

Documenting the Potential Introduction of Dengue Virus into Key West through Airline Passengers from Dengue-Endemic Locations

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Abstract

Background

Dengue Fever is the most common arboviral disease in the world with nearly 100 million cases, 250,000 severe cases, and 25,000 deaths annually. Key West has experienced two outbreaks, one in 2009 and the other in 2010, with a total of about 100 cases. Its susceptibility is due to the warm climate of the city, many mosquito breeding areas, and the multitude of travelers that arrive there daily. Travelers have been responsible for many historic disease outbreaks and have been reported to acquire vector borne disease while in their destination and return to their country of origin infected. The main objective of this special project was to document the potential of commercial airline passengers from dengue endemic areas to introduce dengue virus into Key West.

Methods

Data was received from OAG Aviation, the Pan American Health Organization (PAHO), the National Oceanic and Atmospheric Administration (NOAA) as well as from the National Weather Service (NWS). Dengue virus and airline passenger counts were passed through the following conversion to determine the total number of viremic passenger days experienced by Key West between the years of 2007 to 2010. The correlation of viremic passenger days to passenger counts was also examined. Weather data was evaluated using the container-inhabiting mosquito simulation model (CIMSIM) and was considered an alternate hypothesis.

$$\left(\frac{\text{Cases}}{\text{Year}}\right) \times \left(\frac{5 \text{ Infections}}{\text{Case}}\right) \times \left(\frac{4.5 \text{ ViremicDays}}{\text{Infection}}\right) \times \left(\frac{1 \text{ Year}}{365 \text{ Days}}\right) \times (4 \text{ Days}) = \text{Total Viremic Days}$$

Total Viremic Days x Total Number Passengers = Total Viremic Passenger Days in Key West

Results

Dengue fever, severe dengue, and the number of deaths were on the rise in all of the countries (n = 40) examined between the years of 2007 and 2010. Key West experienced approximately 3.6, 1.2, 3.9, and 8.2 viremic passenger days in 2007, 2008, 2009, and 2010 respectively. Only 55 percent of the variability in these days could be explained by fluctuations in passenger counts. Weather differences were minute and appeared to have no effect upon the receptivity of dengue virus in Key West between the years of 2007 and 2010.

Discussion & Implications

Airline passenger fluxes were tracked over the course of the study and provided useful insight into dengue epidemiology in Key West, and helped ascertain the total passenger viremic days between 2007 and 2010. Future research, similar to this study, on weather, travel, and arboviral vector dynamics should be conducted to mitigate the dengue situation in the city.