National Institute of Environmental Health Sciences

The extinction of dengue through natural vulnerability of its vectors

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Abstract:

BACKGROUND: Dengue is the world's most important mosquito-borne viral illness. Successful future management of this disease requires an understanding of the population dynamics of the vector, especially in the context of changing climates. Our capacity to predict future dynamics is reflected in our ability to explain the significant historical changes in the distribution and abundance of the disease and its vector. METHODOLOGY/PRINCIPAL FINDINGS: Here we combine daily weather records with simulation modelling techniques to explain vector (Aedes aegypti (L.)) persistence within its current and historic ranges in Australia. We show that, in regions where dengue presently occurs in Australia (the Wet Tropics region of Far North Queensland), conditions are persistently suitable for year-round adult Ae. aegypti activity and oviposition. In the historic range, however, the vector is vulnerable to periodic extinction due to the combined influence of adult activity constraints and stochastic loss of suitable oviposition sites. CONCLUSIONS/SIGNIFICANCE: These results, together with changes in water-storage behaviour by humans, can explain the observed historical range contraction of the disease vector. For these reasons, future eradication of dengue in wet tropical regions will be extremely difficult through classical mosquito control methods alone. However, control of Ae. aegypti in sub-tropical and temperate regions will be greatly facilitated by government policy regulating domestic water-storage. Exploitation of the natural vulnerabilities of dengue vectors (e.g., habitat specificity, climatic limitations) should be integrated with the emerging novel transgenic and symbiotic bacterial control techniques to develop future control and elimination strategies.

Source: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3006136

Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Meteorological Factors, Precipitation, Temperature

Temperature: Fluctuations

Geographic Feature:

resource focuses on specific type of geography

Tropical

Geographic Location:

resource focuses on specific location

Non-United States

Non-United States: Australasia

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Vectorborne Disease

Vectorborne Disease: Mosquito-borne Disease

Mosquito-borne Disease: Dengue

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology: ☑

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type: ☑

format or standard characteristic of resource

Research Article

Timescale: ☑

time period studied

Short-Term (

Vulnerability/Impact Assessment: ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content