

Chapter

5

PICOT, Problem Statement, Research Question, Hypothesis

Lucy B. Trice and Kathaleen C. Bloom

Chapter Objectives



At the conclusion of this chapter, the learner will be able to

1. Discuss processes involved in identifying a researchable problem in nursing practice
2. Write an effective problem statement
3. Discuss essential characteristics needed to pose a research question
4. Identify the criteria for establishing research variables
5. Contrast the various types of hypotheses
6. Explain the differences between conceptual and operational definitions
7. Critically evaluate research questions and hypotheses found in research reports for their contribution to the strength of evidence for nursing practice

Key Terms



- Associative hypothesis
- Complex hypothesis
- Categorical variable
- Confounding variable
- Causal hypothesis
- Continuous variable

- Demographic variable
- Dependent variable
- Dichotomous variable
- Directional hypothesis
- Discrete variable
- Extraneous variable
- Hypothesis
- Independent variable
- Nondirectional hypothesis
- Null hypothesis
- Problem statement
- Research hypothesis
- Research question
- Simple hypothesis
- Variable

Introduction

Every research study begins with a problem the researcher would like to solve. For such a problem to be researchable, it must be one that can be studied through collecting and analyzing data. Some problems, although interesting, are by their nature not appropriate research problems because they are not researchable. Problems involving moral or ethical issues are not researchable, as the solutions to these problems are based on an individual's values. For example, one could not research a question such as "Should marijuana use be legalized?" because the answer to the question depends on one's values rather than on a clearly right or wrong answer. This is not to say that marijuana use cannot be studied. One could study people's opinions regarding marijuana use. For example, one might ask the question, "Do cancer patients hold more favorable opinions regarding legalization of marijuana use than the general public?" The need to avoid moral/ethical questions as a research topic applies to both quantitative and qualitative studies.

Other factors influence whether a problem is researchable using quantitative methods. For a problem to be considered researchable by quantitative methods, the **variables** to be studied must be clearly defined and measurable. This clarity is necessary to apply statistical measures that will identify relationships among the variables. Qualitative studies are not subject to the same restriction, as the purpose of these studies is to describe in detail the phenomenon of interest as it is perceived by the study subjects. In other words, qualitative studies are descriptive in nature and are not concerned with relationships among variables.

Identifying Researchable Problems

There are a number of sources from which researchable problems can arise. Personal experience, whether as a healthcare professional or as a consumer of health care, is a rich source. For example, reviewing procedure manuals might raise the question, “Does one procedure for giving mouth care apply to all patients?” In considering such diverse groups of patients as those with endotracheal or nasogastric tubes in place; those with full-blown AIDS, often accompanied by buccal mucosal lesions; and cancer patients on chemotherapy, one might ask, “Does one size fit all, or should separate procedures be established for each case?” Thus, as many authors point out (Macnee & McCabe, 2008; Norwood, 2010; Polit & Beck, 2010; Schmidt & Brown, 2012), practice experience is a major source for identifying gaps in knowledge that would benefit from research.

The nursing literature can also be a valuable source for researchable problems, particularly for the novice researcher (Burns & Grove, 2007; Norwood, 2010; Polit & Beck, 2010). For example, the researcher might identify a topic of interest and then review the nursing research literature to determine which kinds of studies have been done in that area. Seeing how other researchers have approached a problem can often spark new ideas or perhaps point to studies that would benefit from replication. In addition to offering such indirect assistance in the development of a **problem statement**, the research literature, including unpublished dissertations and theses as well as published research articles, provides direct assistance through specific suggestions for future research in the area. These suggestions may be offered under a special heading for future research, or they may be part of the discussion of the findings.

Social issues often give rise to topics relevant to healthcare research (Norwood, 2010; Polit & Beck, 2008, 2010). For example, the feminist movement raised questions about gender equity in health care and in healthcare research. The civil rights movement led to research on minority health problems in general and to explorations of the differences in effectiveness of medical treatment in different ethnic groups.

Shifts in the U.S. population including increasing numbers of elderly, and increasing numbers of individuals with one or more chronic diseases, also provide impetus for healthcare research. For example the emergence of conditions such as Alzheimer’s Disease has led to research dealing with the nursing care of these patients, as well as research in how best to give “care for the caregiver” (Elliott, Burgio, & DeCoster, 2010). The rising epidemic of obesity at all ages of the

population, and especially in childhood, highlights the need for research into methods to promote skill building with regard to healthy lifestyles (Melnik, 2008). The Institute of Medicine's report on professional education suggests that these shifts in population and changing face of our society also demand a revamping of professional education to better deal with these issues (Institute of Medicine Board on Health Care Services, 2003).

? Think Outside the Box



Using the following examples, develop problem statements, research questions, and/or hypotheses for each one. (1) Which information has been used to determine the method of catheterizing a laboring mother? (2) Which information serves as the basis for the range of blood sugars used within newly diagnosed elderly diabetics? (3) Which items need to be included into the formation of a problem statement, research question, and hypothesis?

The research priorities of the profession, and particularly of the funding bodies interested in healthcare research, are also a primary source for generating researchable problems (Burns & Grove, 2011; Norwood, 2010). For example, the National Institute of Nursing Research (NINR, n.d.) is the largest federal funding body dedicated specifically to nursing research. The NINR has as its mission “to promote and improve the health of individuals, families, communities, and populations” (p. 4). The Institute supports both clinical and basic research, and also provides funding for researcher training. The ongoing funding priorities of the NINR are listed in **Table 5-1**. Further elaboration within each priority is provided in the NINR strategic plan located on the Institute's website: <http://www.ninr.nih.gov/AboutNINR/NINRMissionandStrategicPlan>

Table 5-1

Funding Priorities of NINR

1. Health Promotion and Disease Prevention
2. Advancing Quality of Life: Symptom Management
3. Palliative and End-of-Life Care
4. Innovation

Source: National Institute of Nursing Research (NINR). (n.d.). *NINR mission*. Retrieved from <http://www.ninr.nih.gov/AboutNINR/NINRMissionandStrategicPlan>

Determining Significance of the Problem

Once the problem of interest has been identified, and before going any further, the researcher must determine the significance of the problem to nursing as well as the feasibility of studying the problem. Significance refers to whether a problem is worth studying. A number of authors agree on the criteria that can be used to determine the significance of a problem to nursing (Burns & Grove, 2011; LoBiondo-Wood & Haber, 2010; Polit & Beck, 2008):

- Will nursing's stakeholders (patients, nurses, healthcare community) benefit from the findings of the study?
- Will the findings be applicable to practice, education, or administration?
- Will the findings extend or support current theory, or generate new theory?
- Will the findings support current nursing practice or provide evidence for changing current practice and/or policies?

Some authorities recommend that two additional criteria be considered when determining the significance of a problem:

- Will the findings address nursing research priorities? (Burns & Grove, 2007; Polit & Beck, 2010)
- Will the results of the proposed study build on previous findings? (Burns & Grove, 2011; Polit & Beck, 2008, 2010)

If the research problem does not meet the majority of these criteria, it should be reworked or, if that is not possible, simply abandoned. The single most important of these criteria is perhaps the first one: Will nursing's stakeholders (patients, nurses, healthcare community) benefit from the findings of the study? If this question cannot be answered with a resounding "yes," then the problem is probably not worth studying. Nursing is a discipline that takes pride in research aimed at benefitting patients and changing practice for the better. In the move to evidence-based practice (EBP), benefit to patients and applicability to practice—and especially support for current practice or evidence for changing current practice—are paramount in assessing the significance of a research problem. According to Farrell (2006), "Practices are sorely needed that are based on sound evidence" (p. 119).

Examining Feasibility of the Problem

Feasibility refers to whether the study can be done. It includes considerations such as cost of the study, availability of study subjects, time

constraints, availability of facilities and equipment, cooperation of others, interest of the researcher, and expertise of the researcher (Burns & Grove, 2009, 2011; LoBiondo-Wood & Haber, 2010; Norwood, 2010; Polit & Beck, 2008).

Cost

EBP has emerged from the desire of the majority of healthcare providers (both institutions and individuals) to do what is right for the patient and what will result in more good than harm (Craig & Smyth, 2002). The evidence for EBP is gathered through research (DiCenso, Guyatt, & Ciliska, 2005; Schmidt & Brown, 2012)—and all research studies cost money to some degree. It is the researcher's task to obtain support for the research from the institution in which it will be conducted as well as from potential funding bodies, both within the institution itself and in outside agencies. When seeking this support, the researcher must present a clear picture of the value of the research in terms of patient outcomes versus the costs involved. The current economic climate, which emphasizes the link between outcomes value and resources expenditure, demands nothing less (Malloch & Porter-O'Grady, 2006). In the final analysis, the deciding factor with regard to feasibility of a particular study may be how much the study will cost versus the funds and other necessary support that are available to the researcher.

Availability of Subjects

The type and number of study subjects will vary depending on the purpose and design of the study. Larger numbers of participants are generally needed for quantitative studies if the findings are to be considered significant, whereas smaller numbers of subjects are appropriate for studies using a qualitative design. Clearly, a sufficient number of subjects must be available for the study to be feasible.

Time Constraints

Studies done in connection with the pursuit of academic degrees (e.g., research projects, theses, dissertations), of necessity, have a time frame for their completion. The same is true for studies supported by grant monies, as well as studies for which grant monies are being sought. For a study to be considered feasible, it must have the possibility of being completed within the applicable time constraints.

Availability of Facilities and Equipment

The need for special facilities and equipment can add greatly to the cost of a study. Although not all studies require specialized equipment or facilities, for those that do, both the cost and the availability of these items must be taken into consideration when determining the feasibility of the study.

Cooperation of Others

All studies require a certain amount of cooperation from others. The researcher may need referrals from others to obtain research subjects, for example, or to arrange for use of laboratories or other kinds of facilities. Student researchers in particular often need assistance with data entry in quantitative studies, data transcription in qualitative studies, and statistical analysis. These types of assistance are frequently offered to student researchers without a fee; however, obtaining the assistance requires cooperation from those providing these services. The study subjects themselves must also cooperate in a sense, if the data are to be collected in a timely manner. Thus cooperation of these important others is an essential ingredient of a feasible study. Securing that cooperation falls squarely on the shoulders of the researcher. In their discussion of obtaining cooperation from various others, Burns and Grove (2001) contend that researchers need to maintain objectivity throughout the course of the study, avoiding a tendency to take themselves too seriously; “a sense of humor is invaluable” (p. 426).

Interest of the Researcher

Conducting research, although often rewarding when the final results are in, is nevertheless hard work. To embark on a study that is not of fairly profound interest to the researcher is foolhardy at best, and at worst it can lead to failure to complete the study. If the researcher is not interested in doing the research, then carrying out the study is not generally feasible.

Expertise of the Researcher

Ideally, the researcher should have prior knowledge and experience in the field of study in question. This is not to say that a study would be considered not possible solely because it is a new area of study for the researcher. Certainly, seasoned researchers frequently “branch out” into new areas of study. When less experienced researchers are involved, however, Polit and Beck (2008) caution that difficulties may arise in developing and carrying out a study on a topic that is totally new and/or unfamiliar.

Addressing Nursing Research Priorities

If the body of knowledge that deals with the practice of nursing is to be expanded, the major focus of nursing research should be on issues that influence patient outcomes. Further, it is through this type of research that we will gather the evidence to document the quality and effectiveness of nursing care (Moorhead, Johnson, Maas, & Swanson 2008). The specific areas of focus, in terms of patient outcomes, vary widely. As noted elsewhere, doing research can be costly, so it behooves the researcher to attempt to match his or her research interests not only with those of the institution where the individual works, but also with the priorities established by funding agencies. The major federal funding agency dedicated to nursing is NINR. Other funding bodies with research priorities relevant to nursing include the Agency for Healthcare Research and Quality; private organizations such as the Kellogg Foundation and the Helene Fuld Health Trust; professional organizations such as the American Nurses Foundation and Sigma Theta Tau International; and nursing specialty organizations such as the Association of Perioperative Registered Nurses and the American Association of Critical Care Nurses, to name a few. Taking care to address the funding priorities of a particular organization enhances the possibility of obtaining from that organization the funding needed to complete the research project.

Problem Statement

The problem statement presents the idea, issue, or situation that the researcher intends to examine in the study. The statement should be broad enough to cover the concern prompting the study, yet narrow enough to provide direction for designing the study. It can be conceptualized in the form of a declarative sentence or a question. In some cases, the term “research question” is used interchangeably with “problem statement.”

? Think Outside the Box



Formulate a conceptual and operational definition for catheterization, laboring mother, blood sugar, and newly diagnosed elderly diabetic.

The problem statement is the foundation of the study, and as such is usually preceded by several paragraphs of background information that set the stage for the proposed study. These paragraphs identify the significance of the problem, present justification that the problem is researchable, and provide supporting documentation from the literature.

This general discussion of the problem culminates in the problem statement. The problem statement is often further clarified by including the purpose and goal(s) of the study, all of which are derived from the problem statement.

Research Question

Although the terms “**research question**” and “problem statement” are sometimes used interchangeably, the research question is often more specific than the problem statement. Additionally, research questions (rather than hypotheses) are frequently used to guide studies that are exploratory in nature and aimed at describing variables or perhaps identifying differences between groups in relation to these variables. Research questions also guide studies that examine relationships among the variables being studied but do not test the nature of these relationships. Studies designed to test the nature of the relationships among variables are generally guided by hypotheses rather than research questions (Burns & Grove, 2009; Fain, 2009).

Research questions can be used to guide both quantitative and qualitative studies. Quantitative studies are often initiated to answer several questions derived from the problem of interest, each focused on a specific variable to be measured in the population. For example, West et al. (2011) were interested in obesity prevention, and specifically how to prevent regaining weight initially lost during a weight loss regimen. Most weight loss methods focus on behavioral skill refinement, i.e., changing food choice and/or eating patterns. These same methods are used in maintenance programs, but with disappointing results (Wing et al., 2008). West and her colleagues devised a study to compare the efficacy of a motivation-focused treatment versus a skill-based treatment in maintaining weight loss (2011). The following research questions might be used to guide this study:

1. Does a motivation-focused intervention affect weight maintenance in individuals who have recently lost weight?
2. Does a skill-based intervention affect weight maintenance in individuals who have recently lost weight?
3. Do individuals who follow a motivation-focused intervention maintain their weight loss for a longer time period than those who follow a skill-based intervention?

Questions 1 and 2 are narrowly focused, dealing with one **independent variable** (participation in a motivation-focused intervention and participation in a skill-based intervention, respectively) and the **dependent variable** (weight maintenance). The third question,

while more complex, gets at the heart of the matter: Does one intervention work better than the other?

Qualitative studies, by their nature, explore phenomena about which little is known. Burns and Grove (2007) point out that the research questions guiding these types of studies are limited in number and generally broad in scope, and they include variables or concepts that are more complex than those guiding quantitative studies. For example, Karlsson, Bergbom, and Forsberg (2012) investigated the lived experiences of adult intensive care patients who were conscious while undergoing mechanical ventilation. Using a qualitative approach (namely phenomenology), they conducted in-depth interviews with 12 patients who were determined to be conscious while they were being mechanically ventilated. The interviews took place approximately 1 week following their discharge from the intensive care unit. The research question guiding this study might be stated as follows: What are the essential themes common to the experience of being conscious while undergoing mechanical ventilation? The concepts in this question are much broader than those cited for the earlier quantitative example. Qualitative studies, because they are designed to get at understanding behavior and the values/perceptions that underlie it are particularly important as a starting point for designing and implementing nursing interventions (Ketefian & Redman, 2013).

Components of the Problem Statement

A well-written problem statement for a quantitative study, whether written as a declarative statement or a question, has at a minimum, two components: the population of concern and the variable(s) to be studied. The PICOT format described elsewhere, has the advantage of clarifying more fully the population of the study as well as the intervention/comparison of interest, the outcome desired, and the time frame involved. For example, a researcher might be interested in investigating the use of pet therapy to increase morale in hospitalized patients. As stated, the population (hospitalized patients) is fairly broad and does not provide a lot of direction for the literature search or for the study design. Depending on the specific concern and age group under investigation, the researcher could narrow the population by age (e.g., hospitalized patients between the ages of 6 and 10 years) or other characteristics, such as disease and/or treatment (e.g., hospitalized patients between the ages of 6 and 10 years undergoing treatment for cancer). The variables of interest would be pet therapy and morale. Following the PICOT format, the population of interest (P) would be hospitalized patients between the ages of 6 and 10 years undergoing treatment for cancer; the intervention of interest (I) would be pet therapy; the comparison of interest (C) would be

no pet therapy; the outcome of interest (O) would be increased morale; and the time (T) would refer to time of hospitalization.

Strictly speaking, the term “variable” refers to measurable qualities or characteristics of people, things, or situations that can change, vary, or fluctuate. For example, blood pressure, pulse rate, anxiety level, and degree of pain are all characteristics of people that can vary from one person to another. A child’s reaction to the presence (or absence) of a parent in the hospitalized child’s room during painful procedures can vary from one hospitalized child to another. Variables are the foundation of quantitative studies; they constitute what is being studied in the designated population.

Researchers often want to know what causes or influences a particular phenomenon or, in some cases, what alleviates or diminishes that phenomenon. For example, one might want to know if a hospitalized child’s anxiety level during a painful procedure would be lessened if a parent were present during the procedure. In this case, there are two variables of interest: the child’s anxiety level and the presence of a parent during the painful procedure. The researcher is investigating the effect that the presence of a parent has on the child’s anxiety level during a painful procedure. Because the variable “presence of a parent” is having an effect on the variable “child’s anxiety level,” it is termed the independent variable. By the same token, the variable being affected (i.e., child’s anxiety level) is termed the dependent variable. In a study investigating more than one variable, the variable(s) that is (are) acting on, influencing, or causing an effect on the other variable(s) is (are) called the independent variable(s), and the variable(s) being acted on is (are) called the dependent variable(s) (Burns & Grove, 2011; LoBiondo-Wood & Haber, 2010; Norwood, 2010; Polit & Beck, 2010).

Other types of variables that can affect the outcome of the study but are not the variables the researcher is investigating are referred to as **extraneous variables**. In the example cited earlier, the age of the child could affect his or her anxiety level, regardless of whether a parent is present in the room, and therefore would be considered an extraneous variable. The researcher could control for the variable of age by limiting the study population to a particular age group. Another variable that might affect the child’s anxiety level, regardless of whether a parent is present in the room, is the nature of the painful procedure. The procedure could be specified to control for this variable. With any study, it is important to identify and control for extraneous variables; otherwise, the study results may be confusing and inaccurate. Most studies have extraneous variables of one sort or another. It is important for the researcher to recognize and control for these variables, either in the study design or through statistical procedures, to preserve the validity of the study results. If a study cannot control for an extraneous variable, the variable is then termed a **confounding variable**.

The term “**demographic variable**” refers to characteristics of the subjects in the study. Data on these characteristics are usually collected during the study and are then used to describe the study group. Many different kinds of demographic information can be collected, including details about age, gender, ethnicity, educational level, marital status, and number of children. The types of demographic data collected depend on the purpose of the study; however, at a minimum, data on age, gender, and ethnicity should be gathered.

? Think Outside the Box



Why is it necessary to have a problem statement, research question, or hypothesis? What benefit does it provide? Is one better than others? Which restrictions arise related to the use of the problem statement, research question, or hypothesis?

If a variable can take on a wide range of values (from 0 to 100 or larger), it is often referred to as a **continuous variable**. A continuous variable is not limited to whole-number values. Examples of continuous variables include age, weight, salary, and blood pressure. In contrast, variables that can take on only a finite number of values, usually restricted to whole numbers, are referred to as **discrete variables**. For example, respiratory rate would be considered a discrete variable, as it can take on only whole-number equivalents; although variation in respiratory rate can occur from person to person, a finite number of these variations are compatible with life.

Categorical and dichotomous variables are similar because they represent characteristics that can be measured only in the sense that they are either present or not present. These kinds of variables are often assigned a number for identification, but the number does not represent a quantity. For example, ethnicity might be divided into white, African American, Hispanic, Native American, Pacific Islander, and Asian American, with each classification assigned an identifying number. The assigned number, however, would have no meaning other than identifying the occurrence of each race, perhaps to facilitate counting the number of occurrences of that particular race in the study. In this case, race would be considered a **categorical variable**, with each race included in the study representing a category. If only two categories are possible for a categorical variable, it may be referred to as a **dichotomous variable**. For example, gender is considered a dichotomous variable, as two categories are possible—male and female.

Table 5-2

Problem Statements	
Declarative Statement Format	Question Format
Music therapy decreases the level of maternal anxiety during cesarean section.	Does music therapy decrease the level of maternal anxiety during cesarean section?
Nursing home residents who participate in regular exercise have fewer falls than those who do not.	Do nursing home residents who participate in regular exercise have fewer falls than those who do not?
Participation in a support group improves morale in family caregivers of Alzheimer's patients.	Does participation in a support group improve morale in family caregivers of Alzheimer's patients?
Diabetic patients who perceive of themselves as obese will participate in a weight management program.	Will diabetic patients who perceive of themselves as obese participate in a weight management program?
The number of medication errors made by nurses increases when the number of medications per patient is greater than three (3).	Does the number of medication errors made by nurses increase when the number of medications per patient is greater than three (3)?

Writing the Problem Statement

As noted previously, problem statements for quantitative studies may be written in the form of a declarative statement or a question (**Table 5-2**). The two components that must be included in every problem statement are the population of interest and the variable(s) to be measured. For example, if we were interested in studying the effect of presence of a parent on anxiety level in children undergoing painful procedures, we might construct a problem statement in the form of a question: “Does the presence of a parent affect the anxiety level in children ages 3–5 years undergoing initiation of intravenous therapy?” Alternatively, the same problem could be stated as a declarative statement: “The presence of a parent affects the anxiety level in children ages 3–5 years undergoing initiation of intravenous therapy.” Both statements contain a population of interest (children ages 3–5 years undergoing initiation of intravenous therapy) and two variables (presence of a parent—*independent variable*; anxiety level of the child—*dependent variable*). The only difference between the two is the form of the statement—one is presented as a question and the other as a declarative statement. Note also that the elements of the PICOT format are readily apparent in each of these examples as well as those in Table 5-2.

? Think Outside the Box



Identify the elements of the PICOT format for each of the problem statements in Table 5-2.

Hypotheses

A research question asks whether a relationship exists between variables in a particular population. In contrast, a **hypothesis** stipulates or predicts the relationship that exists. For example, if the research question is “Does the presence of a parent in the room affect the anxiety level in children ages 3–5 years undergoing initiation of intravenous therapy?”, then we might develop several hypotheses:

1. The presence of a parent in the room affects the anxiety level in children ages 3–5 years who undergo initiation of intravenous therapy.
2. The presence of a parent in the room reduces the anxiety level in children ages 3–5 years who undergo initiation of intravenous therapy.
3. The presence of a parent in the room has no effect on the anxiety level in children ages 3–5 years who undergo initiation of intravenous therapy.
4. The presence of a parent in the room increases the anxiety level in children ages 3–5 years who undergo initiation of intravenous therapy.

The advantage of a hypothesis over a research question is that the hypothesis puts the question into a form that can be tested. It is the nature of hypotheses to predict relationships among or between variables. For a hypothesis to be testable, it must stipulate a relationship between at least two variables in a given population.

Within EBP, the research question format incorporates the population of interest, the intervention, a comparison of interest, outcomes, and timing to ensure clarity of the subject (note that these are the components of the PICOT format). This process can also be applied to developing one or more hypotheses for a research study. Each hypothesis should contain the population of interest, the independent variable(s), the dependent variable(s), and the comparison of interest, all of which should lead to the outcome of the study.

Hypotheses and Qualitative Studies

Hypotheses are used in quantitative studies but are not appropriate for qualitative studies. By their nature, they present the researcher’s opinion in the form of a prediction about the outcome of the study. In qualitative studies, however, researchers focus on the viewpoints of the subjects participating in the study rather than on their own. Thus the participants’ viewpoints, rather than the researcher’s hypothesis, guide the qualitative study. Generally, the purpose of qualitative studies is to explore new concepts and ideas about which little is known, or

to discover new meanings for concepts. In keeping with this purpose, researchers using qualitative methods take great care to set aside their preconceived notions about the phenomena under investigation. A hypothesis would be a disadvantage in a qualitative study, because it would predict the outcome of the study and potentially bias the results. Thus, while qualitative studies may generate hypotheses that can then be tested using quantitative methods, they are not themselves guided by research hypotheses.

Types of Hypotheses

A testable hypothesis, also called the **research hypothesis**, predicts the relationship between two or more variables in a population of interest. All four of the hypotheses in the previous example could be considered testable.

Hypotheses may be directional, nondirectional, or null:

- A **directional hypothesis** predicts the path or direction the relationship will take. In the preceding example, both hypothesis 2 and hypothesis 4 are directional hypotheses. Hypothesis 2 predicts a decrease in anxiety with the presence of a parent, and hypothesis 4 predicts an increase in anxiety with the presence of a parent.
- A **nondirectional hypothesis** predicts a relationship but not the path or direction of the relationship. Hypothesis 1 in the previous example is a nondirectional hypothesis; it states that the presence of a parent affects the anxiety level in children ages 3–5 years but does not stipulate the direction of the effect.
- A **null hypothesis**, also called a statistical hypothesis, predicts that no relationship exists among or between the variables in the study. When inferential statistics are used to analyze data, the assumption is that the null hypothesis is actually being tested. Because this is understood, many researchers do not state the null hypothesis when reporting their findings in the literature. In the previous example, hypothesis 3 is stated in the null form.

Hypotheses may also be classified as simple or complex: A **simple hypothesis** specifies the relationship between two variables, whereas a **complex hypothesis** specifies the relationships between and among more than two variables. In the previous example, all four of the hypotheses could be classified as simple hypotheses. In each case, there are only two variables—the presence of a parent and the anxiety level in children ages 3–5 years. An example of a complex hypothesis might be “Religious beliefs, presence of social support, and ethnic background affect the perception of pain in patients who are terminally

ill with cancer.” Here there are four variables—religious beliefs, the presence of social support, ethnic background, and perception of pain. Complex hypotheses may also be termed multivariate hypotheses for the simple reason that they contain more than two variables.

? Think Outside the Box



Describe a problem in which a null hypothesis would be used and state the null hypothesis.

In addition, hypotheses may be categorized as associative or causal. These terms reflect the relationship between or among the variables in the hypothesis. For example, in an **associative hypothesis**, the hypothesis is stated in a way indicating that the variables exist side by side, and that a change in one variable is accompanied by a change in another. However, there is no suggestion that a change in one variable causes a change in another—merely that the variables change in association with each other (Reynolds, 1971).

In contrast, a **causal hypothesis** is stated in a way indicating that one variable causes or brings about a change in one or more other variables (Burns & Grove, 2011). As one might expect, the variable inducing the change is referred to as the independent variable, and the variable being changed is the dependent variable. Causal hypotheses may also be called directional hypotheses. Continuing with the example of the presence of a parent in the room with a child during a painful procedure and its effect on the child’s anxiety level, two of the hypotheses can be termed causal—hypothesis 2 and hypothesis 4. Hypothesis 2 predicts a decrease in anxiety (dependent variable) with the presence of a parent in the room (independent variable), and hypothesis 4 predicts an increase in anxiety (dependent variable) with the presence of a parent in the room (independent variable).

Defining Variables for the Study

The variables to be studied in quantitative research projects are generally defined in two ways—conceptually and operationally. The conceptual definition is a broad, more abstract definition that is generally drawn from relevant literature, particularly the theoretical literature; the researcher’s clinical experience; or, in some cases, a combination of these sources. The conceptual definition is similar to a dictionary definition in that it provides the general meaning associated with the variable, but it is more in-depth and broader in scope. Although

considered the starting point, conceptual definitions rarely give direction regarding how the variable will actually be measured for the study. The operational definition, by contrast, stipulates precisely how the variable will be measured, including which tools will be used, if applicable. If a conceptual definition is abstract, an operational definition is concrete. This concreteness is necessary to allow for precise measurement of the variable(s) of interest in the study.

Evidence-Based Practice Considerations

Stommel and Wills (2004) point out that the ability to apply research findings to practice is an expected competency of advanced practice nurses. However, if we accept that it is the desire of all practitioners of nursing to provide “only that care that makes a positive difference in the lives of those whom they serve” (Porter-O’Grady, 2006, p. 1), then it is clear that all professional nurses—from the new graduate to the seasoned veteran—should have the ability to apply research findings to practice. Inherent in this ability is an understanding of how the research process unfolds and what constitutes good research.

Further, Melnyk and Fineout-Overholt (2011) maintain that “the goal of EBP is to use the highest quality of [research] knowledge in providing care to produce the greatest impact on patients’ health status” (p. 75). To accomplish this, practitioners—and particularly staff nurses who are at the bedside caring for patients on a daily basis—must have the tools to critically analyze research so as to make appropriate EBP decisions. To critically analyze research, these staff nurses must possess a working knowledge of the language of research; recognize a researchable problem statement; distinguish between and among variables, identifying independent versus dependent variables; determine the population of interest; and above all, recognize a well-conducted study, one whose findings are worth consideration for applying to practice. In its purest and best form, EBP happens at the bedside. The burden of implementation rests squarely on the shoulders of the staff nurse.

For more information on EBP, visit the following site: <http://journals.lww.com/ajnonline/pages/collectiondetails.aspx?TopicalCollectionId=10>

Summary Points

1. Every study begins with a problem the researcher would like to solve.
2. There are many sources for researchable problems, including personal experience, the nursing literature, social issues, and the research priorities of funding bodies.

3. The significance of the problem to nursing and the feasibility of studying the problem are important aspects to consider before embarking on any research project.
4. The problem statement presents the issue or situation to be examined and should identify the population of interest as well as the variables that will be studied.
5. Variables may be classified in a variety of ways: (a) independent versus dependent, (b) continuous versus discrete, (c) extraneous, (d) confounding, (e) categorical, and (f) dichotomous.
6. The problem statement may be written as a question or as a declarative sentence.
7. Placing the problem statement in the PICOT format helps to clarify the population, variables, outcome and time frame involved.
8. Hypotheses predict the relationship between or among variables.
9. Hypotheses may take many forms: (a) directional versus nondirectional, (b) simple versus complex, (c) associative versus causal, and (d) null.
10. Variables to be studied are generally defined both conceptually and operationally.
11. For nurses to pursue evidence-based practice, they must understand the research process and all of its components.



RED FLAGS

- Quantitative studies address research problems, research questions, and/or hypotheses.
- Qualitative studies do not use hypotheses, but rather explore research problems and research questions. If a qualitative study discusses a hypothesis, thought should be given to its focus and validity.
- A hypothesis must have at least one independent variable and one dependent variable; it is usually stated in a declarative statement format rather than as a question.
- Key variables within a study should have at least the operational definition provided for consideration.

Multiple Choice Questions



1. Developing a research study to investigate the availability of health care for minority children whose families are on welfare is an example of a research problem generated primarily from
 - A. Practice.
 - B. Social issues.
 - C. Healthcare trends in society.
 - D. Theory.
2. Problems involving moral or ethical issues are not researchable because
 - A. They are too costly to perform.
 - B. Most researchers are not interested in these studies.
 - C. They are based on individual values.
 - D. Data collection is problematic.
3. Determining if studying the problem will lead to results that are applicable to nursing practice is essential when analyzing the _____ of the problem.
 - A. Feasibility
 - B. Profitability
 - C. Cost
 - D. Significance
4. Which of the following topics would be inappropriate for a researchable problem?
 - A. The morality of abortion as a form of birth control
 - B. The relationship between cigarette smoking and weight loss
 - C. The effect of severe dietary restrictions on well-being
 - D. The relationship between religious beliefs and pain perception
5. Which of the following is the best example of a problem statement containing all parts of the PICOT format?
 - A. Children whose parents stay with them experience less pain.
 - B. Hospitalized patients who have a relative with them experience less pain than those who do not.
 - C. Hospitalized children ages 3–5 years whose parents stay with them during painful procedures experience less pain than those who do not.
 - D. Patients who have a relative with them during a transfusion will experience less anxiety than those who do not.
6. Which of the following best represents a well-constructed problem statement?
 - A. What affects pain perception?
 - B. Obesity negatively impacts self-image in first graders.
 - C. This study will compare the effectiveness of antacids.
 - D. Does time of day affect appetite?

7. The two essential parts of the research problem statement are the population and the
- A. Setting.
 - B. Theory.
 - C. Concepts.
 - D. Variables.
8. The research question is “Obesity increases the risk of type 2 diabetes in teenage boys.” Which of the following is/are the independent variable(s)?
- A. Teenage boys with type 2 diabetes
 - B. Gender and obesity
 - C. Obesity
 - D. Type 2 diabetes, obesity, and gender
9. The research question is “Does massage therapy increase satisfaction during cesarean delivery?” Which of the following is/are the dependent variable(s)?
- A. Massage therapy
 - B. Satisfaction
 - C. Music therapy and satisfaction
 - D. Satisfaction and type of delivery
10. Which statement by a fellow student best describes a confounding variable?
- A. “It can take on a wide range of values.”
 - B. “A variable that is restricted to whole numbers.”
 - C. “It describes the characteristics of the study subjects.”
 - D. “A variable that can’t be controlled.”
11. Which of the following best represents a dichotomous variable?
- A. Blood pressure
 - B. Age at death
 - C. Gender
 - D. Weight
12. Which of the following represents a simple hypothesis?
- A. Exposure to pet therapy increases appetite in elderly patients.
 - B. Family support and positive attitude decrease symptoms of dysreflexia in spinal cord injured patients.
 - C. Social support, balanced diet, and regular exercise decrease the incidence of postpartum depression.
 - D. Daily exercise and eliminating carbohydrates from the diet will result in a significant weight reduction in obese diabetic patients.

13. What is the difference between a null hypothesis and a directional hypothesis?
 - A. One is a declarative sentence; the other is a question.
 - B. One assumes a relationship; the other denies that one exists.
 - C. One is researchable; the other is statistical.
 - D. One includes at least two variables; the other does not.
14. Which statement best represents the relationship between a causal and an associative hypothesis?
 - A. They are the opposite of each other.
 - B. One is written in as a question, the other as a declarative sentence.
 - C. One assumes a relationship, the other denies that one exists.
 - D. They are similar to each other.
15. An operational definition of a variable is one that is:
 - A. Broad and abstract.
 - B. Narrow and abstract.
 - C. Concrete and continuous.
 - D. Narrow and concrete.

Discussion Questions



1. You work in a cardiology clinic that treats patients who have coronary artery disease and are recovering from a myocardial infarction. Many of these patients have hypertension and are overweight, and you have noticed that some of them have more difficulty following their medical regimens than others. You want to develop a research study to investigate this problem. How would you go about doing so? What would be a possible problem statement?
2. You are a BSN student enrolled in a research course. The instructor has given you the following problem statement: “Does completion of a mandatory health promotion course affect the incidence of smoking cessation among college students who smoke?” Develop four hypotheses that might be drawn from this problem statement: a null hypothesis, a directional hypothesis, a nondirectional hypothesis, and an associative hypothesis. Can all of these hypotheses be developed? If any of them cannot be developed, why not?
3. Read the following abstract and then provide the following information:
 - A. Identify the population of interest.
 - B. Identify the variables.
 - C. Construct a research question that could have guided this study.
 - D. Construct a null hypothesis.
 - E. Construct a directional hypothesis.

Abstract: Hypertension Treatment and Control Within an Independent Nurse Practitioner Setting

Objective: To assess blood pressure (BP) control among patients with hypertension managed by nurse practitioners (NPs) versus physicians.

Study Design: Cross-sectional study.

Methods: Retrospective medical record reviews were conducted at 3 independent NP-based practices and at 21 physician-based practices. Investigators at each practice identified a sample of patients 18 years or older with a hypertension diagnosis. The primary outcome was controlled BP.

Results: The propensity score-matched cohort (623 in each group) had similar baseline characteristics. Among the NP cohort, 70.5% had controlled BP compared with 63.2% among the physician cohort; the mean number of antihypertensive medications was lower among NP-treated patients. The adjusted odds of controlled BP were slightly lower for physician-treated patients.

Conclusions: Comparable controlled BP rates were observed among patients with hypertension receiving care from an NP versus a comparison group receiving care from a physician; the groups had similar baseline characteristics. Our findings support the increasingly important role of NPs in primary care (Wright, Romboli, DiTulio, Wogen, & Belletti, 2011).

Suggested Readings



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