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Book Review



Medical biostatistics, fourth edition. A. Indrayan, R.K. Malhotra (CRC Press, Taylor & Francis Group, LLC, Florida, USA) 2018. 984 pages. Price: Not mentioned.

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More than hundred books in Biostatistics and related disciplines have been published by Chapman and Hall under the CRC Biostatistics series, and the present one is one of their latest books. In the present book, various aspects of Biostatistics and their applications in the field of medicine and public health have been presented under 21 chapters. Apart from the text material, brief solutions and answers to the selected exercises, three appendices, each covering statistical software information, some statistical tables and solution illustrations using 'R', are given at the end of the book. Also included is an index, covering various terms and names used in the book. List of references used and exercises have been included at the end of each chapter. Under summary tables, seven tables have been included indicating the parameters of interest and set-up, conditions and main criteria for application and the equation number with the corresponding section. Frequently used notations and their expansions are also given along with a preface for the fourth edition.

In the preface, the authors have highlighted the uncertainties, statistical fallacies and the concept of statistical and medical significance and their differences. This is important while educating students and researchers on statistical significance in relation to medical significance. Epidemiological and biostatistical methods have been given more emphasis over mathematics. The authors have written that the first edition is the most complete book on biostatistics; the second edition, almost an encyclopaedia in breadth; the third edition, an encyclopaedia itself and the present edition, incorporating suggestions given by the reviewers of the previous three editions. The primary target of the book are students, researchers and professionals of medicine and health. The authors have emphasized that the sequence of 21 chapters in the book may not look natural to statisticians who might give comparatively more emphasis on the related mathematical aspects also. The authors have elaborated on topics such as clinical trials, logistic regression, spline regression and many other topics in the present edition.

Chapter 1 deals with medical uncertainties with respect to health and disease, intrinsic variation, biological and genetic variability, and sampling variability and highlights the importance of addressing different types of variations which are directly connected to arriving at final conclusions. This chapter highlights statistical fallacies in reporting medical significance of the results. However, this chapter would have been better placed at the end of the book rather than in the beginning itself. Since most of the fallacies are related to the application of various statistical methods for the analysis of the data and the possible interpretation of the results, it would be better understood and appropriated if the statistical methodologies were explained in the earlier chapters.

In chapter 2, the importance of preparing the study protocol, emphasizing the objectives and hypothesis of the study, review of literature, identifying the appropriate study design, data collection methods and different types of biases which the researcher comes across in the study and how to deal with them are described. This is an important chapter which enumerates the basic requirements in planning any research study. Since variation in study parameters is the basic concept in any research, the methods of addressing these variations have to be addressed and explained in planning the study and in data analysis.

Chapter 3 is well written and deals with the description of the concept of sampling and the various

sampling methods. One sampling method namely multiphase sampling is, however, missing.

Chapter 4 deals with various study designs. The details of observational and experimental studies have been given with examples, however, the details of some of the methodologies are not included.

Chapter 5 deals with medical experiments highlighting the concept of randomization, replication and the limitation of such designs. Various statistical designs including factorial, repeated measures and crossover have been briefly explained. Chapter 6 gives the details of clinical trials. Most of the important aspects in conducting clinical trials have been touched upon in this chapter. Importance of ethical aspects in clinical trials has been highlighted fairly well. The concept of blinding and the design of clinical trials with respect to superiority, inferiority and equivalence have been explained with examples.

In chapter 7, the concept of variation and methods of dealing with it in research have been explained. These have been explained with respect to various parameters - mean, ratio and rate, and proportion. All the five types of averages (mean, median, mode, geometric mean and harmonic mean) have been explained with examples. In chapter 8, various diagrams and graphs which are appropriate in representing the data are given. Growth charts, dendrogram and cartogram have also been included.

Chapter 9 deals with quantitative aspects of medicine with a special reference to Bayes' rules, sensitivity, specificity, accuracy and predictive values of positives and negatives. These have been explained with examples. Also included is receiver operating characteristic curve and its applications. Another important topic which is gaining popularity in medical research, namely 'evidence-based Medicine' has been included in chapter 10. In standard textbooks which are written for undergraduate and postgraduate courses, this topic is not generally included. Although the details of the various methodologies are not given, for a course in biostatistics, the contents could be adequate.

Chapter 11 deals with research in community health. Various demographic and health measures have been explained with examples. Chapters 12 and 13 are specifically on tests of statistical significance and sample size. It would have been better if the chapter on sample size was given separately. However, the various methods for estimation of sample size for various designs have been explained with examples, in this chapter. In chapter 13, inclusion of computingpartitioned Chi-square is a noteworthy one since this aspect is not touched upon in majority of the books in statistical methods. However, more details, with examples, would have been much appreciated. While dealing with proportions and their comparison between groups with smaller sample size is another topic which has been included in chapter 13.

In chapter 14, the concept of relative risk, odds ratio and number needed to treat have been explained with examples. Though the concept of meta-analysis has been explained briefly, the details of the same, with examples, are not adequately dealt with. This is an important method which is applied by many researchers in consolidating the results obtained from different multicentre studies or from several independent studies in the same area.

Chapter 15 deals with methods of inference from means. Analysis of crossover design is an added attraction in this chapter. However, the details of the crossover design analysis could have been included for the benefit of the researchers, though some aspects of the methods, with examples, are included. Chapter 16 deals with the methods of studying relationships with respect to quantitative outcome. Methods for various regression analysis - ridge, multilevel and spline regression are touched upon with brief notes. Chapter 17 deals with qualitative-dependent relationships. Analysis of logistic regression, with examples, has been described. Cohen kappa and biserial correlation have been explained briefly. Chapter 18 deals with survival analysis methods. Most of the important aspects of this analysis have been covered, and appropriate examples given.

Chapter 19 deals with another important topic, methods of dealing with several variables at a time. Although all the methods have been explained well in this chapter, some more detail with examples could have further added value, especially for students, on applying multivariate methods and how to interpret the results. Furthermore, more emphasis should have been given to the explanation of the difference among the various multivariate analysis methods and the caution which has to be taken while interpreting results.

Chapter 20 deals with quality considerations with respect to validation models, coefficient of internal consistency, reliability and so on. More examples on these aspects would have given a better understanding on these aspects to the readers. Chapter 21 deals with statistical fallacies which also includes examples selecting inappropriate methods and how the results are affected by these methods. This is an important chapter providing enough caution to the researchers by selecting the method of analysis with respect to study design, objectives, distribution of the variables, sample size and so on.

Overall, this book will be useful to students and researchers in defining their research studies, selecting appropriate methods of statistical analysis and interpreting the results with caution. Since the results always have to be given with respect to the possible errors such as type 1 and type 2, caution has to be taken in interpreting them appropriately. As indicated earlier, this book may be recommended as a reference book than as a text book. Since a large number of statistical methodologies have been included in this book, ultimately, the researchers have to be cautious in their research right from defining the problem until the conclusions are drawn. Inclusion of a large number of topics required in planning the studies, analysis of data, presenting and interpreting the results with caution is well appreciated.

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