

Contents

Preface	v
Using R	vii
1. Introduction to Medical Research	1
The Scope of Biostatistics & Epidemiology	1
Biostatistics in Medicine	1
The Design of This Book	3
The Organization of This Book	4
Additional Resources	4
2. Study Designs in Medical Research	6
Classification of Study Designs	6
Observational Studies	7
Experimental Studies or Clinical Trials	13
Meta-Analysis & Review Papers	16
Advantages & Disadvantages of Different Study Designs	16
Summary	18
3. Summarizing Data & Presenting Data in Tables & Graphs	20
Purpose of the Chapter	21
Scales of Measurement	22
Summarizing Numerical Data with Numbers	23
Displaying Numerical Data in Tables & Graphs	28
Summarizing Nominal & Ordinal Data with Numbers	34
Tables & Graphs for Nominal & Ordinal Data	40
Describing Relationships Between Two Characteristics	43
Graphs for Two Characteristics	47
Examples of Misleading Charts & Graphs	49
Summary	52
4. Probability & Related Topics for Making Inferences About Data	56
Purpose of the Chapter	58
The Meaning of the Term "Probability"	58
Populations & Samples	62
Random Variables & Probability Distributions	65
Sampling Distributions	73
Estimation & Hypothesis Testing	81
Summary	82
5. Research Questions About One Group	86
Purpose of the Chapter	88
Mean in One Group When the Observations Are Normally Distributed	88
Hypothesis Testing	93
Research Questions About a Proportion in One Group	97
Means When the Same Group Is Measured Twice	100
Proportions When the Same Group Is Measured Twice	103
What to Do When Observations Are Not Normally Distributed	106
Mean Differences When Observations Are Not Normally Distributed	109
Finding the Appropriate Sample Size for Research	110
Summary	112
6. Research Questions About Two Separate or Independent Groups	117
Purpose of the Chapter	118
Decisions About Means in Two Independent Groups	118
Decisions About Proportions in Two Independent Groups	127
Finding Sample Sizes for Means and Proportions in Two Groups	134
Summary	137
7. Research Questions About Means in Three or More Groups	141
Purpose of the Chapter	142
Intuitive Overview of ANOVA	143
Traditional Approach to ANOVA	147
Multiple-Comparison Procedures	150
Additional Illustrations of the Use of ANOVA	154
Nonparametric ANOVA	160
Comparing Frequencies or Proportions in More than Two Groups	160
Sample Sizes for ANOVA	162
Summary	162

8. Research Questions About Relationships Among Variables	166
An Overview of Correlation & Regression	167
Correlation	168
Comparing Two Correlation Coefficients	171
Other Measures of Correlation	173
Linear Regression	176
Use of Correlation & Regression	183
Sample Sizes for Correlation & Regression	186
Summary	187
9. Analyzing Research Questions About Survival	190
Purpose of the Chapter	191
Why Specialized Methods Are Needed to Analyze Survival Data	192
Actuarial, or Life Table, Analysis	193
Kaplan–Meier Product Limit Method	195
Comparing Two Survival Curves	197
The Hazard Function in Survival Analysis	202
The Intention-to-Treat Principle	202
Summary	203
10. Statistical Methods for Multiple Variables	206
Purpose of the Chapter	207
Multiple Regression	209
Controlling for Confounding	215
Predicting Nominal or Categorical Outcomes	219
Predicting a Censored Outcome: Cox Proportional Hazard Model	222
Meta-Analysis	225
Methods for Classification	227
Multiple Dependent Variables	229
Summary of Advanced Methods	230
11. Survey Research	234
The Research Questions	235
Questionnaire Layout	240
Reliability and Validity of Survey Instruments	241
Administration of Surveys	242
Selecting The Sample & Determining N	244
Analysis of Survey Results	245
Summary	246
12. Methods of Evidence-Based Medicine and Decision Analysis	250
Introduction	252
Evaluating Diagnostic Procedures with the Threshold Model	252
Measuring the Accuracy of Diagnostic Procedures	253
Using Sensitivity & Specificity to Revise Probabilities	254
ROC Curves	261
Decision Analysis	262
Using Decision Analysis to Compare Strategies	266
Using Decision Analysis to Evaluate Timing & Methods	269
Computer Programs for Decision Analysis	270
Summary	270
13. Reading the Medical Literature	276
Purpose of the Chapter	276
Review of Major Study Designs	276
The Abstract & Introduction Sections of a Research Report	277
The Method Section of a Research Report	278
The Results Section of a Research Report	285
The Discussion & Conclusion Sections of a Research Report	286
A Checklist for Reading the Literature	286
Appendix A: Tables	301
Appendix B: Answers to Exercises	310
Appendix C: Flowcharts for Relating Research Questions to Statistical Methods	327
Glossary	332
References	344
Index	351