Contents

CHAPTER

1. AN INTRODUCTION TO APPLIED PROBABILITY 1

   1.1. Notation and Definitions 1
   1.2. The Evaluation of a Screening Test 4
   1.3. Biases Resulting from the Study of Selected Samples 8
   1.4. Inferences About a Single Proportion 13
   Problems 15
   References 17

2. ASSESSING SIGNIFICANCE IN A FOURFOLD TABLE 19

   2.1. Methods for Generating a Fourfold Table 20
   2.2. "Exact" Analysis of a Fourfold Table 24
   2.3. Yates' Correction for Continuity 26
   2.4. One-Tailed Versus Two-Tailed Tests 27
   2.5. A Simple Confidence Interval for the Difference Between Two Independent Proportions 29
   2.6. An Alternative Critical Ratio Test 30
   Problems 31
   References 32

3. DETERMINING SAMPLE SIZES NEEDED TO DETECT A DIFFERENCE BETWEEN TWO PROPORTIONS 33

   3.1. Specifying a Difference Worth Detecting 34
   3.2. The Mathematics of Sample Size Determination 38
   3.3. Using the Sample Size Tables 42

3.4. Unequal Sample Sizes 44
3.5. Some Additional Comments 46
Problems 46
References 48

4. How to Randomize 50

4.1. Selecting a Simple Random Sample 51
4.2. Randomization in a Clinical Trial 52
4.3. Variations on Simple Randomization 53
References 55

5. Sampling Method I: Naturalistic or Cross-Sectional Studies 56

5.1. Some Hypothetical Data 57
5.2. Measures of Association Derived from χ^2 58
5.3. Other Measures of Association: The Odds Ratio 61
5.4. Some Properties of the Odds Ratio and its Logarithm 64
5.5. Testing Hypotheses About the Odds Ratio 67
5.6. Confidence Intervals for the Odds Ratio 71
5.7. Attributable Risk 75
Problems 78
References 80

6. Sampling Method II: Prospective and Retrospective Studies 83

6.1. Prospective Studies 83
6.2. Retrospective Studies 87
6.3. Criticisms of the Odds Ratio 90
6.4. Estimating Attributable Risk from Retrospective Studies 93
6.5. The Retrospective Approach Versus the Prospective Approach 95
Problems 97
References 98

7. Sampling Method III: Controlled Comparative Trials 100

7.1. The Simple Comparative Trial 101
7.2. The Two-Period Crossover Design 104

7.3. Alternatives to Simple Randomization 105
Problems 108
References 109

8. The Analysis of Data from Matched Samples 112

8.1. Matched Pairs: Dichotomous Outcome 113
8.2. Matched Pairs: More than Dichotomous Outcome 119
8.3. The Case of Multiple Matched Controls 123
8.4. The Comparison of *m* Matched Samples 126
8.5. Advantages and Disadvantages of Matching 133
Problems 134
References 135

9. The Comparison of Proportions from Several Independent Samples 138

9.1. The Comparison of *m* Proportions 138
9.2. Gradient in Proportions: Samples Quantitatively Ordered 143
9.3. Gradient in Proportions: Samples Qualitatively Ordered 147
9.4. Ridit Analysis 150
Problems 156
References 158

10. Combining Evidence from Fourfold Tables 160

10.1. The Construction and Interpretation of Some Chi Square Tests 161
10.2. Combining the Logarithms of Odds Ratios 165
10.3. Method Due to Cornfield and Gart 168
10.4. The Mantel-Haenszel Method 173
10.5. A Comparison of the Three Procedures 175
10.6. Alternatives to Matching 176
10.7. Methods to be Avoided 178
Problems 185
References 186

11. The Effects of Misclassification Errors 188

11.1. An Example of the Effects of Misclassification 188
11.2. The Algebra of Misclassification 193

11.3. The Algebra of Misclassification: Both Variables in Error 196
Problems 198
References 199

12. The Control of Misclassification Error 201

12.1. Statistical Control for Error 201
12.2. Probabilistic Control for Error 204
12.3. The Experimental Control of Error 205
Problems 209
References 210

13. The Measurement of Interrater Agreement 211

13.1. The Case of Two Raters 212
13.2. Multiple Ratings per Subject 225
13.3. Further Applications 232
Problems 234
References 234

14. The Standardization of Rates 237

14.1. Reasons for and Warnings Against Standardization 239
14.2. Indirect Standardization 240
14.3. A Feature of Indirect Standardization 243
14.4. Direct Standardization 244
14.5. Some Other Summary Indices 247
14.6. Adjustment for Two Factors 249
Problems 253
References 254

Appendix Tables 257

Answers to Numerical Problems 295

Author Index 305

Subject Index 311