Medical Statistics: A Textbook for the Health Sciences (4th edn)

This book has had a change of title and a comprehensive revision since the previous edition. It is longer by more than one hundred pages with the introduction of additional material on reliability and validity, survival analysis and sample size. Many examples have been updated to feature more recent medical literature. Technical derivations are included at the end of each chapter rather than in an appendix. Multiple choice question exercises have been supplemented with testing open questions covering design and interpretation as well as purely statistical issues. The answers are generally clear and comprehensive.

The target audience is medical students and professionals studying statistics for the first time. The first seven chapters are for consumers of statistics and the remaining eight chapters for producers of statistics. This structure matches the needs of medical undergraduates whose first encounter with statistics is often through critical appraisal of medical literature. Statistical analysis is usually required later in the course. The sections titled 'points when reading the literature' in each chapter are very valuable for critical appraisal, but indicate potential pitfalls for producers of statistics as well. The early chapters give higher priority to consideration of the choice of study population, the potential biases and the interpretation of results rather than the method of statistical analysis. The immediate demonstration of the relevance of statistics for communicating and understanding medical information may be a good motivating factor for less mathematical students.

The first seven chapters have been refreshed and reordered. The book starts with clear warnings about the uses and abuses of statistics and introduces confounding and bias within the first few pages. Describing and displaying quantitative and categorical data are now covered in two separate chapters. The chapter on quantitative data includes a very straightforward explanation of within- and between-subject variability. Chapters 4–7 cover probability, distributions, populations and samples, confidence intervals and inference with a strong focus on interpretation and critical appraisal. The definition of the p-value is very clear and principles of testing and confidence intervals are established before calculations are required. Some of the notation here is a little oversimplified. There is an unfortunate error where two lines of text corresponding to the interpretations of p-values either side of 0.05 have been reversed.

The second half of the book for producers of statistics starts with a fairly traditional chapter on hypothesis testing. The next chapter on correlation, linear and logistic regression makes a helpful distinction between the purposes of correlation and regression. The three new chapters are well placed within the existing material. Chapter 10 on survival analysis takes a methodological approach and follows very naturally from the previous chapter on regression. It includes clear diagrams illustrating recruitment over time, loss to follow up and censoring, and explanations of the calculations behind Kaplan–Meier curves, the log rank test and hazard ratios. These explanations are generally easy to understand and follow on from the interpretations of odds ratios and relative risks in the previous chapter. The proportional hazards assumption is mentioned, but not methods for testing it. Chapter 11 on reliability and method comparison studies discourages statistical testing for reliability. There are clear explanations of the purposes and limitations of coefficient of variation, intra-class correlation coefficient, Cohen's kappa, Cronbach's alpha and Bland–Altman plots.

The chapter on observational studies covers study design, choice of control groups, successful reporting and a cautionary section on causation. The chapter on randomized controlled trials includes extremely useful checklists for protocol writing, study design and successful reporting using the CONSORT guidelines. These two chapters will be very valuable for understanding research methods and critical appraisal.

The new chapter on sample size issues follows those on design, therefore the sections on error rates, effect sizes in continuous and binary outcomes and prevalence studies are concise. Simple rules for typical power and significance levels are presented alongside tables and formulae for other values. The final chapter on common pitfalls discusses inappropriate analyses of changes from baseline, repeated measures and multiple comparisons.

There are a few weaknesses within this book. Some elements are oversimplified although this is inevitable with a book of this breadth. The initial definition of the confidence interval is incorrect although this is remedied in subsequent sentences. The authors suggest that the mean of a binary or ordinal categorical variable has a practical interpretation

provided that the lowest category is coded as zero. While true, it is a very unwise suggestion to include in an introductory text as it creates confusion about the appropriate summaries for different types of data. Analysis of variance and the Kruskal–Wallis test have been omitted, although authors of some other introductory texts have made the same decision. There are also more typographical errors than would usually be expected in the 4th edition of a book, but a list of the main errors is available online.

In summary, this edition has been comprehensively revised with extra chapters, more modern examples and additional exercises. The structure of the book in two sections is successful and follows modern medical courses where critical appraisal is required earlier than statistical analysis. The structure of each chapter allows the readers to pursue as much technical detail as desired. The ordering of the chapters creates a very natural flow throughout the book. This is an excellent book for introducing medical statistics to students and professionals.

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