In many surveys, imputation procedures are used to account for nonresponse bias induced by either unit nonresponse or item nonresponse. In this lecture, we will discuss multiple imputation methods, whereby missing data values are filled in more than one time in to create multiple completed data sets. These completed data sets are then analyzed using so-called combining rules in order to obtain valid inference.

We will start by motivating the use of multiple imputation through a worked example, which provides an intuitive rationale behind the use of multiple rather than single imputation. We will then review the theoretical underpinnings of multiple imputation, originally developed by Rubin in the context of missing data in sample surveys. How single imputation methods may have to be altered to provide valid multiple imputation inference will be discussed. We will also discuss the important relationship between the imputation model and the analysis (substantive) model.

Missing data can occur throughout a data set, and often occur in what has been referred to as a “Swiss cheese” missingness pattern. We will review two general multiple imputation approaches that have been proposed to handle such sporadic missingness: joint modeling and fully conditional specification (also referred to as multiple imputation by chained equations).

While many implementations of multiple imputation require an assumption of multivariate normality, many establishment surveys collect data that clearly violate this assumption. We will illustrate alternative multiple imputation methods, including adaptations of ratio imputation, hot deck imputation, and predictive mean matching, that can be used when a normality assumption is questionable.

Multiple imputation has grown in popularity and is now widely available in a range of statistical software packages. Throughout this lecture we will illustrate the use of MI methods in standard software.