THE PRACTICE OF RESEARCH IN SOCIAL WORK

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CHAPTER 4

Measurement

Alcohol abuse is a social problem of remarkable proportions. In 2012, 17 million Americans age 12 or older were alcohol abusers (Substance Abuse and Mental Health Services Administration [SAMHSA], 2012). Alcohol is involved in more than 30% of all fatal traffic crashes (National Highway Traffic Safety Administration, 2013), and almost 1.3 million arrests are made annually for driving under the influence (Federal Bureau of Investigation, 2013). Four in 10 full-time college students ages 18 to 22 binge drink (SAMHSA, 2012), and about 1 in 4 could be diagnosed as alcohol abusers or alcohol dependent (Slutske, 2005).

Whether your goal is to learn how society works, deliver useful services, design effective social policies, or even design your own study, at some point you might decide to read the research literature on that topic. If you are reading literature about alcohol abuse, you will have to answer three questions: (1) What is meant by *alcohol abuse* in this research (conceptualization)? (2) How is alcohol abuse measured (measurement)? and (3) Is the measurement method accurate and valid (reliability and validity)? These questions must be answered when we evaluate prior research and when we design new research. Only when we conclude that a study used valid measures of its key concepts can we have some hope that its conclusions are valid.

Measurement is a crucial component of social work practice and research. When you think of measurement in social work practice, you might think of assessment whereby you are collecting information about a client system; the assessment often includes key concepts and measures of those concepts. When evaluating a program's outcomes, broadly stated goals and objectives are translated into something that can be measured. What you learn from the assessment helps guide intervention decisions; what you learn about a program's outcomes influences the design or continuation of the program.

In this chapter, we describe the process of measurement—from taking an abstract concept and translating the concept to the point that we can assign some value to represent that concept. First we address the issue of conceptualization or how you define key terms, using alcohol abuse and other concepts as examples. We then focus on the characteristics, or levels of measurement, reflected in different measures. In the next section, we discuss different methods to assess the quality of measures, specifically the techniques used to assess reliability and validity. Finally, we discuss the importance of ensuring the cultural relevance of measures and the implications of measurement for evidence-based practice. By the chapter's end, you should have a good understanding of measurement and the crucial role it plays for social work practice and social work research.

Concepts

Although the drinking statistics sound scary, we need to be clear about what they mean before we march off to a Temperance Society meeting. What, after all, is *binge drinking*? The definition SAMHSA (2013) used is "five or more drinks on the same occasion (i.e., at the same time or within a couple of hours of each other) on at least 1 day in the past 30 days." This is only one definition of binge drinking; other researchers suggest that while the definition is appropriate for men, it should be four drinks for women (Wechsler et al., 2002). The 5/4 definition is widely accepted by researchers, so when they use the term they can understand each other.

Is this what you call binge drinking? The National Institute on Alcoholism and Alcohol Abuse (NIAAA; n.d.) provides a more precise definition of binge drinking "as a pattern of drinking alcohol that brings blood alcohol concentration to 0.08 gram percent or above." Most researchers consider the 5/4 distinction to be a reasonable approximation of this precise definition. We cannot say that only one definition of *binge drinking* is correct or better. What we can say is that we need to specify what we mean when we use the term and that others know what definition we are using.

Binge drinking is a **concept**—a mental image that summarizes a set of similar observations, feelings, or ideas. To make that concept useful in research (and even in ordinary discourse), we have to define it. A challenge faced by social work researchers is that many of the topics they study involve abstract concepts or ideas that are not easily observable and not just simple objects. Some concepts, such as age or living arrangement, are straightforward, and there is little confusion about their meaning. When we refer to concepts like alcohol abuse, homelessness,

Concept A mental image that summarizes a set of similar observations, feelings, or ideas.

mental health, or poverty, we cannot count on others knowing exactly what we mean. Even the experts may disagree about the meaning of frequently used concepts. That's okay. The point is not that there should be only one definition of a concept but that we have to specify clearly what we mean when we use a concept, and we expect others to do the same.

Conceptualization in Practice

If we are to do an adequate job of **conceptualization—**working out what our key terms will mean in our research—we must do more than just think up some definition, any definition, for our concepts. We have to turn to social theory and prior research to review appropriate definitions. We may need to identify dimensions of the concept. We should understand how the definition we choose fits within the theoretical framework guiding the research and what assumptions underlie this framework.

Researchers start with a **nominal definition** of the concept; they define the concept in terms of other concepts. Nominal definitions are like those definitions found in dictionaries: You get an understanding of the word and its dimensions, but you still do not have a set of rules to use to measure the concept. For example, child abuse might be defined as evident when either severe physical or emotional harm is inflicted on a child or there is contact of a sexual nature. The nominal definition of child abuse includes concepts such as *severe harm*, *physical abuse*, and *emotional abuse*, but the definition does not provide the set of rules a researcher uses to identify the forms of abuse or distinguish between severe and not severe harm. The actual measure of child abuse should be consistent with the nominal definition.

Conceptualization The process of specifying what we mean by a term. In deductive research, conceptualization helps to translate portions of an abstract theory into testable hypotheses involving specific variables. In inductive research, conceptualization is an important part of the process used to make sense of related observations.

Nominal definition Defining a concept using other concepts.

Alcohol Abuse

What observations or images should we associate with the concept of alcohol abuse? Someone leaning against a building with a liquor bottle, barely able to speak coherently? College students drinking heavily at a party? Someone in an Alcoholics Anonymous group drinking one beer? A 10-year-old boy drinking a small glass of wine in an alley? A 10-year-old boy drinking a small glass of wine at the dinner table in France? Do all these images share something in common that we should define as alcohol abuse for the purposes of a particular research study? Do some of them? Should we take into account cultural differences? Gender differences? Age differences? Social situations? Physical tolerance for alcohol?

Many researchers now use the definition of *alcohol abuse* or *alcohol use disorder* contained in the American Psychiatric Association's (2013) *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*): "a problematic pattern of alcohol use leading to clinically significant impairment or distress, as manifested by at least two of the following, occurring within a 12-month period:" (p. 490). Eleven symptoms or behaviors are listed with the number of presenting symptoms distinguishing between mild (2–3 symptoms), moderate (4–5 symptoms), and severe (6 or more symptoms) alcohol use disorder. Although a popular definition, we cannot judge the *DSM-5* definition of alcohol abuse as correct or incorrect. Each researcher has the right to conceptualize as he or she sees fit. However, we can say that the *DSM-5* definition of alcohol abuse is useful, in part, because it has been widely adopted. The definition is stated in clear and precise language that should minimize differences in interpretation and maximize understanding.

This clarity should not prevent us from recognizing that the definition reflects a particular theoretical orientation. *DSM-5* applies a medical "disease model" to alcohol abuse (as well as to mental illness). This theoretical model emphasizes behavioral and biological criteria, instead of the social expectations that are emphasized in a social model of alcohol abuse. How we conceptualize reflects how we theorize.

Just as we can connect concepts to theory, we can connect them to other concepts. What this means is that the definition of any one concept rests on a shared understanding of the terms used in the definition. So if our audience does not already have a shared understanding of terms such as *adequate social functioning*, *self-care functioning*, and *repeated use*, we must also define these terms before we are finished with the process of defining *alcohol abuse*.

Depression

Some concepts have multiple dimensions, bringing together several related concepts under a larger conceptual umbrella. One such concept is depression. Depression is unlike a normal emotional experience leading to sadness because it includes a range of symptoms, such as negative mood (sadness, loneliness, feelings of worthlessness) and somatic conditions (loss of interest in pleasurable activities, eating and sleeping problems, loss of energy, talking less). Depression is a combination of these different dimensions.

But even when there is agreement about the various dimensions that make up depression, there are still different approaches to measure the presence of depression. One approach assumes that the presence of psychological symptoms is not enough by itself, but these symptoms vary by intensity or severity (Dohrenwend & Dohrenwend, 1982). In the case of depression, it is not sufficient to look at whether the symptoms are present; rather, they have to be persistent, lasting for some time period. The symptoms must be so intense that they interfere with an individual's ability to function. So some researchers use scales that measure the intensity of the different items. For example, the Center for Epidemiologic Studies Depression (CES-D) scale asks respondents to rate the intensity (or severity) of each of the items; then the items are summed to represent a range on a continuum of intensity of depression.

The second approach to measuring depression is derived from the clinical case identification model used in assessment models such as the *DSM-IV-TR* and reflected in scales such as the Patient Health Questionnaire (PHQ-9; Kroenke & Spitzer, 2002). In the clinical diagnostic approach, researchers identify the presence of the various dimensions of depression during a specific time period, but they do not assess the intensity of the symptoms. Furthermore, researchers using this method gather additional information to assess whether the responses conform to criteria for a case of depression. Unlike the previous model, this approach identifies simply whether depression is present or absent.

Do these different perspectives really matter? Joy Newmann (1989) found that the relationship between age and depression depended on the type of assessment method. Studies using scales like the CES-D tended to show that highest depression scores occur among the youngest and oldest age groups, whereas studies using the clinical case method have found that the younger and older cohorts were less depressed than middle-age cohorts.

Poverty

Decisions about how to define a concept reflect the theoretical framework that guides the researchers. For example, the concept *poverty* has always been somewhat controversial because different conceptualizations of poverty result in different estimates of its prevalence and different social policies for responding to it.

Most of the statistics that you see in the newspaper about the poverty rate reflect a conception of poverty that was formalized by Mollie Orshansky, of the Social Security Administration, in 1965 and subsequently adopted by the federal government and many researchers. She defined poverty in terms of what is called an *absolute* standard, based on the amount of money required to purchase an emergency diet that is estimated to be nutritionally adequate for about 2 months. The idea is that people are truly poor if they can barely purchase the food they need and other essential goods. This poverty threshold is adjusted for household size and composition (number of children and adults), and the minimal amount needed for food is multiplied by three because a 1955 survey indicated that poor families spend about one third of their incomes on food (Orshansky, 1977). More recently, a governmental working group has developed a supplemental poverty measure that calculates income and poverty thresholds somewhat differently but is still based on minimum need (Garner, 2010).

Other social scientists reject this way of establishing an absolute standard and suggest an alternative method: the *basic needs budget* approach (Lin & Bernstein, 2008). This approach suggests that we need to establish the market cost of a basket of goods that each of us needs to meet basic needs. The cost of each category or good is estimated separately. This method also forces us to define what an *adequate amount* of that particular good is. Like the official poverty line, this definition requires adjustments for family size, but it also requires adjustments for the labor status of the parent, ages of the children, and geographic region of residence.

Some social scientists disagree with absolute standards and have instead urged adoption of a *relative* poverty standard. One such standard identifies the poor as those having some fraction of income such as whose incomes fall below

50% of the median household income (Wolff, 2009). The idea behind this relative conception is that poverty should be defined in terms of what is normal in a given society at a particular time.

Some social scientists prefer yet another conception of poverty. With the *subjective* approach, poverty is defined as what people think would be the minimal income they need to make ends meet. While some poverty researchers have argued that this approach is influenced too much by the different standards that people use to estimate what they "need," trends of poll responses to asking about the minimum income necessary for a family of four to get along in one's community tend to follow a path similar to changes in the median income (Blank, 2008).

What are the implications of these different approaches? If you are interested in determining the percentage of the population that is poor, a relative approach sets the percentage you consider poor based on income only. Basic needs approaches that attempt to specify the actual amount needed to meet basic needs tend to find three times as many poor in comparison to the multiplier approach used to calculate the Official Poverty Line (Lin & Bernstein, 2008). The different poverty thresholds based on these definitions are displayed on Exhibit 4.1. The differing poverty thresholds have implications for the number of people living in poverty and the types of policies that might be implemented to address poverty.

From Concepts to Observations

After we define the concepts in a study, we must identify corresponding variables and develop procedures to measure them. To measure alcohol abuse we might use any number of variables: one variable might be the count of alcoholic drinks; another variable might involve asking about the presence of blackouts; a third variable may ask about binge drinking, and a fourth variable might reflect a score on a rating scale of 10 questions. Any of these variables could show low or high degrees of substance abuse.

Where do variables fit in the continuum from concepts to operational indicators? Think of it this way: Usually, the term *variable* is used to refer to some specific aspect of a concept that varies and for which we then have to select even more concrete indicators. Concepts vary in their level of abstraction, and this in turn affects how readily we can specify the variables pertaining to the concept. We may not think twice before we move from a conceptual definition

Exhibit 4.1 Poverty Thresholds Using Different Definitions 2013 for Selected Families (in dollars)

Measure	One Parent, One Child	Two Parents, Two Children
Official Poverty Line[a]	16,057	23,624
Basic Needs Budget: Pittsburgh Metropolitan Region[b]	48,040	66,324
Basic Needs Budget: Boston Metropolitan Region[b]	67,924	86,502
Relative Poverty Line: National 50% definition[c]	26,125	26,125
Relative Poverty Line: Pittsburgh Metropolitan Region 50% definition[c]	25,646	25,646
Relative Poverty Line: Boston Metropolitan Region 50% definition[c]	36,454	36,454

Source: Economic Policy Institute; U.S. Census Bureau.

a *Source:* http://www.census.gov/hhes/www/poverty/data/threshld/index.html May 24, 2015.

b *Source:* Economic Policy Institute (2015), Family Budget Calculator http://www.epi.org/resources/budget.

c *Source:* Noss, A. (September 2014). Household income: 2013, American Community Survey Briefs. U.S. Census Bureau, U. S. Department of Commerce.

Research In the News

HOW TO MEASURE RACE AND ETHNICITY IN AMERICA?

The U.S. Bureau of the Census is considering how to best measure race and ethnicity for the 2020 Census. Increasing numbers of people are identifying multiple racial and ethnic categories, forced to respond to categories that they do not believe reflect their background, checking other race or other ethnicity, and/or switch categories from Census to Census.

For Further Thought ?

1. How would you define race and ethnicity?
2. How would you operationalize race? ethnicity?
3. What does a "race" variable or "ethnicity" variable really measure?

Source: Vega, Tanzina. 2014. "Census Considers How to Measure a More Diverse America" *The New York Times*, July 1, 2014 [note downloaded from web site on 7-10-2014].

of *age* as time elapsed since birth to the variable *years since birth*. Binge drinking is also a relatively concrete concept, but it requires a bit more thought. We may define binge drinking conceptually as episodic drinking and select for our research on binge drinking the variable *frequency of five or more drinks in a row*. A single question is sufficient.

A more abstract concept like social support may have a clear role in theory but a variety of meanings in different social settings. For example, research on the concept of social support might focus on the variable *level of perceived support*. We might select as our variable the responses to a series of statements about social support, such as found in Zimet, Dahlem, Zimet, and Farley's (1988) "Multidimensional Scale of Perceived Social Support": "There is a special person around when I am in need."

Not every concept in a particular study is represented by a variable. If we were to study clients' alcohol abuse at an inpatient treatment unit, there is no variation; rather, all the clients are clients. In this case, client is called a constant; it is always the same and therefore is not a variable. Of course, this does not mean we cannot study gender differences among the clients. In this case, gender is the variable; the client is still a constant.

It is very tempting, and all too common, to simply try to measure everything by including in a study every variable we can think of that might have something to do with our research question. This haphazard approach will inevitably result in the collection of data that are useless and the failure to collect some data that are important. Instead, a careful researcher examines relevant theories to identify key concepts, reviews prior research to learn how useful different indicators have been, and assesses the resources available for measuring adequately variables in the specific setting to be studied.

Operationalization

Once we have defined our concepts in the abstract—that is, we have provided a nominal definition—and we have identified the specific variables we want to measure, we must develop measurement procedures. The goal is to devise procedures to indicate the values of cases on a variable. **Operationalization** is the process of connecting concepts to observations.

Researchers provide an **operational definition**, which includes what is measured, how the indicators are measured, and the rules used to assign a value

Operationalization The process of specifying the operations that will indicate the value of cases on a variable.

Operational definition The set of rules and operations used to find the value of cases on a variable.

to what is observed and to interpret the value. Previously, we have provided a nominal definition of *alcoholism*. An operational definition might include the following content:

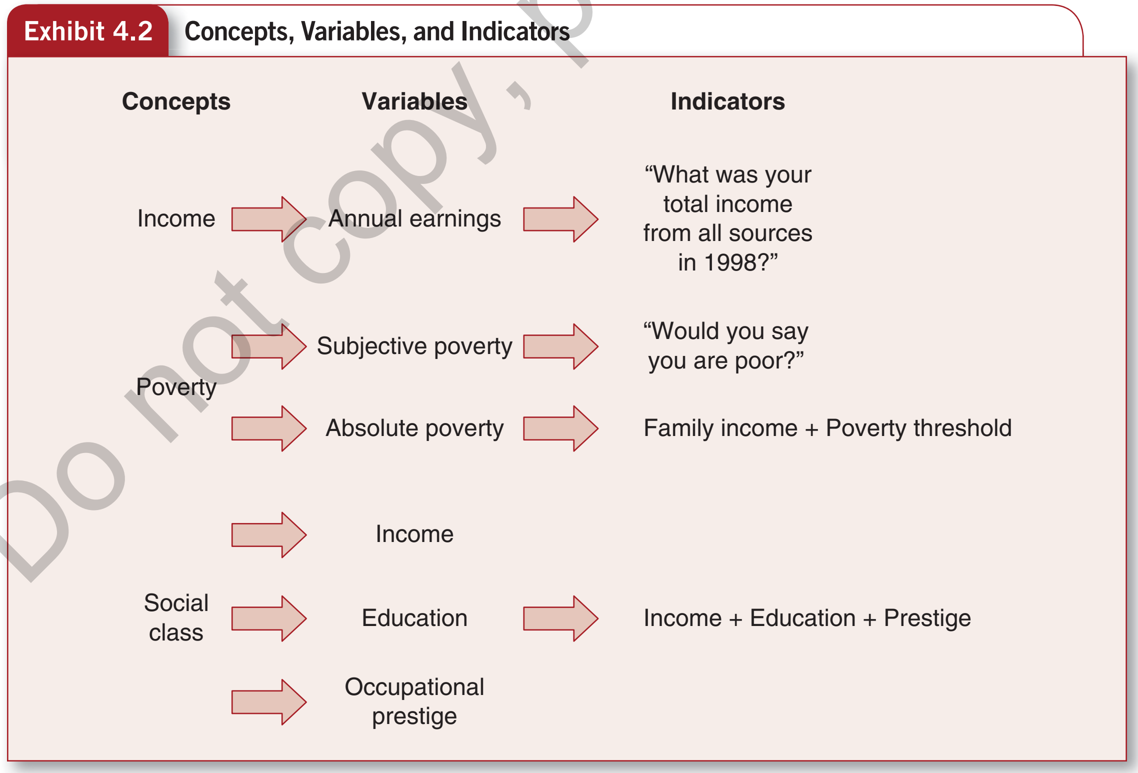
> The Michigan Alcoholism Screening Test (MAST) is a 24-item instrument that includes a variety of indicators of symptoms such as seeing drinking as a problem, seeking treatment for problem drinking, delirium tremens, severe shaking, hearing voices, complaints from others about drinking, memory loss from drinking, job loss due to drinking, social problems from drinking, arrests for drunk driving or for drunken behavior, guilt feelings about drinking, and ability to stop drinking. The scale may be administered orally or may be self-administered. Respondents respond yes or no to each item, and each item is given a weighted score ranging from 0 to 5. There are four items for which the alcoholic response is "no." The weighted item responses are summed, with a score of 0 to 3 indicating no problem with alcoholism, 4 considered to be suggestive of a problem, and 5 or above an indication of alcoholism.

As you can see from this definition, we are provided with the specific indicators included in the measure, the method(s) for data collection, specific scoring rules, and the interpretation of scale scores.

Exhibit 4.2 represents the operationalization process in three studies. The first researcher defines the concept, income, and chooses one variable, annual earnings, to represent it. This variable is then measured with responses to a single question or an item: What was your total income from all sources in 2015? The second researcher defines the concept, poverty, as having two aspects or dimensions: subjective poverty and absolute poverty. Subjective poverty is measured with responses to a survey question: Do you consider yourself poor? Absolute poverty is measured by comparing family income to the poverty threshold. The third researcher decides that the concept is defined by a position on three measured variables: income, education, and occupational prestige.

One consideration is the precision of the information that is necessary. The first researcher in Exhibit 4.2 is seeking information that is quite precise and assumes that respondents will be willing and able to accurately report

Exhibit 4.2 Concepts, Variables, and Indicators


Concepts
Variables
Indicators
Income
Annual earnings
"What was your total income from all sources in 1998?"
Subjective poverty
"Would you say you are poor?"
Poverty
Absolute poverty
Family income + Poverty threshold
Income
Social class
Education
Income + Education + Prestige
Occupational prestige

the information. As an alternative, the question might have been: "Please identify the income category that includes your total income from all sources in 2015." This question will provide less exact information, but people might be more willing to respond to it. Generally, the decision about precision is based on the information that is needed for the research. It may also be based on what the researcher believes people can recall and the content people may be willing to report.

The variables and particular measurement operations chosen for a study should be consistent with the research question. Take the evaluative research question: Are self-help groups more effective in increasing the likelihood of abstinence among substance abusers than hospital-based treatments? We may operationalize the variable *form of treatment* in terms of participation in these two types of treatment. However, if we are answering the explanatory research question: What influences the success of substance abuse treatment? We should probably consider what it is about these treatment alternatives that is associated with successful abstinence. Prior theory and research suggest that some of the important variables that differ between these treatment approaches are level of peer support, beliefs about the causes of alcoholism, and financial investment in the treatment.

Scales to Measure Variables

When several questions are used to measure one concept, the responses may be combined by taking the sum or average of responses. A composite measure based on this type of sum or average is termed a **scale**. The idea is that idiosyncratic variation in response to particular questions will average out so that the main influence on the combined measure will be the concept on which all the questions focus. Each item is an indicator of the concept, but the item alone is often not a sufficient measure of the concept. A scale is a more complete measure of the concept than any single component question.

Scale A composite measure based on combining the responses to multiple questions pertaining to a common concept.

Creating a scale is not just a matter of writing a few questions that seem to focus on a concept. Questions that seem to you to measure a common concept might seem to respondents to concern several different issues. The only way to know that a given set of questions forms a scale is to administer the questions to people like those you plan to study. If a common concept is being measured, people's responses to the different questions should display some consistency.

Scales have been developed to measure many concepts, and some of these scales have been demonstrated to be accurate in a range of studies. It usually is much better to use such a scale to measure a concept than it is to try to devise questions to form a new scale. Use of a preexisting scale both simplifies the work involved in designing a study and facilitates comparison of findings to those obtained in other studies. Scales can be found in research articles; on the Internet, for example the ERIC/AE Test Locator (www.ericae.net/testcol.htm); or in compilations, such as *Measures for Clinical Practice and Research* (Fischer & Corcoran, 2013).

The Center for Epidemiologic Depression Scale (CES-D; see Exhibit 4.3) is a scale used to measure depression. The aspect of depression measured by the scale is the level (the frequency and number combined) of depressive symptoms. Given that depression consists of negative affect, lack of positive affect, and somatic behaviors, the developers of the scale designed questions to assess these dimensions. Many researchers in different studies have found that these questions form an accurate scale. Note that each question concerns a symptom of depression. People may have idiosyncratic reasons for having a particular symptom without being depressed; for example, people who have been suffering a physical ailment may say that they have a poor appetite. By combining the answers to questions about several symptoms, the scale score reduces the impact of this idiosyncratic variation.

The advantages of using scales rather than single questions to measure important concepts are clear, so surveys and interviews often include sets of multiple-item questions. However, several cautions are in order:

Exhibit 4.3 **Example of a Scale: The Center for Epidemiologic Studies Depression Scale (CES–D)**

INSTRUCTIONS FOR QUESTIONS. Below is a list of the ways you might have felt or behaved in the past week.

Please tell me how often you have felt this way during the past week:

Rarely or none of the time (less than 1 day)
Some or a little of the time (1 to 2 days)
Fairly often (3 to 4 days)
Most or all of the time (5 to 7 days)

During the past week:

1. I was bothered by things that usually don't bother me.
2. I did not feel like eating; my appetite was poor.
3. I could not shake off the blues even with help from my family or friends.
4. I felt I was just as good as other people.
5. I had trouble keeping my mind on what I was doing.
6. I felt depressed.
7. I felt everything I did was an effort.
8. I felt hopeful about the future.
9. I thought my life had been a failure.
10. I felt fearful.
11. My sleep was restless.
12. I was happy.
13. I talked less than usual.
14. I felt lonely.
15. People were unfriendly.
16. I enjoyed life.
17. I had crying spells.
18. I felt sad.
19. I felt people disliked me.
20. I could not "get going."

Source: From Radloff, Lenore. 1977. "The CES-D Scale: A Self-Report Depression Scale for Research in the General Population" *Applied Psychological Measurement* 1:385–401.

1. *Our presupposition that each component question is indeed measuring the same concept may be mistaken.* Although we may include multiple questions in a survey to measure one concept, we may find that answers to the questions are not related to one another, so the scale cannot be created. Or we may find that answers to just a few of the questions are not related to the answers given to most of the others. Therefore, we may decide to discard these particular questions before computing the average that makes up the scale.

2. *Some questions in a scale may cluster together in subsets or subscales.* All the questions may be measuring the intended concept, but we may conclude that the concept actually has several different aspects; this results in a **multidimensional scale.** For example, the CES-D has some items that measure only negative affect, other questions that measure only lack of positive affect, and other questions measuring somatic symptoms. Each of these concepts is an indicator of depression. Researchers may choose to use a variable that summarizes the total scale or they may choose to use variables that summarize the subscale scores. Sometimes using the total scale score can obscure important differences among the subscale scores.

Multidimensional scale A scale containing subsets of questions that measure different aspects of the same concept.

3. *Sometimes particular questions are counted, or weighted, more than others in the calculation of the scale.* The individual items in the CES-D scale have equal weight; that is, each item makes the same contribution to

the depression score. Other scales have questions that are more central to the concept being measured than other questions and so may be given greater weight when computing the scale score. The MAST asks questions that are assigned different weights. A positive response to the question, “Have you ever been in a hospital because of your drinking?” is given 5 points (weighted higher) than a positive response to the question, “Do you feel you are a normal drinker?” which is assigned 2 points.

You will come across different kinds of scales, but several of the most popular types include Likert scales, semantic differential scales, and Guttman response scales.

- Likert scales use Likert-response categories and measure the extent to which respondents hold a particular attitude or feeling. The scores are summed or averaged.
- In a semantic differential scale, the concept of interest is described by a number of opposite pairs of words, with each pair being an adjective that captures some aspect of the concept. If you were interested in measuring mood, one pair might be *happy–sad.* Respondents then rate themselves on a 5- or 7-point scale for each of the paired opposite words. The scores are then summed to obtain a measure of the attitude. The challenge is to identify a set of adjectives that captures all the dimensions of the concept.
- Guttman scales are designed to capture different levels of the concept, where the different levels might be differences in the strength of an attitude, different intensity of services, or difficulty in answering the question. The assumption is that if you can answer the difficult question, then you are likely to answer the easier question. In a Guttman scale, there is a hierarchy from the easiest to the hardest or the most general to the most specific.

Treatment as a Variable

Frequently, social work researchers will examine the effectiveness of an intervention or compare two different intervention approaches. When an intervention is compared to no intervention or when two or more interventions are compared, the intervention becomes the independent variable. It is important for the researcher to provide a clear nominal definition of the intervention. It is not enough for the researcher to say that the study is comparing one method to another, such as traditional case management to intensive case management. Although the general meaning of such an approach may be familiar to you, the researcher should define what each approach involves. Case management may include full support so that the social worker working with the chronically mentally ill provides a variety of services and supports, including rehabilitation, social skill building, counseling, links to resources, identification of work and social opportunities, and money management, whereas another social worker may just assess the client, link the client to other services, and periodically reassess the client.

Nominal definitions of an intervention only provide the characteristics or components of the intervention, but fail to fully describe how the intervention was implemented. Researchers provide varying amounts of specificity regarding the actual operationalization of the intervention. Robert Newcomer, Taewoon Kang, and Carrie Graham (2006) evaluated a specialized case management (Providing Assistance to Caregivers in Transition; PACT) for nursing home individuals returning to the community. They specified the five components of the program and provided details about what each component included. In describing caregiver assessment and care management, they identified who carried out the task, where the assessment was completed, the topics covered in the assessment, the process for care planning, and the activities covered by case management. This amount of detail provides a much clearer sense of the nature of the intervention, but it would still not be possible to repeat the research or to use the intervention with clients without additional information. Without the actual description of the intervention and how the treatment model was implemented, you cannot adequately evaluate the research or replicate what was done if you want to implement the intervention at your agency.

Gathering Data

Social work researchers and practitioners have many options for operationalizing their concepts. We briefly mention these options here but go into much greater depth in subsequent chapters.

Researchers may use direct measures, such as visual or recorded observation or a physical measure such as a pulse rate. Although these methods are particularly useful for gauging behavior, they are typically intrusive. The very act of gathering the information may change people's behavior, thereby altering the accuracy of the obtained information. If a caseworker goes to a client's home to observe the client interacting with a child, the nature of the interactions may change because the parent knows the caseworker is present. The parent is likely to behave in a manner that is more socially acceptable to the caseworker. Similarly, self-monitoring of behavior may have the same effect. If a smoker is asked to monitor the number of cigarettes smoked in a day, the act of such monitoring may reduce the number of cigarettes smoked.

Data may be gathered by interviews or self-administered scales and questionnaires. These methods appear to be direct in that we gather the information directly from the respondent or the client. Yet what we are trying to do is infer behavior, attitudes, emotions, or feelings because we cannot observe these directly. These methods may also be quite intrusive, and the quality of the responses can be affected by the nature of the questions or the characteristics of the person asking the questions.

There are other sources of information from which measures can be operationalized. Many large data sets have been collected by the federal government, state governments, and nongovernmental sources. Many of these data sets have social indicators that are relevant to social services, such as employment, program participation, income, health, crime, mental health, and the like. A drawback to these data is that you are constrained by the way those who collected the data operationalized their measures.

Variables can be operationalized using written information in client records. The quality of these records depends on the recording accuracy of the individual staff. As with data collected by other sources, you are constrained by how variables were operationalized by the staff. Staff may not use common definitions, and these definitions may change over time, leading to inaccuracies in the data.

When we have reason to be skeptical of potential respondents' answers to questions, when we cannot observe the phenomena of interest directly, and when there are no sources of available data, we can use indirect or unobtrusive measures, which allow us to collect data about individuals or groups without their direct knowledge or participation (Webb, Campbell, Schwartz, & Sechrest, 2000).

Two types of unobtrusive measures are physical traces and content analysis. The physical traces of past behavior are most useful when the behavior of interest cannot be directly observed and has not been recorded in a source of available data. To measure the prevalence of drinking in college dorms or fraternity houses, we might count the number of empty bottles of alcoholic beverages in the surrounding trash bins. Content analysis studies are representations of the research topic in such media forms as news articles, chatrooms, and Twitter messages. An investigation of what motivates child abuse reporting might include a count of the amount of space devoted to newspaper articles in a sample of issues of the local newspaper or the number of television newscasters reporting on the maltreatment of children.

Combining Measurement Operations

The choice of a particular measurement method is often determined by available resources and opportunities, but measurement is improved if this choice also takes into account the particular concept or concepts to be measured. Responses to such questions as "How socially engaged were you at the party?" or "How many days did you use sick leave last year?" are unlikely to provide information as valid as direct observation or agency records. However, observations at social gatherings may not answer our questions about why some people do not participate; we may just have to ask people. If no agency is recording the frequency of job loss in a community, we may have to ask direct questions.

Triangulation—the use of two or more different measures of the same variable—can make for even more accurate measurement (Brewer & Hunter, 2005). When we achieve similar results with different measures of the same variable, particularly when the measures are based on such different methods as survey questions and field-based observations, we can be more confident in the validity of each measure. If results diverge with different measures, it may indicate that one or more of these measures is influenced by more measurement error than we can tolerate. Divergence between measures could also indicate that they actually operationalize different concepts.

Measurement in Qualitative Research

Qualitative research projects usually take an inductive approach to the process of conceptualization. In an inductive approach, concepts emerge from the process of thinking about what has been observed, compared with the deductive approach that we have described, in which we develop concepts on the basis of theory and then decide what should be observed to indicate that concept. Instead of deciding in advance which concepts are important for a study, what these concepts mean, and how they should be measured, qualitative researchers begin by recording verbatim what they hear in intensive interviews or what they see during observational sessions. This material is then reviewed to identify important concepts and their meaning for participants. Relevant variables may then be identified and procedures developed for indicating variation between participants and settings or variation over time. As an understanding of the participants and social processes develops, the concepts may be refined and the measures modified. Qualitative research often does not feature the sharp boundaries in quantitative research between developing measures, collecting data with those measures, and evaluating the measures.

You learn more about qualitative research in Chapter 9, but an example will help you understand the qualitative measurement approach. Darin Weinberg (2000) observed participants in three drug abuse treatment programs in Southern California. He was puzzled by the drug abuse treatment program participants' apparently contradictory beliefs—that drug abuse is a medical disease marked by "loss of control" but that participation in a therapeutic community can be an effective treatment. He discovered that treatment participants shared an "ecology of addiction" in which they conceived of being *in* the program as a protected environment, whereas being in the community was considered being *out there* in a place where drug use was inevitable—in "a space one's addiction compelled one to inhabit" (Weinberg, 2000, p. 609).

> I'm doing real, real bad right now. . . . I'm havin' trouble right now staying clean for more than two days. . . . I hate myself for goin' out and I don't know if there's anything that can save me anymore. . . . I think I'm gonna die out there. (Weinberg, 2000, p. 609)

Participants contrasted their conscientiousness while in the program with the personal dissolution of those out in "the life."

So Weinberg developed the concepts of *in* and *out* inductively, in the course of the research, and he identified indicators of these concepts at the same time in the observational text. He continued to refine and evaluate the concepts throughout the research. Conceptualization, operationalization, and validation were ongoing and interrelated processes.

Levels of Measurement

The final part of operationalization is to assign a value or symbol to represent the observation. Each variable has categories of some sort, and we need to know how to assign a symbol—typically a number—to represent what has been observed or learned. We may have a discrete variable, whereby its symbol represents a separate category or a different status. The variable may be a continuous variable, for which the number represents a quantity that can be described in terms of order, spread between the numbers, and/or relative amounts.

When we know a variable's level of measurement, we can better understand how cases vary on that variable and so understand more fully what we have measured. Level of measurement also has important implications for the type of mathematical procedures and statistics that can be used with the variable. There are four levels of measurement: nominal, ordinal, interval, and ratio. Exhibit 4.4 depicts the differences among these four levels.

Level of measurement The mathematical precision with which the values of a variable can be expressed. The nominal level of measurement, which is qualitative, has no mathematical interpretation; the quantitative levels of measurement—ordinal, interval, and ratio—are progressively more precise mathematically.

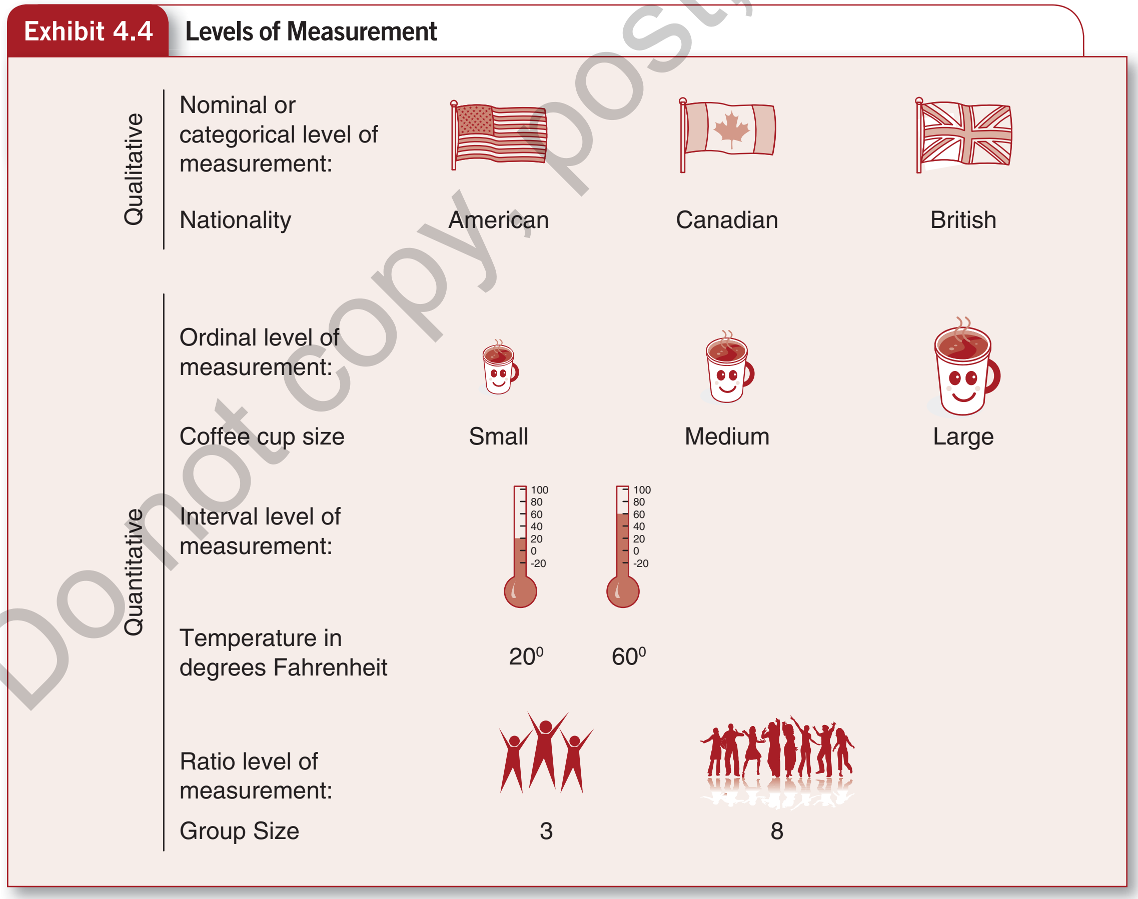
Nominal Level of Measurement

The **nominal level of measurement** identifies variables whose values have no mathematical interpretation; they vary in kind or quality, but not in amount. They may also be called categorical variables. In fact, it is conventional to refer to the values of nominal variables as attributes instead of values. The variable *ethnicity* can have several attributes (or categories or qualities): African American, Hispanic, Asian American, White, Native American, Other. We might indicate African American by the value 1, Hispanic by the value 2, and the like, but these numbers do not tell us anything about the difference between ethnic groups except that they are different. Hispanic is not one unit more of ethnicity than African American, nor is it twice as much ethnicity. The numbers simply represent a category.

Nominal level of measurement Variables whose values have no mathematical interpretation: they vary in kind or quality, but not in amount.

Nominal-level variables are commonplace in social work research. Client characteristics such as marital status (e.g., Married, Widowed, Divorced,

Exhibit 4.4 Levels of Measurement


Qualitative
Nominal or categorical level of measurement:
Nationality
American
Canadian
British
Quantitative
Ordinal level of measurement:
Coffee cup size
Small
Medium
Large
Interval level of measurement:
100
80
60
40
20
0
-20
Temperature in degrees Fahrenheit
20⁰
60⁰
Ratio level of measurement:
Group Size
3
8

Sepaated, Never Married) or mental health diagnosis (e.g., Mood Disorder, Personality Disorder, Other Disorder) are nominal-level variables. Program-related variables such as referral source or types of services used are nominal variables. In each case, the variables have a set of categories whose order has no meaning.

Although the attributes of categorical variables do not have a mathematical meaning, they must be assigned to cases with great care. The attributes we use to categorize cases must be mutually exclusive and exhaustive:

- A variable's attributes or values are **mutually exclusive** if every case can have only one attribute.
- A variable's attributes or values are **exhaustive** when every case can be classified into one of the categories.

Mutually exclusive A variable's attributes or values are mutually exclusive when every case can be classified as having only one attribute or value.

Exhaustive Every case can be classified as having at least one attribute (or one value) for the variable.

When a variable's attributes are mutually exclusive and exhaustive, every case corresponds to one and only one attribute. We know this sounds pretty straightforward, and in many cases it is. However, what we think of as mutually exclusive and exhaustive categories may really be so only because of social convention; when these conventions change, appropriate classification at the nominal level can become much more complicated. The Census Bureau has come to recognize that measuring "race" is not so straightforward (see *Research in the News*).

The only mathematical operation we can perform with nominal-level variables is a count. We can count how many clients last month were females and how many were males. From that count, we can calculate the percentage or proportion of females to males among our clients. If the agency served 150 women and 100 men, then we can say that 60% of the clients were female. But we cannot identify an average gender, nor can we add or subtract or compute any other kind of number.

Ordinal Level of Measurement

The first of the three quantitative levels is the **ordinal level of measurement.** At this level, the numbers assigned to cases specify only the order of the cases, permitting *greater than* and *less than* distinctions. The gaps between the various responses do not have any particular meaning. As with nominal variables, the different values of a variable measured at the ordinal level must be mutually exclusive and exhaustive. They must cover the range of observed values and allow each case to be assigned no more than one value.

Ordinal level of measurement A measurement of a variable in which the numbers indicating a variable's values specify only the order of the cases, permitting greater than and less than distinctions.

The properties of variables measured at the ordinal level are illustrated in Exhibit 4.4 by the contrast among cup sizes at a coffee shop. You might choose between a small, medium, or large cup of coffee—that is ordinal measurement. The categories represent relative cup sizes but the gaps between the various responses do not have any particular meaning whether in quantity or in price.

A common ordinal measure used in social service agencies is a single question about client satisfaction. Often agencies will ask a client a global question about satisfaction with the services provided by the agency, using a rating system such as 4 = *very satisfied*, 3 = *satisfied*, 2 = *dissatisfied*, and 1 = *very dissatisfied*. Someone who responds *very satisfied*, coded as 4, is clearly more satisfied than someone who responds *dissatisfied*, coded as 2, but the person responding with a 4 is not twice as satisfied as the person responding with a 2. Nor is the person responding *very satisfied* (4) two units more satisfied than the person responding *dissatisfied* (2). We only know that the first person is more satisfied than the second person, and therefore the order has meaning. We can count the number of clients who fall into each category. We can also compute an average satisfaction, but the average is not a quantity of satisfaction; rather, the number summarizes the relative position of the group on the given scale.

Agencies sometimes use goal attainment scales to measure the progress of a client in achieving a particular goal. These scales are usually developed by describing the worst indicators, the best indicators, and several steps between.

The gap between the steps has no meaning, but the scoring represents the progress of the client. Exhibit 4.5 provides an example of a goal attainment scale to measure self-esteem and mother's attitude toward children. The social worker evaluates the extent to which there is improvement in self-esteem based on the nature of the verbal and nonverbal responses of the client. There is an order to the levels of achievement, and we can describe how many clients fall into each category.

Interval Level of Measurement

The values of a variable measured at the **interval level of measurement** represent fixed measurement units but have no absolute or fixed zero point. An interval level of measurement also has mutually exclusive categories, the categories are exhaustive, and there is an order to the responses. Further, the gaps between the numbers of the scale are meaningful; a one-unit difference is the same at any point in the scale. This level of measurement is represented in Exhibit 4.4 by the difference between two Fahrenheit temperatures. Because the gaps between numbers are equal, the gap between 60 degrees and 30 degrees is actually 30, but 60 in this case is not twice as hot as 30. Why not? Because heat does not begin at 0 degrees on the Fahrenheit scale. More broadly, the zero value on an interval scale does not indicate the complete absence of the measured variable.

Interval level of measurement A measurement of a variable in which the numbers indicating a variable's values represent fixed measurement units but have no absolute, or fixed, zero point.

There are few true interval-level measures in social work, but many social work researchers treat scales created by combining responses to a series of ordinal-level variables as interval-level measures. Frequently, this is done because there are more mathematical operations associated with interval-level variables. For example, a scale of this sort could be created with responses to Attkisson's Client Satisfaction Questionnaire (CSQ; see Exhibit 4.6 for the CSQ-8). While each question is ordinal, researchers often treat the scores obtained from summing the eight items as an interval-level measure.

Exhibit 4.5 Example of a Goal Attainment Scale

Problem Area	Client Outcome Goal	No Achievement	Some Achievement	Major Achievement
Self-esteem	To develop increased feeling of self-esteem	Makes only negative statements Does not identify strengths No verbal expression of confidence No sense of self-worth	Some positive statements Some negative statements Can identify some strengths but overly critical about self Emerging confidence Emerging self-worth	Makes many positive statements Few to no negative statements Can identify strengths without qualifying statements Is confident Has self-worth
Mother's attitude toward child	Less of a negative attitude toward child	Resists child's affection Constantly shows anger verbally and nonverbally Constantly shows frustration Constantly shows hostility Constantly inpatient	Occasional affection Occasional anger Occasional frustration Occasional hostility Occasional impatience	Accepts child's affection No verbal or nonverbal signs of anger, hostility, or frustration Patient

Exhibit 4.6 **Example of an Interval-Level Measure: Client Satisfaction Questionnaire (CSQ-8)**

Circle your answer:

1. How would you rate the quality of service you have received?

4	3	2	1
Excellent	Good	Fair	Poor

2. Did you get the kind of service you wanted?

1	2	3	4
No, definitely	No, not really	Yes, generally	Yes, definitely

3. To what extent has our program met your needs?

4	3	2	1
Almost all of my needs have been met	Most of my needs have been met	Only a few of my needs have been met	None of my needs have been met

4. If a friend were in need of similar help, would you recommend our program to him or her?

1	2	3	4
No, definitely not	No, I don't think so	Yes, I think so	Yes, definitely

5. How satisfied are you with the amount of help you have received?

1	2	3	4
Quite dissatisfied	Indifferent or mildly dissatisfied	Mostly satisfied	Very satisfied

6. Have the services you received helped you to deal more effectively with your problems?

4	3	2	1
Yes, they helped a great deal	Yes, they helped	No, they really didn't help	No, they seemed to make things worse

7. In an overall, general sense, how satisfied are you with the service you received?

4	3	2	1
Very satisfied	Mostly satisfied	Indifferent or mildly dissatisfied	Quite dissatisfied

8. If you were to seek help again, would you come back to our program?

1	2	3	4
No, definitely not	No, I don't think so	Yes, I think so	Yes, definitely

Source: EVALUATION AND PROGRAM PLANNING by Daniel Larsen, C. Clifford Attkisson, William A. Hargreaves, Tuan D. Nguyen. Copyright 1979 by Elsevier Science & Technology Journals. Reproduced with permission of Elsevier Science & Technology Journals.

Ratio Level of Measurement

The numbers indicating the values of a variable measured at the **ratio level of measurement** represent fixed measuring units with an absolute zero point; in this case, zero means absolutely no amount of whatever the variable indicates. Exhibit 4.4 displays an example of a variable measured at the ratio level. The

Ratio level of measurement A measurement of a variable in which the numbers indicating a variable's values represent fixed measuring unit and an absolute zero point.

number of people in the first group is 3, and the number in the second group is 8. The ratio of the two groups' sizes is then 2:67, a number that mirrors the relationship between the sizes of the groups. Note that there does not actually have to be any group with a size of 0; what is important is that the numbering scheme begins at an absolute zero—in this case, the absence of any people.

Ratio-level variables are common in social work practice and research. We can report to supervisors the number of clients in a program, the time spent providing counseling, or the number of hot meals delivered to homebound elderly. We can describe a community by the number of community development organizations, the number of abandoned buildings, or the number of afterschool programs. In each case, the answer zero is meaningful, representing the complete absence of the variable.

Researchers often treat the interval and ratio levels of measurement as equivalent. In addition to having numerical values, both the interval and ratio levels also involve continuous measures: The numbers indicating the values of variables are points on a continuum, not discrete categories. Despite these similarities, there is an important difference between variables measured at the interval and ratio levels. On a ratio scale, 10 is 2 points higher than 8 and is also 2 times greater than 5. Ratio numbers can be added and subtracted; because the numbers begin at an absolute zero point, they can be multiplied and divided (so ratios can be formed between the numbers). For example, people's ages can be represented by values ranging from 0 years (or some fraction of a year) to 120 or more. A person who is 30 years old is 15 years older than someone who is 15 years old (30 – 15 = 15) and is twice as old as that person (30/15 = 2). Of course, the numbers also are mutually exclusive, are exhaustive, have an order, and there are equal gaps.

The Case of Dichotomies

Dichotomies, variables having only two values, are a special case from the standpoint of levels of measurement. The values or attributes of a variable such as depression clearly vary in kind or quality, not in amount. Thus, the variable is categorical—measured at the nominal level. Yet in practical terms, we can think of the variable in a slightly different way, as indicating the presence of the attribute *depressed* or *not depressed*. Viewed in this way, there is an inherent order: A depressed person has more of the attribute (it is present) than a person who is not depressed (the attribute is not present). We are likely to act given the presence or absence of that attribute; we intervene or refer to treatment a depressed client, whereas we would not do so with a client who was not depressed. Nonetheless, although in practical terms there is an order empirically we treat a dichotomous variable as a nominal variable.

Types of Comparisons

Exhibit 4.7 summarizes the types of comparisons that can be made with different levels of measurement, as well as the mathematical operations that are legitimate. Each higher level of measurement allows a more precise mathematical comparison to be made between the values measured at that level compared with those measured at a lower level. However, each comparison between cases measured at lower levels can also be made about cases measured at higher levels. Thus, all four levels of measurement allow researchers to assign different values to different cases. All three quantitative measures allow researchers to rank cases in order.

Researchers choose levels of measurement in the process of operationalizing the variables; the level of measurement is not inherent in the variable. Many variables can be measured at different levels with different procedures. A variable to describe alcoholic drinking can be measured by asking respondents to identify how many alcoholic drinks they had in the last week, a ratio variable, or answer the same question by checking *None*, *1 to 4*, *5 to 9*, *or 10 or more*, an ordinal variable. A nominal variable about drinking could be created by simply asking, Did you consume any alcoholic drink in the last week" with response categories *yes* or *no*.

It is a good idea to try to measure variables at the highest level of measurement possible if doing so does not distort the meaning of the concept that is to be measured. The more information available, the more ways we have to compare cases. There are more possibilities for statistical analysis with quantitative than with qualitative variables. Further, you

Exhibit 4.7 Properties of Measurement Levels

Examples of comparison statements	Appropriate math operations	Relevant level of measurement			
		Nominal	Ordinal	Interval	Ratio
A is equal to (not equal to) B	= . . .	o	o	o	o
A is greater than (less than) B	> (<)		o	o	o
A is two more than (less than) B	+ (–)			o	o
A is twice (half) as large as B	× (÷)				o

can create ordinal or nominal variables from ratio-level variables, but you cannot go in the reverse direction. If you know the actual number of alcoholic drinks, you can combine the reports into categories at a later time, but if you ask respondents to check the category, you cannot later modify that variable to reflect the actual number of drinks consumed.

Be aware that other considerations may preclude measurement at a high level. For example, many people are reluctant to report their exact incomes even in anonymous questionnaires. So asking respondents to report their income in categories (e.g., less than $10,000, $10,000–19,999, $20,000–29,999) will result in more responses, and thus more valid data, than asking respondents for their income in dollars.

Oftentimes, researchers treat variables measured at the interval and ratio levels as comparable. They then refer to this as the interval-ratio level of measurement. You will learn in Chapter 14 that different statistical procedures are used for variables with fixed measurement units, but it usually does not matter whether there is an absolute zero point.

Measurement Error

No matter how carefully we operationalize and design our measures, no measure is perfect, and there will be some error. It might be that the measurement instrument needs to be corrected or reevaluated. Sometimes people are simply inconsistent in the way that they respond to questions. For example, the U.S. Census Bureau's Survey of Income and Program Participation 1984 Panel included data collected nine times, with 4 months between interviews. Using this data set, Engel (1988) completed a study on poverty and aging. One of the questions dealt with marital status, seemingly an easy question to answer and one that should provide consistent responses. It turned out that a portion of the sample, primarily women, kept moving from divorced to widow and sometimes back to divorced. On reflection, this made sense because, among members of this cohort of older adults (born between 1900 and 1919), divorce was a less acceptable social status than being a widow.

In gathering data, we get a response from the participant, this response being the reported score. The reported score is not necessarily the true score or the true response because of the imperfections of measurement. The true response differs from the reported response because of measurement error, of which there are two types: systematic error and random error.

Systematic error is generally considered to be a predictable error, in that we can predict the direction of the error. Think about weighing yourself on a scale each day. If you put a scale on a particular part of the floor in your house, you will always weigh less (reported score) than you actually do (true score). The direction of the error is predictable; your scale will always underreport your true weight.

Systematic error Error due to a specific process that biases the results.

There are different forms of systematic error, some of which we detail in later chapters, but each of these forms of systematic error reflects some bias:

- *Social desirability.* Social desirability bias occurs when respondents wish to appear most favorable in the eyes of the interviewer or researcher. For example, in the 1980s, polling information about elections between African American Democratic candidates and White Republican candidates typically showed larger victory margins anticipated for the Democratic candidate than actually occurred in the election. One factor was the unwillingness of White Democrats to admit they were unwilling to vote for an African American, even of the same political party, as this would have made the respondents appear less favorable in the eyes of the interviewer.
- *Acquiescence bias.* There is a tendency for some respondents to agree or disagree with every statement, regardless of whether they actually agree.
- *Leading questions.* Leading questions have language that is designed to influence the direction of a respondent's answer. There are many different ways in which this might be done. You might encounter words that have a negative connotation in society (regardless of the reason). For example, during the 1980s, the use of the words *liberal* and *welfare* began to take on negative connotations. So a question like "Do you support the liberal position on . . . ?" is meant to lead people to disagree with the position. Another form of a leading question is to use the names of controversial people in the question. A third way of evoking certain responses is simply to include some responses to a question in the actual question, but not all the responses.
- *Differences in subgroup responses according to gender, ethnicity, or age.* Differences in cultural beliefs or patterns, socialization processes, or cohort effects may bias findings from what otherwise might be a set of neutral questions.

To avoid systematic error requires careful construction of scales and questions and the testing of these questions with different population groups. We explore these methods in depth in Chapter 9.

Random error Errors in measurement that are due to chance and are not systematic in any way.

Unlike systematic error, **random error** is unpredictable in terms of its effects. Random error may be due to the way respondents are feeling that particular day. Respondents may be fatigued, bored, or not in a cooperative mood, or they may be having a great day. Respondents may also be affected by the conditions of the testing. The lighting may be bad, the room may be noisy, the seating may be cramped, the lack of walls in the cubicle may mean other people can hear, there may be other people in the room, or they may not like the looks of the person gathering the information.

Another form of random error is *regression to the mean*. This is the tendency of people who score very high on some measure to score less high the next time or for people who score very low to score higher. What might have influenced the high or low score on the first test may not operate in the second test.

Random error might occur when researchers rating behaviors are not adequately trained to do the rating. For example, two people grading an essay test might come up with different grades if they have not discussed the grading criteria beforehand. A field supervisor and a student might assess a client differently given the variation in their years of experience.

As we have already said, the effects of random error cannot be predicted: Some responses overestimate the true score, whereas other responses underestimate the true score. Many researchers believe that if the sample size is sufficiently large, the effects of random error cancel each other out. Nonetheless, we want to use measurement scales and questions that are stable to minimize the effects of random error as much as possible.

Assessing Measurement Accuracy

Do the operations to measure our variables provide stable or consistent responses—are they *reliable?* Do the operations developed to measure our concepts actually do so—are they *valid?* Why are these questions important? When we test the effectiveness of two different interventions or when we monitor a client's progress, we want the changes we observe to be due to the intervention and not to the instability or inaccuracy of the measurement instrument. We also want to know that the measure we use is really a measure of the outcome and not a measure of some other outcome. We cannot have much confidence in a measure until we have empirically evaluated its reliability and validity.

Reliability

Reliability means that a measurement procedure yields consistent or equivalent scores when the phenomenon being measured is not changing. If a measure is reliable, it is affected less by random error or chance variation than if it is unreliable. Reliability is a prerequisite for measurement validity: We cannot really measure a phenomenon if the measure we are using gives inconsistent results. In fact, because it usually is easier to assess reliability than validity, you are more likely to see an evaluation of measurement reliability in a research report than an evaluation of measurement validity.

Reliability A criterion to assess the quality of scales based on whether the procedure yields consistent scores when the phenomenon being measured is not changing.

Test–Retest Reliability

When researchers measure a phenomenon that does not change between two points separated by an interval of time, the degree to which the two measurements are related to each other is the **test–retest reliability** of the measure. If you take a test of your research methodology knowledge and retake the test 2 months later, the test is performing reliably if you receive a similar score both times—presuming that nothing happened during the 2 months to change your research methodology knowledge. We hope to find a correlation between the two tests of about .7 and prefer even a higher correlation, such as .8.

Of course, if events between the test and the retest have changed the variable being measured, then the difference between the test and retest scores should reflect that change. As the gap in time between the two tests increases, there is a greater likelihood that real change did occur. This also presumes that you were not affected by the conditions of the testing: a **testing effect**. The circumstances of the testing, such as how you were given the test, or environmental conditions, such as lighting or room temperature, may impact test scores. A testing effect may extend to how you felt the first time you took the test; because you did not know what to expect the first time, you may have been very nervous, as opposed to the second time, when you knew what to expect.

Test–retest reliability It is demonstrated by showing that the same measure of a phenomenon at two points in time is highly correlated, assuming that the phenomenon has not changed.

Testing effect Measurement error related to how a test is given; the conditions of the testing, including environmental conditions; and acclimation to the test itself.

Radloff's (1977) initial effort to evaluate the test–retest reliability of the CES-D highlights the difficulties that may emerge from the testing and that make interpreting the scores problematic. A probability sample of households was taken in one county; within each household, one person 18 years or older was randomly chosen to participate in an interview. Each person was also asked to complete and mail back a CES-D scale either 2, 4, 6, or 8 weeks after the initial interview. Only 419 of the initial 1,089 respondents sent back mail questionnaires. The test–retest correlations were moderately high, ranging from .51 at 2 weeks to .59 at 8 weeks. Radloff offered a variety of explanations about the moderate correlations, which included such methodological problems as the bias introduced by nonresponse (maybe those who responded differed from those who did not respond), the problem of using an interview at Time 1 and a self-administered questionnaire for the follow-up (perhaps people responded differently to the interviewer than to the questionnaire), and the effects of being tested twice. Furthermore, she noted that the CES-D was meant to capture depressive symptoms in a 1-week period, and perhaps there had been real changes. This example illustrates how test–retest reliability scores may potentially be affected by real change or by the effect of testing.

Internal Consistency

When researchers use multiple items to measure a single concept, they are concerned with **internal consistency**. For example, if the items composing the CES-D (like those in Exhibit 4.3) reliably measure depressive symptoms, the answers to the questions should be highly associated with one another. The stronger the association among the individual items and the more items that are included, the higher the reliability of the scale.

One method to assess internal consistency is to divide the scale into two parts, or **split-half reliability**. We might take a 20-item scale, such as the CES-D, and sum the scores of the first 10 items, sum the scores of the second 10 items (items 11–20), and then correlate the scores for each of the participants. If we have internal consistency, we should have a fairly high correlation, such as .8 or .9. This correlation typically gets higher the more items there are in the scale. So what may be considered a fairly high split-half reliability score for a 6-item scale might not be considered a high score for a 20-item scale.

There are countless ways in which you might split the scale, and in practical terms, it is nearly impossible to split the scale by hand into every possible combination. The speed of computers allows us to calculate a score that indeed splits the scale in every combination. A summary score, such as **Cronbach's alpha coefficient**, is the average score of all the possible split-half combinations. In Radloff's (1977) study, the Cronbach's alpha coefficients of different samples were quite high, ranging from .85 to .90.

Internal consistency An approach to reliability based on the correlation among multiple items used to measure a single concept.

Split-half reliability Reliability achieved when responses to the same questions divided into two randomly selected halves are about the same.

Cronbach's alpha A statistic commonly used to measure internal reliability. It is the average correlation of all the possible ways to divide a scale in half.

Alternate-Forms Reliability

Researchers are testing **alternate-forms reliability** (or parallel-forms reliability) when they compare subjects' answers to slightly different versions of survey questions (Litwin, 1995). A researcher may reverse the order of the response choices in a scale, modify the question wording in minor ways, or create a set of different questions. The two forms are then administered to the subjects. If the two sets of responses are not too different, alternate-forms reliability is established. You might remember taking the SATs or ACTs when you were in high school. When you compared questions with your friends, you found that each of you had taken different tests. The developers had assessed the tests using alternate-forms reliability to ensure that the different forms were equivalent and comparable.

Alternate-forms reliability A reliability procedure in which participants' answers are compared with participants' responses to slightly different versions of the questions.

Interrater Reliability

When researchers use more than one observer to rate the same people, events, or places, **interrater reliability** is their goal. If observers are using the same instrument to rate the same phenomenon, their ratings should be similar. If they are similar, we can have much more confidence that the ratings reflect the phenomenon being assessed rather than the orientations of the observers.

Assessments of interrater reliability may be based on the correlation of the rating between two raters. Two raters could evaluate the quality of play between five teenage mothers and their children on a 10-point scale. The correlation would show whether the direction of the raters' scores was similar as well as how close the agreement was for the relative position for each of the five scores. One rater may judge the five mothers as 1, 2, 3, 4, and 5, whereas the second rater scores the mothers as 6, 7, 8, 9, and 10. The correlation would be quite high—in fact, the correlation would be perfect. But as demonstrated by this example, the agreement about the quality of the interactions was quite different. So an alternative method is to estimate the percentage of exact agreement between the two raters. In this case, the rater agreement is zero.

Interrater reliability The degree of agreement when similar measurements are obtained by different observers rating the same people, events, or places.

Assessing interrater reliability is most important when the rating task is complex. Consider a commonly used measure of mental health, the Global Assessment of Functioning Scale (GAF). The rating task seems straightforward, with clear descriptions of the subject characteristics that are supposed to lead to high or low GAF scores. However, the judgments that the rater must make while using this scale are complex. They are affected by a wide range of subject characteristics, attitudes, and behaviors, as well as by the rater's reactions. As a result, interrater agreement is often low on the GAF unless the raters are trained carefully.

Intrarater Reliability

Intrarater reliability occurs when a single observer is assessing an individual at two or more points in time. It differs from test–retest reliability in that the ratings are done by the observer as opposed to the subjects. Intrarater reliability is particularly important when you are evaluating a client's behavior or making judgments about the client's progress. Although the GAF has been found to have low interobserver reliability, it has been found to have pretty high intraobserver reliability. It turns out that although different raters disagree, a single rater tends to provide consistent reports about an individual.

Intrarater reliability Consistency of ratings by an observer of an unchanging phenomenon at two or more points in time.

Measurement Validity

Validity refers to the extent to which measures indicate what they are intended to measure. Technically, a valid measure of a concept is one that is (a) closely related to other apparently valid measures of the concept, (b) closely related to the known or supposed correlates of that concept, and (c) not related to measures of unrelated concepts (adapted from Brewer & Hunter, 2005). Measurement validity is assessed with four different approaches: face validation, content validation, criterion validation, and construct validation.

Face Validity

Researchers apply the term **face validity** to the confidence gained from careful inspection of a measure to see whether it is appropriate "on its face." A measure is face valid if it obviously pertains to the meaning of the concept being measured more than to other concepts (Brewer & Hunter, 2005). For example, a count of how many drinks people consumed in the past week would be a face-valid measure of their alcohol consumption.

Although every measure should be inspected in this way, face validation does not provide convincing evidence of measurement validity. The question, "How much beer or wine did you have to drink last week?" looks valid on its face as a measure of frequency of drinking, but people who drink heavily tend to underreport the amount they drink. So the question would be an invalid measure in a study that includes heavy drinkers.

Face validity The type of validity that exists when an inspection of items used to measure a concept suggests that they are appropriate "on their face."

Content Validity

Content validity establishes that the measure covers the full range of the concept's meaning. To determine that range of meaning, the researcher may solicit the opinions of experts and review literature that identifies the different aspects or dimensions of the concept.

An example of an alcoholism measure that covers a wide range of meaning is the MAST. The MAST includes 24 questions representing the following subscales: recognition of alcohol problems by self and others; legal, social, and work problems; help seeking; marital and family difficulties; and liver pathology (Skinner & Sheu, 1982). Many experts familiar with the direct consequences of substance abuse agree that these dimensions capture the full range of possibilities. Thus, the MAST is believed to be valid from the standpoint of content validity.

Content validity The type of validity that exists when the full range of a concept's meaning is covered by the measure.

Content validity is an important step in developing measures and assessing measures. However, like face validity, content validity is a subjective assessment of validity and, therefore, is a weaker form of validity than the next two types of validity, which are based on empirical assessments.

Criterion Validity

Criterion validity is established when the scores obtained on one measure are similar to scores obtained with a more direct or already validated measure of the same phenomenon (the criterion). The criterion that researchers select can be measured either at the same time as the variable to be validated or after that time. **Concurrent validity** exists when a measure yields scores that are closely related to scores on a criterion measured at the same time. A measure of blood-alcohol concentration or a urine test could serve as the criterion for validating a self-report measure of drinking as long as the questions we ask about drinking refer to the same period. A measure of walking speed based on mental counting might be validated concurrently with a stop watch. **Predictive validity** is the ability of a measure to predict scores on a criterion measured in the future. For example, SAT or ACT scores could be compared to academic success in college. In each of these cases, the measure is being compared to some criterion believed to measure the same construct.

Criterion validation is well worth the effort because it greatly increases confidence that the measure is measuring what was intended. It is a stronger form of validity than face or content validity as it is based on empirical evidence rather than subjective assessment.

Criterion validity The type of validity established by comparing the scores obtained on the measure being validated to scores obtained with a more direct or already validated measure of the same phenomenon (the criterion).

Concurrent validity The type of validity that exists when scores on a measure are closely related to scores on a criterion measured at the same time.

Predictive validity The type of validity that exists when a measure predicts scores on a criterion measured in the future.

Construct Validity

Construct validity is demonstrated by showing that a measure is related to a variety of other measures as specified in a theory. This theoretical construct validation process relies on using a deductive theory with hypothesized relationships among the constructs (Koeske, 1994). The measure has construct validity (or theoretical construct validity) if it "behaves" as it should relative to the other constructs in the theory. For example, Danette Hann, Kristin Winter, and Paul Jacobsen (1999) compared subject scores on the CES-D to a number of indicators that they felt from previous research and theory should be related to depression: fatigue, anxiety, and global mental health. The researchers found that individuals with higher CES-D scores tended to have more problems in each of these areas, giving us more confidence in the CES-D's validity as a measure.

A somewhat different approach to construct validation is **discriminant validity**. In this approach, scores on the measure to be validated are compared to scores on another measure of the same variable and to scores on variables that measure different but related concepts. Discriminant validity is achieved if the measure to be validated is related most strongly to its comparison measure and less so to the measures of other concepts. The CES-D would demonstrate discriminant validity if the scale scores correlated strongest with the Beck Depression Inventory (a validated scale to measure depression) and correlate lower with the Beck Anxiety Inventory (a validated scale to measure anxiety).

Convergent validity is achieved when you can show a relationship between two measures of the same construct that are assessed using different methods (Koeske, 1994). For example, we might compare the CES-D scale scores to clinical judgments made by practitioners who have used a clinical protocol. The CES-D scores should correlate with the scores obtained from the clinical protocol.

Construct validity The type of validity that is established by showing that a measure is related to other measures as specified in a theory.

Discriminant validity An approach to construct validity; the scores on the measure to be validated are compared to scores on another measure of the same variable and to scores on variables that measure different but related concepts. There is discriminant validity if the measure to be validated is related most strongly to the comparison measure and less strongly to the measures of other concepts.

Convergent validity The type of validity achieved when one measure of a concept is associated with different measures of the same concept.

Known-groups validity Demonstrating the validity of a measure using two groups with already-identified characteristics.

Factorial validity A form of construct validity used to determine if the scale items relate correctly to different dimensions of the concept.

Another approach to construct validity is referred to as **known-groups validity**. In this method, we might have two groups with known characteristics, and we compare our measure across these two groups. We would expect that our measure should score higher with the group that it is related to and lower with the unrelated group. For example, we might give the CES-D to a group of people who have been clinically diagnosed as depressed and to a group that does not have a clinical diagnosis of depression. We would expect the CES-D scores to be higher among those clinically depressed than those who have no clinical diagnosis.

Finally, another method that has become associated with construct validity is **factorial validity**. This approach relies on factor analysis and, in many ways, is simply an empirical extension of content analysis. This procedure is usually applied when the construct of interest has different dimensions. In the analysis, we look to see whether the items thought to be measuring the same dimension are more highly related to each other than to items measuring other dimensions. The CES-D scale has been hypothesized to have four dimensions: negative affect, positive affect (lack), somatic symptoms, and interpersonal. Several items are associated with each dimension. Therefore, a factor analysis would test whether the items measuring negative affect are more highly related to each other than to items measuring somatic symptoms. Negative affect items such as *feeling blue*, *sad*, *depressed*, and the like should have stronger relationships to each other than to items measuring somatic symptoms such as *overeating*, *sleeping too much*, or *difficulty concentrating*. A test of factorial validity would assess the expected internal theoretical relationships of the construct.

The distinction between criterion and construct validation is not always clear. Opinions can differ about whether a particular indicator is indeed a criterion for the concept that is to be measured. Koeske (1994) suggests that a key difference is simply that with criterion validity, "the researcher's primary concern is with the criterion in a practical context, rather than with the theoretical properties of the construct measure" (p. 50). What if you want to validate a question-based measure of the amount of social support that people receive from their friends? Should you just ask people about the social support they have received? Could friends' reports of the amount of support they provided serve as a criterion? Are verbal accounts of the amount of support provided adequate? What about observations of social support that people receive? Even if you could observe people in the act of counseling or otherwise supporting their friends, can an observer be sure that the interaction is indeed supportive? There is not really a criterion here, just related concepts that could be used in a construct validation strategy.

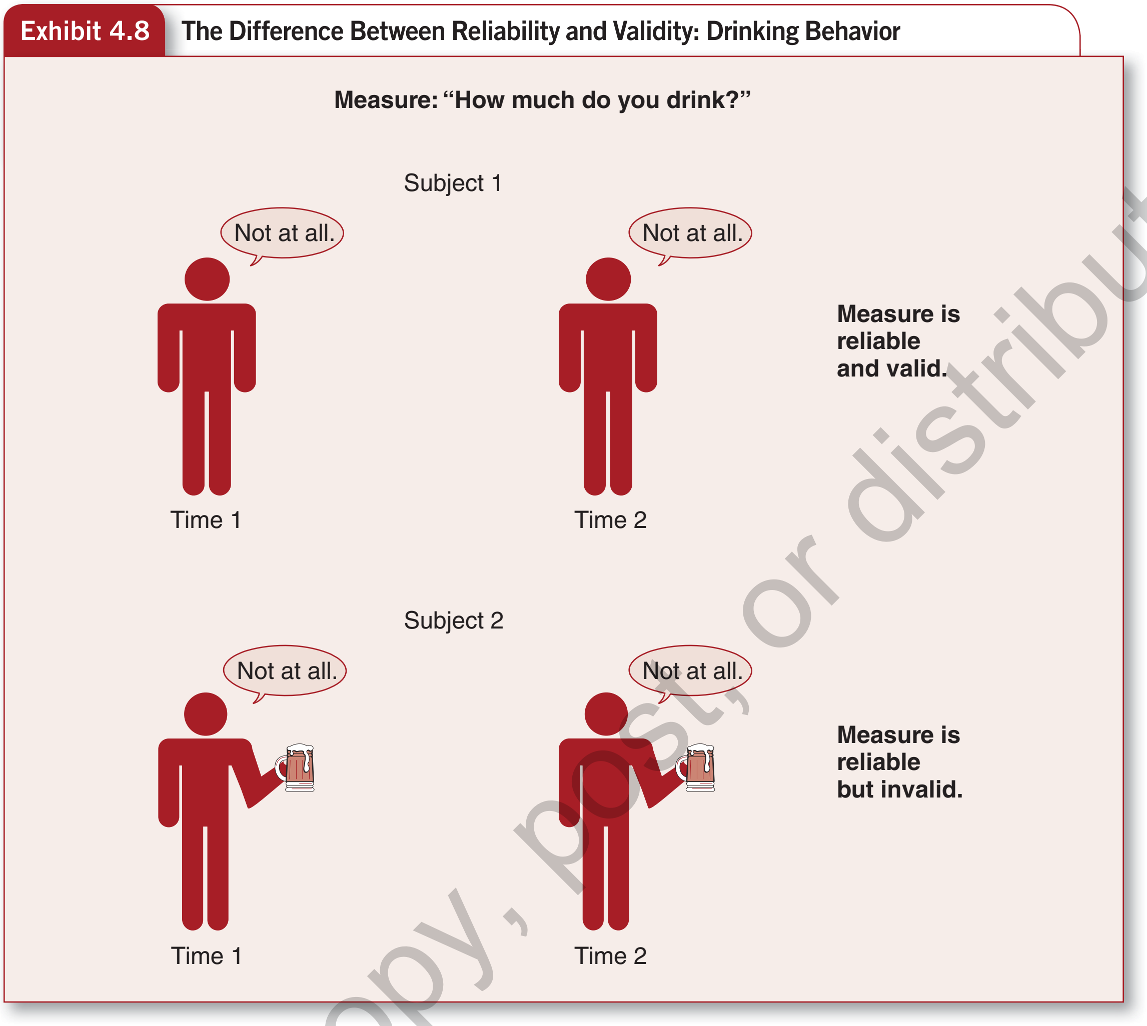
What construct and criterion validation have in common is the comparison of scores on one measure to scores on other measures that are predicted to be related. It is not so important that researchers agree that a particular comparison measure is a criterion rather than a related construct. But it is very important to think critically about the quality of the comparison measure and whether it actually represents a different view of the same phenomenon.

Ways to Improve Reliability and Validity of Existing Measures

A reliable measure is not necessarily a valid measure, as Exhibit 4.8 illustrates. This discrepancy is a common flaw of self-report measures of substance abuse. Most respondents answer questions in a consistent way, so the scales are reliable. However, a number of respondents will not admit to drinking even though they drink a lot. Their answers to the questions are consistent, but they are consistently misleading. So the scales based on self-report are reliable, but invalid. Unfortunately, many measures are judged to be worthwhile on the basis only of a reliability test.

The reliability and validity of measures in any study must be tested after the fact to assess the quality of the information obtained. If it turns out that a measure cannot be considered reliable and valid, little can be done to save the study. Hence, it is important to select in the first place measures that are likely to be reliable and valid. Consider the different strengths of different measures and their appropriateness to your study. Conduct a pretest in which you use the measure with a small sample and check its reliability. Provide careful training to ensure a consistent approach if interviewers or observers will administer the measure. However, in most cases, the best strategy is to use measures that have been used before and whose reliability and validity have been established in other contexts. But the selection of

Exhibit 4.8 The Difference Between Reliability and Validity: Drinking Behavior


Measure: "How much do you drink?"
Subject 1
Not at all.
Not at all.
Time 1
Time 2
Measure is reliable and valid.
Subject 2
Not at all.
Not at all.
Time 1
Time 2
Measure is reliable but invalid.

tried and true measures still does not absolve researchers from the responsibility of testing the reliability and validity of the measure in their own studies.

When the population studied or the measurement context differs from that in previous research, instrument reliability and validity may be affected. So the researchers must take pains with the design of their study. For example, test–retest reliability has proved to be better for several standard measures used to assess substance use among homeless people when the interview was conducted in a protected setting and when the measures focused on factual information and referred to a recent time interval (Drake, McHugo, & Biesanz, 1995). Subjects who were younger, female, recently homeless, and less severely afflicted with psychiatric problems were also more likely to give reliable answers.

If the research focuses on previously unmeasured concepts, new measures will have to be devised. Researchers can use one of three strategies to improve the likelihood that new question-based measures will be reliable and valid (Fowler, 1995):

1. *Engage potential respondents in group discussions about the questions to be included in the survey*. This strategy allows researchers to check for consistent understanding of terms and to hear the range of events or experiences that people will report.

2. *Conduct cognitive interviews.* Ask people a test question, and then probe with follow-up questions about how they understood the question and what their answer meant.

3. *Audiotape test interviews during the pretest phase of a survey.* The researchers then review these audiotapes and systematically code them to identify problems in question wording or delivery.

Using Scales to Identify a Clinical Status

Many scales do not just measure the range or intensity of some phenomenon, but are also used as screening methods to make educated guesses about the presence or absence of some clinical condition. The CES-D has been used not only to measure the level of depressive symptoms, but also to determine whether someone might suffer from depression. Scores on the CES-D scale can range from 0 to 60; people with scores above 16 may be classified as depressed, whereas people below 16 may be classified as not depressed. This score a called a **cut-off score** and is used to define the presence or absence of a particular condition.

Cut-off scores should be as accurate as possible. If not, we risk expending limited resources on what may turn out to be an inaccurate assessment, we risk missing individuals with the condition, and we risk labeling clients with a condition they might not actually have. Typically, the validity of a cut-off score is assessed by comparing the scale's classifications to an established clinical evaluation method or to an already-known condition. For example, the MAST cut-off score might be evaluated against a urinalysis. The CES-D cut-off score might be compared with a clinical diagnosis using the *DSM-5*.

A summary of the analysis of the validity of a cut-off is presented in Exhibit 4.9. If the cut-off score provides an accurate assessment, there should be a high proportion of cases classified as either a **true negative** (cell a) or a **true positive** (cell d). A true negative occurs when, based on the scale, the client is assessed as not having a problem and really does not have the problem. A true positive occurs when it is determined from the obtained scale score that the client has a problem and the client really does have the problem based on the clinical evaluation. There should be few **false negatives** (cell b) when, based on the scale score, you conclude that the client does not have the problem, but the client really does have the problem, and few **false positives** when you conclude from the scale score that the client does have a significant problem, but in reality that person does not have the problem.

Researchers use different measures to establish the validity of the cut-off score. **Sensitivity** describes the true positive cell. It is a proportion based on the number of people who are assessed as having the condition (d) relative to the number of people who actually have the condition, (b + d); that is, d/(b + d). **Specificity** describes the true negative cell. It is a proportion based on the number of people assessed as not having a condition (cell a) relative to the number who really do not have the condition (a + c); its mathematical formula is a/(a + c). False-negative rates and false-positive rates are similarly calculated.

Ideally, we would like both the sensitivity and specificity of the scale's cut-off scores to be very high so that we make few mistakes. Yet there are trade-offs. To identify all the true positives, the cut-off score would need to be eased; in the case of the CES-D, it would need to be lowered. This will increase sensitivity, but will also likely result in more false positives, which means a lower specificity. Making it

Cut-off score A score used in a scale to distinguish between respondents with a particular status and respondents who do not have that status.

True negative When it is determined from a screening instrument score that the participant does not have a particular status and the participant really does not have the status based on a clinical evaluation.

True positive When it is determined from a screening instrument score that the participant does have a particular status and the participant really does have the status based on a clinical evaluation.

False negative The participant does not have a particular problem according to a screening instrument, but the participant really does have the problem based on a clinical evaluation.

False positive The participant has a particular problem according to a screening instrument but in reality does not have the problem based on a clinical evaluation.

Sensitivity The proportion of true positives based on the number of people assessed as having a diagnosis by a screening instrument to the number of people who actually have the diagnosis.

Specificity The proportion of true negatives based on the number of people assessed as not having a diagnosis by a screening instrument relative to the number of people who really do not have the diagnosis.

Exhibit 4.9 Outcomes of Screening Scale Versus Clinical Assessment

	Actual Diagnosis for the Clinical Condition		
Screening Scale Result	Client does not have clinical condition	Client has clinical condition	Total
Assessed as not having condition	True negative (a)	False negative (b)	a + b
Assessed as having the condition	False positive (c)	True positive (d)	c + d
Total	a + c	b + d	

more difficult to test positive, for example, by setting a higher cut-off score, will increase the specificity, but will produce more false negatives, and the sensitivity score will decline.

Two other types of estimates you will see are the positive predictive value and the negative predictive value. The positive predictive value is the proportion of people who actually have the condition (d) compared to the number who were assessed by the screening tool as having the condition (c + d); that is, d/(c + d). The negative predictive value is the proportion of all those who actually do not have the condition (a) compared to all those who were assessed as having the condition (a + b); that is, a/(a + b). The ability to predict accurately is useful when we decide to use a screening scale to get some sense of how prevalent a particular condition is in the community. So if we wanted to assess how common depression is in the community, we would want high predictive values.

Measurement in a Diverse Society

Throughout this chapter, we have suggested that measurement is crucial not just for research, but for every aspect of social work practice. Whether a researcher is examining the prevalence of alcohol abuse in the community or a social worker is assessing substance abuse with a client, it is important to use the best available method. Although it is crucial to have evidence of reliability and validity, it is important that such evidence cut across the different populations served by social workers. Often people of color, women, the poor, and other groups have not been adequately represented in the development or testing of various measurement instruments (S. Witkin, 2001). Just because a measure appears valid does not mean that you can assume cross-population generalizability.

It is reasonable to consider whether the concepts we use have universal meaning or differ across cultures or other groups. C. Harry Hui and Harry C. Triandis (1985) suggest that four components must be evaluated to determine whether a concept differs across cultures:

1. *Conceptual equivalence*. The concept must have the same meaning, have similar precursors and consequences, and relate to other concepts in the same way.
2. *Operational equivalence*. The concept must be evident in the same way so that the operationalization is equivalent.
3. *Item equivalence*. Items used must have the same meaning to each culture.
4. *Scaler equivalence*. The values used on a scale mean the same in intensity or magnitude.

Take the concept *self-esteem*. Bae and Brekke (2003) note that cross-cultural research has found that Asian Americans typically have lower self-esteem scores than other ethnic groups. They hypothesized that Korean

Americans would have lower scores on positively worded items than other ethnic groups but would have similar scores on negatively worded items. They suggested that this response pattern would be due to culture: "Giving high scores on the positive items is intrinsically against their collective culture in which presenting the self in a self-effacing and modest manner is regarded as socially desirable behavior to maintain social harmony" (p. 28). Bae and Brekke did find that overall self-esteem scores were lower among Korean Americans and that it was due to Korean Americans scoring lower on the positively worded items while scoring the same or higher than other ethnic groups on the negatively worded items.

Similar concerns have been noted for scales measuring depression. For example, Joy Newmann (1987) has argued that gender differences in levels of depressive symptoms may reflect differences in the socialization process of males and females. She suggests that some scales ask questions about items such as crying, being lonely, and feeling sad, which are more likely to be responded to in the affirmative by women and not by men because men are socialized to not express such feelings. More recent studies have found similar gender differences in response patterns (S. R. Cole, Kawachi, Maller, & Berkman, 2000; Sigmon et al., 2005). Similarly, Debra Ortega and Cheryl Richey (1998) note that people of color may respond differently to questions used in depression scales. Some ethnic groups report feelings of sadness or hopelessness as physical complaints and therefore have high scores on these questions, but low scores on emotion-related items. Different ethnic groups respond differently to "how do you feel" questions and "what do you think" questions. Ortega and Richey also note that some items in depression scales, such as suicidal ideation, are not meaningful to some ethnic groups. The elderly are more likely to endorse some items that also measure physical changes as opposed to changes brought about by depression (Sharp & Lipsky, 2002).

Scores impacted by response bias can result in practical problems. For example, many scales include cut-off scores to demonstrate the presence or absence of a condition. If there is a response bias, the result could be the treatment of a condition that does not exist or not identifying a condition that does exist (Bae & Brekke, 2003). The failure to measure correctly may affect the ability to identify effective interventions. The relationship of different phenomena may be distorted because of measurement bias. Therefore, it is important to assess the samples used for validation and to use measures that have been validated with the population group to whom it will be administered.

Measurement Implications for Evidence-Based Practice

Measurement is an essential ingredient in social work practice, whether it is your assessment of a client or your monitoring and evaluation of your practice. Further, the studies you review depend, in part, on the quality of the measurement; systematic errors can negate the validity of a particular study (Johnston, Sherer, & Whyte, 2006). You need to be confident that the evidence presented is due to the intervention and not the instability of the measurement instrument.

What should you consider when you examine the efficacy of a measure for your agency? In the previous sections, we have stressed the importance of measurement reliability and validity. That alone is insufficient because there should be evidence of the appropriateness of the measure for the population with whom it will be used. Therefore, when you review research about the reliability and validity of a measure, you need to look at the samples that were used in the studies. Too often these studies are done without consideration of gender, race, ethnicity, or age. It may be that the samples used in the studies look nothing like the population you are serving. If that is the case, the instrument may not be appropriate for your agency or setting.

The same holds true for scales that can be used for diagnostic purposes; there should be statistical evidence that the scale is accurate in its determination of correct diagnoses (true positives and true negatives) with few incorrect diagnoses (false positives and false negatives; Warnick, Weersing, Scahill, & Woolston, 2009). Earlier, we described the CES-D as a commonly used scale with a more or less acceptable cut-off score of 16. On further inspection, researchers found that this score was too low to be useful with the elderly. Some item reports in the CES-D can be due to physical conditions that are common among the elderly. As a result, an appropriate cut-off score for elderly people with physical ailments has been determined to be 20 (Schein & Koenig, 1997). The bottom line is to take nothing for granted about cut-off scores described in the literature.

Of course, you should also keep in mind practical considerations in selecting a measurement scale. These considerations include:

- *Administration of the scale*. Different methods of administration require different amounts of time to complete, as well as skill to gather the data. For example, self-report takes less time than interviewing the client.
- *Cost*. The instrument should be affordable. Many useful measures and scales can be found in the public domain, but many other scales have to be purchased, and sometimes you must also pay for their scoring.
- *Sensitivity to change*. The measure you use should be sufficiently sensitive to pick up changes in the desired outcome and there should be a sufficient number of items that you are able to identify changes.
- *Reactivity*. To the extent possible, you want nonreactive measures, that is, measures that do not influence the responses that people provide.
- *Acceptability*. The measures have to be accepted by staff as measures that will provide valid information

All of these were considerations we had to take into account when we were asked by a family service agency's senior adult unit to recommend a short and simple screen for pathological gambling. The agency uses a 25- to 30-minute psychosocial assessment at intake, screening for a variety of social, economic, health, and mental health concerns, so it did not want something that would add terribly to the length of the assessment. At the same time, the agency wanted something that would be accurate, easy to use, and not offend its older clients. Ultimately, we found a reliable and valid two-item screen that could be added to the intake assessment.

Just as there are systematic reviews of intervention research, you may find systematic reviews of different measurement and screening instruments. For example, Henry O'Connell and his colleagues (2004) recently reviewed self-report alcohol screening instruments for older adults, and Warnick and colleagues (2009) reviewed measures to predict youth mental health.

As you read intervention research or other types of research studies or you develop a research proposal, there are important questions for you to consider. You should identify the major concepts in the study and assess whether the measure is clearly defined. Next, you should examine how the concepts are operationalized. Is the operational definition sufficient to capture the various dimensions of the concept? When scales are used, is there evidence of reliability and validity as well as the scale's appropriateness for the specific study population? Our confidence in the measure is enhanced when the author reports methods used to enhance reliability of the measure, such as the specific training in collecting the information, or using multiple measures.

Conclusion

Remember always that measurement validity is a necessary foundation for social work research. Gathering data without careful conceptualization or conscientious efforts to operationalize key concepts often is a wasted effort. The difficulties of achieving valid measurement vary with the concept being operationalized and the circumstances of the particular study.

Planning ahead is the key to achieving valid measurement in your own research; careful evaluation is the key to sound decisions about the validity of measures in others' research. Statistical tests can help to determine whether a given measure is valid after data have been collected, but if it appears after the fact that a measure is invalid, little can be done to correct the situation. If you cannot tell how key concepts were operationalized when you read a research report, don't trust the findings. If a researcher does not indicate the results of tests used to establish the reliability and validity of key measures, remain skeptical.

Key Terms

Alternate-forms reliability	91
Concept	72
Conceptualization	73
Concurrent validity	93
Construct validity	93
Content validity	92
Convergent validity	93
Criterion validity	93
Cronbach's alpha coefficient	91
Cut-off score	96
Discriminant validity	93
Exhaustive	84
Face validity	92
Factorial validity	94
False negative	96
False positive	96
Internal consistency	91
Interrater reliability	91
Interval level of measurement	85
Intrarater reliability	92
Known-groups validity	94
Level of measurement	83
Multidimensional scale	79
Mutually exclusive	84
Nominal definition	73
Nominal level of measurement	83
Operational definition	77
Operationalization	77
Ordinal level of measurement	84
Predictive validity	93
Random error	89
Ratio level of measurement	86
Reliability	90
Scale	78
Sensitivity	96
Specificity	96
Split-half reliability	91
Systematic error	88
Test–retest reliability	90
Testing effect	90
True negative	96
True positive	96

Highlights

- Conceptualization plays a critical role in research. In deductive research, conceptualization guides the operationalization of specific variables; in inductive research, it guides efforts to make sense of related observations.
- Concepts may refer to either constant or variable phenomena. Concepts that refer to variable phenomena may be similar to the actual variables used in a study, or they may be much more abstract.
- Concepts should have a nominal definition and an operational definition. A nominal definition defines the concept in terms of other concepts, whereas the operational definition provides the specific rules by which you measure the concept.
- The intervention is often a variable requiring an operational definition that describes the intervention in detail.
- Scales measure a concept by combining answers to several questions and thereby reducing idiosyncratic variation. Several issues should be explored with every intended scale: Does each question actually measure the same concept? Does combining items in a scale obscure important relationships between individual questions and other variables? Is the scale multidimensional?
- Measures are not perfect, and there may be two types of measurement error. Systematic error refers to predictable error and should be minimized. Random error is unpredictable in terms of effect on measurement.
- Level of measurement indicates the type of information obtained about a variable and the type of statistics that can be used to describe its variation. The four levels of measurement can be ordered by complexity of the mathematical operations they permit: nominal (least complex), ordinal, interval, and ratio (most complex). The measurement level of a variable is determined by how the variable is operationalized. Dichotomies, a special case, may be treated as measured at the nominal level.
- Measurement reliability is a prerequisite for measurement validity, although reliable measures are not necessarily valid. Reliability can be assessed through a test–retest procedure, in terms of interitem consistency, through a comparison of responses to alternate forms of the test, or in terms of consistency among observers and in one observer over time.
- The validity of measures should always be tested. There are four basic approaches: face validation, content validation, criterion validation (either predictive or concurrent), and construct validation. Criterion validation provides strong evidence of measurement validity, but there often is no criterion to use in validating social science measures.
- Some scales are used to screen for the presence or absence of a clinical condition and, therefore, use cut-off scores. The accuracy of cut-off scores is assessed using measures of sensitivity and specificity.
- In examining studies of measurement reliability and validity, it is important to look at the samples to ensure that there is evidence of reliability and validity for different population subgroups.

Discussion Questions

1. Describe the relationship between a nominal definition and an operational definition of a concept. How are these two types of definitions related?
2. What does "global assessment of functioning" mean to you? What behaviors would you look for to assess global assessment of functioning? Identify two such behaviors. What questions would you ask to measure global assessment of functioning? Create a scale by writing five questions with response choices. How would you assess the reliability and validity of your scale?
3. If you were given a questionnaire right now that asked you about your use of alcohol and illicit drugs in the past year, would you disclose the details fully? How do you think others would respond? What if the questionnaire was anonymous? What if there was a confidential ID number on the questionnaire so that the researcher could keep track of who responded? What criterion validation procedure would you suggest for assessing measurement validity?

Practice Exercises

1. a. Provide nominal and operational definitions for any of the following concepts: self-esteem, school stress, child abuse, and alcohol abuse.
   b. Write down two observable behaviors that you believe would provide feasible measures of the concept you have chosen.
   c. Develop a scale by generating some questions that could serve as indicators for the concept you have chosen.
   d. Outline a plan to assess the validity and reliability of the behavior measures and the scale.
2. Find a research study that uses a scale to measure some concept. How does the author justify the reliability and validity of the scale? Does the author convince you that the scale can be applied to the sample in the study?
3. In the study chosen in Exercise 2, what are the variables? What is the level of measurement for each variable?

Web Exercises

1. How would you define alcoholism? Write a brief definition. Based on this conceptualization, describe a method of measurement that would be valid for a study of alcoholism.
2. Now go to the American Council for Drug Education and read some facts about alcohol (www.acde.org/common/alcohol2.pdf). Is this information consistent with the definition you developed for Question 1?

Developing a Research Proposal

At this point, you can begin the process of conceptualization and operationalization.

1. Identify the concepts you will use in the study. Provide a nominal definition for each concept. When possible, this definition should come from the existing literature—either a book you have read for a course or a research article.
2. How will the concepts be operationalized? Identify the variables you will use to study the research question. Which of

these are independent or dependent variables? What is the level of measurement for each variable? How will these variables be coded?

3. Develop measurement procedures, or identify existing instruments that might be used. If you are using a new measure, what procedures will you use to determine the reliability and validity of the measure? If you are using an existing instrument, report the evidence for the instrument's reliability and validity.

A Question of Ethics

1. Why is it important that the reliability and validity of any scale be evaluated with different populations?