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The long term association between dengue incidence and the climate

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Background: The dengue incidence in Sri Lanka closely resembles the climatic variation of the country. However, climatic conditions have not accurately been incorporated into models to predict dengue incidents.
Objective: Hence the objective of the study was to develop a statistical model to explain the long term association of dengue incidence with the climate.
Method: The monthly reported number of dengue cases, temperature, rainfall, and humidity data were collected for Colombo District for the period 2009 to 2018 from the Meteorological department. The Multivariate Vector Error Correction (VEC) model was used to characterize the joint behaviour of variables.
Results: The Johansen's Multivariate Co integration test indicated that variables move together in equilibrium in the long run. Granger causality indicated a long run causality running from temperature, relative humidity and rainfall, and the Chi square test indicated short run causality for same climatic factors to cases. The coefficients of temperature, relative humidity and rainfall gave an indication of a strong and a negative relationship with number of dengue cases at a significance level of 0.05. Serial autocorrelation and heteroscedasticity was not detected among residuals. Mean absolute percentage error (MAPE) was 2.65. The model can be stated as;

$$(\Delta Case_t) = (cases_{t-1}) - 9.27 * (rainfall_{t-1}) - 596.077 * (temperature_{t-1}) - 102.89 * (relative\ humidity_{t-1}) + 25440.36$$

Conclusion: The selected set of variables representing weather does have a long term equilibrium relationship with the number of dengue cases. The VEC model suggests that present number of dengue cases is significantly influenced by the immediate past values (one month) of number of dengue cases, temperature, relative humidity and rainfall. The findings of the research are in par with the previous findings with different models. However, the residual diagnostics indicate that the current VEC model is better at explaining the association between the climatic variables and the number of dengue cases. Furthermore, this model can be used to forecast the number of dengue cases in order to minimize the disease burden.