TYPE I AND TYPE II ERROR UNDER RANDOM-EFFECTS MISSPECIFICATION IN GENERALIZED LINEAR MIXED MODELS

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Generalized linear mixed models (GLMM) have become a powerful parametric tool for the analysis of non-Gaussian longitudinal data. Estimation is based on maximum likelihood theory which assumes that the underlying probability model determining the behavior of the event investigated is correctly specified. Since random effects are unmeasurable, the accuracy of this assumption is difficult to check. So naturally we are concerned with the effect of misspecifying the random-effects distribution on the properties of the maximum likelihood estimators.

In the present work we have used simulations with a logistic random-intercept model to study the impact of misspecifying the random-effects distribution on the type I and II errors of the tests for the mean structure in GLMM. We found that the misspecification can either increase or decrease the power of the tests, depending on the shape of the underlying random-effects distribution. This makes it very difficult to interpret negative results, i.e., do we fail to reject the null hypothesis because there is no real treatment effect or because of a lack of power? Additionally, we obtained in our simulation study that the type I error rate seems to be maintained around 5% in all the considered scenarios. These findings have led to a theoretical result which states that, whenever a subset of fixed-effects parameters, not included in the random-effects structure and independent from the other covariates in the model, equals zero, the corresponding maximum likelihood estimator will consistently estimate zero. This implies that under certain conditions a significant effect could be considered as a reliable result, even if the random-effects distribution is misspecified.