Contents

Preface to the 2nd Edition xi
Preface to the 1st Edition xiii
Introduction xv

I Some Fundamental Stuff 1

1 First things first – the nature of data 3
   Learning Objectives 3
   Variables and data 3
   The good, the bad, and the ugly – types of variable 4
   Categorical variables 4
   Metric variables 7
   How can I tell what type of variable I am dealing with? 9

II Descriptive Statistics 15

2 Describing data with tables 17
   Learning Objectives 17
   What is descriptive statistics? 17
   The frequency table 18

3 Describing data with charts 29
   Learning Objectives 29
   Picture it! 29
   Charting nominal and ordinal data 30
   Charting discrete metric data 34
   Charting continuous metric data 35
   Charting cumulative data 37

4 Describing data from its shape 43
   Learning Objectives 43
   The shape of things to come 43
CONTENTS

10 Estimating the difference between two population parameters 119
   Learning Objectives 119
   What's the difference? 120
   Estimating the difference between the means of two independent populations – using
   a method based on the two-sample \( t \) test 120
   Estimating the difference between two matched population means – using a method
   based on the matched-pairs \( t \) test 125
   Estimating the difference between two independent population proportions 126
   Estimating the difference between two independent population medians – the
   Mann–Whitney rank-sums method 127
   Estimating the difference between two matched population medians – Wilcoxon
   signed-ranks method 131

11 Estimating the ratio of two population parameters 133
   Learning Objectives 133
   Estimating ratios of means, risks and odds 133

VI Putting it to the Test 139

12 Testing hypotheses about the difference between two population parameters 141
   Learning Objectives 141
   The research question and the hypothesis test 142
   A brief summary of a few of the commonest tests 144
   Some examples of hypothesis tests from practice 146
   Confidence intervals versus hypothesis testing 149
   Nobody's perfect – types of error 149
   The power of a test 151
   Maximising power – calculating sample size 152
   Rules of thumb 152

13 Testing hypotheses about the ratio of two population parameters 155
   Learning Objectives 155
   Testing the risk ratio 155
   Testing the odds ratio 158

14 Testing hypotheses about the equality of population proportions: the chi-squared test 161
   Learning Objectives 161
   Of all the tests in all the world...the chi-squared (\( \chi^2 \)) test 162

VII Getting up Close 169

15 Measuring the association between two variables 171
   Learning Objectives 171
   Association 171
   The correlation coefficient 175
## CONTENTS

### 16 Measuring agreement
- Learning Objectives: 181
- To agree or not agree: that is the question: 181
- Cohen’s kappa: 182
- Measuring agreement with ordinal data – weighted kappa: 184
- Measuring the agreement between two metric continuous variables: 184

### VIII Getting into a Relationship

#### 17 Straight line models: linear regression
- Learning Objectives: 189
- Health warning!: 190
- Relationship and association: 190
- The linear regression model: 192
- Model building and variable selection: 200

#### 18 Curvy models: logistic regression
- Learning Objectives: 213
- A second health warning!: 213
- Binary dependent variables: 214
- The logistic regression model: 215

### IX Two More Chapters

#### 19 Measuring survival
- Learning Objectives: 227
- Introduction: 227
- Calculating survival probabilities and the proportion surviving: the Kaplan-Meier table: 228
- The Kaplan-Meier chart: 230
- Determining median survival time: 231
- Comparing survival with two groups: 232

#### 20 Systematic review and meta-analysis
- Learning Objectives: 239
- Introduction: 239
- Systematic review: 240
- Publication and other biases: 244
- The funnel plot: 244
- Combining the studies: 246

Appendix: Table of random numbers: 251

Solutions to Exercises: 253

References: 273

Index: 277