

# Modeling multiple type count data with dependent observation times: An application to skin cancer prevention study

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In this study we consider there are various types of recurrent events and the total number of occurrences are collected at the random observation times. It has concerned that the observation process may not be independent to the multivariate event processes, hence the total counts and observation times may be correlated and the dependence may exist among different types of the event processes as well. Many methods have developed nonparametric models to accommodate such unknown structures; however, it is difficult to assess and directly quantify their correlation relationships. A multivariate frailty model is proposed to this study, in which the event and observation processes are linked by frailty variables whose joint distribution can be implicitly specified through the multivariate normal distribution with some unknown covariance matrix. The Bayesian inference method is conducted to obtain the estimates of the regression parameters. In addition, we use a form of trigonometric functions to represent the covariance matrix, so that it meets the positive-definiteness condition efficiently during the estimation schemes. The simulation studies demonstrate the utility of the proposed models and a skin cancer prevention study is used to illustrate application of the methodology.

**Keywords:** Bayesian analysis, Covariance matrix, Multivariate count data, Multivariate frailty model, Observation process