Advantages of Likert Scale

- **Ease and efficiency:** Likert scales are quick, cost-effective, and easy to construct, administer, and score.
- **Attitude measurement:** They effectively measure a person's attitude, opinion, or perception regarding various concepts, providing a quantitative assessment of subjective data.

- **Versatility:** Likert scales can be distributed through various channels, including mail, the internet, or in-person, making them adaptable to different research methodologies.
- **Flexibility in responses:** Unlike binary “yes” or “no” questions, Likert scales offer respondents the freedom to express their level of agreement or disagreement, allowing for a more nuanced understanding of attitudes.

Disadvantages of Likert Scale

- **Social desirability bias:** Results may be influenced by individuals who wish to present a socially desirable or favourable impression of their attitudes, potentially leading to less candid responses.
- **Unequal interval interpretation:** The intervals between Likert scale points may not represent equal changes in attitude for all individuals. For some, the difference between “strongly agree” and “agree” may be subtle, while for others, it could be substantial.
- **Internal consistency challenges:** Achieving high internal consistency can be challenging, as it depends on the careful selection and wording of scale items to reliably measure the intended construct.
- **Time-consuming item development:** Crafting well-constructed Likert scale statements that accurately reflect the construct under study can be a time-intensive process.

Semantic Differential Scale

A semantic differential scale is a type of rating scale used to measure the meaning that respondents attribute to objects, events, or concepts. It is particularly valuable for assessing the connotative (implied) meaning or emotional associations people have with a specific item or idea. Unlike Likert scales that measure intensity or agreement, semantic differentials assess the perceived quality or characteristics of a concept along multiple dimensions.

The respondents are asked to rate a concept by selecting one point on the scale that best describes his or her view of the concept. The values for the scale are summed to obtain one score for each subject. A feature such as honesty, for example, would be represented by the semantic differential scale in the following form:

Honest	_____	dishonest.
Friendly	_____	unfriendly
Willing	_____	unwilling
Large	_____	small

For example, a researcher wanted to determine the perception of people from different cultural backgrounds about AIIMS Hospital using semantic differential scale. The respondents will be asked to place a tick (✓) above the line on the scale at the place which they believe comes to the closest in determining their perception about AIIMS Hospital.

Good	✓ _____	Bad
Busy	✓ _____	Quiet
Clean	✓ _____	Dirty
Friendly	_____	Unfriendly

Uses of Semantic Differential Scale

Some common uses of semantic differential scales include:

- Measuring perceptions and attitudes
- Brand and product evaluation
- Psychological research
- Advertising and marketing
- Product development: To identify the desired attributes and characteristics of a product
- Cross-cultural research: Aid in understanding cultural variations in perceptions and associations
- In language and linguistics studies
- Public opinion and policy research

Advantages of Semantic Rating Scale

- It is the most reliable way to get information on people's emotional attitude toward a topic of interest.
- It is easy to understand and administer.
- Information collected by the researcher is very reliable.

Disadvantages of Semantic Rating Scale

- There is a lack of standardization of the tool.
- The numbers of divisions on the scale may be a problem. If too few divisions are used, the scale is crude and lacks meaning. If too many are used, the scale may go beyond the ability of most of the people to discriminate.

Thurstone Scale

A Thurstone scale, also known as a Thurstone attitude scale, is a method for measuring and quantifying the opinions and attitudes of individuals toward a specific subject or issue. It was developed by Louis Leon Thurstone in 1928, making it one of the earliest formal techniques for assessing attitudes in the fields of psychology and sociology.

Thurstone scales typically consist of a series of binary alternatives (e.g., 0–10) that are designed to tap a particular aspect of an individual's attitude. The responses to these alternatives are then used to calculate a scale score that represents the individual's overall attitude Table 10.7.

Advantages of Thurstone Scales

- They provide precise measurement of attitudes and opinions due to the careful construction and expert ratings of items.
- Thurstone scales capture distinct differences in attitudes by arranging items along a continuum.
- **Clear interpretation:** The ordered items make interpretation straightforward, with scores indicating the respondent's position on the continuum.
- **Structured responses:** Respondents choose from predefined items, reducing response ambiguity.

Disadvantages of Thurstone Scales

- **Limited to unidimensionality:** Thurstone scales are typically unidimensional, limiting their use for measuring complex constructs.
- **Resource-intensive:** Constructing Thurstone scales requires expert panels, which can be time-consuming and costly.
- **Expert subjectivity:** The expert ratings of items involve subjectivity and may vary across panels.
- **Reduced flexibility:** Thurstone scales may not be suitable for measuring multidimensional constructs or for open-ended responses.

Table 10.7 Thurstone scale to assess the attitude toward renewable energy

Statement	Agree	Disagree
1. I actively participate in recycling and waste reduction.		
2. Supporting policies and initiatives for renewable energy is important to me.		
3. Conserving natural resources is a priority in my lifestyle.		
4. I believe that environmental protection is essential for our future generations.		
5. Sustainable practices for a cleaner planet are crucial.		

**Table 10.8** Scoring of responses to items of Guttman scale

Respondent	Response					
	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6
R1	1	1	0	0	0	0
R2	1	1	1	0	0	0
R3	1	1	1	1	0	0
R4	1	1	1	1	1	1

Guttman Scale

The Guttman Scale, first described by Louis Guttman in 1944, is a measurement technique that presents a progression of attitudes or beliefs from weak to strong. Respondents are required to choose a point along a continuum of provided responses. A perfect Guttman scale consists of a unidimensional set of items arranged in order of increasing specificity or extremeness.

The fundamental idea behind the Guttman scale is that a person will agree with all statements up to a certain point and then stop agreeing. Specifically, a respondent who agrees with a specific question in the list should also agree with all previous questions. This scale is sometimes known as cumulative scaling or scalogram analysis (Table 10.8).

Example: A 6-item Guttman scale is constructed to assess a patient's comfort level with different aspects of nursing care. If the respondent scores a four, it should mean that the respondent agreed with the first four statements.

1. I am comfortable with a nurse taking my vital signs.
2. I am comfortable with a nurse administering medications to me.
3. I am comfortable with a nurse conducting physical assessments and examinations.
4. I am comfortable with a nurse assisting me with medical procedures, such as wound care or injections.
5. I am comfortable with a nurse discussing sensitive or personal health information with me.
6. I trust my nursing team to provide the best possible care in all situations.

The scale may be used to determine how extreme a view is, with successive statements showing increasingly extremist positions.

Guttman scale is not very commonly used in nursing research.

Visual Analog Scale

A Visual Analog Scale (VAS) is a psychometric measurement tool used to assess a respondent's subjective experiences or opinions. It typically consists of a straight line, often 100 millimeters long, with two endpoints representing contrasting statements or emotions (Fig. 10.3). Respondents mark a point on the line that best represents their perception, and the position of the mark is measured to quantify the response.

It has been proven to be a useful research tool to measure the subjective experiences such as pain, anxiety, fatigue as reported by subjects in clinical settings.

Advantages of VAS

- It is relatively easy to use and understand by the respondents.
- It has a better responsiveness.
- It assesses more closely what patients actually experience.

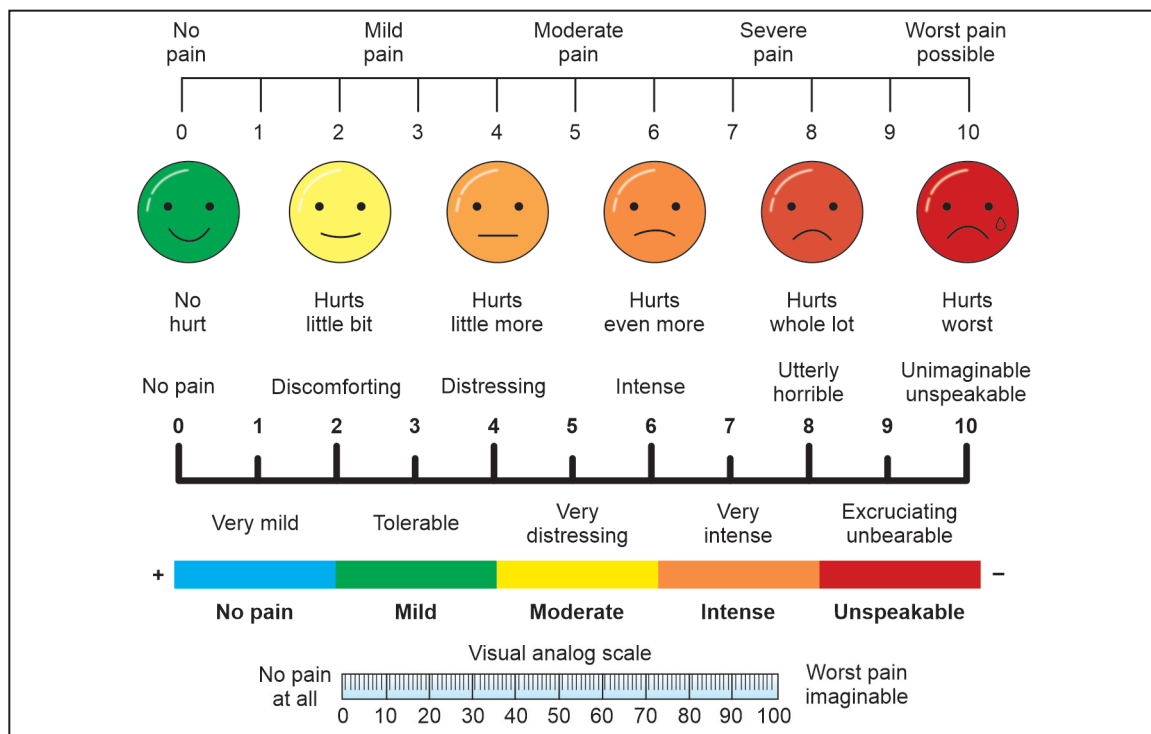


Figure 10.3: Numerical rating scale

Disadvantages of VAS

- It may be difficult to understand by some users.
- It requires a significant time and commitment for instruction and administration, and thus involves more work.
- It is not a valid measure for young children since they do not understand and answer the VAS correctly.
- It might be less specific than the other measures.

Observation Method

Observation is the method of data collection where an investigator collects data by directly observing the study subjects. When the researcher is concerned with attributes other than attitudes and beliefs, observation permits the researcher to watch and note actions and reactions. The researcher records what happens and how frequently it happens to determine the nature and frequency of events or activities of interest.

For example,

Observing the nursing students how frequently they wash hands while caring for the patients.

Observation method of data collection can be used in both **quantitative and qualitative** research studies. In structured observation, researchers typically record their observations using instruments such as checklists or rating scales. These instruments are intentionally designed to generate numerical data, thereby enhancing the quantitative aspect of the research.

Observation is used as a qualitative data collection method by systematically watching and recording behaviors, interactions, and events in natural settings to gain in-depth insights into the context and complexities of a research subject.

Types of Observation

Observation methods can be categorized into three types:

1. Structured and unstructured observation
2. Participatory and nonparticipatory observation, and
3. Controlled and uncontrolled observation.

1. Structured and Unstructured Observation

Structured observation involves systematically defining what to observe and how to record it, often using tools like checklists or rating scales. This method is suitable when the researcher has prior knowledge and involves instruments to ensure accuracy. For example, in nursing, checklists are used to monitor students' adherence to procedures. Similarly rating scale can be used to rate the care provided to the admitted patients in the hospital.

On the other hand, unstructured observation involves spontaneously observing and recording what has been observed. These observations are done without any preplanning and preconceived ideas of what will be seen, while it offers freedom to the observer, it can lead to difficulties in recalling details. This approach demands high concentration and attention from the observer.

In research, a combination of structured and unstructured observations is commonly used to gather comprehensive insights into the phenomenon under study.

2. Participatory and Nonparticipatory Observation

Observation can be categorized as participatory (overt observation) or nonparticipatory (covert observation). In participatory observation, the subjects are aware that they are being observed, and it is transparent. Conversely, nonparticipatory observation involves researchers observing individuals without their knowledge. In this method, researchers may even become part of the observed process, embedding themselves in the subjects' daily lives, as seen in anthropologists marrying and living with the community they study.

Observation can be participatory or it can be nonparticipatory. In participatory, the respondent is aware that he is being observed by the researcher. It is also called **overt observation**. When the investigator is observing the individuals without giving any information to them then it is nonparticipant observation. It is also called **covert observation**. In this method the researcher may even become a part of the process being observed. S/he gets involved in the routine life of the subject. There are classic example of anthropologist getting married into and raising families in the community under observation.

Both participatory and nonparticipatory observations come with their own set of advantages and disadvantages. For example, in participatory observation, subjects might become more conscious of their actions, potentially leading to altered behaviors known as the **Hawthorne effect**. Researchers must consider these factors when choosing the most suitable observation method for their study.

3. Controlled and Uncontrolled Observation

Observation can be categorized as either controlled or uncontrolled. Uncontrolled observation occurs in natural, unaltered conditions and aims to capture spontaneous and real-life situations. On the other hand, controlled observation involves observations carried out under predetermined and structured plans, often in

a laboratory setting with controlled conditions. Researchers opt for controlled observation when they require specific experimental procedures and conditions. The choice between these methods depends on the research objectives and the level of control needed in the study.

Important Considerations while Using Observation Method

Observation method is one of the commonly used techniques in nursing research study. Certain important considerations while planning to use this method include:

Determine the Behavior to be Observed

Before undertaking the observation, it is very important to decide what is going to be observed, i.e., whether it is the skill regarding some procedure, the personal habits of an individual, or the facial expressions of a person, etc.

Decide the Type of Observation

The researcher needs to consider questions of whether the observation is structured or unstructured; covert or overt and the degree of involvement s/he is going to have in the activity being observed.

Decide the Time of Observation

The researcher need to decide the extent to which the observation will be made. That means observing for a set amount of time per hour/ per shift/ per day/per night, etc. or observing whole of the event. The earlier is called the **time sampling** and the later is called the **event sampling**. Observing nurses for a specified period of time to observe their practice is the example of time sampling and observing whole of the procedure, e.g., changing of a dressing is the example of an event sampling.

Train the Observers

The researcher himself needs to be trained well regarding the process of observation. Sometimes there could be more than one observer to collect the data. In that case all the observers should be trained well prior to actual data collection. They must practice until they achieve the same or similar measurements. Inter-rater reliability can be determined in order to have the reliable data.

Decide how Observations will be Recorded

It is always good to record the observations as they are being made to prevent distorting the information. The recording can be a paper-based recording whereby the researcher records the observations on a checklist. There can also be a video recording of the observation. Whatever the method is to be used it should be decided well in advance.

Advantages of Observation Method

- The information obtained is reliable and accurate.
- There is no recall bias provided it is planned.
- It provides direct information about behavior of the individuals and groups.
- It permits evaluators to enter into and understand circumstances/context.
- It provides good opportunities for identifying unanticipated outcomes.
- It exists in natural, unstructured, and flexible setting.
- The subjective bias is eliminated.



Disadvantages of Observation Method

- It is difficult, expensive and time consuming as the researchers have to personally go to the observers.
- In participatory observation the subjects may become aware of being observed and thus change his behavior which may result in distorted information. (*This can be avoided by discarding few initial observations*).
- The researcher can get information about the present behavior of the subjects only.
- It may not be practical in many situations.
- It may suffer from inadequate duration of observation as well as time of observation.
- It needs well-qualified, highly trained observers.
- It may also need content experts.
- Selective perception of the observers may distort the data.
- The quality of data collected through this method is highly dependent on the data collector/observer. If the observer is too lenient, he can rate the subject or the event positively. If the observer is too strict, he may rate the subject/event negatively. The earlier is called the **error of leniency** and the later is called the **error of severity**.
- Respondents' opinion cannot be recorded on certain subjects.
- The observation method is also prone to have **Halo Effect**. It may be there when one trait of a person or thing is used to make an overall judgment of that person or thing. If one likes one aspect of a person, he/she will have a positive predisposition toward everything about him. If one dislikes one aspect of that person, he/she will have a negative predisposition toward everything about him. For example, if a student nurse is good in looking and good communicator, it does not mean that he/she is having through knowledge of the subject also and vice versa.

Advantages and disadvantages of different types of observation methods are shown in Table 10.9.

Table 10.9 Advantages and disadvantages of different types of observation methods

Types of observation	Advantages	Disadvantages
Naturalistic Observation	• Particularly good for observing specific subjects. • Provides ecologically valid recordings of natural behavior. • spontaneous behaviors are more likely to happen.	Ethics: Where research is undisclosed consent will not be obtained. Where consent is not obtained—details may be used which infringe confidentiality.
Structured Observation	• Allows control of extraneous variables. • Reliability of results can be tested by repeating the study. • Provides a safe environment to study contentious concepts such as infant attachment. • The implementation of controls may have an effect on behavior.	• The implementation of controls may have an effect on behavior. • Lack of ecological validity. • Observer effect. • Observer bias.
Unstructured Observation	• Gives a broad overview of a situation. • Useful where situation/subject matter to be studied is unclear.	• Gives a broad overview of a situation. • Useful where situation/subject matter to be studied is unclear.

Contd...



Types of observation	Advantages	Disadvantages
Participant Observation	• Gives an 'insiders' view. • Behaviors are less prone to misinterpretation because researcher was a participant. • Opportunity for researcher to become an 'accepted' part of the environment	• Observer effect. • Possible lack of objectivity on the part of the observer.
Nonparticipant Observation	Avoidance of observer effect	Observer is detached from situation so relies on their perception which may be inaccurate

Checklist

The observation checklist is a strategy to monitor specific skills or behaviors of the subjects. This is the simplest of all the tools used for data collection. It typically consists of a list of items, criteria, or behaviors to be observed, and observers mark or check off each item as they are observed during the data collection process. The presence or absence of each item may be indicated by checking 'yes' or 'no' or multipoint scale. It may be used as an independent tool or as a part of a schedule/questionnaire.

Characteristics of a Checklist

- It enables evaluation of the subjects with particular characteristics.
- The items are well constructed and related to the area or subject.
- It must be complete and comprehensive in itself.
- It should be short and concise enough to be practical (e.g., one sheet of paper).
- The items should be arranged into a logical sequence or flow from start to end.
- The items should be written with clear, detailed wording to minimize the risk of misinterpretation.
- It should be reviewed and properly validated by the experts of the subjects.

Construction of an Observation Checklist

The observation checklist is probably the easiest tool for construction. A 10-step approach of constructing an observation checklist is described below:

1. **Purpose and objectives are defined:** The reason for needing the checklist and the specific observations to be recorded are determined.
2. **Behaviors or events are identified:** The specific behaviors or events to be observed are listed, ensuring clarity and relevance. These go in the vertical column of the checklist.
3. **Response categories are selected:** Response categories (e.g., 'yes' or 'no', 'present' or 'absent') are chosen for recording observations.
4. **Checklist format is designed:** A two-column format is created, with observed items on one side and response categories on the other.
5. **Pretesting and revision are conducted:** The checklist is tested with a small group to ensure clarity, and necessary revisions are made.
6. **Observers are trained:** Training on how to make accurate observations is provided if multiple people will use the checklist.
7. **Observations are conducted:** Observers use the checklist to record their observations during data collection.
8. **Completed checklists are collected:** The completed checklists are gathered from observers after data collection.

9. **Data analysis is performed:** The observation data is analyzed, which may involve tallying responses or calculating frequencies.
10. **Conclusions are drawn:** Conclusions that align with the checklist's objectives are drawn based on the analysis.

Example: Observation checklist for nursing care of thrombolized stroke patients in the first 24 hours is shown in Table 10.10.

Table 10.10 Example of a checklist

Ward: _____ Date: _____ Code: _____

Sl. no.	Nursing actions	Yes	No
1.	Monitoring of the patient		
a.	Blood pressure monitored: Every 15 minutes × 2 hours		
b.	Every 30 minutes × 2–6 hours		
2.	Bleeding precautions		
a.	Invasive procedures strictly withheld for 6 hours		
b.	Antithrombotics withheld for 24 hours		
3.	Patient safety		
a.	Side rails of the bed raised up		
b.	Patient assisted with hygiene activities on the bed		
	Total score		

Score: Yes = 1; No = 0

Advantages of Checklist

- Checklists are comparatively easy to construct, apply, understand and interpret.
- It can be completed even through mail.
- List of items is helpful to provide appropriate guidelines to the subjects.
- It is useful for self-evaluation as well as evaluation by others.
- It is useful for inter-rater reliability.
- It can be used for evaluating the classroom as well as clinical learning activities.
- It is a useful way to obtain a large amount of data.
- The obtained data are in a distinct form because the subject either possess or do not possess a particular behavior/trait, etc.

Disadvantages of Checklist

- There is always a restriction on the subjects to the given options. The respondent is required to make a forced choice response.
- It is a rigid method both in the question as well as responses.
- It is difficult to evaluate personality through checklist.
- It determines only the presence or absence of a particular aspect.

Biophysiological Measures

Biophysiological measures involve collecting physical data from the patients. The measures commonly accessible to nurses include body temperature, blood pressure, biochemical values, blood gases, pulse

oximetry, etc. These measures are generally considered more objective and accurate, as they are less prone to bias. However, the instruments should be functioning properly and calibrated. Sometimes special expertise may be required to use some of the devices.

The physiological measurements may be classified as **in vitro** and **in vivo**. In Latin, Vitro means glass (a test-tube) and vivo means a living person. Thus, **in vitro** means a measurement that is done on a sample taken from a participant but analyzed after it has been removed from the participants. These tests usually measure chemical components carried out as hormone-assays or blood components such as cholesterol, etc. The test can be done on patient's bedside also. For example, glucose monitoring, this is carried out primarily on patients' bedside.

In vivo measurements are those which are directly taken on the participant and the value is obtained at the time of measurements. These are usually the physiological characteristics of participants, for example, blood pressure recordings, temperature, pulse, respiration, pulse oximetry, etc. These measurements may be combined with other measurements in the same study to validate the data. For example, stress can be assessed through various methods, such as using questionnaires like the State-Trait Anxiety Inventory, observing individuals' behaviors when exposed to stressful situations, or measuring stress levels by monitoring physiological indicators like blood pressure, heart rate, or the concentration of adrenocorticotrophic hormone in urine samples. An example of research using biophysiological measures is shown as follows:

Example of a research using biophysiological measures

Kaur J conducted a quasi-experimental study was conducted to assess the effect of "foot massage and reflexology" on physiological parameters, i.e., systolic and diastolic blood pressure, heart rate and oxygen saturation of critically ill patients in intensive care units. Sixty patients were enrolled in this study. An observation checklist was used to record various parameters. Controlled observations for all the physiological parameters under study were recorded for the first 3 days in the morning as well as in the evening hours with the total of six observations. Then, for the next three days the procedure of "foot massage and reflexology" was implemented on the same patients. All the physiological parameters were recorded just before and after the implementation of protocol on each day in the morning as well as in the evening hours.

Disadvantages of Biophysiological Measures

- Some of the instruments measuring the physiological parameters may be expensive to purchase.
- The researcher/data collector has to have the appropriate training to use the instrument.
- Certain instruments may be adversely affected by the changes in environment such as temperature.
- There may be Hawthorne effect if the participant is aware that a test is being performed on him.
- There may be potential harm to the participant in case of use of invasive physiological instruments.

Projective Techniques

In projective technique, the subjects project a meaning into materials that is actually ambiguous or meaningless. In projective methods, a subject is presented with some stimuli designed to be vague or to have no definite meaning. Then the participant is asked to describe the stimulus or to tell what the stimulus appears to represent. The responses reflect the internal feelings of the subjects that are projected into external stimuli.

The commonly used test is the ink blot test. The individual is asked to look at the ink blot on the paper and to tell what he or she sees. The subjects must put meaning into these shapes as per their own beliefs or ideas. The researcher can draw some conclusion about the subject's state of mind by repeating series of these items.

Self portrait is a projective technique in which the subjects are asked to draw a self portrait. It gives the researcher an important data as how the subjects feel about themselves. It encourages self expressions through the construction of some product. The nurses can practice this method as one of the therapeutic interventions. Bellack has recommended the use of projective techniques in research and clinical practice with children.

Types of Projective Techniques

Association Technique

Association technique requires the subject to respond at the presentation of stimulus(word) with the first thing that comes to mind so as to extract information regarding works that have maximum association.

Completion Technique

Completion projective techniques supply the subject with stimulus that is incomplete and the subject is required to complete it as he/she wishes.

For example story completion and sentence completion test.

Construction Test

The subject is required to produce or construct something at direction, usually a story or a picture.

Thematic Appreciation Test

Thematic appreciation test consists of a set of pictures of a normal everyday event and the respondents are asked to describe what they think the pictures present (Fig. 10.4).



Figure 10.4: Sample picture of a thematic appreciation test

Rosenzweig Test

Rosenzweig test uses a cartoon format wherein we have series of cartoons with empty balloons. The respondents are asked to put their own words in an empty balloon space (Fig. 10.5).



Figure 10.5: Resenzweig test

Rorschach Inkblot Test

Rorschach inkblot test is a psychological assessment tool used to gain insight into an individual's thoughts, emotions, and perceptions. Developed by Hermann Rorschach in the early 20th century, it is based on the concept that individuals will interpret ambiguous images, such as inkblots, according to their own unconscious thoughts and feelings.



This test consists of 10 cards having prints of inkblots, where in the design happens to be symmetrical but meaningless. the respondents are asked to and other describe what they perceive in them (Fig. 10.6).

Holtzman Inkblot Test

Holtzman inkblot test consists of 45 cards, which are based on color, movement, shading and other factors. One response per card is interpreted at three levels of appropriateness (Fig. 10.7).



Figure 10.6: Rorschach inkblot test

Advantages of Projective Techniques

- Projective tests are used in psychological research to explore various aspects of personality and behavior.
- Researcher will be able to tap into unconscious aspects of individual's personality.
- These tests provide rich qualitative data that can be useful for understanding an individual's unique experiences.
- Projective tests are flexible and adaptable. So it can be used in various settings.
- Projective tests offer an indirect way to assess personality.

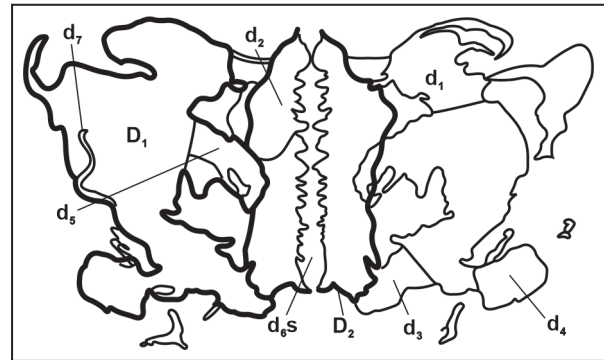


Figure 10.7: Holtzman inkblot test

Disadvantages of Projective Techniques

- The projective tests require special training regarding their administration and interpretation. They need to interpret the feeling of the subjects very cautiously to avoid misinterpretations of the results.
- There is lack of objectivity of the tests.
- There is an issue related to their reliability and validity.
- Projective tests are expensive because of the competence of staff that needs to be employed.

Vignettes

A vignette is a sort of “illustration” in words. Vignettes are simulations of real events which can be used in research studies to elicit subject's knowledge, attitudes or opinions according to how they state they would behave in the hypothetical situation depicted. A vignette question describes an event, happening, circumstance, or other scenario, the wording of which often is experimentally controlled by the researcher and at least one of the different versions of the vignette is randomly assigned to different subsets of respondents.

Vignettes are short scenarios in written or pictorial form, intended to elicit responses to typical scenarios.

For example:

- A vignette could describe a classroom scenario where a teacher faces challenges with a disruptive student.
- A vignette could describe a patient's complex health situations including symptoms, medical history, personal circumstances. Nursing students might be asked how they would prioritize the care.

- The ability to collect information simultaneously from large numbers of subjects, in depth information can be explored.
- Absence of observer effect and avoidance of the ethical dilemmas commonly encountered during observation.

There could be problems in establishing reliability and validity, especially external validity.

Q sort is also called Q methodology. It is a systematic study of participants' viewpoints regarding some issues. The researcher gives the participants a punch of 60–100 cards. Each card contains an individual item developed from literature of a particular field or discipline. The participants are asked to rank order and sort the cards according to some predetermined criteria regarding the issue or the topic under study. These cards contain words, phrases, definitions, pictures, etc. as per the topic being researched. The researcher specifies how many cards can go in one pile to avoid overcrowding of the cards in one pile. Each statement is judged in relation to other. Their responses are analyzed using factor analysis (Fig. 10.8).

1. Defining the domain of discourse on a particular issue;
2. Developing the set of statements (Q sort);
3. Selecting the participants representing different perspectives;
4. Q sorting by the participants;
5. Analysis and interpretation.

NURSING RESEARCH



Example: In nursing research, the Q-sort methodology can be used to assess and understand the perceptions of patients regarding nursing care provided in a selected hospital.

Merits and Demerits of Q-sort

Merits	Demerits
• Captures personal views: It allows people share their personal thoughts and feelings on a topic. • Goes deep into opinions: It helps researchers dive deeply into what people really think, going beyond simple answers to explore complex opinions. • Looks at the big picture: Q-methodology considers many factors at once, giving a more complete picture of people's thoughts. • Participants decide: Participants decide how to sort things based on their views. • Finds similar ideas: It identifies groups of people with similar opinions, helping researchers see patterns and commonalities among participants. • Engaging for participants: Involvement of participants in sorting process makes the research more engaging and reflective.	• Subjectivity concerns: Q-sort method relies on people's opinions, and this subjectivity can make it challenging to ensure that the results truly represent the broader population. • Limited generalization: Findings from Q-sort method has limited generalizability as conventional qualitative research. • Time-consuming: The process of sorting statements and conducting interviews is time-consuming and labour intensive. • Complex analysis: Analyzing the results involves statistical techniques like factor analysis, which can be complex and might be challenging for researchers without a strong background in statistics. • Dependence on statements: The effectiveness of Q-methodology depends heavily on the quality and relevance of the statements given to participants.

Delphi Technique

The Delphi technique is a structured group communication process used for consensus-building and decision-making in various fields, including health care. The Delphi method is a structured process employed to reach a collective opinion or decision by seeking input from a panel of experts. In this method, experts participate in multiple rounds of questionnaires, and the responses are collected, analyzed, and then shared with the group after each round. This iterative approach allows for the refinement and convergence of expert opinions over successive rounds, ultimately leading to a consensus or decision on a particular topic or issue.

The Delphi technique involves several steps to gather and synthesize expert opinions on a specific topic or issue. Following are the typical steps involved in Delphi technique:

1. **Panel selection:** Identify and select a panel of experts with knowledge and expertise in the subject area.
2. **Round 1—questionnaire development:** Develop an initial questionnaire that includes open-ended questions or statements related to the topic under consideration. Send the questionnaire to the selected experts, asking them to provide their opinions, predictions, or recommendations based on their expertise.
 - **Data collection:** Collect the responses from the experts in the first round.
 - **Feedback and analysis:** Analyze the responses and create a summary report without revealing individual expert identities or responses. Provide this summary report to the experts, including aggregated responses and any areas of agreement or disagreement.
3. **Round 2—questionnaire revision:** Develop a second-round questionnaire that may include revised questions based on the feedback and insights from the first round. Send this revised questionnaire to the experts, along with the summary report from the first round.
 - **Data collection and analysis:** Collect the responses from the second round of experts. Analyze the new responses and create another summary report, highlighting any changes in opinions and areas of emerging consensus or divergence.



4. **Iterative rounds:** The process continues with additional rounds, as needed, until a predetermined level of consensus or stability is reached, or until no significant changes occur in the experts' responses between rounds.
5. **Termination:** Decide on the termination criteria for the Delphi process. This can be based on achieving a certain level of consensus, stability in responses, or a predetermined number of rounds.
6. **Final Report:** Prepare a final report summarizing the outcomes of the Delphi process, including any consensus, recommendations, or expert opinions reached.

Advantages of Delphi Technique

- **Anonymity:** Experts can provide opinions without fear of bias or peer pressure, promoting open and honest feedback.
- **Iterative process:** The method allows for multiple rounds, refining opinions and reaching consensus over time.
- **Expertize:** Involves subject matter experts, ensuring high-quality input and well-informed decisions.
- **Reduces groupthink:** Minimizes the impact of dominant personalities and group dynamics, leading to more unbiased results.

Disadvantages of Delphi Technique

- **Resource-intensive:** Conducting multiple rounds and analyzing responses can be time-consuming and costly.
- **Lack of face-to-face interaction:** Anonymity and remote participation may hinder real-time discussions and idea sharing.
- **Subjectivity:** Results are based on expert opinions, which may not always be entirely objective or free from personal bias.
- **Consensus may not be achieved:** There is no guarantee that a final consensus will be reached, and the process can be continued indefinitely.

Record Analysis

Records are the valuable source of data in nursing research. All the other methods including questionnaires, interviews, observations, etc. require the researchers to interact with the subjects in order to obtain information. But the records are an ever-present source of material. Records are basically the compilation of writings and figures that the individuals have collected earlier. It involves the use of existing information for research purposes.

Rest of the details regarding secondary data has already been given in the chapter.

PILOT STUDY

A pilot study is referred to as a mini version of a full-scale study, as well as the specific pretesting of a particular research instrument such as a questionnaire or interview schedule. It is also known as a "feasibility" study. Pilot studies are considered a crucial element of a good study design. Success in the main study is not guaranteed by conducting a pilot study, but it does increase the likelihood of success. A pilot study can be conducted with a small sample size of around 10–20 units, and problems can be identified and rectified by the researchers in a timely manner.



Objectives of Pilot Study

The main objectives to carry out the pilot study are as follows:

- To improve the actual study's quality and efficiency
- To reveal deficiencies in the design of a proposed experiment or procedure. This can then be addressed timely.

Welman and Kruger have listed three values of a pilot study. According to them it is needed to detect possible flaws in measurement procedures (including instructions, time limits, etc). It also helps in identifying unclear or ambiguous items in a questionnaire. Sometimes while conducting a pilot study the researchers may observe the nonverbal behavior of the participants. This also can give important information about any embarrassment or discomfort experienced concerning the content or wording of items in a questionnaire.

Various advantages and limitations of pilot studies are given in Box 10.1 and Box 10.2 respectively.

After carrying out the pilot study, the methodology should be evaluated. If there are major changes, then second pilot study should be done. Documentation of details of modifications in the study design/plan/questionnaire after a pilot study will add vigor to the methodology of the study. The results of any pilot study need to be evaluated to determine the best way to fix existing problems without introducing new ones. It can be simply in the form of changes to the survey instrument and design. However, it is important to note that any introduced changes should also be pretested to avoid unforeseen errors. Certain specific consideration regarding pilot study are shown in Box 10.3.

BOX 10.1 Advantages of conducting a pilot study

- It helps to test the questionnaire/ tool being used in the study.
- It comforts the researchers regarding feasibility issues of main study.
- Availability of the subjects can be assessed.
- It checks if the protocol is effective.
- It assesses the practicability of using proposed methods.
- It helps in estimating the variability in outcomes to help determining sample size.
- Actual requirement of resources needed for study can be estimated.
- It helps in assessing the proposed data analysis techniques to uncover the potential problems.

BOX 10.2 Limitations of conducting a pilot study

- Pilot study is conducted on a smaller scale. Thus, actual results of the study may vary from the results of pilot study.
- It may not be appropriate to carry out a pilot study for case studies.
- A pilot study is usually carried out on the subjects of the related population, but not on those who will form part of the final sample.
- A pilot study is normally small in comparison with the main experiment and therefore, can provide only limited information on the sources and magnitude of variation of response measures.

BOX 10.3 Specific considerations

The results of the pilot study should not be included in the final research as it may contaminate the findings. However, in case of studies about rare diseases or where sample size is too small or tests are very expensive and not much changes are there in methodology after the pilot study, then the pilot data can be included in the main data.

PROCESS OF DATA COLLECTION

Data collection process involves preparing, collection and management of data. The preparation for data collection in research is more or less similar to the preparation for carrying out a nursing procedure on the patients. For example, to perform any procedure, one needs to prepare oneself, select and obtain the equipment and material, prepare the client, and to set up the area where the procedure will take place. Similar is the case of data collection process in research, which is discussed as follows:

- **Self preparation of the researcher/s:** First of all, it is very important for the researcher to prepare himself/herself for data collection. As mentioned earlier, the research project at the undergraduate level is a group activity. Thus, it is to be ensured that all the data collectors have sufficiently practiced the tool, equipment, etc., to make sure a smooth running process during the actual data collection. The tool can be practiced on certain friends. All the data collectors must practice until they achieve inter-rater reliability. This will prevent biased data.
- **Availability of equipment/material:** If any specific equipment or material is being used in data collection, it is indispensable to order them well in advance. Because this process of buying the material usually takes longer, particularly, if the product is to be ordered from overseas. A study was carried out to evaluate the effect of ear muffs on physiological parameters of neonates. These were as such not available from India. The researcher had to purchase them from abroad. The process of buying was started well in advance, so, the researcher did not face any difficulty.
- **Preparing questionnaire and consent form:** As per the sample size, a number of copies of questionnaire, consent form or some other tool as per the research methodology or if an intervention in the form of a booklet/CD, etc. is being used will be required. So, photocopies/printing of all the tools/protocols, etc. should be done well in advance. If, there are more than one groups in the study, different colored files should be prepared, so that proformas are easy to locate in case of any need. A secure place to store the equipment and materials should be ensured.
- **Permission from the authorities:** To carry out a research activity, some sort of permission is always required from the concerned authorities. It can be head of the department, Medical superintendent or even the director of the institute. The researcher needs to write the necessary letters to all the concerned to conduct the study well before the actual data collection time period.
- **Preparation of the site/setting:** The setting for data collection must be carefully determined. Asking the participants to fill up the questionnaire amid of every one or in the corridor will not be appropriate. So, before starting the data collection, a researcher should visit the setting where the data collection will take place and appropriate arrangement should be made.
- **Managing the participants:** The researcher needs to manage the participants involved in the research properly. So, treat all the participants well, because you are dependent on them for your data. They should not be compelled to participate in the study. It is very important to put all the participants at ease as much as possible during the data collection by introducing yourself, reminding the participant of the purpose and procedures of the research and maybe chatting briefly in between just to break the ice.
- **Logging the data:** It is very important to keep a good record of all the data. Each piece of data should be clearly labeled and recorded whether it is questionnaire, audio tape, video tape, etc. A separate list of the code numbers and the participants' name if any, should be kept in the log book.
- **Preparation for data management:** The researcher will probably need to prepare himself regarding management of the data. For example, he/she may need to learn how to code the data, how to operate any data analysis software, setup the computer files for your data, etc.

SUMMARY

- Data collection in research relies on specialized tools or instruments, including questionnaires and observation checklists, to ensure precise measurements and accurate results.
- Data, which can be in various forms such as numbers or text, serves as the foundation for research, and the systematic process of data collection is essential to maintain research integrity and reach valid conclusions.
- The choice of a data collection method in research is influenced by factors including research objectives, the nature of the data needed, research design, available resources, participant characteristics, ethical considerations, and the validity and reliability of the method, among others, to ensure that the collected data effectively addresses the research's core questions.
- Interview methods include structured, semi-structured, and unstructured interviews, in-depth interviews, and focus group discussions, each with distinct characteristics and applications.
- The questionnaire method involves using structured questionnaires to collect data from participants or respondents, containing a series of questions designed to align with research objectives, and responses can be collected through self-administration or interviews.
- Primarily there are two types of questions: Open-ended and the closed-ended questions. Various types of closed-ended questions include dichotomous, multiple choice, Cafeteria questions and scale response questions.
- Observation is the method of data collection where an investigator collects data by directly observing the study subjects. When the researcher is concerned with attributes other than attitudes and beliefs, observation permits the researcher to watch and note actions and reactions.
- Observation method of data collection can be used in both quantitative and qualitative research studies. Observation methods can be categorized into three types: (1) Structured and unstructured, (2) Participatory and nonparticipatory, and (3) Controlled and uncontrolled.
- Biophysiological measures involve collecting physical data from the patients. The measures commonly accessible to nurses include body temperature, blood pressure, biochemical values, blood gases, pulse oximetry, etc. These measures are generally considered more objective and accurate.

ASSESS YOURSELF

Long Answer Questions

1. Discuss the advantages and disadvantages of using secondary data in research.
2. What are the steps in designing a questionnaire? Make a questionnaire to assess knowledge about dengue in nursing students studying in first year in a college.
3. Discuss the various types of questions in the questionnaire.
4. Discuss the advantages and disadvantages of using rating scale.
5. Discuss the advantages of conducting pilot study.
6. Enumerate various methods of data collection in research.
7. Discuss the ethical and moral questions involved when using a participant observation method.
8. Discuss various methods of administering questionnaire.
9. Discuss the various types of interviews that can be conducted to collect the data.
10. Discuss the advantages of using questionnaire as a method of collecting data.
11. Discuss the process of data collection.

Short Answer Questions

1. What points should be kept in mind while selecting a tool?
2. Differentiate between primary and secondary sources of data.
3. Briefly discuss the Q sort method of data collection.
4. Write short notes on biophysiological measures, projective techniques, vignettes, and record analysis as the method of data collection.
5. Write a short note on checklist.

Multiple Choice Questions

1. Which of the following is NOT an advantage of the observation method?
 - a. There is no recall bias provided, it is planned
 - b. It provides direct information about behavior of the individuals and groups
 - c. It permits evaluators to enter into and understand circumstances/context
 - d. It introduces the subjective bias
2. A process that renders data into numbers that can be entered into a database is:
 - a. Matrixing
 - b. Coding
 - c. Transcribing
 - d. Editing
3. A method in which several rounds of questions are given to a panel of experts is called:
 - a. Q-methodology
 - b. Meta-analysis
 - c. Delphi technique
 - d. Content analysis
4. All of the following are the disadvantages of the observation method; except:
 - a. It needs well qualified, highly trained observer
 - b. It provides opportunity to identify unanticipated outcomes
 - c. Subjects may change their behavior
 - d. Selective perception of the observers may distort the data
5. Which of the following terms best describes data which was originally collected at an earlier time by a different person for a different purpose?
 - a. Primary data
 - b. Secondary data
 - c. Experimental data
 - d. Basic data
6. Which of the following could be measured directly?
 - a. Pain
 - b. Hope
 - c. Health
 - d. Weight
7. The main "tools" or data for building new knowledge in qualitative research are:
 - a. Numbers
 - b. Words
 - c. Images
 - d. Statistics
8. When constructing a questionnaire which of the following is NOT one of the principles?
 - a. Do not use "leading" or "loaded" questions
 - b. Avoid double barrelled questions
 - c. Avoid double negative questions
 - d. Avoid using multiple items to measure single construct
9. Secondary data may include which of the following?
 - a. Official documents
 - b. Personal documents
 - c. Archived research data
 - d. All of these
10. Open-ended questions provide primarily which of the following type of data?
 - a. Confirmatory data
 - b. Qualitative data
 - c. Predictive data
 - d. None of these

Answer Key

1. d 2. b 3. c 4. b 5. a 6. d 7. b
8. d 9. d 10. b

BIBLIOGRAPHY

- Arain M, Campbell MJ, Cooper CL, et al. What is a pilot or feasibility study? A review of current practice and editorial policy. *BMC medical research methodology*. 2010;10(1):67.
- Bellack JP, Fleming JW. The use of projective techniques in pediatric nursing research from 1984 to 1993. *J pediatricNurs*. 1996;11(1):10-28.
- Boslaugh S. *Secondary data sources for public health: A practical guide*: Cambridge University Press 2007.
- Bowling, A. Mode of questionnaire administration can have serious effects on data quality. *J public health conf*. 2005;27(3): 281-91
- Bradburn NM, Sudman S, Blair E, et al. *Improving interview method and questionnaire design: Response effects to threatening questions in survey research*: Jossey-Bass San Francisco, CA; 1980.
- Converse J M, Presser S. *Survey questions: Handcrafting the standardized questionnaire*. Newbury Park, CA: Sage; 1986.
- Dempsey PA, Dempsey, A.D. (2000). *Using Nursing Research: Process, Critical Evaluation, and Utilization*. 5th Philadelphia: Lippincott Williams and Wilkins. [online] Available from https://en.wikipedia.org/wiki/Online_interview. [Accessed March 9, 2016].
- Roberts K, Taylor B. *Nursing Research Process: An Australian Perspective*. 2nd Ed. Nelson Australia Pty Limited 2002.
- Steckler A, McLeroy, KR, Goodman RM, et al. Toward integrating qualitative and quantitative methods: an introduction. *Health education quarterly*, 1992;19(1):1-8.
- Types of questions. [online] Available from <http://www.socialresearchmethods.net/kb/questype.php>. [Accessed April 19, 2016].
- Willis GB. *Cognitive interviewing: A tool for improving questionnaire design*. Sage Publications 2004.
- Woodward C, Chambers L. *Guide to Questionnaire Construction and Question Writing*, Canadian Public Health Association. Ottawa, Ontario. 1986.

My Exam Centre
Read & Learn



Solved Papers

Get Question bank covering the complete subject in the form of Subjective exercises and Extra-edge exercises with their solution

Unsolved Papers

Explore the pool of Unsolved Previous Year Exam Papers of top Universities



Scan the QR Code to Download the App

Nursing NextLive
The Next Level of Nursing Education

CBS Phygitl Books >

Nursing Research and Statistics PHYGITAL



Validity and Reliability of Research Tools

LEARNING OBJECTIVES

After the completion of the chapter, the readers will be able to:

- Define validity and reliability.
- Appreciate the characteristics of a data collection instrument.
- Discuss the various methods of establishing validity and reliability of quantitative and qualitative research tools.
- Understand the sensitivity and specificity of diagnostic tools.
- Discuss the various methods of establishing validity and reliability in qualitative research.

CHAPTER OUTLINE

- Introduction
- Characteristics of Data Collection Instruments/Tools
- Establishing Validity of a Tool
- Estimating Reliability
- Sensitivity and Specificity of Diagnostic Tools
- Validity and Reliability in Qualitative Research

KEY TERMS

Concurrent validity: It is the extent to which a new measurement aligns with an already established tool when administered simultaneously.

Construct validity: It refers to the degree to which a test measures the intended theoretical concept or construct.

Content validity: It assesses how well a measurement instrument covers the entire range of the concept it aims to measure.

Criterion-related validity: It indicates how well a test predicts or correlates with a specific outcome or criteria.

External validity: It examines the generalizability of research findings to real-world settings beyond the study itself.

Face validity: It is an initial impression that a test or tool appears to measure what it intends to measure.

Formative validity: It pertains to the quality of the development process of a measurement instrument.

Contd...

Inter-rater reliability: It measures the consistency of scores assigned by different raters or observers.

Internal validity: It examines whether changes in the dependent variable are indeed caused by the independent variable in an experiment.

Negative predictive value: It is the probability of correctly identifying individuals who do not have a condition or characteristic.

Positive predictive value: It is the probability of correctly identifying individuals who have a condition or characteristic.

Predictive validity: It assesses how well a measurement predicts future outcomes or behaviors.

Reliability: It the consistency and stability of a measurement tool over repeated administrations.

Split-half reliability: It measures the internal consistency of a test by splitting it into two halves and assessing their correlation.

Sensitivity: It is an ability of a test to correctly identify individuals who have a particular condition or characteristic.

Specificity: It is an ability of a test to correctly identify individuals who do not have a particular condition or characteristic.

Test-retest reliability: It evaluates the consistency of test scores when the same test is administered on two separate occasions.

Validity: It refers to the extent to which a measurement instrument measures what it is intended to measure.

INTRODUCTION

Research instruments or tools are used to collect the data. Reliability and validity are the key indicators of quality of these instruments. These traits ensure that the data-gathering instrument being used will measure what it is supposed to measure and will do this in a consistent manner. All the researchers must have expertise in examining and establishing the validity and reliability of such instruments. The current chapter is limited to discussion on validity and reliability regarding the tools like questionnaires, interview schedule, etc. The sensitivity and specificity of diagnostic tools have been also touched upon.

CHARACTERISTICS OF DATA COLLECTION INSTRUMENTS/TOOLS

The data collecting instruments/tools must possess certain attributes for the accuracy of the data. These should be considered when making a decision regarding a data collection instrument. Some of these characteristics are as follows:

- **The instrument/tool should be valid:** The validity of an instrument/tool refers to the extent to which a data gathering instrument/tool measures what it is supposed to measure, i.e., the extent to which the instrument/tool obtains data that are relevant to what is being measured. The greater is the validity of an instrument, the more confidence researcher can have about the instrument's performance.
- **The instrument/tool should be reliable:** The reliability is an important characteristic of a quantitative data gathering instrument/tool. Reliability refers to the ability of a measuring instrument/tool to do consistently whatever it is designed to do in the same way each time it is administered. The ability to obtain consistent results when it is reused enables the researcher to be more confident that the scores will not fluctuate too greatly with repeated administration of the instrument.
- **The instrument/tool should be user-friendly:** Usability of a quantitative data collecting instrument/tool refers to the practical aspects that the researcher must consider in selecting a data gathering instrument/tool. These may include the cost, the ease of administration, time constraints, etc. Certain considerations regarding practicality and usability include: How much the tool/instrument will cost? How long will it



take to administer the tool? Are the directions regarding the tools clear? How easy is it to score the tools? Have any problems been reported by others who used the tool the researcher has selected?

The following are few examples regarding usability problems:

- Nursing students are asked to rate a lesson/class taught by the teacher immediately after class. But there are only a few minutes before the next class begins (problem with administration).
- Nursing students are asked to keep self-checklists of their activities after the college. For example, how much time do they devote for self-studies, games, library, sports, other recreational activities, etc. But the directions given by the researcher are complicated and the item descriptions are confusing (problem with interpretation).
- Nursing teachers are asked about their attitudes regarding college policy. But some questions are worded poorly which results in low completion rates (problem with scoring/interpretation).

Various methods of establishing the validity and reliability of the instruments/tools are discussed in the following sections of the chapter.

ESTABLISHING VALIDITY OF A TOOL

Validity is the extent to which an instrument measures what it is supposed to measure and performs as it is designed to perform. An instrument/tool is said to be valid, if it measures what we intend to measure. For example, a clinical thermometer is a valid instrument for measuring body temperature. But a sphygmomanometer is not valid for this purpose. Another example, could be that a researcher wants to measure the empathy level of nursing students using a rating scale. In this case, the validity of this tool refers to the degree to which it accurately reflects or assesses the empathy level of the students.

The data collection tools need to be valid before collecting the data. The following are certain approaches for establishing the validity of a tool.

Content Validity

The content validity of a tool is the extent to which the tool represents the phenomenon under study. It refers to the appropriateness of the content of an instrument. In other words, do the measures (questions, observation logs, etc.) accurately assess what the researcher want to know? For example, if a researcher wants to assess the knowledge of the nurses regarding hepatitis B, then the questionnaire which will be used to assess the knowledge should cover each and every aspect of hepatitis B. It should be evaluated by a group of experts in respective field, who examine the tool and then decide whether in their opinion it will be measuring what it claims to measure. For example, a public health specialist wants to assess, the level of awareness about HIV/AIDS of a college going student using a questionnaire tool, a group of public experts will decide, whether in their opinion the questionnaire tool is really measuring what it claims to measure.

Because there is no statistical test to determine whether a measure adequately covers a content area or adequately represents a construct, content validity usually depends on the judgment of experts in the field.

Face Validity

Face validity is a subtype of content validity. In this, validity is determined by inspecting the items to ascertain whether “on the face of it” the tool contains important matter that measures the phenomenon under study. It is the least time-consuming and least meticulous method for determining validity because it is based entirely on the subjective judgment of the investigator. For example, a researcher has developed a questionnaire to

assess the knowledge of nursing students regarding tracheostomy care. She selects a sample of 100 nursing students and administers the test. After the students complete the test, the researcher asks all the 100 students to complete a follow-up questionnaire. In this questionnaire, the researcher asks them, what they think the purpose of the test is, what construct they believe is being measured, and whether or not they feel the questionnaire was an adequate measure of their knowledge regarding tracheostomy care.

Face validity is rarely used due to its lack of true conformability (might be done inadvertently/subconsciously). However, it is better than establishing no validity at all.

Construct Validity

It is an evaluation of the extent to which an instrument measures the theoretical construct that the investigator wishes to measure. A basic approach to establishing construct validity is the known group technique, in which the instrument is administered to several groups known to differ on a certain construct. If the results obtained demonstrate statistically significant difference as expected, then the instrument is said to have a degree of construct validity. In the previously said example on hepatitis B, if the questionnaire on hepatitis B is administered to different level of nursing students, i.e., diploma, graduate and postgraduate nursing students, the different levels of the students should show different knowledge score regarding hepatitis B. This will establish the construct validity of the tool.

Criterion Validity

Criterion validity of an instrument is determined by comparing the results of an instrument under testing with results of “Gold Standard (GS)”, it refers to the measuring instrument that is being universally accepted or beyond doubt. Validity based on a GS is called Criterion Validity. This is very important aspect of any measuring instrument, because the instrument under testing will not be of any use unless its findings are comparable with GS. If there is no GS available, then criterion validity of an instrument is determined by applying the measuring tool on two groups of respondents who are known to differ and do not differ with respect to concept being measured and compare the finding between the groups.

Criterion-related validity is the general term that includes both the predictive and concurrent validity. Predictive validity is the ability of the instrument to predict an individual's behavior in the future. For example, a psychologist wants to assess the level of empathy of a candidate who wants to join nursing profession. Here, the psychologist wants to predict, based on the empathy assessment, whether the candidate who wants to join the nursing profession is suitable for this profession or not? In short, here the psychologist wants to correlate empathy with suitability. Concurrent validity is a measure of how well an instrument correlates with another instrument that is known to be valid. For example, if a researcher wants to assess the IQ level of an individual, and he is using two tools for the purpose, both the tools should be similar in assessing the IQ level of the individual.

Formative Validity

Formative validity when applied to outcomes assessment, it is used to assess how well a tool is able to provide information to help improve the program under study. In the above-mentioned example on assessment of knowledge regarding hepatitis B, if the tool can provide information that nurses are lacking skills in a specific area, for instance prevention of infection, in that case, tool will provide meaningful information that can be used to improve the course or program requirements.

It is rare, that an instrument be 100% valid. Validity is not an absolute quality. It is a continuous process, where a tool is valid to a certain degree in certain circumstances, and researchers must decide what degree of validity is considered sufficient. The above categories also suggest that there are types of validity that relate to the internal validity of the instrument. Each type of validity is distinct, meaning that the instrument can have one kind of validity but not another. Because of that, the instrument can never really be fully “validated”. It can only be validated for x patient population, under y conditions, and so forth.

The following are certain measures to enhance the validity of the tools:

- Make sure the goals and objectives of the study are clearly defined.
- Match the assessment tools to the goals and objectives of the study.
- Have the test reviewed by faculty/experts of the topic under study.
- Have the others (colleagues) just look over the tool for difficult wording or other difficulties.
- If possible, compare the tool with other similar tools if available.

ESTIMATING RELIABILITY

Reliability is also known as precision, reproducibility, consistency and repeatability. It is the ability of the tool to give similar measurement or reading under the similar condition on the same subject. A reliable instrument is one that gives consistent measurement or reading when it is applied more than once to the same subject under similar conditions, i.e., repeated measurements on the same individual under the similar condition produce similar findings.

Reliability is usually expressed as a number, called a coefficient. Reliability coefficient ranges between -1.00 to $+1.00$, with higher coefficients indicating higher levels of reliability. However, most of the instruments report reliability between 0.50 and 0.80.

The reliability of an instrument is not a permanent entity. This means that if a researcher has chosen a previously reliable tool, it is not mandatory that the tool will be reliable for the present study also. In this regard, Polit has said that “the reliability of an instrument is a property not of the instrument but rather of the instrument when administered to a certain sample under certain conditions”. So, the reliability of a tool should also be assessed again, even though it is previously standardized and is reliable.

There are several types of reliabilities that may be determined through various correlations. The three key aspects of reliability are: (1) Stability, (2) Internal consistency, and (3) Equivalence.

1. Stability (Test-Retest Reliability)

It is a measure of the instrument/tool to obtain similar results by administering the same test twice over a period of time to a group of individuals. The procedure used to assess the stability is the **test-retest reliability**. The scores from Time 1 and Time 2 can then be correlated statistically in order to evaluate the test for stability over time. If the results in both the occasions are same, the correlation coefficient will be about 0.90, and the tool will be said to have test-retest reliability. The time lag between the two tests should be about 1 week. If it is too short, the respondents may remember the responses. But if it is too long, some of the respondents may do better in the re-test because of their own learning and maturation during the interval. Kindly, refer to Chapter 16 of the book regarding calculation of correlation coefficient. The test-retest method is quite easy to establish the reliability. It can be used in self-report, observational, and physiological measures.

2. Internal Consistency

Internal consistency reliability or scale homogeneity is the extent to which all items of an instrument measure the same variable. This type of reliability is appropriate only when the instrument is examining one concept

or construct at a time. It is the most widely used approach to assess the reliability particularly in psychological instruments. The scales and tests that involve summing up of items are usually evaluated for their internal consistency, e.g., the scales measuring the attributes, attitudes, etc.

- **Split-half technique** also called odd-even reliability yields the coefficient of internal consistency. The process of obtaining split-half reliability is begun by “splitting in half” all items of a test that are intended to probe the same area of knowledge in order to form two “sets” of items. The entire test is administered to a group of individuals only once. Then the responses for each individual are divided into two comparable halves. All the responses to even items are to be in one half and all the responses to odd items in the other half. The response score for each individual is then computed separately for the two halves for the even half as well as for odd half. The two sets of scores are then correlated statistically to yield a correlation coefficient. If this is high, the tool is considered to have a good split-half reliability. This method is more effective for longer instruments.
- **Parallel-form reliability:** This method involves using two different versions (but equal) of assessment forms and comparing participants’ scores on both forms. The correlation between the scores on the two forms indicates the reliability. Both versions of the tool must contain items that explore the same construct, skill, knowledge base, etc. Develop two equivalent forms of a test and administer them to the same group of participants. After administering both forms, calculate the correlation coefficient between the scores on the two forms. The Pearson correlation coefficient is commonly used for this purpose.

3. Equivalence (Inter-Rater Reliability)

The equivalence approach is primarily used in observational measures. The most common method used to establish the reliability in equivalence approach is inter-rater/inter-observer reliability. **Inter-rater reliability** is a measure of reliability used to assess the degree to which different observers agree in their assessment decisions. A researcher uses an observation technique. Two or more observers independently observe the same activities/event. Each observer records his observation using the same recording format. No discussion or collaboration can occur when the activity is being observed. Reliability is determined by the correlation of the scores from two or more independent raters.

The strength of the agreement between the two sets of observations may be computed as a correlation.

It is useful because human observers will not necessarily interpret answers the same way; raters may disagree as to how well certain responses or material demonstrate knowledge of the construct or skill being assessed.

SENSITIVITY AND SPECIFICITY OF DIAGNOSTIC TOOLS

The words “sensitivity” and “specificity” are used in screening tests for diseases. When a single test is performed, the person may in fact have the disease or the person may be disease free. The test result may be positive, indicating the presence of disease, or the test result may be negative, indicating the absence of the disease.

Test result	Actual status			
		Disease positive	Disease negative	
	Test positive	TP	FP	PPV = $TP/(TP + FP)$
	Test negative	FN	TN	NPV = $TN/(TN + FN)$
		Sensitivity = $TP/(TP + FN)$		Specificity = $TN/(TN + FP)$

- **Sensitivity:** It is also known as the true positive rate. Sensitivity measures the ability of a diagnostic test/tool to correctly identify individuals with the disease. It is calculated as the ratio of true positives



Table 11.1 Use of validity and reliability in questionnaire/instrument/diagnostic tool/study

	Questionnaire	Instrument	Diagnostic test
Sensitivity	×	√	√
Specificity	×	√	√
PPV	×	×	√
NPV	×	×	√
Content validity	√	×	×
Face validity	√	×	×
Construct validity	√	×	×
Criterion validity	√	×	×
Formative validity	√	×	×
Predictive validity	√	×	×
Reliability	√	√	√
Test-retest reliability	√	√	√
Split-half reliability	√	×	×
Inter-rater reliability	×	√	√
Generalizability	×	×	×

to the sum of true positives and false negatives. A high sensitivity indicates a lower likelihood of false negatives, demonstrating the test's effectiveness in detecting the actual presence of the disease in those who have it.

- **Specificity:** Specificity, or the true negative rate, assesses a diagnostic test's ability to correctly identify individuals without the disease. It is calculated as the ratio of true negatives to the sum of true negatives and false positives. A high specificity implies a lower chance of false positives, showcasing the test's accuracy in excluding individuals who do not have the condition.
- **Positive predictive value (PPV):** PPV represents the percentage of patients with a positive test result who truly have the disease. It is calculated as the ratio of true positives to the sum of true positives and false positives.
- **Negative predictive value (NPV):** NPV signifies the percentage of patients with a negative test result who are genuinely free of the disease. It is calculated as the ratio of true negatives to the sum of true negatives and false negatives.

Overall, the types of validity and reliability in questionnaire/instrument/diagnostic tool are shown in Table 11.1.

VALIDITY AND RELIABILITY IN QUALITATIVE RESEARCH

Qualitative research methods primarily include observations and interviews wherein the researcher observes the behavior or write/record the verbatim of the respondents. These may be purely subjective because these are the researcher's opinion about someone or something, which is gathered while watching, listening or talking to someone.

In qualitative research, the term validity refers to the extent to which the research findings represent reality. Reliability in qualitative research is defined as the measure of the extent to which random variation may have influenced the stability and consistency of the results.

Validity and reliability in qualitative research can be demonstrated by a number of techniques including triangulation, use of contradictory evidence, respondent validation, and constant comparison.

Triangulation is using two or more methods, data sources, investigators, or approaches, etc. to study the same phenomenon and then validating the similarity among them. The main aim of triangulation is to overcome the personal biases of the researchers.

Contradictory evidence, often known as deviant cases do not fit within the conclusions of the study. These must be sought out, examined, and accounted for in the analysis to ensure that the biaseness of researcher does not interfere with or alter his/her perception of the data and any insights offered.

In **respondent validation**, the participants read the data and analyze. They provide feedback on the researchers' interpretations of their responses. It also provides researchers with a method of checking for inconsistencies and an opportunity to reanalyze their data. The use of constant comparison means that one piece of data (for example, an interview) is compared with previous data. It enables the researchers to treat the data as a whole rather than fragmenting it.

SUMMARY

- Validity and reliability are crucial factors in ensuring the quality of data collection instruments in research.
- Content validity assesses whether the instrument accurately covers the relevant aspects of the phenomenon under study and relies on expert judgment.
- Construct validity involves evaluating whether the instrument measures the theoretical construct the researcher intends to assess.
- Criterion validity compares the instrument's results with a universally accepted standard to determine its accuracy.
- Reliability, expressed as a coefficient, indicates the instrument's ability to provide consistent measurements or readings over time and under similar conditions. It includes stability, internal consistency, and equivalence as key aspects of assessment.
- Sensitivity measures a test's ability to correctly identify individuals with a disease, while specificity measures its ability to correctly identify those without the disease.
- In qualitative research, validity refers to the extent to which research findings represent reality, while reliability is the measure of how random variation may have influenced the stability and consistency of results. Techniques like triangulation, contradictory evidence analysis, respondent validation, and constant comparison are used to ensure validity and reliability in qualitative research.

ASSESS YOURSELF

Long Answer Questions

1. What are the characteristics of a data collection instrument?
2. Define validity. Discuss any two methods to establish validity of a tool.
3. Define reliability. Discuss any two methods to estimate the reliability of a tool.

Short Answer Questions

1. What is the significance of having an instrument valid as well as reliable?
2. Write a short note on sensitivity and specificity of a diagnostic tool.



Multiple Choice Questions

1. Which of the following is TRUE about face validity?
 - a. It measures theoretical construct
 - b. It uses test-retest method
 - c. It is a subtype of content validity
 - d. It is dependent on personality of the subjects
2. Which type of validity of any test/tool is determined by comparing it with a Gold Standard?
 - a. Content validity
 - b. Criterion validity
 - c. Concurrent validity
 - d. Construct validity
3. If a measure is based on a full and close examination of the underlying concept, along with the related theoretical approaches, then it is said to have high:
 - a. Content validity
 - b. Face validity
 - c. Convergent validity
 - d. Construct validity
4. The terms repeatability, precision, reproducibility, and consistency are used to indicate:
 - a. Validity
 - b. Sensitivity
 - c. Specificity
 - d. Reliability
5. Which of the following is linked with the inter-rater reliability?
 - a. Stability
 - b. Homogeneity
 - c. Equivalence
 - d. Validity
6. A Likert scale is best described as a list of:
 - a. Open-ended items (questions) with unlimited responses
 - b. Closed-ended items with a fixed number of alternative responses
 - c. Open and closed-ended items with variable responses
 - d. Closed-ended items with a dichotomous response
7. The degree with which all items on a scale measure the same variable is:
 - a. Validity
 - b. Equivalence
 - c. Homogeneity
 - d. Stability
8. Which of the following statements accurately describe test-retest reliability?
 - a. Measures of consistency of over time
 - b. Measures of consistency of scores obtained from two equivalent halves of the same test
 - c. Measures of consistency with which a test measures a single construct or concept
 - d. Measures of degree of agreement between two or more scorers
9. Which of the following is NOT true regarding the "sensitivity" of an instrument/tool?
 - a. It is the ability of an instrument/test/tool to identify a "case" correctly
 - b. It is the rate of an instrument of yielding "true positives"
 - c. It is the ability of an instrument to identify noncases correctly
 - d. It is a measure of how likely it is for a test to pick up the presence of a disease in a person who has it
10. Reliability is mostly a matter of _____, while validity is mostly about _____.
 - a. Consistency, accuracy
 - b. Accuracy, consistency
 - c. Similarity, dissimilarity
 - d. Similarity, consistency

Answer Key

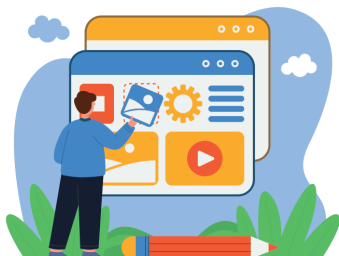
1. c	2. b	3. d	4. d	5. c	6. b	7. c
8. a	9. c	10. a				

BIBLIOGRAPHY

- Dempsey, PA, Dempsey AD. *Using Nursing Research: Process, Critical Evaluation, and Utilization*. 5th Edition, Philadelphia: Lippincott Williams and Wilkins; 2000.
- http://www.ncssm.edu/courses/math/Stat_Inst/Stats2007/Stat%20and%20Calc/Sensitivity%20and%20Specificity.pdf. Sensitivity and specificity. Accessed on 10 July 2015.
- <https://www.uni.edu/chfasoa/reliabilityandvalidity.htm>. [online] Available form Exploring reliability in academic assessment. [Accessed March 2016].
- Kimberlin CL, Winterstein AG. Validity and reliability of measurement instruments used in research. *Am J Health-Syst Pharm*. 2008;65:227-84.
- Nieswiadomy RM. *Foundations of Nursing Research*. 5th edition. New Delhi: Dorling Kindersley; 2008.
- Polit DF, Beck CT. *Nursing research: Principles and methods*. 7th edition. Philadelphia: Lippincott Williams & Wilkins; 2004.
- Roberts K, Taylor B. *Nursing Research Process: An Australian Perspective*. 7th edition. Singapore: Thompson, Nelson Australia Pty Limited; 2002.

Add Ons

Dil Mange More Content



See & Perceive

Watch and learn with the selective Important Topic-wise

Recent Update

Regular updates related to Recent advancements & Book Errata

e-Book

Get PDFs of important chapter/section (Annexures/Appendices) of book (optional and exclusive for Pro-users and Institutions)

Scan the QR Code to Download the App



Nursing NextLive
The Next Level of Nursing Education

CBS Phygital Books >

Nursing Research and Statistics PHYGITAL



Analysis and Interpretation of Data

LEARNING OBJECTIVES

After the completion of the chapter, the readers will be able to:

- Discuss the key terms used for data analysis.
- Discuss the processing of data for analysis.
- Appreciate the methods used to present the research findings.
- Discuss the importance of careful interpretation of findings.
- Discuss the findings of the research study.
- Relate the findings to the study hypothesis.
- Write the conclusion, limitations, implications and recommendations of the research study.

CHAPTER OUTLINE

• Introduction • Types of Data • Unit of Analysis • Levels of Measurements • Analyzing Quantitative Data • Use of Computers and Statistical Packages for Quantitative Data Analysis	• Analyzing Qualitative Data • Software Packages for Qualitative Research • Validity and Reliability of Qualitative Research • Presentation of Research Findings • Writing Conclusion, Limitations, Implications and Recommendations

KEY TERMS

Categorical data: Data that represents categories or labels rather than numerical values.

Conclusion: A summary of the main findings and outcomes of a study or research.

Continuous data: Data that can take on an infinite number of values within a given range.

Curvilinear relationship: A relationship between variables that does not follow a straight line but instead forms a curve or nonlinear pattern.

Contd...

Figures: Visual elements, such as graphs or charts, used to illustrate data and findings in a research report.

Frequency distribution: A table or graph that shows the frequency of each value in a dataset.

Histogram: A graphical representation of data that uses bars to display the frequency distribution of continuous data.

Implications: The potential consequences or effects of research findings on a broader context or application.

Line diagram: A graph that uses lines to show trends and relationships between data points.

Linear relationship: A relationship between variables that follows a straight line pattern.

Limitations: The constraints, boundaries, or weaknesses of a study that may impact the generalizability of its findings.

Measures of central tendency: Statistical values, such as mean, median, and mode, that represent the center or typical value of a dataset.

Measures of dispersion: Statistical values, like range or standard deviation, that indicate the spread or variability of data.

Nonparametric tests: Statistical tests used when specific data distribution assumptions are not met.

Normal distribution: A symmetrical probability distribution where data is evenly distributed around the mean.

Parametric tests: Statistical tests used when data meets normal distribution and certain variance assumptions.

Pie chart: A circular chart divided into sectors to represent proportions or percentages of a whole.

Scatter plots: Graphs that display individual data points to visualize the relationship between two variables. It is used to illustrate correlations between two variables.

Statistical significance: The likelihood that research findings are not due to chance but are representative of a true effect or relationship.

Table: A structured arrangement of data in rows and columns for easy reference and analysis.

Units of analysis: The specific entities or subjects being studied in research, such as individuals, groups.

INTRODUCTION

After the data collection phase, the research process enters an interesting new phase, where analysis, presentation, and interpretation of data take place. To ensure a successful and meaningful analysis, the raw data must be appropriately compiled, edited, and coded. The research findings can be presented through the adept use of text, tables, and figures. Accurate and objective data interpretation is of utmost importance to provide readers with a coherent and meaningful understanding of the findings. A well-crafted discussion of the findings includes the proper interpretation of data. In the concluding section of the write-up (article/thesis), conclusions, implications, and recommendations not only convey what has been newly discovered in a specific research study but also outline what needs to be addressed in future research within this particular area.

To grasp the process of data analysis, researchers are expected to be acquainted with key terms, such as types of data, units of analysis, and levels of measurements. In this chapter, these terminologies are discussed, along with an in-depth exploration of data analysis processes, various methods for presenting research findings, and the interpretation and discussion of research findings.

TYPES OF DATA

Data is the piece of information that has been collected from an experiment, a survey, etc. Understanding of the type of data to be analyzed is very important for its proper interpretation. A study can have both the quantitative as well as qualitative data. Those characteristics that can be measured in numbers are the



quantitative characteristics or the variables and the values of such characteristics are called the quantitative data, e.g., height, weight, marks scored in a test, etc. On the other hand, the characteristics of the unit which cannot be measured in numbers are called the qualitative characteristics or the attributes and the data representing such classification are called qualitative data, e.g., sex, religion, etc.

Quantitative data are further classified as categorical/discrete data and continuous data.

- **Categorical discrete data:** Categorical means something that is specific. It can assume a finite number only and has limited number of possible values. For example: members per family, population of a town, number of leaves on a tree, number of students in a class, number of times heads come up while tossing a coin, etc. These cannot be represented in decimals or fractions. For instance, the number of family members cannot be depicted as 2.33. It can be whole numbers 4, 6, 9, etc., but not fractions.

For some of the categorical data, numbers assigned to categories and the order of the categories are arbitrary. For example, when asking about marital status, there are a limited set of possible responses like married, unmarried, widow, etc., and categories can be ordered in the numerous ways. For other kinds of categorical data, numbers assigned to categories have inherent meaning and the order of the categories follows a logical progression in the values assigned to responses. A question where the responses range from 1 = “strongly agree” to 5 = “strongly disagree” is an example of this type of categorical data.

- **Continuous data:** A continuous data is one for which there are many possible values between any two possible values. It can take any infinite value in a range or interval. It does not take distinct value like discrete variable. There is a logical progression in the numerical values assigned to responses and the interval between values is meaningful.

For example: Age, height, weight, income, marks, etc. For instance, height can have values like 152.5 cm or 164.5 cm.

Note:

- Categorical data are counted but not measured.
- Continuous data are measured but not counted.

UNIT OF ANALYSIS

The unit of analysis is the major entity that the researcher is analyzing in his research study. It is the “what” or “who” that is being studied by the researchers. It can be an individual, a group, or a program. Some of the studies include more than one units of analysis. In that case, the researcher must look forward to the conclusions he or she wishes to make with regard to each unit of analysis. For example, if a researcher is examining what kinds of nursing students are most successful in nursing profession, but also wants to examine what kinds of nursing colleges (govt. or privates) produce the students most successful in their professions carrier; he or she is working with two separate units of analysis, i.e., individuals (nursing students) and the organizations (nursing colleges).

The units of analysis must be chosen at the time of conceptualization stage of research and after the formulation of the research objectives and must be done before choosing the research instruments. Common Units of Analysis include individuals (students, residents, workers, voters, parents, faculty, patients, etc.); groups (children, adult, elderly, male, female); social organizations (colleges, academic departments, supermarkets, etc.), social artifacts (books, newspapers, paintings, poems, automobiles, pottery, jokes, buildings, songs, photos, etc.) and social interactions (court cases, traffic accidents, fistfights, friendship choices, divorces, race riots, final exams, etc.).

Individual human beings are perhaps the most commonly used units of analysis in nursing research.

LEVELS OF MEASUREMENTS

The classification of levels of measurements describes the nature of information within the numbers assigned to variables. In any study, an investigator makes some measurements to depict properties/characteristic/attributes of an object on some scale. For example, an individual having certain educational level, income and occupation is mapped on some scale of socioeconomic status, like low, middle or upper class according to some rule of correspondence. In case of measurement of continuous variable like income on a 5-point scale. The rule of correspondence may be to assign 1 to “high income”; 2 to “moderate income”; 3 to “average income”; 4 to “moderate low income” and 5 to “low income”.

It is important for the investigator to understand the different levels of measurement. These play an important role in determining the statistical tests that are carried out on data. These also help the researcher to decide how to interpret the data from that variable. For example, if a measure is nominal, then we know that we would never average the data values or do a t-test on the data.

In ascending order of level of measurement, there are four scales of measurement namely nominal scale, ordinal scale, interval scale and ratio scale (Fig. 12.1). These can be remembered by the acronym “NOIR” going from weakest to the most robust.

Nominal Scale

- The nominal scale is the weakest form of measurement.
- It categorizes observations based on characteristics without any inherent order or ranking.
- Examples include gender (male or female) and religion (Hindu, Muslim, Sikh).
- Numbers can be assigned to categorize for data entry, but these numbers are arbitrary.

Ordinal Scale

- The ordinal scale categorizes observations based on characteristics and allows ranking in ascending or descending order. However, it does not indicate how much more or less one category is compared to another.
- For example, socioeconomic status categories like “upper middle class” and “middle class” can be ranked, but the degree of difference is not known.

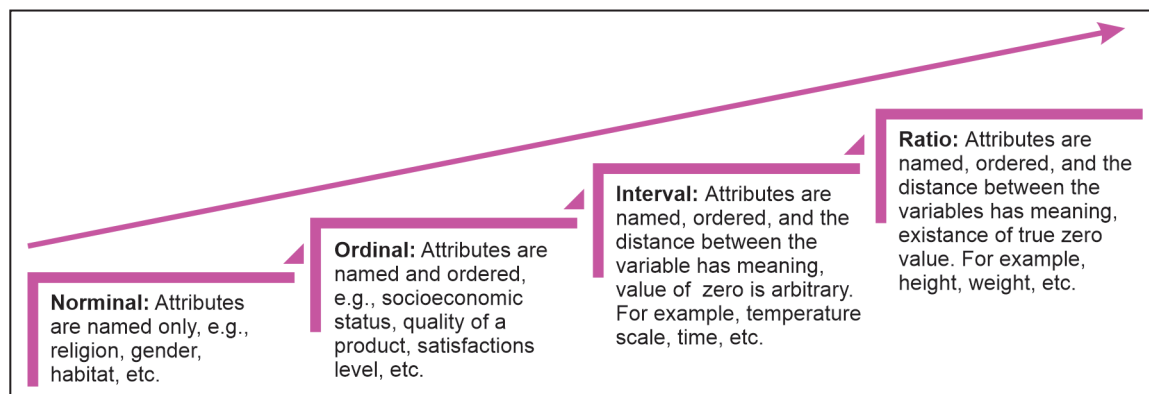


Figure 12.1: Levels of measurements with examples

Interval Scale

- The interval scale of measurement is a type of scale that measures continuous variables using fixed, equal intervals.
- Values on an interval scale have a consistent order, uniform intervals, and support meaningful arithmetic operations like addition and subtraction. However, it lacks a true zero point, which means that ratios between values are not meaningful.
- Example:** Temperature measurement in degree Celsius is an example of data on an interval scale.
 - If 20°C is recorded one day and 40°C is recorded the next day, it can be correctly stated that the second day is 20°C hotter than the first day. However, it cannot be said that it is “twice as hot” on the second day as it was on the first day because there is no true zero point (reference point) in the Celsius scale.

Ratio Scale

- It is the ultimate, the highest level and most informative measurement scale. It is an interval scale with absolute zero. It tells the exact value between the units. With a ratio scale, one can compare both differences in scores and the relative magnitude of scores.
 - For example, the difference between 10 and 20 kg weight is the same as that between 20 and 30 kg and 20 kg is twice as much as 10 kg.
 - Ratio scale has all mathematical properties of the number system. Even multiplication and divisions can be done. One can apply an extensive range of both the descriptive as well as inferential statistics. Example: height, weight, lengths and times are the other examples of ratio scale.
- The strength of all the measurement scales is compared as given in Table 12.1.

Table 12.1 Measurement scales and their strength

Measurement scale	Nominal	Ordinal	Interval	Ratio
Frequency distribution	Yes	Yes	Yes	Yes
Median and percentiles	No	Yes	Yes	Yes
Add or subtract	No	No	Yes	Yes
Mean, SD, standard error of the mean	No	No	Yes	Yes
Ratio, or coefficient of variation	No	No	No	Yes

The summary of comparison of scales of measurement with examples has been given in Table 12.2.

Table 12.2 Summary of comparison of scales of measurement with examples

Scale type	Description	Examples of variables
Nominal scale	Weakest level, no inherent order, arbitrary numbers	Gender, religion, marital status
Ordinal scale	Relative ranking, no specific differences	Socioeconomic status, educational level, pain
Interval scale	Uniform intervals, no true zero point, supports math ops	Temperature (Celsius or Fahrenheit), IQ score, pH
Ratio scale	Absolute zero point , supports differences and ratios	Weight (kg), height (cm), income (rupees/dollars)

ANALYZING QUANTITATIVE DATA

Quantitative data analysis is the process of using statistical methods to describe, summarize, and compare the data. It provides quantifiable and easy to understand results.

Analyzing quantitative data is a systematic process that involves transforming raw numerical information into meaningful insights. It follows a structured approach consisting of four key steps: (1) Preparation of data, (2) Description, (3) Inference, and (4) Interpretation. These steps guide researchers in making sense of data, drawing conclusions, and sharing their findings effectively.

Step 1: Preparation of Data for Analysis

The preparation of data involves organizing the data for analysis. It includes compiling, editing, and coding the raw data. The extent of processing the data for analysis depends on the type of study. The steps of preparation of quantitative data for analysis are depicted in Figure 12.2.

1. **Compiling the data:** Compiling means putting together or composing the collected data. It includes arranging all the collected data in a sequence; an orderly and organized manner so that the further steps of data analysis process can be taken.
2. **Editing the data:** It is important to monitor the data for quality and comprehensiveness. Each piece of data should be checked for accuracy and completeness. Information gathered during data collection may lack uniformity. Some of the questions may be left unanswered by the subjects. Sometimes information may be given in a form which needs reconstruction into some different category, e.g., converting family income into per capita income, etc. In fact, it should be checked during the process of data collection, so that if possible, the researcher can complete it side by side.
3. **Coding the data:** Coding is translating answers into numerical values or assigning numbers to the various categories of a variable that can be entered into the database in a form in which they can be analyzed easily. For example, in a question on marital status of the subjects, the alternative choices given may be: married, unmarried, divorced, and separated. The alphabetical codes assigned to these alternatives could be a, b, c, and d. Similarly, numerical codes to these alternatives could be 1, 2, 3, and 4, respectively. The alternatives must be mutually exclusive, i.e., defined in one concept or term only. A master coding sheet may be prepared by the researcher (Box 12.1).

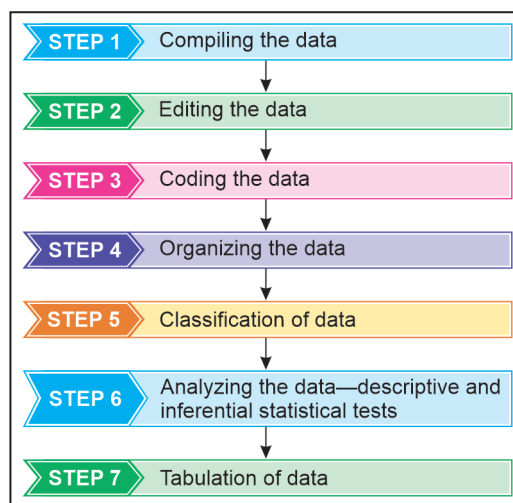


Figure 12.2: Steps of processing the data for analysis

Coding of all the forms should be done on daily basis in order to manage the work. Codes can even be assigned after a data collection tool is finalized. There could be some open-ended questions also. All the answers to open-ended questions are placed in various categories and each category is assigned a code. These require a lot of work on the part of researcher as far as the process of coding of open-ended questions is concerned.



BOX 12.1 Sample of master coding sheet

Q 1: Participant code: 1

Q 2: Age: 56 years

Q 3: Gender:

1 = Male; 2 = Female

Q 4: Professional Qualification:

1 = MSc Nursing; 2 = BSc Nursing; 3 = GNM

—

—

—

—

—

Q 10: Have you ever attended any conference/workshop on stroke?

1 = No; 2 = Yes

Q 11: How satisfied were you with the knowledge gained from the conference?

1 = Very dissatisfied; 2 = Dissatisfied; 3 = Satisfied; 4 = Very satisfied; 99 = Not applicable

4. **Organizing the data:** Organizing the data is a very important segment of preparing the data for analysis. Let us discuss it in detail:

- **Selecting a software package:** Except in small studies, the researchers always make use of computer for the analysis of data. Data can be analyzed using various softwares like SPSS, Epi Info, etc. MS Excel is often used to organize the data before it is exported to statistical package for analysis due to its user friendliness and easy availability of software.
- **Entering the data:** The data can be entered directly from the questionnaires. It depends on the length of the questionnaire as well as the expertise of the researchers. Sometimes, some of the researchers first enter the data into coding sheets and then into the selected software. It is always good to have two persons entering the data to prevent errors and mistakes. MS Excel is often used to enter the data. If the data is collected through online forms, there is no need to manually enter the data, the data is captured in worksheets.
- **Data cleaning and managing the missing value:** After completing whole of data entry, the researcher must take out the print of that file. Checking the data for errors is commonly called cleaning. The entered data should be checked randomly for any wrong entry. If the data file is small, each datum on the print out can be cross-checked with the original one for precision. The missing value in the data is a problem that every researcher will have to deal with, at some time. This occurs where due to some reasons; the data are missing for certain variables. For example, a respondent may not have given an answer for a question. If a whole section of data is consistently missing, then it may not be possible to enter that particular section of any of the subject. Some data analysis programs have a mechanism for handling missing values, giving them a code or not using that case in the data analysis. If the variable is numerical, it is important not to put zero for a missing value, as this will lower the value of the mean. The researcher can either leave it or put in the median value for that particular variable. If extensive data is missing, that subject should be completely excluded from the study.

5. **Classification of data:** The raw data needs to be grouped for similar details of individual responses. The classification of the data implies that the collected raw data is categorized into common groups having common features. So, the process of organizing data into groups and classes on the basis of certain characteristics is known as the classification of data. Classification helps in making comparisons among the categories of observations.

- It can be either according to numerical characteristics or according to attributes. The numerical characteristics are classified on the basis of class intervals. The numerical feature of data can be measured quantitatively and analyzed with the help of some statistical unit like the data relating to income, age, weight, etc. For example, age up to 20 years may form a group and the number of respondents reporting age in this range may form its frequency. Similarly, further group can also be made like age group 20 to 30 and so on. The number of items entered against each class is known as the frequency of the class. Every class has a lower and an upper limit. The difference between the upper and lower limits is known as the range of the class.
 - As per attributes, the data is classified on the basis of common characteristics that can be descriptive like literacy, sex, honesty, marital status, etc. The classification of data can easily be done by using the statistical packages.
6. **Analyzing the data:** Now, the data is ready for analysis. First the descriptive statistics is employed to obtain the frequencies of descriptive variables. This helps the researcher to become familiar with the nature of data obtained on various variables of the study. This is followed by application of inferential statistics to test the hypothesis, research questions or objectives.
Details regarding various types of tests used in descriptive and inferential statistics are discussed in Chapter 15–17 of the book.
7. **Tabulation of data:** After editing and organizing the data, once it is ensured that the information is complete and accurate and categorized in an appropriate form, the data are put together in some kinds of tables. It also undergoes various other forms of statistical analysis. Tabulation is an orderly arrangement of data in rows and columns. It conserves space. It facilitates process of comparison and summarization. It also facilitates detection of errors and omissions and establishes the basis of various statistical computations.
Rest of the details regarding tabulation of data has been discussed under Presentation of Research Findings in the following text.

Step 2: Description of Data (Descriptive Statistics)

Descriptive statistics is a fundamental component of the data analysis process, providing a comprehensive summary of the main characteristics of a dataset. This step is crucial in quantitative research as it helps researchers make sense of the data, identify patterns, and communicate their findings effectively.

Descriptive statistics primarily involves frequency distribution, measures of central tendency, measures of variability, and data visualization.

- **Frequency distribution:** It is the frequency of occurrence of a score or value in a given set of data. The scores may be systematically arranged from highest to lowest or lowest to highest. Frequencies can be used for categorical or continuous data. Frequency distribution of 50 patients from age 21 to 25 is shown in Table 12.3.

Table 12.3 Frequency distribution of patients' age

Age (years)	Frequency (f)	Percentage (%)
21	5	10
22	15	30
23	20	40
24	5	10
25	5	10
	$N = 50 = \sum f$	$\Sigma\% = 100$

It is recommended to show the percentage also along with each frequency score. Percentage is the given number of units divided by the total number of units and multiplied by 100. There is no need to calculate the percentages very precisely. For example, if the calculated percentage is 5.46, it can be expressed as 5.5%. However, the total number of subjects on which the distribution is based should always be given in the table.

For quick communication, the frequency data can also be shown in graphs like **histogram and frequency polygons** as discussed later in this chapter.

- **Measures of central tendency:** Measures of central tendency are a fundamental component of statistics. These measures describe the central point of distribution. The three main measures of central tendency are (1) **Mean**, (2) **Median**, and (3) **Mode**. Each measure provides a slightly different view of the distribution of the data for a sample.
 1. **Mean ($\bar{X}$)** is the most common measure of central tendency. It is the sum of all the values in a group, divided by the number of values in that group. The result is referred to as the mean or, more commonly, the average. It is the most useful measure of central tendency. It is most appropriate for interval and ratio data. In Table 12.3, the mean age of the patients is 23 ($21 + 22 + 23 + 24 + 25 = 115/5 = 23$).
 2. **Median** is the midpoint in a dataset. It divides the distribution exactly in half with 50% of the cases above and below the distribution. It is appropriate for ordinal data.
 3. **Mode** is the most general measure of central tendency, but it still plays an important role in understanding the characteristics of the data. It is defined as the most frequently occurring value in a dataset. It is appropriate for nominal data.
- **Measures of dispersion or variability:** It is not possible to fully interpret measures of central tendency without knowing the variance or degree to which scores vary from the measure of central tendency. The measures of dispersion describe the spread of the values in a dataset from the mean. The commonly used measures of dispersion are range and standard deviation (for detail, refer to Chapter 15).
 - **Range** is a number that reflects the spread of the scores. It is calculated by subtracting the highest score from the lowest score in a distribution. It is generally used in combination with other measures of dispersion. In Table 12.3, the range of the patients' age is 4 ($25-21$).
 - **Standard deviation (SD)** is used to assess the average spread of values around the mean. A small standard deviation indicates that most values are very close to the mean, whereas a large SD indicates that many values are far from the mean. A large SD indicates that the data is dispersed or spread out. Standard deviation is the most widely used measure of dispersion with interval and ratio level data.

The formulas and calculation methods of descriptive statistics are detailed in **Chapter 15**.

- **Normal distribution:** A graph of a **normal distribution** looks like a bell, with one "hump" in the middle, centered around the population mean, and the number of cases tapering off on both sides of the mean. The spread of a normal distribution is controlled by the standard deviation. Smaller the standard deviation the more concentrated the data. The mean, median and the mode are the same in a normal distribution. In a normal distribution, 68% of the observations fall within **1 standard deviation** of the **mean**, 95% of the observations fall within **2 standard deviations** of the **mean** and 99.7% of the observations fall within **3 standard deviations** of the **mean** (Fig. 12.3) (refer to Chapter 16 for further details).
- **Measures of relationship (correlation coefficient):** Correlation coefficient is used to assess the degree and direction of the relationship between two or more variables in a dataset. The correlation coefficient quantifies how variables are related to each other. Correlation ranges from -1 (perfect negative correlation) to 1 (perfect positive correlation), with 0 indicating no linear correlation (Details in Chapter 16).

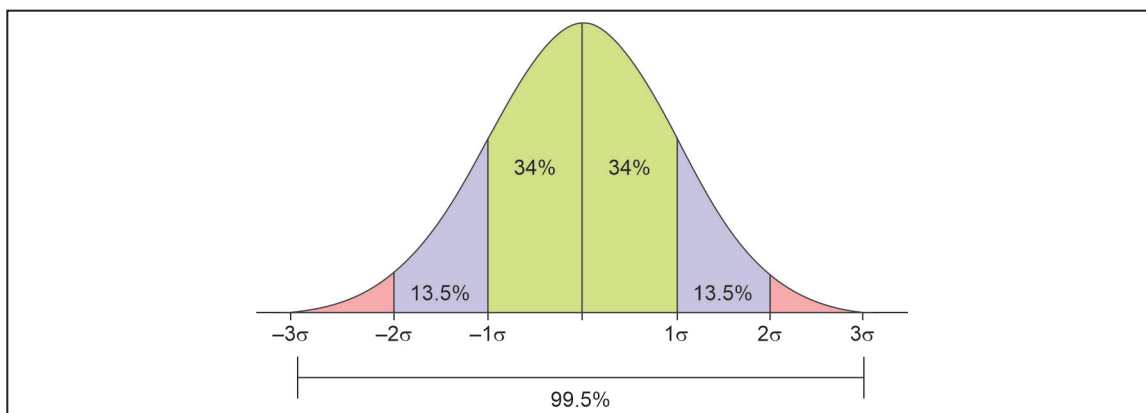


Figure 12.3: Normal distribution

Step 3: Drawing Inferences from Data (Application of Inferential Statistics)

After summarizing the data, the inferential statistics tests the significant differences between the groups and/or significant relationship between the variables. Inferential statistics methods use the samples to make generalizations about the populations from which the samples were drawn.

In research studies, it is often impractical or impossible to collect data from the entire population. Instead, researchers work with a sample, which is a subset of the population. Inferential statistics is used to make inferences about the population based on the sample. Hypothesis testing is a fundamental concept in inferential statistics. Researchers formulate null and alternative hypotheses to test whether there is a significant effect or difference in the population. Inferential statistical tests, such as t-test, chi-square tests, are used to test these hypotheses.

Inferential statistics involves estimating population parameters (e.g., population mean or proportion) based on sample statistics (e.g., sample mean or proportion). Confidence intervals are commonly used to provide a range of values within which the population parameter is likely to fall.

Concept of Inferential Statistics

Understanding the following key concepts of inferential statistics is crucial for researchers and analysts.

Hypothesis

In order to test for statistical significance, it is crucial to define the relationship between the variables being studied. This is typically done through a hypothesis, which states the expected difference between scores on a variable, whether it is between groups or within groups.

- **Null hypothesis (H_0):** This is the hypothesis of “no difference”. It suggests that there is no significant difference between the variables. For instance, it might state that administering oral rehydration solution will have no impact on the natremic status of postoperative traumatic brain injury patients.
- **Alternate hypothesis (H_1):** The alternate hypothesis states the expected relationship between the variables. In the above given example, it might state that administering oral rehydration solution will have a significant impact on the natremic status of the patients in the intervention group.



Level of Significance

After the establishment of hypotheses, the level of significance is determined. This level serves as the criterion for the acceptance or rejection of the null hypothesis and is usually expressed as a percentage.

- **Common levels:** The most commonly used levels are 0.05 (5%) and 0.01 (1%), but the standard is 0.05.
- **Interpretation of the result:** If the findings of the study reveal a statistically significant difference ($p < 0.05$), the null hypothesis is rejected. If there is no statistically significant difference ($p > 0.05$), it is not rejected.
- **Understanding probability:** At a 0.05 level of significance, it means that the findings could be expected by random chance in five out of a hundred cases, or in other words, there is a 5% chance of obtaining these results by chance alone.

Note: To avoid ambiguity and ensure clarity in the context of hypothesis testing, it is better to use the phrasing “null hypothesis is not rejected” rather than “null hypothesis is accepted.” Using “not rejected” accurately conveys that the null hypothesis has not been disproven based on the available evidence. This is the recommended and standard practice in statistical and scientific writing.

Errors in Statistical Testing

In the process of determining the statistical significance of study results, two types of errors can occur: (1) “Type I error” and (2) “Type II error” (Table 12.4).

1. **Type I Error:** Type I error occurs when the null hypothesis is wrongly rejected, even though it is actually true. In this case, one incorrectly concludes that there is a significant difference between the groups. Type I error is similar to a false-positive test result. It is particularly significant in medical research, where it can lead to the incorrect diagnosis of a condition that is not actually present. The probability of committing a Type I error (known as p value) is denoted as “alpha” and is represented by the symbol “ α ”.
2. **Type II Error:** Type II error involves not rejecting the null hypothesis when it is actually false. In other words, accepting a hypothesis which is false in reality. Here, the researcher mistakenly concludes that there is no significant difference between the groups when there actually is. Type II error is similar to a false negative in which a condition or effect is erroneously deemed absent. The probability of committing a Type II error is denoted as “beta” and is represented by the symbol “ β ”.

Confidence Interval

A confidence interval (CI) is a statistical concept used in inferential statistics to estimate a range of values within which a population parameter is likely to fall. It provides a level of confidence regarding the precision of this estimate. In other words, a confidence interval is a range of values, computed from sample data, that is likely to contain the true value of a population parameter, such as a population mean or proportion.

Table 12.4 Type I and II errors

	Reject H_0	Not Reject H_0
H_0 True	Type I error	Correct decision
H_0 False	Correct decision	Type II error

Table 12.5 Comparison of mean weight of male and female patients with diabetes (N = 60)

Variable	Male (N = 30)	Female (N = 30)	Mean difference	95% Confidence interval		t value	p value
	Mean (SD)	Mean (SD)		Lower	Higher		
Weight in kg	69.3 (7.77)	58.6 (8.78)	10.6	2.31	5.99	4.58	<0.001

In many statistical analyses, a point estimate of a population parameter, such as the sample mean, is calculated. This point estimate offers a single value that represents the best estimate for the true population parameter based on the sample data. However, data can exhibit variability, and different samples taken from the same population may yield different point estimates. This variability is taken into account when constructing confidence intervals.

A confidence interval is constructed by defining a range of values around the point estimate. This range is determined based on the sample data and the desired level of confidence. The level of confidence, often represented as a percentage (e.g., a 95% confidence interval), signifies the degree of confidence in the likelihood that the true population parameter falls within the calculated interval. For instance, a 95% confidence interval means that, if the process of taking multiple samples and constructing intervals were repeated, approximately 95% of those intervals would contain the true population parameter.

Table 12.5 depicts the comparison of mean weight of male and female patients using independent t-test. The 95% confidence interval presented in the Table 12.5 is a crucial component of the statistical analysis. It provides a range within which the true population mean weight difference between male and female patients is likely to fall.

Interpretation: In Table 12.5, the 95% confidence interval for the mean weight difference is (2.31, 5.99). This means that we are 95% confident that the true mean weight difference between male and female patients with diabetes falls within this interval.

The estimation of Confidence Interval is detailed in Chapter 17.

Degrees of Freedom

Degrees of freedom are the number of values in a study that are free to vary. In a statistical calculation, they represent how many values involved in a calculation have the freedom to vary. They are dependent upon the sample size, or observations, and the parameters to be estimated. They are the number of observations minus the number of parameters. This means there are more degrees of freedom (df) with a larger sample size. The degrees of freedom can be calculated to help ensure the statistical validity of various tests like chi-square tests, t-tests and F-tests with each having different formula to calculate it.

These are discussed along with the description of each statistical test in Chapter 17.

Tests of Significance

Tests of significance are a fundamental component of statistical analysis used to determine the significance of observed differences or relationships in data. These tests are categorized into two main groups: (1) Parametric tests, and (2) Nonparametric tests. Parametric tests are employed when data meet specific assumptions, such as normal distribution and equal variances. They tend to be more powerful in detecting true effects under these conditions. Nonparametric tests come into play when these assumptions are not met, making them suitable for non-normally distributed or unequal data. Table 12.6 provides a reference for selecting the suitable parametric and nonparametric statistical tests based on the type and distribution of the data.

Table 12.6 Applicability of parametric and nonparametric tests based on type and distribution of data

Attribute	Types of data	Distribution	Number of groups	Statistical test
≥2 independent groups or unpaired groups	Quantitative	Parametric	2 groups	Unpaired “t” test
			>2 groups	One-way ANOVA
		Nonparametric	2 groups	Mann-Whitney
			>2 groups	Kruskal-Wallis
	Qualitative (Categorical) >2 groups Chi Square	2 groups	Chi-Square, Fisher’s exact	
Paired Groups (e.g., Before and After)	Quantitative	Parametric	2 groups	Paired “t” test
			>2 groups	Repeated measures ANOVA
		Nonparametric	2 groups	Mann-Wilcoxon
			>2 groups	Friedman’s test
	Qualitative (Categorical)	2 groups	McNemar’s test	
		>2 groups	Cochran’s Q test	
Looking for relationship/ association between two variables	Quantitative	Both variables are parametric	Pearson’s correlation coefficient 0 = No correlation, +ve = Direct correlation, -ve = Negative correlation	
		Both variables are nonparametric	Spearman’s rank correlation coefficient, Kendall’s test	
	Qualitative (Categorical)	2 × 2 data	Risk ratio	
		Otherwise	Chi-square for trend, logistic regression	

The commonly used parametric and nonparametric tests are discussed in detail in **chapter 16**.

Parametric Tests

Parametric tests are used when specific assumptions about the distribution of data are met. These assumptions typically include the data being normally distributed and having homogeneity of variances. Parametric tests are generally more powerful when their assumptions are met, meaning they are more likely to detect true effects. However, they may yield unreliable results when applied to non-normally distributed data or data with unequal variances. Examples: Unpaired t-test, paired t-test, ANOVA.

Parametric analysis is preferred approach only if the following data assumptions are fulfilled or met.

- Variable of interest has normal or Gaussian distribution. Various measures to test normal or Gaussian distribution are statistical tests like Kolmogorov Smirnov test, Shapiro Wilk test and graphical plots like histograms and quantile-quantile (Q-Q) plot.
- Variance of outcome variable between two study groups is homogeneous. A rule of thumb is that standard deviation (square root of variance) of an outcome in one group should not exceed standard deviation of other groups by a factor of >3.
- A minimum sample size of each group should be 30 before parametric test can be applied.

In addition to aforementioned generic assumptions, each parametric statistical test may entail specific assumptions, which must be met for reliable and valid statistical result.

One must resort to nonparametric testing if there is serious departure from above-mentioned assumptions. However, most parametric tests are quite robust to mild to moderate violations of assumptions provided there is adequate sample size in each study group.

The commonly used parametric tests with application and example have been given in Table 12.7.

Advantages

- Parametric tests are generally more powerful when their assumptions are met, meaning they are better at detecting true effects or differences in the data.
- They often provide more precise estimates of population parameters, such as means and variances.
- Parametric tests are well-established and widely used in scientific research.
- In cases where data meets the assumptions, parametric tests require smaller sample sizes to achieve the same level of statistical power compared to nonparametric tests.

Disadvantages

- When assumptions for parametric tests are violated, results can be unreliable.
- They are not suitable for non-normally distributed data, ordinal or nominal data, or data with unequal variances.
- Parametric tests may yield misleading results when applied to non-normally distributed data, potentially leading to Type I or Type II errors.

Nonparametric Tests

Nonparametric tests are used when the assumptions for parametric tests are not met. They are distribution-free and are often applied to ordinal or nominal data. While nonparametric tests are less powerful than parametric tests in detecting effects, they are valuable in situations where the data does not meet the parametric assumptions. They are often used when dealing with real-world data that may not conform to idealized assumptions. Nonparametric tests can provide reliable results under these conditions.

Examples: Chi-square test, Mann-Whitney U test, Kruskal-Wallis test.

The commonly used nonparametric tests with application and example have been given in Table 12.7.

Advantages

- Nonparametric tests are distribution-free and do not rely on assumptions about the data's distribution.
- They are suitable for real-world data that often deviates from assumptions.
- Nonparametric tests can be used for ordinal, nominal, and non-normally distributed data, as well as data with unequal variances.
- Nonparametric tests are often easier to understand and apply, especially for those with limited statistical expertise.

Disadvantages

- Nonparametric tests are generally less powerful than parametric tests when both sets of assumptions are met. This means they may be less effective at detecting real effects.
- Nonparametric tests may provide less precise estimates of population parameters compared to parametric tests.
- In some research fields, nonparametric tests are less commonly used, which can make it more challenging to find appropriate guidance or references for analysis.

Table 12.7 Commonly used parametric and nonparametric tests with application and example

Tests of significance	Application	Example
Parametric tests		
Independent samples T-test	Comparing means of two independent groups.	Compare the mean weight (in kg) of male and female patients.
Paired samples T-test	Comparing means of two measurements (of the same variable) taken from the same group (before and after).	Compare the mean weight of a group of patients before and after an exercise regimen.
One-sample T-test	Determining if a sample mean differs from a known population mean.	Test whether the average test scores of a class differ from the national average.
Z-test	Comparing a sample mean to a known population mean when the population standard deviation is known.	Compare the average income of employees in a company to the national average income.
One-way ANOVA	Comparing means of more than two independent groups.	Compare the average test scores of students in multiple schools.
Two-way ANOVA	Comparing means when there are two independent variables.	Investigate the effect of both gender and age on exam scores.
Repeated measures ANOVA	Comparing means of three or more related groups (pretest, post-test 1, and post-test 2).	Evaluate the effect of a training program by comparing knowledge scores before and after 1 month or 3 months of training sessions.
Linear regression	Analyzing the relationship between a dependent variable and one or more independent variables.	Examine the relationship between the number of hours studied and exam scores.
Nonparametric tests		
Mann-Whitney U test/ Wilcoxon rank-sum test	Nonparametric alternative to the independent samples T-test when normality is not met.	Compare the median income of two groups of employees when income data is not normally distributed.
Wilcoxon signed-rank test	Nonparametric alternative to the paired samples T-test.	Evaluate the effect of an exercise therapy on weight by comparing weights before and after the exercise therapy in the same group.
Kruskal-Wallis test	Nonparametric alternative to one-way ANOVA.	Compare the exam scores of students from multiple schools when the scores are not normally distributed.
Friedman's test	Nonparametric alternative to repeated measures ANOVA for comparing three or more related groups.	Evaluate the effect of a training program by comparing knowledge scores before and after 1 month or 3 months of training sessions when the knowledge score is not normally distributed.
Spearman's rank-order correlation	Nonparametric alternative to Pearson's correlation, suitable for ordinal or non-normally distributed data.	Evaluate the relationship between the rank of employees based on seniority and their performance rankings.

Contd...

Tests of significance	Application	Example
Chi-square test	Testing association between two unrelated categorical variables.	Assess the association between gender and smoking status.
McNemar's test	Assessing changes or differences in categorical data in paired observations (related group).	Analyze changes in smoking habits before and after a smoking cessation program.
Fisher's exact test	Assessing the association between two categorical variables in small samples.	Investigate the relationship between education level and job status in a small sample size.

Step 4: Writing Interpretation of Data and Discussion

Once the data is analyzed using descriptive and inferential statistics, the crucial step of interpretation and discussion comes into play. This stage is where the researcher transforms the numerical or textual findings into a coherent narrative, providing context, insight, and relevance to the research.

Inferences drawn from data analysis form the basis for discussion. Researchers rely on these inferences to make statements about the population, relationships between variables, and the broader implications of their findings. Interpretation is the process of making sense of the data. It is about connecting the dots between numbers and information to answer research questions or test hypotheses. Researchers use interpretation to evaluate their hypotheses. They determine whether the data supports or contradicts their initial assumptions. This validation is fundamental for drawing reliable conclusions. Interpretation helps uncover patterns, trends, and relationships within the data.

Interpreting the Findings

Interpretation of data is a crucial step following data analysis. It involves assigning meaning and making sense of the data. Accurate interpretation is essential for a comprehensive understanding of study results. The following considerations are important during the interpretation process:

- **Data accuracy:** Before initiating the interpretation, researchers must have confidence in the accuracy of data entry and analysis. The validity of research findings relies on the precision of these processes.
- **Alignment with research objectives:** Findings should be logically analyzed and presented in the context of the study's specific research questions and objectives. Interpretation should directly address how the data relates to the research objectives.
- **Start with descriptive interpretation:** It is advisable to begin by interpreting the descriptive research findings. This step provides a demographic and information profile of the sample, offering insights into the study's context. Important demographic and information profiles can also be compared to previous research findings.
- **Distinguish common and unique features:** It is important to separate common features from unique or special aspects of the study. Identifying what sets the research apart is crucial for a nuanced interpretation.
- **Organize information:** All facts and findings should be presented in an organized manner, step by step. A structured presentation aids in clarity and comprehension.

- **Summary of results:** Researchers offer a concise summary of the key findings. The emphasis is on the most pertinent and substantial results.
- **Consider data presentation:** Interpretation varies depending on how the data is presented. Interpreting a table is different from interpreting diagrams, graphs, or maps. The interpretation method should align with the format of data representation.

Writing the Discussion

The discussion section of a research study is one of the most difficult tasks, especially for the beginners. It usually requires several writing attempts. It is considered the heart of the study. It should be written in such a way so as to facilitate the readers understand the results of the study. Though discussion is written at the end of the study after analyzing the data, the researcher should be thinking about what will be written in this chapter from the beginning of the study.

Before start writing, the researcher should develop an outline to organize the thoughts in a logical form as per the various aspects of the study. Discussion should begin with a paragraph regarding general and precise information about the study followed by another paragraph showing the main results of the study and then subsequently the interpretation of results of other aspects of the study. The studies which have already been cited in the Chapter on Literature Review can be used here to discuss the findings of the current study.

The researcher should explain the meaning and the significance of the findings. Then relate the current study findings to those of other studies. The findings of other studies may or may not support the current findings. In case of supporting, it will strengthen the importance of the study results. It is also important to point out how the findings of the present study differ from other similar studies. Carefully consider all the possible explanations for the study results. In both the cases whether the study findings are in agreement or not in agreement with the results of the previous research, these should be discussed properly (Box 12.2).

While discussing the findings in the light of other studies, it is very important not to criticize the findings of other studies. One should not use the discussion section to inflate the interpretation of the results. The researcher should remain focused on his/her data only. Care must be taken to provide explanation and interpretation of the results. Do not repeat results here.

Some researchers think that only the significant results that are in agreement with the study predictions should be shown in the results or discussion sections. But it should not be so. Whether the results are positive or negative, all should be shown and reported and discussed properly in the light of the previous research studies.

BOX 12.2 Discussion of the findings that is contrary to the previous evidences/finding

"A study was carried out to estimate the '**Point prevalence of bed sore among the admitted patients in a tertiary care hospital**'. Patients in critical care units have been reported to have an increased risk of pressure ulcers. High prevalence (41%) and incidence (33%) have been reported from other countries. However, in the present study, none of the patients was found to be having bed sore from intensive care units. This may be because of the fact that, all the patients admitted in intensive care units are provided with alternating air mattresses and are repositioned after every 2 hours. The nurse-patient ratio is also better (1:1 or 1:2). All other basic nursing care principles like care of bowel, bladder, beddings, skin care, etc., are followed meticulously in these units."

BOX 12.3 General guidelines for writing discussion

- **Organized approach:** Start the discussion by moving from specific findings to the broader, general implications. This organized structure enhances the coherence of the discussion.
- **Clarity and precision:** Use clear and precise language when interpreting and discussing the results.
- **Relevance to research questions:** Always link the interpretations back to the research questions or objectives. Explain how each finding addresses the initial research goals, providing a clear connection.
- **Reference existing research:** Support the interpretations by referencing relevant studies from the existing literature. Discuss how the findings align with or deviate from prior research, providing context.
- **Consider alternative explanations:** Demonstrate awareness of potential alternative explanations for the findings. Acknowledge the presence of other possible interpretations, showing a comprehensive analysis.
- **Avoid repetition:** Address each issue or point in a single location within the discussion. Avoid unnecessary repetition of ideas to maintain a concise and focused discussion.
- **Minimize opinion bias:** Highlight all significant previous studies, regardless of their results. Avoid letting personal biases influence the presentation of research findings.
- **Peer review:** Seek input from peers, colleagues, or mentors before finalizing the interpretation and discussion. External perspectives can identify blind spots and enhance the overall quality of the discussion.

Discuss the hypothesis as per the findings of the study whether to accept or reject the null hypothesis. All studies have certain limitations. These should also be reported and discussed in the study.

General guidelines for writing discussion are shown in Box 12.3.

USE OF COMPUTERS AND STATISTICAL PACKAGES FOR QUANTITATIVE DATA ANALYSIS

The use of computers in quantitative data analysis has revolutionized the research landscape, making it more efficient and accessible than ever before. They are invaluable tools for data entry, organization, analysis, and data presentation. Over the past few decades, numerous statistical software programs have emerged, making data analysis more accessible. Many of these programs are free, increasing their affordability and usability for novice researchers. Consequently, it has become essential for researchers to acquaint themselves with at least one frequently used statistical software in their specific domain. Commonly employed software includes Statistical Package for Social Sciences (SPSS), Microsoft Excel, Epi Info, STATA, and Minitab, each of which has unique features designed to streamline data analysis and presentation.

Statistical Packages

- **Statistical Package for Social Sciences:** SPSS, owned by IBM, is a widely popular software program for statistical analysis, particularly in social sciences and various other disciplines. It boasts features for data documentation, management, presentation, and in-depth analysis. SPSS can efficiently process data from various file types, generating tabulated reports, charts, plots, descriptive statistics, and complex statistical analyses. It provides a Data Editor that resembles a workbook, allowing users to enter and edit data. With Data View for displaying data values and Variable View for handling variable information, SPSS offers a versatile platform for researchers.
- **Microsoft Excel:** Microsoft Excel, a part of the Microsoft Office suite, provides a grid of cells organized in rows and columns, allowing users to arrange numeric and textual data. Excel is equipped with mathematical formulas for data analysis, and it automatically recognizes patterns, making it a powerful



tool for presenting results with charts and graphs. Excel also offers Visual Basic for Applications, enabling users to apply a wide range of numerical methods, although it involves more user input and potential for errors.

- **STATA:** STATA, derived from “statistics” and “data”, is a general-purpose statistical software package created in 1985 by Stata Corp. Researchers from various fields, including economics, sociology, and biomedicine, use STATA. It excels in data management, statistical analysis, graphics, simulations, regressions, and custom programming. STATA provides versatile commands to manipulate data and no formal upper limit on the number of observations in a dataset. Its user-friendly interface and intuitive command syntax make it a preferred choice for applied research.
- **Minitab:** Minitab, developed in 1972 at Pennsylvania State University, is used for data management and various statistical analyses. It offers graphical representation of results that can be edited and exported. Minitab performs statistical tests, including hypothesis testing and normality tests, making it a valuable tool for quality control and reliability analysis. It is also compatible with methodologies like CMMI and Six Sigma.
- **Epi Info:** Epi Info is particularly known for its efficiency in questionnaire development, data entry customization, and rapid data analysis. It is commonly used in public health for outbreak investigations, disease surveillance system development, and epidemiological research. Epi Info significantly reduces the time required for data entry and analysis compared to traditional paper surveys.

Artificial Intelligence Tools for Data Analysis

Data analysis has become a cornerstone in today’s data-driven health care and nursing research. It allows health care professionals and researchers to transform vast datasets into valuable insights that inform critical decision-making processes. What is even more remarkable is the availability of a wide range of tools designed to cater to the needs of both experienced professionals and those with limited backgrounds in data analysis. These tools not only help visualize and analyze data but also streamline the tracking of health care-related information to derive essential insights for achieving health care goals. In this context, artificial intelligence (AI) plays a pivotal role in shaping the future of data analysis in health care and nursing research.

AI stands as the driving force behind an effective data analytics strategy in health care. Its powerful, efficient, and user-friendly capabilities make it an ideal choice for processing health care-related data. Artificial intelligence excels at examining enormous datasets, identifying trends and patterns that are critical for deriving insights to enhance health care processes.

It streamlines data analysis by consolidating vast amounts of health care data into a single solution, providing users with a comprehensive overview of patient information and clinical outcomes. When AI is employed for Predictive Analytics in health care, researchers and health care professionals can develop forecasts and evaluate various scenarios to determine the likelihood of success in treatment plans and patient care strategies.

AI-powered data analysis tools are indispensable for health care and nursing organizations looking to thrive in a data-driven world. Some of the popular AI tools tailored for health care and nursing research are discussed here:

- **Tableau:** Tableau is an analytics and data visualization platform that empowers health care professionals and researchers to interact with their health care data effectively. The beauty of Tableau is that it requires no coding knowledge, making it accessible to a wide range of health care professionals. With Tableau, users can create insightful reports and seamlessly share them across desktop and mobile platforms.



This data analytics tool supports data visualization and analytics, allowing health care professionals to create reports that can be shared within a browser or embedded in health care applications. Available from: <https://www.tableau.com/>

- **Microsoft Power BI:** Another remarkable AI tool for health care data analysis is Microsoft Power BI. This powerful business intelligence platform empowers health care professionals to filter through health care data, visualize it for meaningful insights, and build personalized health care dashboards. Power BI seamlessly integrates with various health care applications and allows the import of data from nearly any source. It also supports machine learning models and other AI-powered features, making it a versatile choice for health care professionals. Available from: <https://powerbi.microsoft.com/en-us/>
- **Polymer:** Polymer is a robust AI tool that stands out for its ability to transform health care data into a streamlined, flexible, and powerful database. What sets Polymer apart is that it doesn't require any coding, making it accessible to health care professionals with various backgrounds. This tool relies on AI to analyze health care data, enhancing health care professionals' understanding of patient information. It instantly transforms spreadsheets into searchable, intelligent, and interactive databases, making it a valuable asset for health care data analysts. Available from: <https://www.polymersearch.com/>
- **Akkio:** Akkio is an AI tool designed for health care professionals who are just getting started with data analysis. It offers a no-code machine learning platform, making it accessible to beginners in health care research. Akkio empowers health care professionals to upload their health care datasets and select variables for prediction. It builds a neural network around these variables, making it a valuable asset for predictive analysis in health care. Available from: <https://www.akkio.com/>
- **MonkeyLearn:** MonkeyLearn is another AI tool tailored for health care data analytics. This no-coding platform uses AI data analysis features to help health care professionals visualize and rearrange patient and clinical data. It includes multiple AI-powered text analysis tools that instantly analyze and visualize health care data, making it easy to sort data according to health care topics or patient intents. Health care professionals can use MonkeyLearn to set up text classifiers and text extractors, facilitating automatic data sorting and processing. This AI tool can save health care professionals hours of manual data processing by automating workflows and analyzing text, a valuable asset in health care and nursing research. Available from: <https://monkeylearn.com/>

ANALYZING QUALITATIVE DATA

In qualitative research, data analysis presents a significant challenge. In nursing and public health research, a widely adopted approach for qualitative data analysis is thematic analysis. This method involves coding, which involves labeling specific text segments in the transcript, followed by categorizing, which entails grouping similar codes together. Ultimately, this process leads to the identification of themes, which are overarching patterns that summarize inferences derived from various data sources. For instance, if “apple”, “banana”, and “guava” serve as codes, the category would be “fruit”, and the theme might be “fruits are sweet”. It is worth noting that in some disciplines, the terms “codes” and “categories” are used interchangeably.

Steps in Qualitative Data Analysis

Although the steps given here seem to suggest that the analytical process is linear, most often analysis is an iterative process. These steps and terminology are primarily derived from the analytic techniques of grounded theory approach.

Step 1: The interview verbatim is carefully read.

The data is initially acquainted with by thoroughly reading the data, such as transcribed interviews, field notes, or other qualitative materials. This initial reading aims to familiarize with the content and context of the data.

Step 2: The codes and themes that are covered in the data are decided.

As the data is read, patterns, recurring ideas, or concepts are identified. These codes and themes are the ones that will be extracted from the data. Keeping an open mind during this stage and not imposing preconceived categories onto the data is essential. For example, themes like “Patient Experiences” or “Quality of Care” may emerge from the data collected from patient on their hospital experience.

Step 3: The quotations (paragraphs, lines, or words) are marked.

Once potential codes or themes are identified, the specific portions of the text that relate to these codes are marked. This involves highlighting or tagging relevant quotations, paragraphs, lines, or even individual words within the data. For example, specific patient statements highlighting their satisfaction with the care provided or areas of concern may be marked.

Step 4: The codes are assigned.

In this step, a coding system is created to label and categorize the marked quotations. Codes are typically short phrases or labels that represent the essence of the content. A coding software may be used, or a manual list of codes is created. For nursing research, codes like “Communication”, “Comfort”, or “Treatment Effectiveness” may be assigned to relevant excerpts.

Example: The following extract has been taken from an interview with a mother about health care seeking behavior in child health.

“My baby was very hot with fever in the night. He was sleepy and refused to take feed. I called my mother-in-law from her room. She said to wait until morning as it was nothing serious. I was really worried. I stayed up all night. In the morning, my husband and mother-in-law said that we should take him to the clinic.”

After thoroughly reading the text, coding was conducted.

“He had fever in the night” – Code 1 – Initial symptoms

“I called my mother-in-law from her room” – Code 2 – Informal help seeking

“In the morning, my husband and mother-in-law said that we should take him to the clinic” – Code 3 – Decision making

“Take him to the clinic” – Code 4 – Formal help seeking

In this way, the whole dataset should be coded. Extracts from all interviews or FGDs are put together and patterns across the whole dataset are looked at (i.e., pile of similar extracts).

Step 5: A list of items under one theme from across the interviews is made.

After coding, related codes are grouped into broader themes or categories. This step involves synthesizing the data by bringing together all the coded excerpts that relate to a particular theme. This helps in organizing and summarizing the information. In nursing research, themes like “Patient Satisfaction” or “Challenges in Health care Delivery” may be formed.

Step 6: The relationships between themes are checked.

Once the themes have been identified and organized, consideration is given to how they relate to each other. Are there patterns or connections between themes? This step helps in developing a more comprehensive

understanding of the data. In nursing research, the relationship between themes like “Patient Experience” and “Quality of Care” may be explored.

Step 7: The patterns are interpreted.

In this interpretive step, a deeper exploration is undertaken into the meaning of the themes and patterns that have been identified. This may involve the exploration of the implications, context, or underlying reasons behind the themes. A nuanced understanding of the data is developed in this step. For instance, in nursing research, the interpretation may involve understanding the impact of patient experiences on health care quality and identifying areas for improvement.

Step 8: The quotes are mentioned in reports.

When reporting the findings, support is provided for the analysis with specific quotes or excerpts from the data. These quotes serve as evidence and examples to illustrate the themes and patterns that have been uncovered. They also help in making the findings more transparent and credible. For nursing research reporting, including patient quotes can make the research findings more relatable and impactful.

SOFTWARE PACKAGES FOR QUALITATIVE RESEARCH

A number of computer software packages are now available for analysis of qualitative data. Some of the popular packages include ATLAS.ti, NVivo, MaxQDA, Dedoose, and Anthropac.

A brief review of a few of these softwares is as follows:

- **ATLAS.ti:** It is a powerful software for the qualitative analysis. It helps to arrange, reassemble and manage the data in systematic ways. The program provides tools that lets the user locate, code, and annotate findings. It consolidates large volumes of data. It keeps track of all notes, annotations, codes and memos in all fields and analysis of text, images, audio, and video data. Any file format can be used to import data. It also provides analytical and visualization tools which are designed to open new interpretative views of the data.
- **NVivo:** Tom Richards developed the first NVivo software product in 1999. It is used for qualitative data having lot of text-based and/or multimedia information. It helps the users to organize and analyze non-numerical or unstructured data. It facilitates them to classify, sort, arrange information and examine relationships in the data. Word and pdf files can be imported for analysis.
- **Anthropac:** It is available in two versions: (1) DOS and (2) Windows. It is used for collecting and analyzing data on cultural domains. The program helps collect and analyze structured qualitative and quantitative data including free-lists, pile-sorts, triads, paired comparisons, and ratings. Anthropac’s analytical tools include techniques that are unique to Anthropology like consensus analysis as well as standard multivariate tools such as multiple regression, factor analysis, cluster analysis, multidimensional scaling and correspondence analysis. It also provides a wide variety of data manipulation and transformation tools, plus a full-featured matrix algebra language.

VALIDITY AND RELIABILITY OF QUALITATIVE RESEARCH

Lack of understanding about qualitative research among researchers who were trained only in quantitative research methods have led to qualitative research being seen as not following scientifically rigorous steps. Often, the validity of the interpretation/inferences is frequently debated. Validity indicates “trustworthiness” of findings of qualitative research.

Although data collected in qualitative research is in relatively unstructured form, it is important to ensure that analysis is reliable and validity is safeguarded.

To maximize validity and reliability:

- It should be ensured that conclusions are based on supporting evidence. Context provided should be enough to enable the reader to judge the interpretation.
- A clear account of the procedure used should be provided so that others can understand how the conclusions were drawn from the evidence.
- Ensure that the evidence, e.g., field notes, transcripts of the interviews, can be inspected/audited independently.
- The procedures for data analysis should be clearly described.

A number of specific techniques have been recommended to assure validity and quality. These include:

- **Use of more than one data analyst/coder:** If more than one analyst codes the data independently, similarity of findings can be assessed. Hence, having more than one coder enhances the validity. Although, some disciplines (psychology) may favor such inter-coder reliability, discrepancies between the coders are not necessarily a bad thing. Actually, it can reveal different ways of interpreting a particular data.
- **Respondent validation:** This is also known as member checking. It checks if respondents or similar people agree with the researcher's interpretation of the data. This involves sharing the findings of the study back with the participants, and assessing how far they consider the findings to be reflecting their perspectives.
- **Triangulation:** Data triangulation involves using different sources of information (e.g., IDI, FGD) in order to increase the validity of a study. Thus, in triangulation, a research question is studied from multiple perspectives. Use of multiple sources of data to approach the same issue will provide a more holistic and better understanding of the phenomenon under study.
- **Dealing with deviant cases:** Deviant cases are those which do not fit within the overall themes identified or exceptions to the common patterns observed. The researcher should look in detail at such deviant cases and try to figure out why they differ. Explaining deviant cases will strengthen the analysis.

Currently, there is considerable emphasis on ensuring that methods of qualitative research and their reporting fulfill certain criteria, similar to that of certain checklists/criteria used in quantitative research. Some researchers also favor use of such checklists to assess the quality of qualitative research, while others have differing views. The key contribution of qualitative research lies in developing conceptual explanation where inferences drawn from one setting hold true for other similar settings.

PRESENTATION OF RESEARCH FINDINGS

When we start analyzing the data to organize the study results, it is advisable to not to adopt a hurried approach. There is no need to directly apply various tests of significance. First we need to be familiar with our data. It is better to begin with making univariate tables. Then, we go for bivariate/correlation tables as per the need. Actually, an attempt should be made to play with the data. Try to present the findings in different ways. Then select the method which suits the best. Data can be presented in two ways:

1. Tabulation
2. Graphical and diagrammatic presentation

All these should be appropriately used. In this regard, it has been said that the way data are displayed is as important as the data that are being displayed. Care must be taken to choose the best way of presentation. In general, tables are



considered better than graphs for showing structured numeric information. Graphs are better for demonstrating trends, making comparisons or showing relationships. It should be kept in mind that all tables and graphs should be self-explanatory. The reader should be able to comprehend these without referring to the text. The title should be informative and comprehensive. Rows and columns of tables or axes of graphs should be clearly labeled. The text in the results section should always mention the key points of the table or figure. All information need not be repeated in the text.

Presenting Data in Tables

Tables are the most effective ways and the commonly used method by majority of the researchers to present their research findings. Tables show numerical values or textual information arranged orderly in rows and columns. These summarize statistical information/results regarding the research question or hypothesis of the study. The benefit of using tables is that they can recapitulate a large amount of data in a small space.

An informative table supplements the text. It is a common mistake by the students that they write description regarding each and every thing about whatever is given in the table. However, the results presented in the table should not be reported in their totality in the text. Only the highlights of every table should be referred in the text. If the text discusses every item of the table, then the purpose of preparing the table becomes redundant. Moreover, the table should be cited in the text by its number, e.g., *as shown in Table 1 or 1.1*. The discussion of the table should be as clear as possible in the text.

For the tables showing the relationship of variables for hypothesis testing, the value of that particular test, along with degree of freedom (df), and probability level (p value) should be either shown in the table itself, or as a footnote. The exact p value (up to two decimal places) can be written instead of writing $p < 0.05$ or $p < 0.01$.

It has been observed that some researchers divide the table into a number of columns and rows as per the observation she/he wants to present. It is alright as per the number of columns are concerned, but if more rows are shown in the table, then the table looks more congested. So, more number of rows may be avoided.

There should be right-sided alignment of the data column in the table, so that the decimal point if present is lined up under each other. If data are not available for a particular section of the table, a dash (-) should be entered rather than leaving a blank space. It will ensure that data has not been left mistakenly.

Parts of a Table

A table consists of the following parts:

- **Table number:** It is written at the top of the table along with the title of the table.
- **Title:** It indicates characteristic of the data given in the table. It should be brief, concise, clear and self-explanatory.
- **Rows:** These are the horizontal lines of the table.
- **Columns:** These are the vertical lines of the table.
- **Cell:** The intersection of rows and columns is called a cell.
- **Caption:** It is the heading of the column. It may contain subcaptions depending upon the nature of the data.
- **Stubs:** These are headings of the rows.
- **Body:** It contains numerical information. Data is arranged in the body. It is the most important part of the table.
- **Footnotes and sources of data:** These are mentioned for clarifications and further references and are placed directly below the body of the table.

Basic Principles of Tabulation

- Tables should be clear, concise and adequately titled.
- Every table should be distinctly numbered for easy reference.
- Column headings and row headings of the table should be clear and brief.
- Units of measurement should be specified at appropriate places.
- Explanatory footnotes concerning the table should be placed at appropriate places.
- Source of information of data should be clearly indicated.
- Comparable data should be put alongside.
- Where ever possible, the data should be arranged in descending or ascending order.
- Abbreviations should be avoided.
- Each table should be comprehensive and complete in itself.

Types of Tables

Tables can be classified according to their purpose, stage of inquiry, nature of data or number of characteristics used. On the basis of the number of characteristics, tables may be classified as follows:

1. **Simple or one-way table:** A simple or one-way table is the simplest table which contains data of one characteristic only. A simple table is easy to construct and simple to follow.
2. **Two-way table:** A table, which contains data on two characteristics, is called a two-way table. In such case, therefore, either stub or caption is divided into two coordinate parts.
3. **Manifold table:** A table, which has more than two characteristics of data is considered a manifold table. Manifold tables, though complex are good in practice as these enable full information to be incorporated and facilitate analysis of all related facts. However, not more than four characteristics should be represented in one table to avoid confusion.

Frequency Distribution Table

These tables show the frequencies for a particular observation, i.e., the number of times any observation is occurring in the data. These tables can be used both for qualitative and quantitative observations. For frequency distribution of any given data, we have to create a table first called, a frequency distribution table.

Steps of Organizing Data in a Frequency Distribution Table

Illustration 1:

Sex-wise data of candidates appeared for an interview in a nursing college is given and now we want to organize this raw data in a table. The following steps are to be followed:

1. Examine set of raw data (Here 'F' denotes **Female** and 'M' denotes **Male**)

“M, M, M, F, F, M, F, F, M, F, M, M, M, F, M, F, F, M, F, F,
F, M, M, F, M, F, F, M, M, M, F, F, F, F, M, M, M, M, F, F,
M, F, F, M, M, F, M, M, F, F, F, F, F”

2. Now to form a frequency distribution table for above raw data. We have to create a table as given below:

Sex	No. of students
Male	
Female	
Total	

3. Now count the number of “Fs” and “Ms” to fill the body of above table. This counting can be done in three ways:
- We just count the “Fs” and “Ms” separately and fill in the body of table, or
 - We arrange the data in the groups of “Ms” and “Fs” and then count the number of “Ms” and “Fs” and fill in the body of table. For example

MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM

and

FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF

Here, M = 25 and F = 28

- We can use tally marks technique. It is popular because it minimizes the labor which is usually there in the other techniques when data is large enough or bulky.

In this method we have to make a table as follows:

Sex	Tally marks
Male	
Female	

Examine the raw data carefully and for each ‘M’ and ‘F’ a vertical line (tally mark) is put against each row heading.

In the given dataset, the first attribute is ‘M’, so we shall put one tally against ‘M’ and cross or tick the first item in the raw data to avoid any confusion and so on Till 8 items (raw data) the table looks like as below:

Sex	Tally marks
Male	IIII
Female	IIII
Total	

To further facilitate the counting process, the tally marks are arranged in the blocks of five by drawing fifth tally across the four tallies. For example, in the given dataset, when we want to make tally of 9th to 10th item, then, it is shown as below:

Sex	Tally marks
Male	
Female	

Thus, table for the given dataset is as follows:

Sex	Tally marks	Frequency
M		25
F		28

Finally, we get the frequency distribution table as shown below:

Sex	No. of students
Male	25
Female	28
Total	53

Frequency Distribution for Variables

On the basis of the type, nature, size of variables/data, we can decide about the format of frequency distribution table.

Ungrouped frequency distribution: It is used for small data sets in which we use values as it is.

Illustration 2:

Form a frequency distribution for the following data relating to the number of family members.

1, 3, 7, 8, 7, 6, 5, 3, 1, 2, 2, 7, 10, 11, 7, 10, 11, 11, 10, 4, 4,
5, 1, 2, 3, 7, 8, 6, 7, 3, 4, 3, 10, 11, 8, 9, 11, 12, 14

From the above data, we find that the smallest value is '1' and the largest value is '14'.

So, we make the following table format.

No. of family members	Tally marks	Frequency
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

The body of the table is filled by the tally marks technique and we obtain the following from of table.

No. of family member	Tally marks	Frequency
1	III	3
2	III	3
3		5
4	III	3
5	II	2
6	II	2
7		5
8	III	3
9	I	1
10		4
11		5
12	I	1
13		0
14	I	1

We get final table as follows:

Title: Frequency distribution of family members

No. of family members	Frequency
1	3
2	3
3	5
4	3
5	2
6	2
7	5
8	3
9	1
10	4
11	5
12	1
14	1

- **Grouped frequency distribution:** It is necessary to group the data into class intervals to justify the purpose of summarization. For example, in above data, there are 14 rows. It is too big. It can be shortened by using class intervals. Grouped frequency distribution is used for large datasets.

Properties of Class Intervals

- The classes should be exhaustive, mutually exclusive and of equal width.
- Number of classes or class intervals should neither be too large nor be too small to maintain the nature of data.
- As per convention, the number of class intervals can vary from 5 to 10.
- The width of class intervals should be equal and depends on the basis of range or variability of the data.
- The class limit should be definite and clearly stated, either in an inclusive manner or in an exclusive manner.
- Open-ended classes should be avoided under normal conditions.

Illustration 3:

Create a frequency distribution table for following data regarding marks of 50 BSc Nursing 1st year students in the subject of Fundamentals of Nursing.

67, 64, 54, 66, 36, 38, 46, 48, 49, 52, 58, 62, 75, 78, 88, 92, 5
8, 57, 66, 72, 53, 57, 65, 55, 45, 35, 75, 66, 81, 82, 93, 96, 9
39, 47, 37, 38, 78, 66, 72, 38, 45, 39, 48, 57, 68, 75, 78, 77, 62

Solution:

Steps:

- First, note minimum and maximum values in the dataset. They are: Minimum (Min) = 35 and Maximum (Max) = 98.
- Obtain range = (Max – Min) = (98 – 35) = 63
- On the basis of range and size of data, we decide the number of classes and width of class intervals (CI).
- Suppose, we want to take 5 class intervals then width of class intervals is calculated by given formula:

$$w = R/k \quad \dots(1)$$

Here,

w = Width of class interval

R = Range of data

k = No. of class intervals

So, $w = 63/5 = 12.6$

Hence, by using formula (1) we can take width of each class interval 12 or 13.

- We can also use Sturge's formula, to get number of class intervals

Number of class intervals = $1 + 3.322 \log_{10} N$

Here,

k = No. of class intervals

N = No. of subjects, i.e., 50

$\log_{10} N$ = logarithm of 10N

$$k = 1 + 3.322 \log_{10} N$$

$$k = 1 + 3.322 \times 1.7$$

$$k = 1 + 5.6474$$

$$k = 6.6474$$

So $k \approx 7$

By using Sturge's formula, we can take 7 class intervals.

- So, width (w) of each class interval as per Sturge's formula is 9.

$$w = \frac{R}{k} = \frac{63}{7} = 9$$

- If we take number of class intervals as 5, then width of CI would be around 13.
- Or, if we use Sturge's formula, then we got the number of class interval as 7 and width of CI as 9.
- It usually depends on researcher's judgment and his suitability to take the number of class intervals and class width as per dataset.
- Suppose, we decided to take 5 class intervals each of width 12.6 ($63/5 = 12.6$), then we have the following class interval in the inclusive manner (35–47.6), (47.7–60.3), (60.4–73), (73.1–85.7) and (85.8–98.4).
Or,
- If we decide to take class intervals of 13, then we have the following class intervals (in inclusive manner) (35–48), (49–62), (63–76), (77–90) and (91–104).
Or, we can create the following class intervals (in exclusive manner) of width 13.
(35–48) (48–61) (61–74) (74–87) 4 (87–100)
Where in the first class interval (35–48), the value 35 is included, but not 48. The value 48 will be included in the second class interval, i.e., (48–61) and so on.
- For the facilitation, we can have the following class interval for the above data
 - (35–44), (45–54), (54–64), (65–74), (75–84), (85–94), (95–104) (No. of CI = 7, width = 10)
 - (35–49), (50–64), (65–84), (85–104) (No. of CI = 4, width = 15)
 - (31–45), (46–60), (61–75), (76–90), (91–105) (No. of CI = 5, width = 15)

Corresponding Class Boundaries

The class intervals, e.g., 31–45, can be conversed to (30.5 to 45.5) without losing any frequency for the class interval (31–45).

'31' and '45' are called 'lower' and 'upper' class limits, respectively, for the first class interval and while '30.5' and '45.5' are called the corresponding class boundaries.

Finally, we can get frequency distribution table as given in Table 12.8.

Table 12.8

Frequency distribution table showing marks of BSc Nursing 1st year students in the subject of Fundamental of Nursing

Marks obtained by students	Tally marks	No. of students or Frequency
31–40		8
41–50		7
51–60		9
61–70		10
71–80		9
81–90		3
91–100		4
Total		50



Graphical and Diagrammatic Presentation

The term figure is used to indicate any type of visual presentation other than table. A figure may be a chart, a graph, a photograph, a drawing or any other illustration or nontextual depiction. These also show relations among scores or variables. Graphics are easier to interpret than the tables, thus illustrating the old saying that “a picture is worth a thousand words”. A good figure supplements, rather than duplicating the text. It conveys only the important details and are easy to read and understood.

Charts and graphs are often the best way to demonstrate trends in data and make comparisons between different groups. Different types of graphs are required to present various types of findings in an efficient and effective way.

Tabulation of data requires labor and time. It makes the comparison of data difficult as one has to read the figures and then compare them. Easily interpretable and easier way of presenting the data are: Graphical and Diagrammatic.

Graphs and diagrams present the data in an interesting and attractive manner. They simplify the data and facilitate its comparison in an easier way. These can also be understood by a lay man which is difficult in case of tables. Some of the important types of graphical and diagrammatic representation of data are described here in detail.

A graph is a picture that represents data in an organized manner. It is a line or curve drawn on a number line or coordinate plane. A graph is drawn between X- and Y-axes, where X-axis is a horizontal line while Y-axis is a vertical line.

Graph is the best tool to understand the data in an easy way. These are used to present quantitative and continuous data.

The various types of graphical representation of data are as follows:

1. Histogram
2. Frequency polygon
3. Frequency curve
4. Ogive
5. Bar diagram
6. Pie chart/diagram
7. Pictogram
8. Map diagram
9. Scattered diagram

1. Histogram

A histogram is most commonly used for graphical representation of frequency distribution.

It is a bar graph showing the frequency distribution. In this, class intervals are taken on X-axis and frequencies on Y-axis. A rectangle is drawn corresponding to each class interval whose height is frequency and width is class interval. The area of rectangle drawn is proportional to frequency. However, it cannot be constructed for open end classes. Adjustments in frequencies are to be made when distribution has unequal class intervals.

Illustration 4:

Draw a histogram for the data of heights of 30 nursing students. Their height (in cm) are: 146.6, 152.4, 153.6, 158.4, 161.5, 164.4, 167.6, 173.7, 176.7, 165.4, 188.9, 179.8, 173.7, 170.6, 164.5, 161.5, 159.8, 155.4, 149.8, 158.2, 168.8, 167, 163.4, 166, 182, 149.6, 154.6, 161.6, 157.4.

Table 12.9 Frequency distribution table for heights of nursing students

Class	Frequency
146–150	3
151–155	5
156–160	4
161–165	7
166–170	5
171–175	2
176–180	2
181–185	1
186–190	1
Total	30

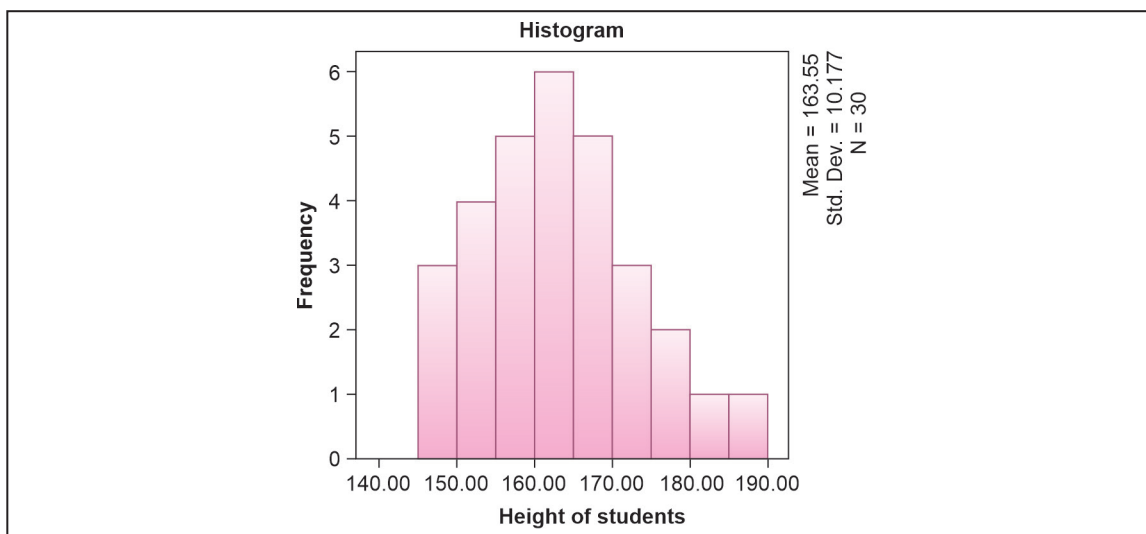


Figure 12.4: Histogram showing heights of nursing students

Solution:

First, construct a frequency distribution table as given in Table 12.9 and Figure 12.4.

2. Frequency Polygon (Fig. 12.5)

A frequency polygon is a graph obtained on joining the midpoints of top of rectangles by a straight line in a histogram. The area of the polygon is equal to the area of the histogram. It is used for making comparisons between two or more frequency distributions. For example, comparison of birth and death rates of two countries or a country at two different times.

These are also not used for open-ended classes.

Illustration 5:

Draw a frequency polygon for the data given in above illustration.

Solution:**Merits of frequency polygon over histogram**

- Frequency polygon is simpler than histogram.
- It clearly outlines the data in the form of a curve.
- It makes the comparison easier by plotting the different distributions on the same axis.

3. Frequency Curve (Fig. 12.6)

It is obtained in the same manner as frequency polygon except that the midpoints are joined by a free hand curve rather than a straight line. The curve should begin and end at baseline. Two class intervals (with zero frequency), one at the beginning and one at the end is added outside the histogram. The two ends of the curve at baseline are extended to midpoints of the added class intervals. It is not necessary to include all points in a frequency curve.

The area under the curve is approximately the same as frequency polygon.

4. Ogive

It is a graph of cumulative frequency distribution. These are the curves obtained by plotting cumulative frequencies, therefore, also known as cumulative frequency curves. For this, a frequency distribution table is prepared with cumulative frequency (Table 12.10). There are two methods of constructing cumulative frequency curves:

- “Less than” type method (Fig. 12.7)
- “More than” type method (Fig. 12.8)

For the construction of ogive, frequency distribution table with “less than type” and “more than type” of cumulative frequencies have to be constructed.

Using the data from illustration no. 4, Table 12.10 can be constructed:

“Less than” Type

In this, less than type of cumulative frequencies is plotted against upper class limits. A rising curve is obtained in Figure 12.7.

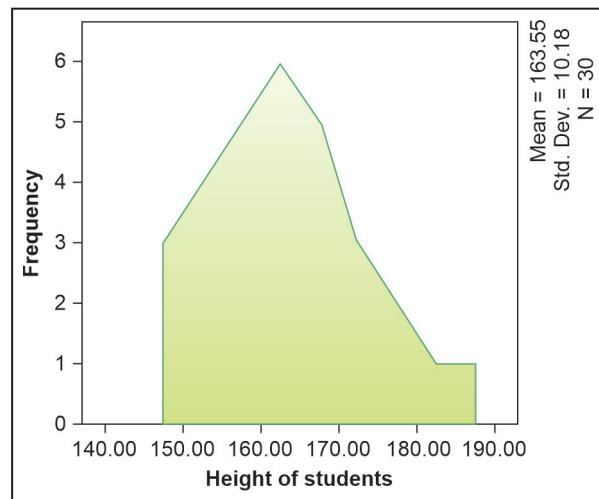


Figure 12.5: Frequency polygon

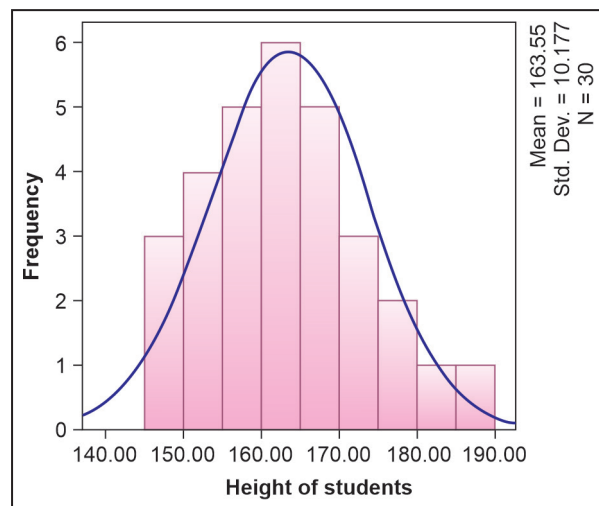


Figure 12.6: Frequency curve

Table 12.10 Cumulative frequency distribution table for heights of nursing students

	LCL*	UCL**	Frequency	Less than type frequency	More than type	Midpoint
146–150	146	150	3	3	30	148
151–155	151	155	5	8	27	153
156–160	156	160	4	12	22	158
161–165	161	165	7	19	18	163
166–170	166	170	5	24	11	168
171–175	171	175	2	26	6	173
176–180	176	180	2	28	4	178
181–185	181	185	1	29	2	183
186–190	186	190	1	30	1	188

* Lower class limit

**Upper class limit

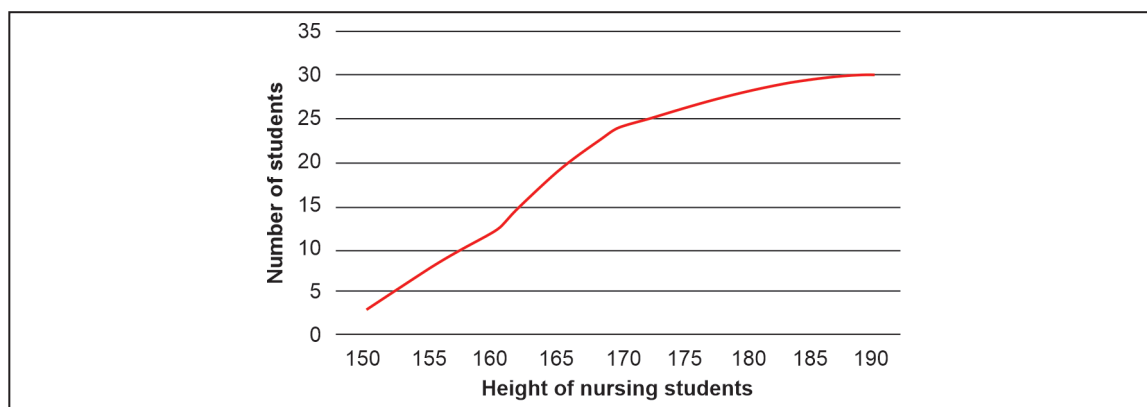


Figure 12.7: Cumulative frequency curve by “less than” method

“More than” Type

In this, more than type of cumulative frequencies is plotted against lower class limits. A declining curve is obtained in Figure 12.8.

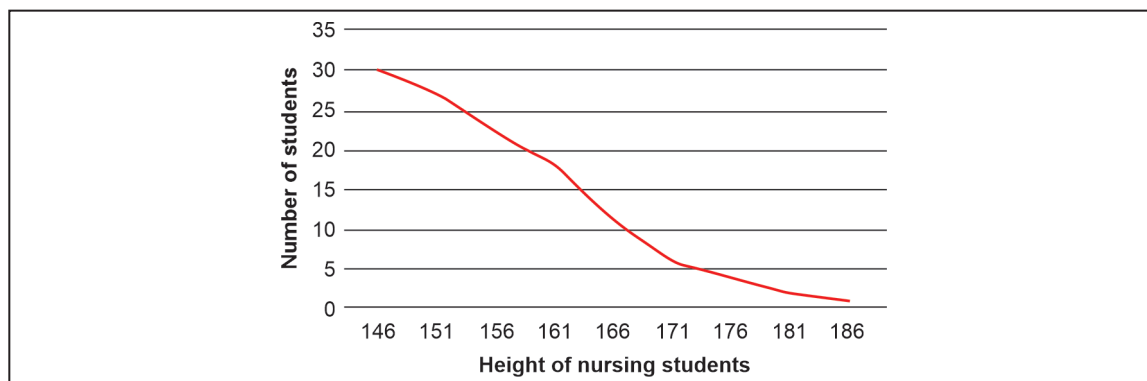


Figure 12.8: Cumulative frequency curve by “more than” method

Ogive can be used for locating median, quartiles and percentiles. There is less overlapping in ogive as compared to frequency curve, therefore, many frequency distributions can be compared in on the same grid.

There is one limitation that only the person with knowledge and experience can interpret ogive easily.

5. Bar Diagram

Bar diagrams show graphical distribution of data using length of bars. These can be used to show the value, or breakdown, of a variable. They can be presented vertically or horizontally with each bar representing a variable. They can show absolute values, make comparisons, and emphasize differences or change. It allows for easy comparison of the groups.

Either horizontal or vertical, its height represents the frequency. They must be of uniform width with spaces in between them. Before construction of this diagram, a scale is decided on basis of the highest value in the series. These diagrams can represent only one category of data.

These are mainly of three types:

1. Simple bar diagram
2. Multiple bar diagram
3. Stacked bar diagram

Illustration 6:

Represent the following data of population (in thousands) of India in different years by a simple bar graph.

Year	1951	1961	1971	1981	1991	2001	2011
Population (in thousands)	361,088	4,392,345	548,159	683,329	846,421	10,288,737	1,210,193

Simple Bar Diagram

It is the simplest method of comparing the magnitude of different frequency distributions. Simple bar diagrams are used to represent one variable only.

The population is shown on the Y-axis and the time duration (years) in the given example on the X-axis. Hence, the simple bar diagram for the data is given in Figure 12.9.

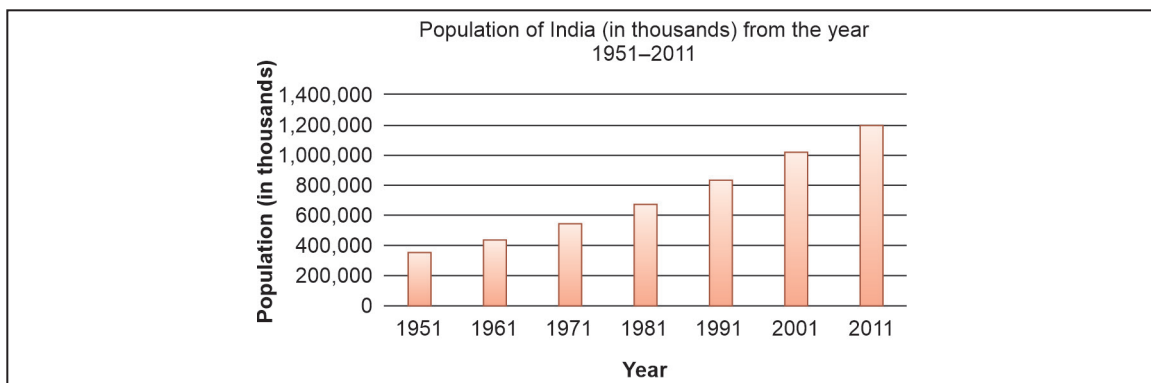


Figure 12.9: Simple bar diagram

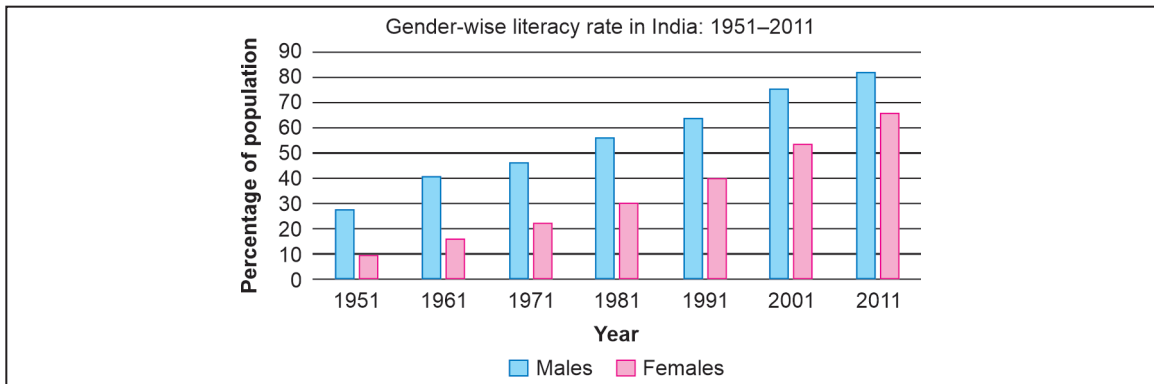


Figure 12.10: Multiple bar graph

Multiple Bar Graph

It is used to compare data of two or more different categories of a single variable. These are constructed in such a way that one bar is adjacent to another bar. These two bars are differentiated by either different colors or patterns. An illustration of multiple bar graph (Fig. 12.10) showing gender-wise literacy rates from the year 1951 to 2011.

Stacked Bar Graph

In a stacked bar graph, bars for different categories of a variable are stacked over the other. Height of this stacked bar is equal to the combined frequencies of different categories taken into consideration. It is drawn in the same way as multiple bar graph except the stacking of one bar over the other rather than constructing it side by side. For example, stacked bar graph for data on gender-wise literacy rate is given in Figure 12.11.

6. Pie Chart/Diagram

These use a circle or pie that is segmented so that each section represents a percentage associated with the value of a specific variable. These pie charts show the proportions of subgroups in a group. These are very useful for showing an overall breakdown of variables within a group.

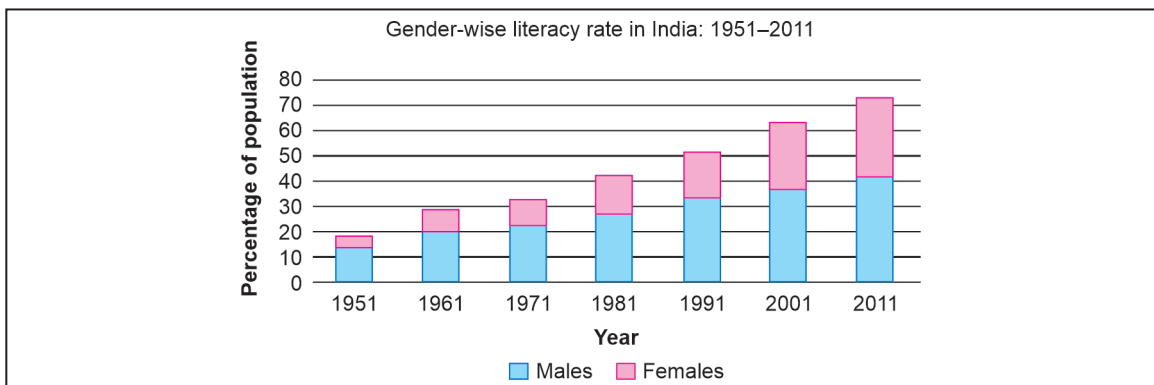


Figure 12.11: Stacked bar graph

Each component in pie diagram is depicted on a pie by an angle at the radius. The angle for each component is calculated by a formula:

$$\frac{\text{Value for a particular component}}{\text{Sum of values of all components}} \times 360^\circ$$

Illustration 7:

Fees for admission (₹) to a nursing college is given in the following table. Draw a pie diagram for the following data.

Registration	10,000
Tuition	24,000
Building Fund	12,000
Hostel charges	18,000
Miscellaneous	12,000
Total	76,000

Solution:

First an angle for each component of the table is calculated.

Component	Fee (in ₹)	Degree
Registration	10,000	$\frac{10,000}{76,000} \times 360^\circ = 47.4^\circ$
Tuition	24,000	$\frac{24,000}{76,000} \times 360^\circ = 113^\circ$
Building fund	12,000	$\frac{12,000}{76,000} \times 360^\circ = 56.8^\circ$
Hostel charges	18,000	$\frac{18,000}{76,000} \times 360^\circ = 85.26^\circ$
Miscellaneous	12,000	$\frac{12,000}{76,000} \times 360^\circ = 56.8^\circ$
Total	76,000	

Using these degrees, angles at the radius of a circle can be constructed to form a pie diagram as shown in Figure 12.12.

7. Pictogram

A pictogram is a representation of frequency of data using a pictorial symbol. It can easily be understood by a layman as no bars or lines are used in it. It really depicts the type of data we are dealing with. The Figure 12.13 shows the persons (in hundreds) died due to lung cancer and oral cancer.

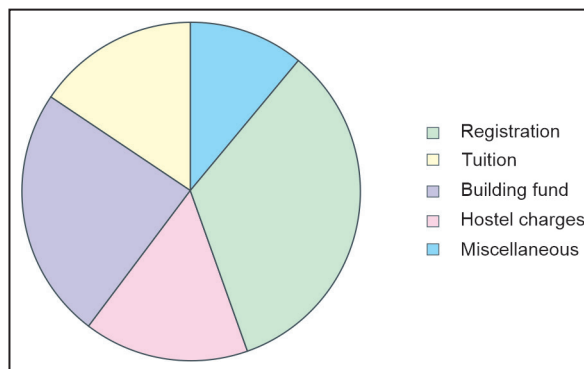


Figure 12.12: Components of fees for admission to a nursing college

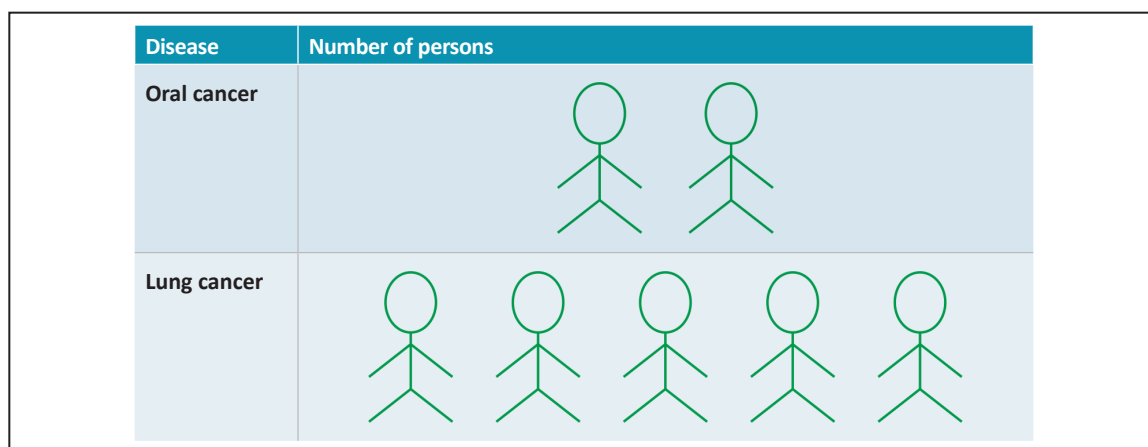


Figure 12.13: Pictogram

8. Map Diagram

These are used to represent data as a geographical basis. It can be shown on a map using different shades, patterns, dots, etc. (Fig. 12.14).

For example: Map of Chandigarh showing the areas selected for data collection using dots of different colors.

9. Scattered Diagram

A scattered diagram is also called a scatter plot. It is a visualization of the correlation between two variables measures on the same set of individual. One is represented along the X-axis and the other along the Y-axis. The scattered diagram can have three forms (Fig. 12.15):

- Linear relationship (positive and negative):** This is represented in a form of a straight line running from one corner to another. It can have either negative or positive direction. The positive relationship is presented as a diagonal line from lower left to the upper right corner. Higher values on X-axis go with higher value on Y-axis and vice versa. A negative relationship is a line from upper left to the lower right corner. It means higher values on one variable go with lower values on the other.
- Independence:** This looks like a random scatter with no pattern, or a straight line that is exactly parallel to the horizontal or vertical axis. This shows that there is no relationship between two variables.
- Curvilinear relationship:** It means that the center of a maze of cases would form a U-curve or upside down. Here, as one variable increases and so does the other variable. But, only up to a certain point, after which as one variable continues to increase, the other decreases. This will be an inverted-U.

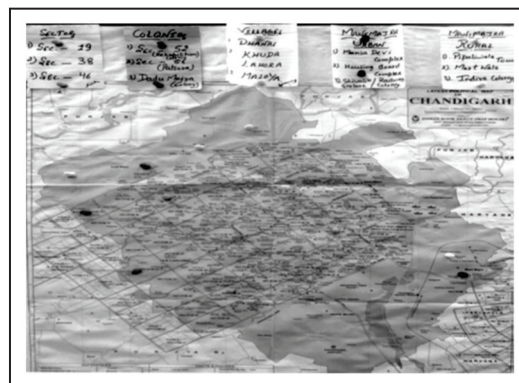


Figure 12.14: Map diagram locations selected for data collection in a project

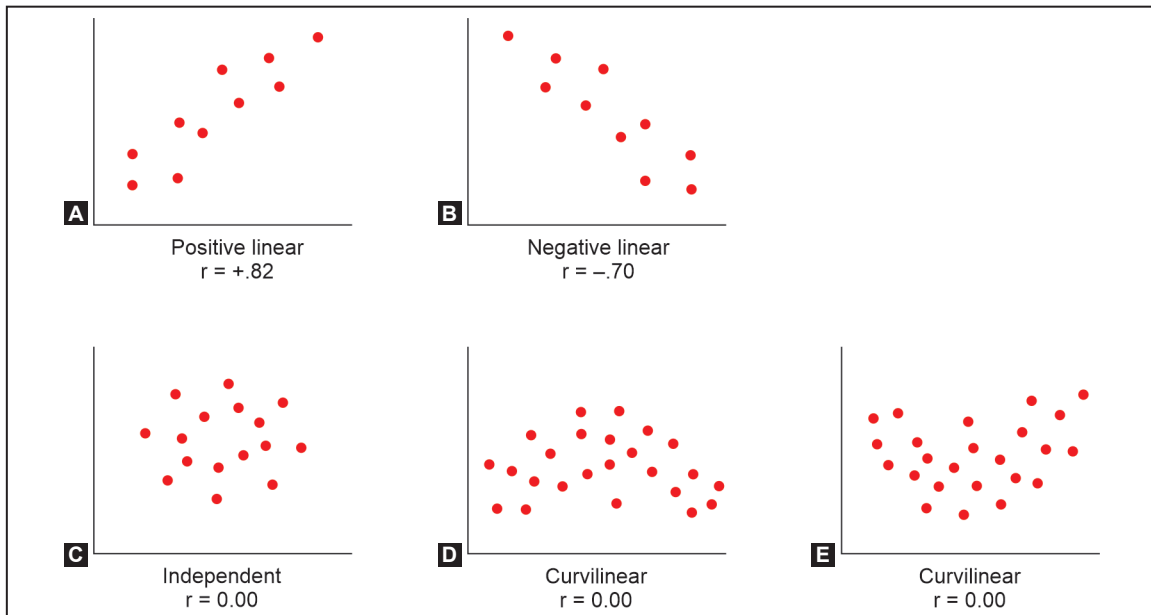


Figure 12.15: Scattered diagram

Differences between Bar Graphs and Histograms

The main differences between bar graphs and histograms are as follows:

- A bar graph is made up of columns which are plotted on a graph with spaces within the adjacent columns whereas a histogram is made up of columns with no space between the columns.
- The items in bar graph are separate entities whereas items in a histogram are usually numbers (grouped or categorical).
- Usually, bar graph is used to show visual comparison of discrete items whereas histogram makes the comparison of frequency of continuous items.

WRITING CONCLUSION, LIMITATIONS, IMPLICATIONS AND RECOMMENDATIONS

Conclusion

The conclusion is not a summary but a conviction based on the interpretation of the research findings and the evidence accumulated through the research study. The conclusion of the study is the researchers' attempt to show what knowledge has been gained by the study and is an attempt to generalize the findings.

At this point, the conclusion is shared with the readers, and it should be characterized by a systematic, brief nature. It should not contain any new information that has not been reported, interpreted, and discussed in the preceding text. The conclusion serves as the capsule for the overall wrapping up of the study and should, therefore, be made very concise and precise. The study problem, research questions, objectives, hypothesis, theoretical framework, and so on should be revisited by the researcher when writing the conclusion.

The researcher is required to think over various questions, such as whether the research questions have been answered, if the objectives have been met, and if the research hypotheses are supported.

Though the conclusion needs to be very short, an overview of all these aspects must be provided by the researcher. Therefore, the conclusion must be supported by data and should not go beyond the data. Any generalizations made must be consistent with the methodology and realistic in light of the findings. The conclusion must also align with the analysis of the data and the interpretation of the findings of the study.

Example of writing conclusion

Conclusion of a study on 'A randomized observer blind clinical study to compare the efficacy, safety and pharmacoeconomic evaluation of "Ichthammol glycerin", "Heparinoid preparation" and "Magnesium sulfate glycerin" application on the reduction of post-cannulation phlebitis' (Basu et al. 2015).

Among the three agents, Ichthammol glycerin showed the best result in reducing phlebitis score. As per pharmacoeconomic basis, it was also the most cost-effective followed by magnesium sulfate glycerin. Heparinoid preparation has found to be the most expensive drug among three interventions. None of the subject showed any kind of adverse drug reactions in three groups.

Limitations

Limitations in a study are factors that can potentially weaken the research but are beyond the control of the researchers. These limitations may impact the credibility and generalizability of the study findings. They include aspects like sample size, time constraints, budget limitations, respondent characteristics, and the accuracy of responses, among others. It is crucial for the researcher to identify and discuss these weaknesses in the study to ensure transparency and prevent later criticism from readers.

The distinction between limitations and delimitations is important. Limitations refer to weaknesses that the researcher recognizes at the end of the study, such as a small sample size. Delimitations, on the other hand, are characteristics that are set in advance and define the scope and boundaries of the research, including aspects like research objectives, questions, methodology, variables, and the target population. Delimitations are established during the planning phase of the study.

An example showing the limitations and delimitations of the above cited study is shown as follows:

Example on limitations and delimitations of a study

The above said study had the following limitations:

- The subjects were not on same kind of peripheral venous access.
- The subjects were from different treatment regimen for comorbid diseases.
- The same kinds of cannulation practice were not present on every subjects.
- The sample size was too small.
- The study was limited to only Advanced Cardiac Center, PGIMER, Chandigarh.

Implications

Implications mean considering the conclusions of the findings of a research study for the development of theory, future research, nursing education, administration and nursing practice. Thus, the implications may be addressed to the theorist, researchers, clinicians, educators, or administrators. Implications are based on the conclusion of the findings. These provide more specific suggestions for implementing the findings of the study. For example, if the study pertains to theory development, the theory may be confirmed in part or as a

whole, rejected or found to have no impact. In such cases, the results of the study should be used to support the theory, propose modifications to it, and so forth. Regarding the implication for future research, it is quite common that a research study sparks new questions, paving the way for further research to explore and address them. Similarly, it is important to evaluate the findings for the implication for practice, assuming that they are of clinical significance. If they are so, it needs to be evaluated that how they can be applied in practice.

Example on implications and recommendations of the above-said study

The study presented here has the following implications and recommendations.

Nursing Implications

Nursing practice

- The study provides empirical evidence for effectiveness of Ichthammol glycerin in phlebitis following peripheral intravenous cannulation.
- It provides guidelines to the nurse practitioner regarding intervention of phlebitis related to peripheral intravenous cannulation.

Nursing education

- The intervention can be incorporated into nursing curriculum.

Recommendations

Based on the findings of the present study, it is recommended that:

Nursing research

- There is a need to develop and standardize the protocol regarding treatment of phlebitis following intravenous cannulation
- The study can be conducted on a large sample and in different hospitals.
- The researcher while working found that the incidence of phlebitis with NTG (Nitroglycerin) was very rare and incidence of phlebitis with Amiodarone was very high. It is recommended that further study to be done to compare the incidence of phlebitis related to NTG and Amiodarone therapy.
- Further research could be carried out to identify the occurrence of post-cannulation phlebitis with different sizes and types of cannulas by adopting probability random sampling of all patients with intravenous peripheral access.
- The literature showed that Essaven gel had shown good response in post-cannulation phlebitis. In future, a double-blind randomized control trial could be carried out among Ichthammol glycerin, Heparinoid preparation, Magnesium sulfate glycerin and Essaven gel to measure efficacy, safety and pharmacoeconomy in post-cannulation phlebitis patients.

Nursing practice

- The Ichthammol glycerin can be used as an intervention in post-cannulation phlebitis.

Recommendations

In the research study, recommendations hold significant importance as they represent the ultimate outcome of the research process. Stemming from the study's findings, conclusion, and implications, researchers should carefully consider what recommendations are warranted. These recommendations can encompass a range of areas, including further research, practice, education, theory development, and administration. Importantly, recommendations naturally flow from the implications, essentially extending their implications. In fact, recommendations are the extension of the implications. Each researcher, after having undergone through the process of research, often makes suggestions for future studies that emerge logically from the results of the present study. This may include replicating the study on larger sample, doing a multicentric study, conducting the same study on some other subjects, etc. It is essential to refrain from offering recommendations that is not linked to the study findings.



SUMMARY

- Data in research can be classified as quantitative (measured in numbers) or qualitative (attributes or categories). Quantitative data can be further divided into categorical (discrete) data with distinct values like the number of students in a class, and continuous data, which can have infinite values in a range.
- The unit of analysis is the main entity under study in research, such as individuals, groups, or social organizations. Researchers need to choose their unit of analysis carefully as it impacts the conclusions they can draw from their research.
- There are four levels of measurement: (1) Nominal (categorical), (2) Ordinal, (3) Interval, and (4) Ratio. Understanding the level of measurement is crucial for selecting appropriate statistical tests and interpreting data effectively.
- The first step in analyzing quantitative data involves preparing the data. This includes compiling the collected data, editing it for quality and completeness, coding the data into numerical values, and organizing it in a way that makes it suitable for analysis.
- The second step in analyzing quantitative data is description of characteristics of dataset. Descriptive statistics is a fundamental component of the data analysis process, providing a comprehensive summary of the main characteristics of a dataset. This step is crucial in quantitative research as it helps researchers make sense of the data, identify patterns, and communicate their findings effectively.
- Third step is drawing inferences from the data. Inferential statistics involves estimating population parameters (e.g., population mean or proportion) based on sample statistics (e.g., sample mean or proportion).
- Tests of significance are a fundamental component of statistical analysis used to determine the significance of observed differences or relationships in data. These tests are categorized into two main groups: (1) Parametric tests and (2) Nonparametric tests.
- Fourth step is writing interpretation and discussion from the analyzed data. This stage is where the researcher transforms the numerical or textual findings into a coherent narrative, providing context, insight, and relevance to the research.
- Commonly employed software for quantitative data analysis includes Statistical Package for Social Sciences (SPSS), Microsoft Excel, Epi Info, STATA, and Minitab, each of which has unique features designed to streamline data analysis and presentation.
- In nursing and public health research, a widely adopted approach for qualitative data analysis is thematic analysis. This method involves coding, which involves labeling specific text segments in the transcript, followed by categorizing, which entails grouping similar codes together.
- Tabulation and graphical presentations are widely accepted and used method of presentation of data. This includes tables, bar graphs, pie charts, frequency polygon, histogram, line graph, pictograph, maps, etc.
- The conclusion in a research study is not a mere summary but a concise and systematic presentation of the researcher's convictions based on the interpretation of findings, ensuring alignment with the research questions, objectives, and methodology.
- Limitations in a study encompass factors beyond the researchers' control that can potentially weaken the research, such as sample size and time constraints, impacting the credibility and generalizability of findings.
- Implications entail considering the conclusions of findings and their relevance to theory development, future research, nursing education, administration, and practice.



ASSESS YOURSELF

Long Answer Questions

1. How will you prepare the data for analysis?
2. Discuss the importance of careful interpretation of data.
3. What points will you keep in mind while writing conclusion of a research study?
4. Write the various methods of graphical presentation of data.

Short Answer Questions

1. Write a short note on implications and recommendations.
2. Write a short note on the following:
 - a. Tabulation method of data presentation
 - b. Frequency distribution
 - c. Scattered diagram
 - d. Ogive
 - e. Polygon

Multiple Choice Questions

1. Which of the following is NOT included in making a table?
 - a. Its title should be comprehensive.
 - b. It should be self-explanatory.
 - c. Whole of the data of the table should be included in the text of the table.
 - d. It should be checked in text by its numbers.
2. Which of the following is a type of bar graph?
 - a. Polygon
 - b. Histogram
 - c. Normal curve
 - d. Line graph
3. Which of the following is TRUE of missing value?
 - a. Not to put zero for it
 - b. May put mode to replace it
 - c. Should not be basis for exclusion
 - d. Does not affect the results
4. Which of the following is TRUE about diagrammatic representation of data?
 - a. Histogram is used for discrete data
 - b. Pie chart can be drawn as rectangle
 - c. Random scatter diagram implies lack of relationships
 - d. Positive correlation is indicated by a horizontal line
5. Which of the following data presentation method uses angle for construction?
 - a. Table
 - b. Pie graph
 - c. Bar chart
 - d. Frequency
6. When interpreting the data, it is easier to start with the:
 - a. Hypothesis testing
 - b. Correlation
 - c. Descriptive data
 - d. Conclusion
7. A statistically significant result is conventionally indicated by a cut off p value of:
 - a. <0.9
 - b. <0.5
 - c. <0.1
 - d. <0.05

8. The process of transforming qualitative research data from written or tape recorded interviews into typed text is called:
 - a. Segmenting
 - b. Coding
 - c. Transcription
 - d. Memoing
9. Researchers are usually interested in supporting which of the following hypothesis?
 - a. The alternate hypothesis
 - b. The null hypothesis
 - c. Both the alternate and null hypothesis
 - d. Neither the alternate nor the null hypothesis
10. Which of the following is an important point to kept in mind while writing 'results' section?
 - a. Do not explain how you handled your missing values
 - b. Do not explain the techniques you used to 'clean' your data
 - c. Specify any computer programs used for data analysis
 - d. Do write the interpretation of results in this section

Answer Key

1. c	2. b	3. b	4. c	5. b	6. c	7. d
8. c	9. a	10. d				

BIBLIOGRAPHY

- Armitage P, Berry G, Matthews JN. *Statistical Methods in Medical Research*, 4th edition. USA: Blackwell Science; 2002.
- Burns N, Grove SK. *Understanding Nursing research*. 4th Edition. Noida: Elsevier; 2008.
- Dempsey PA, Dempsey AD. *Using Nursing Research: Process, Critical Evaluation, and Utilization*. 5th edition Philadelphia: Lippincott Williams and Wilkins [online] Available from.
- <http://masternmathandscience.classworksonline.com/courses/lesson.php?id.> [Accessed on August 2015]
- <https://www.mheducation.co.uk/openup/chapters/9780335227242.pdf>. [Accessed August 2015]
- Le CT. *Introductory Biostatistics*. New Jersey: John Wiley and Sons; 2003.
- Nieswiadomy RM. *Foundations of Nursing Research*. 5th edition, New Delhi: Dorling Kindersley; 2008.
- Polit DF, Beck CT. *Nursing research: Principles and methods*. 7th edition Philadelphia: Lippincott Williams and Wilkins; 2004.
- Roberts K, Taylor B. *Nursing Research Process: An Australian Perspective*. 2nd edition. Thompson, Nelson Australia Pty Limited; 2002.



Mapping of the most important topics from the Book at one place with one click search
Get 50+ Important topics for Seamless Learning and Quick Understanding



Scan the QR Code to Download the App

Nursing Next Live
The Next Level of Nursing Education

CBS Phyigital Books >
Nursing Research and Statistics PHYITAL



Communication, Critiquing and Utilization of Research Findings

LEARNING OBJECTIVES

After the completion of the chapter, the readers will be able to:

- Understand ways to disseminate the research findings.
- Discuss the preparation of a research report.
- Discuss the characteristics of a good research report.
- Identify various ways of presentation at the conference.
- Explore the steps in publishing an article.
- Comprehend importance of writing references.
- Identify various styles of writing references.
- Understand use of reference management software.
- Comprehend process of critical review of research.
- Discuss the guidelines for critically evaluating a research articles and thesis.
- Enumerate the guidelines while writing the critical review.
- Discuss the need of utilization of research in nursing.
- Identify the barriers to utilization of research in nursing.
- Discuss the measures to be taken to facilitate utilization of research in nursing.

CHAPTER OUTLINE

• Introduction	• Oral Presentations
• Communicating/Disseminating Research Findings and Their Importance	• Developing a Policy Brief
• Criteria for Communicating the Research	• Peer Reviewed Research Papers/Scientific Writing
• Methods of Communicating Research Findings	• Writing Research Report
• Abstracts	• Funding for Research
• Posters	• Research Utilization

KEY TERMS

Bibliography: A list of sources and references used in a research project or paper.

Critical review of research: A systematic and in-depth assessment of a research study's strengths and weaknesses.

Dissemination: The act of spreading research results and knowledge to a wider audience, often through various communication channels.

In-text citation: The practice of citing sources within the body of a research paper or document to give credit to the original authors.

Information source: A location or reference, whether print or digital, from which data or knowledge can be obtained.

Interactive data visualization: The creation of visual representations of data that allow users to interact with and explore the information.

Journal research article: A scholarly paper published in an academic journal presenting the findings of a research study.

Knowledge transfer: The transfer of research-based knowledge from one context or group to another, facilitating its practical application.

Research articles: Scholarly papers that report the results of research studies, often published in academic journals.

Research communication: The process of sharing research findings and insights with the academic community and the public.

Research grant: Financial support provided to researchers for conducting specific research projects or studies.

Research impact: The measure of the effect and influence of research on various aspects, such as policy, practice, or society.

Research use: The application of research findings to inform decision-making, policies, or practical actions.

Thesis: A formal document that presents the author's research and findings on a specific topic, often as a requirement for an academic degree.

Visual analytics: The use of interactive visual representations to explore and analyze complex datasets.

INTRODUCTION

An essential element of knowledge translation, dissemination and impact is sharing and communicating research findings, which is the final and one of the paramount steps of the research process. It is an integral part of research which involves indirect connections, about engagement and learning (rather than just dissemination and transfer) and concerned with varied ways of research utilization.

Communicating research is important to reach a wider variety of people (general public, scientific community, funding agencies, industry (pharmaceutical), policy makers, government, and the health care professionals), for its critical appraisal and to identify relevance of findings in wider context to deliver its potential impact.

The first part of this chapter aims to summarize the means of communicating research findings, from writing an abstract, presenting a poster to publishing a peer-reviewed original research paper, including guidelines for writing a policy brief, and the later part focuses on procuring funds for research.

COMMUNICATING/DISSEMINATING RESEARCH FINDINGS AND THEIR IMPORTANCE

Dissemination of research findings is the process of communicating the research results to various audiences. It is the process of sharing research results with the scientific community, policymakers, and the general public. The purpose of communicating or disseminating research findings is discussed as follows:

- **Informing policy and practice:** Disseminating research findings ensures that policymakers, health care professionals, and educators have access to the latest evidence-based information. This knowledge

informs policy decisions, clinical practices, and educational curricula, ultimately improving the quality of care and decision-making.

- **Impact on society:** Research findings can influence public policies, drive changes in health care systems, and even impact economic sectors by offering solutions or insights that benefit society as a whole.
- **Promoting health and well-being:** Dissemination ensures that the latest advances are accessible to health care providers and the public, ultimately promoting wellness and reducing the burden of illness.
- **Advancing knowledge and understanding:** Dissemination is essential for expanding the understanding of various conditions and treatment approaches. It contributes to the accumulation of scientific knowledge and fosters ongoing research in a specific field or subject.
- **Ensuring quality and ethics:** The dissemination process involves peer review and scrutiny, which helps ensure the quality, accuracy, and ethical conduct of the research.
- **Guidance and policy changes:** Dissemination can lead to changes in regulations, protocols and best practices.
- **Fostering innovation and new ideas:** By sharing research findings, researchers contribute to the generation of new ideas and insights. These findings can spark further research inquiries and drive innovation in various fields.
- **Transparency in resource allocation:** For funded research projects, dissemination is essential to demonstrate how research funds are being used. This transparency is crucial for accountability and securing future funding.
- **Educational impact:** Research findings are often integrated into educational curricula, helping to train the next generation of health care professionals and researchers.

CRITERIA FOR COMMUNICATING THE RESEARCH

'Giving right information to the right people in the right format at the right time' is the point to be kept in mind by every researcher in communicating the research findings effectively.

The criteria for effective communication of research include four important elements:

1. **Know your audience:** Be specific in identifying whom you want to reach with your findings, understand their needs, interests and their cultural and traditional boundaries.
2. **Identify key message/major outcome:** Be clear about the findings identified in your research and understand their varied implications.
3. **Tailor output:** Choose the relevant method of disseminating your research. Use varied, usable means of communication in a timely way.
4. **Support users in use of findings:** Ensure provision of evidence, reference links, supplementary material and supporting documents to support your findings and encourage further engagement of reader with your research.

METHODS OF COMMUNICATING RESEARCH FINDINGS

There are traditional methods of communicating research findings, mainly written reports and verbal presentations, and also novel methods which include digital and interactive data visualization methods (Fig. 13.1).

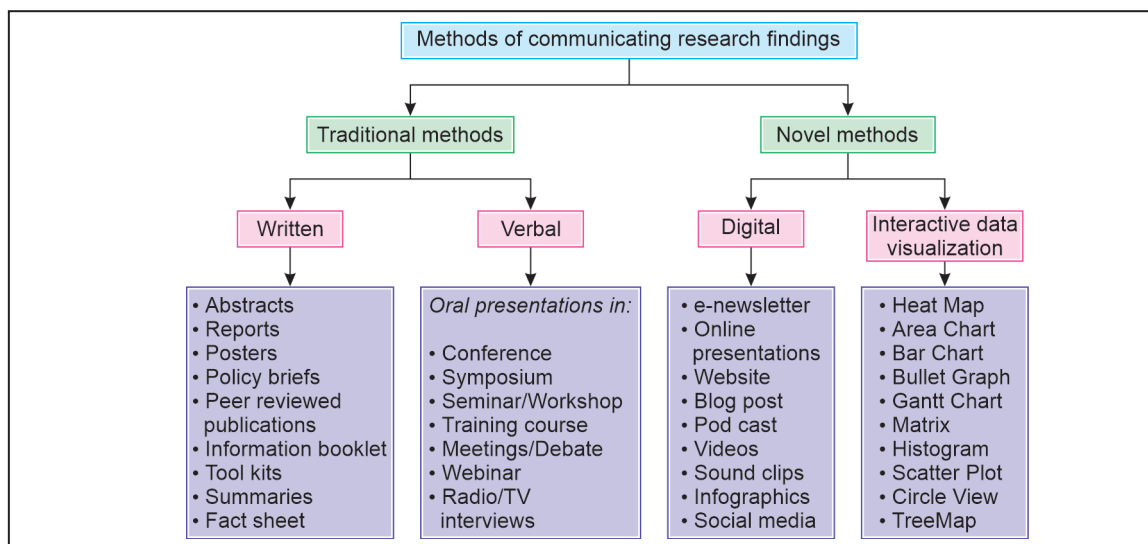


Figure 13.1: Methods of communicating research findings

Traditional Methods

- **Written:** This method includes the reports documented by the researchers after analyzing the data collected while conducting research. There are many forms of written reports, such as:
 - Writing a detailed research report (thesis), writing articles for publication in journals (full/short communication)
 - Abstracts (e.g., research report, key findings summary, magazine article, press release, policy brief, fact sheet, etc.)
 - Peer reviewed research publications
 - Reports
 - Poster
 - Research summaries
 - Toolkits
 - Guides
 - Frameworks
 - Teaching resources
 - Information booklets explaining the research
- **Verbal:** This method includes the reports presented orally by the researchers after analyzing the data collected while conducting research. These oral presentations could be done at local/national/international conferences or symposiums, workshops, journal clubs, continuing in-service educational programs and seminars and in events such as training courses, meetings, conferences, debate, webinars, radio/TV/podcast interviews, etc. Presentations at local-level meetings and at various hospital committee meetings constitute some other ways of conveying the research findings verbally.



Novel Methods

- **Digital:** These are the reports created and publicized electronically. It includes e-newsletter, online presentation, website, blog post, podcast, videos, sound clips, infographics, social media, etc.
- **Interactive data visualization:** Interactive data visualization is the use of modern software tools and processes to produce visual representation of data which can be explored and analyzed directly within the visualization itself.

An interactive report facilitates researchers to easily perform various types of data discovery and analysis (such as drilling down, filtering, or sorting) and independently conduct deeper mining (extracting information from big data) and custom reports on demand.

Visual analytics is the science of analytical reasoning facilitated by advanced interactive visual interfaces which uses visualization and interaction techniques to integrate human judgment in the data analysis process. With the practice of animation, embedded video, stunning graphics, and other visual elements, interactive reports are more dynamic, more engaging, and more effortless to track as compared with static reports.

Examples of Interactive Data Visualization (Navdeep Singh Gill)

- MailChimp (Interactive Annual Report)
- The New Yorker (Interactive Visual Content for Media)
- SAP Intouch Wall (Interactive Executive Presentations)
- Bloomberg (Interactive Financial Data)
- The Lowy Institute Poll (Interactive Polling Data)

Details of the important and most commonly used methods of communicating research findings (in health care research) are given below such as abstracts, posters, e-posters, oral presentation, peer reviewed publications, research reports and policy briefs.

ABSTRACTS

An abstract is the concise summary of a study. Usually it is limited to 200–250 words (APA/Vancouver format). Following the title, this is the most read part of the article. This brief but comprehensive overview is helpful for the readers in deciding whether to read the full text or not. Therefore, a good abstract is one that captures the report's main thrust, impresses the reader, and makes him/her curious to read the entire report. As a guide, it is generally much easier to write an abstract after completing research report.

Abstracts can be **structured or unstructured**. In structured format, abstract is written in the format of IMRaD, i.e., introduction, methods, results and discussion. However, in an unstructured format, the flow of writing remains the same, but it is without subheads.

- The introduction should briefly state the motivation for the research, followed by objectives.
- Material and methods should contain all the aspects of methodology in brief, i.e., research design, setting, participants, sample size, etc.
- The results should show the key findings.
- With brief discussion and the conclusion, it should state the implications of the research findings.
- References should not be cited in the abstract.

Keywords

Keywords must be descriptive and should capture the vital aspects of the study. These words are mainly used for indexing in databases and as search engines to find out the detailed information regarding the study.



BOX 13.1 Template to find keywords

Fill-in your topic and keywords

Eg	Initial Topic	Similar Terms	Broader Terms	Narrower Terms	Related Terms
1.	Kangaroo	Kangaroos, roos, joeys	Mammalia (class), Marsupialia (order), Macropodidae (family)	Macropus (genus), Giganteus (species), Eastern Gray Kangaroo	Australia, Grassland, Wallabies
2.	Fever	Pyrexia, Feverishness, Febrility	Altered body temperature, disturbed thermoregulation	Raised body temperature	Infection, Chills, Flu

It is allowed to include three to five words/phrases/acronyms as keywords (APA format). Keywords have to address the important elements of the research report such as the topic of the study, population, method, application of results or findings (Box 13.1).

POSTERS

A scientific poster is an illustrated abstract of research that is displayed at meetings and conferences. It is one of the preferred ways of presenting research findings to reach a large audience. It is a static, visual medium, containing text, graphics, tables and photos that synoptically present each phase of the research in storyboard layout. The difference between poster and oral presentations is that the presenter should let the poster do most of the “talking”, i.e., the material presented in it should communicate the real meaning of the presenter’s message.

The poster is organized into sections like title, names of the authors along with their affiliations, introduction, material and methods, results, conclusions, recommendations, references and acknowledgments.

For preparing a poster, the instructions regarding the size of the poster, type of display area provided, and other specific criteria regarding the contents of the display, are given by the organizers of the conferences. Regarding the color, it is better to have the background of light color and the colored boxes to emphasize the text and graphics. There should be self-explanatory graphics and tables. The text should be minimum. Use short sentences and avoid jargon, acronyms and unusual abbreviations. In general, there should be about 30% text, 50% graphics and 20% empty space. The empty space should be used between different parts of the poster to differentiate and to put emphasis on these parts. Graphic materials as well as the write-up on the poster should be visible from at least 6 feet away. The overall design of the poster should have a logical flow (Box 13.2).

A successful poster grabs the attention of viewers and communicates the key message clearly. A review of 142 posters by an author in a conference found that 33% of posters were cluttered or sloppy, 22% were difficult to read because of too small font and 38% found it difficult to trace the objectives even in a one-minute search. Avoiding these mistakes is important to ensure that the poster has a positive impact.

BOX 13.2 A useful tip for presentation

Irrespective of the type of presentation, it needs to be creative and original.

Electronic posters (e-posters): A recent development has been the electronic poster (e-poster) which is used in academic conferences of health sciences especially.

Some conferences prefer e-posters in PowerPoint or PDF files, whereas some may prefer using special e-poster software with templates. It is recommended to use infographics, use of multiple audios, videos, enlarged graphics, hyperlinks while preparing an e-poster to make it more informative and engaging. All these features make the e-poster more versatile and informative than a printed poster.

Many of the ideas regarding font, color combination, overall design, logical flow, etc., remain the same as of paper poster.

ORAL PRESENTATIONS

The oral presentation provides an opportunity for the researcher to present the current findings of the study verbally. The advantage of an oral presentation could be that the audience can interact with the presenter and clear their doubts during the presentation. However, there is no permanent record of the presentation other than the conference abstract book.

Process of Oral Presentation

The process of oral presentation in conferences involves multiple steps which include the following:

1. **Abstract submission and acceptance:** The process begins with a call from conference organizers for researchers to submit abstracts of their research papers. These abstracts are evaluated by the organizers to ensure alignment with theme and objectives of the conference. Researchers are informed whether their accepted abstracts will be presented orally or as posters.
2. **Mode of presentation:** The mode of presentation, whether oral or poster, may be determined by the conference organizers or based on the researcher's preference as indicated during abstract submission.
3. **Time allotment:** The conference organizers specify the time allotted for oral presentations. Commonly, ten minutes are provided, with eight minutes designated for the presentation itself and two minutes for discussion or questions.
4. **Presentation content:** The content of the oral presentation follows the IMRaD (Introduction, Methods, Results, and Discussion) structure commonly used in research articles. There is no need to specify a separate literature review section; it can be integrated into the introduction or background. Presentation content should be well-structured, sequenced logically, and free of ambiguity.
5. **Presentation style:** Effective oral presentations require attention to various stylistic elements:
 - **Time management:** Condense the material to fit within the allotted time, typically no more than 10–15 minutes.
 - **Pace:** Speak at a moderate pace to ensure listeners can follow the presentation.
 - **Volume and tone:** Maintain a sufficiently high volume for audibility, and vary tone to engage the audience.
 - **Eye contact:** Maintain eye contact with the audience to enhance their engagement and focus.
 - **Poise:** Present professionally by dressing appropriately, maintaining good posture, avoiding informal speech patterns and mannerisms, minimizing unnecessary movements, and keeping hands out of pockets.
6. **Visual aids:** Visual aids, often in the form of PowerPoint presentations, can enhance effectiveness of presentation. Visuals, such as graphs, tables, and photographs, simplify complex information and help the audience process the material. It is crucial to interact with visual aids during the presentation, pointing to them as needed.



7. **Clarity in presentation:** The presentation should be clear, logical, and easy for the audience to follow. Include important details, and remember that effective communication is not about what you say but what the audience hears, understands, and retains.
8. **Subject knowledge:** The presenter must demonstrate a thorough understanding and mastery of the content of presentation. This includes a deep knowledge of the research and the ability to answer questions or provide further insights during the discussion.

Handling the fear of presentation: Having some fear and getting nervous when speaking in front of a group of people is a common phenomenon. It even expected of skilled speakers too. Poor preparation, lack of command over the content are the major reasons for fear. Proper preparation can reduce fear.

Certain suggestions to overcome presentation fear includes:

- **Follow the 9 Ps of preparation:** Prior, Proper, Preparation, Prevents, Poor, Performance of the Person, Putting on Presentation.
- **Know the room:** Arrive early and become familiar with the place of presentation.
- **Know the audience:** Greet some of the audience as they come and converse.
- Know your topic
- Relax and calm down before presentation
- Give attention to your presentation
- Imagine yourself presenting on the stage and just think that you are presenting successfully.
- Turn your nervousness into positive energy by using purposeful body movements and gestures. Do not let the audience know that you are getting nervous.

DEVELOPING A POLICY BRIEF

Considerations while writing a policy brief:

- Consider who your audience is.
- Policy makers tend to be busy and are unlikely to read long research papers or publications, so be clear and concise in any communications and keep the brief short. Do stick to the topic.
- Have all the relevant information, statistics and evidence prepared.
- Write your policy brief when your research has just been published, or when it is relevant to a policy issue, in order to build on the momentum of publication or public or political interest.
- Use accessible language and short sentences.
- Use infographics and images to illustrate points.
- Clearly define the sections of your policy brief so it can be scanned easily; prove your argument or issue and include facts and figures.

The contents of a policy brief should be presented in the following format:

- Title—it should be short and informative.
- Executive summary or summary statement that includes the key points of the brief.
- Context and scope of the problem—why is it important; evidence of research; facts and figures.
- Conclusions.
- Policy recommendations or options.
- Sources of information and references—keep this to a limited number.
- Supplementary materials, e.g., case studies, graphs, charts.
- Contact details



PEER REVIEWED RESEARCH PAPERS/SCIENTIFIC WRITING

Research which is not published is research which is not done. Not publishing a research work is treated as unethical on researchers' part. There are many studies conducted in health care sciences, especially by students as a part of their course requirement which is found unpublished.

Research findings whatever the outcome it is, either it is positive or negative/significant or not a significant outcome, it has to be published. Peer reviewed journals are the authentic platforms for communicating research findings.

Writing a scientific paper or a manuscript is an important skill every researcher is supposed to possess. Developing this skill needs experience which comes as one starts writing.

Process of Publishing Research Article

The researchers have to keep in mind that this is just another step in their evaluation as researcher, as they have managed to conduct the whole study. The process of publishing the research article has been depicted in Figure 13.2.

Selecting/Choosing a Journal

Journals are the main information channels for scientific communications. Selecting a relevant and right journal enhances the probability of acceptance of the manuscript. The journal should ideally be chosen before drafting the manuscript to make the writing focused. It is better to keep in mind the second and third choice journals, because if the paper gets rejected by the first journal, one can quickly submit it to the other journal. The following points should be considered while choosing a journal:

- One of the most yet avoidable reasons of rejection of a manuscript is the mismatch between the subject of manuscript and the aims, and scope of the journal, because journals are usually very specific about their subject area, and intend to publish limited areas of research. Therefore, choose a journal which matches your area of study, design and the objectives.
- Decide in which journal to submit the article, possibly by talking to others who have already submitted articles to that particular journal, in order to gauge their responses and get inside information about the journal's reviewing procedures, level of difficulty in getting an article published, etc.
- Also check the popularity of the journal because once the paper is published, it should be read widely by other researchers. Open access policy should also be looked.
- Always look for a peer reviewed and the journal with good impact factor. The journal should be indexed in the popular subject-specific databases. This improves the visibility of research in chosen field of research. Journal impact factor (JIF) is one of the most popular indicators of usage. It shows the average number of citations per paper published in a certain journal in the last two years.
- Prestigious journals usually have eminent researchers as members of their editorial board. Visit the journal website to check the names on the Editorial Board as well as the publishers. Journals published by prestigious publishers imply experience, precision and quality.

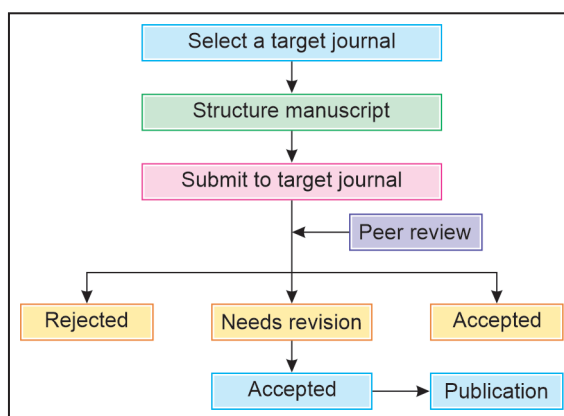


Figure 13.2: Process of publishing research article

- Check whether the journal is published online or in printed format. Publishing in journals that are only circulated in printed form can seriously limit the number of people coming across or reading your work.
- Make sure regarding the frequency of publication. A monthly journal is much more likely to review your article quickly compared with a journal that is published only once a year.
- Digital object identifier (DOI) is a unique digital signature for each paper. It helps in locating the paper on the internet.
- Read an article published in the journal, which is similar to the researcher's own in terms of style, organization and content, etc.
- Follow the guidelines of the chosen journal. Every journal has its own guidelines for writing the articles. Locate the section in the journal about these guidelines. It may be inside the front or at the back cover of the journal. Get this page photocopied and read well. The researcher will come to know the requirements of that particular journal to write the article. This will help in preparing the article properly.

Writing the Manuscript

Format of a Manuscript

Usually the word limit of an article in various journals varies from 3,000 to 5,000. Therefore, whole of the research report needs to be adjusted to suit the requirement of the journal.

The general format of an article includes the title page, abstract, keywords, and the main text written in IMRaD including Introduction, Material and Methods, Results, and Discussion.

Further, it depends whether whole of the research study is to be published as a single article or there could be various aspects of the study, which can be published in more than one article. If it is a single article, it will not take much time to write an article and it would be easy to organize the manuscript writing. All parts of the study, i.e., introduction including review of literature, material and methods, results, discussion along with the conclusion, limitations, implications and recommendations should be shortened as per the word limits of the journal. The essential features of the study should remain intact while condensing the material.

If certain 'part of the study' is to be extracted for publication, then the researcher needs to spend more time in deciding how he/she will do this. He/she should be clear about the focus of the article. It will most probably need a new introduction, a certain amount of extra work in the body of the article and an appropriate conclusion and other things.

References should be as per the format of the journal. It may be different from the style that has been followed in the thesis, so, should be changed accordingly. Discussion and conclusion should be well-substantiated.

When the write-up is over, it is important to check the manuscript for spelling and grammatical errors, and logical flow of ideas. When the manuscript is final from the researcher's side, he/she should request some colleagues to read for content, grammar, flow of ideas and whether the article is fit for the selected journal or not. As per their feedback, the manuscript should be modified.

The last step involves making sure that the manuscript is typed according to the specification of each journal. Generally, these include:

- Double-spacing the entire manuscript.
- Leaving 1 1/2 inch margin on all sides of the page.
- The cover letter, abstract, references, tables, and figures, etc., to be on separate pages.

Fulfill the other requirements as per the guidelines of the journal in which the article is to be submitted.

Prepare the Title Page

Title page depicts information regarding the type of article, a brief title of the article (10–12 words); and the names, designation, and complete address of all the authors. One of the authors is designated as a corresponding author with whom the future correspondences are made by the publishers regarding the publication progress.

Example of title page

- The type of article: Original article
- Title of the article: Awareness among patients with T2DM regarding the disease at a tertiary care referral center
- Names of all authors:
 - Dr Sukhpal Kaur: Lecturer, National Institute of Nursing Education, PGIMER, Chandigarh. Phone Number, Email ID. (Corresponding author).
 - Ms Lata Mandal: Lt col, CON, AFMC, Pune. E-mail ID
 - Ms Priya Nair: Maj, CON, Command Hosp, Eastern Command Kolkata, E-mail ID
 - Ms Narinder Kaur: Vice Principal, Saraswati College of Nursing, Garuan, Punjab. E-mail ID

Presently, majority of the articles are submitted online. A manuscript number is allotted immediately after submitting the manuscript. However, if the hard copy is also to be submitted, do that. Some of the journals require creating a new user name and password to submit the article online.

Following the submission of the article to the editors, the authors are given acknowledgment that their manuscript has been received and that they will be informed about the future progress of the manuscript.

Submitting the Manuscript

After the manuscript has been perfectly written, the researcher should submit it to the chief editor with a cover letter (Box 13.3).

Review Process by the Editors of the Journal

The submitted manuscript is sent for review to 2–3 reviewers of the journal. Following the submission of comments of the reviewers to the editors, after a period of time (usually around 2–3 months), they send a letter to the authors stating either that the article has been rejected (they will write the reasons) or it has been accepted as such or the article needs to be revised further. Comments of all the reviewers are sent to the corresponding author. If the article has been rejected, do not get depressed. See why it was rejected and make

BOX 13.3 Cover letter

To,
The Chief Editor
Name of Journal
Subject: Submission of manuscript.

Sir/Madam

I am pleased to submit the enclosed manuscript entitled '_____' for review and potential consideration for publication in _____ journal. This article is neither published nor under publication in any other journal.

Thanking You

Your name

Corresponding author.



the necessary corrections. Modify the article, select some other journal and submit it again. If the article is to be revised, the authors need to make the relevant corrections and resubmit the article. In some cases, the researcher may not agree with all of the reviewer's comments. Try to make as many corrections as possible.

While resubmitting the article, reply each comment individually. This will ensure that the authors have taken the comments seriously. Once the editors are satisfied, an acceptance letter is sent to the authors.

Publication of the Article

Once the article has been accepted, it is sent to the publishers of the journal. The proofs of the article are sent to the corresponding author, which shows exactly how the article will finally appear in the journal. The authors are asked to go through the article properly and to point out corrections, if any. Following the satisfactory reply from the authors, they are informed regarding the issue of the journal, in which the article will be published.

WRITING RESEARCH REPORT

Characteristics of a Good Research Report

- **Clear objectives:** The report should clearly state the research objectives, outlining the purpose and scope of the study.
- **Logical structure:** Information should be organized in a logical sequence, with a well-defined structure including sections like introduction, literature review, methodology, results, discussion, and conclusion.
- **Comprehensive literature review:** A thorough literature review provides context, demonstrates knowledge of existing research, and justifies the research question.
- **Clear methodology:** The research methods and procedures should be clearly outlined, allowing for the replication of the study by others.
- **Accurate and reliable data:** Data collection and analysis should be meticulous, ensuring the accuracy and reliability of the results.
- **Critical analysis:** The report should critically analyze the findings, discussing strengths, limitations, and potential areas for improvement.
- **Implications and applications:** Discuss the practical implications of the research findings and their potential applications in relevant fields.
- **Concise and precise writing:** The report should be written in a concise and precise manner, avoiding unnecessary details and jargon.
- **Proper citation and referencing:** All sources and references should be properly cited following a recognized citation style, ensuring academic integrity.
- **Ethical considerations:** The report should address ethical considerations, including participant consent, confidentiality, and any potential conflicts of interest.
- **Clarity in presentation:** The report should be presented in a clear and easily understandable language.
- **Visual enhancements:** Effective use of visuals, such as graphs, tables, and charts, can enhance the presentation and interpretation of data.
- **Formatting:** The report should be formatted in a reader-friendly way, with appropriate headings, subheadings, and use of white space.
- **Conclusion and recommendations:** The report should provide a concise and well supported conclusion, summarizing key findings.
- **Transparent and open communication:** The report should communicate findings transparently, discussing unexpected results and uncertainties when necessary.



Guidelines for Writing Research Reports

- Use simple sentences; you might want to use a readability check.
- Avoid jargon wherever possible; if you have to use jargon then you should explain it.
- Avoid gendered and discriminatory language.
- Try to convey your research in a concise and usable way. Infographics can help to illustrate the key parts of your message and may be better for your audience than a lot of text, graphs, and charts.
- Use three simple rules:
 - i. State what are you going to communicate in the report.
 - ii. Communicate precisely.
 - iii. Summarize what you have communicate.
- Always proofread your communications before sending them out.
- Consider audiences with specific communication needs such as the non-hearing, those with sight issues, intellectual and learning difficulties, and dyslexia.

Format of Research Report

The format of a research report is a structured and standardized way of presenting the findings of a research project. The format varies from institution to institution depends on their guidelines, however, the format of a research report typically adheres to the IMRAD structure, which stands for Introduction, Methods, Results, and Discussion. While, the IMRAD format serves as a foundation, specific reporting guidelines may vary, such as those provided by organizations like CONSORT (Consolidated Standards of Reporting Trials) for clinical trials or STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) for observational studies. These guidelines offer detailed instructions on reporting specific types of research, ensuring transparency, and enhancing the overall quality of research reporting. Researchers are encouraged to consult relevant guidelines aligned with their study type to optimize the reporting process and contribute to the advancement of scholarly knowledge. The various reporting guidelines are listed in Table 13.1. The IMRAD format of research report is discussed below:

Introduction

The introduction of a research report often follows a funnel-shaped approach, gradually narrowing down from general information to specific details. The introduction of a research report serves as the gateway to the study, laying the groundwork for readers to comprehend the context, significance, and purpose of the research. It unfolds in several key components:

- **Background of the study:** Provides a historical context or overview of the topic under investigation.
- **Need for the study:** Justifies the relevance and importance of the research, addressing gaps in existing knowledge.
- **Problem statement:** Clearly, defines the problem or issue that the research aims to address.
- **Objectives:** Outlines the specific goals or aims of the research.
- **Hypothesis:** If applicable, states the expected outcomes or relationships to be tested.
- **Assumptions:** Explicitly mentions any assumptions made during the research.
- **Operational definition:** Clearly, defines the key concepts or variables in measurable terms.
- **Conceptual framework:** Illustrates the theoretical foundation guiding the study.
- **Literature review:** Explores the existing literature related to the research topic, highlighting key studies and theories. In research thesis, there is a separate chapter for Review of Literature.



Methods and Materials

This section of a research report is a crucial component that outlines how the study was conducted and the tools and materials employed. It provides a detailed road map for readers to understand the research process. This section typically includes:

- **Research approach:** Describes the overall strategy or approach used in the research (quantitative, qualitative, mixed methods).
- **Research design:** Details the specific design chosen for the study (e.g., experimental, observational, case study).
- **Research setting:** Specifies the location or context where the research took place.
- **Target population:** Identifies the broader group to which the study findings are intended to be applied.
- **Sample:** Describes the participants or subjects selected for the study.
- **Sampling technique:** Explains the method used to choose participants (random sampling, stratified sampling, etc.).
- **Sample size:** Justifies the number of participants in the study.
- **Inclusion/Exclusion criteria:** Defines the characteristics that qualify or disqualify individuals from participating.
- **Tool description:** Details the instruments or tools used for data collection.
- **Validity of tools:** Addresses the reliability and validity of measurement tools.
- **Data collection procedure:** Describes how data was gathered, including steps and protocols.
- **Intervention (if applicable):** Details any treatments or interventions applied during the study.
- **Pilot study:** Describes a preliminary study conducted to test the research procedures.
- **Ethical considerations:** Discusses ethical issues and measures taken to protect participants.
- **Plan for data analysis:** Outlines the statistical or analytical methods used to analyze the data.

Results

This section of a research report is where the findings of the study are presented in a clear and organized manner. It focuses on both descriptive and inferential statistical analyses, providing readers with a comprehensive understanding of the collected data. This section typically includes tables and figures.

Discussion

The section of a research report is where the researcher interprets the results, examines the implications of the findings, and contextualizes them within the broader scope of existing knowledge. This section typically includes the following elements:

- **Major findings:** It summarizes and highlights the key results.
- **Interpretation:** Interprets the meaning and implications of the findings.
- **Comparison with previous research:** Compares the results with existing literature or prior research.
- **Theoretical or conceptual framework:** Connects the results to the theoretical or conceptual framework established in the introduction.
- **Practical implications:** Discusses how the findings can be applied in practical settings. Addresses the real-world impact of the research.
- **Limitations:** Acknowledges any limitations in the study design, methodology, or data collection. Discusses the potential impact of these limitations on the study's validity.

- **Future research directions:** Suggests areas for future research based on the limitations of current study or unanswered questions.
- **Clinical or policy relevance:** Explores the relevance of the findings to clinical practice, policy-making, or other relevant areas.

Conclusion

This section serves as the final synthesis of the study, summarizing key insights, emphasizing the study's contributions, and providing closure to the reader.

Other Aspects of Research Report

- **Title:** The title is a concise and descriptive phrase that summarizes the main focus or topic of the research report. It should be clear, specific, and reflective of the study's content.
- **Abstract:** The abstract is a brief summary of the entire research report in 150–250 words. It typically includes key elements such as the research question, methods, results, and conclusions. The purpose is to provide readers with a quick overview of the study.
- **Keywords:** Keywords are specific terms or phrases that represent the main concepts and topics addressed in the research. They are used to index and categorize the report, making it easier for readers to find relevant studies in databases.
- **References:** The references section lists all the sources (books, articles, websites, etc.) that were cited or consulted during the research. It follows a specific citation style (e.g., Vancouver, APA) to provide accurate information for readers to locate the sources.
- **Acknowledgments:** The acknowledgments section is where the researcher expresses gratitude to individuals or organizations that contributed to the research. This can include funding agencies, colleagues, mentors, or anyone who provides support during the study.

Table 13.1 shows the reporting guidelines for the main study types.

Table 13.1 Reporting guidelines for the main study types (EQUATOR network)

Study design	Reporting guidelines
Randomized trial	CONSORT (Consolidated Standards of Reporting Trials)
Observational study	STROBE (Strengthening the Reporting of Observational Studies in Epidemiology)
Systematic review	PRIMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)
Case report	CARE (Consolidated Criteria for Reporting Qualitative Research)
Qualitative research	SRQR (Standards for Reporting Qualitative Research)
Diagnostic studies	STARD (Standards for Reporting Diagnostic Accuracy Studies)
Economic evaluations	CHEERS (Consolidated Health Economic Evaluation Reporting Standards)
Animal pre-clinical studies	ARRIVE (Animal Research: Reporting of In Vivo Experiments)
Study protocols	SPIRIT (Standard Protocol Items: Recommendations for Interventional Trials)

Writing the References/Bibliography

Referencing is a practice followed by academicians or researchers to indicate the source of ideas, theories, quotes, facts or any other evidence, data or the information that has been used for any write up or assignment. As per the considerations of research ethics, the researchers should identify and acknowledge various sources they have used in their work/write up.

Benefits of Referencing

- Allows reader to locate the original source of information
- Supports specific facts or claims which he/she had made in his/her text, it stands as an evidence
- Makes the information more authenticated
- It shows the extent of reading that the authors have done.
- Removes plagiarism. By referencing, the authors cannot be accused of plagiarism.
- The authors can recognize the scholarly knowledge of another author by citing the information from his or her published work or ideas.

Differences between Reference and Bibliography

References and bibliography are almost the same with subtle differences. References are given to the content which is quoted in the article/text or assignment, whereas bibliography is the list of all the sources which a researcher has gone through to conceive the idea. The key differences between references and bibliography are shown in Table 13.2.

There are different styles of writing references. Most commonly used referencing styles are:

- Vancouver style
- American Psychological Association (APA) style

Vancouver Style of Reference Writing

The Vancouver style, formally known as Uniform Requirements for Manuscripts Submitted to Biomedical Journals Style, is based on an American National Standards Institute (ANSI) standard adapted by the National

Table 13.2 References versus bibliography

Reference	Bibliography
References are given to the content which is quoted in the article/text or assignment	The bibliography includes list of all the sources which a researcher has gone through to conceive the idea
Mostly from the primary data sources	From both primary and secondary data sources
The list is arranged either alphabetically or numerically	The list is arranged numerically
Considers only in-text citations	Considers both in-text citations and other sources referred to develop an idea
Used for thesis and dissertation	Used for journal articles and research papers
Supports arguments by strengthening the evidence	It cannot be used in arguments



Library of Medicine (NLM) for databases such as Medline. It was developed in Vancouver in 1978 by editors of medical journals. They now meet annually at the International Committee of Medical Journal Editors (ICMJE).

Most journals in medical sciences use the Vancouver system to write the references. In this system, reference number does the citation in the text. In the list, the references are in a numeric order in which they are first cited in the manuscript. References are numbered consecutively in the order they are first mentioned in the text. Each reference number is placed in parentheses or superscripted, e.g., throughout the text, tables, and legends. If you want to cite two or more references together, place a comma between the numbers, e.g., ^{1,2} or (1, 2). In case you want to cite a series of consecutive references, dash can be used, e.g., ¹⁻⁶ or (1-6). The author should remain consistent throughout the manuscript. If the same reference is used again, the original number is re-used. Direct quotes are to be used very sparingly. If a direct quote is necessary, quotation marks are placed around the quote and the reference is numbered as usual.

In Vancouver style, while writing the reference list, up to six authors, the names of all the authors are written. If there are more than six authors, then after writing the first six authors, 'et al.' is used.

This style recommends the use of official abbreviations for titles of journals (if available).

While using Vancouver style, if an author's name is to be used in text, it is mandatory to use the citation number as well, immediately after the name of the author. For example, Kaur emphasized the high prevalence of depression in elderly. If there is more than one author it is recommended to use term "et al" after writing the surname of first author. Format of writing the references using Vancouver style has been given in Table 13.3.

APA Style

The APA style is a structured format for all sort of academic writings including the journal articles, books and other commentaries devised by the American Psychological Association (APA) (Table 13.4). The style guide titled as '*Publication Manual of the American Psychological Association*' was first published in 1929 as a seven-page document. After eighty years, the sixth edition of the manual was published in 2009. This style is widely used in social and behavioral sciences like psychology, sociology, social work, nursing and education.

Table 13.3 Format of writing the references using Vancouver style

Type of source	Format	Example
Book personal author(s)	"Surname Initial(s). Book title. Edition - if available. Place of publication: Publisher; Year."	Dempsey PA, Dempsey AD. Using Nursing Research: Process, Critical Evaluation, and Utilization. 5th ed. Philadelphia: Lippincott Williams and Wilkins; 2000.
Book author(s) and editor(s)	"Surname author Initial(s). In: Surname editor Initial(s), editor(s). Book title. Place of publication: Publisher; Year. page(s)."	Kaur S, Singh M. In: Singh A, Kaur S, Kishore J. Comprehensive Textbook of Elderly Care. New Delhi: Century Publications, 1st Edition 2014. p. 239-248.
Chapter in a book	Surname author Initial(s). Chapter title. In: Surname editor Initial(s), editor(s). Book title. Place of publication: Publisher; Year. page(s)."	Meltzer PS, Kallioniemi A, Trent JM. Chromosome alterations in human solid tumors. In: Vogelstein B, Kinzler KW, editors. The genetic basis of human cancer. New York: McGraw-Hill; 2002. p. 93-113.

Contd...



Type of source	Format	Example
e-Book	Surname- Author Initial(s). Title of work. [Internet]. Place of publication: Publisher; Year [cited Month Date]. Available from http.....	Langford S. Transporting your patient: Guidelines for organizing and preparing patients for transfer by air [Internet]. Jandakot (WA): Royal Flying Doctor Service; 2015 [cited 2015 Jun 23]. Available from: http://healthprofessionals.flyingdoctor.org.au/Download Document.ashx? Document ID = 132
Journal article	“Surname Initial(s). Title of article. Journal title/or title abbreviation. Year; volume (issue): page(s). DOI - if available” *It is optional to omit the month and issue number if a journal carries continuous pagination. *It is also optional to use the database unique identifiers such as PMID for PubMed and the clinical trial registration number.	Kaur S, Singh A, Dhillon MS, Tewari MK, Sekhon PK. Incidence of bed sore among the admitted patients in a tertiary care hospital. JPMER 2015; 49(1): 26–31.
Journal article on the internet	Surname Initial(s). Title of article. Journal title/or title abbreviation. [Internet] Year Month {cited Year Month Date} volume (issue): page(s). Available from http://...	Gautam S. Marriage and mental illness. IJSP [Internet] 2018 June {cited 2018 July 8} 15(2): 155–59. Available from https://www.nlm.nih.gov/bsd/marriage/mental.com
Web page	“Author. Title [Internet]. Place: Publisher; Date of publication [date updated; cited date]. Available from: http://...”	Waters J. Phenomenological Research Guidelines. 2 Aug, 2014. Available from http://www.capilanou.ca/psychology/student-resources/research-guidelines/Phenomenological-Research-Guidelines .
Dissertation and master thesis	“Surname Initial(s). Title [type of publication]. Place: Publisher; Year.”	Libang U. A methodological study to develop a nursing care protocol for nurses in meeting physical and psychological needs of stroke patients admitted in selected wards, Nehru Hospital, PGIMER, Chandigarh (M.Sc. nursing thesis, unpublished). National Institute of Nursing Education, PGIMER, Chandigarh; 2014.
Newspapers and popular magazines	“Surname Initial(s). Article title. Newspaper title. Date, year: page.”	Singh N. Well meaning spirit. The Tribune. April 12, 2014:11.
Conference paper (Unpublished paper)	“Surname Initial(s). Paper title. Paper presented at Name of conference; Date; Place”.	Kaur S, Singh AJ, Grover G. Experiences of implementing a nursing approach for management and prevention of bedsores among bedridden patients: A Mixed method approach. International Conference on Evidence Informed Practice: An approach to Health Care Reform; 24–25 Jan; Manipal, 2015.
Government agency	Name of organization or agency. Title. Place of publication: Publisher; Year of publication.	Irish Department of Health and Children. A vision for change: Report of the expert group on mental health policy. Dublin: Stationary Office, 2006.

The manual has a total of twelve chapters. Each chapter covers a specific component of scientific writing like the manuscript structure and content, mechanics of style, display of results, crediting sources and the publication process. Chapter 6 of the manual provides guidance on reference citation. It instructs readers on when and how to cite references in text and on how to construct a reference list that contains everything readers need to locate for each source. Chapter 7 offers a comprehensive set of reference examples for readers to model. It demonstrates the reference components that readers need to locate the work, with an emphasis on electronic sources.

Table 13.4 Format of writing the references using APA style

Type of source	Format	Example
Book personal author(s)	"Author, A.A. (Year of Publication). Title of work. Publisher City, State: Publisher".	Kaur, S., Singh, M. (2014). Clinical Neuroscience and Critical Care Nursing. 1st Edition. New Delhi : Jaypee Medical Publishers
Book author(s) and editor(s)	"Author, A.A. (Year of publication). Title of book. In Editor's First Initial. Last Name (Ed.). Place of publication: Publisher.	Chongtham, V (2016). Aggression in psychiatric patients. In N Sharma (Eds.). New Delhi: Sage.
Chapter in a book	"Author, AA, and Author, B. B. (1995). Title of chapter or entry. In A Editor, B. Editor, and C. Editor (Eds.), Title of book (pp. xxx-xxx). Location: Publisher".	Mohan, J. and Kaur, N. (2014). Emotional Intelligence in relation to leadership traits in young women. In M. Meenakshi, A.K. Vashist, Luxmi and P.K. Ansal (Eds.). Emotional Intelligence. Past and present trends- shaping the future. (pp.1-6). New Delhi: YS books.
e-Book	"Author, A.A. (Year of Publication). Title of work [E-Reader Version]. Retrieved from http://xxxx or doi:xxxx"	Zolli, A. and Healy, A.M. (2012). Resilience : why things bounce back.[E-Reader] Retrieved from https://books.google.co.in/books?id=Af17NTCJqIUcandprintsec=frontcoverandsourc=gbgs_ge_summary_randcad=0#v=onepageandqandf=false
Journal article	"Author, A.A. Author, B. B., and Author, C. C. (year). Title of article. Title of journal, xx, pp-pp. doi:xx.xxxxxxxx"	Ager, A. (2013). Annual Research Review: Resilience and child well-being – public policy implications. Journal of Child Psychology and Psychiatry, 54(4), 488–500. doi:10.1111/jcpp.12030
Journal article on internet	"Author, A.A. Author, B. B., and Author, C. C. (year). Title of article. Title of journal, xx, pp-pp. Retrieved from (give URL of journal homepage) *No retrieval date is needed."	Brook, J.S., Gordon, A.S., Whiteman, M., Cohen, P. (1986). Dynamics of childhood and adolescent personality traits and adolescent drug use. Developmental Psychology, 22, 403–14 18. Retrieved from http://psycnet.apa.org/index.cfm?fa=buy.optionToBuyandid=1986-24169-001
Website/web page	"Author, A. (Date of publication). Title of work. Retrieved month, day, year, from full URL"	Woollastan, V. (2014, Oct 1). What's it like to grow old in YOUR country? Global index ranks the world based on quality of life for the over-60s. Retrieved June 24, 2015 from http://www.dailymail.co.uk/sciencetech/article-2776444/What-s-like-grow-old-YOUR-country-Global-index-ranks-world-based-quality-life-60s.html

Contd...

Type of source	Format	Example
Web page (no authors' name)	"Title of work. Retrieved month, day, year, from full URL"	Elements of a research problem. (April 9th, 2016). Retrieved from http://universalteacher.com/1/elements-of-a-research-problem/ .
Unpublished doctoral dissertation and master thesis	"Author, A. A. (Year). Title of doctoral dissertation or master's thesis (Unpublished Doctoral dissertation or master's thesis). Name of Institution, Location".	Jaggi, G. (2008). A study of psychosocial aspects of happiness among adolescents. [Unpublished Doctoral Dissertation]. Panjab University: Chandigarh.
Doctoral dissertation, from the web	"Author, A. A. (Year). Title of doctoral dissertation or master's thesis (Doctoral dissertation, Location, Name of Institution) Retrieved from URL".	Klassen, C.G. (2013). Job stress and turnover among registered nurses in acute care: a regression analysis. (Doctoral Dissertation, Trinity, Trinity western University) Retrieved from http://www.twu.ca/library/theses/243967_pdf_232870_5747A09C-2B0F-11E3-82FF-D062EF8616FA_klassen_c_g.pdf
Newspaper/magazine article in print	"Author, A.A. (Year, Month, Date of Publication). Article title. Newspaper Title, pp. xx-xx".	Singh, N. (2014, April 12). Well meaning spirit. The Tribune, p. 11.
Online newspaper article	"Author, A.A. (Year, Month, Date of Publication). Article title. Newspaper Title, Retrieved from http://www.nytimes.com "	Woodfield, J. (2015, June 23). Islet transplantation safely restores blood glucose control in type 1 diabetes. Diabetes News. Retrieved from http://www.diabetes.co.uk/news/2015/jun/islet-transplantation-safely-restores-blood-glucose-control-in-type-1-diabetes-90518589.html
Conference paper in print proceedings	"Author of Paper, A., and Author of Paper, B. (Year, Month, date). Title of paper. In A. Editor, B. Editor, and C. Editor. Title of Published Proceedings. Paper presented at Title of Conference: Subtitle of Conference, Location (inclusive page numbers). Place of publication: Publisher"	Sharma, N. and Kaur, S. (2011, March 26). Assessment of quality of life in non-working females. Anthropological and Psychological Approaches for a healthy society. Paper presented at Special Session of the section on Anthropological and Behavioral Sciences of Indian Science Congress, Chandigarh. Chandigarh: DST-Pursue Grant.
Conference proceedings	"Editor, A., and Editor, B. (Eds.). (Year). Title of conference: Subtitle of conference, Location, Date. Place of publication: Name of Publisher".	Mohan, J. (2012). Eastern and Western Perspectives of Positive Psychology: The Rebirth of Consciousness. Proceedings of the 99th Session of the Indian Science Congress. Section of Anthropological and Behavioral Sciences. Bhubneshwar, India.
Government publication	Author Surname, First Initial. Or Government Name. Name of Government Agency. (Year). Title: Subtitle (Report No. xxx [if available]). Place of Publication: Publisher.	US Food and Drug Administration/Center for Drug Evaluation and Research. (2004). Worsening depression and suicidality in patients being treated with antidepressant medications: FDA public health advisory. Washington, DC: Author.



Citing References in Text in APA Style

While citing reference in text, where one needs to cite one work by one author, the following format is used: "Author's Surname (year)". For example, Sharma (2014) reported that 43% of antenatal females experience intimate partner violence. When the citation has three, four, or five authors, cite all authors when the reference appears for the first time; in subsequent citations, include only the surname of the first author followed by et al. and the year. For example, Kaur, Sharma, Bakshi and Sinha (2012) reported high prevalence of stress among nurses. (Used as first citation in text) Kaur et al. (2012) also found (Use as subsequent citation per paragraph thereafter). For a web page with no author, cite the first few words of the title and the year using double quotation marks around the title. The Government documents, books, technical/research reports or brochures can also be considered for writing the references. If a person is named on the title page, use him or her as author. If no person is named, use the government agency, department, or branch as a group author.

Creating a Reference List in APA Style

The reference list is written at the end of the article. The list provides the necessary information required to identify and retrieve each source. In APA style, the reference list should include only those references which are actually used in preparation of article. Hence, the APA style requires use of reference list not bibliography. The order of the reference list is prepared by arranging all entries in alphabetical order by the surname of first author followed by initials of the author's given name. The rule is to alphabetize letter by letter. When there are several works by the same author, they are to be arranged by year of publication, the earliest first. For example, Sharma N (2010) precedes Sharma N (2014). One-author entries precede multiple-author entries beginning with the same surname even if the multiple-author work was published earlier. For example, Kaur (2014) shall precede Kaur, Singh and Sharma (2010). This style mandates writing names of all the authors in reference list up to seven authors. If there are more than seven authors, the following format is used: Kaur, S., Sharma, N., Sharma, S., Thakur, M., Agnihotri, N. Thakur M,....Saini, S. (2015). Effectiveness of Peer evaluation in nursing training. Education and Research Journal, 6, 167-177. For Govt. agency with no author, it can be written as US Food and Drug Administration, 2004.

Reference Management Software (Zotero and EndNote)

With the rapid expansion of scientific literature, various reference management packages have been developed. This software interfaces directly with the most commonly used word processing software. With such tools, the reference information can be organized using whatever citation style has been stipulated. These software packages normally consist of a database in which full bibliographic references can be entered, plus a system for generating selective lists of articles in different formats required by publishers and scholarly journals. Modern reference management packages can usually be integrated with word processors so that a reference list in the appropriate format is produced automatically as an article is written. It decreases the risk that a cited source is not included in the reference list. They will also have a facility for importing the details of publications from bibliographic databases.

There are various reference management software packages available these days. EndNote is one of them, which is popular among many others. EndNote is a commercial software package. The software has a feature wherein it groups the citations into library. Any reference can be added to such library manually either by importing or by copying. Most of the bibliographic databases have an option of directly exporting the given citation to EndNote library itself and saves the user from having to manually enter the citation information and the abstracts. EndNote can automatically format the citation into whatever format the user wishes from a list of over two thousand different styles.

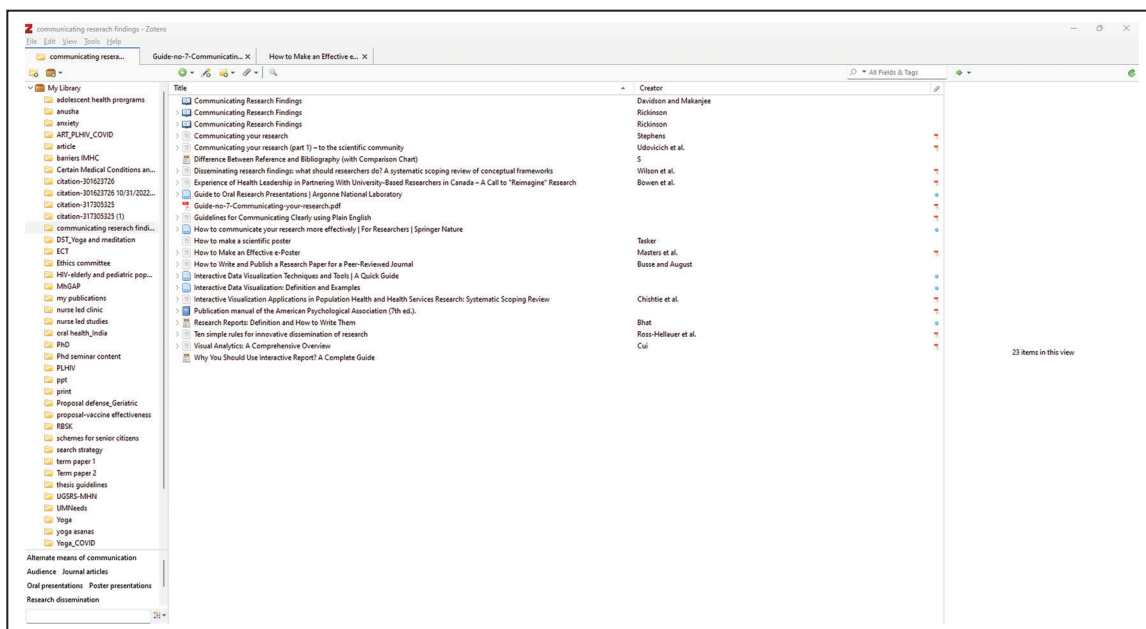


Figure 13.3: Home page of Zotero software

Another common reference management software, which is free is Zotero. This software program also has certain features like web browser integration, online syncing, generation of in-text citations, footnotes and bibliographies, as well as integration with the word processors like Microsoft Office which makes it distinguished.

The software is user friendly and easy to use. Whenever the user is searching any commonly used websites and databases like Google Scholar or PubMed, a small icon of Zotero appears on window (Fig. 13.3). A simple click on the icon would save the whole document to Zotero library. You can add PDFs, images, audio and video files, snapshots of web pages, etc. Zotero automatically indexes the full-text content of your library, enabling you to find exactly what you are looking for with just a few clicks. Figure 13.4 shows the icon for saving into Zotero folder in Word document.

Critical Review of Research Reports

The critical evaluation of published research work involves the assessment of a research report (thesis or research article) in a constructive and intellectually beneficial manner. By examining various aspects of a research report, ideas for further research development or enhancements in planned studies may be generated. The evaluation of a research report aims to impartially assess its strengths and weaknesses.

The term “critical” implies an unbiased examination based on specific criteria and guidelines, rather than taking a negative viewpoint or dismissing others’ mistakes. Thus, the entirety of the study should be read by the reviewers to systematically and methodically evaluate the research work. The clarity, quality, originality, relevance, and presentation of the research are appraised.

The purpose of a critical review is to summarize and evaluate a text and provide a recommendation based on the evaluation.

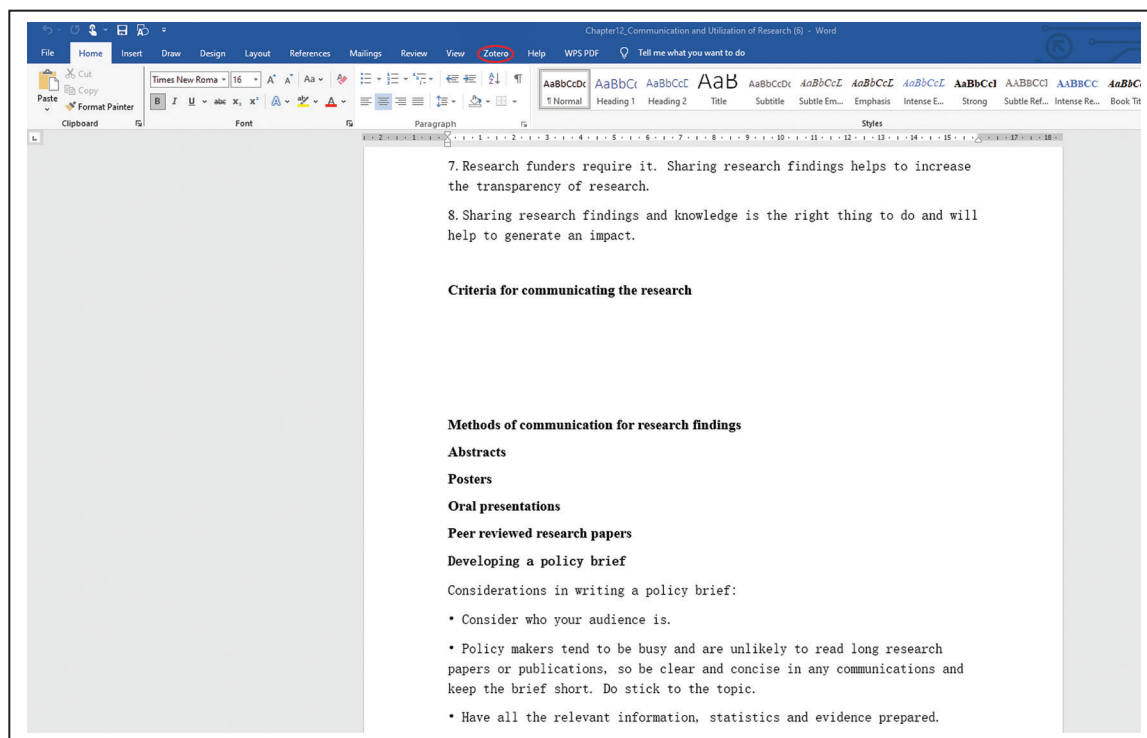


Figure 13.4: Icon for saving into Zotero folder in Word document

Characteristics of a Good Review

A good review

- Conveys the content of the article, the author's approach to the subject, and the author's conclusions.
- Avoids a point-by-point listing of themes in favor of a more integrated approach.
- Places the work in the perspective of its field and gives logic of the significance of work.
- Highlights adequacy and appropriateness of the methods and findings of the study.
- Presents an impartial analysis of the strengths and weaknesses of the article and illustrates those points with examples.
- Is written in a clear and lively style which makes it both interesting and engaging for the readers.

Procedure for writing a critical review:

- **Step 1:** Skim read the article to get a general idea of what it is about
- **Step 2:** Discuss the article with someone else
- **Step 3:** Read the article again and take the important notes
- **Step 4:** Check the main points once more
- **Step 5:** Put the article aside and think about what you have read. Good critical review writing requires careful deliberation and clear thinking.
- **Step 6:** Read through your notes again and look at the diagram you have made. These criticisms could include theoretical claims being made, evidence used, case method procedures used, methodological



BOX 13.4 Template for critical analysis: (Wallace and Wary, 2020)

- Why is this article of interest to me?
- What is the aim or purpose of the authors in writing the article?
- What research gap does the article identify?
- What are the main claims in the article and how do they relate to my work?
- To what extent are the authors' claims convincing?
- What evidence is advanced by the authors to support their claims?
- What arguments are used by the authors in support of their claims?
- What methodology (if applicable) is used by the authors in arriving at their evidence for their claims?
- What positive points can be made in response to the article?
- What negative points can be made in response to the article (i.e., critical comments)?
- On balance, what do I think of the article?

techniques used, sample size, population used in study, statistical support used, use of other writers' arguments.

- **Step 7:** Begin to write an introduction to the review which should be about 10% of the total review. It should include: a general overview of the article; an overview of your review (your approach to the article); an anticipation of your conclusion (i.e., what you will say about the major ideas expressed in the article).
- **Step 8:** Write the body of the review. This must consist of a summary and criticism sections in roughly equal proportions.
- **Step 9:** Write the conclusion. This should be about 10% of the review.

The template for critical analysis is given in the Box 13.4.

Critical Evaluation of Research Article

Journals, also known as periodicals or serials, are publications issued on an ongoing basis, with periodicity ranging from weekly to annually. They are identified by volume and issue numbers. The journal's title typically indicates the subject matter it covers. For instance, "Nursing Research" primarily publishes nursing research articles.

Research articles in journals serve as primary sources of information for individuals in their respective fields of study. These articles provide firsthand information, making them invaluable to researchers. Given the rapidly changing landscape of scientific knowledge, recent and up-to-date journals are particularly valuable. Typically, literature from the past five years is considered relevant. The common layout of a research article is has been presented in Table 13.5.

Guidelines for Critically Evaluating the Journal Article

The simplest way to evaluate the review of the article is to pursue the organization of the article, i.e., under which all headings it is written. As discussed earlier, a well-organized research article has the sections as the title, authors, abstract, introduction, methodology, results, and discussion including the conclusions and recommendations. Guidelines for critically evaluating a journal article have been gives in Table 13.6.



Table 13.5 Common layout of a research article

Title: It indicates the subject matter of an article that primarily what the article is all about.

Author/s: It includes the name/s, their qualifications and place of work/affiliation of all the authors.

Abstract: It is a summary of the article describing the purpose, material and method, results and conclusions of the article.

Keywords: These are the words used to describe the main topics within the article. These are used to help retrieve the article from an online database.

Introduction and literature review: The literature review may be a part of the introduction. It describes what the article is about, what the issue is being addressed in the article, etc. It also details other literature related to the issue being addressed and how it informs the current work.

Methodology/method: It explains the materials and methodology used in the study. This section should present clearly, concisely, and precisely the way in which the research was carried out, and why that method was chosen.

Results: It includes the results of the research study. These should be presented clearly and consistently, in line with the stated objectives of the study. The results are not commented in this section, but should be fully presented, using visual methods such as graphs or tables.

Discussion/conclusion/recommendations: This section discusses the interpretation of the study in the light of other studies, and summarizes the conclusions and recommendations of the research findings. The conclusion should sum up what was most useful and interesting about the study. This should also include an evaluation of the strengths and weaknesses of the findings, as well as of their general significance to further researchers and the general field.

References: It enlists the sources (books, research articles, etc.) cited in the article.

Table 13.6 Critically evaluating a journal article

Aspects of a research article	What to look for
The Journal For a scholarly article, the journal should also be of high-quality.	- Did the article come from a scholarly and appropriate journal? - Is the journal "peer reviewed," In other words, have the articles been reviewed by professionals in the field? - Check the journal for the list of reviewers (editorial board).
Title Focus of the study should be apparent in the title. It should be short and to the point.	- Does the title show the sample and variables? - Is it concise?
Authors The credentials of the authors should be listed. The authors should be experts or specialists in the field. Credentials indicate the institution with which the author is associated and information about their education and past writings.	- Is the author qualified to write about the topic? - Is the author affiliated with a reputable university, government agency, or organization? - Has the author published other articles or books? - Has the author provided any contact information?
Abstract An abstract is a brief summary of the main points of an argument.	- Is there an abstract? - Is the abstract complete and comprehensive including the methods used, main findings, conclusion and recommendation?
Keywords Describe the important subject matter within the article.	- Are the keywords written following the abstract? - Are the keywords appropriate?

Contd...

Aspects of a research article	What to look for
Introduction and literature review It should show a brief exploration of the study area, background information on the problem being studied and the significance of the problem to nursing.	• Does the author clearly define a research problem or topic? • Is its significance explained? Are core issues or research variables identified? • Is specific terminology properly defined? • Does the author provide an adequate, relevant and up-to-date literature review? • Does it discuss current research on the problem? • Are the research objectives clearly stated? Are hypotheses or specific research questions identified?
Material and methods This section should address the key points of the study. It should thoroughly describe the methods used to investigate the problem, and should also describe why these methods were used.	• Does the author clearly identify the research methodology and any associated limitations of the research design? • Are participants described, including the method of sample selection? • Are instruments adequately described, including issues of appropriateness, validity and reliability? • Are any ethical considerations described and explained? • Are details of data collection clearly described and justified?
Results The authors should thoroughly detail the results of the study. The results should be supplemented by figures and tables which should be briefly explained.	• Are the major findings of the study clearly presented? • Do the findings adequately address the stated research objectives? • Are charts, graphs, maps, photographs used to illustrate concepts? • Are the illustrations relevant? • Are the results clear?
Discussion including conclusion and recommendations This involves restating the problem the authors have attempted to study. They should summarize how the results have addressed it. They should discuss the significance of all the results, and interpret their meaning in the light of other findings. It should end with an overall conclusion and recommendations for further research.	• Are the results of the study validating the author's conclusions and/or recommendations? • Are limitations of the research considered? • Is there discussion of any variance between the author's research and prior research findings? • Does the author's research suggest any direction for further research? • Is the practical or theoretical significance of the research emphasized? • Are the conclusions supported by the results? • Are the implications of the study identified? • Do the recommendations outline areas of possible future research? • Do the researchers recommend ways in which current research could be improved?
References Intellectual work always contains a list of resources that were consulted. This reference list should be in sufficient quantity and appropriate for the content.	• Is the reference list exhaustive? • Is the citation style clear and consistent? • Are the references relevant to the study? • Are the references current?

Critical Evaluation of a Thesis

Research thesis consists of preliminary pages including the title page, certificate, table of contents, list of tables, list of figures, acknowledgments, and an abstract. The body of report broadly consists of chapters on introduction, review of literature, methodology, results, discussion, and summary, though each chapter has many subsections. Lastly, there is supporting material constituting the references and appendices.

It has been observed that majority of the authors start critiquing a research report from the body of a research report, i.e., statement of the research problem. However, the preliminary pages and the appendices should not be overlooked; they should also be evaluated critically by the reviewers in order to avoid the mistakes (if any) in future.

For the preliminary pages, it is basically the format of writing which should be proper as per the institution or the university. The Guidelines for evaluation of research thesis is provided in Table 13.7.

Table 13.7 Guidelines for evaluation of research thesis

Component	What to look for
Abstract	Abstract is an outline of the core points of the thesis. It ought to be tangible. It provides an opportunity for the reader to quickly preview the contents of the thesis. The abstract should: • Include a statement of the thesis. • Present the central hypothesis and indicate how the hypothesis was tested. • Summarize primary results of the research. • Include information about sampling and population parameters. • Be limited between 200 and 250 words.
Introduction	It should stimulate the readers' interest in the subject. It should not be written in dull or uninterested manner; otherwise the readers may stop reading. It should convince the readers of the importance of subject. The introduction should: • Clearly relate to the subject of the thesis • Clearly communicate the central idea or theme of thesis • Demonstrate relationships among all parts of the thesis.
Problem statement	Problem statement communicates the central idea of the thesis to the reader. The problem statement should be composed with care so that it accurately reflects the content of the thesis. In a sense, it is the answer to the central question or problem raised. The thesis statement is often incorporated into the introduction. Some of the basic requisites for a problem statement are: • Is the problem clearly identified? • Is the background information on the problem presented? • Are the rationales for selecting the problem clear? • Is the problem timely in terms of current trends in nursing? • Is the problem significant to nursing in that the results could benefit nursing practice and/or contribute to nursing knowledge? • Is the approach appropriate for investigating the problem?
Objectives	• Are the objectives in congruence with the research study? • Are they stated clearly and concisely? • Are the primary/secondary or main/sub-objectives framed separately?
Hypothesis	The purpose of the research hypothesis is to organize and focus the research. If the hypothesis is carefully formulated, all the procedures of the research methodology will be followed. A hypothesis proposes a relationship between two or more variables. These may not be framed for all the types of research studies. If hypotheses are being tested, then see whether the hypotheses: • Logically relate to the research problem • Specify an expected relationship among variables • Clearly and concisely stated • Stated in measurable terms by stating the level of significance ($p = 0.05$) to accept or reject the hypothesis

Contd...



Component	What to look for
Definition of terms (Operational Definitions)	Are all relevant terms clearly defined directly, operationally or theoretically? Assumptions: Are all significant assumptions stated clearly and logically? Delimitations: Are the delimitations clearly mentioned in the thesis? Conceptual or theoretical framework: • Is there a clear elaboration and presentation of the theoretical framework? • Is the framework appropriate for the research problem? • Is this framework clearly developed? • Is the framework useful for clarifying pertinent concepts and relationships?
Review of literature	It is imperative to the identification and specification of the problem, refinement of ideas, specification of research procedures, and interpreting the research results. The review allows the researchers to assess their ideas in the context of others and to replicate, extend, or modify them through critical analysis and synthesis. The literature review should address the following issues: • Is the review extensive enough to cover important research and present assorted positions on the subject? • Is the review relevant to the study? • Does the review inform the author as to the main findings, trends, areas of debate or controversy, and suggestions for additional research? • Does the literature review contribute insight into the subject regarding research procedures and building hypothesis? • Are the references well documented and current? • Is the relationship of the problem to previous research clear?
	• Is there a range of opinions and varying points of view about the problem? • Does the review identify important gaps in the literature? • Is the organization of the review logical? • Does the review conclude with a brief summary of the literature and its implications for the problem?
Research design	Research design is the basic plan for a research study. The questions to consider include: • Is the design clearly identified? • Is the design appropriate for the purpose of the study?
Setting	• Is the setting of study clearly described? • Is the setting appropriate for the study?
Subject selection	• Is the target population clearly described? • Is the method for selecting the sample appropriate? • Is the calculation of sample size discussed? • Is the sample size adequate for the problem being investigated?
Data collection instruments	• Are the instruments appropriate for the study design? • Are the rationales for selecting each instrument discussed? • Is each instrument described as per the purpose, content, strengths, and weaknesses? • Is the type of validity of each instrument described? • Is the type of reliability described? • Is the procedure for development of instrument described? • Is pretesting of the tool discussed?
Data collection procedures	• Are the steps in the data collection procedure clearly described? • Is the data collection procedure appropriate for the study? • Are the problems (if any) during the data collection procedure mentioned by the researcher?

Contd...



Component	What to look for
Ethical considerations	• Is the benefit of carrying out the study stated? • Is the procedure for obtaining informed consent described? • Is information regarding permission from appropriate authority mentioned? • Is permission from Institute Ethics Committee taken? • If the study poses any potential risks to subjects, does the researcher describe these risks and evaluate them?
Data Analysis	• Are the data analyzed using both descriptive and inferential statistics? • Is the application of statistical procedures correct for the level of measurement of the data? • Are the data analyzed as per the objectives of the study? • Are the hypotheses tested and the results reported accurately? • Are tables and figures appropriately used? • Are the tables and figures clear, well labeled, and appropriately discussed?
Discussion	• Are the interpretations based on the data? • Are the findings discussed in relation to the purpose of the study? • Are the findings discussed in relation to the theoretical or conceptual framework and the previous studies? • Is the distinction made between statistical significance and clinical relevance and discussed, if appropriate?
Conclusion, limitations and recommendations	• Is the conclusion clearly stated? • Is the conclusion based on the data and as per objectives of the study? • Are the limitations of the study mentioned and appropriately discussed? • Are the implications for nursing reasonable and relevant? • Are the recommendations clearly formulated and appropriate?
References	• Are all the references written as per the format? • Is each reference complete in all the aspects? • Are the references current?
Other supporting documents	• Is the copy of all the instruments attached? • Is the patient information sheet and consent form in proper format attached? • Is the permission letter from the appropriate authority attached? • Is the permission letter to use an instrument (if applicable) attached? • Is certificate of editing of the thesis is attached?

Concluding the Review

After having gone through the research report, an overall concluding remark based upon the following points can also be given.

- Is the research timely and worthwhile?
- Is the material organized and focused?
- Is the presentation understandable?
- Are the results original and significant?
- Does the author provide fresh insight or stimulate needed discussion in the field?
- Is the article/thesis well structured?
- Are the various sections of the article/thesis of appropriate length?
- Do the author's style and language maintain interest and clarity?

BOX 13.5 Writing the critical review

- Read the entire article thoroughly to get a general idea about the objectives, methodology and results of the study.
- Work thoroughly on each section of the thesis/article in detail as per the criteria provided above.
- While writing the review, first sum up the main points such as the key findings, methodology used to show that the reviewer had read the study and had understanding of the study. Then write the strengths and weaknesses of each section of the study.
- The strength and weaknesses should be supported with examples.
- Write the review in bullet points to make sure that every aspect of the article thesis has been covered.

Writing the Critical Review

Certain guidelines should be taken into consideration while writing the critical review of a research report. These have been enumerated in Box 13.5.

FUNDING FOR RESEARCH

Over the last 50–100 years in science and allied fields, we have evolved a system of doing research. Both private and government institutions are engaged in research. Many private agencies or companies (individually or in groups) are also involved in research activities. Educational and research institutes (colleges, universities and hospitals) are the usual organizations involved in generating new knowledge. These institutes are no longer merely degree delivering institutions, but also work in the development of new facts and knowledge, not only providing the basis for postgraduate (MSc and MD) research projects, but also encouraging and supporting research at doctoral and post-doctoral levels.

Private or government agencies, institutes and individuals have different financial capacities to support and develop research activities. Accordingly, they allocate funds for research and development (R&D). On this basis, the research activities conducted by the institute are either funded or non-funded. In majority of the cases, latter is the case. Therefore, researchers need to build their own financial capacity and search for funding agencies which allocate funds to researchers or scientists on the basis of importance of their area of research. These agencies choose and support only those R&D activities through which society gets the benefits from investment. Thus, each proposal has to compete with others and only the best ones get the funding. In India and worldwide, many organizations provide such financial assistance. The well-known Indian agencies that support biomedical and social science research are the Indian Council for Medical Research (ICMR), Council for Scientific and Industrial Research (CSIR), Department of Biotechnology (DBT), Defense Research Development Organization (DRDO), Department of Science and Technology (DST), Indian Council of Agricultural Research (ICAR), Indian Council for Social Science Research (ICSSR), Indian Space Research Organization (ISRO), Science and Engineering Research Council (SERC), University Grants Commission (UGC), Department of Ocean Development (DOD), etc.

Every funding agency has its own procedures and guidelines for writing the research proposal. Although the basic elements of proposal are same, agencies may have specific formats. These agencies sometimes seek proposals, which are date bound, and focus on specific topics. In general, most agencies accept proposals throughout the year and can be approached anytime. Apart from this, these have committees, which look into the ethical aspects. There is usually a research cell which documents and keeps a tab on individual funded research prospects.

Writing a Research Proposal

Submitted research proposal has both short-term and long-term functions. Short-term function is targeted toward the funding agency. While in long-term a proposal helps the researcher provide the framework to carry out research smoothly, reduce wastage and maximize the output.

Before writing any proposal, it is vital to identify and relate its research interests with those of the research institute and/or sponsoring agency, which have their own priority areas. The selected project must broadly fall in that. These agencies also have set format for screening, proposal valuation and project grants, with only minor variations. More details about the application procedure and format of research institutes and/or sponsoring agencies are available on their websites – PGIMER (<http://pgimer.edu.in>), ICMR (<http://www.icmr.nic.in>), ICAR (<http://www.icar.org.in>); DST (<http://www.nic.dst.gov.in>); DBT (<http://www.dbt.org.in>); CSIR (<http://www.csir.res.in>); UGC (<http://www.ugc.ac.in>).

Writing Preproposal

As per the ICMR proposal while writing guidelines, the researchers or scientists have to first write a preproposal, which has to be submitted or uploaded as a PDF document. Once the Project Review Committees (PRCs) approve the concept proposal, the researcher has to send a full proposal.

Thus, the emphasis while writing preproposal should be on both the study concept and on the writing format. It is mandatory for a preproposal prepared for ICMR to have the following sub headings and specific word limit:

- **Title:** It must be correctly spelt, and the maximum word limit is twenty five words.
- **Introduction:** It should not exceed 250 words.
- **Novelty:** This part must not have more than 100 words.
- **Applicability:** Maximum word limit for it is 100 words.
- **Description of the project:** This section should not go beyond 700 words. This includes methodology, outcome, budget, etc.

The shortlisted proposal is to be uploaded online on the system. Its acceptance or rejection is communicated to the investigator in due course of time. If accepted, the principal investigator (PI) will have to submit detailed proposal online in stipulated time frame. For this, the ICMR adhoc proposal format has to be used. Ten hard copies and a soft copy (CD) must be submitted apart from the online submission.

Apart from this, there are many other formalities. There are around twenty five documents that the principal investigator has to submit as codal formalities at different stages. About nine of these are to be given when full proposal is submitted. These are mentioned as follows:

1. Certificate of previous ICMR project
2. Declaration and attestation form
3. Department of Scientific and Individual Research (DSIR) certificate
4. Institutional ethical clearance project approval
5. Justification of staff, equipment, contingency and TA
6. Nonavailability equipment form
7. Nonsubmission to other agency
8. Undertaking of proposal limits
9. Undertaking of staff recruitment
10. Institutional bio-safety committee (IBSC) certificate (IBSC cert)
11. Mandate form
12. Radio tagged material clearance

13. Budget acceptance by PI
14. Financial conflict of interest by the investigators
15. Undertaking I—Policy for staff recruited
16. Undertaking II—Undertaking to be obtained by the head of the institute from the ad hoc employees of the project.
17. Check list for utilization certificate
18. Cost details of permanent equipment/assets
19. Equipment codal formalities
20. Equipment transfer form
21. Final statement for expenditure
22. Format for annual progress report
23. Format for annual statement of accounts
24. Format for final report
25. Format for utilization certificate
26. Statutory auditors of the host institute (Stat Audit)

Elements/Components of a Research Proposal

The process of developing a research proposal commences with the identification of a general study area. Focused research questions are subsequently formulated for addressing specific inquiries. In addition to complying with funding agency requirements, formalities of the host institute necessitate the submission of specific documents and forms. Institutional ethics committee approval is a prerequisite before the research protocols are considered by the funding agency and before commencing data collection.

A research proposal is an elaborated piece of writing that forms the foundation for the final detailed research, lacking only results, evaluations, and recommendations. The essential components include a rationale, measurable objectives, hypotheses or research questions, literature reviews, and research designs. The study design encompasses a work plan, budget, data collection techniques, and analysis methods, with clear articulation of what, why, and how of each activity. The proposal should also outline the dissemination procedure for sharing research findings with other professionals or policymakers.

Every institute or the funding agency has its own framework for a research proposal. However, the basic components/elements of a research proposal remain the same (Box 13.6).

The components of a standard research proposal are discussed below under their respective heading.

Title

Choosing a title poses a significant and challenging task that gives the first impression and that holds the utmost impact. The research protocol's title must be catchy, interesting, unambiguous, and self-explanatory. Specificity and brevity are crucial, as excessively long or overly general titles fail to capture the reviewer's interest. Recognizing that the title creates a lasting impression, it is imperative to prioritize the most relevant terms, utilizing acronyms if applicable.

Competitive writing is key to ensuring the proposal's selection over others. To achieve this, the title should be finalized after composing the entire research protocol. Emphasizing the importance of conveying the proposal's essence, the title should incorporate a keyword for added appeal. It must be concise yet comprehensive, effectively indicating the project's nature. A good research title is specific, directly addressing the main research topic, enhancing its overall quality. Examples of 'bad' and 'good' titles are provided in Table 13.8.



BOX 13.6 Elements/components of a research proposal

I. Preliminary pages

Title
Names, qualification, affiliation of investigators
Table of contents
Abstract/summary

II. Body of proposal

Introduction

Background of the study
Rationale/relevance/need of the study
Study problem
Research questions
Aims and objectives, hypothesis, assumptions, delimitations, operational definitions.

Review of literature

Research methodology

Study approach
Study design
Setting
Subjects/participants
Inclusion/exclusion criteria
Sampling technique
Method of assignment to study groups
Instruments and materials
Procedure of data collection
Ethical considerations, consent form, privacy of information
Statistical considerations: Plan for data analysis
Dissemination of results
Pilot study
References

III. Appendices

Tools (initial draft)
Intervention (if any)
Patient information sheet and consent form
Permission letters

Table 13.8 Examples of bad and good titles

Sl. no.	Bad title	Good title
Example 1	"The effect of physical activity on obese"	"Testing the effect of physical activity on weight reduction in obese Indian males"
Example 2	"Effects of ambient noise on ADHD children"	"Evaluating the effect of ambient noise on test scores of children with ADHD"
Example 3	"A counseling based pilot study for Prevention, Detection and Treatment of Genetic Disorders and Congenital Malformations"	"Developing and Testing a Flow Chart Based Counseling Service for Prevention, Detection and Treatment of Genetic Disorders and Congenital Malformations: A Pilot Study from a Tertiary Medical Institution of North India"

Title Page

The researcher not just has to focus on the title but also has to give equal attention to the title page. Every sponsoring agency has its own specific format for the title page. Title pages can be general or specific. General title page contains type of proposal; project title; descriptive subtitle; if needed; name of researcher; name of submitting organization; name of funding agency; and date of submission. A specific one will have the following: type of proposal; title of project; descriptive subtitle, if necessary; funding agency; principal investigator's name, qualification and designation; name and address of submitting organization; modes of communication; date submitted; project period; and monetary amount.

Table of Contents

A brief proposal with few sections does not need a table of contents. Detailed proposals require a table of contents. They should follow the order of chapters/contents mentioned in the proposal. The table of contents should list all major parts (Table 13.9).

Abstract/Summary

Abstract is the summary of the entire research protocol. It should be concise (at the most 200–250 words). It must cover the research question, theoretical framework, research design, sampling method, instrumentation, and data analysis procedure. It must have logical and clear presentation of main features. These include—the problem statement; overall objective; design or methodology; time schedule. Format for writing abstract can be structured or unstructured.

Introduction

Introduction should include statement of problem, purpose or rationale and significance of study. It outlines why the study has been planned.

Study Problem

Study problem is also referred to as the research problem. It clearly states the purpose of the study. It should be framed considering the three most imperative questions of research:

1. Why is there a need to conduct this research study?
2. What specific issues are being raised in the study that has not been observed in the literature pertaining to the topic?
3. How the study will attempt to answer these questions?

The importance of the study will only be clear when these questions are answered.

Table 13.9 Table of contents

Sl. no.	Name of chapter/contents	Page no.

Rationale/Relevance of the Project

Rationale clearly indicates the importance or the worth of carrying forward the research. It includes major issues and other relevant problems to be addressed. It sets the stage for research questions in such a way as to show its need. It also outlines what phenomenon and variables are to be identified and studied. It also states the theory or hypothesis on which the study is based.

Specific Study Aims and Objectives

Aim states what one hopes to achieve. It is not specific and measurable. It is the goals to be attained through the study. It broadly highlights the importance of project and the beneficiaries. The objectives of the study are specific and measurable. They must always be stated in measurable terms. Before finalizing any objective, the researcher must be able to answer these questions – Can the outcome be achieved? Can it be evaluated? And finally, can it be evaluated in terms of attainment?

Examples: “To explore the opinions of study subjects regarding the issues affecting their adherence to exercise regime”

“To ascertain the treatment seeking behavior of women with hypertension”

Review of Literature

Review is a process of reading the past studies related to the topic and then linking them to justify the relevance of study. It sets the background and significance of the investigation. It is a critical summary of research topic, generally done to justify a study problem. It states what all is known, and what are the research gaps and weaknesses in prior studies to justify a new study. It also explains why we do not know it yet; and describe how it will be answered. It mentions what has already been done and which problems are still unanswered. The reason for doing literature review is to gain insight into the topic. Going through the previously used methodology helps researcher in preparing effective research design. The good and bad points of past research prevent future mistakes. A good review aids the readers to gain insight into the researcher's thought process and the whole concept behind the research topic.

This is achieved through two steps, i.e., literature search and review. The first step is to find and collect all possible studies and information on the topic. Next is its analysis and use it in a logical and cohesive manner. The researcher has to read previous studies, dissertations, thesis, abstracts, books, systematic reviews, meta-analysis, periodicals, etc., to get a thorough, complete and up-to-date knowledge about the current topic. The literature review must be logical and not a recitation of earlier studies. To the reader, review of literature illustrates how knowledgeable the researcher is.

Types of Review

1. **Self-study review:** This kind of review is for self-study. It increases the knowledge about the subject and builds the confidence of researcher.
2. **Context review:** This is done for readers to see the importance of project. This is achieved through background review that links the project with previous studies.
3. **Historical review:** This review traces the development of the research issue.
4. **Theoretical review:** In this, different theories are put together to relate and address a problem.



5. **Methodological review:** The review is done to analyze the methods and designs used in previous studies. Comparing them highlights the weaknesses and strengths of these studies.
6. **Integrative review:** This review summarizes the current knowledge about the topic by drawing conclusion from the studies conducted in past.

Research Methodology

Science and research progresses through replication. Hence, methodology is a vital section. It needs to be elaborated. Only then other researchers will be able to repeat similar study using same methods. Research proposal is a plan that helps researcher to head in right direction. It should be clear enough to tell the reader how the study will be done. The methodology used can be either flexible or inflexible depending on the subject.

This section provides description of the planned activities to be performed to answer the study questions, i.e., the detailed steps of executing it. The activities include formative research, audience segmentation, intervention development, program implementation, monitoring, revision and evaluation. It also specifically states the type of study (case study, experimental, quasi-experimental), variables to be examined and their relationship. Study design gives details of methods through which study objectives will be achieved and measured. It also tells what all resources will be required (equipment, personnel, etc.).

Justification of selecting the particular apparatus or instruments also needs a mention. The subsection must provide a description of area, where the study will be carried out and of the individuals that will participate in the study and their recruitment details. The demographic characteristics, inclusion and exclusion criteria must also be mentioned. Apart from this the data needed to be collected, and the gathering techniques and tools must be stated in this section. Well explained sampling procedure, sample size, analysis methods and interpretation of data (qualitative and/or quantitative) must also be its part.

In the proposal, the investigators need to mention the objectives of pilot study, if included in the research proposal. The detailed information regarding pilot study has already been given in Chapter 10.

Ethical aspect of the study has to be mentioned clearly. The benefits and risks related to the study subjects must be clearly stated. A sample format of ethical considerations has been depicted in Box 13.7. Modifications can be done as per the need of a particular study.

The methodology part of the proposal also describes exactly how you propose to analyze the data. The technique and formulas, which will be used for evaluating the outcome variables, have to be mentioned beforehand. The statistical package opted for analysis needs to be stated.

BOX 13.7 Sample format of ethical considerations

- The planned study will benefit the participants in terms of _____.
- Formal approval will be obtained from the Institution Ethical Committee.
- A written permission will be taken from Head, department of _____.
- All the participants will be informed about the study and its purpose; and also about their participation and duration of their involvement in the research.
- A written consent will be obtained from each participant involved in the study.
- It will be ensured that there will be no interference in the routine care and treatment of the participants while collecting data.
- The anonymity and confidentiality of the participants will be maintained while collecting data and reporting the results of the study.
- Study participants will not be forced to participate in the study and they will have freedom to withdraw from study anytime, during the course of study.
- Care will be taken not to cause any harm or discomfort to the study subjects.



The proposal should include a plan for dissemination of results. It should state that it will be done by presenting the findings at some conference, writing the report, and by publishing the paper in a good journal.

Tentative Budget

This section describes project's monetary requirement. Once cost of all the study activities are listed, split the costs as per the format of funding agencies. Most of them need cost details (year wise and activity wise) under these heads, viz. establishment (salaries), recurring and non-recurring. These include cost of hiring project personnel, equipment and material cost, administrative cost, travel and subsistence, publication cost and others.

The budget should match the details given in the work program. It must be justifiable. Thus, avoid over budgeting; as a good proposal with inflated budget has no chance of acceptance.

Consent Form

The project needs to have a patient information sheet and consent form and explain how to obtain the consent from the participants. Privacy of information and other ethical considerations must be its part.

Research Team

The name of all research team members along with their qualification, specialization and designation must be clearly mentioned.

References

References are a systematic list of research articles, books, web versions of printed articles, online resources, newspaper and magazine articles, etc., which are referred for writing the research proposal. There are various styles of writing references. Generally, the research agencies mention the styles in which they want the references. If not mentioned, then the references can be written in the most commonly used style of writing, i.e., Vancouver format.

Plagiarism

It is very important that the research proposal should be written in one's own words and not copied. The researcher before submitting the research proposal should get the plagiarism checked for the proposal. Every educational and/or research institute has software for detecting plagiarism. The proposals should preferably have similarity index <10%.

RESEARCH UTILIZATION

Nursing research is very important because it adds to the nursing knowledge that nurses can further apply in patient care. Nurses can enhance their practice by using the evidences created through research. Nurses at any point of the steps of nursing process can use these evidences. In assessment phase of the process, they can make use of a protocol based on research findings. In the planning phase, they can make preferences for the best evidence-based research findings. In implementing the care plan, they can choose research-based methods of giving care. Finally, they can use a research process for evaluating patient care.

Definition and Meaning

Research utilization is a process in which a nursing problem in need of scientific solution is identified, the valid findings from literature are located, they are critically evaluated for their applicability to the problem; the research-based interventions for use in practice are formulated and ultimately the outcome is evaluated.

Research utilization is the process of synthesizing, disseminating, and using research generated knowledge to make an impact on or change in the existing practices in society. It is the use of research findings in one or all aspects of one's work as a registered nurse. At its simplest, it is the use of research. Therefore, research utilization is a systematic process by which the scientifically valid results of research are transferred for use in practice. It means changing a current practice by developing a new research-based document, such as clinical protocol, a procedure, or a policy, which transforms research-based knowledge so that it can be used in practice.

Conducting Research versus Utilizing Research

Conducting research and utilizing the research findings are separate processes. However, they are complementary and interdependent on each other. The purpose of conducting research is to identify and generate the scientific knowledge that can be used to provide optimum care to the patients. The purpose of research utilization is to make use of that knowledge into the practice setting.

Barriers to Research Utilization

Worldwide, since many decades, tremendous volume of research evidences has been generated. Many of them are ready to be implemented in nursing practice. Because of certain reasons, they are not brought into practice. Often, there is a time lag of 10–15 years in between generating the knowledge and implementing in practice. Otherwise, the nurses who are providing direct care to the patients are in a prime position to evoke changes in nursing practice. There are certain barriers/reasons that have been perceived for utilizing these evidences in nursing practice. These are discussed as follows:

- **Gap between research and practice:** There exists a major gap between research and practice all over the world. Historically, there has been separation of nursing education and nursing practice. Nursing research is taught to the students who are undergoing their respective training program as part of their curriculum. After completing the research, there is hardly any dissemination of the research findings. On the other hand, there is no culture of any research activity amongst the practicing nurses.
- **Lack of understanding of research methodology:** There is a lack of understanding of research methodology amongst the nurses. To implement research findings, an ample amount of knowledge of research, research evaluation skills, access to library/journals, etc., is required. However, in India, there is severe lack of knowledge of research especially among the practicing nurses. There are very few people from the nursing education who take interest in conducting research.
- **Resistance to change the practice:** The people are reluctant to change. The nurses generally resist change. They can find all sorts of reasons like changing routines would not work in practice. They are very comfortable with the conventional methods of practice. They are reluctant to accept the results of the research studies more than the safe and sound, established practices, expenditure of implementing fresh practices or rewriting the currently practiced procedures. Actually, changes require efforts, retraining

and restructuring of work habits. It is imperative to demonstrate them (who are unwilling to change certain practices) the benefits they can provide to their patients and their institutions by providing better nursing care based on research findings.

- **Lack of continuing education program:** Another blockade to implement research into nursing practice is the dearth of continuing education programs. Lack of funding, trained staff, and time may be the hindrances to organize the workshops to teach research.
- **Lack of motivation:** There is lack of reward for application of research findings to practice. Few words of appreciation for doing extra work can make a difference. However, motivation is lacking in nursing. Therefore, majority of the nurses do their assigned work only. However, there may be few who continue to do research out of their own interest.
- **Lack of time:** Lack of time is a major barrier to implement the research findings. Lack of convenient access to libraries during work time discourages the nurses to read research.

Facilitating Research Utilization

If the research is done on a need-based issue, it has better acceptance. Therefore, need assessment has to be the first step in any research process. Some of the important steps for facilitating research utilization are as follows:

1. **Interdisciplinary and transdisciplinary research:** Research utilization is viewed as a collaborative venture that requires the concerted efforts, knowledge and skills of all the members of the entire nursing profession. One of the major recommendations for facilitating research utilization is the collaborative approach of educators, researchers, clinicians, practicing nurses, and administrators. Although each group carries out their own tasks, they all can be complementary to each other, and can perform better if work together.

The nursing educators must teach the students the subject of research and must integrate research utilization knowledge and skills at all the levels of nursing training. The nursing researchers must generate and disseminate the scientific knowledge base. After completing the study, the findings should be shared with the respective staff of that particular department/unit and everyone should be trained if the intervention has been found successful. Although, the practice cannot be changed just based upon the results of a single study, even then all the nursing personnel and others will definitely get some insight into that particular research which later on can be replicated to generate more evidences.

2. **Administrative support:** The administrators should facilitate organizational activities in various ways, i.e., allocating adequate financial as well as human resources, establishing a reward system and recognizing the research activities.
3. **Sensitizing the nursing personnel regarding research:** Periodical in-service education on research should be organized to sensitize the nurses irrespective of their cadre. The practicing nurses should be encouraged to begin the process of research by identifying clinical problems and by locating research findings relevant to practice and proposing ways to integrate these findings into clinical practice. Educators should provide the knowledge and skills to all the levels of practicing nurses so that they begin to participate in research utilization. Many nursing conferences include presentations of research studies that have clinical relevance. The people, who are regular in attending various professional conferences, get opportunities to meet researchers and explore practical implications.

SUMMARY

- Dissemination of research findings is the process of communicating the research results to various audiences. It is the process of sharing research results with the scientific community, policymakers, and the general public.
- There are traditional methods of communicating research findings, mainly written reports and verbal presentations, and also novel methods which include digital and interactive data visualization methods.
- An abstract is the concise summary of a study. Usually it is limited to 200-250 words (APA/Vancouver format). Following the title, this is the most read part of the article. This brief but comprehensive overview is helpful for the readers in deciding whether to read the full text or not.
- A scientific poster is an illustrated abstract of research that is displayed at meetings and conferences. It is one of the preferred ways of presenting research findings to reach a large audience.
- The oral presentation provides an opportunity for the researcher to present the current findings of the study verbally. The advantage of an oral presentation could be that the audience can interact with the presenter and clear their doubts during the presentation.
- Peer reviewed journals are the authentic platforms for communicating research findings. Research findings whatever the outcome it is, either it is positive or negative/significant or not a significant outcome, it has to be published. Writing a scientific paper or a manuscript is an important skill every researcher is supposed to possess.
- The format of a research report is a structured and standardized way of presenting the findings of a research project. The format varies from institution to institution depends on their guidelines, however, the format of a research report typically adheres to the IMRAD structure, which stands for Introduction, Methods, Results, and Discussion.
- Referencing is a practice followed by academicians or researchers to indicate the source of ideas, theories, quotes, facts or any other evidence, data or the information that has been used for any write up or assignment.
- The critical evaluation of published research work involves the assessment of a research report (thesis or research article) in a constructive and intellectually beneficial manner. By examining various aspects of a research report, ideas for further research development or enhancements in planned studies may be generated.
- Submitted research proposal has both short-term and long-term functions. Short-term function is targeted toward the funding agency. While in long-term a proposal helps the researcher provide the framework to carry out research smoothly, reduce wastage and maximize the output.

ASSESS YOURSELF

Long Answer Questions

1. Discuss the characteristics of a good research report.
2. Discuss strategies for encouraging research utilization.
3. Discuss how you will prepare yourself for an oral presentation in a conference.
4. Discuss how you will prepare yourself for a poster presentation in a conference.
5. Discuss various styles of writing references.
6. Discuss the guidelines to evaluate a journal article.
7. Discuss the guidelines to evaluate a thesis.
8. Explain the differences between references and bibliography.



Short Answer Questions

1. Why is it important to publish nursing research studies?
2. State the key elements of a research proposal along with brief explanation.
3. Write a short note on Zotero.

Multiple Choice Questions

1. Which of the following is most likely to reach the largest population?
 - a. Thesis
 - b. Article published in a journal
 - c. Poster presentation
 - d. Oral presentation
2. In which of the following section, the researcher fully interprets and evaluates the results:
 - a. Introduction
 - b. Methods
 - c. Results
 - d. Discussion
3. Which of the following is true about writing a conclusion of a research report?
 - a. Can introduce new information.
 - b. Must be based only on material presented in the report.
 - c. It is the same as the abstract.
 - d. Should focus only on the objectives of the research.
4. Which of the following *Do NOT* justify the dictum "Dissemination of research findings is the prime responsibility of a researcher"?
 - a. Research that is not reported is meaningless
 - b. It does not contribute to the body of knowledge
 - c. The findings may be useful to improve the practice
 - d. It may help others to plan their research more effectively
5. Which section of a research report is considered the mirror of the study?
 - a. Methods
 - b. Abstract
 - c. Results
 - d. Discussion
6. In the methods section of the report, the researcher needs to:
 - a. Discuss the results of the research
 - b. Discuss the theoretical background for the research
 - c. The daily research activities conducted during the research process
 - d. Set out in detail how data was gathered and analyzed
7. Which is *true* regarding abstract?
 - a. Is usually placed after the methods
 - b. It summarizes the study
 - c. Is generally of >500 words
 - d. Does not mention methods and objectives
8. Which of the following is *not true* regarding introduction?
 - a. It informs the readers the rationale of the study
 - b. It ends with the research questions
 - c. It outlines the methods
 - d. It gives background of the study
9. Which is *not true* regarding methodology of a research report?
 - a. It should be written in the past tense
 - b. It does not show the ethical justification
 - c. It should describe the tools used in the study
 - d. It should include the details regarding the research designs

10. Which is *not true* regarding a poster presentation?
 - a. The write-up on the poster should be legible from a distance of 3 feet
 - b. There should be self-explanatory graphics and tables on the poster
 - c. The text should be limited to 20% on the poster
 - d. There should not be any empty space on the poster
11. Which one of the following will NOT be a part of a good research proposal?
 - a. Focus on addressing the research objectives
 - b. Focus on specific style of writing references
 - c. Consider only research previously done only in the western countries
 - d. Provide researchers names and address
12. Which one of the following part of the research proposal outlines the data needed for solving a research problem?
 - a. Introduction
 - b. Consent form
 - c. Research design
 - d. Methodology
13. Which of the following option is the best description of a research proposal?
 - a. A framework for data analysis
 - b. A written account of the plan for the intended study
 - c. A description of ethical perspective of the study
 - d. An argument for the merit of the study
14. Which of the following is the purpose of writing a research proposal?
 - a. Acts as a guide for conducting study
 - b. Saves money of the funding agency
 - c. Prevents replication by others in doing a similar study
 - d. Aims to solve some problems through literature review
15. Title of a good protocol includes:
 - a. Keywords
 - b. The overall plan
 - c. The budget
 - d. Consent
16. Which of the following is a part of the process of writing a research proposal?
 - a. PowerPoint presentation
 - b. Training the researcher
 - c. Prewriting
 - d. Selection of the research staff
17. Which of the following is not a reference management software?
 - a. Zotero
 - b. BibDesk
 - c. EndNote
 - d. Strata
18. Which referencing system most of journals in medical sciences use?
 - a. The Vancouver system
 - b. APA system
 - c. Harvard system
 - d. WHO system
19. Which reference writing system mandates that references are to be numbered consecutively in the order they are first mentioned in the text?
 - a. APA style
 - b. Vancouver style
 - c. Harvard style
 - d. Both a and b
20. Copying material you have previously produced and passing it off as a new production is known as:
 - a. Referencing
 - b. Self-plagiarism
 - c. Citation
 - d. Quotation



21. Identify the correct order of a quantitative research report:
 - a. Literature review, results, methods, discussion
 - b. Literature review, methods, results, discussion
 - c. Discussion, Literature review, methods, results
 - d. Methods, results, literature review, discussion
22. Which of the followings is in a research report but not in a proposal?
 - a. Title page
 - b. Abstract
 - c. Findings
 - d. Supporting material
23. Which of the following parts of a journal article is read the most?
 - a. Results
 - b. Discussion
 - c. Introduction
 - d. Abstract

Answer Key

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

BIBLIOGRAPHY

- APA Style Guide to Electronic References, Sixth edition. Washington, DC: American Psychological Association 2012.
- Attig GA and Winichagoon P. Effective proposal writing. Mahidol University: Institute of Nutrition; 1993.
- Dempsey PA, Dempsey AD. Using Nursing Research: Process, Critical Evaluation, and Utilization. 4th edition. Philadelphia: Lippincott Williams and Wilkins; 2000.
- Difference between Bibliography and References. [online] Available from <http://www.difference-between.net/language-difference-between-bibliography-and-references>. [Accessed June 9, 2015]
- End Note. (n.d.) In Wikipedia. [online] Available from https://en.wikipedia.org/wiki/EndNote#Notes_and_references. [Accessed June 23, 2015]
- Hoogenboom BJ, Manske RC. How to write a scientific article. The International Journal of Sports Physical Therapy 20 12; 7 (5): 517
- How to Prepare an Annotated Bibliography: The Annotated Bibliography [online] Available from <http://guides.library.cornell.edu/annotatedbibliography>. [Accessed April 14, 2016]
- How to write References: Library and Learning Resources [online] Available from <http://library.bcu.ac.uk/references.pdf>. [Accessed April 11, 2010]
- Nahata MC. Tips for writing and publishing an article. Ann Pharmacol. 2008;42:273-77.
- Newman W L. Social research methods: Qualitative and quantitative approaches. Boston: Allyn and Bacon; 1991.
- Nieswiadomy RM. Foundations of Nursing Research. 4th edition. New Delhi: Dorling Kindersley; 2008.
- Nursing Research Society of India. Nursing Research and Statistics. First edition. Dorling Kindersley (India) Pvt. Ltd. Noida; 2013
- Olk H. How to Write a Research Proposal. In Deutscher Akademischer Austausch dienst Dienst (DAAD); 2009.
- Pajares F. Elements of a proposal. Emory University; 2007. Available at: <http://www.des.emory.edu/mfp/proposal.html>
- Polit DF, Beck CT. Nursing Research: Generating and Assessing Evidence for Nursing Practice. 9th edition. Philadelphia: Wolters Kluwer Health/Lippincott Williams and Wilkins; 2012.
- Publication Manual of the American Psychological Association 6th edition. Washington, DC: American Psychological Association, 2010.
- Pzreworski A, Salomon F. The Art of Writing Proposals . Social Science Research Council. 1995 rev. 1988. Available at: <http://www.ssrc.org/publications/view/7A9CB4F4-815F-DE11-BD80-001CC477EC70/>



- Reference management software.[online] Available from Retrieved from http://en.wikipedia.org/wiki/Reference_management_software. [Accessed June 9, 2015]
- Referencing – The Harvard System [online] Available from https://education.exeter.ac.uk/dll/studyskills/harvard_referencing.PDF [Accessed June 5, 2015]
- Roberts K, Taylor B. *Nursing Research Process: An Australian Perspective*. 2nd edition. Thompson, Nelson Australia Pty Limited; 2002.
- Shah J, Shah A, Pietrobon R. Scientific writing of novice researchers: What difficulties and encouragements do they encounter? *Acad Med*. 2009;84(4):511-16.
- Shapek R. *Proposal Writing: Stages and Strategies with Examples*; 1995. Available at: <http://facstaff.gpc.edu/~ebrown/infobr3.htm#shapek>
- University of Calgary. *Research Policy: Ethics of Human Studies*. University of Calgary; 1994. Available at: <http://www.ucalgary.ca/~rs/pethics.htm>
- Verhoef MJ and Hilsden RJ. *Writing an effective research proposal*. Departments of Medicine and Community Health Sciences University of Calgary. Available at: http://www.academia.edu/4988207/WRITING_AN_EFFECTIVE_RESEARCH_PROPOSAL.
- Wong PTP. *How to Write a Research Proposal (Part 1)*. Available at: <http://www.dr paulwong.com/how-to-write-a-research-proposal/>
- *Writing a reference list in the Vancouver style* [online] Available from <http://www.ntnu.no/viko/english/papers/vancouverlist>. [Accessed June 9, 2015]
- *Writing a Research Proposal for External Funding*. <https://naarm.org.in/VirtualLearning/vlc/Writing%20research%20proposal.pdf>
- Zotero. [online] Available from <https://www.zotero.org>. [Accessed June 25, 2015]

Congratulations!!

You have completed the CHAPTER thoroughly, now it's time to assess your knowledge and learn more through **My Phygital Book**



Scan the QR Code to Download the App

Nursing Next Live
The Next Level of Nursing Education
CBS Phygital Books > **Nursing Research and Statistics PHYGITAL**



My Phygital Book
Listen, Learn & Practice

Reading is not enough, Now **Listen, Learn & Practice** Every Chapter



Golden Points

Get One Liners of Chapter summary in the PODCAST form

Solved Exercises

Subjective and objective exercises given in book with their solutions to evaluate and assess the complete chapter knowledge

MCQs

Chapter-wise extra MCQs in the form of Practice test to give in-depth concept clarity