Public Abstract
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For many datasets, multiple variables measured on (possibly differing) geographical units are available. We wish to simultaneously model both 1) the spatial relations within each variable, and 2) the relations between variables. Unlike other approaches to constructing multivariate generalizations of an existing model, the CAR model, we instead require that each marginal distribution is an ordinary, univariate CAR model. The method is based on transforming each variable to a variable that is marginally standard normal, but with a cross-covariance matrix between each pair proportional to a fixed region "overlap matrix" analogous to an adjacency matrix. This method allows the possibility that the geographies of each variable differ from each other, but at the disadvantage of a set of conditions to ensure positive definiteness that quickly become cumbersome as the number of variables increases.

The remainder of this work describes the advantages and consequences of incorporating an Imprecise Probability Model into the analysis of competing risks data with masked failure types. Competing risks data arises when we are analyzing the time to a failure or death and multiple types of failure can occur, for example, when analyzing time until death, the cause of death may be heart attack, stroke, etc. Masking of failure types occurs when we have only partial information about what kind of failure occurred. Using an imprecise probability model can be interpreted either in terms of the theory of imprecise probability models directly, or less controversially, in terms of Bayesian sensitivity analysis where the imprecise probability model is viewed as a method of making Bayesian inferences more robust against prior assumptions. Modeling competing risks data with masked failure types is complicated by the unidentifiability of the model, that is, distinct values of the unknown components of the model result in the same likelihood of the observed data, leading to difficulty in estimating those unknown parameters. This has been handled previously by making restrictive identifying assumptions about the parameters or by specifying a proper Bayesian prior on the unidentified components. Both of these approaches suffer from making untestable modeling decisions which affect the inferences made. The approach of the proposed model uses an imprecise probability model to avoid such decisions about the unidentified components.