Invasive mosquitoes and mosquito-borne diseases in the United States

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The global community is at greater risk of emerging vector-borne diseases than ever before.

Why?

- increased globalization
- increased air travel
- population growth
- unplanned urbanization, poor water and waste management
- ineffective mosquito control
- changing pathogens
Lessons from West Nile Virus in North America?

Encephalitis Strikes 3 People, 1 Fatally, In Queens, City Says
By ABBY GOODNOUGH
New York Times (1857-Current file); Sep 4, 1999; ProQuest Historical Newspapers, pg. A1

Encephalitis Strikes 3 People, 1 Fatally, In Queens, City Says

By ABBY GOODNOUGH

An elderly resident of Queens died this week from a mosquito-borne viral disease known as St. Louis encephalitis, and city health officials fear that at least nine other people have been infected, Mayor Rudolph W. Giuliani said yesterday.
Diseases of great concern for introduction or spread in the USA

- Dengue
- Chikungunya
- Japanese Encephalitis (30% mortality)
- Venezuelan Encephalitis (25% mortality)
- Rift Valley Fever (up to 50% mortality)
• 50-100 million dengue fever cases/year
• 500,000 cases of DHF
• 2/3 of world’s population at risk
• among top global neglected diseases

No vaccine and no treatment for dengue
Dengue Fever Hits Key West

Officials Confirm Cases of the Tropical Disease Carried by Mosquitos

By JOHN GEVER
MedPage Today Senior Editor

May 20, 2010—

More than two dozen cases of locally-acquired dengue fever have hit the resort town of Key West, Fla., in the past nine months, officials from the U.S Centers for Disease Control and Prevention said.

Although not the first cases of home-grown dengue in the U.S., or even in Florida, the outbreak highlights the need for physician vigilance regarding this and other formerly exotic tropical diseases, the CDC said in the May 21 issue of Morbidity and Mortality Weekly Report.
Hawaii Investigates Dengue Fever Cases

Apr 3, 2011 – 11:04 AM

Health officials in Hawaii are concerned about an outbreak of dengue fever after four cases were confirmed in Oahu.

AOL News Staff
AOL News

Three members of the same family and their neighbor in Pearl City became infected with the disease, according to Hawaii News Now. Dengue fever is a viral disease transmitted by mosquitoes in tropical and subtropical regions.

Officials said results on 12 other possible cases are still pending in Oahu. The state Department of Health issued an alert about the disease late last month, after the first two cases were confirmed.
Symptoms of Classical Dengue

- sudden onset
- fever
- headache
- muscle and joint pain
- bruising and bleeding
Symptoms of Dengue Hemorrhagic Fever

- intense capillary leakage
- hemorrhaging
- shock
- death
Chikungunya

from the Makonde language "that which bends up"

“CHIK” virus
Chikungunya symptoms

• Sudden onset with fever
• Severe, often debilitating joint pains in the wrists, elbows, fingers, knees and ankles
• Arthritis with joint swelling in some patients
• Rash
• Headache
• Fatigue
• Nausea and vomiting
• Prolonged symptoms lasting weeks to months in some individuals (fatigue, joint pain and arthritis)
• 3-25 % of people are asymptomatic
• Traditionally self limiting
Predicted dispersal pattern of Chikungunya virus from Africa to the Indian Ocean and Europe during the past 20 to 50 years.
In a northern Italian village, a tropical epidemic

By Elisabeth Rosenthal
Published: Friday, December 21, 2007

CASTIGLIONE DI CERVIA, Italy — Panic was spreading in August through this tidy village of 2,000 as one person after another fell ill with weeks of high fever, exhaustion and excruciating bone pain, just as most of Italy was enjoying Ferragosto, its most important summer holiday.
Yellow fever mosquito

Asian tiger mosquito

African bush mosquito

photo by Mike Sandhu, USAMRIID
Invasive *Aedes* mosquitoes transmit more than 22 different pathogens impacting human and animal health

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<tr>
<th>Chikungunya</th>
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<td>West Nile virus</td>
<td>Venezuelan equine encephalitis</td>
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Current challenges in dengue and chikungunya prevention and control

- Vaccine development
- Antiviral therapies
- Mosquito control
  - Finding new targets
  - Understanding vector biology
  - Understanding who is at risk
  - Developing sustainable control strategies
Research on novel targets at Cornell:

• Interruption of mating
• Reduction of blood feeding
• Reduced egg production
Research on understanding public risk at Cornell:

• How quickly will chikungunya be established after introduction in USA?

• How will climate change affect dengue and chikungunya risk?
Although daily weather and seasonal to inter-annual climatic variability influence mosquito vector biology and risk of vector-borne disease, this information is not readily employed in disease control programs.

We have recently begun a study that seeks to bridge this divide. It integrates the expertise of climatologists, entomologists, risk communication experts, and public health and vector control professionals to develop a system for predicting and monitoring risk of mosquito vectors, West Nile virus (WNV) transmission, and human health risk that will be readily usable by public health professionals for decision-making.

Support for this research was provided by Cornell’s Center for a Sustainable Future and grants from Hatch (NYC-139410), USDA/CSREES Multistate (MRF) project NE-507, National Oceanic and Atmospheric Administration (NA04GAAR4310184).

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How capable are North American strains of the Asian tiger mosquito to transmit chikungunya virus?
Support for surveillance and control is important

Support for research is also critical to develop new approaches is also essential
Thank you!