



Global Seasonal Influenza Epidemics and Climate

James Tamerius

Environmental Health Sciences, Columbia University, New York, USA

Recent evidence suggests that low specific humidity conditions facilitate the transmission of the influenza virus in temperate regions and result in annual winter epidemics. However, this relationship does not account for the epidemiology of influenza in tropical and subtropical regions where epidemics often occur during the rainy season or transmit year-round without a well-defined season. We assessed the role of specific humidity and other local climatic variables on influenza virus seasonality by modeling epidemiological and climatic information from 78 study sites sampled globally. We substantiated that there are two types of environmental conditions associated with seasonal influenza epidemics: “cold-dry” and “humid-rainy”. For sites where monthly average specific humidity or temperature decreases below thresholds of approximately 11-12 g/kg and 18-21 °C during the year, influenza activity peaks during the cold-dry season (i.e. winter) when specific humidity and temperature are at minimal levels. For sites where specific humidity and temperature do not decrease below these thresholds, seasonal influenza activity is more likely to peak in months when average precipitation totals are maximal and greater than 150 mm per month. Based on these findings, we develop Susceptible-Exposed-Infected-Recovered-Susceptible (SEIRS) models forced by daily weather observations of specific humidity and precipitation that simulate the diversity of seasonal influenza signals worldwide.