THIRD EDITION

STATISTICS
in Criminology and Criminal Justice

Analysis and Interpretation

Jeffery T. Walker and Sean Maddan

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Third Edition

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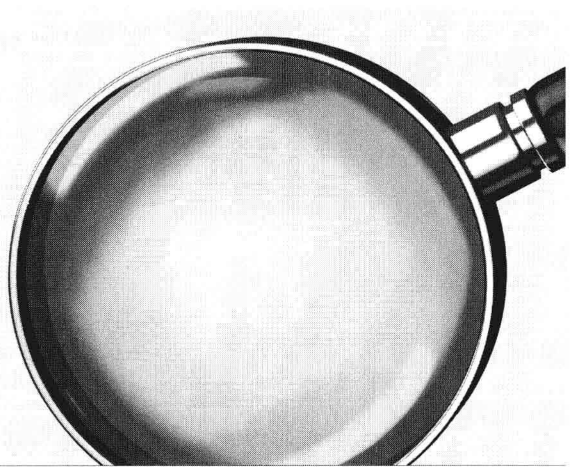
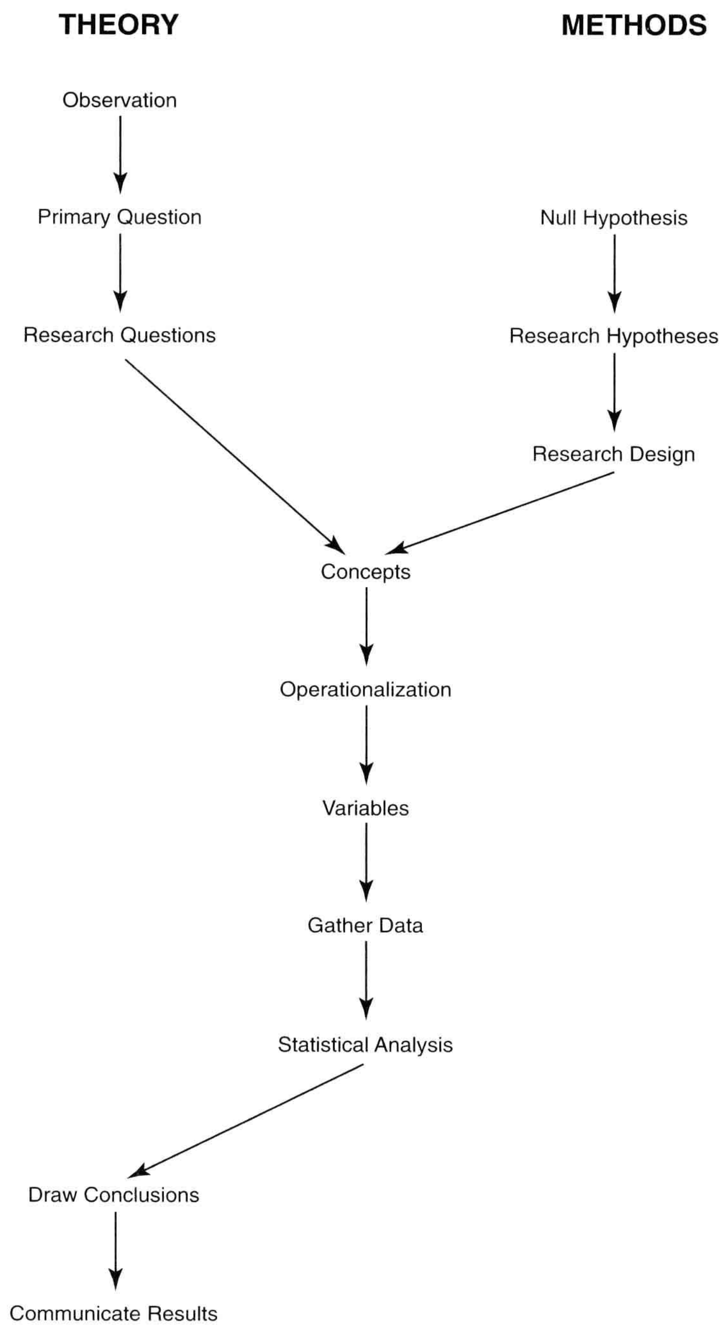


Use of SPSS and Data Sets with This Book

Although there are some formulas that can be worked by hand, this book is centered around determining the proper statistical analysis procedure to use with particular data and how to interpret the analyses. Throughout the book, SPSS output is displayed showing analyses. If you purchased a book bundled with SPSS, you may also follow the procedures in the book to conduct your own analyses. Sample data sets associated with the book are available at the Jones and Bartlett website associated with the book. The version of SPSS bundled with this book (or a copy of SPSS Grad Pack purchased separately) can be used to conduct most of the analyses in this book. A few of the multivariate analyses (Chapters 12, 13, and 14) require either a complete copy of SPSS or another program altogether, like SAS or Stata (for poisson/negative binomial regression).


THEORY
METHODS
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Primary Question
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Null Hypothesis
Research Hypotheses
Research Design
Concepts
Operationalization
Variables
Gather Data
Statistical Analysis
Draw Conclusions
Communicate Results

CHAPTER 1

The Logic of Comparisons and Analysis

Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write.

—H. G. Wells

■ Introduction: Why Analyze Data?

Discovery and innovation may be the distinguishing characteristics between modern human activity and that of our ancestors. The Renaissance period brought forth an emphasis on learning and advancing our way of doing things that has prevailed to the present. Scientists, inventors, and others involved in the process of scientific inquiry have often been held in awe for their works. Galileo, Einstein, Madam Curie, and others are singled out in grade school books for their works and discoveries. As you will learn, so too should be people such as Pearson, Kendall, and Yule.

Statistical analysis is all about **discovery**. The process of **scientific inquiry** provides a method of examining things that interest us in a systematic manner. This process generally requires evidence to support an argument. One of the clearest methods of establishing evidence is by examining numbers associated with the objects being studied. That examination takes place through statistical analysis. As such, statistical analysis is the linchpin of discovery, and mastery of it draws us closer to Einstein and Galileo.

■ Some Statistical History

The earliest form of what is now considered **statistical analysis** was developed by Pythagoras in the 6th century BC. This was the forerunner of **descriptive statistics** (what would eventually be known as the *mean*, or what is commonly known as an *average*). The other type of statistical analysis (**inferential statistics**) is thought to have first developed in the Orient around 200 BC (Dudycha and Dudycha, 1972). This was a form of probability analysis used in assessing whether an expected child was likely to be male or female. Probability theory, as it would come to be known, continued in the form of gambling mathematics in the works of Blaise Pascal (1623–1662) and Lord Christianus Huygens (1629–1695) (David, 1962). Many of the other descriptive statistics were developed in the late 1800s and early 1900s by mathematicians and scientists such as Galton (1883) and Pearson (1895).

Statistics moved beyond gambling and purely mathematical concepts through what was called *political arithmetic,* a term coined because of its close association with those studying political topics, including economics. (This probably began the close association between political lying and statistical lying.) The first known use of this political arithmetic was by John Graunt (1662), who used what is now called descriptive statistics to study London's death rates. Although there is fierce debate concerning the original use of the term **statistics** (Yule, 1905), the greatest support is that it was coined by Eberhard August Wilhelm von Zimmerman in the preface of *A Political Survey of the Present State of Europe* (1787). Modern use of the term *statistics* (as opposed to *mathematics*) is often attributed to R. A. Fisher and his work *Statistical Methods for Research Workers* (1925), wherein he stated that "a statistic is a value calculated from an observed sample with a view to characterizing the population from which it is drawn." Since that time, statisticians have added to the techniques available to analyze data, many adding their names to the procedures; and the addition of statistical techniques continues today. Analysis procedures have been added to the statistical repertoire in the past few years that have greatly increased the ability of researchers in criminology, criminal justice, and other fields to examine the relationship between variables more accurately.

> A single death is a tragedy, a million deaths is a statistic.
>
> —Joseph Stalin

Uses of Statistics

The term *statistics* is often misunderstood because there are actually two practical applications of it. The first, reflecting the history of the term, is a collection of data—often expressed in summary form—that is collected and preserved. The best example of these are census statistics or mortality statistics, which depict the characteristics of the living or the causes of death, respectively. The second application is the subject of this book: a method of analyzing data. Statistics as you will come to know them are methods used to examine data collected in the process of scientific inquiry. These methods allow researchers to think logically about the data and to do one of two things: to come to some succinct and meaningful conclusions about the data *(descriptive statistics)*, or to determine—or infer—characteristics of large groups based on the data collected on small parts (samples) of the group *(inferential statistics)*. For example, data could be gathered on all correctional officers in Arkansas for a research project to determine the sex and race breakdown of the officers. This would be a descriptive analysis that could be used to examine the employment patterns for the Arkansas Department of Corrections. Alternatively, a sample of correctional officers from each state could be collected and the data from the sample used to make statements about all correctional officers in the nation. This would be drawing conclusions (inferences) about a large group based on information about a sample of the group.

Statistical analysis is the workhorse of discovery and knowledge. The scientific process, using research to test theory, requires that empirical evidence (data) drawn from the research subjects be examined systematically. The use of mathematics in general and statistical analysis in particular allows researchers to make these comparisons and to discover new information that will provide a better understanding of their subject.

In the scientific process, the purpose is usually to discover something that was previously unknown or to prove something true or false that was previously thought to be true but was never supported by hard evidence. The way to obtain that evidence is by gathering information (data) and subjecting it to statistical analysis.

■ Theory Construction at a Glance

Three elements in social science research, or any research for that matter, are essential to sound investigation: theory, research methods, and statistical analysis. Although these elements are intimately linked, there is debate—even among those most supportive of the research process—on their ordering, importance, and what should be included from each element in a textbook. It is not possible to cover all of these elements adequately in one course or in one textbook, so it becomes an issue of how much of each element should be included in a discussion of the other. In this book, theory is covered primarily in this chapter, research spans this chapter and several that follow, and statistical analysis prevails thereafter.

What Is Theory?

At the most basic level, **theory** consists of statements concerning the relationship or association among *social phenomena* such as events and characteristics of people or things. For example, in criminology, there are theories addressing how people learn to be criminal. In these theories, statements are constructed dealing with the role of peers in a person's learning criminal behavior, how the rewards from a crime can influence behavior, and what influence punishment can have on the decision to commit a crime.

The goal of these statements is to develop explanations of why things are as they appear and to try to explain their meaning. From an early age, humans have ideas about the causes of events and why things work the way that they do. The problem with these explanations, however, is that they are often too simplistic to be of any real value. Theory attempts to provide a stronger foundation for these ideas by asking questions about them, such as:

- What is the point of all of this?
- What does it mean?
- Why are things this way?

Without theory, there is often only conjecture and war stories. With theory, we may begin to develop statements or ideas that are based on sound observation and thought.

Theory and Research

Theory may be developed in several ways. Researchers may look at the world around them, find the **social phenomena** that pique their interest, and begin to develop statements concerning why these phenomena work the way they do. This is called **induction**. An example could be a researcher who follows crime trends in a city for a number of years. She may begin to see that the crimes follow a definite pattern of movement in the city, moving from east to west across the city. From this, she might set out to determine what the cause of this movement could be, ultimately developing a theory of crime movement in urban areas. This is a process of moving from data to theory and attempting to make sense of the data with the theory.

Alternatively, researchers may become curious about something and set out to develop statements and then to test them. This is called **deduction**. The process of deduction begins with an idea and an attempt to test the idea with data and analysis. For example, a researcher might believe that increased supervision of probationers would prevent them from becoming involved in subsequent crimes. This researcher might create an experiment where a random sample of probationers are put under intensive supervision while another random sample receives a normal amount of supervision. The results of this experiment could either support or refute the researcher's initial beliefs. This is a process of moving from theory to data, where the data tests the theory. It should be noted that Sherlock Holmes was not exactly correct in his understanding of the difference between induction and deduction. When Holmes made his famous statement, "brilliant deduction, Watson!", he should actually have been commending Watson on his inductive reasoning. Watson was drawing conclusions based on what he had observed, not testing previously developed conclusions, as discussed later.

Finally, and probably most often the case, a researcher may start with either induction or deduction, but by the time a project is finished, he or she has used both induction and deduction. This is called **retroduction**. With this process, the researcher investigating supervision of probationers might conduct the intensive supervision experiment as a deductive process. After examining the data, however, it might be obvious that the experiment could be done better or that there was something in the data that needed further explanation. For example, those probationers who received the most supervision were successful, whereas those who received intensive, but less than the most intensive, supervision were not successful. The researcher might then rethink part of the theory and set out to retest it. This process might continue until the theory was supported or disproven. This is a process of moving from theory to data to theory and so on; or data to theory to data and so on. The key here is that it is an alternating process between induction and deduction.

■ The Process of Scientific Inquiry

The process of scientific inquiry (using a deductive method) is shown in **Figure 1-1**. As shown in this diagram, theory is at the starting point of the process. Theory is driven by observations and leads researchers to initiate the research process through primary questions and research questions. It is from this process of theory building that researchers follow the process from developing a null hypothesis to communicating results. The process of scientific inquiry and its individual parts are discussed further in the remainder of the chapter.

Observation and Inquisitiveness

The first step in the process of scientific inquiry, and one of the most important, is often overlooked: **observation** and *inquisitiveness*. Many research projects are never begun because the researcher was not aware of his or her surroundings or did not recognize something as a topic worthy of research.

It is often theory that stimulates observation and scientific inquiry. As you go through school and read research and material you find interesting, you will sometimes think that you have a better way to do something, or what you read may stimulate you in other areas. By using a structured scientific process to evaluate your observations and formulate statements of why these phenomena are behaving the way they are, you are developing theory.