

Simulated Transmission of the Dengue Virus across the US-Mexico Border Using Remotely Sensed and Ground Based Weather Data

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Incidence of dengue fever, caused by a mosquito transmitted virus, have increased in the Americas during recent decades. In the US, local transmission has been reported in southern Texas and Florida. However, despite its close proximity to dengue endemic areas in Mexico and the presence of a primary mosquito vector, there are no reports of local transmission in Arizona. Many studies have demonstrated that weather influences dengue virus transmission by regulating vector development rates, vector habitat availability, and the duration of the virus extrinsic incubation period (EIP). The EIP, the period between mosquito infection and the ability for it to retransmit the virus, is especially important given its high sensitivity to temperature and the short lifespan of mosquitoes. Other studies, however, have suggested that human related factors such as socioeconomic status and herd immunity may explain much of the disparity in dengue incidence in the US-Mexico border region. Using a meteorologically driven model of vector population dynamics and virus transmission we compare simulations of dengue fever cases in southern Arizona and northern Mexico. A Monte Carlo approach is employed to select parameter values by evaluating simulations in Hermosillo Mexico with reported dengue fever case data. Simulations that replicate the case data best are retained and rerun using remotely sensed climate data from other Arizona and Mexico locations to determine the relative influence of weather on virus transmission. Although human and environmental factors undoubtedly influence dengue transmission in the US-Mexico border regions, weather is a major facilitator of the transmission process.