One Health Research Project Abstract

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Research Abstract:

Dengue epidemics are strongly associated with several environmental and human factors (Díaz-Castro et al., 2017; Karim et al., 2012; Méndez et al., 2006). Most research on dengue has been conducted in areas with consistently favorable conditions with year-round dengue transmission and focused on factors that are temporally close to outbreaks. In regions with seasonally favorable conditions and seasonal dengue transmission, however, longer term environmental factors may have a greater impact on dengue transmission.

Hermosillo, Mexico is located on the northern edge of dengue's transmissible range and experiences seasonal dengue dynamics in the summer and early fall. While dengue is endemic to the region it occasionally experiences epidemic outbreaks. In this research, we aim to study the 2014 dengue outbreak by establishing what human and environmental factors are associated with dengue epidemics, and the temporal scale necessary to assess these factors. We postulate that seasonal factors like winter temperature and precipitation may have a greater effect on dengue transmission than factors occurring during the dengue season. These assessments will be used to build a model to predict dengue outbreaks in marginal environments.

Dengue persistence in marginal regions relies on its survival during times of inactive transmission. A possible method of persistence is via vertical transmission of dengue from a mother mosquito to her offspring within local *Ae. aegypti* populations. It is well-established from both lab and field experiments that *Ae. aegypti* can vertically transmit dengue (Martínez et al., 2014; Medeiros et al., 2018; Sánchez-Vargas et al., 2018). However, the role of vertical transmission in dengue persistence remains uncertain; some argue that the percentage of vertical transmission needed for dengue persistence is mathematically impossible (Grunhill & Boots, 2016). Determining the viability of vertical transmission as a factor in dengue persistence is crucial to understanding its ecology in marginal environments and for developing preventative strategies.

The main goals for this project are:

1. Develop a model for predicting human outbreaks of dengue.
    a. Determine human and environmental factors associated with dengue outbreaks using data from the 2014 dengue outbreak in Hermosillo.
    b. Determine efficacy of model at predicting dengue outbreaks.
2. Determine the efficacy of pool testing for detection of dengue virus and other flaviviruses in *Ae. aegypti* mosquitoes.
    a. Improve the sensitivity of PCR tools for detecting dengue virus in pooled mosquito samples using qPCR in place of existing RT-PCR methods.
3. Determine extent of vertical transmission of dengue in wild *Aedes aegypti* populations in Hermosillo, Mexico.
    a. Test male *Ae. aegypti* caught during surveillance for dengue to determine vertical transmission using qPCR protocol.
    b. Determine level of vertical transmission in population.

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