

Developing a model to show the potential impact of weather patterns on dengue disease and vector densities

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The emergence and re-emergence of dengue epidemics have suggested the influence of weather patterns on dengue vector density (*Aedes aegypti* and *Aedes albopictus*) and epidemiology of dengue disease. Understanding of weather patterns on dengue vector densities, therefore, is crucial in optimizing vector control strategies. The objective of the present study was to understand the relationship between dengue vector density and the weather variability to develop a model to show the association between weather variability, vector density and dengue cases.

Data collection was done monthly in Kaduwela MOH division from 2009 to 2011. The vector densities (Breteau index) were determined by larval surveys. The data set contained 36 observations with 5 variables (monthly: rainfall, humidity, temperature and number of rainy days). There was a significant correlation between number of rainy days during a month with rainfall ($r=0.685$), humidity ($r=0.655$) and vector density ($r=0.655$) as well as between monthly rainfall and humidity ($r=0.737$). The monthly average temperature, however, did not show a significant correlation with other variables.

Random sample of 30 observations were selected to fit a multiple linear regression model to predict the vector densities. The model with all predictor variables indicated the existence of multicollinearity. Hence, the stepwise regression method was used to find the best model. Simple linear regression model with the predictor: number of rainy days during month, was selected as the best model (R^2 36.56%). After transform response variable (vector density) with Box-cox transformation, the resulting model showed a significant improvement in R^2 (45.63%). This model was used to predict the vector densities of left-out six observations and the actual values were well within the 95% prediction intervals. The validation of the model did not indicate any violation of model assumptions. The results of this study, therefore, suggest that unobservable factors other than observed variables may account the total variability of monthly vector density. Future studies will focus on developing predictive models to forecast weather induced dengue epidemics in Sri Lanka.