Clinical Data Analysis on a Pocket Calculator

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Clinical Data Analysis on a Pocket Calculator

Understanding the Scientific Methods of Statistical Reasoning and Hypothesis Testing

Second Edition

Springer

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Prefaces to First Edition

Book One

The time that statistical analyses, including analysis of variance and regression analyses, were analyzed by statistical analysts has gone for good, thanks to the availability of user-friendly statistical software. The teaching department, the educations committee, and the scientific committee of the Albert Schweitzer Hospital, Dordrecht, the Netherlands, are pleased to announce that since November 2009, the entire staff and personnel are able to perform statistical analyses with the help of SPSS Statistical Software in their offices through the institution's intranet.

It is our experience as master's and doctorate class teachers of the European College of Pharmaceutical Medicine (EC Socrates Project) that students are eager to master adequate command of statistical software for carrying out their own statistical analyses. However, students often lack adequate knowledge of basic principles, and this carries the risk of fallacies. Computers cannot think and can only execute commands as given. As an example, regression analysis usually applies independent and dependent variables, often interpreted as causal factors and outcome factors. For example, gender and age may determine the type of operation or the type of surgeon. The type of surgeon does not determine the age and gender. Yet, software programs have no difficulty to use nonsense determinants, and the investigator in charge of the analysis has to decide what is caused by what, because a computer cannot do a thing like that, although it is essential to the analysis.

It is our experience that a pocket calculator is very helpful for the purpose of studying the basic principles. Also, a number of statistical methods can be performed more easily on a pocket calculator, than using a software program.

Advantages of the pocket calculator method include the following:

1. You better understand what you are doing. The statistical software program is kind of a black box program.
2. The pocket calculator works faster, because far less steps have to be taken.

3. The pocket calculator works faster, because averages can be used.
4. With statistical software all individual data have to be included separately, a time-consuming activity in case of large data files.

Also, some analytical methods, for example, power calculations and required sample size calculations, are difficult on a statistical software program and easy on a pocket calculator. This book reviews the pocket calculator methods together with practical examples, both hypothesized and real patient data. The book was produced together with the similarly sized book *SPSS for Starters* from the same authors (edited by Springer, Dordrecht 2010). The two books complement one another. However, they can be studied separately as well.

Lyon, France — Ton J. Cleophas
December 2010 — Aeilko H. Zwinderman

Book Two

The small book *Statistical Analysis of Clinical Data on a Pocket Calculator* edited in 2011 presented 20 chapters of cookbook-like step-by-step analyses of clinical data and was written for clinical investigators and medical students as a basic approach to the understanding and carrying out of medical statistics. It addressed subjects like the following:

1. Statistical tests for continuous/binary data
2. Power and sample size assessments
3. Calculation of confidence intervals
4. Calculating variabilities
5. Adjustments for multiple testing
6. Reliability assessments of qualitative and quantitative diagnostic tests

This book is a logical continuation and reviews additional pocket calculator methods that are important to data analysis:

1. Logarithmic and invert logarithmic transformations
2. Binary partitioning
3. Propensity score matching
4. Mean and hot deck imputations
5. Precision assessments of diagnostic tests
6. Robust variabilities

These methods are, generally, difficult on a statistical software program and easy on a pocket calculator. We should add that pocket calculators work faster, because summary statistics are used. Also you better understand what you are doing. Pocket calculators are wonderful: they enable you to test instantly without the need to download a statistical software program.

The methods can also help you make use of methodologies for which there is little software, like Bhattacharya modeling, fuzzy models, Markov models, binary partitioning, etc.

We do hope that *Statistical Analysis of Clinical Data on a Pocket Calculator 1* and *2* will enhance your understanding and carrying out of medical statistics and help you dig deeper into the fascinating world of statistical data analysis. We recommend to those completing the current books to study, as a next step, the two books entitled *SPSS for Starters 1* and *2* from the same authors.

Lyon, France
March 2012

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Preface to Second Edition

We as authors were, initially, pretty unsure, whether, in the current era of computer analyses, a work based on pocket calculator analyses of clinical data would be appreciated by medical and health professionals and students. However, within the first two years of publication, over thirty thousand e-copies were sold. From readers' comments we came to realize that statistical software programs had been experienced as black box programs producing lots of p-values, but little answers to scientific questions, and that many readers had not been happy with that situation.

The pocket calculator analyses appeared to be, particularly, appreciated, because they enabled readers for the first time to understand the scientific methods of statistical reasoning and hypothesis testing. So much so that it started something like a new dimension in their professional world.

The reason for a rewrite was to give updated and upgraded versions of the forty chapters from the first editions, including the valuable comments of readers. Like in the textbook complementary to the current work, entitled *SPSS for Starters and 2nd Levelers* (Springer Heidelberg 2015, from the same authors), an improved structure of the chapters was produced, including background, main purpose, scientific question, schematic overview of data files, and reference sections. In addition, for the analysis of more complex data, twenty novel chapters were written. We will show that, also here, a pocket calculator can be very helpful.

For convenience the chapters have been reclassified according to the most basic difference in data characteristics: continuous outcome data (34 chapters) and binary outcome data (26 chapters). Both hypothesized and real data examples are used to explain the sixty pocket calculator methods described. The arithmetic is of a no-more-than high-school level.

Lyon, France
October 2015

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