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GENERALIZED GAMMA REGRESSION MODELS WITH APPLICATION TO CD4 CELL COUNTS DATA OF AIDS PATIENTS

ADEKANMBI D.B

Research Scholar, Department of Statistics, LADOKE Akintola University of Technology,
Ogbomoso, Oyo-State, Nigeria

ABSTRACT

The gamma regression model is a sensible choice of model to analyze responses that are continuous, skewed and take on only positively valued integer outcomes with constant coefficient of variation; of which CD4 cell counts of AIDS patients is a type. CD4 counts may vary by level of formal education, gender, marital status and age of AIDS patients. A detailed theoretical framework of gamma regression was given in this study, and applied to retrospective data set of AIDS patients to determine the relationship between the risk factors and CD4 count of the AIDS patients. Three gamma regression models were considered with three different links for the mean, namely: log, identity and inverse. The choice of link function for the gamma regression is very critical to the accuracy of the model. There appears to be a linear positive effect of sex, level of education, and marital status and a negative effect of age variable on the CD4 counts of the AIDS patients. All the three models showed significant positive impact of sex on the CD4 counts of AIDS patients. The difference between log link and identity link was minimal. The gamma regression model with inverse link function fits poorly, while gamma regression models with an identity link seems to provide a more precise fit to the AIDS data, and was therefore preferred. The result showed that older patients have reduced CD4 cell counts compared to the younger AIDs patients, while males generally have higher CD4 counts than females. However, all the three gamma regression models failed to capture the nature of the observed distribution of the CD4 cell counts. The models were evaluated by the comparison of their deviances and the Akaike Information criterion. Diagnostic evaluation of the models revealed no major problem in the models, except for a few non-influential outlets that were identified. Based on the visual and empirical evidences; the fit of the reciprocal model is therefore preferred for modeling the AIDS data. The results of this study have the potential to be useful for health workers attempting to determine factors associated with improved health of AIDS patients, and for policy makers who are interested in costs and outcomes associated with treatment of AIDS patients.

KEYWORDS: Acquired Immune Deficiency Syndrome, CD4 Cell Count, Gamma Regression, Link Functions, Akaike Information Criterion (AIC)