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El Niño-Southern Oscillation and dengue early warning in Ecuador

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Dengue fever, a mosquito-borne viral disease, is one of the most important emerging tropical diseases. Dengue is hyper-endemic in coastal Ecuador, where all four serotypes co-circulate. The El Niño-Southern Oscillation (ENSO) influences climate in Ecuador, with positive phase ENSO (El Niño) associated with wetter and warmer conditions over the southern coastal region. In turn, greater rainfall increases the availability of mosquito breeding sites for the dengue mosquito (Aedes aegypti), while warmer temperatures increase rates of larval development, mosquito biting, and viral replication in the mosquito. We report a statistical model for assessing the importance of climate as a driver for inter-annual variability in dengue fever in southern coastal Ecuador. Climate variables from a local meteorology station (precipitation, number of rainy days, minimum/maximum/mean air temperature), combined with gridded climate products, and anomalies of Pacific sea surface temperatures (Oceanic Niño Index, ONI) were used to predict monthly dengue standardized morbidity ratios (SMR) (1995-2010). Non-climatic confounding factors such as serotype introduction and vector control effort were also considered. Preliminary results indicated a statistically significant positive association between dengue risk and the number of rainy days during the previous month. Both the number of rainy days and dengue SMR were positively associated with the Pacific SST anomalies with a lead time of several months. Due to time lags involved in the climate-disease transmission system, monitoring El Niño / La Niña evolution in the Pacific Ocean could provide some predictive lead time for forecasting dengue epidemics. This is the first study of dengue fever and climate in this region. This research provides the foundation to develop a climate-driven early warning system for dengue fever in Ecuador.