Joint Modelling of Dengue Data using a Semi Parametric Survival Response and a Parametric Count Response

H. H. M. Hettiarachchi[1]*, M. R. Sooriyarachchi[1]

[1] Department of Statistics, Faculty of Science, University of Colombo, Sri Lanka

* himashamuvindi.info@gmail.com

In Sri Lanka, dengue has become an increasing health concern in the recent past. The spread of Dengue is influenced by the living surroundings. Therefore the dengue data are related to the climate and also correlated within districts as the weather is similar within a district. The survival time of a patient and the incidences of the disease (count) are frequently encountered phenomenon in medical studies that can be related to each other. Therefore, it is important to give attention to Dengue survival time and Dengue count simultaneously, because these can provide interesting and improved results, rather than modelling survival time and count data separately, while considering the multilevel structure of a district cluster effect. The objective of this study is to perform a joint modeling of survival time and count. A semi-parametric method for modelling the survival data is preferred as it is often difficult to determine the survival distribution, and there is also censoring of the observations. Hence, a frailty piecewise constant proportional hazard semi-parametric model with approximated baseline hazard was preferred to model the survival response. As log of counts are normally distributed, the normal model is preferred as the count sub model. The literature does not contain joint modelling of survival time and the count using the above mentioned sub models, and therefore this is an added novelty of this study. For this study, data recordings on dengue patients all over Sri Lanka from 2006 to 2008 have been used. As explanatory variables, there were the climate variables rainfall, temperature, and humidity with their first and second lag values, as well as Year, Quarter, Outcome, Age, Sex, Classification and Expected Exposed. Districts are considered as clusters. The performance of the proposed joint models is compared with univariate fixed effect models that can be fitted separately for the two responses. According to the model fit statistics which are -2 log likelihood, AIC, AICC and BIC values, the performance of the joint model was superior to the separate univariate models.

Keywords: Survival Semi Parametric Modeling, Dengue, Piecewise Proportional Hazard