Joint Multilevel Discrete Competing Risk with Continuous Outcome via Bivariate Copula model – Application to a Dengue Epidemiology Study, Sri Lanka

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The Competing risk is a special branch of medical research where multiple events can happen. It can encompass the joint modeling approach for dengue epidemiology to model the relationship in different destinations of the length of stay and platelet count. Also, the district effect is an inherent feature of dengue highly associated with climate change. Therefore, this leads to the joint multilevel approaches for analyzing the length of stay of a dengue patient and platelet count in different destinations. Here, length of stay is in discrete form and platelet count is in continuous form. The joint modeling is done through a copula model with the formation of multilevel utility models for discrete competing risk response (length of stay in different destinations) and a multilevel linear regression model for platelet count. The within and between-study variability models are joined through random effects. The fitted model indicated that the white blood cell (WBC) count, year, and sex are the only associated factors for the platelet count and time indicators, age, classification, temperature, and rainfall have a significant impact on the rate of a discharging patient, and only time indicators and classification were significant for death rate in the joint model. Moreover, the joint model yielded more precise results than the univariate model.

Keywords: Multilevel Competing risk, Utility models, Copula