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Flexible Random Effects Copula Models for Clustered Mixed Outcomes – Application in Toxicology

We employ random effects models to analyze clustered mixed-outcomes and account for associations between discrete and continuous outcomes within clusters. The regression parameters in models for both outcomes are marginally meaningful; in addition, by assuming a latent variable framework to describe discrete outcomes, complications of copulas to discrete variables are avoided. The marginal distributions can be chosen from any distributions. Maximum likelihood estimation is implemented using SAS. Results of simulations concerning the bias and efficiency of the estimates are reported. The proposed methodology is motivated by and illustrated using a developmental toxicity study of ethylene glycol in mice.