Appraising the aptness of GEE models for longitudinal binary data via graphical and numerical methods

K.C. Lin[1*] and Y.J. Chen[2]

[1] *Professor, Department of Business Administration, Tainan University of Technology, Taiwan; t20053@mail.tut.edu.tw.*
[2] *Associate Professor, Department of Statistics, Tamkang University, Taiwan; ychen@stat.tku.edu.tw.*
[*] *Presenting author*

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Longitudinal binary data are pervasively utilized in a variety of fields, and commonly fitted by the generalized estimating equations (GEE) approach. We develop two graphical methods and one numerical goodness-of-fit test for appraising the aptness of GEE fitted models under independent and unstructured working correlation matrices. Two graphical approaches are marginal model plots (MMP) and local mean deviance methods (LMDP). A goodness-of-fit test based on nonparametric smoothing approach is provided. Moreover, the estimations of mean and standard deviation functions in the MMP procedure are employed the kernel smoothing technique, and the number of groups is determined by hierarchical clustering method in the LMDP procedure. Two real data sets are used to demonstrate the application of the numerical and graphical approaches. The results show that the models are adequate by utilizing the numerical goodness-of-fit test based on both independent and unstructured working correlations. Furthermore, the graphical LMPD procedure offers more visual plots to depict that the unstructured working correlation is more adequate for the feature of data, and the MMP procedure furnishes the detailed plots for the model with or without particular covariates.