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Space and Time Modeling of Child Mortality rates in a Developing country: A case study of Nigeria DHS data

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Abstract

In this presentation, we discuss Bayesian spatio-temporal modeling strategies for analyzing a large number of mortality outcomes with the aim of providing a guideline for epidemiologists and public health researchers to choose a reasonable model for estimating mortality (or incidence) risks. Maps displaying the crude mortality rates or standardized mortality rate (SMR) or ratios are usually misleading because of the instability of the estimators in areas with small population sizes. Areas having small population size do vary greatly, which is compounded by the variability in the observed cases making it usually higher than expected value leading into over dispersion. Overdispersion can be mainly due to spatial autocorrelation, unstructured heterogeneity or to a combination of these two, and also, when studying very rare diseases, and often encounter an excess of zeros in the data. The existing literature has suggested many smoothing methods based on Poisson inference by accounting for the extra-Poisson variation by incorporating random effects. In the study, we formulated models with spatially structured and unstructured random effects, correlated time effects, time varying confounders and space-time interaction terms. All model parameters were implemented using integrated nested Laplace approximation (INLA) and the smoothed SMR maps were produced. The model performance and predictions were evaluated using predictive measures such as Deviance information criterion (DIC) and Conditional Predictive ordinates (CPO). The proposed models are illustrated using mortality data extracted from the Nigeria Demographics and Health Survey of 2008 and 2013.

KEY WORDS: Bayesian methods, Geographical inequalities, child health outcomes, Small area estimation and spatial epidemiology

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