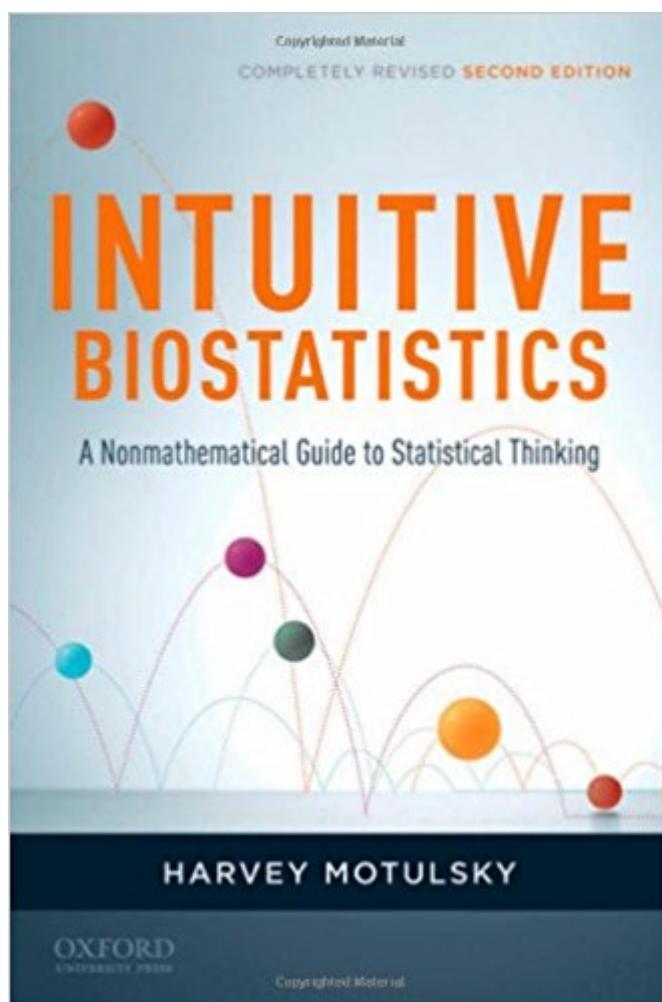


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# Intuitive Biostatistics: A Nonmathematical Guide To Statistical Thinking, 2nd Revised Edition



## Synopsis

THIS IS FOR THE 2nd EDITION. THE 3rd EDITION IS NOW AVAILABLE. Overview

Intuitive Biostatistics is both an introduction and review of statistics. Compared to other books, it has: Breadth rather than depth. It is a guidebook, not a cookbook. Words rather than math. It has few equations. Explanations rather than recipes. This book presents few details of statistical methods and only a few tables required to complete the calculations.

Who is it for? I wrote Intuitive Biostatistics for three audiences: Medical (and other) professionals who want to understand the statistical portions of journals they read. These readers don't need to analyze any data, but need to understand analyses published by others. Undergraduate and graduate students, post-docs and researchers who will analyze data. This book explains general principles of data analysis, but it won't teach you how to do statistical calculations or how to use any particular statistical program.

Scientists who consult with statisticians. Statistics often seems like a foreign language, and this text can serve as a phrase book to bridge the gap between scientists and statisticians.

What's new in the second edition? Though the spirit of the first edition remains, very few of its words do. It is hard to explain what is new in this edition, since I essentially rewrote the entire book.

New and expanded topics in the second edition of Intuitive Biostatistics include: Chapter 1 explains how our intuitions can lead us astray in issues of probability and statistics. Chapter 11 (and later examples) highlight the fact that lognormal distributions are common. Chapter 21 explains the idea of testing for equivalence vs. testing for differences.

Chapters 22, 23, and 40 discuss the pervasive problem of multiple comparisons.

Chapters 24 and 25 discuss testing for normality and for outliers.

Chapter 35 shows how to think about statistical hypothesis testing as comparing the fits of alternative models.

Chapters 37 and 38 give expanded coverage of the usefulness--and traps--of multiple, logistic, and proportional hazards regression.

Chapter 43 briefly mentions adaptive study designs where sample size is not chosen in advance.

Chapter 46 (inspired by, and written with, Bill Greco) reviews many topics in this book and more general issues of how to approach data analysis.

## Book Information

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## Customer Reviews

I am entranced by the book. Statistics is often difficult for many scientists to fully appreciate. Your writing style and explanation makes the concepts accessible. ---Tim Bushnell, Director of Flow Cytometry, Univ. Rochester Med. Center (added by author)"The second edition of Intuitive Biostatistics is a substantial improvement. I am particularly impressed by the chapters on multiple comparisons. This is increasingly important for such molecular trickery as gene expression chips, which produce a very large number of possible comparisons. Individual comparisons and even a Bonferroni correction are often inadequate. Motulsky deals with a newer method, false discovery rate (FDR), in a clear, understandable way. I'll be recommending the new edition with even greater enthusiasm."--James F. Crow, University of Wisconsin "This splendid book meets a major need in public health, medicine, and biomedical research training--a user-friendly biostatistics text for non-mathematicians that clearly explains how to make sense of statistical results and how to avoid being confused by statistical nonsense. You may enjoy statistics for the first time!"--Gilbert S. Omenn, Professor of Medicine, Genetics, Public Health, and Computational Medicine & Bioinformatics, University of Michigan

View the web page for this book, including errata, at [intuitivebiostatistics.com](http://intuitivebiostatistics.com) CONTENTS FOR 2nd EDITION (3rd NOW AVAILABLE) Part A: Introducing Statistics 1. Statistics and Probability Are Not Intuitive 32. Why Statistics Can Be Hard to Learn 143. From Sample to Population 17 Part B: Confidence Intervals 4. Confidence Interval of a Proportion 255. Confidence Interval of Survival Data 386. Confidence Interval of Counted Data 47 Part C: Continuous Variables 7. Graphing Continuous Data 578. Types of Variables 679. Quantifying Scatter 7110. The Gaussian Distribution 7811. The Lognormal Distribution and Geometric Mean 8312. Confidence Interval of a Mean 8713. The Theory of Confidence Intervals 9614. Error Bars 103 Part D: P Values and Significance 15. Introducing P Values 11116. Statistical Significance and Hypothesis Testing

12217. Relationship Between Confidence Intervals and Statistical Significance 13018. Interpreting a Result That Is Statistically Significant 13419. Interpreting a Result That Is Not Statistically Significant 14120. Statistical Power 14621. Testing for Equivalence or Noninferiority 150PART E: Challenges in Statistics 22. Multiple Comparisons Concepts 15923. Multiple Comparison Traps 16824. Gaussian or Not? 17525. Outliers 181PART F: Statistical Tests 26. Comparing Observed and Expected Distributions 19127. Comparing Proportions: Prospective and Experimental Studies 19628. Comparing Proportions: Case-Control Studies 20329. Comparing Survival Curves 21030. Comparing Two Means: Unpaired t Test 21931. Comparing Two Paired Groups 23132. Correlation 243PART G: Fitting Models to Data 33. Simple Linear Regression 25534. Introducing Models 27035. Comparing Models 27636. Nonlinear Regression 28537. Multiple, Logistic, and Proportional Hazards Regression 29638. Multiple Regression Traps 315PART H The Rest of Statistics 32139. Analysis of Variance 32340. Multiple Comparison Tests After ANOVA 33141. Nonparametric Methods 34442. Sensitivity and Specificity and Receiver-Operator Characteristic Curves 35443. Sample Size 363PART I Putting It All Together 37544. Statistical Advice 37745. Choosing a Statistical Test 38746. Capstone Example 39047. Review Problems 40648. Answers to Review Problems 418Appendices A. Statistics With GraphPad 451B. Statistics With Excel 456C. Statistics With R 458D. Values of the t Distribution Needed to Compute CIs 460E. A Review of Logarithms 462

I'm a retired cancer researcher (molecular biology) turned biomedical writer/editor. My use of statistics (and increasing ignorance thereof) was limited, because, in general, if an experiment didn't yield at least a 10x difference, we threw it out. Now I can't do my job without knowing biostatistics. Motulsky's book has been enormously helpful in teaching me the basics of biostatistics and enabling me to evaluate manuscripts for correct use of statistical terms and methods. Previously I used (and still do) Motulsky's manual for his GraphPad software, the AMA Manual online, and, of course, the internet. The only problem with the book is that a digital version isn't available. However, as the author pointed out to me, you can search the book to some extent on its .com product page. Finally, the author's immediately available via email. This is a terrific resource and value!

This is a first-rate book on biostatistics. Strongly recommended for physicians and others who read and must make sense of the biomedical literature. It should also be required reading for scientists who are publishing biomedical research, preferably early in their careers when they are still impressionable. Clearly shows the strengths and limitations of statistics in interpreting research

results. Does a great job on the ever-present problem of multiple comparisons and retrospective data torture. Other texts are cookbooks which show you how to perform various statistical tests, but ultimately it is far more important to understand the rationale behind statistical methodology and to see what statistical tests can--and can't--tell us. Enforces the notion that statistical tests have assumptions and describes when these assumptions can be violated and when such violations render the tests worthless. Debunks the notion that "statistical significance" is an absolute concept and shows how p

Possibly one of the best scientific textbooks I've ever read; it really manages to deliver many important concept of biostats in a very reader-friendly format, without requiring fancy math knowledge. There are a quite a few errors here and there, but there's a good errata online to account for them, and also a new edition has come out since I've bought it. In my opinion, this should be read by any biology PhD or MD. Very highly recommended

This biostatistics book is very well written with lots of examples from real experimental data. It is easy to follow and one can always go back to it as a reference when in doubt of what statistical method to use for a planned experiment. The book is very light on math. I did miss a few more equations, however that may even be a plus for people with lesser mathematical background.

This book presents most of the common statistical methods in a conceptual way and gives many examples from actual biomedical studies. It greatly emphasizes when a statistical method should or should not be used, and corrects some the most common misconceptions in statistics. While the book contains some math and does quite a good job explaining it to the non-mathematician, this may not be the best book for someone who wants to deeply understand statistics from a mathematical point of view (and the author acknowledges that).

This is a must for every medical student. For those engaging in research there is sufficient detail to be able to apply the correct statistical technique and to interpret the results. For the rest it gives a very clear introduction to biostatistics and particularly aids understanding of research articles without which a doctor will quickly lose touch with evidence based medicine. For the scientist and science student I would recommend this as an adjunct to any statistical course and as a reference to have on hand when reading those articles. I regularly picked up the first edition to check I was understanding something correctly - this edition is an order of magnitude better.

I have read numerous statistics books, most of which are very poorly written. This book, however, is very well written and has many examples of interest to those who work in the medical field. This should be required reading for all biomedical researchers and physicians. For those who have a fear of statistics this book will help you overcome your fears. The author should be applauded for pointing out numerous misconception with regards to statistics and clear explanations for which statistical analysis should be used and how the results should be properly interpreted.

I am a scientist and have a side interest in statistics -- after all statistics quantifies randomness, error and helps us interpret meaning from data. This should be required reading for all scientists. If so, the quality of science may improve dramatically. I love the most common application errors are identified and put in context. Although, my lab members would probably prefer that I let them continue making the same old mistakes...

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