MULTILEVEL MODELS FOR INTENSIVE LONGITUDINAL DATA WITH HETEROGENEOUS ERROR STRUCTURE: COVARIANCE TRANSFORMATION AND VARIANCE FUNCTION MODELS

Seungmin Jahng

Dr. Phillip K. Wood, Dissertation Supervisor

ABSTRACT

Recent developments in data collection methods in the behavioral and social sciences, such as Ecological Momentary Assessment (EMA) enables researchers to gather intensive longitudinal data (ILD) and to examine more detailed features of intraindividual variation of a variable(s) over time. Due to its high intensity of assessments within individuals, ILD often has different characteristics from traditional longitudinal data with a few measurement occasions and requires different assumptions of statistical models in use. In the present thesis, issues in the analysis of ILD and problems of current use of statistical models for the analysis of ILD are discussed and investigated. Specifically, the issue of heterogeneity of autocorrelation and variance across individuals in ILD is extensively studied for multilevel models (MLMs). In chapter 2, a brief introduction to multilevel models and issues in modeling residual covariance structure in MLMs are provided and discussed. In chapter 3, it is shown that bias in estimation of parameters in MLMs under homogeneity assumption is not ignorable when autocorrelation differs across individuals and its average is high. It is also shown that a transformation method, which multiplies variables in the model by the inverse of Cholesky factor of individual-specific error covariance, attenuates the bias for ILD. Chapter 4 reviews variance function models for heterogeneous variance and introduces a two-step MLM approach for modeling heterogeneous variance using squared residuals. A simulation study showed that the two-step MLM does not suffer from non-convergence and is applicable to ILD.