Climate change and communicable disease in Taiwan

Abstract:

Extreme weather conditions are becoming more intense and are likely to become more frequent as global climate changes. For epidemiologists, one important aspect of these trends is their impact on the spread of infectious disease. In this paper, we apply a retrospective study to examine relationships between Dengue fever cases and meteorological variables and try to build a predictive model.

This study uses the weekly Dengue fever cases and meteorological data in Taiwan from 1999 to 2005. In all 6,342 indigenously confirmed cases of Dengue fever, women account for 53.4% (3,384 cases) and the male versus female case sex ratio is 0.87. Average ages of Dengue fever cases are 46.4 years old and average incidence rate is 4.0 out of 100,000 persons. Average incidence rate increases with age. The most serious breakout was in 2002. 5,336 cases occurred in that year alone, which account for 84.1% of all cases. And 94.5% of the cases from 1999 to 2005 (5,996 cases) occurred in the southern tip of Taiwan: Kaohsiung city, Kaohsiung county, and Pingtong county (hereafter, KKP area).

The KKP area enjoys the highest annual average temperature and annual average insolation rate in Taiwan, which are 25.2 degrees Celsius and 52.3% respectively. This study finds a time lag between meteorological factors and the occurrence of Dengue fever cases. Among the meteorological factors examined, weekly average relative humidity, weekly percentage of rainy day, and weekly average insolation rate are found to be significantly related to the weekly occurrence of Dengue fever cases. This finding is based on two multiple regression models. With the exception of weekly average temperature, which exhibits different time lags, six weeks vs. nine weeks, all other meteorological factors show consistent and significant effect on the occurrence of Dengue fever cases. These two models explain 0.420 to 0.425 of the variance. Controlling for other variables, weekly number of Dengue fever cases will decrease 1 to 2 cases if El Nino occurs.

This study finds: Global climate events (El Nino/La Nina), and regional weather conditions such as average relative humidity, percentage of rainy day, percentage of rainy day with a ten-week lag, average insolation rate with a two-week lag, average temperature with a six-week or nine-week lag are important predictors of Dengue fever case occurrence. These two models will facilitate preliminary predictions of future Dengue fever case occurrence.

Key word: Climate change, El Nino, La Nina, Surveillance, Dengue fever