2 Key Concepts and Terms in Qualitative and Quantitative Research

Research, like nursing or any other discipline, has its own language and terminology—its own *jargon*. Some terms are used by both qualitative and quantitative researchers (although in some cases, the connotations differ), whereas others are used predominantly by one or the other group. New terms are introduced throughout this textbook, but we devote this chapter to some fundamental terms and concepts so that more complex ideas can be more readily grasped.

THE FACES AND PLACES OF RESEARCH

When researchers address a problem or answer a question through disciplined research—regardless of the underlying paradigm—they are doing a **study** (or an **investigation** or **research project**). Studies involve various people working together in different roles.

Roles on a Research Project

Studies with humans involve two sets of people: those who do the research and those who provide the information. In a quantitative study, the people who are being studied are referred to as **subjects** or **study participants**, as shown in Table 2-1. (Subjects who provide information to researchers by answering questions directly—e.g., by filling out a questionnaire—may be called **respondents**.)

The term *subjects* implies that people are *acted upon* by researchers (i.e., are subject to research protocols), and usually is avoided by qualitative researchers. In a qualitative study, the individuals cooperating in the study play an active rather than a passive role in the research, and are usually referred to as study participants, **informants,** or **key informants**. Collectively, both in qualitative and quantitative studies, study participants comprise the **sample**.

The person who undertakes the research is the **researcher** or **investigator** (or sometimes, especially in quantitative studies, the **scientist**). Studies are often undertaken by several people rather than by a single researcher. **Collaborative research** involving a team of nurses with both clinical and methodologic expertise (or involving different members of a health care team) is increasingly common in addressing problems of clinical relevance.

When a study is undertaken by a research team, the person directing the investigation is referred to as the **project director** or **principal investigator (PI).** Two or three researchers collaborating equally are **co-investigators**. When specialized expertise is needed on a short-term basis (e.g., for statistical analysis), projects may involve one or more **consultants**. In a large-scale project,

TABLE 2.1 Key Terms Used in Quantitative and Qualitative Research

CONCEPT	QUANTITATIVE TERM	QUALITATIVE TERM
Person Contributing Information	Subject Study participant Respondent	— Study participant Informant, key informant
Person Undertaking the Study	Researcher Investigator Scientist	Researcher Investigator —
That Which Is Being Investigated	— Concepts Constructs Variables	Phenomena Concepts — —
System of Organizing Concepts	Theory, theoretical framework Conceptual framework, conceptual model	Theory Conceptual framework, sensitizing framework
Information Gathered	Data (numerical values)	Data (narrative descriptions)
Connections Between Concepts	Relationships (cause-and-effect, functional)	Patterns of association
Quality of the Evidence	Reliability Validity Generalizability Objectivity	Dependability Credibility Transferability Confirmability

dozens of individuals may be involved in planning the study, producing research-related materials, collecting and analyzing the information, and managing the flow of work. The examples of staffing configurations that follow span the continuum from an extremely large project to a more modest one.

Examples of staffing:

Example of Staffing on a Quantitative Study

The first author of this book has been involved in a complex, multicomponent 6-year study of poor women living in four major cities (Cleveland, Los Angeles, Miami, and Philadelphia). As part of the study, she and two colleagues prepared a book-length report documenting the health problems and health care concerns of about 4000 welfare mothers who were interviewed in 1998 and again in 2001 (Polit, London, & Martinez, 2001). The total project staff for this research involves well over 100 people, including two co-investigators; lead investigators of the 6 project components (Polit was one of these); a dozen other senior-level researchers; over 50 interviewers; 5 interview supervisors; and dozens of research assistants, computer programmers, secretaries, editors, and other support staff. Several health consultants, including a prominent nurse researcher, were reviewers of the report. The project was funded by a consortium of government agencies and private foundations.

Example of Staffing on a Qualitative Study

Beck (2002) conducted a qualitative study focusing on the experiences of mothers of twins. The team included Beck as the PI (who gathered and analyzed all the information herself); a childbirth educator (who helped to recruit mothers into the study); an administrative assistant (who handled a variety of administrative tasks, like paying stipends to the mothers); a transcriber (who listened to tape-recorded conversations with the mothers and typed them up verbatim); and a secretary (who handled correspondence). This study had some financial support through Beck's university.

In addition to participants and researchers, other parties sometimes are involved in studies. When financial assistance is obtained to pay for research costs, the organization providing the money is the **funder** or **sponsor**. **Reviewers** are sometimes called on to critique various aspects of a study and offer feedback. If these people are at a similar level of experience as the researchers, they may be called **peer reviewers**. Student projects are more likely to be reviewed by faculty advisors. Sometimes students or young researchers get advice and support from **mentors**, who not only give direct feedback but model standards of excellence in research.

Research Settings

Research can be conducted in a wide variety of locales—in health care facilities, in people's homes, in classrooms, and so on. Researchers make decisions about where to conduct a study based on the nature of the research question and the type of information needed to address it.

Generally speaking, the **site** is the overall location for the research—it could be an entire community (e.g., a Haitian neighborhood in Miami) or an institution within a community (e.g., a hospital in Boston). Researchers sometimes engage in **multisite studies** because the use of multiple sites usually offers a larger or more diverse sample of study participants. For example, in a study of a new nursing intervention, researchers may wish to implement the intervention in both public and private hospitals or in urban and rural locations.

Settings are the more specific places where data collection occurs. In some cases, the setting and the site are the same, as when the selected site is a large hospital, and information is collected exclusively within that setting. When the site is a larger community, however, the researcher must decide where data should be collected—in nursing homes, homeless shelters, and so on. Because the nature of the setting can influence the way people behave or feel and how they respond to questions, the selection of an appropriate setting is important.

Some studies take place in **naturalistic settings** (in the *field*), such as in people's homes or offices. In-depth qualitative studies are especially likely to be done in natural settings because qualitative researchers are interested in studying the context of participants' experiences. When researchers go into the field to collect their information, they are engaged in **fieldwork**. In qualitative studies, fieldwork may take months or even years to complete. Qualitative fieldwork often involves studying participants in multiple settings within the selected site (e.g., in their homes, at meetings, and so on).

At the other extreme, studies sometimes are conducted in highly controlled **laboratory settings** that may or may not have elaborate scientific equipment installed. Both human and nonhuman research can occur in laboratory settings.

For nurse researchers, studies are often conducted in quasi-natural settings, such as hospitals or other similar facilities. These are settings that are not necessarily natural to the participants (unless the participants are nurses or other health care personnel), but neither are they highly contrived and controlled research laboratories.

Example of a study in a naturalistic setting:

Carlisle (2000) studied the search for meaning in the caregiving experience among informal carers of people living with HIV and AIDS. The researcher gathered in-depth information from carers in their homes and in HIV/AIDS volunteer organizations.

Example of a study in a laboratory setting:
Pierce and Clancy (2001) studied the effects of hypoxia on diaphragm activity in anesthetized rats.

THE BUILDING BLOCKS OF A STUDY

Phenomena, Concepts, and Constructs

Research focuses on abstract rather than tangible phenomena. For example, the terms *pain*, *coping*, *grief*, and *resilience* are all abstractions of particular aspects of human behavior and characteristics. These abstractions are referred to as **concepts** or, in qualitative studies, **phenomena**.

Researchers (especially quantitative researchers) also use the term **construct**. Like a concept, a construct refers to an abstraction or mental representation inferred from situations or behaviors. Kerlinger and Lee (2000) distinguish concepts from constructs by noting that constructs are abstractions that are deliberately and systematically invented (or constructed) by researchers for a specific purpose. For example, *self-care* in Orem's model of health maintenance is a construct. The terms *construct* and *concept* are sometimes used interchangeably, although by convention, a construct often refers to a more complex abstraction than a concept.

Theories and Conceptual Models

A **theory** is a systematic, abstract explanation of some aspect of reality. In a theory, concepts are knitted together into a coherent system to describe or explain some aspect of the world. Theories play a role in both qualitative and quantitative research.

In a quantitative study, researchers often start with a theory, **framework**, or **conceptual model** (the distinctions are discussed in Chapter 6). On the basis of theory, researchers make predictions about how phenomena will behave in the real world *if the theory is true*. In other words, researchers use deductive reasoning to develop from the general theory specific predictions that can be tested empirically. The results of the research are used to reject, modify, or lend credence to the theory.

In qualitative research, theories may be used in various ways (Sandelowski, 1993). Sometimes conceptual or **sensitizing frameworks**—derived from various disciplines or qualitative research traditions that will be described in Chapter 3—provide an impetus for a study or offer an orienting world view with clear conceptual underpinnings. In such studies, the framework may help in interpreting information gathered by researchers. In other qualitative studies, theory is the *product* of the research: The investigators use information from the participants inductively as the basis for developing a theory firmly rooted in the participants' experiences. The participants' input is the starting point from which the researcher begins to conceptualize, seeking to explain patterns, commonalities, and relationships emerging from the researcher—participant interactions. The goal in such studies is to arrive at a theory that explains phenomena *as they occur*, not as they are preconceived. Inductively generated theories from qualitative studies are sometimes subjected to more controlled confirmation through quantitative research.

Variables

In quantitative studies, concepts are usually referred to as **variables**. A variable, as the name implies, is something that varies. Weight, anxiety levels, income, and body temperature are all variables (i.e., each of these properties varies from one person to another). To quantitative researchers, nearly all aspects of human beings and their environment are variables. For example, if everyone weighed 150 pounds, weight would not be a variable. If it rained continuously and the temperature was always 70°F, weather would not be a variable, it would be a **constant**. But it is precisely because people and conditions *do* vary that research is conducted. Most quantitative researchers seek to understand how or why things vary, and to learn how differences in one variable are related to differences in another. For example, lung cancer research is concerned with the variable of lung

cancer. It is a variable because not everybody has this disease. Researchers have studied what variables might be linked to lung cancer and have discovered that cigarette smoking is related. Smoking is also a variable because not everyone smokes. A variable, then, is any quality of a person, group, or situation that varies or takes on different values.

Variables are the central building blocks of quantitative studies. There are different types of variables, as discussed next.

Continuous, Discrete, and Categorical Variables

Sometimes variables take on a wide range of values. A person's age, for instance, can take on values from zero to more than 100, and the values are not restricted to whole numbers. Such **continuous variables** have values that can be represented on a continuum. In theory, a continuous variable can assume an infinite number of values between two points. For example, consider the continuous variable *weight*: between 1 and 2 pounds, the number of values is limitless: 1.005, 1.7, 1.33333, and so on.

By contrast, a **discrete variable** is one that has a finite number of values between any two points, representing discrete quantities. For example, if people were asked how many children they had, they might answer 0, 1, 2, 3, or more. The value for number of children is discrete, because a number such as 1.5 is not a meaningful value. Between the values 1 and 3, the only possible value is 2.

Other variables take on a small range of values that do not inherently represent a *quantity*. The variable gender, for example, has only two values (male and female). Variables that take on only a handful of discrete nonquantitative values are **categorical variables**. Another example is blood type (A, B, AB, and O). When categorical variables take on only two values, they are sometimes referred to as **dichotomous variables.** Some examples of dichotomous variables are pregnant/not pregnant, HIV positive/HIV negative, and alive/dead.

Active Versus Attribute Variables

Variables are often characteristics of research subjects, such as their age, health beliefs, or weight. Variables such as these are **attribute variables**. In many research situations, however, the investigator *creates* a variable. For example, if a researcher is interested in testing the effectiveness of patient-controlled analgesia as opposed to intramuscular analgesia in relieving pain after surgery, some patients would be given patient-controlled analgesia and others would receive intramuscular analgesia. In the context of this study, method of pain management is a variable because different patients are given different analgesic methods. Kerlinger and Lee (2000) refer to variables that the researcher creates as **active variables**. Note that an active variable in one study could be an attribute variable in another. For example, a researcher might create an "active" salt-intake variable by exposing two groups of people to different amounts of salt in their diets. Another researcher could examine the salt-intake "attributes" of a sample by asking about their consumption of salt.

Dependent Versus Independent Variables

Many studies are aimed at unraveling and understanding causes of phenomena. Does a nursing intervention *cause* more rapid recovery? Does smoking *cause* lung cancer? The presumed cause is the **independent variable**, and the presumed effect is the **dependent variable**. (Note that some researchers use the term **criterion variable** rather than dependent variable. In studies that analyze the consequences of an intervention, it is usually necessary to establish criteria against which the intervention's success can be assessed—hence, the origin of the term *criterion variable.* Others use the term **outcome variable**—the variable capturing the outcome of interest—in lieu of dependent variable. The term *dependent variable,* however, is more general and is the term used throughout this book.)

Variability in the dependent variable is presumed to *depend on* variability in the independent variable. For example, researchers investigate the extent to which lung cancer (the dependent variable) depends on smoking (the independent variable). Or, investigators may be concerned with the extent to which patients' perception of pain (the dependent variable) depends on different nursing actions (the independent variable).

Frequently, the terms *independent variable* and *dependent variable* are used to indicate *direction of influence* rather than causal link. For example, suppose a researcher studied the behaviors of people caring for cognitively impaired elders and found that the patient's age and the caregivers' use of social touch were related: the older the patient, the less social touch the caregiver used. The researcher would likely not conclude that patient age *caused* reductions in social touch. Yet the direction of influence clearly runs from age to touch: it makes *no* sense to suggest that caregivers' social touch influenced elders' age! Although in this example the researcher does not infer a cause-and-effect connection, it is appropriate to conceptualize social touch as the dependent variable and age as the independent variable, because it is the caregivers' use of social touch that the researcher is interested in understanding, explaining, or predicting.

Many dependent variables studied by nurse researchers have multiple causes or antecedents. If we were interested in studying factors that influence people's weight, for example, we might consider their height, physical activity, and diet as independent variables. Multiple *dependent* variables also may be of interest to researchers. For example, an investigator may be concerned with comparing the effectiveness of two methods of nursing care for children with cystic fibrosis. Several dependent variables could be used as criteria of treatment effectiveness, such as length of hospital stay, number of recurrent respiratory infections, presence of cough, and so forth. In short, it is common to design studies with multiple independent and dependent variables.

Variables are not *inherently* dependent or independent. A dependent variable in one study could be an independent variable in another study. For example, a study might examine the effect of nurses' contraceptive counseling (the independent variable) on unwanted births (the dependent variable). Another study might investigate the effect of unwanted births (the independent variable) on the incidence of child abuse (the dependent variable). In short, whether a variable is independent or dependent is a function of the role that it plays in a particular study.

Example of independent and dependent variables:
Varda and Behnke (2000) asked, What is the effect of the timing of an initial bath on temperature in newborns? Their independent variable was timing of the infant's initial bath (1 hour versus 2 hours after birth). Their dependent variable was axillary temperature.

Heterogeneity

A term frequently used in connection with variables is *heterogeneity*. When an attribute is extremely varied in the group under investigation, the group is said to be **heterogeneous** with respect to that variable. If, on the other hand, the amount of variability is limited, the group is described as relatively **homogeneous**. For example, for the variable height, a group of 2-year-old children is likely to be more homogeneous than a group of 18-year-old adolescents. The degree of **variability** or **heterogeneity** of a group of subjects has implications for study design.

Definitions of Concepts and Variables

Concepts in a study need to be defined and explicated, and dictionary definitions are almost never adequate. Two types of definitions are of particular relevance in a study—conceptual and operational.

The concepts in which researchers are interested are, as noted, abstractions of observable phenomena. Researchers' world view and their outlook on nursing shape how those concepts are defined. A **conceptual definition** presents the abstract or theoretical meaning of the concepts being studied. Conceptual meanings are based on theoretical formulations, on a firm understanding of relevant literature, or on researchers' clinical experience (or on a combination of these). Even seemingly straightforward terms need to be conceptually defined by researchers. The classic example of this is the concept of *caring*. Morse and her colleagues (1990) scrutinized the works of numerous nurse

researchers and theorists to determine how *caring* was defined, and identified five different categories of conceptual definitions: as a human trait; a moral imperative; an affect; an interpersonal relationship; and a therapeutic intervention. Researchers undertaking studies concerned with caring need to make clear which conceptual definition of caring they have adopted—both to themselves and to their audience of readers. In qualitative studies, conceptual definitions of key phenomena may be the major end product of the endeavor, reflecting an intent to have the meaning of concepts defined by those being studied.

In quantitative studies, however, researchers need to clarify and define the research concepts at the outset. This is necessary because quantitative researchers must indicate how the variables will be observed and measured in the actual research situation. An **operational definition** of a concept specifies the operations that researchers must perform to collect the required information. Operational definitions should correspond to conceptual definitions.

Variables differ in the ease with which they can be operationalized. The variable weight, for example, is easy to define and measure. We might operationally define weight as follows: the amount that an object weighs in pounds, to the nearest full pound. Note that this definition designates that weight will be determined with one measuring system (pounds) rather than another (grams). The operational definition might also specify that subjects' weight will be measured to the nearest pound using a spring scale with subjects fully undressed after 10 hours of fasting. This operational definition clearly indicates what is meant by the variable *weight*.

Unfortunately, few variables of interest in nursing research are operationalized as easily as weight. There are multiple methods of measuring most variables, and researchers must choose the method that best captures the variables as they conceptualize them. Take, for example, *anxiety*, which can be defined in terms of both physiologic and psychological functioning. For researchers choosing to emphasize physiologic aspects of anxiety, the operational definition might involve a physiologic measure such as the Palmar Sweat Index. If, on the other hand, researchers conceptualize anxiety as primarily a psychological state, the operational definition might involve a paper-and-pencil measure such as the State Anxiety Scale. Readers of research reports may not agree with how investigators conceptualized and operationalized variables, but precision in defining terms has the advantage of communicating exactly what terms mean within the context of the study.

Example of conceptual and operational definitions:

Beck and Gable (2001) conceptually defined various aspects of *postpartum depression* and then described how the definitions were linked operationally to a measure Beck developed, the Postpartum Depression Screening Scale (PDSS). For example, one aspect of postpartum depression is *cognitive impairment*, conceptually defined as "a mother's loss of control over her thought processes leaves her frightened that she may be losing her mind." Operationally, the PDSS captured this dimension by having women indicate their level of agreement with such statements as, "I could not stop the thoughts that kept racing in my mind."

Data

Research **data** (singular, datum) are the pieces of information obtained in the course of the investigation.

In quantitative studies, researchers identify the variables of interest, develop operational definitions of those variables, and then collect relevant data from subjects. The actual *values* of the study variables constitute the data for the project. Quantitative researchers collect primarily **quantitative data**—that is, information in numeric form. As an example, suppose we were conducting a quantitative study in which a key variable was depression; we would need to measure how depressed study participants were. We might ask, "Thinking about the past week, how depressed would you say you have been on a scale from 0 to 10, where 0 means 'not at all' and 10 means 'the most possible'?" Box 2-1 presents some quantitative data for three fictitious

BOX 2.1 Example of Quantitative Data

Question:	Thinking about the past week, how depressed would you say you have been on a scale from 0 to 10, where 0 means "not at all" and 10 means "the most possible?"
Data:	9 (Subject 1) 0 (Subject 2) 4 (Subject 3)

respondents. The subjects have provided a number corresponding to their degree of depression—9 for subject 1 (a high level of depression), 0 for subject 2 (no depression), and 4 for subject 3 (little depression). The numeric values for all subjects in the study, collectively, would comprise the data on depression.

In qualitative studies, the researcher collects primarily **qualitative data**, that is, narrative descriptions. Narrative information can be obtained by having conversations with the participants, by making detailed notes about how participants behave in naturalistic settings, or by obtaining narrative records from participants, such as diaries. Suppose we were studying depression qualitatively. Box 2-2 presents qualitative data for three participants responding conversationally to the question, "Tell me about how you've been feeling lately—have you felt sad or depressed at all, or have you generally been in good spirits?" Here, the data consist of rich narrative descriptions of each participant's emotional state.

Typically, an operation known as **coding** is required to make research data amenable to analysis. In quantitative studies, coding is the process of translating verbal data into numeric form. For example, answers to a question about a subject's gender might be coded "1" for female and "2" for male (or vice versa). In qualitative coding, researchers develop coding categories that represent important themes in the data.

Relationships

Researchers are rarely interested in a single isolated concept or phenomenon, except in descriptive studies. As an example of a descriptive study, a researcher might do research to determine the percentage of patients receiving intravenous (IV) therapy who experience IV infiltration. In this example, the variable is IV infiltration versus no infiltration. Usually, however, researchers study phenomena in relation to other phenomena—that is, they explore

BOX 2.2 Example of Qualitative Data

Question:	Tell me about how you've been feeling lately—have you felt sad or depressed at all, or have you generally been in good spirits?
Data:	Well, actually, I've been pretty depressed lately, to tell you the truth. I wake up each morning and I can't seem to think of anything to look forward to. I mope around the house all day, kind of in despair. I just can't seem to shake the blues, and I've begun to think I need to go see a shrink. (Participant 1) I can't remember ever feeling better in my life. I just got promoted to a new job that makes me feel like I can really get ahead in my company. And I've just gotten engaged to a really great guy who is very special. (Participant 2) I've had a few ups and downs the past week, but basically things are on a pretty even keel. I don't have too many complaints. (Participant 3)

or test relationships. A **relationship** is a bond or a connection between phenomena. For example, researchers repeatedly have found a *relationship* between cigarette smoking and lung cancer. Both qualitative and quantitative studies examine relationships, but in different ways.

In quantitative studies, researchers are primarily interested in the relationship between the independent variables and dependent variables. The research question focuses on whether variation in the dependent variable is systematically related to variation in the independent variable. Relationships are usually expressed in quantitative terms, such as *more than*, *less than*, and so on. For example, let us consider as our dependent variable a person's body weight. What variables are related to (associated with) a person's weight? Some possibilities are height, caloric intake, and exercise. For each of these independent variables, we can make a prediction about the nature of the relationship to the dependent variable:

Height: Taller people will weigh more than shorter people.
Caloric intake: People with higher caloric intake will be heavier than those with lower caloric intake.
Exercise: The lower the amount of exercise, the greater will be the person's weight.

Each statement expresses a predicted relationship between weight (the dependent variable) and a measurable independent variable. Terms such as *more than* and *heavier than* imply that as we observe a change in one variable, we are likely to observe a corresponding change in weight. If Nate is taller than Tom, we would predict (in the absence of any other information) that Nate is also heavier than Tom. Most quantitative studies are undertaken to determine whether relationships exist among variables.

Quantitative studies typically address one or more of the following questions about relationships:

- Does a relationship between variables *exist*? (e.g., is cigarette smoking related to lung cancer?)
- What is the *direction* of the relationship between variables? (e.g., are people who smoke *more* likely or *less* likely to get lung cancer than those who do not?)
- How *strong* is the relationship between the variables? (e.g., how powerful is the relationship between smoking and lung cancer? How probable is it that smokers will be lung cancer victims?)
- What is the *nature* of the relationship between variables? (e.g., does smoking *cause* lung cancer? Does some other factor *cause* both smoking and lung cancer?)

As this last question suggests, quantitative variables can be related to one another in different ways. One type of relationship is referred to as a **cause-and-effect** (or **causal**) **relationship**. Within the positivist paradigm, natural phenomena are assumed not to be random or haphazard; if phenomena have antecedent factors or causes, they are presumably discoverable. For instance, in our example about a person's weight, we might speculate that there is a causal relationship between caloric intake and weight: consuming more calories causes weight gain.

Example of a study of causal relationships: Keller and Treviño (2001) studied whether a regimen of walking (and different frequencies of walking) caused reductions in cardiovascular risk factors, such as obesity and high blood lipids, in Mexican-American women.

Not all relationships between variables can be interpreted as cause-and-effect relationships. There is a relationship, for example, between a person's pulmonary artery and tympanic temperatures: people with high readings on one tend to have high readings on the other. We cannot say, however, that pulmonary artery temperature *caused* tympanic temperature, nor that tympanic temperature *caused* pulmonary artery temperature, despite the relationship that exists between the two variables. This type of relationship is sometimes referred to as a **functional relationship** (or an **associative relationship**) rather than as a causal relationship.

Example of a study of functional relationships: Pressler and Hepworth (2002) examined the relationship between preterm neonate's behavioral

competence on the one hand, and the infant's gender and race on the other.

Qualitative researchers are not concerned with quantifying relationships, nor in testing and confirming causal relationships. Rather, qualitative researchers seek patterns of association as a way of illuminating the underlying meaning and dimensionality of phenomena of interest. Patterns of interconnected themes and processes are identified as a means of understanding the whole. In some qualitative studies, theories are generated by identifying relationships between emerging categories. These new connections help to "weave the fractured story back together after the data have been analyzed" (Glaser, 1978, p. 72).

Example of a qualitative study of patterns: Lam and Mackenzie (2002) explored Chinese parents' experiences in parenting a child with Down syndrome. One major theme that emerged in the in-depth interviews was parental acceptance of the child. Although the researchers had not specifically sought to examine differences between mothers and fathers, they noted that mothers and fathers did not accept their child at the same pace.

KEY CHALLENGES OF CONDUCTING RESEARCH

Researchers face numerous challenges in conducting research, including the following:

- Conceptual challenges (How should key concepts be defined? What are the theoretical underpinnings of the study?)
- Financial challenges (How will the study be paid for? Will available resources be adequate?)
- Administrative challenges (Is there sufficient time to complete the study? Can the flow of tasks be adequately managed?)
- Practical challenges (Will there be enough study participants? Will institutions cooperate in the study?)
- Ethical challenges (Can the study achieve its goals without infringing on human or animal rights?)
- Clinical challenges (Will the research goals conflict with clinical goals? What difficulties will be encountered in doing research with vulnerable or frail patients?)
- Methodologic challenges (Will the methods used to address the research question yield accurate and valid results?)

Most of this book provides guidance relating to the last question, and this section highlights key methodologic challenges. However, other challenges are also discussed in this book.*

Reliability, Validity, and Trustworthiness

Researchers want their findings to reflect the *truth*. Research cannot contribute evidence to guide clinical practice if the findings are inaccurate, biased, fail adequately to represent the experiences of the target group, or are based on a misinterpretation of the data. Consumers of research need to assess the quality of evidence offered in a study by evaluating the conceptual and methodologic decisions the researchers made, and producers of research need to strive to make good decisions to produce evidence of the highest possible quality.

Quantitative researchers use several criteria to assess the quality of a study, and two of the most important criteria are reliability and validity. **Reliability** refers to the accuracy and consistency of information obtained in a study. The term is most often associated with the methods used to measure research variables. For example, if a thermometer measured Bob's temperature as 98.1°F one minute and as 102.5°F the next minute, the reliability of the thermometer would be highly suspect. The concept of reliability is also important in interpreting the results of statistical analyses. Statistical reliability refers to the probability that the same results would be obtained with a completely new sample of subjects—that is, that the results are an

*The following chapters present relevant materials: conceptual issues—Chapter 6; financial issues—Chapter 25; administrative, practical, and clinical issues—Chapter 4; and ethical issues—Chapter 7.

accurate reflection of a wider group than just the particular people who participated in the study.

Validity is a more complex concept that broadly concerns the *soundness* of the study's evidence—that is, whether the findings are cogent, convincing, and well grounded. Like reliability, validity is an important criterion for assessing the methods of measuring variables. In this context, the validity question is whether there is evidence to support the assertion that the methods are really measuring the abstract concepts that they purport to measure. Is a paper-and-pencil measure of depression *really* measuring depression? Or is it measuring something else, such as loneliness, low self-esteem, or stress? The importance of having solid conceptual definitions of research variables—as well as high-quality methods to operationalize them—should be apparent.

Another aspect of validity concerns the quality of the researcher's evidence regarding the effect of the independent variable on the dependent variable. Did a nursing intervention *really* bring about improvements in patients' outcomes—or were other factors responsible for patients' progress? Researchers make numerous methodologic decisions that can influence this type of study validity.

Qualitative researchers use somewhat different criteria (and different terminology) in evaluating a study's quality. In general, qualitative researchers discuss methods of enhancing the **trustworthiness** of the study's data (Lincoln & Guba, 1985). Trustworthiness encompasses several different dimensions—credibility, transferability (discussed later in the chapter), confirmability, and dependability. **Dependability** refers to evidence that is consistent and stable. **Confirmability** is similar to objectivity; it is the degree to which study results are derived from characteristics of participants and the study context, not from researcher biases.

Credibility, an especially important aspect of trustworthiness, is achieved to the extent that the research methods engender confidence in the truth of the data and in the researchers' interpretations of the data. Credibility in a qualitative study can be enhanced through various approaches (see Chapter 18), but one in particular merits early discussion because it has implications for the design of all studies, including quantitative ones. **Triangulation** is the use of multiple sources or referents to draw conclusions about what constitutes the truth. In a quantitative study, this might mean having alternative operational definitions of a dependent variable to determine if predicted effects are consistent across the two. In a qualitative study, triangulation might involve trying to understand the full complexity of a poorly understood phenomenon by using multiple means of data collection to converge on the truth (e.g., having in-depth discussions with study participants, as well as watching their behavior in natural settings). Nurse researchers are also beginning to triangulate across paradigms—that is, to integrate both qualitative and quantitative data in a single study to offset the shortcomings of each approach.

Example of triangulation:
Tarzian (2000) used triangulation of data methods in her qualitative study on caring for dying patients with air hunger. Tarzian interviewed 10 nurses who had cared for air-hungry patients and, to complement the nurses' accounts, two family members who witnessed spouses suffering from air hunger. Trustworthiness of the study findings was enhanced because family members confirmed important themes. For example, nurses disclosed that air hunger evoked a physical effect, such as feeling out of breath just watching patients struggling to breathe. Family members supported this theme. One husband recalled, "My chest hurt just watching her, breathing like that all day long" (p. 139).

Nurse researchers need to design their studies in such a way that threats to the reliability, validity, and trustworthiness of their studies are minimized. This book offers advice on how to do this.

Bias

Bias is a major concern in designing a study because it can threaten the study's validity and trustworthiness. In general, a **bias** is an influence that produces a distortion in the study results. Biases can affect the quality of evidence in both qualitative and quantitative studies.

Bias can result from a number of factors, including the following:

- *Study participants' candor*. Sometimes people distort their behavior or their self-disclosures (consciously or subconsciously) in an effort to present themselves in the best possible light.
- *Subjectivity of the researcher*. Investigators may distort information in the direction of their preconceptions, or in line with their own experiences.
- *Sample characteristics*. The sample itself may be biased; for example, if a researcher studies abortion attitudes but includes only members of right-to-life (or pro-choice) groups in the sample, the results would be distorted.
- *Faulty methods of data collection*. An inadequate method of capturing key concepts can lead to biases; for example, a flawed paper-and-pencil measure of patient satisfaction with nursing care may exaggerate or underestimate patients' complaints.
- *Faulty study design*. A researcher may not have structured the study in such a way that an unbiased answer to the research question can be achieved.

To some extent, bias can never be avoided totally because the potential for its occurrence is so pervasive. Some bias is haphazard and affects only small segments of the data. As an example of such **random bias,** a handful of study participants might fail to provide totally accurate information as a result of extreme fatigue at the time the data were collected. **Systematic bias**, on the other hand, results when the bias is consistent or uniform. For example, if a spring scale consistently measured people's weights as being 2 pounds heavier than their true weight, there would be systematic bias in the data on weight. Rigorous research methods aim to eliminate or minimize systematic bias—or, at least, to detect its presence so it can be taken into account in interpreting the data.

Researchers adopt a variety of strategies to address bias. Triangulation is one such approach, the idea being that multiple sources of information or points of view can help counterbalance biases and offer avenues to identify them. Quantitative researchers use various methods to combat the effects of bias, and many of these entail research control.

Research Control

One of the central features of quantitative studies is that they typically involve efforts to control tightly various aspects of the research. **Research control** involves holding constant other influences on the dependent variable so that the true relationship between the independent and dependent variables can be understood. In other words, research control attempts to eliminate contaminating factors that might cloud the relationship between the variables that are of central interest.

The issue of contaminating factors—or **extraneous variables**, as they are called—can best be illustrated with an example. Suppose we were interested in studying whether teenage women are at higher risk of having low-birth-weight infants than are older mothers *because of their age*. In other words, we want to test whether there is something about women's maturational development that causes differences in birth weight. Existing studies have shown that, in fact, teenagers have a higher rate of low-birth-weight babies than women in their 20s. The question here is whether maternal age itself (the independent variable) causes differences in birth weight (the dependent variable), or whether there are other mechanisms that account for the relationship between age and birth weight. We need to design a study so as to control other influences on the dependent variable—influences that are also related to the independent variable.

Two variables of interest are the mother's nutritional habits and her prenatal care. Teenagers tend to be less careful than older women about their eating patterns during pregnancy, and are also less likely to obtain adequate prenatal care. Both nutrition and the amount of care could, in turn, affect the baby's birth weight. Thus, if these two factors are not controlled, then any observed relationship between mother's age and her baby's weight at birth could be caused by the mother's age itself, her diet, or her prenatal care. It would be impossible to know what the underlying cause really is.

These three possible explanations might be portrayed schematically as follows:

1. Mother's age→infant birth weight
2. Mother's age→prenatal care→infant birth weight
3. Mother's age→nutrition→infant birth weight

The arrows here symbolize a causal mechanism or an influence. In examples 2 and 3, the effect of maternal age on infant birth weight is mediated by prenatal care and nutrition, respectively; these variables would be considered **mediating variables** in these last two models. Some research is specifically designed to test paths of mediation, but in the present example these variables are extraneous to the research question. Our task is to design a study so that the first explanation can be tested. Both nutrition and prenatal care must be controlled if our goal is to learn if explanation 1 is valid.

How can we impose such control? There are a number of ways, as discussed in Chapter 9, but the general principle underlying each alternative is the same: *the extraneous variables of the study must be held constant*. The extraneous variables must somehow be handled so that, *in the context of the study*, they are not related to the independent or dependent variable. As an example, let us say we want to compare the birth weights of infants born to two groups of women: those aged 15 to 19 years and those aged 25 to 29 years. We must then design a study in such a way that the nutritional and prenatal health care practices of the two groups are comparable, even though, in general, the two groups are not comparable in these respects. Table 2-2 illustrates how we might deliberately select subjects for the study in such a way that both older and younger mothers had similar eating habits and amounts of prenatal attention; the two groups have been **matched** in terms of the two extraneous variables; one third of both groups have the same nutrition ratings and amount of prenatal care. By building in this comparability, nutrition and prenatal care have been held constant in the two groups. If groups differ in birth weight (as they, in fact, do in Table 2-2), then we might infer that age (and not diet or prenatal care) influenced the infants' birth weights. If the two groups did not differ, however, we might tentatively conclude that it is not mother's age *per se* that causes young women to have a higher percentage of low-birth-weight babies, but rather some other variable, such as nutrition or prenatal care. It is important to note that although we have designated prenatal care and nutrition as extraneous variables in this particular study, they are not at all extraneous to a full understanding of the factors that influence birth weight; in other studies, nutritional practices and frequency of prenatal care might be key independent variables.

By exercising control in this example, we have taken a step toward explaining the relationship between variables. The world is complex, and many

TABLE 2.2 Fictitious Example: Control of Two Extraneous Variables

AGE OF MOTHER (YEARS)	NUTRITIONAL PRACTICES	NO. OF PRENATAL VISITS	INFANT BIRTH WEIGHT
15–19	33% rated "good" 33% rated "fair" 33% rated "poor"	33% 1–3 visits 33% 4–6 visits 33% > 6 visits	20% ≤ 2500 g; 80% > 2500 g
25–29	33% rated "good" 33% rated "fair" 33% rated "poor"	33% 1–3 visits 33% 4–6 visits 33% > 6 visits	9% ≤ 2500 g; 91% > 2500 g

variables are interrelated in complicated ways. When studying a particular problem within the positivist paradigm, it is difficult to examine this complexity directly; researchers must usually analyze a couple of relationships at a time and put pieces together like a jigsaw puzzle. That is why even modest studies can make contributions to knowledge. The extent of the contribution in a quantitative study, however, is often directly related to how well researchers control contaminating influences.

In the present example, we identified three variables that could affect birth weight, but dozens of others might be relevant, such as maternal stress, mothers' use of drugs or alcohol during pregnancy, and so on. Researchers need to isolate the independent and dependent variables in which they are interested and then pinpoint from dozens of possible candidates those extraneous variables that need to be controlled.

Example of control through matching: Mackey, Williams, and Tiller (2000) compared the stress and birth outcomes of women who experienced preterm labor during pregnancy with those who did not. To keep the groups similar, the groups were matched in terms of age, race, parity, gestational age, and method of hospital payment.

It is often impossible to control all variables that affect the dependent variable, and not even necessary to do so. Extraneous variables need to be controlled only if they simultaneously are related to both the dependent and independent variables. This notion is illustrated in Figure 2-1, which has the following elements:

- Each circle represents all the variability associated with a particular variable.
- The large circle in the center stands for the dependent variable, infant birth weight.
- Smaller circles stand for factors contributing to infant birth weight.
- Overlapping circles indicate the degree to which the variables are related to each other.

In this hypothetical example, four variables are related to infant birth weight: mother's age, amount of prenatal care, nutritional practices, and smoking during pregnancy. The first three of these variables are also interrelated; this is shown by the fact that these three circles overlap not only with infant birth weight but also with each other. That is, younger mothers tend to have different patterns of prenatal care and nutrition than older mothers. The mother's prenatal use of cigarettes, however, is unrelated to these three

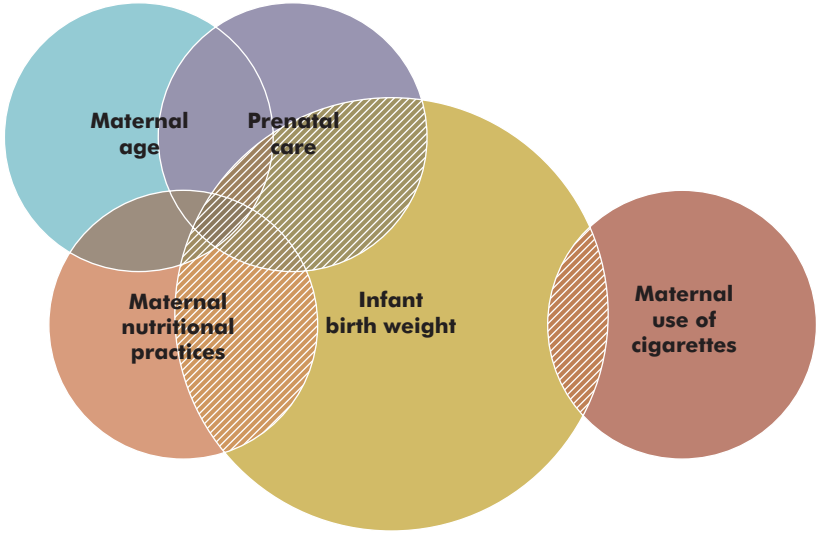

FIGURE 2.1
Hypothetical representation of factors affecting infant birth weight.

variables. In other words, women who smoke during their pregnancies (according to this fictitious representation) are as likely to be young as old, to eat properly as not, and to get adequate prenatal care as not. If this representation were accurate, then maternal smoking would not be need to be controlled to study the effect of maternal age on infant birth weight. If this scheme is incorrect—if teenage mothers smoke more or less than older mothers—then maternal smoking practices should be controlled.

Figure 2-1 does not represent infant birth weight as being totally determined by the four other variables. The darkened area of the birth weight circle designates "unexplained" variability in infant birth weight. That is, other determinants of birth weight are needed for us to understand fully what causes babies to be born weighing different amounts. Genetic characteristics, events occurring during the pregnancy, and medical treatments administered to pregnant women are examples of other factors that contribute to an infant's weight at birth. Dozens, and perhaps hundreds, of circles would need to be sketched onto Figure 2-1 for us to understand factors affecting infant birth weight. In designing a study, quantitative researchers should attempt to control those variables that overlap with both independent and dependent variables to understand fully the relationship between the main variables of interest.

Research control in quantitative studies is viewed as a critical tool for managing bias and for enhancing the validity of researchers' conclusions. There are situations, however, in which too much control can introduce bias. For example, if researchers tightly control the ways in which key study variables can manifest themselves, it is possible that the true nature of those variables will be obscured. When the key concepts are phenomena that are poorly understood or the dimensions of which have not been clarified, then an approach that allows some flexibility is better suited to the study aims—such as in a qualitative study. Research rooted in the naturalistic paradigm does not impose controls. With their emphasis on holism and the individuality of human experience, qualitative researchers typically adhere to the view that to impose controls on a research setting is to remove irrevocably some of the meaning of reality.

Randomness

For quantitative researchers, a powerful tool for eliminating bias concerns the concept of **randomness**—having certain features of the study established by chance rather than by design or personal preference. When people are selected at random to participate in the study, for example, each person has an equal probability of being selected. This in turn means that there are no systematic biases in the make-up of the sample. Men are as likely to be selected as women, for example. Randomness is a compelling method of controlling extraneous variables.

Qualitative researchers almost never consider randomness a desirable tool for fully understanding a phenomenon. Qualitative researchers tend to use information obtained early in the study in a purposive (nonrandom) fashion to guide their inquiry and to pursue information-rich sources that can help them expand or refine their conceptualizations. Researchers' judgments are viewed as indispensable vehicles for uncovering the complexities of the phenomena of interest.

Generalizability and Transferability

Nurses increasingly rely on evidence from disciplined research as a guide in their clinical practice. If study findings are totally unique to the people, places, or circumstances of the original research, can they be used as a basis for changes in practice? The answer, clearly, is no.

As noted in Chapter 1, **generalizability** is the criterion used in a quantitative study to assess the extent to which the findings can be applied to other groups and settings. How do researchers enhance the generalizability of a study? First and foremost, they must design studies strong in reliability and validity. There is little point in wondering whether results are generalizable if they are not accurate or valid. In selecting subjects, researchers must also give thought to the types of people to

whom the results might be generalized—and then select them in such a way that a nonbiased sample is obtained. If a study is intended to have implications for male and female patients, then men and women should be included as participants. If an intervention is intended to benefit patients in urban and rural hospitals, then perhaps a multisite study is warranted. Chapter 10 describes other issues to consider in evaluating generalizability.

Qualitative researchers do not specifically seek to make their findings generalizable. Nevertheless, qualitative researchers often seek understandings that might prove useful in other situations. Lincoln and Guba (1985), in their highly influential book on naturalistic inquiry, discuss the concept of **transferability**, the extent to which qualitative findings can be transferred to other settings, as another aspect of a study's trustworthiness. An important mechanism for promoting transferability is the amount of information qualitative researchers provide about the contexts of their studies. **Thick description**, a widely used term among qualitative researchers, refers to a rich and thorough description of the research setting and of observed transactions and processes. Quantitative researchers, like qualitative researchers, need to describe their study participants and their research settings thoroughly so that the utility of the evidence for others can be assessed.

Replication

Virtually every study has flaws or limitations. Even the most rigorous study is likely to contain some bias, or to engender unresolved questions about the validity or trustworthiness of the findings. And few studies are broad enough that findings can be generalized to all groups or settings of interest.

Nursing practice is almost never changed on the basis of a single study, no matter how sound. Evidence-based practice generally builds on accumulated evidence. **Replications** are attempts to validate the findings from one study in an independent inquiry. Replication is, in effect, a form of triangulation—the use of multiple sources and referents (multiple findings) to draw conclusions about the validity or truth of findings. Replication research is critical for the development of nursing science. Yet, remarkably, there is a dearth of replication studies—or, at least, *published* replication studies. This may reflect a strong preference on the part of researchers, editors, and funders for originality and "breaking new ground." "Paving the way," however, is just as critical as breaking new ground, and well-planned and well-executed replication studies are an important paving tool on the road to evidence-based practice. Some strategies for replication are described in Chapter 10.

RESEARCH EXAMPLES

This section presents brief overviews of a quantitative and a qualitative study. These overviews deal primarily with key concepts that were presented in this chapter. You may wish to consult the full research report in thinking about differences in style and content of qualitative and quantitative reports.

Research Example of a Quantitative Study

Health care strategies for urinary incontinence (UI) have emerged and been tested in several studies of community-dwelling women. Dougherty and her co-researchers (2002) noted, however, that health care strategies designed for adults in urban settings do not always transfer well to rural environments. They designed a study to implement and test the efficacy of a behavioral management for continence (BMC) intervention for older women with UI in seven rural counties in north Florida. The intervention involved self-monitoring, bladder training, and pelvic muscle exercise with biofeedback in the women's homes.

Over a 2-year period, 218 women aged 55 years and older who had regular involuntary urine loss were recruited for the study. Half the subjects were selected, at random, to receive the intervention. This procedure permitted a rigorous comparison of the outcomes of the two groups who, because selection into them was random, were presumably alike in all respects—except for receipt of the intervention.

Group membership (i.e., whether a woman was in the BMC group) was the independent variable. Both groups received follow-up visits, during which time outcome data were gathered, every 6 months for up to 2 years. The primary dependent variable was urine loss. This was operationalized as the amount of urine lost in grams per 24 hours, as measured by the change in weight of incontinence pads. Secondary dependent variables relating to urinary outcomes included measures obtained from 3-day bladder diaries that subjects maintained (e.g., micturition frequency and episodes of urine loss). In addition, the researchers assessed the effect of the intervention on subjects' quality of life. This concept was operationalized using a paper-and-pencil instrument known as the Incontinence Impact Questionnaire (IIQ). The IIQ, which involved 26 questions about the extent to which incontinence affected functioning in various areas (e.g., daily living, social interactions, self-perception), previously had been shown to be a reliable and valid indicator of quality of life.

The findings were encouraging. Over the 2 years in which the women were followed, the BMC group sustained UI improvement, whereas those in the other group experienced worsening severity in urine loss. The two groups also differed at follow-up with regard to episodes of urine loss and quality of life.

The study was methodologically strong. Half the women, selected at random, received the special intervention and the other half did not. This is a particularly powerful way to control extraneous variables. Although the number of subjects was fairly small—and therefore replications are clearly needed—it is noteworthy that the sample was drawn from seven different rural counties.

Research Example of a Qualitative Study

Wise (2002) examined the experience of children who received liver transplants from the time before transplantation, through the surgery, and after. The sample consisted of nine children between the ages of 7 and 15 years. Wise conducted all the interviews with the children herself either in their homes or in an outpatient setting. These conversations ranged in length from 20 to 40 minutes. The interviews were audiotaped and transcribed.

Before the interviews, Wise asked the children if they would draw two pictures of themselves, one before the transplantation and one that reflected their present status. The purpose of this artwork was to help the children relax and also to provide an opening for the interviews. An art therapist who interpreted the children's artwork served as a consultant for this qualitative study; the artwork thereby provided an opportunity for triangulation. The qualitative data obtained from the interviews were analyzed and interpreted to discover the underlying themes of the children's experiences.

Wise used thick description in reporting her results. Four themes emerged that described the essence of the phenomenon of pediatric liver transplantation: (1) search for connections with peers before and after transplantation, and also for connections with the donor, (2) ordinary and extraordinary experiences of hospitalization, (3) painful responses and feelings of being out of control, and (4) parents' responses to the illness. The following quote illustrates this fourth theme and is an example of Wise's thick description:

> I will never tell my Mom how I feel about anything. I don't think I would ever tell the truth because I would never want to upset her. I can just see the statement on her face. I know how she feels . . . she has been through so much stuff with me. I basically worry if she is all right instead of me (p. 86).

Wise engaged in a number of activities to establish the rigor of her study. To enhance trustworthiness, for instance, she maintained a journal in which she documented her observations, analysis decisions, and so on. Credibility was established by having an older adolescent validate the themes and also by having an advisor and three colleagues review her findings.

SUMMARY POINTS

- A research **study** (or **investigation** or **research project**) is undertaken by one or more **researchers** (or **investigators** or **scientists**). The people who provide information to the researchers are referred to as **subjects, study participants,** or **respondents** (in quantitative research) or study participants or **informants** in qualitative research; collectively they comprise the **sample**.

- **Collaborative research** involving a team of nurses with both clinical and methodologic expertise is increasingly common in addressing problems of clinical relevance.
- The **site** is the overall location for the research; researchers sometimes engage in **multisite studies**. **Settings** are the more specific places where data collection will occur. Settings for nursing research can range from totally naturalistic environments to formal laboratories.
- Researchers investigate **concepts** and **phenomena** (or **constructs**), which are abstractions or mental representations inferred from behavior or events.
- Concepts are the building blocks of **theories,** which are systematic explanations of some aspect of the real world.
- In quantitative studies, concepts are referred to as *variables*. A **variable** is a characteristic or quality that takes on different values (i.e., a variable varies from one person or object to another).
- Variables that are inherent characteristics of a person that the researcher measures or observes are **attribute variables**. When a researcher actively creates a variable, as when a special intervention is introduced, the variable is an **active variable**.
- Variables that can take on an infinite range of values along a continuum are **continuous variables** (e.g., height and weight). A **discrete variable**, by contrast, is one that has a finite number of values between two points (e.g., number of children). Variables with distinct categories that do not represent a quantity are **categorical variables** (e.g., gender and blood type).
- The **dependent variable** is the behavior, characteristic, or outcome the researcher is interested in understanding, explaining, predicting, or affecting. The **independent variable** is the presumed cause of, antecedent to, or influence on the dependent variable.
- Groups that are highly varied with respect to some attribute are described as **heterogeneous**; groups with limited **variability** are described as **homogeneous**.
- A **conceptual definition** elucidates the abstract or theoretical meaning of the concepts being studied. An **operational definition** is the specification of the procedures and tools required to measure a variable.
- **Data**—the information collected during the course of a study—may take the form of narrative information (**qualitative data**) or numeric values (**quantitative data**).
- Researchers often focus on relationships between two or more concepts. A **relationship** is a bond or connection (or pattern of association) between two phenomena. Quantitative researchers focus on the relationship between the independent variables and dependent variables.
- When the independent variable causes or affects the dependent variable, the relationship is a **cause-and-effect** (or **causal**) **relationship**. In a **functional** or **associative relationship**, variables are related in a noncausal way.
- Researchers face numerous conceptual, practical, ethical, and methodologic challenges. The major methodologic challenge is designing studies that are reliable and valid (quantitative studies) or trustworthy (qualitative studies).
- **Reliability** refers to the accuracy and consistency of information obtained in a study. **Validity** is a more complex concept that broadly concerns the *soundness* of the study's evidence—that is, whether the findings are cogent, convincing, and well grounded.
- **Trustworthiness** in qualitative research encompasses several different dimensions. **Dependability** refers to evidence that is believable, consistent, and stable over time. **Confirmability** refers to evidence of the researcher's objectivity. **Credibility** is achieved to the extent that the research methods engender confidence in the truth of the data and in the researchers' interpretations of the data.
- **Triangulation**, the use of multiple sources or referents to draw conclusions about what constitutes the truth, is one approach to establishing credibility.
- A **bias** is an influence that produces a distortion in the study results. **Systematic bias** results when a bias is consistent or uniform across study participants or situations.

- In quantitative studies, **research control** is used to hold constant outside influences on the dependent variable so that the relationship between the independent and dependent variables can be better understood.
- The external influences the researcher seeks to control are **extraneous variables**—extraneous to the purpose of a specific study. There are a number of ways to control such influences, but the general principle is that the extraneous variables must be held constant.
- For a quantitative researcher, a powerful tool to eliminate bias concerns **randomness**—having certain features of the study established by chance rather than by design or personal preference.
- **Generalizability** is the criterion used in a quantitative study to assess the extent to which the findings can be applied to other groups and settings. A similar concept in qualitative studies is **transferability**, the extent to which qualitative findings can be transferred to other settings. An important mechanism for promoting transferability is **thick description**, the rich and thorough description of the research setting or context so that others can make inferences about contextual similarities
- **Replications**, which are attempts to validate the findings from one study in an independent inquiry, are a crucial form of triangulation. Replication research is essential for the development of nursing science and evidence-based practice.

STUDY ACTIVITIES

Chapter 2 of the *Study Guide to Accompany Nursing Research: Principles and Methods, 7th edition*, offers various exercises and study suggestions for reinforcing concepts presented in this chapter. In addition, the following study questions can be addressed:

1. Suggest ways of conceptually and operationally defining the following concepts: nursing competency, aggressive behavior, pain, home health hazards, postsurgical recovery, and body image.
2. Name five continuous, five discrete, and five categorical variables; identify which, if any, are dichotomous.
3. Identify which of the following variables could be active variables and which are attribute variables (some may be both): height, degree of fatigue, cooperativeness, noise level on hospital units, length of stay in hospital, educational attainment, self-esteem, nurses' job satisfaction.
4. In the following research problems, identify the independent and dependent variables:
   a. How do nurses and physicians differ in the ways they view the extended role concept for nurses?
   b. Does problem-oriented recording lead to more effective patient care than other recording methods?
   c. Do elderly patients have lower pain thresholds than younger patients?
   d. How are the sleeping patterns of infants affected by different forms of stimulation?
   e. Can home visits by nurses to released psychiatric patients reduce readmission rates?

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