Hierarchical Bayesian Overdispersion Models for Non-Gaussian Repeated Measurement Data

Mehreteab Aregay[1]   Ziv Shkedy[2]   Geert Molenberghs[1,2]

[1] *I-BioStat, Katholieke Universiteit Leuven, B-3000 Leuven, Belgium*

[2] *I-BioStat, Universiteit Hasselt, B-3590 Diepenbeek, Belgium*

Abstract

Overdispersion is a common phenomenon in non-Gaussian outcomes (binomial, count and time to event data) but not for i.i.d binary data. For repeated measurement of these data, both overdispersion and correlation between the repeated measurements can occur at the same time though the overdispersion is a weak phenomenon for correlated binary data. This paper focuses on how we can handle these two issues simultaneously during modeling. To this end, two separate random effects were used, one for the correlation and the other for the overdispersion not already accommodated. The second random effect, which accounts for the overdispersion, was introduced either additively to the linear predictor or as a multiple factor in the mean level. These models were implemented in a real life data and compared using a simulation study as well. Moreover, the impact of misspecification of the generalized linear model and generalized linear mixed model for hierarchical and overdispersed data was studied using real life problems and simulation study.

Some Keywords: Overdispersion; Additive model; Multiplicative model; Generalized linear model; Generalized linear mixed model.