

measurement ERROR webinar series

Assessing diet-health relationships with FFQ: focus on dietary components consumed daily by nearly all persons

(Webinar 7)

Objectives:

- Identify challenges in estimating diet-health relationships caused by measurement error in dietary assessment, with a focus on components consumed nearly daily by nearly all persons.
- Describe approaches to correct estimated diet-health relationships for bias due to measurement error when diet is assessed by a food frequency questionnaire.
- Understand the role of calibration studies in assessing and correcting for measurement error in dietary instruments.

Recommended resources:

- Carroll RJ, Ruppert D, Stefanski LA, Crainiceanu CM. Measurement error in nonlinear models: a modern perspective, 2nd edition. Boca Raton, FL: Chapman and Hall CRC Press; 2006. Chapter 4, Regression calibration.
- Freedman LS, Schatzkin A, Midthune D, Kipnis V. Dealing with dietary measurement error in nutritional cohort studies. *J Natl Cancer Inst.* 2011;103:1086-1092.
- Kipnis V, Subar AF, Midthune D, Freedman LS, Ballard-Barbash R, Troiano RP, Bingham S, Schoeller DA, Schatzkin A, Carroll RJ. Structure of dietary measurement error: results of the OPEN biomarker study. *Am J Epidemiol.* 2003;158(1):14-21; discussion 22-6.
- Rosner B, Spiegelman D, Willett WC. Correction of logistic regression relative risk estimates and confidence intervals for measurement error: the case of multiple covariates measured with error. *Am J Epidemiol.* 1990;132(4):734-45.
- Rosner B, Willett WC, Spiegelman D. Correction of logistic regression relative risk estimates and confidence intervals for systematic within-person measurement error. *Stat Med.* 1989;8(9):1051-69; discussion 1071-3.

Key terms:

Attenuation factor

The multiplicative factor by which an estimate of a regression coefficient is shrunk due to measurement error in a covariate.

Calibration equation

An equation for predicting a true covariate value (for example, usual dietary intake) given all of the observed covariates in a regression model; usually developed from data gathered in a calibration substudy.

Calibration substudy	A small-scale study performed to enable calibration of the main study instrument using a reference instrument; data from the substudy are used as the basis for regression calibration. Such studies can be conducted either as external calibration or internal calibration.
Confidence interval	A range in which, for a specified degree of assurance, the true value of the parameter lies.
Contamination factor	A value that indicates the magnitude of residual confounding in a regression model with multiple exposures measured with error.
De-attenuation	The process of statistically adjusting the estimated relationship between an outcome and a covariate measured with error to remove bias toward the null.
Exposure	A potential determinant of a health or disease outcome; often a substance in the environment (for example, air pollution) or a personal habit (for example, dietary intake, smoking).
Food frequency questionnaire (FFQ)	A dietary instrument that asks respondents to report their usual frequency of consumption of each food in a list of foods over a specific period of time.
Linear regression	A statistical model that relates a dependent variable (for example, an outcome) to one or more independent variables (for example, exposures).
Logistic regression	Statistical model that relates a binary outcome to one or more independent variables, using the logit link.
Nonepisodically consumed dietary components	A term describing nutrients and foods that are consumed nearly every day by nearly everyone in the population and whose intake may therefore rarely, if ever, be reported as zero on a particular day.
Null hypothesis	An assertion that two or more groups do not differ in the measure of interest or that exposure is not associated with the health outcome under study.
Odds ratio	A statistical measure that quantifies the association between an exposure and a health outcome; often used in case-control studies.
Power	The probability that a test correctly rejects the null hypothesis when the alternative hypothesis is true.

Reference dietary instrument	An instrument that is administered in a substudy and is used to calibrate or validate the main or study instrument; examples include recovery biomarkers. The reference instrument is assumed to provide estimates that are closer to truth than the main instrument.
Regression calibration	A statistical method for correcting estimated regression coefficients for bias due to measurement error in one or more continuous covariates.
Standard error	The standard deviation of the sampling distribution of an estimated population parameter; used to assess the precision of an estimate.
Twenty-four-hour dietary recall (24HR)	A dietary instrument that requires the respondent to remember and report all foods and beverages consumed in the preceding 24 hours or during the preceding day.