CHAPTER ONE

THE IMPORTANCE OF STATISTICS IN THE CRIMINOLOGICAL SCIENCES OR WHY DO I HAVE TO LEARN THIS STUFF?

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You gain strength, courage, and confidence by every experience in which you really stop to look fear in the face.

—Eleanor Roosevelt

Do not worry about your difficulties in Mathematics. I can assure you mine are still greater.

—Albert Einstein

Learning Objectives

1. Describe the role statistical analyses play in criminological and criminal justice research.
2. Identify the difference between a sample and a population.
3. Explain the purpose of probability sampling techniques.
4. Define the different types of probability and nonprobability samples.
5. State the difference between descriptive and inferential statistics.
6. Specify the different types of validity in research.

INTRODUCTION

Most of you reading this book are probably taking a course in statistics because it is required to graduate, not because you were seeking a little adventure and thought it would be fun. Nor are you taking the course because there is something missing in your life and, thus, you think the study of statistics is necessary to make you intellectually "well rounded." At least this has been our experience when teaching statistics courses. Everyone who has taught a statistics course has probably heard the litany of sorrows expressed by their students at the beginning of the course—the "wailing and gnashing of teeth." "Oh, I have been putting this off for so long—I dreaded having to take this." "I have a mental block when it comes to math—I haven't had any math courses since high school." "Why do I have to learn this, I'm never going to use it?"

There are those fortunate few for whom math comes easy, but the rest of us experience apprehension and anxiety when approaching our first statistics course. Psychologists, however, are quick to tell us that what we most often fear is not real—it is merely our mind imagining the worst possible scenario. FEAR has been described as an

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acronym for False Expectations Appearing Real. In fact, long ago it was Aristotle who said, "Fear is pain arising from anticipation." But then, this may not comfort you either because it is not Aristotle who is taking the course—it's you!

Although it is impossible for us to allay all of the fear and apprehension you may be experiencing right now, it may help to know that virtually everyone can and will make it through this course, even those of you who have trouble counting change. This is not a guarantee, and we are not saying it will be easy, but it can be done with hard work. We have found that persistence and tenacity can overcome even the most extreme mathematical handicaps. Those of you who are particularly rusty with your math, and those of you who just want a quick confidence builder, should refer to Appendix A at the back of this book. Appendix A reviews some basic math lessons. Our book also includes practice problems and, more important, the answers to those problems. After teaching this course for over two decades, we have found that every student who puts forth effort and time can pass the course! Our chapters are designed to provide step-by-step instructions for calculating the statistics with real criminal justice data and case studies so you will not only learn about statistics but also a little about research going on in our discipline.

Another incentive to learning this material is that careers related to criminology and criminal justice are increasingly becoming data driven. Understanding how to organize data and interpret statistics will be a tremendous asset to you, no matter what direction you plan to take in your career. Virtually every job application, as well as applications to graduate school and law school, now asks you about your data analysis skills. We now exist in a world where programs to organize and manipulate data are everywhere. The quotes from former students at the beginning of each chapter are testimony to this.

We hope that after this course you will be able to understand and manipulate statistics for yourself and that you will be a knowledgeable consumer of the statistical material you are confronted with daily. In addition to the mathematical skills required to compute statistics, we also hope to leave you with an understanding of what different statistical tests or operations can and cannot do, and what they do and do not tell us about a given problem. The foundations for the statistics presented in this book are derived from complicated mathematical theory. You will be glad to know that it is *not* the purpose of this book to provide you with the proofs necessary to substantiate this body of theory.

In this book, we provide you with two basic types of knowledge: (1) knowledge about the basic mathematical foundations of each statistic, as well as the ability to manipulate and conduct statistical analysis for your own research, and (2) an ability to interpret the results of statistical analysis and to apply these results to the real world. We want you, then, to have the skills to both calculate and comprehend social statistics. These two purposes are not mutually exclusive but related. We think that the ability to carry out the mathematical manipulations of a formula and come up with a statistical result is almost worthless unless you can interpret this result and give it meaning. Therefore, information about the mechanics of conducting statistical tests and information about interpreting the results of these tests will be emphasized equally throughout this text.

Learning about statistics for perhaps the first time does not mean that you will always have to calculate your statistics by hand with the assistance of only a calculator. Most, if not all, researchers do their statistical analyses with a computer and software programs. Many useful and "user-friendly" statistical software programs are available, including SPSS, SAS, Stata, R, Excel, and Minitab. Because learning to conduct statistical analyses with a computer is such an essential task to master, we provide a discussion of the computer software program SPSS on the student website for this book, along with data sets that can be downloaded. We have also included SPSS data analysis exercises at the end of each chapter; however, you can easily use these exercises for virtually any other statistical software program including the spreadsheet program Excel.

You may be wondering why you have to learn statistics and how to calculate them by hand if you can avoid all of this by using a computer. First, we believe it is important for you to understand exactly what it is the computer is doing when it is calculating statistics.

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Without this knowledge, you may get results, but you will have no understanding of the logic behind the computer's output and little comprehension of how those results were obtained. This is not a good way to learn statistics; in fact, it is not really learning statistics at all. Without a firm foundation in the basics of statistics, you will have no real knowledge of what to request of your computer or how to recognize an incorrect result. Computer programs provide results even if those results are wrong. Despite its talent, the computer is actually fairly stupid; it has no ability to determine whether what it is told to do is correct—it will do pretty much anything it is asked, and it will calculate and spit out virtually anything you want it to, correct or not. The adage "garbage in, garbage out" is appropriate here. Moreover, a computer program won't interpret the results. That is your responsibility!

SETTING THE STAGE FOR STATISTICAL INQUIRY

Before we become more familiar with statistics in the upcoming chapters, we first want to set the stage for statistical inquiry. The data we use in criminology are derived from many different sources: from official government agency data such as the Federal Bureau of Investigation's (FBI) Uniform Crime Reports; from social surveys conducted by the government (the Bureau of Justice Statistics' National Crime Victimization Survey), ourselves, or other researchers; from experiments; from direct observation, as either a participant observer or an unobtrusive observer; or from a content analysis of existing images (historical or contemporary), such as newspaper articles or films. As you can see, the research methods we employ are very diverse.

Criminological researchers often conduct "secondary data analysis" (Riedel, 2012), which, simply put, means reanalyzing data that already exist. These data usually come from one of two places: Either they are official data collected by local, state, and federal agencies (e.g., rates of crime reported to police, information on incarcerated offenders from state correctional authorities, or adjudication data from the courts), or they are data collected from surveys sponsored by government agencies or conducted by other researchers. Virtually all of these data collected by government agencies and a great deal of survey data collected by independent researchers are made available to the public through the Inter-University Consortium for Political and Social Research (ICPSR), which is located at the University of Michigan.

The ICPSR maintains and provides access to a vast archive of criminological data for research and instruction, and it offers training in quantitative methods to facilitate effective data use. For example, data available online at ICPSR include the Supplementary Homicide Reports (SHR) provided by the U.S. Department of Justice, which contain information for each homicide from police reports, including such details as the relationship between victims and offenders, use of weapons, and other characteristics of victims and offenders; survey data from the National Crime Victimization Survey (NCVS), which interviews a sample of U.S. household residents to determine their experiences with both property and violent crime, regardless of whether the crimes were reported to police or anyone else; survey data from samples of jail and prison inmates; and survey data from the National Opinion Survey of Crime and Justice, which asked adults for their opinion about a wide range of criminal justice issues. These are just a few examples of the immense archive of data made available at the ICPSR. Take a look at what is available by going on the website: www.icpsr.umich.edu.

THE ROLE OF STATISTICAL METHODS IN CRIMINOLOGY AND CRIMINAL JUSTICE

Over the past few decades, statistics and numerical summaries of phenomena such as crime rates have increasingly been used to document how "well" or "poorly" a society is doing. For example, cities and states are described as relatively safe or unsafe depending on their respective

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levels of violent crime, and age groups are frequently monitored and compared with previous generations to determine their relative levels of deviancy based on criteria such as their drug and alcohol use. Other criminal justice-related phenomena like the number of people under correctional supervision are also monitored closely.

Research and statistics are important in our discipline because they enable us to monitor phenomena over time and across geographic locations, and they allow us to determine relationships between phenomena. Of course, we make conclusions about the relationships between phenomena every day, but these conclusions are most often based on biased perceptions and selective personal experiences.

Science: A set of logical, systematic, documented methods for investigating nature and natural processes; the knowledge produced by these investigations.

In criminological research, we rely on scientific methods, including statistics, to help us perform these tasks. **Science** relies on logical and systematic methods to answer questions, and it does so in a way that allows others to inspect and evaluate its methods. In the realm of criminological research, these methods are not so unusual. They involve asking questions, observing behavior, and counting people, all of which we often do in our everyday lives. The difference is that researchers develop, refine, apply, and report their understanding of the social world more systematically.

CASE STUDY

Youth Violence

The population of the United States all too frequently mourns the deaths of young innocent lives taken in school shootings. The deadliest elementary school shooting to date took place on December 14, 2012, when a 20-year-old man named Adam Lanza walked into an elementary school in Newtown, Connecticut, armed with several semiautomatic weapons and killed 20 children and 6 adults. On April 16, 2007, Cho Seung-Hui perpetrated the deadliest college mass shooting by killing 32 students, faculty, and staff and left over 30 others injured on the campus of Virginia Tech in Blacksburg, Virginia. Cho was armed with two semiautomatic handguns that he had legally purchased and a vest filled with ammunition. As police were closing in on the scene, he killed himself. The deadliest high school shooting occurred on February 4, 2018, in Parkland, Florida, at Marjory Stoneman Douglas High School. Nikolas Cruz, a former student at the school, killed 17 and injured another 17 before fleeing. Cruz is currently awaiting trial in Florida.

None of these mass murderers were typical terrorists, and each of these incidents caused a media frenzy. Headlines such as "The School Violence Crisis" and "School Crime Epidemic" were plastered across national newspapers and weekly news journals. Unfortunately, the media play a large role in how we perceive both problems and solutions. What are your perceptions of violence committed by youth, and how did you acquire them? What do you believe are the causes of youth violence? Many (frequently conflicting) factors have been blamed for youth violence in American society, including the easy availability of guns, the lack of guns in classrooms for protection, the use of weapons in movies and television, the moral decay of our nation, poor parenting, unaware teachers, school and class size, racial prejudice, teenage alienation, the Internet and the World Wide Web, anti-Semitism, violent video games, rap and rock music, and the list goes on.

Of course, youth violence is not a new phenomenon in the United States. It has always been a popular topic of social science research and the popular press. Predictably, whenever a phenomenon is perceived as an epidemic, numerous explanations emerge to explain it. Unfortunately, most of these explanations are based on the media and popular culture, not on empirical research. Unlike the anecdotal information floating around in the mass media, social scientists interested in this phenomenon have amassed a substantial body of findings

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that have refined knowledge about the factors related to the problem of gun violence, and some of this knowledge is being used to shape social policy. Research that relies on statistical analysis generally falls into three categories of purposes for social scientific research: Descriptive, Explanatory, and Evaluation.

Descriptive Research

Defining and describing social phenomena of interest is a part of almost any research investigation, but **descriptive research** is the primary focus of many studies of youth crime and violence. Some of the central questions used in descriptive studies are as follows: "How many people are victims of youth violence?" "How many youth are offenders?" "What are the most common crimes committed by youthful offenders?" and "How many youth are arrested and incarcerated each year for crime?"

Descriptive research: Research in which phenomena are defined and described.

Police reports: Data used to measure crime based on incidents that become known to police departments.

Uniform Crime Reports (UCR): Official reports about crime incidents that are reported to police departments across the United States and then voluntarily reported to the Federal Bureau of Investigation (FBI), which compiles them for statistics purposes.

National Incident-Based Reporting System (NIBRS): Official reports about crime incidents that are reported to police departments across the United States and then voluntarily reported to the Federal Bureau of Investigation (FBI), which compiles them for statistics purposes. This system is slowly replacing the older UCR program.

Surveys: Research method used to measure the prevalence of behavior, attitudes, or any other phenomenon by asking a sample of people to fill out a questionnaire either in person, through the mail or Internet, or on the telephone.

CASE STUDY

How Prevalent Is Youth Violence?

Police reports: One of the most enduring sources of information on lethal violence in the United States is the FBI's SHR. Data measuring the prevalence of nonlethal forms of violence such as robbery and assaults are a bit more complicated. How do we know how many young people assault victims each year? People who report their victimizations to police represent one avenue for these calculations. The FBI compiles these numbers in its **Uniform Crime Reports (UCR)** system, which is slowly being replaced by the **National Incident-Based Reporting System (NIBRS)**. Both of these data sources rely on state, county, and city law enforcement agencies across the United States to participate voluntarily in the reporting program. Can you imagine why relying on these data sources may be problematic for estimating prevalence rates of violent victimizations? If victimizations are never reported to police, they are not counted. This is especially problematic for victimizations between people who know each other and other offenses like rape in which only a fraction of incidents are ever reported to police.

Surveys: Many, if not most, social scientists believe the best way to determine the magnitude of violent victimization is through random sample surveys. This basically means randomly selecting individuals in the population of interest and asking them about their victimization experiences via a mailed or Internet, telephone, or in-person questionnaire. The only ongoing survey to do this on an annual basis is the NCVS, which is sponsored by the U.S. Department of Justice's Bureau of Justice Statistics. Among other questions, the NCVS asks questions like, "Has anyone attacked or threatened you with a weapon, for instance, a gun or knife; by something thrown, such as a rock or bottle, include any grabbing, punching, or choking?" Estimates indicate that youth aged 12 to 24 years all have the highest rates of violent victimization, which have been declining steadily since the highs witnessed in the early 1990s, despite the recent increases observed in homicide rates for this age group in some locations.

Another large research survey that estimates the magnitude of youth violence (along with other risk-taking behavior such as taking drugs and smoking) is called the Youth Risk Behavior Survey (YRBS), which has been conducted every two years in the United States since 1990. Respondents to this survey are a national sample of approximately 16,000 high-school students in grades 9 through 12. To measure the extent of youth violence, students are asked a number of questions, including the following: "During the past 12 months, how many times were you in a physical fight?" "During the past 12 months, how many times were you in a physical

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fight in which you were injured and had to be seen by a doctor or nurse?" "During the past 12 months, how many times were you in a physical fight on school property?" and "During the past 12 months, how many times did someone threaten or injure you with a gun, knife, or club on school property?"

Of course, another way to measure violence would be to ask respondents about their offending behaviors. Some surveys do this, including the Rochester Youth Development Study (RYDS). The RYDS sample consists of 1,000 students who were in the seventh and eighth grades in the Rochester, New York, public schools during the spring semester of the 1988 school year. This project has interviewed the original respondents at 12 different times including the last interview that took place in 1997 when respondents were in their early 20s (Thornberry, Krohn, Lizotte, & Bushway, 2008). As you can imagine, respondents are typically more reluctant to reveal offending behavior compared with their victimization experiences. However, these surveys have been a useful tool for examining the factors related to violent offending and other delinquency. We should also point out that although this discussion has been specific to violence, the measures we have discussed in this section, along with their strengths and weaknesses, apply to measuring all crime in general.

Explanatory Research

Explanatory research: Research that seeks to identify causes and/or effects of social phenomena.

Dependent variable: Variable that is expected to change or vary depending on the variation in the independent variable.

Independent variable: Variable that is expected to cause or lead to variation or change in the dependent variable.

Many people consider explanation to be the premier goal of any science. **Explanatory research** seeks to identify the causes and effects of social phenomena, to predict how one phenomenon will change or vary in response to variation in some other phenomenon. Researchers adopted explanation as a goal when they began to ask such questions as "Are kids who participate in after school activities less likely to engage in delinquency?" and "Does the unemployment rate influence the frequency of youth crime?" In explanatory research, studies are often interested in explaining a **dependent variable** by using one or more independent variables. In research, the dependent variable is expected to vary or change depending on variation or change in the **independent variable**. One of our students came up with this way to describe it, "The dependent variable is dependent on the level or change in the independent variable, whereas, the independent variable is not dependent, but independent!" In this causal type of explanation, the independent variable is the cause and the dependent variable the effect.

CASE STUDY

What Factors Are Related to Youth Delinquency and Violence?

When we move from description to explanation, we want to understand the direct relationship between two or more things. Does *x* (the independent variable) explain *y* (the dependent variable) or if *x* happens, is *y* also likely to occur? What are some of the factors related to youth violence? Nathalie Fontaine and her colleagues Fontaine, Brendgen, Vitaro, and Tremblay (2016) were interested in how several factors including parental supervision and attachment to school affected the probability of adolescents engaging in violent behavior. They used a longitudinal data set collected in Montreal, Canada, which followed boys from kindergarten until they were 17 years old. By following this sample of boys over time, the researchers could determine that parental supervision and attachments in school came before the violent offending, which is extremely important when attempting to determine factors that predict violence.

Theory: Logically interrelated set of propositions about empirical reality that can be tested.

Testing hypotheses generated from theory is often a goal of explanatory research. A **theory** is a logically interrelated set of propositions about empirical reality. Examples of criminological

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theories include social learning theory, general strain theory, social disorganization theory, and routine activities theory. A **hypothesis** is simply a tentative statement about empirical reality, involving a relationship between two or more variables.

Hypothesis: Tentative statement about empirical reality, involving the relationship between two or more variables.

Social control theory contends that conformity to the rules of society is produced and maintained by the ties individuals have to different things including family, friends, schools, jobs, and so on. These ties or bonds serve to increase the costs of delinquency and crime, and as such, serve to control individual offending. Fontaine and her colleagues (2016) measured two types of social control: parental attachment and school engagement (independent variables) that they hypothesized would be related to self-reported violent offending (dependent variable). Results indicated that boys who had greater parental supervision and school engagement were less likely to engage in violent delinquency compared with their less supervised and engaged counterparts. In fact, while boys who had been aggressive as children were more likely to be violent as adolescents, the relationship between childhood and adolescent violence was virtually eliminated for those boys who had high levels of parental supervision and school engagement.

Evaluation Research

Evaluation research seeks to determine the effects of a social program or other types of intervention. It is a type of explanatory research because it deals with cause and effect. However, evaluation research differs from other forms of explanatory research because evaluation research considers the implementation and effects of social policies and programs. These issues may not be relevant in other types of explanatory research.

Evaluation research: Research about social programs or interventions.

Evaluation research is a type of explanatory research, but instead of testing theory, it is most often used to determine whether an implemented program or policy had the intended outcome. To reduce violence and create a safer atmosphere at schools across the country, literally thousands of schools have adopted some form of violence prevention training. These programs generally provide cognitive-behavioral and social skills training on various topics using a variety of methods. Such programs are commonly referred to as conflict resolution and peer mediation training. Many of these prevention programs are designed to improve interpersonal problem-solving skills among children and adolescents by training children in cognitive processing, such as identifying interpersonal problems and generating nonaggressive solutions. Despite the millions of dollars being paid by school districts for such violence and bullying prevention programs, you may be surprised to learn that very few of these programs have been evaluated scientifically. That is, we know very little about whether they actually prevent bullying and violence.

CASE STUDY

How Effective Are School Bullying and Violence Prevention Programs?

Randomized control trials (RCTs), otherwise known as **true experimental designs**, are the gold standard in science to determine whether there is true causality between and independent and dependent variable. In the case of violence prevention programs, the program would be the independent variable that is assumed to affect bullying or violent behavior. RCTs randomly assign individuals to either receive the treatment or participate in the program, which is called the experimental group. Those who are not randomly assigned to the experimental group do not receive the new program and are called the control group. Random assignment to the two

Randomized control trial (RCT) or true experimental design: When two groups are randomly assigned with one group receiving the treatment or program (experimental group) while the other group (control group) does not. After the program or treatment, a post-test determines whether there is a change in the experimental group.

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groups is the key because in this way, researchers can assume that the two groups are expected to be equivalent except for one group receiving a new treatment or program.

There are several anti-bullying programs being marketed both in the United States and in other countries, including the *Olweus Bullying Prevention Program*, *Steps to Respect*, *Restorative Whole-School Approach*, to name a few. Many of these programs include elements intended to increase staff supervision to prevent bullying and to increase the emotional intelligence of students to increase empathy and the ability to resolve conflicts without violence. Both of these mechanisms are hypothesized to decrease rates of bullying in schools. But do they work?

Gaffney, Ttofi, and Farrington (2019) reviewed studies that have evaluated these prevention programs since 2009. They performed a meta-analysis, which is actually a complicated statistical analysis that determines the average effect of similar programs on an outcome, which in this case was bullying behavior. They used the Centers for Disease Control and Prevention definition of bullying that includes three elements: (1) an intention to harm; (2) repetitive in nature; and (3) a clear power imbalance between perpetrator and victim. Without getting too deep into the statistical nitty-gritty, the researchers determined that the average effect of the bullying prevention programs served to decrease bullying perpetration by around 19%.

POPULATIONS AND SAMPLES

The words "population" and "sample" should already have some meaning to you. When you think of a population, you probably think of the population of some locality such as the United States, or the city or state in which you reside, or the university or college you attend. As with most social science research, samples in criminology consist of samples at different units of analysis including countries, states, cities, neighborhoods, prisons, schools, individuals, etc. Since it is too difficult, too costly, and sometimes impossible to get information on the entire population of interest, we must often solicit the information of interest from samples. **Samples** are simply subsets of a larger **population**.

Sample: Subset of the population that a researcher must often use to make generalizations about the larger population.

Population: Larger set of cases or aggregate number of people that a researcher is actually interested in or wishes to know something about.

Most official statistics collected by the U.S. government are derived from information obtained from samples, not from the entire population (the U.S. Census taken every 10 years is an exception). For example, the NCVS is a survey used to obtain information on the incidence and characteristics of criminal victimization in the United States based on a sample of the U.S. population. Every year, the NCVS interviews more than 100,000 individuals aged 12 years or older to solicit information on their experiences with victimization that were both reported and unreported to the police. Essentially, professional interviewers ask persons who are selected into the sample if they were the victim of a crime in the past six months, regardless of whether this victimization was reported to police.

You may be thinking right now, "Well, what if I am only interested in a small population?" Good question! Let's say we were interested in finding out about job-related stress experienced by law enforcement officers in your state. Although it would be easier to contact every individual in this population compared with every U.S. citizen, it would still be extremely difficult and costly to obtain information from every law enforcement officer, even within one state. In fact, in almost all instances, we have to settle for a sample derived from the population of interest rather than study the full population. For this reason, the "population" usually remains an unknown entity whose characteristics we can only estimate. The **generalizability** of a study is the extent to which it can be used to inform us about persons, places, or events that were *not* studied.

Generalizability: Extent to which information from a sample can be used to inform us about persons, places, or events that were not studied in the entire population from which the sample was taken.

We usually make a generalization about the characteristics of a population by using information we have from a sample; that is, we make inferences from our sample data to the

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population. Because the purpose of sampling is to make these generalizations, we must be very meticulous when selecting our sample. The primary goal of sampling is to make sure that the sample we select is actually representative of the population we are estimating and want to generalize to. Think about this for a minute. What is representative? Generally, if the characteristics of a sample (e.g., age, race/ethnicity, and gender) look similar to the characteristics of the population, the sample is said to be representative. For example, if you were interested in estimating the proportion of the population that favors the death penalty, then to be representative, your sample should contain about 50% men and 50% women because that is the makeup of the U.S. population. It also should contain about 85% whites and 15% nonwhites because that is the makeup of the U.S. population. If your sample included a disproportionately high number of males or nonwhites, it would be unrepresentative. If, on the other hand, your target population was individuals older than 65 years of age, your sample should have a somewhat different gender distribution. To reflect the gender distribution of all individuals in the United States older than 65, a sample would have to contain approximately 60% women and 40% men since this is the gender distribution of all individuals older than age 65 in the United States as defined by the Census Bureau.

In sum, the primary question of interest in sample generalizability is as follows: *Can findings from a sample be generalized to the population from which the sample was drawn?* Sample generalizability depends on sample quality, which is determined by the amount of **sampling error** present in your sample. Sampling error can generally be defined as the difference between the sample estimate and the population value that you are estimating. The larger the sampling error, the less representative the sample and, as a result, the less generalizable the findings are to the population.

Sampling error: The difference between a sample estimate (called a sample statistic) and the population value it is estimating (called a population parameter).

With a few special exceptions, a good sample should be representative of the larger population from which it was drawn. A representative sample looks like the population from which it was selected in all respects that are relevant to a particular study. In an unrepresentative sample, some characteristics are overrepresented and/or some characteristics may be underrepresented. Various procedures can be used to obtain a sample; these range from the simple to the complex as we will see next.

Probability sampling methods: These methods rely on random selection or chance and allow us to know in advance how likely it is that any element of a population is selected for the sample.

Nonprobability sampling methods: These methods are not based on random selection and do not allow us to know in advance the likelihood of any element of a population being selected for the sample.

HOW DO WE OBTAIN A SAMPLE?

From the previous discussion, it should be apparent that accuracy is one of the primary problems we face when generalizing information obtained from a sample to a population. How accurately does our sample reflect the true population? This question is inherent in any inquiry because with any sample we represent only a part—and sometimes a small part—of the entire population. The goal in obtaining or selecting a sample, then, is to select it in a way that increases the chances of this sample being representative of the entire population.

One of the most important distinctions made about samples is whether they are based on a probability or nonprobability sampling method. Sampling methods that allow us to know in advance how likely it is that any element of a population will be selected for the sample are **probability sampling methods**. Sampling methods that do not let us know the likelihood in advance are **nonprobability sampling methods**.

The fundamental aspect of probability sampling is **random selection**. When a sample is randomly selected from the population, this means every element of the population (e.g., individual, school, or city) has a known, equal, and independent chance of being selected for the sample. All probability sampling methods rely on a random selection procedure.

Random selection: The fundamental aspect of probability sampling. The essential characteristic of random selection is that every element of the population has a known and independent chance of being selected for the sample.

Probability sampling techniques not only serve to minimize any potential bias we may have when selecting a sample, but also they allow us to gain access to probability theory in our data analysis, which you will learn more about later in this text. This body of mathematical theory allows us to estimate more accurately the degree of error we have when generalizing

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results obtained from known sample statistics to unknown population parameters. But don't worry about probability theory now. For now, let's examine some of the most common types of probability samples used in research.

Flipping a coin and rolling a set of dice are the typical examples used to characterize random selection. When you flip a coin, you have the same chance of obtaining a head as you do of obtaining a tail: one out of two. Similarly, when rolling a die, you have the same probability of rolling a 2 as you do of rolling a 6: one out of six. In criminology, researchers generally use random numbers tables, such as Table B.1 in Appendix B, or other computer-generated random selection programs to select a sample. Because they are based on random selection, probability sampling methods have no systematic bias; nothing but chance determines which elements are included in the sample. As a result, our sample also is more likely to be representative of the entire population. When the goal is to generalize your findings to a larger population, it is this characteristic that makes probability samples more desirable than nonprobability samples. Using probability sampling techniques serves to avoid any potential bias we might introduce if we selected a sample ourselves.

PROBABILITY SAMPLING TECHNIQUES

Simple Random Samples

Simple random sample: Method of sampling in which every sample element is selected only on the basis of chance through a random process.

Perhaps the most common type of probability sample to use when we want to generalize information obtained from the sample to a larger population is called a **simple random sample**. Simple random sampling requires a procedure that generates numbers or identifies cases of the population for selection strictly on the basis of chance. The key aspect of a simple random sample is random selection. As we stated earlier, random selection ensures that every element in the population has a known, equal, and independent chance of being selected for the sample. If an element of the population is selected into the sample, true simple random sampling is done by replacing that element back into the population so that, once again, there is an equal and independent chance of every element being selected. This is called sampling with replacement. However, if your sample represents a very small percentage of a large population (say, less than 4%), sampling with and without replacement generally produce equivalent results.

Random digit dialing (RDD): Random dialing by a machine of numbers within designated phone prefixes, which creates a random sample for phone surveys.

Organizations that conduct large telephone surveys often draw random samples with an automated procedure called **random digit dialing (RDD)**. In this process, a computer dials random numbers within the phone prefixes corresponding to the area in which the survey is to be conducted. Random digit dialing is particularly useful when a sampling frame is not available. The researcher simply replaces any inappropriate numbers, such as those numbers that are no longer in service or numbers for businesses, with the next randomly generated phone number. Many surveys rely on this method and use both numbers for land lines and cell phones (Bachman & Schutt, 2017). For example, National Intimate Partner Violence and Sexual Victimization Surveys sponsored by The Centers for Disease Control and Prevention selects a random sample of adult males and females residing in the United States by using the RDD sampling technique.

Systematic Random Samples

Systematic random sampling: Method of sampling in which sample elements are selected from a list or from sequential files, with every kth element being selected after the first element is selected randomly within the first interval.

Simple random sampling is easy to do if your population is organized in a list, such as from a phone book, registered voters list, court docket, or membership list. We can make the process of simple random selection discussed earlier a little less time-consuming by systematically sampling the cases. In **systematic random sampling**, we select the first element into the sample randomly, but instead of continuing with this random selection, we *systematically* choose the rest of the sample. The general rule for systematic random sampling is to begin with a single element (any number selected randomly within the first interval, say the 10th) in the population

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and then proceed to select the sample by choosing every *k*th element thereafter (say, every 12th element after the 10th). The first element is the only element that is truly selected at random. The starting element can be selected from a random numbers table or by some other random method. Systematic random sampling eliminates the process of deriving a new random number for every element selected, thus, saving time.

For systematic sampling procedures to approximate a simple random sample, the population list must be truly random, not ordered. For example, we could not have a list of convicted felons ordered by offense type, age, or some other characteristic. If the list is ordered in any way, this will add bias to the sampling process, and the resulting sample is not likely to be representative of the population. In virtually all other situations, systematic random sampling yields what is essentially a simple random sample.

Multistage Cluster Samples

There are often times when we do not have the luxury of a population list but still want to collect a random sample. Suppose, for example, we wanted to obtain a sample from the entire U.S. population. Would there be a list of the entire population available? Well, there are telephone books that list residents of various locales who have telephones; there are lists of residents who have registered to vote, lists of those who hold driver's licenses, lists of those who pay taxes, and so on. However, all these lists are incomplete (some people do not list their phone numbers or do not have telephones; some people do not register to vote or drive cars). Using these incomplete lists would introduce bias into our sample.

In such cases, the sampling procedures become a little more complex. We usually end up working toward the sample we want through successive approximations: by first extracting a sample from lists of groups or clusters that are available and then sampling the elements of interest from within these selected clusters. A cluster is a naturally occurring, mixed aggregate of elements of the population, with each element appearing in one and only one cluster. Schools could serve as clusters for sampling students, prisons could serve as clusters for sampling incarcerated offenders, neighborhoods could serve as clusters for sampling city residents, and so on. Sampling procedures of this nature are typically called **multistage cluster samples**.

Multistage cluster sampling: Sampling in which elements are selected in two or more stages, with the first stage being the random selection of naturally occurring clusters and the last stage being the random selection of multilevel elements within clusters.

Drawing a cluster sample is at least a two-stage procedure. First, the researcher draws a random sample of clusters (e.g., blocks, prisons, and counties). Next, the researcher draws a random sample of elements within each selected cluster. Because only a fraction of the total clusters from the population are involved, obtaining a list of elements within each of the selected clusters is usually much easier.

Many large surveys sponsored by the federal government use multistage cluster samples. The U.S. Justice Department's NCVS is an excellent example of a multistage cluster sample. Because the target population of the NCVS is the entire U.S. population, the first stage of sampling requires selecting a first-order sample of counties and large metropolitan areas called primary sampling units (PSUs). From these PSUs, another stage of sampling involves the selection of geographic districts within each of the PSUs that have been counted by the 2000 census. And finally, a probability sample of residential dwelling units are selected from these geographic districts. These dwelling units, or addresses, represent the final stage of the multistage sampling. Or in a cluster sample of students, a researcher could contact the schools selected in the first stage and make arrangements with the registrars to obtain lists of students at each school. Figure 1.1 displays the multiple stages of a cluster sample like this.

Weighted or Stratified Samples

In some cases, the types of probability samples described earlier do not actually serve our purposes. Sometimes, we may want to make sure that certain segments of the population of interest are represented within our sample, and we do not want to leave this to chance. Say, for example,

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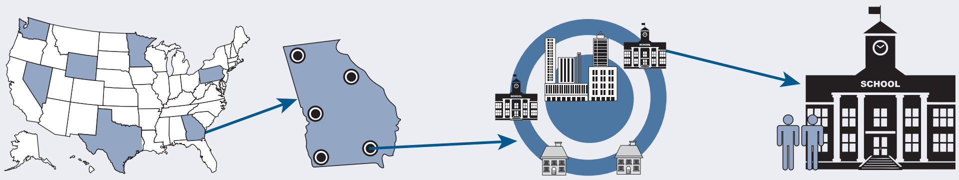
Figure 1.1 Example of Cluster Sampling



that we are interested in incidents of personal larceny involving contact, such as purse snatching. We know from the NCVS that Americans older than 65 years of age are as vulnerable to this type of crime as those who are younger than 65. We may be interested in whether there are differences in the victimization circumstances (e.g., place or time of occurrence and number of offenders) between two groups of persons: those younger than 65 and those older than 65. To investigate this, we want to conduct a sample survey with the entire U.S. population. A simple random sample of the population, however, may not result in a sufficient number of individuals older than 65 to use for comparison purposes because individuals older than 65 make up a relatively small proportion of the entire population (approximately 12%).

Stratified or weighted sampling: Method of sampling in which sample elements are selected separately from population strata or are weighted differently for selection in advance by the researcher.

One way to achieve this goal would be to weight the elements in our population disproportionately. These samples are referred to as **stratified or weighted samples**. Instead of having an equal chance of being selected, as in the case of random samples, individuals would have a known but unequal chance of being selected. That is, some elements would have a greater probability of being selected into the sample than others. This would be necessary in our study of purse snatching because those older than 65 represent only about 12% of the total U.S. population. Because we want to investigate differences between the victimizations of those younger than and older than 65, we want to have more than this 12% proportion represented in our sample. To do this, we would disproportionately weight our sample selection procedures to give persons older than 65 a better chance of being selected. It is important to note that if we were going to make generalizations from a weighted sample to the population, then adjustments to our statistics would be necessary to take this sample weighting into account. This is a somewhat complicated procedure that is usually accomplished through the aid of computer technology.

NONPROBABILITY SAMPLING TECHNIQUES

As you can imagine, obtaining a probability sample such as those described in the previous section can be a very laborious, and sometimes costly, task. Many researchers do not have the resources, in either time or money, to obtain a probability sample. Instead, many rely on nonprobability sampling procedures. Unlike the samples we have already discussed, when samples are collected using nonprobability sampling techniques, elements within the target population do *not* have a known, equal, and independent probability of being selected. Because the chance of one element being selected versus another element remains unknown, we cannot be certain that the selected sample actually represents our target population. Since we are

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generally interested in making inferences to a larger population, this uncertainty can represent a significant problem.

Why, then, would we want to use nonprobability sampling techniques? Well, they are useful for several purposes, including those situations in which we do not have a population list. Moreover, nonprobability-sampling techniques are often the only way to obtain samples from particular populations or for certain types of research questions, especially those about hidden or deviant subcultures. At other times when we are just exploring issues we may not need the precision (and added costs and labor) of a probability sample. We will briefly discuss three types of nonprobability samples in this section: availability, quota, and purposive or judgement samples.

Availability Samples

The first type of sampling technique we will discuss is one that is perhaps too frequently used and is based solely on the availability of respondents. This type of sample is appropriately termed an **availability sample**. The media often pass availability samples off as probability samples. Popular magazines and Internet sites periodically survey their readers by asking them to fill out questionnaires, and those individuals inclined to respond make up the availability sample for the survey. Follow-up articles then appear in the magazine or on the site displaying the results under such titles as "What You Think About the Death Penalty for Teenagers." Even if the number of people who responded is large, however, these respondents only make up a tiny fraction of the entire readership and are probably unlike other readers who did not have the interest or time to participate. In sum, these samples are not representative of the total population—or even of the total population of all readers.

Availability sampling: Sampling in which elements are selected on the basis of convenience.

You have probably even been an element in one of these samples. Have you ever been asked to complete a questionnaire in class, say as a course requirement for a psychology class? University researchers frequently conduct surveys by passing out questionnaires in their large lecture classes. Usually, the sample obtained from this method consists of those students who voluntarily agree to participate or those who receive course credit for doing so. This voluntary participation injects yet another source of bias into the sample. It is not surprising that this type of sample is so popular; it is one of the easiest and least expensive sampling techniques available. But it may produce the least representative and least generalizable type of samples.

Quota Samples

Quota sampling is intended to overcome availability sampling's biggest downfall: the likelihood that the sample will just consist of who or what is available, without any concern for its similarity to the population of interest. The distinguishing feature of a quota sample is that quotas are set to ensure that the sample represents certain characteristics in proportion to their prevalence in the population.

Quota sampling: Nonprobability sampling method in which elements are selected to ensure that the sample represents certain characteristics in proportion to their prevalence in the population or to oversampled segments of the population.

Quota samples are similar to stratified probability samples, but they are generally less rigorous and precise in their selection procedures. Quota sampling simply involves designating the population into proportions of some group that you want to be represented in your sample. Similar to stratified samples, in some cases, these proportions may actually represent the true proportions observed in the population. At other times, these quotas may represent predetermined proportions of subsets of people you deliberately want to oversample.

The problem is that even when we know that a quota sample is representative of the particular characteristics for which quotas have been set, we have no way of knowing if the sample is representative in terms of any other characteristics. Realistically, researchers can set quotas for only a small fraction of the characteristics relevant to a study, so a quota sample is really not much better than an availability sample (although following careful, consistent procedures for selecting cases within the quota limits always helps).

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Purposive or Judgment Samples

Purposive or judgment sampling: Nonprobability sampling method in which elements are selected for a purpose usually because of their unique position.

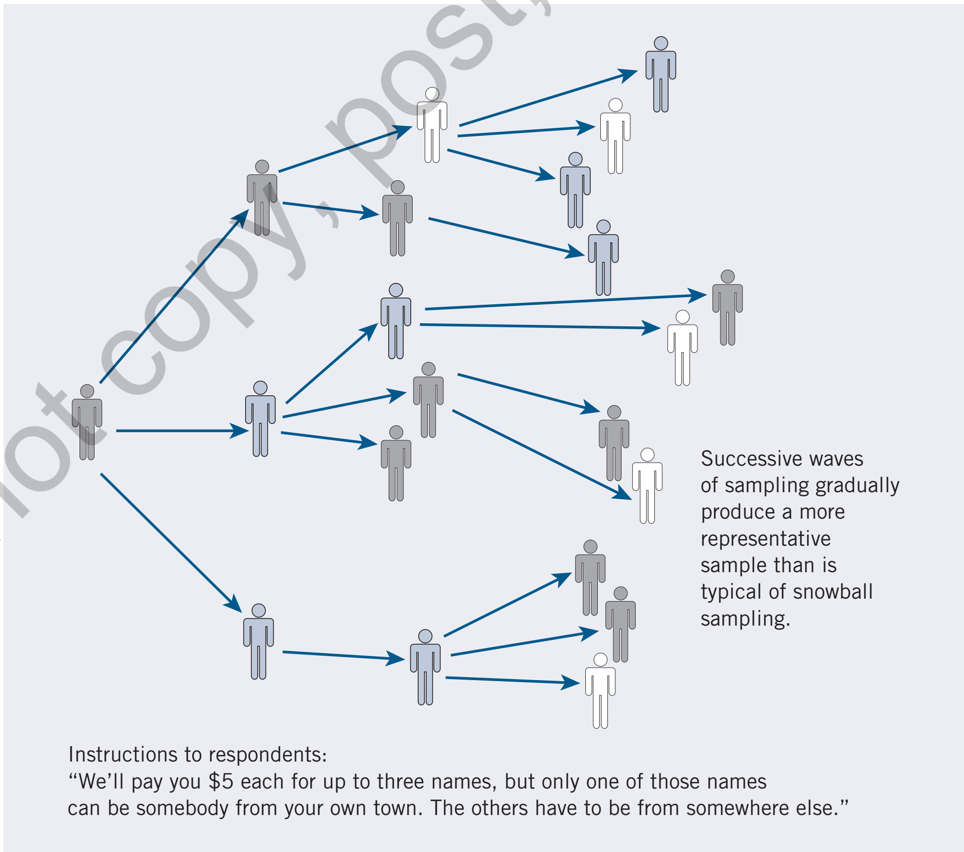
Another type of nonprobability sample that is often used in the field of criminology is called a **purposive** or **judgment sample**. In general, this type of sample is selected based on the purpose of the researcher's study and on his or her judgment of the population. It is often referred to as judgment sampling because the researcher uses her or his own judgment about whom to select into the sample, rather than drawing sample elements randomly. Although this type of sample does not provide the luxury of generalizability, it can provide a wealth of information not otherwise attainable from a typical random sample.

Many noted studies in the field of criminology have been carried out by using a purposive or judgment sample. For example, in the classic book *The Booster and the Snitch: Department Store Shoplifting*, Mary Cameron (1964) tracked a sample of individuals who had been caught shoplifting by department store employees.

Snowball sample: Type of purposive sample that identities one member of a population and then asks him or her to identify others in the population. The sample size increases as a snowball would rolling down a slope.

Another variation of a purposive sample is called a **snowball sample**. By using this technique, you identify one member of the population and speak to him or her, then ask that person to identify others in the population and speak to them, then ask them to identify others, and so on. The sample size increases with time as a snowball would rolling down a slope. This technique is useful for hard-to-reach or hard-to-identify interconnected populations where at least some members of the population know each other, such as drug dealers, prostitutes, practicing criminals, gang leaders, and informal organizational leaders. Figure 1.2 displays the process of snowball sampling.

Figure 1.2 Example of Snowball Sampling



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To investigate the co-occurrence of intimate partner violence (IPV) and animal abuse, Fitzgerald and her colleagues Barrett, Stevenson, and Cheung (2019) obtained a purposive obtaining a random sample of the population would not be the ideal way to answer this research question. Of the women they surveyed, 55 women reported owning a pet while with their abusive partner. Of these women, 49 reported that their abusers also maltreated their pets. While the most common form of pet abuse included threats to get rid of the pet, or scaring or intimidating the pet, over 50% of the women reported that their pets were hit or had objects thrown at them, 20% reported that their pets were injured, and about 15% reported that their pets had been killed by their abusers. Based on these results, Fitzgerald et al. (2019) concluded that abuser's maltreatment of their partner's pets was driven by a "desire to cause them emotional harm and/or to enact power and control over them." (p. 1823)

We believe it is fundamental to identify the types of samples that are used in research before beginning a course in statistics. All inferential statistics we will examine in this text assume that the data being examined were obtained from a probability sample. What are inferential statistics, you ask? Good question. We will answer this next.

DESCRIPTIVE AND INFERENTIAL STATISTICS

Traditionally, the discipline of statistics has been divided into descriptive and inferential statistics. In large part, this distinction relies on whether one is interested in simply describing some phenomenon or in "inferring" characteristics of some phenomenon from a sample to the entire population. See? An understanding of sampling issues is already necessary.

Descriptive statistics can be used to describe characteristics or some phenomenon from either a sample or a population. The key point here is that you are using the statistics for "description" only. For example, if we wanted to describe the number of parking tickets given out by university police or the amount of revenues these parking tickets generated, we could use various statistics, including simple counts or averages.

Descriptive statistics: Statistics used to describe the distribution of a sample or population.

If, however, we wanted to generalize this information to university police departments across the country, we would need to move into the realm of **inferential statistics**. Inferential statistics are mathematical tools for estimating how likely it is that a statistical result based on data from a random sample is representative of the population from which the sample was selected. If our interest is in making inferences, a **sample statistic** is really only an estimate of the population statistic, called a **population parameter**, which we want to estimate. Because this sample statistic is only an estimate of the population parameter, there will always be some amount of error present. Inferential statistics are the tools used for calculating the magnitude of this sampling error. As we noted earlier, the larger the sampling error, the less accurate the sample statistic will be as an estimate of the population parameter. Of course, before we can use inferential statistics, we must be able to assume that our sample is actually representative of the population. And to do this, we must obtain our sample using appropriate probability sampling techniques. We hope the larger picture is beginning to come into focus!

Inferential statistics: Mathematical tools for estimating how likely it is that a statistical result based on data from a random sample is representative of the population from which the sample was selected.

Sample statistic: Statistic (i.e., mean, proportion, etc.) obtained from a sample of the population.

Population parameter: Statistic (i.e., mean, proportion, etc.) obtained from a population. Since we rarely have entire population data, we typically estimate population parameters using sample statistics.

VALIDITY IN CRIMINOLOGICAL RESEARCH

Before we conclude this introductory chapter, it is important to cover two more concepts. In criminological research, we seek to develop an accurate understanding of empirical reality by conducting research that leads to valid knowledge about the world. But when is knowledge valid? In general, we have reached the goal of validity when our statements or conclusions about empirical reality are correct. If you look out your window and observe that it is raining, this is probably a valid observation. However, if you read in the newspaper that the majority of Americans favor the death penalty for adolescents who commit murder, this conclusion should

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be held up to stronger scrutiny because it is probably based on an interpretation of a social survey. There are two types of validity that we will examine here: measurement validity and causal validity.

Measurement Validity

Measurement validity: When we have actually measured what we intended to measure.

In general, we can consider **measurement validity** the first concern in establishing the validity of research results because if we haven't measured what we think we have measured, our conclusions may be completely false. To see how important measurement validity is, let's go back to the descriptive research question we addressed earlier: "How prevalent is youth violence and delinquency in the United States?"

Data on the extent of juvenile delinquency come from two primary sources: official data and surveys. Official data are based on the aggregate records of juvenile offenders and offenses processed by agencies of the criminal justice system: police, courts, and corrections. As noted earlier, one primary source of official statistics on juvenile delinquency is the UCR or the newer NIBRS produced by the FBI. However, the validity of these official statistics for measuring the extent of juvenile delinquency is a subject of heated debate among criminologists. Although some researchers believe official reports are a valid measure of serious delinquency, others contend that these data say more about the behavior of the police than about delinquency. These criminologists think the police are predisposed against certain groups of people or certain types of crimes.

Unquestionably, official reports underestimate the actual amount of delinquency. Obviously, not all acts of delinquency become known to the police. Sometimes delinquent acts are committed and not observed; other times they are observed and not reported, and if the official data include arrests, then even crimes that are observed and reported frequently do not result in anyone being arrested. In addition, there is evidence that UCR data often reflect the political climate and police policies as much as they do criminal activity. Take the U.S. "War on Drugs," which heated up in the 1980s. During this time, arrest rates for drug offenses soared, giving the illusion that drug use was increasing at an epidemic pace. However, self-report surveys that asked citizens directly about their drug use behavior during this same time period found that the use of most illicit drugs was actually declining (Regoli & Hewitt, 1994). In your opinion, then, which measure of drug use, the UCR or self-report surveys, was more valid? Before we answer this question, let's continue our delinquency example.

Despite the limitations of official statistics for measuring delinquency, these data were relied on by criminologists and used as a valid measure of delinquency for many decades. As a result, delinquency and other violent offending were thought to involve primarily minority populations and/or disadvantaged youth. In 1947, however, James Wallerstein and Clement Wyle surveyed a sample of 700 juveniles and found that 91% admitted to having committed at least one offense that was punishable by one or more years in prison and 99% admitted to at least one offense for which they could have been arrested had they been caught. In 1958, James Short and F. Ivan Nye reported the results from the first large-scale self-report study involving juveniles from a variety of locations. In their research, Short and Nye concluded that delinquency was widespread throughout the adolescent population and that youth from high-income families were just as likely to engage in delinquency as youth from low-income families. Contemporary studies using self-report data from the National Youth Survey (NYS) indicate that the actual amount of delinquency is much greater than that reported by the UCR and that, unlike these official data where nonwhites are overrepresented, self-report data indicate that white juveniles report almost exactly the same number of delinquencies as non-whites, but fewer of them are arrested (Elliott & Ageton, 1980).

This is just one example that highlights the importance of measurement validity, but it should convince you that we must be very careful in designing our measures and in subsequently evaluating how well they have performed. We cannot just assume that the measures we

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use are measuring what we believe them to measure. Remember this as we use real data and case studies from the criminology and criminal justice literature throughout this book.

Reliability

There are several types of reliability, but we are only going to concentrate on the basic concept here. **Reliability** means that a measure procedure yields consistent scores as long as the phenomenon being measured is not changing. For example, if we gave students a survey about alcohol consumption with the same questions, the measure would be reliable if the same students gave approximately the same answers six months later, assuming their drinking patterns had not changed much. Reliability is a prerequisite for measurement validity; we cannot really measure a phenomenon if the measure we are using gives inconsistent results. Figure 1.3 illuminates the difference between reliability and measurement validity.

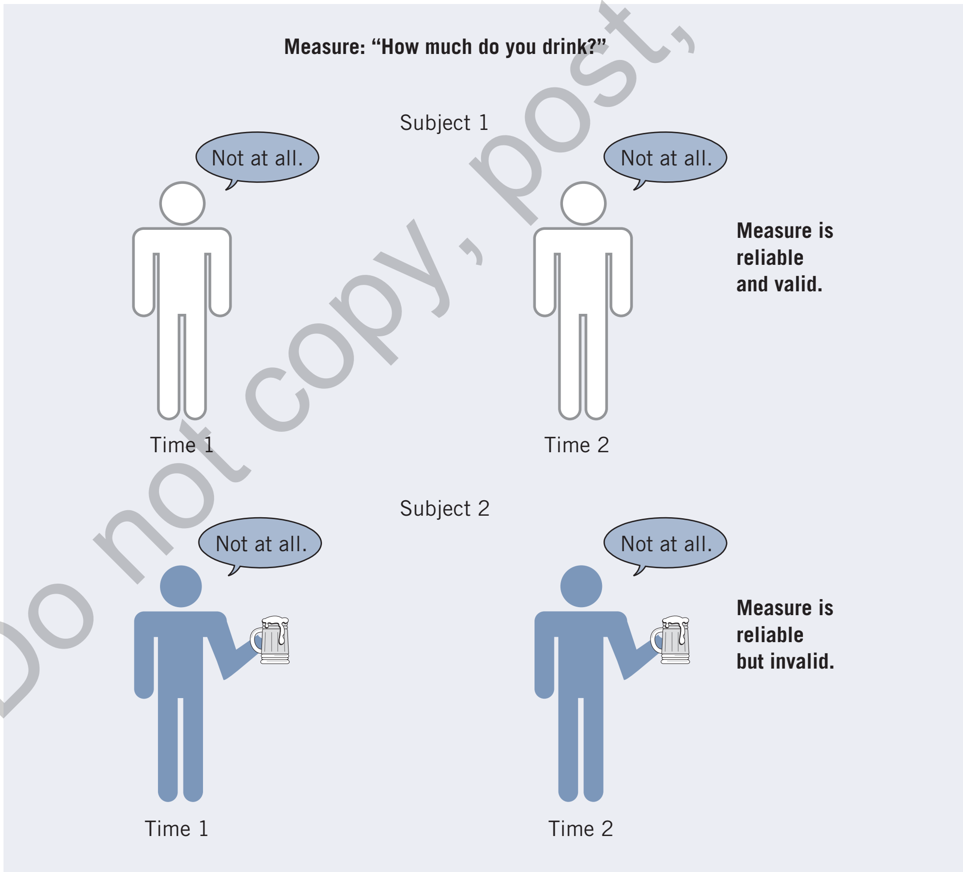
Reliability: Measure that is reliable when it yields consistent scores or observations of a given phenomenon on different occasions. Reliability is a prerequisite for measurement validity.

Causal Validity

Causal validity (internal validity): When we can assume that our independent variable did cause the dependent variable.

Causal validity, also known as **interval validity**, is another issue of validity we are concerned with and has to do with the truthfulness of an assertion that an independent variable did, in

Figure 1.3 Difference Between Reliability and Measurement Validity: Drinking Behavior



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fact, cause the dependent variable, or that *X* caused *Y*. Let's go back to the issue of violence prevention programs in schools. Imagine that we are searching for ways to reduce violence in high schools. We start by searching for what seems to be particularly effective violence prevention programs in area schools. We find a program at a local high school—let's call it Plainville Academy—that a lot of people have talked about, and we decide to compare rates of violence reported to the guidance counselor's office in that school with those in another school, Cool School, that does not offer the violence prevention program. We find that students in the school with the special program have lower rates of reported violence, and we decide that the program caused the lower rates. Are you confident about the causal validity of our conclusion? Probably not. Perhaps the school with the special program had lower rates of reported violence even before the special program began. Maybe kids who go to Cool School are at a greater risk of violence because of where it is located.

This is the sort of problem that randomized experiments, like those reviewed by Gaffney and her colleagues (2019) are designed to resolve. Randomly assigning students to either receive a bullying prevention program or not made it very unlikely that students who were more aggressive would be disproportionately represented in either group. In addition, causal conclusions can be mistaken because of some factor that was not recognized during planning for the study, even in randomized experiments. Statistical control of other factors thought also to explain or predict the phenomenon of interest is essential in determining causal validity. The final two multiple regression chapters in this book highlight the ways research uses statistical methods to control for many independent variables thought to affect a dependent variable.

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SUMMARY

Our goal in this introductory chapter is to underscore the nature of the importance of statistics in criminology and criminal justice along with several fundamental aspects of the research process. We have set the stage for us to begin our exploration into the realm of statistics. Can't wait!

We have seen that, unlike observations we make in everyday life, criminological research relies on scientific methods. Statistical methods play a role in three types of research we conduct in our field: descriptive research, explanatory research, and evaluation research. The goal of all research is validity—for our statements or conclusions about empirical reality to be correct. Measurement validity exists when we have actually measured what we think we have measured. Causal or internal validity exists when the assertion that an independent variable causes a dependent variable, or that *X* causes *Y*, is correct. Generalizability, also known as external validity, exists when we can assume that results obtained from a sample can be generalized to the population.

Because it is almost never possible to obtain information on every individual or element in the population of interest, our investigations usually rely on data taken from samples of the population. Furthermore, because virtually all of the statistics we will examine in this text are based on assumptions about the origins of our data, we have provided a discussion of the most common types of samples used in our field of study. Samples generally fall within two categories: those derived from probability sampling techniques and those derived from nonprobability sampling techniques. The fundamental element in probability sampling is random selection. When a sample is randomly selected from the population, it means that every element (e.g., individual) has a known and independent chance of being selected for the sample.

We examined four types of probability samples: the simple random sample, the systematic random sample, the multistage cluster sample, and the weighted sample. In addition, we discussed three types of nonprobability samples: quota samples, purposive or judgment samples, and availability samples. We concluded the chapter with a brief discussion of descriptive and inferential statistics and highlighted the importance of measurement and causal validity.

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KEY TERMS ➤ REVIEW KEY TERMS WITH eFLASHCARDS

PRACTICE PROBLEMS

1. Obtain a list of students from the statistics or research methods course in which you are currently using this book. Using this list and the random numbers table in Appendix B, select a simple random sample of 15 students. What are the steps you performed in doing this? Comment on how well this sample represents the entire sophomore class. Now draw a systematic random sample from the same list. Are there any differences?
2. How can you approximate a simple random sample when you do not have a list of the population?
3. Discuss the importance of probability sampling techniques.
4. How does random selection ensure that we are obtaining the most representative sample possible?
5. If we wanted to make sure that certain segments of the population were represented and/or overrepresented within our sample, what are two types of sampling techniques we could use?
6. What is the danger in using nonprobability samples in research?
7. In what types of situations would nonprobability samples be the most appropriate?
8. What is reliability? Why is this important?
9. What is measurement validity? Why is this important?
10. In their book, *Armed Robbers in Action: Stickups and Street Culture*, Richard Wright and Scott Decker (1997) conducted in-depth interviews with armed robbers to understand their mindset and decision making when planning, executing, and leaving an armed robbery. The sample was obtained through connections with current respondents where they were paid to get others to participate for interviews. What type of sampling is this?

SPSS EXERCISES

Data for Exercise	
Dataset	**Description**
2013YRBS.sav	The 2013YRBS, short for Youth Risk Behavior Survey, is a national study of high school students. It focuses on gauging various behaviors and experiences of the adolescent population, including substance use and some victimization.

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1. SPSS introduction: SPSS, short for "Statistical Package for the Social Sciences," is a professional statistical analysis program that is used by universities, hospitals, and businesses. The exercises at the end of each chapter are intended to get you comfortable with the basics of SPSS. The first thing we've got to do is open some data:
    a. First, go to the website for this textbook (**edge .sagepub.com/bachmansccj5e**) and download all the data sets somewhere you can access easily.
    b. **Opening a data set in SPSS:** After double clicking on the SPSS icon you'll see a spreadsheet in the background and a welcome screen pop up, asking what you want to do. Select "Open another file . . ." and "Open." (or simply double click "Open another file . . ." This will cause a browser to open, at which point you must simply go to the folder that contains the data set of interest; in this case, that is the 2013 YRBS.sav file. SPSS also allows you to import data from other packages by clicking "File," "Import Data" and then clicking the file the data you wish to import is in.
    c. Alternately, if the welcome screen does not pop up, you can always select file->open->data from the menu bar to access your data set.
2. **Navigating SPSS:**
    a. SPSS uses two main screens through which you can view your data set. The buttons to switch between "views" are on the bottom left of the SPSS window. By default you open up to the **Data View** screen. However, let's begin with **Variable View**:
        i. **Variable View in SPSS:**
            1) Variable view in SPSS lets you look at information on each variable in the data set. Each numbered row corresponds to a different measure from the survey. Some of the information in the columns is not of interest to us for this book; instead, focus on the following:
                a) **Name:** The name of the variable. Double clicking allows you to edit this field.
                b) **Label:** A summary of what the variable tells us or how the question was asked. Double clicking allows you to edit this field.
                c) **Values:** This allows us to put labels on numeric values. For instance, we could tell SPSS that responses with a 1 should be labeled as "White." You can specify your own labels or view them by clicking the cell for a given row and clicking the ". . ." field.
                d) **Missing:** This tells us values that SPSS will treat as missing, excluding them from analyses. Many surveys code cases as –9 or a similar value rather than leaving them blank so it is important to make sure these are treated as missing. You can specify missing values by clicking in the cell and pressing the ". . ." box.
        ii. **Variable View Exercises:**
            1. Identify the variable name, label, and value labels for the following variables:
                a. Row 2
                b. Row 4
                c. Row 23
                d. Row 45
            2. **Searching for variables:** If you know the variable name, you can search for it to make the process faster. Do this by clicking on the column "Name" and press ctrl+F on your keyboard, enter the name of the variable, and click "Find Next"; or selecting edit->find. There are also tabs for "Go to case" and "Go to variable" that can be used for finding specific cases and variables, respectively. Find the labels and values for the following variables:
                a. qn43
                b. qhallucDrug
                c. qnowt
            3. How many variables are in this data set?
        iii. **Data View:**
            1. On the bottom left of the screen next to "Variable View" is "Data View" In Data View each column is a different variable. Each row corresponds to a respondent; it contains a person's specific responses to all the survey questions.
            2. You'll notice lots of "." marks; these are "system missing" responses. We just don't have data for that person for whatever reason! SPSS ignores these automatically.

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EXCEL EXERCISES

Data for Exercise	
Dataset	**Description**
2013YRBS.xls	The 2013YRBS, short for Youth Risk Behavior Survey, is a national study of high-school students. It focuses on gauging various behaviors and experiences of the adolescent population, including substance use and some victimization.

1. Excel introduction: Excel is not short for anything, but is rumored to have been named Excel because it can do anything. Excel is also a popular program used in universities, hospitals, and businesses just like SPSS and Stata. Excel is unique in that it can do everything covered in this textbook from basic analyses to complicated regression. Ironically, the easier output is typically harder to obtain than the more complicated outputs in Excel.
   a. Go to (**edge.sagepub.com/bachmansccj5e**) to download the data.
   b. **Opening a data set in Excel:** Excel data files contain a ".xls" or ".xlsx" at the end of its name. You can simply double click any ".xls" or ".xlsx" file for it to be opened in Excel; or in programs such as Stata or SPSS where the data are already loaded for example, click "File," "Export" and then click "Data to Excel Spreadsheet."
2. **Navigating Excel:**
   a. Excel uses one main screen that contains the list of the variables that are currently in Excel to be used on the first row with letters representing columns. You can easily add "Sheets" by clicking the plus on the bottom. This is useful to copy and paste certain variables into a new sheet for easier analysis.
      i. **Data Editor in Excel:**
         1) Everything for Excel is contained on the main screen where you can click on any cell and make any changes.
            a) **Name:** The name of the variable is in the first row and the column represents the values of the variable. You can change the variable name simply by entering the new name. Note that the rows represent individual cases.
            b) **Label:** There are no explicit ways to label variables in Excel unless you add it to the variable name. This can be done by adding a parenthesis after the name and including relevant information.
            c) **Missing:** Missing values can take the form of dots (".") or simply blank spaces.
      ii. **Data Editor Exercises:**
         1) **Searching for variables:** If you know the variable name, you can search for it to make the process faster. Do this by clicking "Ctrl+F" and entering the variable name. Find the values for the following variables:
            a) qn43
            b) qhallucDrug
            c) qnowt
         2) How many variables are in this data set?
      iii. **Data Editor Exercises:**
         1. What was respondent 1's (i.e., row 1) response to question q13?
         2. What was respondent 71's race according to the variable race7?
         3. How many respondents do we have in this data set?

STATA EXERCISES

Data for Exercise	
Dataset	**Description**
2013YRBS.dta	The 2013YRBS, short for Youth Risk Behavior Survey, is a national study of high-school students. It focuses on gauging various behaviors and experiences of the adolescent population, including substance use and some victimization.

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1. While SPSS is focused upon a point and click method, Stata primarily utilizes command lines but does allow for point and click.
   a. Similarly to SPSS, go to (**edge.sagepub.com/bachmansccj5e**) to download the data.
   b. **Opening a data set in Stata:** Stata data files contain a ".dta" at the end of the file name. You can simply double click any ".dta" file for it to be opened in Stata, or in Stata, click "File," "Open" and then click the dataset you wish to use. If this is not the case, however, Stata is very flexible in incorporating data from other software packages. To import an SPSS dataset that ends in ".sav", click "File" in Stata, "Import" and then "SPSS data (*.sav)." Note also all of the other programs you can import into Stata.
2. **Navigating Stata:**
   a. Stata uses one main screen that contains the command line history, output window, command line, and variable list of the variables that are currently in Stata to be used.
      i. **Data Editor in Stata:**
         1. At the top of Stata, there is a task bar with two "Data Editor" tabs: one is for browsing and the other is for editing. It is safer to stay in the browsing tab so as to not make unwanted changes to the data; you can easily transfer over to the editor if need be.
            a. **Name:** The name of the variable is in the top shaded row. If you click on a variable, a box titled "Properties" appears and describes the variable. In edit mode, you can change the variable name simply by entering the new name. Note that the rows represent individual cases.
            b. **Label:** Under the "Properties" tab, describes the variable. Similar to "Name," you can click on this in editor mode and change the values.
            c. **Missing:** In the viewer, all of the dots (".") represents data that are missing.
      ii. **Data Editor Exercises:**
         1. **Searching for variables:** If you know the variable name, you can search for it to make the process faster. Do this by entering the name of the variable in the line titled "Filter variables here" below the "Variables" tab. Find the labels and values for the following variables:
            a. qn43
            b. qhallucDrug
            c. qnowt
         2. How many variables are in this data set?
      iii. **Data Editor Exercises:**
         1. What was respondent 1's (i.e., row 1) response to question q13?
         2. What was respondent 71's race according to the variable race7?
         3. How many respondents do we have in this data set?

STUDENT STUDY SITE

Access the eFlashcards, data sets, and software output for SPSS, Excel, and Stata at **edge.sagepub.com/bachmansccj5e**.

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