Understanding and tackling measurement error: A review of modern practical methods

Abstract Number:

1502

Submission Type:

Professional Development Course/CE

Participants:

Pamela Shaw (1), Paul Gustafson (2)

Institutions:

(1) Kaiser Permanente Washington Health Research Institute, N/A, (2) University of British Columbia, N/A

Co-Instructor:

Paul Gustafson
University of British Columbia

Primary Instructor:

Pamela Shaw
Kaiser Permanente Washington Health Research Institute

Description:

Measurement error and misclassification of variables are frequently encountered in epidemiological and clinical research and involve variables of considerable importance in public health, such as dietary intakes, physical activity, smoking, and environmental pollutants. Further, the rising interest in research with electronic health records has brought new challenges and renewed interest in robust and practical methods to address error prone exposures and outcomes. The overall objective of this course is to introduce the issues raised by measurement error and the implementation of practical analysis approaches to mitigate its effects. The course will begin with a discussion of the effects of measurement error in regression analyses, then move to techniques for mitigating those effects via statistical analysis and study design. Analytical methods discussed include regression calibration, simulation extrapolation (SIMEX), likelihood-based methods, and Bayesian methods. The emphasis will be on practical application and worked examples will be used throughout. The course will incorporate formal lectures as well as practical sessions in which participants will work through a series of real data examples using R software.

Instructor Background:

Pamela Shaw is a Senior Investigator in the Biostatistics Division at the Kaiser Permanente Washington Health Research Institute. Dr. Shaw has a robust research record in measurement error methods, particularly methods to address non-differential error in survival analyses, and has applied these methods to epidemiologic studies from the Hispanic Community Health Study and other cohorts. She has a particular interest in electronic health records data and nutritional and physical activity epidemiology.

Paul Gustafson is Professor of Statistics at the University of British Columbia. Dr. Gustafson is an established leader in measurement error methods, with application across many areas in epidemiology, public health and biostatistics. His methods work in measurement error stems from his overall research focus on how to extract information from difficult data and has made methods contributions in Bayesian analysis, partial identification, and causal inference.

Course Outline:

1. Introduction to measurement error and its effects
2. Regression Calibration
3. Simulation Extrapolation (SIMEX)
4. Practical worked examples + R exercises: Session 1
5. Special considerations for categorical variables
6. Bayesian methods for measurement error correction
7. Practical worked examples + R exercises: Session 2
8. Outcome and other types of measurement error
9. Considerations for Design
10. Concluding remarks

Participants should be familiar with regression analyses, including linear, logistic and survival models. Experience with R software is also recommended. To participate in the practicum, participants need to bring a laptop with base R loaded.

Learning Outcomes:

Learning Objectives:
After successful completion of this course, students will be able to:
1. Recognize the impact of different types of error-in-variables on target parameters in regression analyses, as well as statistical power
2. Be able to apply established techniques to mitigate measurement error, including regression calibration and SIMEX
3. Have a good understanding on how to apply more advanced techniques, including likelihood-based and Bayesian methods
4. Be familiar with available resources, including software, to conduct measurement-error adjusted analyses

Sponsors:

Biometrics Section [1]
Section on Statistics and the Environment [3]
Section on Statistics in Epidemiology [2]

Do you need additional equipment for your course?

No

Length of Course (pick 1)

Full Day Course