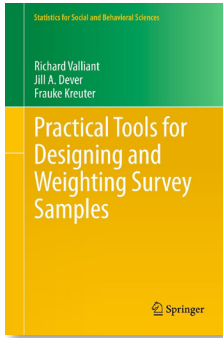# Book Reviews

Richard Valliant, Jill A. Dever, Frauke Kreuter (2013):
Practical Tools for Designing and Weighting Survey
Samples
Springer (Statistics for Social and Behavioral Sciences; 51)
ISBN: 978-1-4614-6448-8
692 pages
€59.49

The preface of the book starts with: "Survey sampling is fundamentally an applied field. During this roundtable, we will discuss techniques long used by experienced survey statisticians with little or no references in the literature". And at the beginning of Chapter 1 one can read: "This is a practical book". This shows the basis of the book. The authors try to address three groups of readers:

1. *Students* seeking a more in-depth understanding of applied sampling either through a year-long course or by way of a supplementary reference.
2. *Survey statisticians* searching for practical guidance on how to apply concepts learned in theoretical or applied sampling courses.
3. *Social scientists* and other *survey practitioners* who desire insight into the statistical thinking taken to design, select, and weight random survey samples.

The book is organized into four parts with 18 chapters: *Designing Single-Stage Sample Surveys (Chapters 2-7)*, *Multistage Designs (Chapters 8-11)*, *Survey Weights and Analyses (Chapters 12-16)* and *Other Topics (Chapters 17-18)*. At the beginning of the first three parts the authors introduce each part with a real life example of a survey project, give some useful examples and at the end a solution. At the end of the book more than 100 pages are reserved for *Notation Glossary*, *Data Sets*, *R Functions Used in this Book, References, Solutions to Selected Exercises, Author Index* and *Subject Index*.

In Chapter 1 the authors mention that designing a sample plan requires the consideration of the following factors:

1. Specifying the objective(s) of the study.
2. Translating a subject-matter problem into a survey problem.
3. Specifying the target population, units of analysis, key study variables, auxiliary variables (i.e. covariates related to study variables and for which population statistics may be available), and population parameters to be estimated.

4. Determining which sample frame(s) are available for selecting units.
5. Selecting an appropriate method of data collection.

The book also contains hints such as: How to write a technical report describing the sample design.

In Chapter 2 the first of several projects demonstrates the workflow of designing a single-stage personnel survey. This chapter includes specifications for the study, questions raised by sampling experts in response to the specifications, preliminary analyses and documentation.

Chapter 3 contains several commonly used probability sampling plans, e.g. simple random sampling, stratified simple random sampling including different types of allocations of the sample size to the strata, sampling (with and without replacement) with varying probabilities, systematic sampling and Poisson sampling. Not only sampling designs are considered but also different estimators for estimating population parameters, such as means, totals and portions. Already at this stage the authors introduce the concept of the design effect. Sampling rare populations and estimation for subgroups (domains) is mentioned. R and SAS are presented as statistical software packages usable for sample selection, along with some examples. A lot of exercises complete Chapter 3.

Chapter 4 deals with one- and two-sided tests and power calculation.

In Chapter 5 the reader learns the methods of multi-criteria optimization for single-stage designs using the Microsoft Excel Solver, the SAS PROCs NLP and OPT-MODEL or the R package Alabama.

Chapter 6 introduces disposition codes and outcome rates following the standard definitions of AAPOR.

In Chapter 7 solutions to the multipurpose design of a survey introduced in Chapter 2 are suggested.

With Chapter 8, Part II of the book starts with a new project designing an area sample.

First the known formulae in the context of multistage samples are presented and then their use is illustrated by an example using a data set called Maryland area population. The authors elaborate the rules for designing primary sampling units. The Current Population Survey and other surveys serve as examples to explain the different concepts to the reader.

The important field of weighting starts with Chapter 13. Different reasons for the necessity of using weights are given, such as reducing the variance of estimators and to adjust for under-coverage by using appropriate auxiliary data. Different kinds of calibration techniques, including post-stratification, raking and the well-known GREG are introduced. Especially the GREG is illustrated by general examples.

Variance estimation serves to determine the precision of an estimator. Exact methods, linearization and replication methods are presented. The weighting part is completed by a detailed example.

Chapter 17 is the beginning of part IV "Other Topics" introducing multiphase designs that are helpful, i.e. in the case of non-respondent subsampling. In Chapter 18 process control and quality measures are discussed. Performance rates and several other indicators are evaluated as important quality control tools. Also, data editing and documentation as essential parts of a survey are mentioned.

The authors do not cover all topics in the context of sample surveys, e.g. handling of missing data or using multiple frame problems which nowadays are wide spread in telephone sampling.

At URL *https://umd.app.box.com/s/9yvvibu4nz4q6rlw98ac* there is a folder containing files that accompany the book. "Examples.zip" contains R-code for 65 examples in the Practical Tools book (updated 2014.10.24). Changes and updates to the PracTools Package (updated 2015.01.21) are in the "NEWS changes and updates.pdf". In the R package PracTools (February 19, 2015) one can find functions for sample size calculation for survey samples using stratified, clustered, and or one-, two-, and three-stage sampling designs. Other functions compute variance components for multistage designs and sample sizes in two-phase designs. However, they are built under R Version 3.1.3 and will be hopefully soon updated to newer versions of R. The different projects mentioned in the book can be found in "Projects.zip".

A special offer is that one can buy single chapters of the book via http://www.springer.com/de/book/9781461464488.

The book is very helpful for researchers, practitioners and all people designing a survey in practice, and does not just give the reader the formulae in the context of the sampling design and the estimators. The parts at the planning stage of a survey and the important quality control steps are often not mentioned in other textbooks. The abundance of examples helps the reader to understand the whole process. Thus, I can highly recommend this book.

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