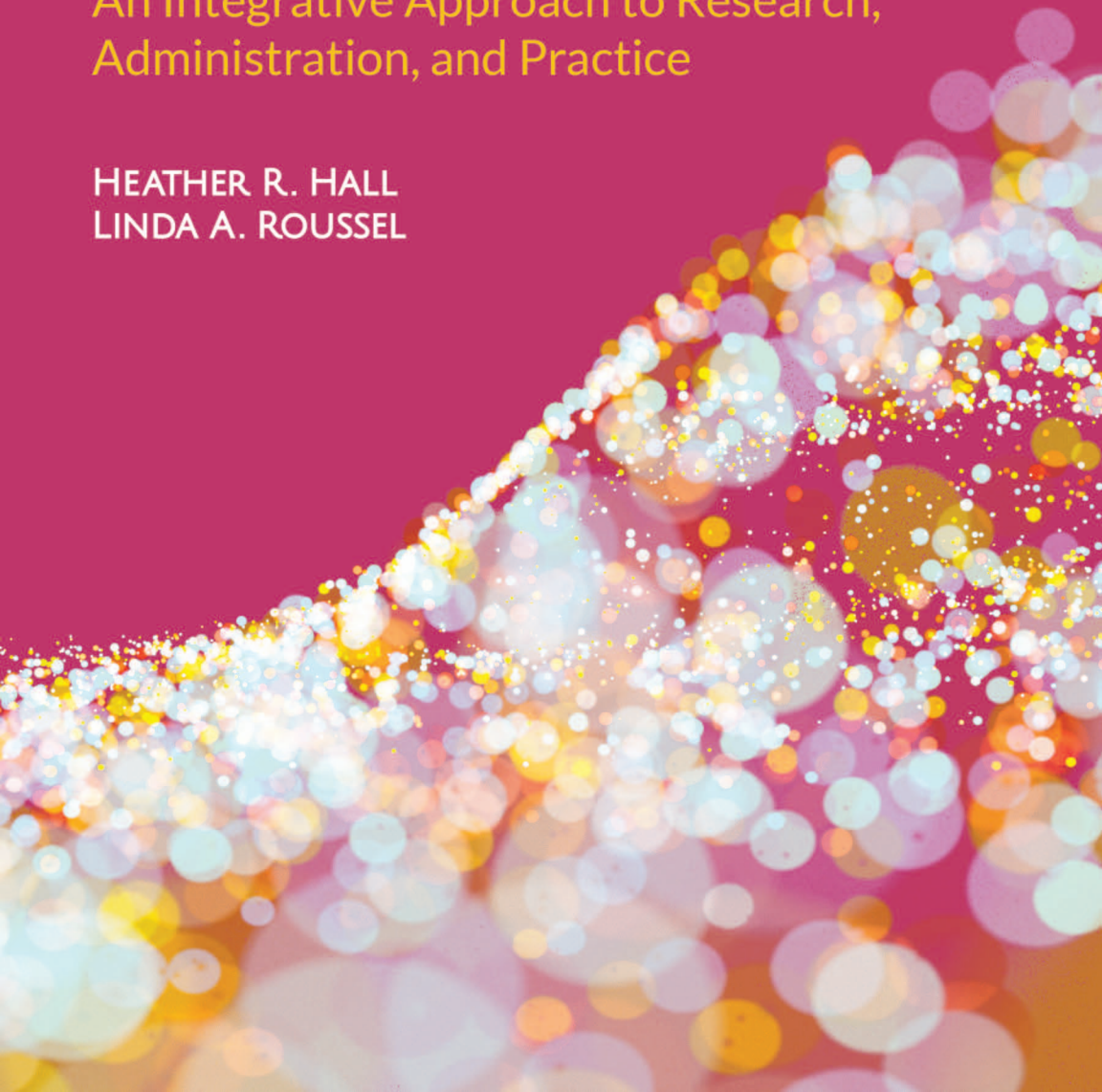
THIRD EDITION

Evidence-Based Practice

An Integrative Approach to Research, Administration, and Practice

Heather R. Hall
Linda A. Roussel



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To the many wonderful colleagues, staff, family, friends, and students. I would like to acknowledge the excellent work of my coeditor, Linda—thank you for your friendship and continuous support throughout the completion of each edition of this book. This revised edition could not have been accomplished without you. I am appreciative of all of the authors who contributed their valuable time and expertise to this book.

—Heather R. Hall

I am most appreciative of our contributors and stakeholders who create healthcare environments that translate best practices for improvement. Thank you for your tireless efforts, commitment, and relentlessness to safe, quality care for those we are privileged to partner with in innovation and sustained improvement. A special thanks to my coeditor, Heather, who contributed to our scholarly work in completing our third edition.

—Linda A. Roussel

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Preface

We are privileged to be part of the ongoing dialogue that informs healthcare education in the 21st century. We are honored to be given continued opportunities to offer up our lived experiences in research, administration, and practice in putting together this collaborative effort shaped by our work with patients, students, stakeholders, and colleagues.

The first edition of this work began as an effort to better guide our graduate students in their understanding of the research, evidence-based practice (EBP), and quality improvement connection. We have observed students struggling with the magnitude of scientific studies and the complexity of health systems. This led to a discussion between the two of us related to the need for better models and structures to frame EBP from learning, translation, and application experiences. From ongoing feedback from our students, patients, and colleagues, we noted the disconnect between students' overall practice experience with research and the use of evidence. We, as editors, were inspired by our experience teaching doctoral students and guiding them through what was for many their first experience with EBP and quality improvement translation in health care. Gaps were identified in the foundational knowledge when graduate students entered into coursework, as evidenced by their confusion about asking the clinical question, finding the best research evidence, and synthesizing the volumes of studies, as well as their limited critical appraisal skills. Following this through, we noted difficulties with translating evidence into practice and connecting improvement and team science to the process of change and innovation. Although there is much respected literature, we wanted a book that would be user friendly and filled with great examples, tools, and reflective questions. In addition, the book needed to be relevant throughout the student's educational experience.

We believe that combining our own personal experiences and those of our contributors will be beneficial to multiple disciplines. This work has continued to evolve up to the final edits of the third edition. We live in a fast-paced health system that demands that we move forward as we reflect on our past and create our future. These experiences, along with our own search for meaning, have shaped our scholarship and professionalism. We have had a number of iterations and deep reflections, which were necessary for our own scholarship. In the spirit of these reflections and the synthesis of this work, we were able to extract the necessary components of research, administration, and practice.

The book has three components: Part I: Critical Appraisal of Research to Support Scholarship, Part II: Scholarship of Administrative Practice, and Part III: Scholarship of Clinical Practice. Each component consists of chapters that provide detailed, specific information on the targeted area. Each chapter has learning

objectives, key ideas, and reflective activities. As we expanded our own understanding and application of EBP and improvement science, we included the wisdom and struggles from our international colleagues. The future of safe, quality care depends heavily on our ability to integrate our research, administrative, and clinical practices through intercollaborative teams.

Acknowledgments

We would like to thank Melina Leon-Haley, Christina Freitas, and Escaline Charlette Aarthi as well as the rest of the staff at Jones & Bartlett Learning, who have been supportive throughout this process.

Finally, we would like to acknowledge each other in our work together. Writing together has provided many opportunities to engage in discussions that always (or mostly!) led to new ways of thinking and understanding our work. We have learned so much from each other and truly appreciate the power of friendship and teamwork.

Heather R. Hall, PhD, RNC, NNP-BC
Linda A. Roussel, PhD, RN, NEA-BC, CNL, FAAN

Introduction

Interdisciplinary Collaboration and the Integration of Evidence-Based Practice

Heather R. Hall and Linda A. Roussel

Identified gaps in the application of research and knowledge have affected policy changes in education and practice in health care. Such gaps have proved costly in terms of patient outcomes, death notwithstanding. Freshman, Rubino, and Chassiakos (2010) described collaboration in the healthcare setting as a coming together of professionals that occurs among the healthcare team. Professionals from multiple disciplines come together to increase collaborative efforts to add value and improve communication processes. Additionally, collaboration among the healthcare team enhances understanding of system processes. The system includes a variety of disciplines responsible for the patient; integrative collaboration is a cornerstone of successful patient care (Freshman et al., 2010).

Goldman and Kahnweiler (2000) provide a classic definition of collaboration as "a mutually beneficial and well defined relationship entered into by two or more organizations to achieve common goals" (p. 435). Collaboration across professions and nations is being encouraged by higher education institutes and research and health organizations (e.g., World Health Organizations [WHO], International Council of Nurses [ICN], and Sigma Theta Tau International [STT]). These collaborations are particularly being encouraged in research and scholarly activities to identify best practices across the world (Uhrenfeldt, Lakanmaa, Flinkman, Basto, & Attree, 2014).

Uhrenfeldt et al. (2014) identified two key factors related to international scholarly collaboration that were consistent with the literature. These factors include "Facilitators" and "Barriers" that encompassed "both the individual (micro) and contextual/organizational (meso/macro) level factors" that either supported or obstructed collaboration (Uhrenfeldt et al., 2014, p. 495). In regard to Facilitators, personal attributes that assist with collaboration at the micro level include obligation, common goals, aiming to succeed and develop, and enthusiasm. Factors related to the contextual and organizational factors that are essential to collaboration at the meso and macro level include coordination, organization, networks, occasions, funding, and guidance by others. Inhibiting "Factors/Barriers" identified from the analysis included deficiency in support and older mentors (Edwards, Webber, Mill, Kahwa, & Roelofs, 2009). Other inhibiting factors include unmet requirements for time and funding for research, workload burden, pressure, conflict in the role, and inadequate resources (Uhrenfeldt et al., 2014).

Table 1 Critical Success Factors for Collaboration

Database	Search Terms and Combinations	Limitations	Hits	Included After Abstract Review

A conceptual model of the "Critical Success Factors for Collaboration" comprising three key criteria attributes (Structures/Inputs, Process/Mechanisms, and Outcomes) was developed (Uhrenfeldt et al., 2014). The initial success factors to complete for collaboration are considered to be structures, contexts, and inputs. The processes are predicted as essential collaborative mechanisms and are considered core collaborative skills. The structures/contexts and processes/mechanisms are thought to be required circumstances for the accomplishment of the necessary outcomes of collaboration (see **Table 1**) (Uhrenfeldt et al., 2014, p. 496). The critical success factors for the collaboration model is initial work, with additional research required to validate the components (Uhrenfeldt et al., 2014).

A collaborative meeting would create a consensus to include knowledge and learning. Leadership is required in collaboration; however, leadership can take on a social structure among unrestricted groups. Team success can be enhanced using collaborative team methods to problem-solve with the limited resources available (Straus & Layton, 2002). Porter-O'Grady and Malloch (2010) described paying attention, encouragement of feedback, and the resolution of conflict as constituting the basis of efficient collaboration. A leader of innovation will flourish in a team with professionals from multiple disciplines. The leader and members of the team will use an approach that is evidence based to recognize gaps in the literature in order to establish whether the gap is based on the needs of the patient or on published evidence (see **Figure 1**). To address complexity and novel ideas, transdisciplinary conversations must take place (Porter-O'Grady & Malloch, 2010). Members of the team should be persuaded to comment on all ideas presented. The process is considered counterproductive if members refuse to comment (Porter-O'Grady & Malloch, 2010).

Bennett and Gadlin (2011) stated that collaboration is supported by healthcare providers who come together to improve patient outcomes and simplify processes. A few of the rationales of collaborating include (a) access to skills provided by experts, (b) access to resources, and (c) multidisciplinary transformation. Many advances are brought forth secondary to collaboration. These improvements include increased funding, improved learning, and enhanced cross-training among disciplines. If healthcare providers are aware of individual jobs, the clinical pathways and protocols will be developed effortlessly (Bennett & Gadlin, 2011).

Bennett and Gadlin (2011) described productive collision as "a process by which parties who see different aspects of a problem can constructively explore

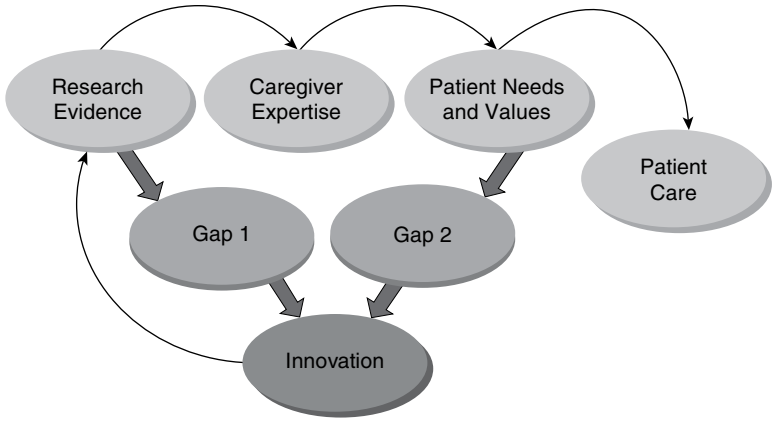

Figure 1 Gap Identification: Evidence-Based Practice and Innovation Leadership

Reproduced from Porter-O'Grady, T., & Malloch, K. (2010). *Innovation leadership: Creating the landscape of health care*. Sudbury, MA: Jones and Bartlett.

their differences and search for solutions that go beyond their own limited vision of what is possible" (Slide 4). A lack of collaboration can result in the following: (a) problems without reason and definition differences; (b) future interests of many stakeholders; (c) stakeholders struggling with power difficulties; (d) lack of access to various levels of necessary information and experts; (e) difficulties distinguished by technological and scientific insecurity; (f) differences of opinions related to a problem-causing conflict; (g) unproductive work; and (h) inefficiencies in procedures to solve problems (Bennett & Gadlin, 2011).

Team members face challenges in any form of collaboration. Such problems may include (a) decline in listening; (b) reduction of original terminology; (c) arguments related to goals and system success; (d) conflicts in conceptual frameworks; (e) rivalries related to authority, control, and credit; (f) self-esteem and/or rank intimidation; (g) failure to integrate a diverse point of view; (h) unsuccessful attempts to have differences of opinions appreciated; (i) difficulties accessing funds; and (j) problems finding publication sources (Bennett & Gadlin, 2011).

In the Institute of Medicine publication *Crossing the Quality Chasm: A New Health System for the 21st Century* (Briere, 2001), a common process to organizing health care is the use of multidisciplinary teams. Much consideration has been placed on the value of such teams. For teams to be efficient, they must be maintained. Members of the team are usually educated separately, which does not include working collaboratively (Briere, 2001). Leaders take on the responsibility of developing and communicating the goals of the organization. To facilitate success, these individuals need to listen to the goals of others, give direction, develop incentives, integrate efforts for improvement, encourage environment of support, and encourage developments to facilitate success (Briere, 2001). It is important for leaders to use their own observations and thoughts related to quality improvement to provide reinforcement for team members. It is vital for leaders to understand "how units relate to each other—a form of systems thinking—and to facilitate the transfer of learning across units and practices" (Briere, 2001, p. 138).

Elwell and White (2011) noted that integrative or holistic health care is provided by the advanced practice nurse. "Nurses are educated to be holistic practitioners—attentive to the whole person, the mind, body, and spirit" (Kreitzer, Kligler, & Meeker, 2009, p. 13). Scholars included in the research component of health care may include PhD-prepared or research nurses, statisticians, or other stakeholders with common interests. Administration team members often include directors, quality improvement officers, chief officers, and managers. The translational nursing component often includes the Doctor of Nursing Practice (DNP), clinical pharmacists, nurse educators, bedside nurses, physical/occupational therapists, social workers, and other direct patient care providers. The multidisciplinary team is assembled to enable collaborative efforts that lead to evidence-based policy and quality improvement systems change. The aim of this book is to explore how each aspect—research, administration, and practice—can be integrated by multidisciplinary scholars collaborating with each other in evidence-based practice (EBP).

Integration and Collaboration

EBP is a part of the success of a system or organization. Polit and Beck (2017) described the emphasis of EBP as integrating the best available research evidence with other facets. The integration of research evidence needs to be included along with knowledge and clinical expertise. Important aspects of EBP and integration include the preferences and values of the patient. For example, the patient may reveal a negative perspective on a possible beneficial intervention (Polit & Beck, 2017). *Decision aids,* tools used to assist a patient in considering all available options, prove helpful so the patient can make an informed decision. Research evidence is crucial to EBP; however, the expertise of the clinician, preference of the patient, and the circumstances must be integrated into the final decision (Livesley & Howarth, 2007).

Scholarship

Scholarship is a process that has evolved over time. The profession level increases secondary to this evolution through involvement in generating new knowledge and participating in the exchange of ideas (Tymkow, 2011). Clinical scholarship includes applying and disseminating the evidence, which leads to a greater understanding of knowledge development (Dreher, 1999). While in the early phase of international collaboration, specific strategies for publishing should be established (Suhonen, Saarikoski, & Leino-Kilpi, 2009). The American Association of Colleges of Nursing (AACN, 2006) stated that scholarship and research are two core elements in doctoral education. Graduates from a research doctoral program are prepared with skills in research necessary to identify new knowledge in nursing (AACN, 2006). Practice experts should be well versed in "knowledge management, poised to extract information and apply it in a novel or utilitarian way, and then efficiently translate and disseminate this new conceptualization of the evidence" (Dreher & Glasgow, 2011, p. 30).

Approach

This book is organized into three main parts, and scholarship is the foundation for all three. Part I describes the process of critical appraisal of research to support scholarship. Part II outlines the scholarship of administrative practice. Part III presents the scholarship of clinical practice.

Part I: Critical Appraisal of Research to Support Scholarship

Part I consists of six chapters that describe quantitative research, qualitative research, mixed methods research, data analysis, institutional review board procedure, and critical appraisal process of evidence-based research. Grove, Burns, and Gray (2013) described the critical appraisal process of research as a methodical, impartial, precise review of all aspects of a study.

Part II: Scholarship of Administrative Practice

Part II consists of seven chapters that describe leadership; organizational systems; change; microsystems, macrosystems, and mesosystems; quality improvement: historical and future perspectives; and health policy. Chapters in Part II discuss quality improvement science and the process of integrating health policy into practice.

Part III: Scholarship of Clinical Practice

Part III consists of seven chapters that describe philosophical and theoretical perspectives guiding inquiry, synthesis projects, translational research in the clinical setting, and dissemination of the evidence. The chapters discuss problem identification, evidence-based research, searching the literature, and incorporating evidence-based research into practice.

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PART I

Critical Appraisal of Research to Support Scholarship

CHAPTER 1

Quantitative Research

Susan L. Neely Barnes and Robin Lennon-Dearing

OBJECTIVES

- Identify steps in the quantitative research process.
- Identify preexperimental, quasi-experimental, and experimental research studies when examining published research.
- Assess internal and external validity and reliability of various research designs.
- Recognize and understand the methodological issues in quantitative research designs.

Critical Appraisal

Research is broadly defined as a process of scientific inquiry to answer a question and create new knowledge. Quantitative research, more specifically, takes a positivist approach and reduces data to quantities or numbers that can be measured and analyzed using statistics (Grinnell, Williams, & Unrau, 2016). The goal of this chapter is to help readers understand the process of quantitative research so they can critically identify the usefulness of different studies for their own research or clinical practice. Appraising information critically and in a systematic way is important to practitioners' ability to base their clinical decisions on the research evidence. Healthcare providers must be able to understand the basic process of quantitative research to evaluate the strengths and weaknesses of a study.

A foundational understanding of qualitative methods is key to understanding evidence-based practice. Evidence-based practice is "a systematic process that blends current best evidence, client preferences (whenever possible), and clinical expertise" (Shlonsky & Gibbs, 2004, p. 137), resulting in services that are individualized and empirically sound. Evidence-based practice involves the application of the best research evidence to decisions about the care of individual clients (Gibbs & Gambrill, 2002). An understanding of quantitative methods is also fundamental to translational research. Translational research is the process of applying discoveries made in basic research to trials in humans and the enhancement of the

adoption of best practices in the community (Rubio et al., 2010). We must first understand quantitative methods before we can apply them to choosing best practices for our patients.

The Quantitative Research Process

Quantitative research involves a systematic process—the scientific method—to build knowledge. Quantitative research methods involve collecting numerical data to explain, predict, and/or control phenomena of interest. Data analysis is mainly statistical; it answers questions of what, and under what condition(s), specific independent variables predict or explain dependent variables through the use of numerical data suitable for statistical analysis (Solomon & Draine, 2010). Depending on the problem or issue under inquiry and after researchers have identified sufficient knowledge from a literature review, they begin with a research question or hypothesis (Keele, 2011). Whereas quantitative research questions look at the relationships among variables, quantitative hypotheses are predictions the researcher makes about the expected relationship among variables. The research design becomes the blueprint for the study—that is, how the study sample is selected and how the data are collected and analyzed (Keele, 2011). An overview of the basic steps in the quantitative research process is shown in **Box 1-1**.

When a problem of interest has been identified, the research process is applied to discover what is known about a topic and where knowledge gaps exist (Schmidt & Brown, 2012). First, the researcher searches for existing knowledge on a subject using library databases to find existing studies. This information is summarized to form a literature review. Second, the researcher uses what is learned from the literature review to create a focused research question (Yegidis & Weinbach, 2011). Third, a research hypothesis is stated as an answer to a research question (Yegidis & Weinbach, 2011). **Table 1-1** shows three examples of how the problem of interest has been narrowed to an answerable question and then to a hypothesis statement.

For example, Tongvichean, Aungsuroch, and Preechawong (2019) wanted to understand if an exercise program could improve physical fitness in people with prehypertension and obesity. First, they searched the literature for other studies on

Box 1-1 Steps in Quantitative Research

1. Problem identification
2. Research question formulation
3. Literature review
4. Construction of hypothesis
5. Research design and planning
6. Data collection
7. Sorting and analysis of data
8. Specification of research findings
9. Interpretation of research findings
10. Dissemination of research findings
11. Use of findings by practitioner

Yegidis & Weinbach, 2009.

Table 1-1 Study Examples of a Research Question and a Research Hypothesis

Study	Research Question	Research Hypothesis
Schwindt, R. G., McNeils, A. M., & Sharp, D. (2014). Evaluation of a theory-based education program to motivate nursing students to intervene with their seriously mentally ill clients who use tobacco. *Archives of Psychiatric Nursing, 28,* 277–283.	What is the effect of a tobacco education program on the perceived competence and motivation of baccalaureate nursing students to intervene with severely mentally ill clients?	1. Students who complete a self-determination theory (SDT)-informed education program will perceive themselves as more competent to deliver tobacco dependence interventions. 2. Students who complete an SDT-informed education program will be more autonomously motivated to deliver tobacco dependence interventions.
Chapelain, P., Morineau, T., & Gautier, C. (2015). Effects of communication on the performance of nursing students during the simulation of an emergency situation. *Journal of Advanced Nursing, 71,* 2650–2659.	How is clinical performance affected by different forms of spontaneous team communications?	1. A message transmitted through an earpiece to nursing students would facilitate reflective thinking and consequently improve performance. 2. There would be some significant positive correlations between the communication in nurse teams and their performance.
Tongvichean, T., Aungsuroch, Y., & Preechawong, S. (2019). Effect of self-management exercise program on physical fitness among people with prehypertension and obesity: a quasi experimental study. *Pacific Rim International Journal of Nursing Research, 23,* 6–17.	What is the effectiveness of the Self-Management Exercise Program (SMEP) on physical fitness among persons with prehypertension and obesity?	1. Participants in the experimental group would have lower mean of heart rate, higher mean of number of completed stand for muscular endurance, and higher mean distance between starting and reached point of flexibility compared to the control group.

the relationship between exercise, physical fitness, obesity, and hypertension. Using this literature, they formed a research question on the effectiveness of their proposed exercise program and a hypothesis that the exercise program would be effective in lowering heart rate, improving muscular endurance, and increasing flexibility.

The research hypothesis commonly states the type of relationship, as described in **Box 1-2**, between variables that it is presumed they have. In quantitative research studies, variables are numerical (Brown, 2014). Objective measurable data are then collected to confirm or refute a hypothesis (Schmidt & Brown, 2012). Biophysical variables such as height, weight, blood pressure, and pulse may be measured

Box 1-2 Relationships Between Variables Expressed in Hypotheses Association

Certain value categories of *X* are found with certain value categories of *Y*.

Correlation	Higher values of *X* are found with higher values of *Y* and vice versa, or higher values of *X* are found with lower values of *Y* and vice versa.
Causation	Values or value categories of *X* cause values or value categories of *Y*.

Data from Yegidis, B. L., & Weinbach, R. W. (2011). *Research methods for social workers* (7th ed.). Reprinted by permission of Pearson Education, Inc., Upper Saddle River, NJ.

Box 1-3 Types of Variables

Independent Variable	This is manipulated by the researcher to influence the dependent variable; it also may be called the predictor variable.
Dependent Variable	This is the variable of primary interest to the researcher; it also may be called the outcome variable.
Confounding Variable	An extraneous third variable that influences the relationship between the independent and dependent variables.

Yegidis, B. L., & Weinbach, R. W. (2011). *Research methods for social workers* (7th ed.). Reprinted by permission of Pearson Education, Inc., Upper Saddle River, NJ.

directly. Conceptual variables have attributes or characteristics that differ in quantity or quality and describe people or things (Babbie, 2012), and they must be operationalized—that is, defined in terms that give precise indicators to be observed, and specify the level of those indicators (Rubin & Babbie, 2014). Tools used to measure conceptual variables are called instruments.

For example, Schwindt, McNeils, and Sharp (2014) wanted to measure the effect of a tobacco education program on nursing students' perceived competence and motivation to intervene. Unlike weight or blood pressure, competence and motivation are not variables that can be measured directly. Instruments must be used to operationalize and measure the concepts. Schwindt and colleagues chose the Learning Self-Regulation Questionnaire (SRQ-L) to measure motivation and the Perceived Competence Scale (PCS) to measure competence.

As shown in **Box 1-3**, the independent variable is what the researcher introduces and controls to measure its effect on the dependent variable (Yegidis & Weinbach, 2011). The dependent variable is the focus of the intervention and is what is measured. Confounding variables are factors that interfere with the relationship between the independent and dependent variables (Schmidt & Brown, 2012). In the Schwindt et al. (2014) study, the delivery intervention (two 60-minute training sessions on intervening with patients who use tobacco) was the independent variable. Perceived competence and motivation were the independent variables. Confounding variables included the race, gender, and age of the participants.

Research hypotheses suggest and test for relationships between variables. Relationships between variables can be positive, negative (inverse), or curvilinear. For example, in a study looking at the role of social networks and support as they relate to symptoms of depression in women who have recently given birth, Surkan, Peterson, Hughes, and Gottlieb (2006) chose the Medical Outcomes Study Social Support Survey and a social network item as the independent variable and the Center for Epidemiologic Studies of Depression Scale as the dependent variable. Using the appropriate statistical analysis, the researchers found that both social networks and social support were independently and inversely correlated to symptoms of depression. Women who reported more social support from friends and family showed fewer depressive symptoms and reported lower scores on the measure for depression.

The strength and direction of a relationship, the *effect size*, between two variables can be statistically tested. One example of a test that gives an effect size is a correlation coefficient, such as Pearson's *r*. The direction of the relationship is positive (+1.0 is a perfect positive relationship) or negative (–1.0 is a perfect negative relationship). The closer the value gets to +1 or –1, the stronger the relationship; a value close or equal to 0 indicates no relationship (Brown, 2014). High correlation only implies a pattern in the relationship between variables; it does not equal causation (Brown, 2014).

Sampling

To answer the research question and test the research hypothesis, a researcher must define the population of interest. Studying an entire population of interest is usually prohibitive in terms of time, money, and resources, so a subset of a given population must be selected; this is called sampling (Yegidis & Weinbach, 2011). The method used for choosing a sample affects its representativeness of the population and thus the generalizability of results. There are two types of sampling: *probability* sampling and *nonprobability* sampling. Probability sampling means that all participants have the same chance of being chosen in the sample (Rubin & Babbie, 2014). Four probability sampling methods (see **Table 1-2**) are simple random sampling, stratified sampling, cluster sampling, and systematic sampling (Schmidt & Brown, 2012).

Nonprobability sampling (see **Table 1-3**) uses methods such as convenience sampling, quota sampling, purposive sampling, and snowball sampling (Schmidt & Brown, 2012). For some research studies, probability sampling is not possible or not feasible because of costs. In these situations, the researcher must rely on nonprobability methods. Research studies that use nonprobability methods can have scientific merit but will have limited generalizability to the larger population.

Data Collection

Quantitative data collection relies on structured data collection instruments that produce results that are easy to summarize, compare, and generalize. Four levels of measurement are used to quantify data, depending on what is being measured. Nominal measures differentiate between categories but do not place variables in any order or ranking. Ordinal measures rank categories in order but do not specify the distance between the categories. Interval measures use continuous data in

Table 1-2 Probability Sampling Methods

Method	Definition	Benefits and Limitations
Simple random sampling	Each subject has the same chance to be selected. Strategy used upholds randomization.	High probability that the sample will represent the population as long as sample size is sufficient.
Stratified random sampling	Strata must be mutually exclusive so a subject can be assigned to only one stratum. Random sampling is used to select subject from each stratum.	High probability that the sample will represent the population if number of subjects in each stratum is sufficient.
Cluster sampling	Simple random sampling is used first to select clusters and then to select subjects within each cluster.	Greater potential for the sample to not represent the population depending on how the initial clusters are selected.
Systematic random sampling	Begin with random sampling and count the Nth subject on the list.	If bias occurs, this type of sampling is not as representative as the other three methods.

Data from Haber, J. (2014). Sampling. In G. LoBiondo-Wood & J. Haber (Eds.), *Nursing research: Methods and critical appraisal of evidence-based practice* (pp. 230–234). Sudbury, MA: Jones & Bartlett; Wood, M., & Ross-Kerr, J. (2011). *Basic steps in planning nursing research: From question to proposal* (6th ed.). Sudbury, MA: Jones & Bartlett.

which values are rank-ordered, and the distance between categories is equal. Ratio scales, the highest level of measurement, measure equal interval data and employ a fixed-point zero (Schmidt & Brown, 2012).

Common data collection methods of quantitative research include questionnaires, rating scales, and physiologic measures such as blood tests and vital signs (Keele, 2011). In this chapter, we provide a basic overview of issues of validity (see **Box 1-4** and **Table 1-4**) and reliability (see **Box 1-5**) of measure. Readers are encouraged to consult other texts for in-depth reviews of measurement construction and measurement theory.

Internal Validity

Internal validity is concerned with the possibility that a change in the dependent variable (outcome) is the result of some cause other than the independent variable that is the target of the experiment. It is beyond the scope of this chapter to include an in-depth review of all threats to internal validity. Briefly, one should remember that respondents improve for many reasons other than the intervention or technique that is the target of the research experiment. It is possible that research subjects improve because they age (maturation), because they can better fill out the measure of the dependent variable (testing), or because they are exposed to an external event that caused the improvement (history). It is also possible that

Table 1-3 Nonprobability Sampling Methods

Method	Definition	Benefits and Limitations
Convenience sampling	Inclusion criteria are identified prior to selection of subjects. All subjects are invited to participate.	Because the sample is selected for ease of data collection, it may not be representative of the target population.
Quota sampling	Strata must be mutually exclusive so that a subject can be assigned to only one stratum. Convenience sampling is used to select subject from each stratum.	Because the sample within each stratum is selected using convenience sampling, it may not represent the population.
Purposive sampling	Researcher has sufficient knowledge of topic to select sample of experts. Researcher should identify criteria to include in selection of subjects.	Because the sample is selected by researcher, it cannot generalize to the population; generalizing the results is not an expected outcome.
Snowball sampling	Researcher selects initial subjects for study. Data saturation is reached.	Cannot generalize to the population; generalizing the results is not an expected outcome.

Data from Haber, J. (2014). Sampling. In G. LoBiondo-Wood & J. Haber (Eds.), *Nursing research: Methods and critical appraisal of evidence-based practice* (pp. 226–230). Sudbury, MA: Jones & Bartlett; Wood, M., & Ross-Kerr, J. (2011). *Basic steps in planning nursing research: From question to proposal* (6th ed.). Sudbury, MA: Jones & Bartlett.

research subjects would have improved regardless of the experimental intervention (regression to the mean), or for other reasons not mentioned here.

Whereas internal validity refers to the confidence with which the study results can conclude that a treatment or intervention (independent variable) causes change in the dependent variable (see Table 1-4), external validity has to do with the generalizability of the research findings. Rubin and Babbie (2014) described external validity as "the extent to which we can generalize findings of a study to settings and populations beyond the study conditions" (p. 247). They also noted that "a study must be generalizable to some real-world settings." Characteristics of good quantitative research are presenting the research design and methods in enough detail that other researchers could replicate the study and obtain their own results (Durbin, 2004). Obtaining the same results through repeated experimentation by different researchers increases the value and worth of the findings (Durbin, 2004).

Reliability

Reliability measures the consistency and stability of responses over time in a standardized measurement instrument. Reliability does not ensure that measures are accurately measuring what researchers think they measure (Babbie, 2012). *Internal*

Table 1-4 Internal Validity

Threats to Internal Validity*	Maximizing Internal Validity
History—Events occurring between repeated measurements	Use a control group from the same population as the experimental group.
Maturation—Changes in participants that occur over time	Use a control group and keep the study of short duration.
Testing—Change resulting from being measured; practice effect	Use a research design that does not include a pretest or unobtrusive data collection.
Instrumentation—Changes in outcome because of equipment or human factors	Use standardized instruments, administration, or data collection procedures.
Statistical regression—The natural tendency of very high or low scores to regress toward the mean during retest	Avoid using extreme scores.
Mortality—Participants dropping out	Use random assignment with large groups and follow up with a portion of those who leave the study.
Selection of subjects—Choosing participants in such a way that groups are not equal before the experiment	Use random selection and random assignment of subjects. If random selection and assignment are not possible, use certain other statistical techniques.

*Internal validity is the degree to which we can confidently conclude that the treatment caused the outcomes observed.

Box 1-4 Measurement of Validity

Construct	Validity is *convergent* when results correspond to the results of methods measuring the same concept. It has *discriminant* validity when results do not highly correspond to other constructs as they do with measures of the same construct.
Content	Experts judge whether the measure covers the range of meanings within the concept.
Criterion-related	Compares with an external measure of the same variable or concurrent variable.
Face	The degree to which a test appears to measure what the researcher intended.
Factorial	How many different constructs are measured and whether these are what the researcher intends to measure.

Rubin, A., & Babbie, E. (2014). *Research methods for social work* (8th ed.). Belmont, CA: Brooks/Cole Cengage.

Box 1-5 Measurement of Reliability

Interrater reliability	The degree of agreement or consistency between raters.
Test-retest reliability	A measure that provides consistency in measurement over time.
Internal consistency	This assesses the correlation of scores on each item with the reliability of scores on the rest of the items. Cronbach's alpha should have a value of 0.80 or greater to be considered reliable.

Table 1-5 Research Types

Research Type	Design Technique	Description
Exploratory research	Preexperimental	Research is conducted to explore a topic about which little is known.
Descriptive research	Quasi-experimental	Descriptive research involves collecting data to test hypotheses or answer questions concerning the current status of the subjects of the study. Describes the variables. Lacks the element of random assignment.
Explanatory research	Experimental	Participants are assigned to groups based on some selected criterion often called an independent variable. At least one variable is manipulated so as to measure its effect on one or more dependent variables.

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consistency reliability is a measure of how closely items in a questionnaire measuring the same construct are related. Cronbach's alpha addresses overall average reliability, and items are considered to represent a similar construct when Cronbach's alpha is approximately 0.80.

Research Design

The value of evidence from a study depends on the design used. In quantitative research, a clearly defined step-by-step process is followed based on the research design chosen (Schmidt & Brown, 2012). The following pages review research designs (see **Table 1-5**) used as tools to answer research questions and test research hypotheses.

Group Design

Group design is a commonly used technique in quantitative research and is relatively well known among students of research. When asked to design a research study, most students of quantitative methods will incorporate a group design.

Group design is defined by Grinnell and Unrau (2011, p. 565) as "research design conducted with two or more groups of cases, or research participants, for the purpose of answering research questions or testing hypotheses." The method encompasses preexperimental, quasi-experimental, and experimental techniques. The most rigorous of group designs have an explanatory purpose to prove cause-effect relationships, whereas the least rigorous of these designs are used to generate or explore a theory. From the evidence-based practice perspective, rigorous group designs are more valued than less rigorous designs. This is because rigorous designs minimize threats to internal validity.

There are many variations of group design. The more commonly used designs will be covered. Readers are encouraged to consult other texts for a more in-depth review.

Preexperimental Design

The purpose of preexperimental designs is to explore new topics of research. Preexperimental designs rank low in the evidence-based practice hierarchy (Rubin & Babbie, 2014). Yet, the designs have an important role in testing new intervention approaches, evaluating programs, and generating theories. Examples of research questions that could be addressed using a preexperimental design are as follows: (a) Are patients leaving the hospital satisfied with discharge planning services? (b) Are patients in a health education program doing better than they were before they started?

One-Shot Case Study

The one-shot case study is the most basic of group designs, so it is a good starting point. However, it is a weak design. Campbell and Stanley (1963) noted that these studies have a total absence of control and almost no scientific value. One-shot case studies are usually diagrammed as follows, with X standing for a stimulus such as an intervention, and O standing for an observation.

X O

Despite the weakness of this study design, one-shot case studies are used quite frequently. In higher education, student evaluations of teaching are an example of this design. Many hospitals and social service agencies use this design to ask patients or participants about their knowledge or skills gained from a service. The problem with this design is that there are no points of comparison. We do not know the respondents' level of knowledge or skills prior to receiving the service, nor do we know how their current level of knowledge or skills compared with those of individuals who did not receive services. Many other options are available to provide a more rigorous design.

One-Group Pretest-Posttest

The one-group pretest-posttest design assesses the dependent variable before and after the stimulus or intervention is introduced. It is usually diagrammed as follows (Campbell & Stanley, 1963):

O_1 X O_2

This design has the advantage of establishing both time ordering and correlation. A researcher can use this design to demonstrate that the study group improved if scores are better at Observation 2 than they were at Observation 1. For reasons related to internal validity, this design cannot establish causality. For example, imagine that you are evaluating a diabetes education program for adolescents aged 12–15 years. You hypothesize that the program will improve healthy eating habits and reduce blood glucose levels. The program lasts for 1 year. You give a pretest at the beginning of the year and a posttest at the end of the year. You are able to establish that the adolescents' eating habits and blood glucose levels have improved. Did your program cause the change? There are several alternative explanations: (a) It could be that the adolescents' eating habits and management of their blood sugar improved because the adolescents matured and were 1 year older at the time of the posttest. (b) It could be that something extraneous occurred during that year that caused the change. For example, a popular show geared toward teens portrayed a young adult with diabetes. (c) It could be that the adolescents were referred when they were at their worst period of management, and they would have improved anyway. Without the presence of a control group, it is not possible to rule out these alternative explanations.

Quasi-Experimental Design

There are many situations in which it is not possible for researchers to use experimental designs. It may be unethical to deny treatment to a control group. Agency or hospital administration may not allow program participants to be randomly assigned. In these situations, quasi-experimental designs can be used. Quasi-experimental designs usually involve assignment to two groups without randomization or the use of a comparison group in place of a control group. Although less rigorous than an experimental design, quasi-experimental designs are an improvement over preexperimental designs. Three common quasi-experimental approaches will be reviewed here. Readers interested in a more in-depth discussion of the approach should consult other texts (Cook & Campbell, 1979).

Nonequivalent Comparison Groups

Suppose that one high school in town has adopted a novel sex education curriculum. You as a researcher would like to evaluate this curriculum compared with the usual one, but the principal will not allow any students to be assigned to a control group. However, a high school across town has demographics similar to those of the one with the novel curriculum. The principal of this high school agrees to participate in your study and have students fill out the same pretest-posttest given to the high school students with the novel curriculum. In this example, you have a quasi-experimental design with nonequivalent comparison groups. You are not able to randomly assign the students to their conditions, but you hope that the two groups are similar enough to be comparable. This design is denoted:

$O_1 \quad X \quad O_2$

$O_1 \quad O_2$

This use of the comparison group in this design addresses the concerns that students might have changed because of aging or an external event. Yet, some problems still remain in this design. The two groups were not randomly assigned. If their outcomes are different, we cannot rule out the possibility that demographic differences between the groups led to the difference in outcomes.

Time-Series Design

As mentioned, one concern in experimental research is that the intervention group may have changed regardless of the intervention. One of the ways of examining whether this is true is to administer multiple pretests before starting the intervention. By using multiple pretests, the researcher can detect whether there was a trend. In other words, was the group already engaged in a change process before the intervention started?

A more rigorous extension of the multiple pretest design is a time-series design. The time-series design allows the research to examine the question of whether there was a trend in the data both before and after the intervention. Opinions differ as to how many pretests and posttests are needed in a time-series design. In the example that follows, the dependent variable is measured four times before the intervention and four times after:

$O_1 \quad O_2 \quad O_3 \quad O_4 \quad X \quad O_5 \quad O_6 \quad O_7 \quad O_8$

To further increase the rigor, researchers can use a multiple time-series design. The multiple time-series design adds a nonequivalent comparison group. The nonequivalent comparison group gets the same number of observations of the dependent variable in the same time frame but does not receive the intervention. The multiple time-series design addresses the concern that an external event occurring simultaneous to the intervention could have influenced the dependent variable. It is usually denoted:

$O_1 \quad O_2 \quad O_3 \quad O_4 \quad X \quad O_5 \quad O_6 \quad O_7 \quad O_8$

$O_1 \quad O_2 \quad O_3 \quad O_4 \qquad O_5 \quad O_6 \quad O_7 \quad O_8$

Case-Control Studies

Many questions do not lend themselves to experimental designs. Suppose we want to understand what leads a person to become a perpetrator of child abuse, what contributes to becoming a high school dropout, or which health habits contribute to high blood pressure. Designing a controlled experiment to answer one of these questions may be difficult or even impossible. Though not as rigorous as an experimental design, a case-control study is a good alternative. A case-control study collects retrospective data from people who are and are not in the outcome condition and uses multivariate statistical analysis to compare the two groups and identify variables that may have contributed to the outcome condition. It is a more convenient and inexpensive way to collect outcome data than an experimental design. A downside of this design is that it relies on retrospective data. Some participants may have difficulty recalling events and circumstances of their early life, and many may not recall accurately.

Experimental Design

Experimental designs seek to answer explanatory research questions. In explanatory research, the investigator seeks to test hypotheses and explain how an independent variable influences a dependent variable. In an ideal experiment, it would be possible to say with certainty that an independent variable caused a dependent variable. It is unusual for a researcher in nursing or any medical or social science field to have sufficient control over the design of an experiment to produce the ideal (Grinnell, Unrau, & Williams, 2011). Yet, the following three criteria can produce a high degree of certainty that an explanatory relationship exists (Rubin & Babbie, 2014):

- The independent variable (cause) should come before the dependent variable (effect) chronologically.
- The independent and dependent variables should be empirically related to each other.
- The relationship between the independent and dependent variables cannot be explained as the result of the influence of a third variable.

Two key techniques in experimental design separate it from preexperimental or quasi-experimental design. The first is the use of a *control group*. A control group is a set of research respondents who resemble the experimental group in every way except that they do not receive the target intervention of the research study (Rubin & Babbie, 2014). The second technique is *randomization*. Randomization is the assignment of respondents to either the experimental or control group at random. Techniques for randomization include flipping a coin, using a random numbers table, and assigning by an even or odd identification number (Rubin & Babbie, 2014). Without randomization, there is a chance that participants assigned to either an experimental or control group could be inherently different from each other. In other words, there is a risk for *selection bias*. The term *randomized controlled trial,* used frequently in evidence-based practice, refers to experimental group designs with both randomization and a control group. Three of the designs most commonly discussed in the research literature are reviewed here (see **Table 1-6**).

Pretest-Posttest Control Group Design

The first type of experimental design, sometimes known as the classic experimental design, is denoted as follows, with R signifying randomization to group:

R O_1 X O_2

R O_1 O_2

The classic experimental design minimizes many threats to internal validity, including maturation, history, and selection bias. This design does not account for the problem of testing effects. It is possible that participants in both the experimental and control groups will improve simply because they are retested on the same measure and have improved in completing the measure. To address the problem of testing, a different design will be described next.

Table 1-6 Study Examples of Research Designs

Study	Research Design and Sampling	Instruments	Intervention	Findings
Wyatt, T. H., & Hauenstein, E. J. (2008). Pilot testing Okay With Asthma: An online asthma intervention for school-age children. *Journal of School Nursing, 24*(3), 145–150.	One-group pretest-posttest quasi-experimental design; convenience sample	The Asthma Information Quiz The Child Attitude Toward Illness Scale Given at baseline and 1 week and 2 weeks after the intervention	Okay With Asthma program	Significant improvements in asthma knowledge scores at the 1- and 2-week evaluations and significant improvements in attitude scores 2 weeks after the program
Park, J., Lee, N., Cho, Y., & Yang, Y. (2015). Modified constraint-induced movement therapy for clients with chronic stroke: Interrupted time series (ITS) design. *Journal of Physical Therapy Science, 27,* 963–966.	Time series design; assessments were performed five times in a 3-week period before and after intervention; no control group	Modified Barthel Index (MBI) and the Box and Block Test (BBT)	Modified constraint-induced movement therapy	Improved upper extremity functions and performance of daily living activities
Alexandropoulou, M. (2013). Evaluating a health educational first aid program for special education school personnel: A cluster randomized trial. *International Journal of Caring Sciences, 6,* 115–126.	Solomon four-group design; five to seven schools randomized to each group with 32–54 participants per group	First aid questionnaire	Health educational first aid program for special education school personnel	Significant improvement in scores for the intervention groups

Solomon Four-Group Design

If researchers would like to know about pretest-posttest change but are concerned about the problem of testing effects, they can use the Solomon four-group design. This highly regarded research design involves dividing respondents into four groups: two are experimental, and two are control. One of the experimental groups and one of the control groups are pretested but not the other. It is denoted:

R	O_1	X	O_2
R	O_1		O_2
R		X	O_2
R			O_2

Alternative Treatment Design or Dismantling Study

Researchers often seek to compare alternative treatment approaches. For example, researchers may want to compare two drugs, two patient education programs, or two case management strategies. One method of comparing is to randomly assign participants to one of two groups: one receiving intervention A (X_A) and one receiving intervention B (X_B). Such a design could answer which of the two treatment alternatives is superior. However, what if the researcher is concerned that both treatments have no effect? To answer this question, a control group must be included in the study design. Then, the study would consist of three groups: one receiving intervention A, one receiving intervention B, and a final receiving no intervention. This would be denoted:

R	O_1	X_A	O_2
R	O_1	X_B	O_2
R	O_1		O_2

A final design called a dismantling study can be used to explore which components of the intervention are needed to achieve the desired effect. In the first group, participants are randomly assigned to receive both intervention components A and B. In the second, participants receive only intervention A. In the third, participants receive only intervention B. The final group is a control group receiving no intervention. If either of the groups in the second or third rows shows as much improvement as the first group, the component in the second or third row would be all that is needed (Rubin & Babbie, 2014). This approach is denoted:

R	O_1	X_{AB}	O_2
R	O_1	X_A	O_2
R	O_1	X_B	O_2
R	O_1		O_2

An example of a dismantling study can be found in an article by Kroeze, Oenema, Dagnelie, and Brug (2008). This study examined a computed-tailored intervention aimed at reducing dietary fat intake among adults. The four conditions in the dismantling study were (1) feedback on dietary fat intake, (2) feedback relative to one's peers, (3) the first two types of feedback plus practical suggestions on how to change fat intake, and (4) general information. Kroeze et al. found that the third condition, personal and peer feedback with practical suggestions, was effective in reducing fat intake among the high-risk populations. The first two conditions were effective only in changing intention to reduce fat intake.

Reactivity and Placebo Effects

All the experimental designs described earlier involve the use of a control group. The use of a control group introduces rigor in a study design to address many threats to internal validity. However, it also introduces problems of reactivity of study participants. It is possible that experimental group participants will improve simply because they are receiving additional attention that accompanies treatment. Another possibility is that control group participants will become frustrated with the study because they are not receiving treatment and drop out. On the other hand, control group participants may engage in compensatory rivalry, trying to find treatments elsewhere that mirror the one that the experimental group is receiving. All these possibilities threaten the validity of the study.

One option to address reactivity is to use a placebo. Use of a placebo has become standard practice in drug studies, but it also can be used in other types of intervention studies. Researchers who examine psychosocial or health education interventions may be concerned that the additional time and attention given to the experimental group over the control group will influence the outcome regardless of whether the intervention is effective. Thus, some researchers will introduce an alternative program for the control group that is not believed to have an impact on the dependent variables of interest. For example, Duru, Sarkisian, Leng, and Mangione (2010) completed a randomized controlled trial of a faith-based physical activity intervention for older African American women. Because the researchers were concerned about placebo effects, the control group received group lectures about topics important to seniors, such as financial planning. These group lectures were useful to the participants but were not expected to affect the outcome variables, such as body mass index and blood pressure.

Systematic Reviews and Meta-Analyses

From an evidence-based practice perspective, systematic reviews and meta-analyses hold the spot at the top of the hierarchy of research evidence. The purpose of systematic reviews and meta-analyses is to create an unbiased synthesis of the literature on a particular research question. The terms *systematic review* and *meta-analysis* are not synonymous, but the two techniques are highly compatible and can be used together to summarize a large body of research and generate new insights (Littell, Corcoran, & Pillai, 2008).

For example, Shah and Shah (2010) were interested in whether domestic violence during pregnancy has an adverse impact on the fetus. A literature review

turned up a large number of studies. Some of the studies found that domestic violence increases risk, and others found no impact. How does one make sense of this variation in the literature? Shah and Shah used the systematic review process to search for literature and evaluate it. They used meta-analysis techniques to combine the results of multiple studies. Their conclusion was that domestic violence is associated with increased risk for low birth weight and preterm birth.

Systematic Review

A systematic review is a process of comprehensively locating and synthesizing the research on a particular question using organized, transparent, and replicable procedures (Littell et al., 2008). The first step in the systematic review process is to develop a protocol. The first element of a protocol is a clearly formulated and answerable research question and a set of hypotheses. As part of the research question, there should be explicit inclusion and exclusion criteria to determine which studies are to be included in the review. These inclusion and exclusion criteria will specify problems or conditions, populations, interventions, settings, comparisons, outcomes, and study designs that are or are not to be included in the review. The protocol will specify the techniques to locate and screen studies. These techniques include search terms, databases and search engines to be used, and strategies to locate unpublished studies. When a systematic review is being prepared for inclusion in the Cochrane or Campbell Library, the protocol is submitted to and approved by peer review before the systematic review process begins. The final version of the approved protocol is posted online (Higgins & Green, 2011).

After the protocol has been formulated, the researchers locate and screen studies. Ideally, the researchers should keep a record of every abstract screened and the method by which it was retrieved. Database searches are usually the first step in a systematic review. Many systematic reviews will augment the database search with a hand search of 10–15 journals that frequently publish on the topic of review. Strong reviews will make every effort to locate unpublished studies. Methods for finding unpublished studies include reviewing proceedings of relevant conferences and searching the websites of government and nonprofit organizations that have an interest in the study topic. After the initial screening, two reviewers will read the study and determine whether it meets eligibility criteria for inclusion in the review. If the two reviewers disagree, a third usually breaks the tie.

After studies are located and screened, included studies are rated for study quality and data are extracted from the study. Data extraction involves recording the sample size and characteristics, the type of interventions used (if the focus of the research question is intervention), and the outcome variables and measures chosen. Study quality ratings are undertaken to assess whether there is any bias in the reporting of study outcomes. The *Cochrane Handbook* (Higgins & Green, 2011) recommends that reviewers assess the following types of bias: (a) selection bias—whether there were systematic differences in the composition of groups; (b) performance bias—whether there were systematic differences in care between the groups other than the intervention; (c) attrition bias—whether one group withdrew or dropped out at a higher rate than the other; (d) detection bias—whether there were systematic differences in outcome assessment because of unblinded assessment; and (e) reporting bias—whether there was a tendency to report only significant findings.

Meta-Analysis

Meta-analysis has been defined as "a set of statistical techniques for combining quantitative results from multiple studies to produce a summary of empirical knowledge on a given topic" (Littell et al., 2008, pp. 1–2). Meta-analysis is used after data have been extracted in the systematic review process. A meta-analysis produces an effect size, a measure of strength and direction of a relationship. Several different metrics can be used to estimate the effect size in a meta-analysis. When dependent variables are continuous, it is common to use standardized mean differences, also known as Cohen's *d*. When dependent variables are dichotomous, odds ratios or risk ratios are frequently the chosen metric.

Heterogeneity, or lack of equivalence, across research studies can cross out the option of conducting a meta-analysis; however, even when statistical groupings are reasonable, this remains a problem. Proper testing for heterogeneity is necessary, except when it is evident at a glance "that effects are consistent in magnitude and direction" (Polit & Beck, 2012, p. 662). Creating a forest plot will achieve a visual assessment of heterogeneity. The effect sizes of the studies will be estimated with the graph and jointly with a 95% confidence interval around the estimates (Polit & Beck, 2012).

A researcher conducting a meta-analysis frequently needs to consider how bias in outcome reporting could have an impact on the effect size. Several methods can be undertaken to address bias. If the researcher is including studies that are randomized by group (e.g., family unit, school), the intraclass correlation coefficient may be needed to examine whether observations within clusters are independent. Reporting (publication) bias also may have an impact on the effect size. To address publication bias, researchers can use a funnel plot to examine the distribution of effect sizes across studies included in the review. If there is no bias, the funnel plot should be symmetrical. If bias is found, researchers can use the trim and fill method to impute the values of studies that are assumed missing because of publication bias and recalculate the effect size (Duval, 2005). Variation of rigor in study design and inclusion of small studies in the meta-analysis also may lead to bias. Again, researchers can use funnel plots to examine this bias. They also can calculate the effect size with and without the small or less rigorously designed studies (Littell et al., 2008).

An example of a systematic review and meta-analysis can be found in an article by Chan et al. (2019). Chan and his colleagues were interested in whether pharmacotherapy could improve outcomes for patients addicted to methamphetamines/amphetamines (MA/A). They conducted a comprehensive search of the literature to find both published and unpublished studies of pharmacotherapy and MA/A use disorders and identified 5,936 citations. The researchers screened the citations and included only randomized controlled trials (RCTs) and systematic reviews that tested pharmacotherapies (along or in conjunction with psychotherapy techniques or contingency management) as compared to control group, usual care, or placebo. The outcomes the researchers chose were abstinence, MA/A use, and retention in treatment. The research team identified 17 RCTs and 1 systematic review that met inclusion criteria. These 18 studies examined the use of 17 different drugs for MA/A addiction including antidepressants, psychostimulants, anticonvulsants, antipsychotics, and opioid antagonists. After summarizing the findings, Chan and colleagues were able to find low-strength evidence that methylphenidate may reduce

MA/A use. They found either no effect or unclear evidence for the 16 other drugs studied. Systematic reviews and meta-analyses, such as this one by Chan and colleagues, are an important method for synthesizing quantitative research evidence and applying it to evidence-based practice.

Conclusion

Critical appraisal of research is a fundamental part of evidence-based practice. It begins with understanding the research process to carefully and systematically evaluate studies to judge their relevance for clinical practice. Understanding quantitative methods is key to applying the techniques of evidence-based practice and translational research. To determine significance of the research you are considering, examine the following areas:

- Does the study test a stated hypothesis?
- Who is being studied? How were participants selected?
- Is the research design appropriate for the research question/hypothesis?
- Is each feature of the research design clear and replicable?
- What measures were used, and how were the data collected?
- What are the results of the study, and are they statistically significant?

This chapter summarized the different types of quantitative research to support critical appraisal of studies to improve patient outcomes.

Reflective Activities

1. How are variables operationalized?
2. Which variable—independent, dependent, or confounding—is the focus of the research study?
3. What key techniques separate experimental from nonexperimental research designs?
4. What research design would best compare two patient interventions (e.g., for lowering cholesterol)?
5. Why might a practitioner use a quasi-experimental research design in the practice setting?
6. How does a systematic review differ from a meta-analysis?

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