Hierarchical Likelihood for Longitudinal Count Data

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Generalized linear mixed models are a common tool in statistics, extending generalized linear models to situations where data are hierarchically clustered or correlated. However, likelihood estimation in random effect models is often complicated because the marginal likelihood involves an analytically intractable integral. An alternative is the use of Lee and Nelder's (1996) hierarchical likelihood, which avoids such burdensome numerical integration. One of the merits of h-likelihood is that it leads to reliable estimators using a Laplace approximation to the marginal likelihood with an additional adjustment to the measures of precision to accommodate the estimation of the fixed effects parameters. In addition, different parametric families can be assumed for the random effects. In this work we adopt h-likelihood methods to provide an alternative approach to the analysis of longitudinal count data with the possibility of inclusion of random effects to deal with overdispersion and perhaps serial correlation. The concept and definition of h-likelihood is reviewed and we provide an extension to correlated random effects allowing not only population heterogeneity but also a measure of association. Simulation results suggest good performance, although high variability can be noticed in the standard error estimate of the correlation parameter when there is a small amount of heterogeneity. Finally we present an application of this approach using a longitudinal study to evaluate the impact of periodic vitamin A supplementation on diarrhoea and acute lower respiratory infection (ALRI).