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Spatial-temporal analysis of the of the risk of Rift Valley Fever in Kenya

B. Bett, A. Omolo, F. Hansen, A. Notenbaert, and S. Kemp
International Livestock Research Institute, P. O. Box 30709-00100, GPO, Nairobi.

Historical data on Rift Valley Fever (RVF) outbreaks in Kenya covering the period 1951 – 2010 were analyzed using a logistic regression model to identify factors associated with RVF occurrence. The analysis used a division, an administrative unit below a district, as the unit of analysis. The infection status of each division was defined on a monthly time scale and used as a dependent variable. Predictors investigated include: monthly precipitation (minimum, maximum and total), normalized difference vegetation index, altitude, agro-ecological zone, presence of game, livestock and human population densities, the number of times a division has had an outbreak before and time interval in months between successive outbreaks (used as a proxy for immunity). Both univariable and multivariable analyses were conducted. The models used incorporated an auto-regressive correlation matrix to account for clustering of observations in time, while dummy variables were fitted in the multivariable model to account for spatial relatedness/topology between divisions. This last procedure was followed because it is expected that the risk of RVF occurring in a given division increases when its immediate neighbor gets infected. Functional relationships between the continuous and the outcome variables were assessed to ensure that the linearity assumption was met. Deviance and leverage residuals were also generated from the final model and used for evaluating the goodness of fit of the model. Descriptive analyzes indicate that a total of 91 divisions in 42 districts (of the original 69 districts in place by 1999) reported RVF outbreaks at least once over the period. The mean interval between outbreaks was determined to be about 43 months. Factors that were positively associated with RVF occurrence include increased precipitation, high outbreak interval and the number of times a division has been infected or reported an outbreak. The model will be validated and used for developing an RVF forecasting system. This forecasting system can then be used with the existing regional RVF prediction tools such as EMPRES-i to downscale RVF risk predictions to country-specific scales and subsequently link them with decision support systems. The ultimate aim is to increase the capacity of the national institutions to formulate appropriate RVF mitigation measures.