As discussed in the textbook, some studies focus on research questions that are fairly straightforward and that involve understanding the relationship between two variables. Examples may include exploring:

- The effect of an illness (the independent variable or IV) on fatigue (the dependent variable or DV),
- The effect of a nursing intervention (IV) on pain (DV), or
- The effect of pain (IV) on quality of life (DV).

Sometimes, however, researchers study multiple variables that may be interrelated in complex ways. This Supplement describes some aspects of complex relationships and complex hypotheses. We begin by explaining moderating and mediating variables. For those who wish to learn more, Bennett (2000) has written a useful description of the conceptual and statistical differences between the two.

MODERATING VARIABLES

A moderator variable (MV) affects the strength or direction of an association between the independent and dependent variable. Identifying moderators may be important in understanding when and for whom to expect a relationship between the IV and DV, and it often has clinical relevance—for example, who benefits the most or the least from an intervention.

Research Question 1: What is the effect of nurses’ use of humor (versus the absence of humor, the IV) on stress (the DV) in hospitalized cancer patients (the population)?

Research Question 2: Does nurses’ use of humor have a different effect on stress in male versus female patients?

Research Question 1 is a simple research question with only two variables. Research Question 2 examines whether the relationship between the IV and the DV is influenced by or moderated by a third variable. In this example, gender is an MV. Moderator (or moderating) variables can be characteristics of the population (e.g., male versus female patients), of the circumstances (e.g., rural versus urban settings), or of external agents (e.g., male versus female nurses using humor). The following are examples of question templates that involve an MV:

- Treatment, intervention: In (population), does the effect of (IV: intervention) on (DV) vary by (MV)?
- Prognosis: In (population), does the effect of (IV: disease, condition) on (DV) vary by (MV)?
- Etiology, harm: In (population), does (IV: exposure, characteristic) cause or increase risk of (DV) differentially by (MV)?
MEDIATING VARIABLES
When a study purpose is to understand causal pathways, research questions may involve a mediating variable—a variable that intervenes between the IV and the DV and helps to explain why the relationship exists. For example, we might ask the following: Does nurses’ use of humor have a direct effect on the stress of hospitalized patients with cancer, or is the effect mediated by humor’s effect on immune function (natural killer cell activity)? A mediating variable can be conceptualized like this:

humor → natural killer cell activity → patient stress

This means that the path through which nurses’ humor affects stress is its effect on natural killer cell activity.

Many of the theoretical models described in Chapter 6 of the book involve mediating factors. Important health outcomes are often not directly affected by nursing actions but rather by their effects on such factors as self-efficacy, anxiety, improved health-promoting behaviors, and so on. In intervention research, moderating variables help researchers better understand how the intervention works. Chapter 18 of the book provides an example of how hypotheses about mediating variables are tested.

TIP: For those with strong statistical skills, a paper by Levy and colleagues (2011) discusses advances in statistical methods for testing hypotheses about mediation effects. This paper is available online as an open-access article, and a link to it is provided in the Toolkit on thePoint for Chapter 4.

Example of a Simple Hypothesis: Nafiu and Onyewuche (2014) hypothesized that abdominal obesity (IV) increases the risk of perioperative adverse respiratory events (DV) in children undergoing elective, noncardiac surgeries.

Example of Moderating and Mediating Variables: Christopherson and Conner (2012) studied health-risk behaviors in late adolescence. In their study of 437 adolescents, loneliness was a mediating variable, mediating the relationship between parental attachment and smoking. Gender moderated the relationships, and so separate analyses were undertaken for males and females.

FIGURE 4.1 Schematic representation of a simple hypothesis. IV, independent variable; DV, dependent variable.
Complex Hypotheses
Most phenomena are affected by a multiplicity of factors. A person’s weight, for example, is affected simultaneously by such factors as height, diet, bone structure, activity level, and metabolism. If the DV were weight and the IV was a person’s caloric intake, we would not be able to explain or understand individual variation in weight very well. For example, knowing that Alex O’Hara’s daily caloric intake averages 2,500 calories would not permit a good prediction of his weight. The overlap in circles indicating the strength of the relationship between caloric intake and weight would likely be smaller than what is shown in Figure 4.1.

Many other factors are related to a person’s weight, however. Knowledge of those factors, such as Alex’s height, would improve our ability to accurately understand and predict his weight. Figure 4.2 presents a schematic representation of a complex hypothesis, showing the situation in which the DV is influenced by two IVs (IV1 and IV2). To pursue the preceding example, the hypothesis might be: Taller people (IV1) and people with higher caloric intake (IV2) weigh more (DV) than shorter people and those with lower caloric intake. In this example, we expect that caloric intake and height would do a better job in helping us explain variation in weight (DV) than caloric intake alone. Complex hypotheses have the advantage of allowing researchers to capture some of the complexity of the real world.

Just as a phenomenon can be caused or influenced by more than one IV, a single IV can also influence more than one phenomenon, as illustrated in Figure 4.3. A number of studies have found, for example, that cigarette smoking (IV) can lead to both lung cancer (DV1) and coronary disorders (DV2). Complex hypotheses are common in studies that try to assess the effect of a nursing intervention on multiple outcomes.

Although hypotheses can be even more complex (e.g., two IVs predicting two DVs), the hypotheses in nursing studies often are like the ones shown in Figures 4.1, 4.2, or 4.3.
Hypotheses are also complex if mediating or moderator variables are included in the prediction. For example, it might be hypothesized that the effect of caloric intake \((X)\) on weight \((Y)\) is moderated by gender \((Z)\)—that is, the relationship between height and weight is different for men and women. Or, we might predict that the effect of ephedra \((X)\) on weight \((Y)\) is indirect, mediated by ephedra’s effect on metabolism \((Z)\).

REFERENCES CITED IN CHAPTER 4 SUPPLEMENT


*A link to this open-access journal article is provided in the Toolkit on thePoint for this chapter in the accompanying Resource Manual.*