Revision to CDC’s Zika Travel Notices: Minimal Likelihood for Mosquito-Borne Zika Virus Transmission at Elevations Above 2,000 Meters

Martin Cetron, MD

On March 11, 2016, this report was posted as an MMWR Early Release on the MMWR website (http://www.cdc.gov/mmwr). Since May 2015, when Zika virus, a flavivirus transmitted primarily by Aedes aegypti mosquitoes, was reported in Brazil, the virus has rapidly spread across the Region of the Americas and the Caribbean. The association between maternal Zika virus infection and adverse fetal and reproductive outcomes, including microcephaly, prompted CDC to issue a Level 2 alert travel notice* for the 37 countries and U.S. territories (at the national and territorial level) that have reported recent Zika virus transmission as of March 11, 2016. In addition to mosquito bite precautions for all travelers, CDC advises that pregnant women postpone travel to affected countries and U.S. territories. Within a nation's borders, ecologic factors, such as temperature, precipitation, vegetation, and human population density, that define suitable habitats for Aedes species vary. Where habitat is unsuitable, the mosquito vector is likely to be absent, and risk for mosquito-borne Zika virus transmission is likely to be negligible.

The first step in developing subnational travel notices required identification of a single, easily quantifiable ecologic variable that could be used as a substitute for the likely absence of Aedes aegypti. Of the many ecologic factors affecting habitat suitability and Aedes aegypti survival as a vector for Zika virus, temperature has been the most frequently investigated and rigorously quantified (3); however, temperature varies widely and is difficult to predict locally and over the long term. Historically, elevation has served as a reasonable proxy for temperature. Because it is static and relatively easy to measure (4), elevation was selected for further investigation. Previous reports from various global regions suggest that Aedes aegypti is present, but rare, between elevations of 1,700–2,100 m (5,6). Therefore, this analysis was restricted to countries and U.S. territories that have 1) ongoing Zika virus transmission and 2) areas with high elevations (starting at >1,500 m). Sixteen countries, including Bolivia, Brazil, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, and Venezuela have areas which fit these criteria.§ No U.S. territories had elevations at that level.

Spatial analyses were conducted using multiple data sets: global data on predicted probabilities of the presence of Aedes aegypti based on 20,000 observed occurrences during 1960–2014 (7); remotely sensed data on human population density (8); global geographic data on human dengue cases;...
during 1960–2012 (9); and a digital elevation model (10); zonal statistics were used to relate the data sets. Within each of the 16 countries, the area of land suitable for *Ae. aegypti*, and the human population counts within each area were quantified. The quantification was done in 100-m elevation segments for elevations between 0 m and 2,500 m. Across all 16 countries, at elevations >2,000 m, *Ae. aegypti* was predicted to be largely absent. Because of sparse current geographic data on Zika virus cases, cases of dengue, another vector-borne viral disease spread primarily by *Ae. aegypti*, were examined as a proxy for Zika cases. Only 1.1% (28/2,682) of dengue cases in the global data set (9) were reported to have occurred at elevations >2,000 m in the 16 countries.

A CDC Zika virus travel notice is currently applied to an entire country or U.S. territory when transmission is confirmed by a local public health authority. However, *Ae. aegypti* might not be uniformly present because of differences in ecologic suitability. Recent advances in scientific modeling have allowed for more precision in geospatial analyses. CDC applied these approaches to previously published and rigorously evaluated data to determine if more precise guidance to travelers and persons living in affected regions could be established. The results from the spatial analyses of 16 countries with ongoing Zika virus transmission and elevation points >1,500 m indicate that *Ae. aegypti* is unlikely to be found at elevations >2,000 m because of unsuitable ecologic factors, including but not limited to, low temperatures. Consequently, at elevations above 2,000 m, the risk for mosquito-borne exposure to Zika virus is considered to be minimal. These findings support revising the Zika travel notice to reflect enhanced geographic precision regarding the likelihood of Zika virus presence at certain elevations.

With this revision, CDC recommends that women who are pregnant should postpone travel to areas that are at elevations <2,000 m above sea level in countries and U.S. territories with ongoing Zika virus transmission. Because Zika virus is primarily spread by mosquitoes, CDC recommends that travelers protect themselves from mosquito bites. Travel that is entirely limited to elevations >2,000 m is considered to pose minimal likelihood for mosquito-borne Zika virus transmission.** As additional geographic data specific to Zika virus cases in relation to elevation become available, these recommendations will be reviewed and revised as needed.

References


division of Global Migration and Quarantine, National Center for Emerging and Zoonotic Infectious Diseases, CDC.

Corresponding author: Martin Cetron, MCetron@cdc.gov, 770-488-7100.