# Generalized linear mixed models based on latent Markov heterogeneity structures

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**Abstract**

Latent Markov models (LM) can be seen as a flexible device for taking into account time-varying subject-specific unobserved heterogeneity. In the basic LM, a random intercept is flexibly allowed to evolve over time. The available formulations of mixed LM often assume that any additional random effect is time-constant, with few specific exceptions. In this work we formulate a mixed latent Markov model in which all random effects may freely evolve over time. The size of the parameter space is controlled with the possibilities of assuming block independence of random effects, and/or that groups of random effects may share some or all aspects of their distribution. Parameter estimation is carried out with a simple expectation maximization strategy, analogous to that used for the basic latent Markov model, after an adaptation of the usual forward backward recursions and a parsimonious representation of the expected complete likelihood. Standard errors are derived using Oakes' identity. Dependence among random effects is summarized using Watanabe's total correlation and described with log-odds ratios and higher-order log-linear interactions. We illustrate with an original application to the relationship between health literacy and depression in a panel of adolescents. In this example subjects are clustered in schools, which leads to high-dimensional multivariate time-varying random effects.

*url: http://www.farmaciamedicina.uniroma1.it/?s=docenti&cognome=208