# CORRECTION OF BIAS FROM NON-RANDOM MISSING LONGITUDINAL DATA USING AUXILLARY DATA

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A very common problem in longitudinal studies is that persons who are lost to follow-up would perform more poorly on outcome measures if they had been tested than the persons not lost to follow-up. This non-random missingness creates bias in the estimation of rates of change in the outcome. Likelihood-based mixed effects models for longitudinal data give valid estimates when the data are missing at random (MAR), an assumption that is untestable without further information, and is unlikely to be valid. In some studies, additional auxiliary information known to be correlated with the outcome of interest might be available when the outcome of interest is missing; such additional data allows the MAR assumption to be tested and can be used to reduce or eliminate bias when the missing data process depends on the unobserved outcome only through the auxiliary information and the observed outcome. We apply and compare three methods of utilizing the additional information: multivariate longitudinal analysis, multiple imputation, and using the auxiliary information as covariates. Simulations show that the three methods not only eliminate the bias when the missingness depends on the unobserved outcome through the auxiliary information, but also reduce the bias compared to regular mixed model when the missing data process further depends on the unobserved outcome. Finally, we demonstrate the use of these methods using telephone cognitive assessments to correct for missing longitudinal cognitive data in the Einstein Aging Study, primary care provider assessments to correct for missing longitudinal cognitive data in a study of dementia screening in primary care practice, and telephone gait questionnaires to correct for missing longitudinal gait assessments in a gait study.