

# PREFACE

Statistics permeates nearly every aspect of our lives, and its role has become particularly important in the biological, life, medical, and health sciences. From opinion polls to clinical trials in medicine and analysis of big data from health applications, statistics influences and shapes the world around us. *Biostatistics for the Health and Biological Sciences* forges the relationship between statistics and our world through extensive use of a wide variety of real applications that bring life to theory and methods.

## Goals of This Second Edition

- Incorporate the latest and best methods used by professional statisticians.
- Include features that address all of the recommendations included in the *Guidelines for Assessment and Instruction in Statistics Education* (GAISE) as recommended by the American Statistical Association.
- Provide an abundance of new and interesting data sets, examples, and exercises.
- Foster personal growth of students through critical thinking, use of technology, collaborative work, and development of communication skills.
- Enhance teaching and learning with the most extensive and best set of supplements and digital resources.

## Audience/Prerequisites

*Biostatistics for the Health and Biological Sciences* is written for students majoring in the biological and health sciences, and it is designed for a wide variety of students taking their first statistics course. Algebra is used minimally, and calculus is not required. It is recommended that students have completed at least an elementary algebra course or that students should learn the relevant algebra components through an integrated or co-requisite course. In many cases, underlying theory is included, but this book does not require the mathematical rigor more appropriate for mathematics majors.

## Hallmark Features

Great care has been taken to ensure that each chapter of *Biostatistics for the Health and Biological Sciences* will help students understand the concepts presented. The following features are designed to help meet that objective.

### Real Data

Hundreds of hours have been devoted to finding data that are real, meaningful, and interesting to students. Fully 87% of the examples are based on real data, and 89% of the exercises are based on real data. Some exercises refer to the 18 data sets listed in Appendix B, and 12 of those data sets are new to this edition. Exercises requiring use of the Appendix B data sets are located toward the end of each exercise set and are marked with a special data set icon .

Real data sets are included throughout the book to provide relevant and interesting real-world statistical applications, including biometric security, body measurements, brain sizes and IQ scores, and data from births. Appendix B includes descriptions of

the 18 data sets that can be downloaded from the companion website [www.pearsonglobaleditions.com/triola](http://www.pearsonglobaleditions.com/triola), and Pearson MyLab Statistics.

### Readability

Great care, enthusiasm, and passion have been devoted to creating a book that is readable, understandable, interesting, and relevant. Students pursuing any major in the biological, life, medical, or health fields are sure to find applications related to their future work.

### Website

This textbook is supported by [www.pearsonglobaleditions.com/triola](http://www.pearsonglobaleditions.com/triola) which is continually updated to provide the latest digital resources, including:

- Statdisk: A free, robust statistical software package designed for this book.
- Downloadable Appendix B data sets in a variety of technology formats.
- Downloadable textbook supplements including *Glossary of Statistical Terms* and *Formulas and Tables*.
- Online instructional videos created specifically for this book that provide step-by-step technology instructions.
- Triola Blog, which highlights current applications of statistics, statistics in the news, and online resources.

### Chapter Features

#### Chapter Opening Features

- Chapters begin with a **Chapter Problem** that uses real data and motivates the chapter material.
- **Chapter Objectives** provide a summary of key learning goals for each section in the chapter.

#### Exercises

Many exercises require the *interpretation* of results. Great care has been taken to ensure their usefulness, relevance, and accuracy. Exercises are arranged in order of increasing difficulty, and they begin with *Basic Skills and Concepts*. Most sections include additional *Beyond the Basics* exercises that address more difficult concepts or require a stronger mathematical background. In a few cases, these exercises introduce a new concept.

#### End-of-Chapter Features

- **Chapter Quick Quiz** provides review questions that require brief answers.
- **Review Exercises** offer practice on the chapter concepts and procedures.
- **Cumulative Review Exercises** reinforce earlier material.
- **Technology Project** provides an activity that can be used with a variety of technologies.
- **From Data to Decision** is a capstone problem that requires critical thinking and writing.
- **Cooperative Group Activities** encourage active learning in groups.

## Other Features

**Margin Essays** There are 57 margin essays designed to highlight real-world topics and foster student interest.

**Flowcharts** The text includes flowcharts that simplify and clarify more complex concepts and procedures. Animated versions of the text's flowcharts are available within Pearson MyLab Statistics.

**Quick-Reference** Table A-3 (*t* distribution) is reproduced at the end of the book.

**Formula and Table Supplement** This supplement, organized by chapter, gives students a quick reference for studying, or for use when taking tests (if allowed by the instructor). It also includes the most commonly used tables. This is also available for download at [www.pearsonglobaleditions.com/triola](http://www.pearsonglobaleditions.com/triola) and in Pearson MyLab Statistics.

## Technology Integration

As in the preceding edition, there are many displays of screens from technology throughout the book, and some exercises are based on displayed results from technology. Where appropriate, sections include a reference to an online *Tech Center* subsection that includes detailed instructions for Statdisk, Minitab®, Excel®, StatCrunch, or a TI-83/84 Plus® calculator. (Throughout this text, "TI-83/84 Plus" is used to identify a TI-83 Plus or TI-84 Plus calculator). The end-of-chapter features include a *Technology Project*.

The Statdisk statistical software package is designed specifically for this textbook and contains all Appendix B data sets. Statdisk is free to users of this book, and it can be downloaded at [www.statdisk.org](http://www.statdisk.org).

## Changes in This Edition

### New Features

**Chapter Objectives** provide a summary of key learning goals for each section in the chapter.

**Larger Data Sets:** Some of the data sets in Appendix B are much larger than in the previous edition. It is no longer practical to print all of the Appendix B data sets in this book, so the data sets are *described* in Appendix B, and they can be downloaded at [www.pearsonglobaleditions.com/triola](http://www.pearsonglobaleditions.com/triola), and Pearson MyLab Statistics.

**New Content:** New examples, new exercises, and Chapter Problems provide relevant and interesting real-world statistical applications, including biometric security, drug testing, gender selection, and analyzing ultrasound images.

|           | Number | New to This Edition | Use Real Data |
|-----------|--------|---------------------|---------------|
| Exercises | 1600   | 85%                 | 89%           |
| Examples  | 200    | 84%                 | 87%           |

## Major Organization Changes

### All Chapters

- **New Chapter Objectives:** All chapters now begin with a list of key learning goals for that chapter. *Chapter Objectives* replaces the former *Overview* numbered sections. The first numbered section of each chapter now covers a major topic.

### Chapter 1

- **New Section 1-1: Statistical and Critical Thinking**
- **New Subsection 1-3, Part 2: Big Data and Missing Data: Too Much and Not Enough**

## Chapters 2 and 3

- **Chapter Partitioned:** Chapter 2 (Describing, Exploring, and Comparing Data) from the first edition has been partitioned into Chapter 2 (Summarizing and Graphing) and Chapter 3 (Statistics for Describing, Exploring, and Comparing Data).
- **New Section 2-4: Scatterplots, Correlation, and Regression** This new section includes scatterplots in Part 1, the linear correlation coefficient  $r$  in Part 2, and linear regression in Part 3. These additions are intended to greatly facilitate coverage for those professors who prefer some early coverage of correlation and regression concepts. Chapter 10 includes these topics discussed with much greater detail.

## Chapter 4

- **Combined Sections:** Section 3-3 (Addition Rule) and Section 3-4 (Multiplication Rule) from the first edition are now combined into one section: 4-2 (Addition Rule and Multiplication Rule).
- **New Subsection 4-3, Part 3: Bayes' Theorem**

## Chapter 5

- **Combined Sections:** Section 4-3 (Binomial Probability Distributions) and Section 4-4 (Mean, Variance, and Standard Deviation for the Binomial Distribution) from the first edition are now combined into one section: 5-2 (Binomial Probability Distributions).

## Chapter 6

- **Switched Sections:** Section 6-5 (Assessing Normality) now precedes Section 6-6 (Normal as Approximation to Binomial).

## Chapter 7

- **Combined Sections:** Sections 6-4 (Estimating a Population Mean:  $\sigma$  Known) and 6-5 (Estimating a Population Mean:  $\sigma$  Not Known) from the first edition have been combined into one section: 7-2 (Estimating a Population Mean). The coverage of the  $\sigma$  known case has been substantially reduced and it is now limited to Part 2 of Section 7-2.
- **New Section 7-4: Bootstrapping: Using Technology for Estimates**

## Chapter 8

- **Combined Sections:** Sections 7-4 (Testing a Claim About a Population Mean:  $\sigma$  Known) and 7-5 (Testing a Claim About a Population Mean:  $\sigma$  Not Known) from the first edition have been combined into one section: 8-3 (Testing a Claim About a Mean). Coverage of the  $\sigma$  known case has been substantially reduced and it is now limited to Part 2 of Section 8-3.

## Chapter 10

- **New Section: 10-5 Dummy Variables and Logistic Regression**

## Chapter 11

- **New Subsection: Section 11-2, Part 2 Test of Homogeneity, Fisher's Exact Test, and McNemar's Test for Matched Pairs**

## Chapter 14

- **Combined Sections:** Section 13-2 (Elements of a Life Table) and Section 13-3 (Applications of Life Tables) from the first edition have been combined into Section 14-1 (Life Tables).
- **New Section: 14-2 Kaplan-Meier Survival Analysis**

## Flexible Syllabus

This book's organization reflects the preferences of most statistics instructors, but there are two common variations:

- **Early Coverage of Correlation and Regression:** Some instructors prefer to cover the basics of correlation and regression early in the course. Section 2-4 now includes basic concepts of scatterplots, correlation, and regression without the use of formulas and greater depth found in Sections 10-1 (*Correlation*) and 10-2 (*Regression*).
- **Minimum Probability:** Some instructors prefer extensive coverage of probability, while others prefer to include only basic concepts. Instructors preferring minimum coverage can include Section 4-1 while skipping the remaining sections of Chapter 4, as they are not essential for the chapters that follow. Many instructors prefer to cover the fundamentals of probability along with the basics of the addition rule and multiplication rule (Section 4-2).

## GAISE

This book reflects recommendations from the American Statistical Association and its *Guidelines for Assessment and Instruction in Statistics Education* (GAISE). Those guidelines suggest the following objectives and strategies.

1. **Emphasize statistical literacy and develop statistical thinking:** Each section exercise set begins with *Statistical Literacy and Critical Thinking* exercises. Many of the book's exercises are designed to encourage statistical thinking rather than the blind use of mechanical procedures.
2. **Use real data:** 87% of the examples and 89% of the exercises use real data.
3. **Stress conceptual understanding rather than mere knowledge of procedures:** Instead of seeking simple numerical answers, most exercises and examples involve conceptual understanding through questions that encourage practical interpretations of results. Also, each chapter includes a *From Data to Decision* project.
4. **Foster active learning in the classroom:** Each chapter ends with several *Cooperative Group Activities*.
5. **Use technology for developing conceptual understanding and analyzing data:** Computer software displays are included throughout the book. Special *Tech Center* subsections are available online, and they include instruction for using the software. Each chapter includes a *Technology Project*. When there are discrepancies between answers based on tables and answers based on technology, Appendix D provides *both* answers. The website [www.pearsonglobaleditions.com/triola](http://www.pearsonglobaleditions.com/triola) includes free text-specific software (Statdisk), data sets formatted for several different technologies, and instructional videos for technologies.
6. **Use assessments to improve and evaluate student learning:** Assessment tools include an abundance of section exercises, *Chapter Quick Quizzes*, *Review Exercises*, *Cumulative Review Exercises*, *Technology Projects*, *From Data to Decision* projects, and *Cooperative Group Activities*.

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Marc Triola

Mario Triola

Jason Roy

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