

Second Edition

# STATISTICS FOR SOCIAL WORKERS

---

Essential Concepts

DAVID ROYSE, DENISE MONTCALM,  
AND AUSTIN GRIFFITHS



# **Statistics for Social Workers**

---

## **Essential Concepts**

SECOND EDITION

**DAVID ROYSE**

University of Kentucky

**DENISE MONTCALM**

University of Nevada, Reno

**AUSTIN GRIFFITHS**

Western Kentucky University



Bassim Hamadeh, CEO and Publisher  
Amy Smith, Senior Project Editor  
Alia Bales, Production Editor  
Jess Estrella, Senior Graphic Designer  
Stephanie Kohl, Licensing Coordinator  
Kim Scott/Bumpy Design, Interior Designer  
Natalie Piccotti, Director of Marketing  
Kassie Graves, Senior Vice President of Editorial  
Jamie Giganti, Director of Academic Publishing

Copyright © 2022 by Cognella, Inc. All rights reserved. No part of this publication may be reprinted, reproduced, transmitted, or utilized in any form or by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information retrieval system without the written permission of Cognella, Inc. For inquiries regarding permissions, translations, foreign rights, audio rights, and any other forms of reproduction, please contact the Cognella Licensing Department at [rights@cognella.com](mailto:rights@cognella.com).

Trademark Notice: Product or corporate names may be trademarks or registered trademarks and are used only for identification and explanation without intent to infringe.

Cover image copyright © 2016 iStockphoto LP/marlenka.

Design images:

Design IMG 1: Copyright © 2015 Depositphotos/creativestall.

Design IMG 2: Copyright © 2015 Depositphotos/creativestall.

Design IMG 3: Copyright © 2015 Depositphotos/creativestall.

Design IMG 4: Copyright © 2013 Depositphotos/DavidArts.

This book was previously published by Pearson Education, Inc.

Printed in the United States of America.

# Brief Contents

---

	Preface . . . . .	xiii
<b>CHAPTER 1</b>	Introduction: Developing Data Processing Skills . . . . .	1
<b>CHAPTER 2</b>	Ethical Considerations . . . . .	14
<b>CHAPTER 3</b>	The Nature of Data . . . . .	27
<b>CHAPTER 4</b>	Frequency Distributions: What Do They Tell Me? . . . . .	44
<b>CHAPTER 5</b>	Preparing Figures: How Do I Best Display Important Data? . . . . .	72
<b>CHAPTER 6</b>	Measures of Central Tendency: Which Statistic Best Represents the Typical Client? . . . . .	89
<b>CHAPTER 7</b>	Understanding Data Dispersion: What Does Variability of Data Mean? . . . . .	111
<b>CHAPTER 8</b>	The Normal Distribution . . . . .	127
<b>CHAPTER 9</b>	Inferential Statistics: Understanding Probability and Sampling . . . . .	148
<b>CHAPTER 10</b>	Hypothesis Testing . . . . .	181
<b>CHAPTER 11</b>	Bivariate Analysis . . . . .	199
<b>CHAPTER 12</b>	Understanding and Interpreting Correlation . . . . .	216
<b>CHAPTER 13</b>	$t$ -Tests and ANOVA: Testing Hypotheses About Means . . . . .	238
<b>CHAPTER 14</b>	A Glimpse Into Multivariate Analyses . . . . .	262
<b>CHAPTER 15</b>	Selecting the Appropriate Statistical Test . . . . .	287
<b>APPENDIX</b>	Answers to Review Questions and Application Exercises . . . . .	302
	Index . . . . .	323

# Detailed Contents

---

Preface . . . . .	xiii
<b>CHAPTER 1 Introduction: Developing Data Processing Skills . . . . .</b>	<b>1</b>
Knowledge of Statistics Increases the Social Worker’s Skill Set . . . . .	1
Misgivings You May Have About Statistics . . . . .	3
Our Practice Responsibility. . . . .	4
The Focus of This Book. . . . .	6
How Do Quantitative and Qualitative Analyses Differ? . . . . .	7
Quick Review of Research Terms . . . . .	8
Terms to Know. . . . .	11
Review Problems. . . . .	11
Group Discussion Questions . . . . .	12
Application Exercises . . . . .	12
Reference . . . . .	13
<b>CHAPTER 2 Ethical Considerations . . . . .</b>	<b>14</b>
Protecting Research Subjects . . . . .	15
Ethical Dilemmas . . . . .	17
Telling the Truth With Statistics . . . . .	19
Misguiding by Reporting Only Percentages. . . . .	19
When One Is More Than One . . . . .	20
Presumption of Similarity . . . . .	20
Personal Biases . . . . .	21
Misrepresentation in Graphics . . . . .	22
Terms to Know. . . . .	24
Review Problems. . . . .	25
Group Discussion Questions . . . . .	25
Application Exercises . . . . .	26
References . . . . .	26
<b>CHAPTER 3 The Nature of Data . . . . .</b>	<b>27</b>
What Are Data? . . . . .	27
Levels of Measurement . . . . .	30
Nominal Measurement . . . . .	30
Ordinal Measurement . . . . .	31

Interval Measurement . . . . .	32
Ratio Measurement . . . . .	33
Selecting a Level of Measurement . . . . .	34
Coding Data . . . . .	35
Terms to Know . . . . .	41
Review Problems . . . . .	41
Group Discussion Questions . . . . .	41
Application Exercises . . . . .	42
References . . . . .	43
<b>CHAPTER 4 Frequency Distributions: What Do They Tell Me? . . . . .</b>	<b>44</b>
Simple or Absolute Frequency Tables . . . . .	45
Cumulative Frequencies . . . . .	48
Grouped Frequencies . . . . .	49
Relative Frequencies . . . . .	51
Cautionary Notes Regarding Data Misrepresentation . . . . .	53
SPSS Illustration . . . . .	54
Summarizing Qualitative Data . . . . .	54
Organizing Text Data . . . . .	56
Identifying Meaningful Pieces of Data (Coding) . . . . .	58
Assigning Initial Codes . . . . .	61
Reviewing, Refining, and Reorganizing the Groupings . . . . .	63
Interpreting Your Findings . . . . .	63
Terms to Know . . . . .	64
Review Problems . . . . .	64
Group Discussion Questions . . . . .	66
Application Exercises . . . . .	66
References . . . . .	70
<b>CHAPTER 5 Preparing Figures: How Do I Best Display Important Data? . . . . .</b>	<b>72</b>
Bar Graphs . . . . .	73
Pie Charts . . . . .	74
Histograms . . . . .	75
Frequency Polygons . . . . .	77
Using Figures to Display Differences Across Groups . . . . .	78
Stem and Leaf Display . . . . .	79
Using Graphical Displays With Single-System Designs . . . . .	81
Graphically Displaying Qualitative Data . . . . .	82
Recognizing Distorted Data . . . . .	83
Terms to Know . . . . .	85
Review Problems . . . . .	85
Group Discussion Questions . . . . .	85
Application Exercise . . . . .	86
References . . . . .	88

<b>CHAPTER 6</b>	<b>Measures of Central Tendency: Which Statistic Best Represents the Typical Client?</b>	<b>89</b>
	Identifying the “Typical” Response	90
	The Mode	90
	The Median	93
	The Mean	99
	Deciding Which Measure to Use	103
	Level of Measurement	103
	Shape of the Distribution	103
	Intended Use of Inferential Statistics	104
	Describing the “Typical” Qualitative Response	106
	Terms to Know	108
	Review Problems	108
	Group Discussion Questions	109
	Application Exercise	109
	References	110
<b>CHAPTER 7</b>	<b>Understanding Data Dispersion: What Does Variability of Data Mean?</b>	<b>111</b>
	The Range	113
	Percentiles and Quartiles	114
	The Interquartile Range	114
	The Variance	116
	The Standard Deviation	117
	The Boxplot: A Means of Obtaining a Five-Number Summary	121
	Terms to Know	123
	Review Problems	123
	Group Discussion Questions	124
	Application Exercise	124
	References	126
<b>CHAPTER 8</b>	<b>The Normal Distribution</b>	<b>127</b>
	What Shape Are Your Data In?	127
	Interpreting Skewness	129
	Viewing Symmetry in the Context of Modality	130
	Defining Properties of Normal Distributions	131
	Interpreting Kurtosis	132
	The Area Under a Normal Curve	134
	The Standard Normal Distribution or $z$ -Curve	137
	Defining Characteristics	137
	$z$ -Scores	137
	Using $z$ -Scores to Define Specific Areas Under the Standard Normal Distribution	138

Using the Standard Normal Curve to Determine a Score's Relative Standing . . . . .	139
Using $z$ -Scores to Compare Scores Across Distributions . . . . .	142
Using the Standard Normal Distribution to Estimate the Probability of an Event . . . . .	145
Infographics and Building Digital Skills . . . . .	145
Terms to Know . . . . .	146
Review Problems . . . . .	146
Group Discussion Questions . . . . .	146
Application Exercises . . . . .	147
References . . . . .	147
<b>CHAPTER 9 Inferential Statistics: Understanding Probability and Sampling . . . . .</b>	<b>148</b>
Parameters Versus Statistics . . . . .	149
Inference: The Act of Moving From the Few to the Many . . . . .	149
Probability Sampling: Our Gateway to Inference . . . . .	150
Probability: The Basics . . . . .	151
Viewing the Standard Normal Curve as a Probability Distribution . . . . .	156
Contrasting Probability With Odds . . . . .	158
The Sampling Distribution: Bridging the Gap Between a Sample and Its Population . . . . .	159
Simulating a Sampling Distribution . . . . .	160
Characteristics of a Sampling Distribution of the Mean . . . . .	160
Defining the Sampling Distribution in Terms of Shape . . . . .	160
Defining the Sampling Distribution in Terms of Central Tendency . . . . .	162
Defining the Sampling Distribution in Terms of Dispersion . . . . .	162
Estimation Procedures . . . . .	164
Is the Estimator Unbiased? . . . . .	164
Is the Estimator Consistent? . . . . .	164
Is the Estimator Efficient? . . . . .	164
Constructing an Interval Estimate (a Confidence Interval) . . . . .	165
Parameter Estimates Involving Small Samples . . . . .	168
Interval Estimates Involving Proportions . . . . .	172
Interpreting Interval Estimates . . . . .	175
Terms to Know . . . . .	176
Review Problems . . . . .	176
Group Discussion Questions . . . . .	178
Application Exercises . . . . .	179
References . . . . .	180
<b>CHAPTER 10 Hypothesis Testing . . . . .</b>	<b>181</b>
Defining the Research and Null Hypotheses . . . . .	181
Directionality: Which Way Will the Data Flow? . . . . .	183
A "Tail" of Two Hypotheses . . . . .	184

The Null as a Research Hypothesis . . . . .	185
The Hypothesis Testing Procedure . . . . .	186
Step 1: State the Research Hypothesis ( $H_1$ ) . . . . .	186
Step 2: State the Null or Statistical Hypothesis ( $H_0$ ) . . . . .	187
Step 3: Specify the Significance Level . . . . .	188
Step 4: Select and Compute the Test Statistic . . . . .	189
Step 5: Make a Decision Regarding $H_0$ . . . . .	190
Separating Statistical From Substantive Significance . . . . .	191
Why Do We Retain Rather Than Accept $H_0$ ? . . . . .	192
Type I and Type II Errors . . . . .	192
Terms to Know . . . . .	196
Review Problems . . . . .	196
Group Discussion Questions . . . . .	197
Application Exercise . . . . .	198
Reference . . . . .	198
<b>CHAPTER 11 Bivariate Analysis . . . . .</b>	<b>199</b>
The Difference Between Univariate and Bivariate Analyses . . . . .	199
Beginning a Chi-Square Analysis: Examining the Data . . . . .	201
Recoding With SPSS . . . . .	202
Beginning a Chi-Square Analysis: After Recoding the Data . . . . .	203
Goodness of Fit . . . . .	208
Measures of Association . . . . .	210
Three-Way Cross-Tabulation . . . . .	212
Terms to Know . . . . .	212
Review Problems . . . . .	213
Group Discussion Questions . . . . .	213
Application Exercises . . . . .	214
References . . . . .	215
<b>CHAPTER 12 Understanding and Interpreting Correlation . . . . .</b>	<b>216</b>
The Use of Correlation by Social Workers . . . . .	217
Scattergrams . . . . .	217
Perfect Correlations . . . . .	218
A Note About Causality . . . . .	220
Outliers . . . . .	220
Excluding Outliers . . . . .	223
Interpreting the Strength (Magnitude) of a Correlation . . . . .	224
Statistical Significance . . . . .	225
Negative Correlations . . . . .	226
Conditions Needed for Correlation . . . . .	227
Rank-Order Correlation . . . . .	229
Interpreting a Correlation Matrix . . . . .	232
Terms to Know . . . . .	232

Review Problems . . . . .	233
Group Discussion Questions . . . . .	234
Application Exercises . . . . .	235
References . . . . .	237
<b>CHAPTER 13 <i>t</i>-Tests and ANOVA: Testing Hypotheses About Means . . . . .</b>	<b>238</b>
Examples of Open-Ended Items Producing Interval/Ratio Data . . . . .	239
Examples of Items Producing Categorical Data . . . . .	240
The <i>t</i> -Test . . . . .	241
Independent-Samples <i>t</i> -Test . . . . .	243
Paired-Samples <i>t</i> -Test . . . . .	244
One-Sample <i>t</i> -Tests . . . . .	246
Analysis of Variance (ANOVA) . . . . .	249
Scenario: Program Assessment With ANOVA . . . . .	249
Analysis of Variance Assumptions . . . . .	252
Interpreting the Degrees of Freedom in One-Way ANOVA . . . . .	253
Post Hoc Comparisons . . . . .	253
Reporting <i>t</i> -Tests and ANOVAs in Manuscripts . . . . .	256
Terms to Know . . . . .	257
Review Problems . . . . .	257
Group Discussion Questions . . . . .	261
Application Exercise . . . . .	261
References . . . . .	261
<b>CHAPTER 14 A Glimpse Into Multivariate Analyses . . . . .</b>	<b>262</b>
Multiple Correlation . . . . .	263
Outcomes Associated With Multiple Correlation . . . . .	263
Multiple Correlation in Action . . . . .	264
Why Adjust $R^2$ ? . . . . .	266
Conditions Needed for Multiple Correlation . . . . .	267
Multiple Regression . . . . .	268
Least Squares Method . . . . .	269
Multiple $R$ and Multiple $R^2$ , Revisited . . . . .	269
The $b$ Coefficient and the Standardized Beta . . . . .	269
Multiple Regression in Action . . . . .	270
Selecting Variables for Inclusion . . . . .	271
Conditions Needed for Multiple Regression . . . . .	273
Dummy Variables . . . . .	274
Two-Way (Two-Factor) Analysis of Variance . . . . .	275
The Language of ANOVA . . . . .	275
The Logic of Two-Way ANOVA . . . . .	276
Two-Way ANOVA in Action . . . . .	276
The Output of Two-Way ANOVA . . . . .	279
Conditions Needed for Two-Way ANOVA . . . . .	281
Terms to Know . . . . .	282

Review Problems . . . . .	282
Group Discussion Questions . . . . .	285
Application Exercises . . . . .	285
References . . . . .	286
<b>CHAPTER 15 Selecting the Appropriate Statistical Test . . . . .</b>	<b>287</b>
Constructing Convincing and Credible Research . . . . .	287
Considerations in Selecting a Statistical Test . . . . .	289
Independence of Observations . . . . .	289
Level of Measurement . . . . .	290
Normal Distribution . . . . .	291
Sample Size . . . . .	291
Types of Samples . . . . .	292
Robustness . . . . .	293
Assumptions for Multiple Regression . . . . .	293
A Statistical Guide . . . . .	294
Nonparametric Statistical Procedures . . . . .	295
An Example of the Mann–Whitney $U$ Test . . . . .	298
Terms to Know . . . . .	299
Review Problems . . . . .	299
Group Discussion Questions . . . . .	300
Application Exercises . . . . .	300
References . . . . .	301
<b>APPENDIX Answers to Review Questions and Application Exercises . . . . .</b>	<b>302</b>
Index . . . . .	323



# Preface

---

There appear to be three different groupings of students who encounter statistics in a college course. In the first group are those individuals who had a good experience with math classes all through their schooling, who know that mathematical operations are logical and trustworthy—they might even be said to enjoy working with numbers. A second group seems to consist of those who are not overly fond of numbers—but not strongly opposed to learning about them. A third group is formed by those who want nothing to do with numbers; they might even be called math avoiders. These individuals have anxiety about solving problems with numbers and may be suspicious of them. Some of this may be the fault of having received poor instruction in math or just a lack of interest in the topic. We all have different interests, so it is understandable that we won't have the same taste or like the same things.

The good news for the readers of *Statistics for Social Workers: Essential Concepts* is that we have tried to present our material in such a way to reach students in groups two and three. We know that many, if not most, social work students just want to help people with problems; our students don't usually come to the field because they want to be researchers or evaluators. We understand that. By focusing on the essential content that forms the foundation for understanding the statistics reported in professional journal articles, we hope that this text will make you a better consumer of the professional literature you need to be able to read and understand not only in your college years, but throughout your career as a social worker.

Because of the availability of statistical computation software online and at colleges and universities, we have removed most manual calculation illustrations from this edition. We won't ask you to calculate much at all manually. Instead, our focus is on your learning concepts like what statistical significance means and some of the basic statistical procedures you can do from your laptop—to see, for instance, if one group of clients has progressed more or faster than another group with a different intervention. Our hope is that you will find the content useful for your practice in social work—that at a minimum it will show you how to think about using numbers in a way you may not have understood before.

The technology that our computers afford us provides much more data each hour, each day, each week than we could have envisioned even 20 years ago. Statistics help us understand the extent of our social problems and find solutions to the problems our clients bring. We need to understand trends and needs in our communities, and things like the characteristics of clients who drop out of care and those who don't. As practitioners, you will be writing reports for your agencies and be involved in communities and in the profession. You may need to draw on statistics for funding applications to examine the effectiveness of new interventions in your place of employment compared to other available data.

*Statistics for Social Workers* is written for undergraduate social work students; however, it certainly can be used with MSW students as well. Our goal has been to make the text as reader friendly as possible, with interesting excerpts from actual studies and review problems so that you can see how well you followed and understood the content. There are also possible assignments at the end of each chapter that your instructor may choose to assign to make sure you “got it.” Our wish is that you will find *Statistics for Social Workers* takes some of the mystery out of “those numbers” and thus serves as a key steppingstone in your becoming an evidence-based practitioner.

## CHAPTER 1

# Introduction: Developing Data Processing Skills

---

Statistics are useful tools to help us understand information. Due to the ever-increasing volume of data to be managed and the ease with handling it from digital platforms and databases, a knowledge of basic statistics is becoming even more important. This chapter will review terms you may already know that will be used in this book.

## Knowledge of Statistics Increases the Social Worker's Skill Set

Data surround us. What are data? Bits of information like a client's age, gender, educational level, marital status, household income. Organizations and agencies of all kinds (private, public, hospitals, and colleges) collect information like this to determine eligibility for services or the amount the client might have to pay for services. Sometimes the information is submitted electronically, but sometimes it is placed on paper forms that can be collected and may be temporarily stacked in cluttered piles, for example in mounds of client intake forms heaped on a desk. Sometimes the information is almost invisible until we tap a few keys on our office computer, laptop, or phone. And sometimes data reside in a professional journal article or report we want to read. At other times we social workers identify data we want or need and discuss or plan ways to capture it in surveys or interviews with clients, other service providers, or community residents. These are just a few forms of data that come to mind.

Unlike the past when information was kept mostly in libraries or stored in agencies in metal filing cabinets, we can now access amazing databases without too much effort, databases with information so current that it might have been collected just last week or overnight. As you undoubtedly know, our electronic devices give us access to all kinds of information maintained on websites we can find from a Google search—websites that vary tremendously in terms of credibility and the validity of the information they present. Not

all information is good and reliable. Some websites exaggerate their information. Sometimes the individual presenting the data does so in a way to give a misleading impression. Are you always able to recognize when the data have been “cooked” to show a particular conclusion? One of the reasons you are studying statistics is to acquire the ability to think about the information presented and have the “tools” to check out suspicious claims or assertions—in other words, to be able to think critically about a presentation involving numerical information.

Another reason to study statistics is to be able to identify patterns in the data so that you have a good understanding of what the data show. For instance, with a small set of data (e.g., 25 students in a classroom) you could quickly talk with a group of your friends and identify a pattern if 15 of the students told you they would be going to an outdoor music festival in two weeks. Fifteen of 25 students is 60%, so you would know that most of the students in the class were planning on attending. And similarly, a majority pattern could be rapidly detected if, closer to the date, the weather prediction was for rain all weekend and 12 of your 15 classmates changed their minds and indicated *no interest* in attending the festival.

Even if you are in a class of 400 students in a college lecture hall, statistics could be used to quickly determine how many students you would need information from to get an accurate prediction of the proportion of students who would be going the event. The point here is that a knowledge of statistics gives us tools you can use to do the following:

- a) Understand the data you have—for instance, to prepare a description of the “average” client or to examine the amount of intervention that the most and least successful client groups received. Managers might need to know how many cases on average their direct service social workers are carrying.
- b) To predict which data items are good indicators of certain outcomes (like avoiding future rearrests). You might want to use client data to try and predict which clients are most likely to drop out of care and not complete their intervention.
- c) To compare and evaluate the effectiveness of different interventions or program models. Does one type of intervention lead to significantly better results than another? Has your supervisor indicated that too many of your clients drop out before completing their program? Are you less successful than other social workers? How does your agency data compare to other similar agencies in the region or state? Do you get better results than what is being reported in the literature?
- d) To assess the needs of a community and determine where pockets of poverty and other problems exist, residential areas where special populations like older adults or persons of color live.

Statistical procedures are tools that can help us recognize problems with our approaches thought to help those who come to us for care. Are there groups of clients who tend to drop out prematurely? A familiarity with statistics can inform us about when we have too

much missing information or data we should be capturing in our databases. Could there be potential clients in our communities with needs we are overlooking and underserving that an analysis of service statistics could show?

Almost worse than no information, though, is unsophisticated thinking. For instance, what if a social work intern looked through recent agency data and found one or more clients with exorbitant numbers (e.g., a veteran arrested for vagrancy 27 times) and assumed the homeless client was “typical” of those being served by the agency. What problems might that create in how one might approach the clientele, the resources needed by them, even the metric for judging successful outcomes?

Statistical tools allow us to be better managers of our services and agencies by enabling us to be more competent in assessing, providing service, and evaluating efforts. We can use statistics to compute average caseloads so that we can identify if workloads are spread evenly across the agency or if some social workers are being tasked much more than others.

In their eagerness to get to the work of helping clients in need, social work students often express little interest in learning about statistical procedures. That’s understandable. After all, you chose social work as a field because you want to help people, not because you wanted to solve math problems.



## Misgivings You May Have About Statistics

You will be happy to know that there are several things about statistics that might help you to like them. First, almost no one computes statistics manually—so you very likely won’t be expected to either. Computers almost always do the number crunching for social work researchers. There are a few very simple problems your instructor may suggest you do to help you get involved with the material. Or your instructor may want you to try out the Statistical Package for the Social Sciences (SPSS). If that software is not available to you, there is an astonishing amount of free interactive statistical software options on the internet (e.g., [www.Statpages.info](http://www.Statpages.info).) Like SPSS, these programs are menu-driven, student friendly, and quite simple to understand and use. Forget the idea that you will have to memorize long, complicated formulas or do something like long division by hand. Just about any calculation you might need on to do can be done on your tablet or laptop. Some you might want to do on your phone.

Second, statistical procedures often assist us with ways of evaluating the quality of the information they provide. They can tell us how certain they are of their answers. One statistical procedure performed on the computer might indicate something to this effect: “Don’t place much confidence in this finding; I don’t have enough information.” In response to another question, the computer may be much more confident and communicate something like this: “This is important; I’m 95% sure of what I am about to say.” Of course, the statistical procedures or software don’t actually say these kinds of sentences, but you’ll learn their way of communicating their confidence and findings.

Third, although you may fear you’ll have to learn 10,000 new words and symbols that look like hieroglyphics to understand statistics, you don’t. You’ll only need to add a few new words and phrases to your vocabulary. These will be necessary to help you navigate your way when various observations and experiences of the world are transformed into numerical values—the language of statistics. Admittedly, this requires some new learning on your part, but that’s what an education is all about! Further, the new terms will always be in **bold font** in this text so you can easily find them.

## Our Practice Responsibility

Social work practice involves decision making at various levels: macro policymaking and planning; administration of agencies (great and small); and direct service intervention with individuals, families, and groups. Agencies, whether operating on a national, state, or local level, need to know if their programs and interventions are effective. Are clients better or worse off after their treatment? As social workers, we are required by our professional ethics to evaluate our interventions. The following statement is a passage taken from the National Association of Social Workers (NASW) Code of Ethics (2017):

Social workers should monitor and evaluate policies, the implementation of programs, and practice interventions (sec. 5.02).

Increasingly, there is an expectation that we social workers should employ empirically validated treatments with our clients and that we must evaluate these efforts. In the past, social workers could defend their choice of interventions based on “practice wisdom” and not worry about gathering evidence to demonstrate whether they succeeded with their individual cases. But today our society is more litigious, and individuals are quick to seek legal remedies when they feel their rights (e.g., to competent treatment) have been neglected. Indeed, taxpayers and funding sources want to know that what they are paying for is money well spent. Undoubtedly, you know about evidence-based practice and its importance. If one approach is not working well, what other alternatives, supported by good data, can be applied? (Note: Data can originate from quantitative or qualitative studies. Most often, statistical procedures are associated with quantitative studies. Quantitative studies are those where the data are expressed in numbers. The term *empirical* can also be applied to qualitative data in that this information is based on observation that generally can be verified.

There will be more about quantitative data later in this chapter. Where appropriate, we will discuss analysis of both qualitative and quantitative forms of information.)

Besides our roles in direct practice, social workers are also researchers. At times we must conduct needs assessments to learn what new programs are needed in the community, to determine the characteristics of the clients using our services, and to answer such questions as “Has the number of babies born with neonatal abstinence syndrome in Metropolitan Hospital increased or decreased in the last 2 years?” Social workers also conduct basic research and might want to look, for instance, into whether children who have been in foster care are at increased risk for encounters with the juvenile justice system. Or we might want to investigate the extent of mental illness among incarcerated youth, or new methodologies for addressing posttraumatic stress disorder. To answer our questions and explore such topics, it is not acceptable to base decisions on our success or failure with one or two clients. The use of statistics for decision making generally involves a large group of clients, participants, or cases. And of course, the more individuals in your study, the less likely you will know each of them well and be able to summarize their progress or lack of it with a short narrative. However, the number of individuals is not a problem when numerical data is used to summarize their progress. Large samples of clients or respondents can inform us with a confidence we don’t receive with several clients or a few interviews.

Good decision making requires that judgements be formed on reliable information. To this end, research methodology—that is, the systematic collection, analysis, and interpretation of data—is used by social workers to investigate the various questions we encountered in practice. After the data are collected, statistics are used to analyze the data and answer our questions. In this book, we’ll learn several different statistical procedures because the correct procedure is influenced by the type of data you have and what you want to know.

As a teaching aid we may employ a variation of the old maxim used to help children cross the street: Stop. Look. Listen. For instance, before selecting a statistical approach we may do something like this:

**STOP:** What question are you trying to answer?

**LOOK:** What data do you have access to or could obtain? What type of data would you have (e.g., categorical, interval, etc.)?

**EXAMINE:** Is there a good fit between the statistical procedure you want to use, the type of data you have, and the question you want answered?

Knowledge of statistics will help you design better research projects and make better decisions when engaged in evidence-based practice and choosing from the various interventions and approaches available to help clients. A knowledge of statistics will be helpful as you read and learn about the effectiveness of new treatments in published research—whether it involves a promising intervention with Alzheimer’s patients, comparing the costs of various treatment approaches for depressed clients, making sense of retention data on foster parents, or examining academic improvement in a program for children with autism.

How important is it that you learn how to think about data, statistics, and research? It is so important the Council on Social Work Education requires all social work education programs in colleges and universities to prepare students to have the competency to “engage in practice-informed research and research-informed practice” (competency 4) as well as the competency to “evaluate with individuals, families, groups, organizations, and communities” (competency 9). In other words, to be a competent social worker you must learn about research and evaluation of practice. Suffice it to say that having at least a basic knowledge of how to read and interpret statistics and possibly the competency to apply the right statistic in any study you might plan or be asked to conduct could very well say something about how you present yourself to others as a social worker.

## The Focus of This Book

Most social work students come into this field because they want to do something about people who are hurting and often share a social problem with many others due to homelessness, substance abuse, domestic violence, mental illness, emotional abuse, and others. Social work students often observe and meet clients with these experiences but may not see themselves as researching or writing about these problems. Accordingly, the focus of this book is on teaching the kind of practical statistics you need to help solve problems for your agency and clientele. We will help you learn to recognize the various types of data social workers create and encounter, as well as interpret and understand the statistics you will be reading in professional journals and reports. Finally, we hope that you will become enough of an “expert” to be able to use statistical procedures to evaluate the programs where you are employed—even though you may feel this isn’t anything that interests you right now. Food for thought: The authors of this text never realized as students that we might end up teaching, using statistics professionally, and writing about them! Could the same happen to you?

We encourage you to perform some of the statistical procedures discussed in the book to give you greater familiarity with them, which will likely decrease any anxiety you feel about working with numbers. We promise, it won’t be that bad. A major benefit of performing statistical procedures is that statistics is one of those topics best learned by doing. A Chinese fortune cookie recently noted wisely, “Learning does not acquire you. *You* must acquire learning.” Knowing how numbers can be condensed to reveal a pattern or trend and what statistical values can tell you can be very helpful in interpreting the data you have and preparing you to get the most from it in your evidence-based practice.

The goal of this text is to help you comprehend statistical terms and procedures commonly used in the social sciences. If by the end of the academic term you can recognize, for example, when it is appropriate to apply one statistical procedure rather than another, then our goal will have been achieved—whether or not you like math or ever thought of yourself as a “number cruncher.”

If you have already taken a research course, you probably learned some of the terms that will appear in this text. That’s great; even if you have not thought about them for a while

or forgotten a few of them, a quick review will aid your recall. If you are taking a statistics course simultaneously with a research course, or even if you have not yet taken your first research course, we'll give you a brief definition of key terms. Our text does not assume that you have had a prior course in research methodology; it can be used as a primary text for introductory statistics or as a supplement for a research methods text.

## How Do Quantitative and Qualitative Analyses Differ?

This text deals mostly with **quantitative data** (e.g., things, objects, events, characteristics, attitudes that be counted or measured). Quantitative data analysis usually involves responses gathered from 25 or more individuals all the way up to hundreds or thousands of individuals or surveys or interviews. However, our text is somewhat unique in that it also introduces you to some basic concepts necessary for analyzing qualitative data.

**Qualitative data** analysis is not concerned with counting or statistical analysis but with stories and discoveries that could not have been anticipated or expected, such as the experiences of single mothers trying to raise children alone and work to support them, or the stories that children in foster care told themselves when they were not adopted. Qualitative research has more of a journalistic quality, where the reader learns about the lives of individuals who have been severely burned or parents who had a child murdered, or who those recovering from substance abuse. Often small samples or numbers of participants are interviewed (for example, six or 10) and it is the depth and richness of the information that contributes to our understanding of these individuals and their situations. Qualitative researchers can probe and ask follow-up questions to illuminate and learn more about something a participant has said—something that quantitative researchers cannot always do with their surveys or other data-gathering procedures.

For instance, one social worker in clinical practice encountered a patient with dissociative identity disorder (DID). The patient was an extremely talented artist, but very lonely because few people could understand what they perceived to be her mercurial mood swings and idiosyncrasies. By coincidence, the social worker therapist also had another patient with the same diagnosis, artistic interests, and profound loneliness. With their permission, he introduced the two patients to each other, and the strategy seemed to work—they each gained a new friend who understood them. A qualitative researcher might write about the lives of these two unique individuals and how they accommodated each other's personalities. What strategies did they use? What changes did the primary identity of each client notice a little later? Did their friendship thrive or die after a short time?

The qualitative researcher might use personal interviews or possibly analyze emails, journals, or letters written by the two patients. This intervention likely could be evaluated by qualitative methods. A quantitatively oriented researcher would find it extremely difficult to obtain a large sample of individuals with DID who had been brought together by a therapist so that the use of the friendship strategy could be evaluated.

Quantitative researchers are always concerned with trying to improve their measurements of attitudes, knowledge, and behaviors and rely on statistics for those tasks. Qualitative

researchers put much more emphasis on trying to discover the meaning of an event and the thoughts and feelings of the participants in their own words. Qualitative researchers usually do not use prepared questionnaires or standardized instruments but let their questions emerge naturally from the give-and-take of their interviews or observations.

As you can imagine, quantitative and qualitative researchers rely on different data analysis techniques. Social workers need to understand both perspectives. We will show you how these two types of data and their analyses look, but we won't go into depth with qualitative analysis because, well, statistics aren't usually involved.

## Quick Review of Research Terms

Social work programs, as well as their host colleges or universities, differ in many ways, including the way courses are structured and sequenced. In some programs, a statistics course might be required before a research methods course can be taken, and in other programs the opposite might be true. If you have not yet completed a research methods course, then you will need to pay special attention to learn some terms in the next section. They will be used later in the book and are relevant for the analysis of data. If you have completed a research methods course, you may find this section a helpful review.

The following are some terms you will need to learn, if you don't already know them:

A **population** represents the total elements or individuals who are defined as a group in a study, report, or publication. A population can refer to all the recent college graduates within a country, all the households in Columbus, Ohio, without a car, all the people in Arizona over the age of 95 who live independently, or all the middle school children in Knoxville who are home-schooled. A population can also refer to all the inhabitants of a geographic location (e.g., the population of Los Angeles).

A **sample** is a small group or subset of the larger population. If you are looking at the whole group of clients who received crisis intervention services during calendar year 2021, that group is the population. However, if there are too many clients for you to look at all of them (say there were over 2,500 clients), then you might draw a smaller, more manageable random sample (e.g., 300) to represent the client population for that year.

Social work researchers often use **descriptive statistics** to summarize data coming from either a sample or a population. For instance, you might find that the average age of the agency sample was 27.5 years, that 80% were female, two thirds were high school graduates, and 15% were African American. Do you see how this works? Even though you haven't seen the data, you already have some idea about who would and who wouldn't be the typical client. You would have an entirely different concept if the average age were 70.2 years and two thirds had earned a PhD. Descriptive statistics provide "snapshots" that allow us to form mental pictures of the patterns that characterize our data. Averages and percents are descriptive statistics.

**Inferential statistics** are employed when data gathered from samples are used to make estimates about certain characteristics of a population. For instance, suppose you are a staff

member paid to advise a U.S. senator from Ohio on social service issues. Further, the senator is planning to propose some changes to Medicare legislation but first wants to learn what constituents think. She asks you to interview some voters back home. Your sample (whether it involves five, 50, or 500 individuals) and how it is selected (e.g., drawn randomly from a list of voters or a convenience sample taken at a political rally) has important implications for how well it can represent all the population of eligible voters in Ohio; you want to be able to infer, to deduce or conclude with some accuracy, the sentiments of the voters. Inferential statistics allow you to determine how well the sample represents the population by understanding the amount of sampling error (more about that later). Inferential statistics permit comparisons among groups so that you can check whether males hold different opinions than females, or whether younger voters differ from older voters. Inferential statistics are involved when we start looking to see if there are significant differences between or among groups of individuals or clients.

The actual interviews or surveys you complete constitute the **raw data**, the unprocessed information that is tabulated or entered into the computer. When you are directly involved in conducting interviews or distributing surveys, it is possible to get a feel for the data. Imagine a scenario in which eight out of the first 10 voters you talk with happily endorse the changes being advocated by the senator. If that pattern continues as you talk with additional voters, you could easily predict how the survey would turn out. Maybe you also get the impression that Republican voters oppose the changes, whereas Democrats favor them. Statistics allow you to check your impressions against reality.

Inferential statistics are often used when you are concerned with the probability of being in error, and when there are formal hypotheses to test. By way of review, a **hypothesis** is a statement about a presumed relationship. For instance, you might jot down the following hypothesis:

The proposed Medicare amendments will be more popular with older than with younger citizens.

You might be interested in any association between age and attitudes about the Medicare amendments. Your project director, however, might be more concerned with another hypothesis:

Registered Democrats are more likely to support the Medicare amendment than registered Republicans.

Notice that in the first hypothesis we would probably conduct a survey, but it could be of individuals in a city, or multiple locations—there's no specificity where they would come from. In the second hypothesis, our data could come from a list of those who were registered to vote. Are those who are registered to vote and those who voted the same group of people? Actually, there are usually more individuals registered to vote than make it to the polls on election day. Researchers must concern themselves with such fine distinctions. In fact, we **operationalize** our terms so that others will know exactly how we defined things and arrived at our conclusions. In operationalizing our terms, we move from an abstract

concept to a concrete indicator that enables measurement by specifying the characteristics (**attributes**) of interest and often the rules for who is included or excluded. For instance, Jasmine might operationalize voters as registered voters who the election board recorded as voting in the last presidential election (since national elections tend to attract more voters than statewide ones). Thus, she would have a sample frame (or list of all these voters), and if someone was not on the list, then they couldn't be included in the study. Wanda, on the other hand, might accept and operationalize voters as anyone who says they are registered to vote or stated they voted in a recent election.

Researchers have a lot of freedom when operationalizing concepts. Even so, the availability or format of the data often has a strong effect on the way terms are defined. For instance, you might decide to operationalize *repeat abuser* as those with new reports of abuse within the last 3 years. Although going back 5 or 10 years might produce stronger research, there are always pragmatic decisions about what data are available to us and at what cost to obtain it. The amount of time we have or the urgency with which we must submit a report or evaluation can also be a factor affecting the data we decide to use or collect. Each time we operationalize, we are by necessity determining what or who gets included and what or who is excluded from our study.

Whenever researchers quantify, measure, or categorize observations about our research subjects—whether it be examining subjects' physical characteristics, unconscious attitudes, past behaviors, or knowledge about a topic—we create **variables**. A variable is an operationalized concept that can be measured. In studies, variables are defined in terms of their **attributes**, characteristics, or qualities. Age, gender, and height are variables, and so are attitudes about marijuana smoking and abortion. The number of alcoholic beverages consumed in the past month is a variable, as is the number of candy bars eaten in a typical week, and the amount of money donated to charitable causes in the past year. To go a little further with an example, age can be defined by one's exact date of birth, by how many years old a person reports being, or whether we use categories such as arbitrarily defining *young adult* as those between 18 and 29.

**Independent variables** are those that help us to analyze data by sorting and categorizing. Independent variables influence, help us predict or explain outcomes or phenomena of interest. We might use age as a variable to examine the question, "Do older respondents have different attitudes about corporal punishment than younger ones?" Independent variables might investigate modality of treatment. For instance, "Is group therapy more effective than individual counseling?" The frequency or "dose" of therapy might be an independent variable as you could explore whether meeting twice a week with clients helped them to resolve problems faster than scheduling your meetings once a week. The independent variable of race might be used to investigate the concern, "Are African American adolescents more fatalistic than Native American teens?" In this question, fatalism is the topic of investigation and therefore is the **dependent variable**. Our dependent variable is the thing we are trying to understand or predict: the outcome or subject of our hypothesis or research question. We could use statistical techniques to see if there are significant differences between Native American and African American youths in

the extent of their fatalistic thinking, or to see if attitudes about corporal punishment varied by age group.

These are some of the basic terms you need to know. At the end of each chapter, we list the new vocabulary terms introduced in that chapter so you can study and test yourself without seeing any accompanying definitions. Make sure you learn the terms!

### TERMS TO KNOW

Attributes	Independent variables	Quantitative data
Data	Inferential statistics	Raw data
Dependent variables	Operationalize	Sample
Descriptive statistics	Population	Variable
Hypothesis	Qualitative data	

### REVIEW PROBLEMS

*The vignette:* Bob has read the case records of 50 adolescent clients admitted to the outpatient treatment center in the past 12 months. He has randomly selected these cases from approximately 900 persons 13 to 18 years of age admitted in the past year. He observes that 18% of clients have poor attendance in school, that most are female, and that on average the clients are 16.3 years old.

1. Has Bob operationalized *adolescent clients*?
2. Are the 50 case records he selected a sample or a population?
3. Bob has a hunch that a diagnosis of depression is more likely to be made for clients who have become heavy users of drugs and alcohol than for those who not involved with these substances. Could this hunch become a working hypothesis?
4. Bob is trying to understand depression—who is depressed and what contributed to the diagnosis in teen clients. Is the variable of depression diagnosis a dependent or independent variable?
5. Bob and Sam get into a discussion. Bob maintains that the raw data for his study came from the 50 case files he read, but Sam argues that 850 case files he didn't read represent the raw data. Who is right?
6. What are the three independent variables mentioned in the vignette?
7. Do these independent variables provide examples of descriptive or inferential statistics?
8. Bob found in the admission records the adolescents' high school GPAs. He wants to use this to classify the students in terms of three groups. He says that students with a GPA of 3.0 or higher are "good" students, those with a GPA of 2.0 to 2.99 are

“average,” and that those with a GPA below 2.0 are “poor.” Has he operationalized the variable *academic standing* for his study?

9. Sam wants Bob to interview six of the teens in the 50 he selected to ask them a series of open-ended questions about how satisfied they are with the outpatient counseling they have been receiving. As a supervisor of the adolescent unit, Sam wants to know about their experience in counseling. Could this be considered a qualitative study?
10. At the point the adolescent clients entered the counseling center, they completed a comprehensive assessment instrument that measured their level of depression in terms of a numerical score and a percentage providing a comparison to teens the same age who were not depressed. Does this sound like Bob’s study is a quantitative study?
11. Tricia will be working with homeless clients next semester in her practicum. When she thinks about those who might have been employed in the past, what might the attributes of a variable she’ll call past employment be? (There could be more than one way to operationalize this variable.)

### GROUP DISCUSSION QUESTIONS

1. In past employment, your practicum, or in past courses, have you had to gather raw data or use statistics to summarize the data? If so, share your experience with the class.
2. Although you may only want to work directly in a clinical capacity, how do you think a knowledge of statistics might be relevant and help you as a social worker?
3. What fears do you have about taking a statistics course?
4. What strengths do you have that will help you with this course?

### APPLICATION EXERCISES

1. In some news site that you usually read (electronic magazine, newspaper, etc.) or a professional journal article, find the use of one or more of the terms highlighted in bold in this chapter. Copy the excerpt making note of the source and your instructor will tell you to either print it, bring it to class, or forward it electronically.
2. Imagine that Bob from the earlier vignette is not interested in adolescents who are depressed but those who may have some other problem or behavior needing attention. Identify that problem or behavior in a sentence or two and then operationally define the variable so that its manifestation is clear to others. In other words, specify which clients would be included in the study (because they met the criteria/operational definition) and who would be excluded.
3. Complete the brief Anxiety About Statistics scale. Your instructor may wish to combine your data with that of your classmates to demonstrate what you can do with

this raw data. You may want to keep a record of how you responded if your instructor collects the data and shares details on how the class as a whole responded to the items. If each member of the class does this, will it constitute raw data? What might you learn about your classmates and their concerns about taking a statistics course? Want to make any predictions about how the class will respond to each of these items?

### Anxiety About Statistics

	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
1. I usually do not mind working with numbers.	_____	_____	_____	_____	_____
2. Numbers like $2,457 + 112$ make me nervous.	_____	_____	_____	_____	_____
3. I am confident about my ability to think through math problems.	_____	_____	_____	_____	_____
4. I understand that professional social workers need to understand data presented in research articles.	_____	_____	_____	_____	_____
5. If I had a magic wand, I would remove statistics from being a required course.	_____	_____	_____	_____	_____
6. I anticipate I may have to use statistics later in my practice as a social worker.	_____	_____	_____	_____	_____
7. I have a fear of failing this course.	_____	_____	_____	_____	_____
8. The number of math or algebra courses I completed in high school is _____.	_____				

## REFERENCE

National Association of Social Workers. (2017). *Code of ethics*. Author.

## Credit

IMG 1.1: Copyright © 2014 Depositphotos/monkeybusiness.