Carlos Sathler

Prof. Joanne Luciano

I-590 Data Science for Drug Discovery, Health and Translational Medicine

October 15, 2017

# Predictive Modeling of Dengue Fever Epidemics: Abstract

Dengue is a disease caused by four types of related viruses transmitted by a mosquito. In it's less severe form infected patients will experience intense flu-like symptoms, but severe dengue or, Dengue Hemorrhagic Fever, can be fatal without proper medical care. According to the World Health Organization (WHO), Dengue and Severe Dengue Fact Sheet "severe dengue affects most Asian and Latin American countries and has become a leading cause of hospitalization and death among children and adults in these regions." [1]. Dengue incidence is common in tropical and sub-tropical areas of the globe; not only does the main vector for the disease, the Aedis aegypti mosquito, thrive in warm, humid environments with high precipitation levels, but also warm temperatures further increase the incidence of the disease by shortening viral replication in the mosquito. The Centers for Disease Control and Prevention (CDC) on its "Dengue and climate" web page states that "in countries where transmission does routinely occur, short-term changes in weather, particularly temperature, precipitation, and humidity, are often correlated with dengue incidence." [2]. Many researchers have explored and confirmed this correlation between climate and this disease [3][4][5][6] and in 2015 the US Department of Commerce released the Dengue Forecasting project [7] inviting data scientists to develop predictive models to forecast dengue using climate related data. On our project we will explore this data and will create predictive models of our own. We will compare our approach and results to those analyzed by Naish et al. in their paper "Climate change and dengue: a critical and

systematic review of quantitative modeling approaches" [8]. Finally, we will submit our model results to the "DengAI: Predicting Disease Spread" competition from DrivenData [9] to compare our model against those of other aspiring data scientists. The WHO in their publication "Global strategy for dengue prevention and control 2012-2020" [10] asserts that "Dengue morbidity can be reduced by implementing improved outbreak prediction and detection through coordinated epidemiological and entomological surveillance" [10, p3]. Models that quantitatively predict incidence of the disease based on climate data can potentially serve as one of the many tools to survey the risk of impending Dengue outbreaks.

Works Cited

[1] "Dengue and Severe Dengue." *Dengue and Severe Dengue: Fact Sheet*, World Health Organization, Apr. 2017, www.who.int/mediacentre/factsheets/fs117/en/.

[2] "Dengue and climate" *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 27 Sept. 2012, www.cdc.gov/dengue/entomologyecology/climate.html.

[3] Hurtado□Díaz, M., et al. "Impact of climate variability on the incidence of dengue in Mexico." Tropical medicine & international health 12.11 (2007): 1327-1337.

[4] Johansson, Michael A., et al. "Local and Global Effects of Climate on Dengue Transmission in Puerto Rico." PLoS Neglected Tropical Diseases, vol. 3, no. 2, 2009, doi:10.1371/journal.pntd.0000382.

[5] Morin, Cory W., Andrew C. Comrie, and Kacey Ernst. "Climate and dengue transmission: evidence and implications." Environmental health perspectives 121.11-12 (2013): 1264.

[6] Patz, Jonathan A., et al. “The Effects of Changing Weather on Public Health.” *Annual Review of Public Health*, vol. 21, no. 1, 2000, pp. 271–307., doi:10.1146/annurev.publhealth.21.1.271.

[7] US Department of Commerce, NOAA, National Weather Service. “Dengue Forecasting.” *Dengue Forecasting*, NOAA's National Weather Service, dengueforecasting.noaa.gov/.

[8] Naish, Suchithra, et al. "Climate change and dengue: a critical and systematic review of quantitative modelling approaches." BMC infectious diseases 14.1 (2014): 167.

[9] DrivenData. *DengAI: Predicting Disease Spread*, DrivenData, www.drivendata.org/competitions/44/dengai-predicting-disease-spread/page/80/.

[10] Global strategy for dengue prevention and control World Health Organization - Geneva: World Health Organization, 2012