Hong Kong WSC 2013 - Short Course programme
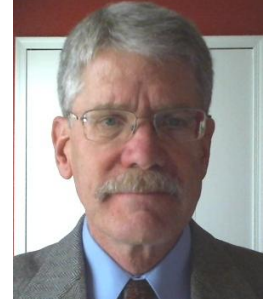
COURSE TITLE

Practical Tools for Designing and Weighting Survey Samples

DURATION

1 day

INSTRUCTOR 1

Richard Valliant, Ph.D., Research Professor, University of Michigan & University of Maryland, USA

BIOGRAPHICAL SKETCH

Richard Valliant has been a Research Professor at the University of Michigan and the Joint Program for Survey Methodology at the University of Maryland since 2003. He has over 35 years of experience in survey sampling, estimation theory, and statistical computing. He was formerly an Associate Director at Westat and a mathematical statistician with the Bureau of Labor Statistics where he worked on some of the major U.S. economic surveys. He is a fellow of the American Statistical Association and has been an associate editor of the *Journal of the American Statistical Association*, *Survey Methodology*, and the *Journal of Official Statistics*.

INSTRUCTOR 2

Jill A. Dever, Ph.D., Senior statistician at RTI International , Washington, DC, USA

BIOGRAPHICAL SKETCH

Jill A. Dever has worked as a survey researcher for more than 18 years in areas such as health care, education, and the U.S. military. Her experience includes creating software for optimizing complex sample designs; constructing linearization and replicate analysis weights using calibration techniques; and analysing data from complex surveys. Dr. Dever's current research focuses on variance estimation for calibration estimators with estimated control totals under a complex sample design, and techniques to evaluate the utility of non-probability sampling. Her programming experience includes R, SAS, and SUDAAN.

COURSE DESCRIPTION

A main goal of this short course and of the text that accompanies it is to give students tools that can be directly used to design single-stage and multi-stage samples in the real world. This includes deciding on a sample size given a specified budget, creating strata, allocating the sample to the strata given a set of constraints or requirements for detectable differences between group estimates, estimating variance components, and determining what sample sizes to use at different stages in a multi-stage sample. We will also cover software for calculating sample sizes, computing survey weights, and estimating variances.

SYLLABUS

The course will cover these topics:
- Determining sample sizes in single-stage samples
    - finding sample sizes based on targets for coefficients of variation and margins of error for key estimates
    - sample sizes in probability proportional to size sampling
    - finding sample sizes in stratified single-stage sampling
    - sample size determination when using general regression estimators
    - sample sizes based on power calculations
    - Calculations will be illustrated with functions in the PracTools package
- Mathematical programming (linear and nonlinear) to determine sample sizes for surveys having multiple estimation goals
- Designing area probability and other types of multistage samples
    - Variance component estimation in 2 and 3-stage samples
    - Sample sizes of first-, second-, and third-stage units
    - Methods of identifying certainty units

- Weighting
  - Base weights, adjustments for unknown eligibility, nonresponse adjustments, calibration to population control totals
- Variance estimation
  - Exact methods, linearization, replication (including jackknife, balanced repeated replication, and bootstrap)

Use of statistical software is an important feature of the short course and the recommended textbook. R®, SAS®, and Microsoft Excel® will all be used in examples. R is a freely available software system that has a core set of thousands of statistical functions and hundreds of specialized, user-written packages. One of these is the survey package which is geared toward the analysis of complex survey data. The R system and its add-ons are ideal for developing countries in Asia and elsewhere. Any statistician with Internet access can obtain the software and have access to the expert advice of its worldwide community of R users.

We have written a suite of functions in the R language for sample size calculation and other tasks, which will be available to the students on a website and also in an R package called PracTools. These functions perform specialized calculations that are not part of any standard statistical software. We will also provide examples using the R survey package of practical applications of calibration and variance estimation. Students will leave the course with a set of practical tools that, in conjunction with the recommended textbook, will enable them to do useful work in their home countries.

Recommended text:
Valliant, R., Dever, J.A., Kreuter, F. (2013). *Practical Tools for Designing and Weighting Survey Samples.* New York: Springer.

TARGET AUDIENCE

Professional statisticians, social scientists, and economists who have some familiarity with applied sampling and survey design and want more in-depth knowledge of sample size determination in complex samples, survey weighting, and variance estimation methods.