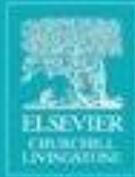


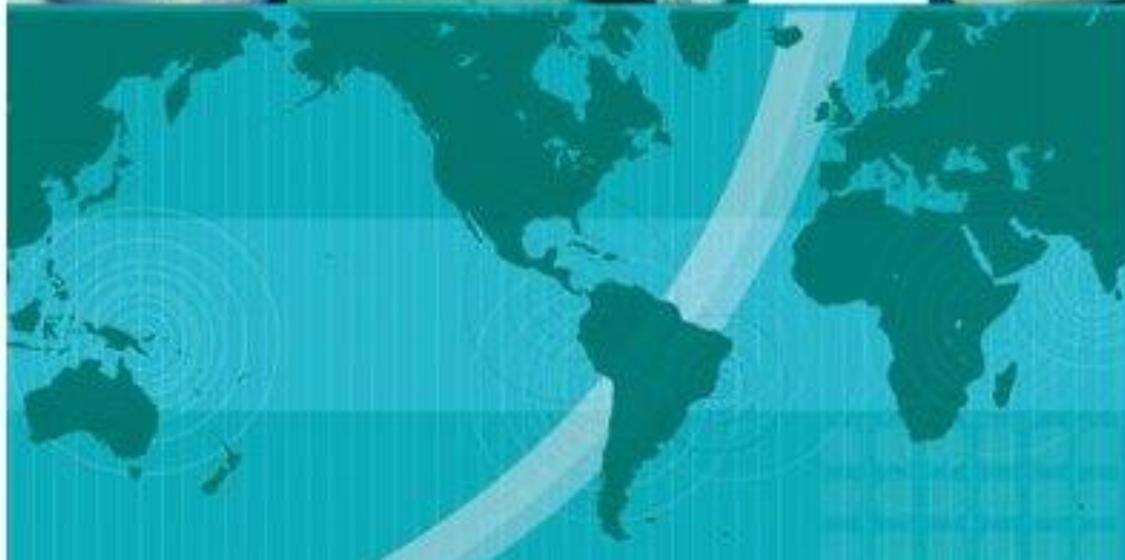
# Emerging Infectious Diseases

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# TROPICAL DERMATOLOGY





# Global Warming

Morens and Fauci: Dengue and  
hemorrhagic fever: a potential threat  
to public health in the United States

JAMA 299: 214-216; 2008

# White Nose Syndrome

- *Geomyces destructans*
- Millions of bats have died in the northeast USA since 2006
- Bats are the largest consumers of mosquitoes



# Emerging Arboviruses in the Western Hemisphere

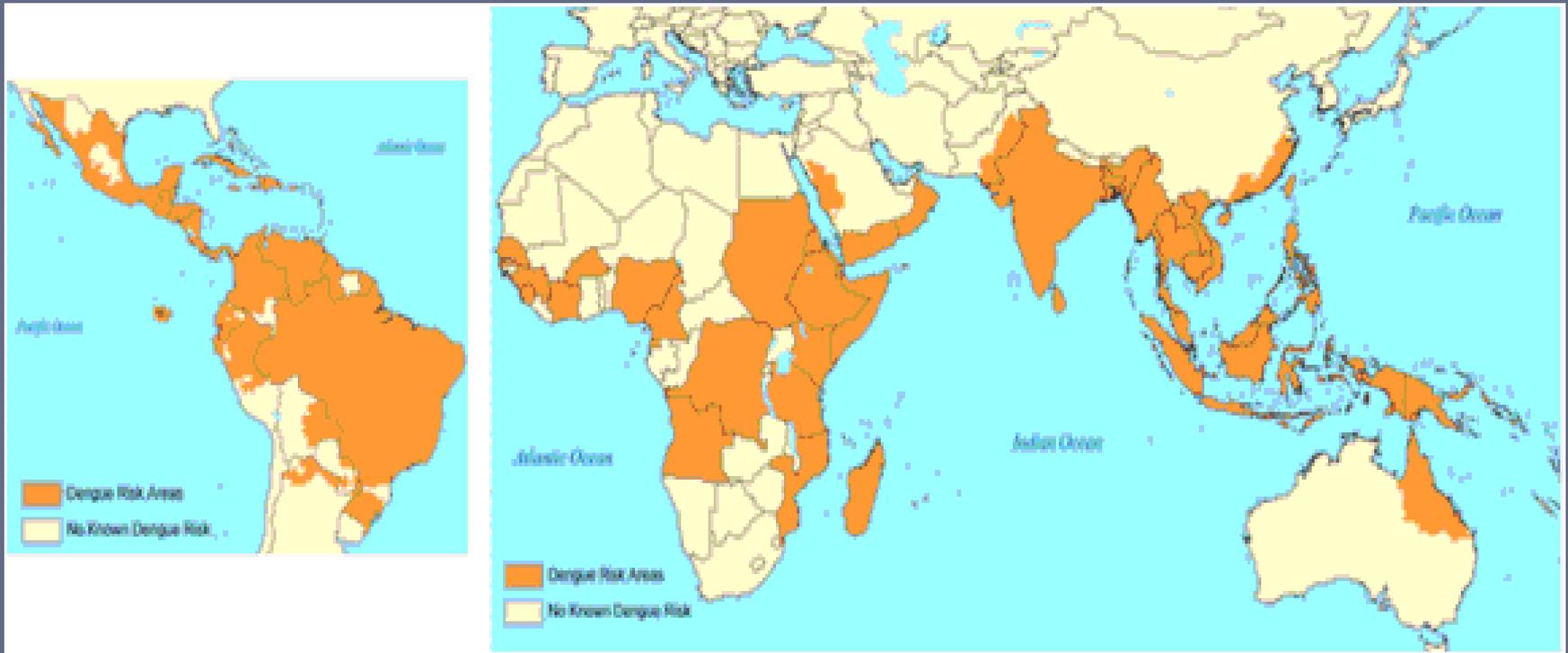


- West Nile virus: September 27, 1999 (Queens, NY)
- Chikungunya: December 17, 2013 (Saint Martin)
- “Ebola: September 28, 2014 (Dallas, Texas)”  
(filovirus)
- Zika: May 15, 2015 (Bahia, Brazil)/July 26, 2016 (Miami, FL)
- *Dengue: expanding range*

# Dengue: Global 2016

- About 2.5 billion people, or 40% of the world's population, live in areas where there is a risk of dengue transmission. Dengue is endemic in at least 100 countries in Asia, the Pacific, the Americas, Africa, and the Caribbean. The World Health Organization (WHO) estimates that 50 to 100 million infections occur yearly, including 500,000 DHF cases and 22,000 deaths, mostly among children

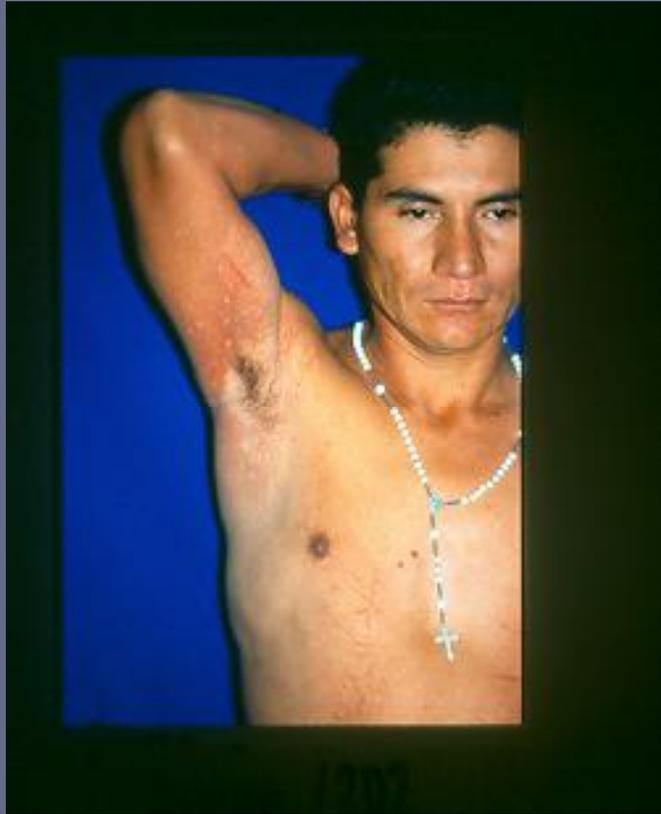
# Dengue: 2016



# Dengue

- Four virus types (DENV 1, DENV 2, DENV 3, DENV 4)
- Infection with one serotype does not protect against the others, and sequential infections put people at greater risk for dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS).
- Two mosquito vectors: *Aedes aegypti* and *Aedes albopictus*
- Incubation Period: 4-7 days

# Islands in sea of red and conjunctival hemorrhages



# Dengue: symptoms

- fever
- headache
- pain behind the eyes
- joint and muscle pain
- nausea/vomiting
- mild bleeding, such as nose or gum bleeding or easy bruising

# Dengue hemorrhagic fever (DHF): tourniquet test



# DHF: Signs and Symptoms

- Severe abdominal pain or persistent vomiting
- Petechiae and ecchymoses
- Bleeding from nose or gums
- Vomiting blood
- Black, tarry stools
- Drowsiness or irritability
- Pale, cold, or clammy skin
- Difficulty breathing
- No antivirals available: treat symptomatically

# Dengue Prevention



- Mosquito control
- Quadrivalent vaccine (Sanofi Pasteur): 56% reduction in dengue; approved in Philippines, Mexico and Brazil

# Chikungunya



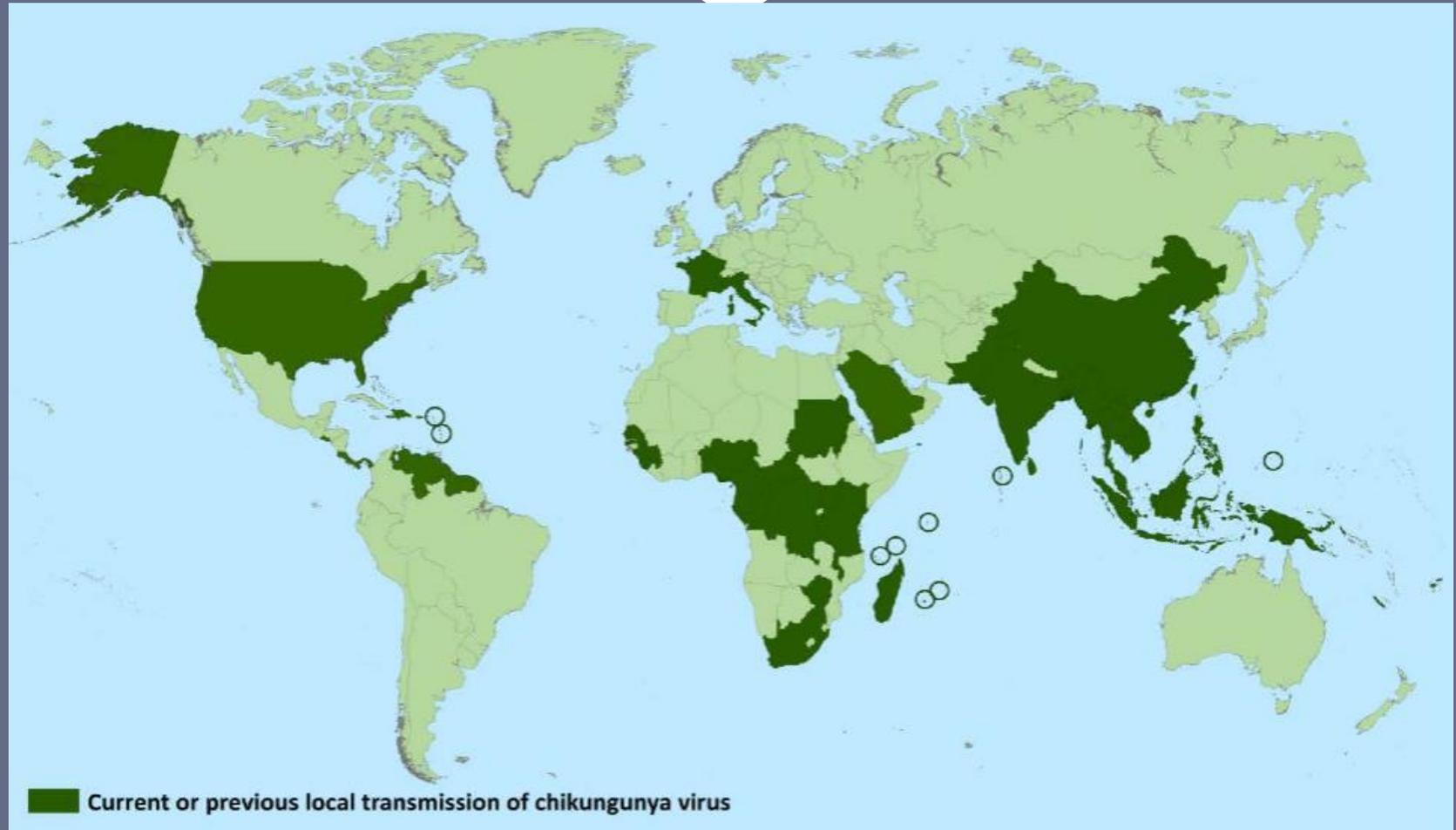
- *Togaviridae*
- *Aedes* Mosquito borne illness.
- Transmission similar to dengue fever.
- Makonde for “that which bends up.”
- Discovered in Africa in 1952 with several outbreaks in Africa, South Asia, and Southeast Asia.
- Emerged in the Caribbean in 2013.

# Chikungunya



- Since 2006, over 200 cases have been reported in the United States, but only in people who had traveled to other countries.
- On July 17<sup>th</sup>, 2014 the first chikungunya case acquired in the United States was reported in Florida by the CDC. A subsequent case in Florida was reported on July 29<sup>th</sup>, 2014.
- Now: 100,000s of cases

# Countries and territories where chikungunya cases have been reported.



# Clinical Manifestations



- Fever and malaise
  - Up to 104 F
- Polyarthralgia
  - Usually symmetrical
  - Commonly involves multiple joints
    - ✦ Hands, wrists, ankles.
- Skin Manifestations (40 to 75% of patients)

# Morbilliform Rash



# Morbilliform Rash



# Nasal Hyperpigmentation



# Erythema with aphthous-like ulcers



# Purpuric Macules



# Zika Virus



- Single stranded RNA Virus
- Genus *Flavivirus*, Family *Flaviviridae*
- Closely related to dengue, yellow fever, Japanese encephalitis and West Nile viruses

# Transmission



- Bite of an infected *Aedes aegyptus* (or *A. albopictus*) mosquito
  - Also spreads dengue, chikungunya and yellow fever viruses
- Rarely, maternal-fetal transmission
  - Intrauterine transmission (congenital infection)
  - Intrapartum transmission
- Through infected blood or **sexual** contact
  - Only arbovirus documented to be sexually-transmitted



# Geographic Distribution



- **1947:** First isolated from a rhesus monkey in Zika forest, Uganda.



# Geographic Distribution



- **1951-1981:** Sporadic human infections were found in Africa and Asia.



# Geographic Distribution



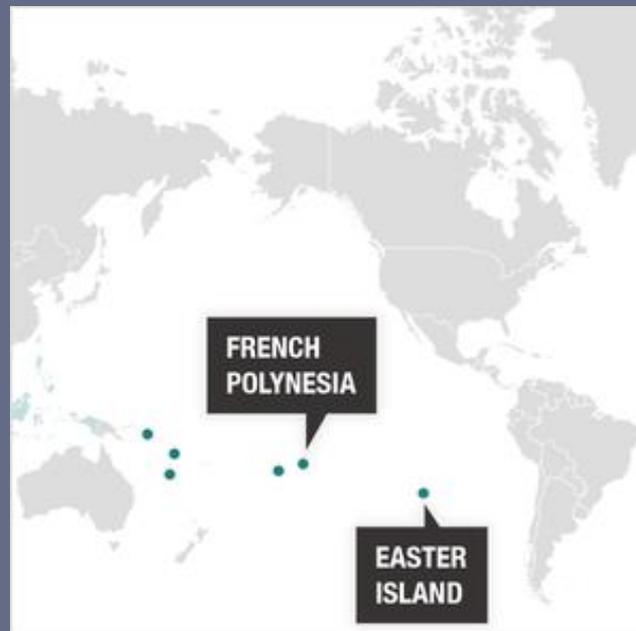
- **2007:** The first major recognized outbreak occurred in the **Yap Island**, affecting >70% of the population (5005 cases).



# Geographic Distribution



- **2013 to 2014:** Another larger outbreak occurred in **French Polynesia**, affecting about 28,000 people.



# Current Outbreak in the Americas



- **May 2015:** the first locally-acquired cases in the Americas were reported in Brazil
- **Currently:** outbreaks are occurring in many countries in the Americas



# Zika in the U.S. (as of August 3, 2016)



- Continental U.S.

- Travel-associated cases reported: 1818 (479 pregnant)
- Locally acquired through sexual transmission: 16
- Locally acquired vector-borne cases reported: 16
- Guillain-Barre syndrome: 5

- U.S. Territories

- Travel-associated cases reported: 23
- Locally acquired cases reported: 5525 (Puerto Rico & Virgin Island)
- Pregnant: 493
- Guillain-Barre syndrome: 18

Reported active transmission



# Clinical Manifestations



Symptoms	N (n=31)	%
Macular or papular rash	28	90%
Mild fever	20	65%
Arthralgia (small joints)	20	65%
Conjunctivitis (nonpurulent)	17	55%
Myalgia	15	48%
Headache	14	45%
Retro-orbital pain	12	39%
Edema	6	19%
Vomiting	3	10%

Duffy M. N Engl J Med 2009

# Zika Rash



- Blanchable macules and papules
- Start on the face or trunk, 3-5 days after the febrile phase, and become more diffuse



# Zika Course and Outcomes



- Symptoms develop in **20%** of infected individuals
- Occur **2-12 days** after the mosquito bite
- Usually mild
  - Severe disease requiring hospitalization is uncommon
  - Case-fatality rates are low
- Symptoms resolve within **2-7 days**
- Guillain-Barré syndrome reported following Zika virus infection
  - Relationship to Zika virus infection is not known
  - Colombia has reported 3 deaths due to GB in Zika patients

# Zika vs Dengue & Chikungunya



- Diseases have similar clinical features

Features	Zika	Dengue	Chikungunya
Fever	++	+++	+++
Conjunctivitis	++	+	+
Myalgia	+	++	+
Hemorrhage	-	++	-
Pruritus	+++	+	+

# Diagnosis



- Clinically
  - Recent travel history to active transmission area
  - Unprotected sexual contact with a person with recent travel
    - ✦ Presence 2 of the 4 major symptoms
      - Rash, fever, arthralgia, conjunctivitis
- Lab
  - Viral RNA RT-PCR ( $\leq 7$  days after illness onset)
  - Antibody testing ( $\geq 4$  days after illness onset)
    - ✦ IgM ELISA
    - ✦ Plaque reduction neutralization test (PRNT)

# Management



- No specific antiviral therapy
- Treatment is supportive (i.e., rest, fluids, analgesics, antipyretics)
- Suspected Zika virus infections should be evaluated and managed for possible dengue or chikungunya
- Aspirin and other NSAIDs should be avoided until dengue can be ruled out to reduce the risk of hemorrhage

# Zika Virus and Microcephaly



- Reports of a substantial increase in number of babies born with microcephaly in 2015 in Brazil (20-fold increase compared to 2014)
  - Zika virus identified in several infants with microcephaly and in early fetal losses
  - Some infants with microcephaly\* have tested negative for Zika virus
  - In February 2016, the WHO declared a “Public Health Emergency of International Concern”
- Studies are underway to characterize the relationship between Zika and congenital microcephaly
- Retrospective investigation in French Polynesia outbreak in 2013-2014



\*head circumference  $< 2$  SD below mean

# Reporting Zika Disease Cases



- Zika virus disease is now a nationally notifiable disease
  - Healthcare providers encouraged to report suspected cases to their state health department
- State health departments are requested to report laboratory-confirmed cases to CDC

# Prevention



- No vaccine or medication available
- Primary prevention measure is to reduce mosquito exposure
- Pregnant women should consider postponing travel to areas with ongoing Zika virus outbreaks
- Protect infected people from mosquito exposure during first week of illness to prevent further transmission
- Pregnant women should abstain from sex (or use condoms) with male partners who traveled to areas with active Zika transmission (8 weeks if male is asymptomatic/laboratory negative, 6 months after symptoms/laboratory positive)

# What Comes After Zika?



- Nipah (Malaysia)
- MERS (middle east)
- Hendra (Australia)
- Enteroviruses: e.g. EV71 (southeast Asia)
- Influenza: new human, swine and avian strains
- Hantaviruses: new strains

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Thank you



# Thank you



Any questions?

