

Chikungunya Virus

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Objectives / Overview

- What is Chikungunya
- Historical outbreaks
- Recent spread of disease
- Potential importation into US
- Reporting and investigating cases

Chikungunya Virus

- RNA virus in *Alphavirus* genus
 - ss (+) in Semliki Forest Complex
 - Three genotypes: Asian, West African, East Central South African (ECSA)
- Transmitted by mosquitos of *Aedes* genus
 - Primarily *aegypti* (vector of Dengue)
- Reservoirs are infected humans
- Infection causes Chikungunya fever

Chikungunya Fever

- Mosquito-borne viral disease characterized by acute onset of fever and severe polyarthralgia
- Name “chikungunya” means “that which bends” describing the stooped appearance of persons suffering characteristic painful arthralgia
- Historically self limiting illness, recovery in several months
- Often occurs in large outbreaks with high attack rates

Chikungunya History

- Virus first isolated from mosquitoes and humans during Tanzania epidemic in 1952
- Outbreaks are unpredictable and the virus seems to “re-emerge” in endemic areas every 7-8 years

Réunion Island Outbreak

- 2005 – 2006 outbreak centered in the southwest Indian Ocean featured several new factors:
 - Increased mortality
 - Genetic shift of virus → enhanced vector competence of *A. albopictus*

Réunion Island CHIK Outbreak

- Island population 770,000
 - 970 square miles
 - Robeson County 951 square miles for comparison
- 1 Mar 05 – 30 Apr 06: 255,000 cases reported
 - At outbreak end 38% seropositive
 - 85% of infections were symptomatic

Soumahoro, et. al. PLoS Neglected Tropical Diseases. June 2011; 5(6)

Réunion Island CHIK Mortality

- Recovery historically considered universal
- Analysis of crude death rate (CDR) during outbreak compared to historical data indicated 260 excess deaths
 - Observed primarily in those over 75 years old
 - CDR is relatively stable in a defined population and no other health events identified at the time
- Estimated CHIK case fatality rate of 1/1000.

Josseran, et. al. Emerging Infectious Diseases. December 2006; 12(12), pp. 1994-1995

Réunion Island CHIK Virus/Vector

- ECSA A226V
 - A shift at envelope protein E1 position 226 from alanine to valine resulted in *Aedes albopictus* being a very efficient vector of the virus
- On Réunion Island, as in many places in the US, *albopictus* has replaced *aegypti* as the dominant *Aedes* species
- However, not all *albopictus* are created equal

SW Indian Ocean Since 2006

- ECSA A226V variant continues to circulate and has caused subsequent, smaller, outbreaks on Réunion Island and Madagascar

D'Ortenzio, et. al. Emerging Infectious Diseases. February 2011; 17(2), pp. 309-311

Shift to the Caribbean

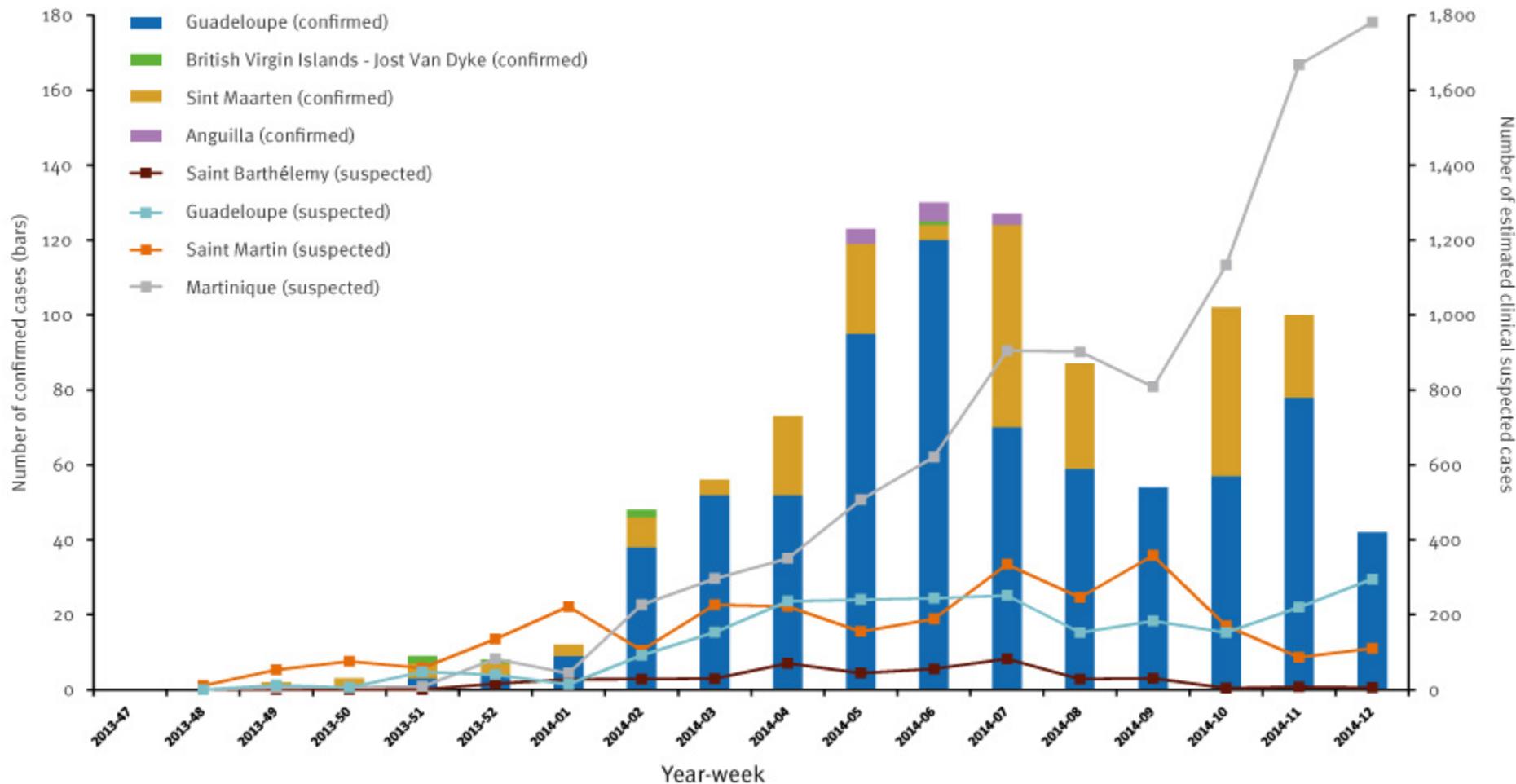
- In late 2013, the first local transmission of CHIKV in the Americas was reported in St. Martin
- The vector has been identified as *A. aegypti*
- However, both the European Centre for Disease Prevention and the CDC indicate a risk for introduction of the disease into the continental EU and the US due to presence of *A. albopictus*

Countries and territories in the Caribbean where chikungunya cases have been reported* (as of April 7, 2014)

*Does not include countries or territories where only imported cases have been documented. This map is updated weekly if there are new countries or territories that report local chikungunya virus transmission.



Number of confirmed and estimated suspected chikungunya cases reported in the Caribbean by week of sampling, 1 December 2013–23 March 2014



Van Bortel. Euro Surveill. 2014;19(13):pii=20759. Available online: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20759>

The Good News is...

- The chikungunya strain currently circulating in the Caribbean region does not belong to the ECSA genotype but to the Asian genotype.
- The Caribbean strain is related to strains recently identified in Indonesia, China and the Philippines and is not the strain from the Reunion Island outbreak

Leparc-Goffart, et. al. The Lancet, Volume 383, Issue 9916,
Page 514, 8 February 2014

However...

- This episode represents the first evidence for the emergence of autochthonous chikungunya cases in the Americas. It is likely that the chikungunya epidemic will extend to other Caribbean islands, and it also has substantial potential for spreading from this region visited yearly by millions of tourists to the American mainland where *A aegypti* is endemic.
- Assuming that this strain will be transmitted efficiently by *A albopictus* mosquitoes, its persistence in the Caribbean would also represent...a great threat for southern European countries where the mosquito has recently dispersed. This situation warrants reinforced epidemiological surveillance and specific preparedness.

Leparc-Goffart, et. al. The Lancet, Volume 383, Issue 9916,
Page 514, 8 February 2014

CDC Alert, 13 DEC 13



- Recommendations for Public Health
 - Chikungunya virus infection should be considered in patients with acute onset of fever and polyarthralgia, especially those who have recently traveled to the Caribbean.
 - Healthcare providers are encouraged to report suspected chikungunya cases to their state or local health department to facilitate diagnosis and to mitigate the risk of local transmission.
 - Health departments should perform surveillance for chikungunya cases in returning travelers and be aware of the risk of possible local transmission in areas where *Aedes* species mosquitoes are currently active.
 - State health departments are encouraged to report laboratory-confirmed chikungunya virus infections to ArboNET, the national surveillance system for arthropod-borne viruses.

<http://emergency.cdc.gov/HAN/han00358.asp>

Chikungunya virus in the United States

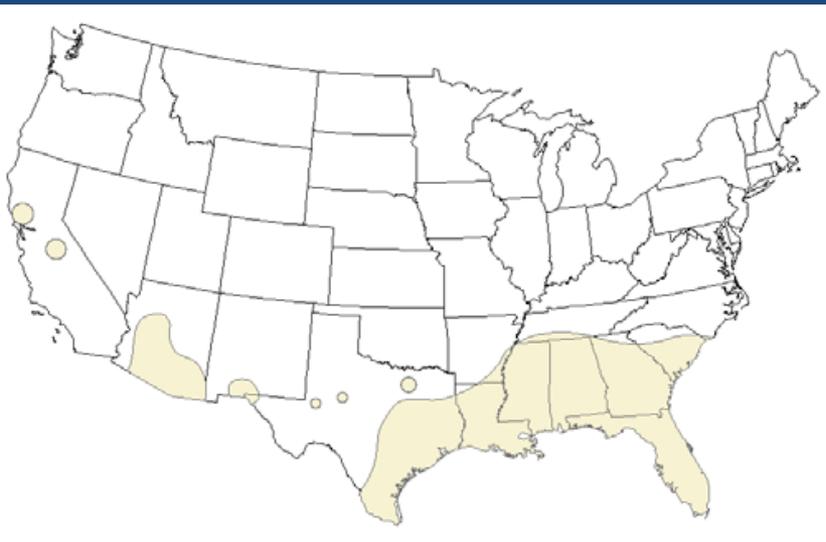
- Chikungunya virus is not currently found in U.S.
- From 2006-2009, 106 laboratory-confirmed chikungunya cases identified in travelers visiting or returning to U.S.
- None triggered a local outbreak in U.S.
- With outbreaks in Caribbean, number of chikungunya cases among U.S. travelers will likely increase
- Imported cases may result in virus introduction and local spread in some areas of U.S.



A. aegypti



A. albopictus



Surveillance

- Inform travelers going to areas with known virus transmission about risk of disease
- Consider chikungunya in patients with acute onset of fever and polyarthralgia
- Be aware of possible local transmission in areas where *Aedes* species mosquitoes are active

Diagnostic Testing

- Culture for virus*
- Reverse transcriptase-polymerase chain reaction (RT-PCR) for viral RNA
- Serology for IgM and confirmatory neutralizing antibodies
- Serology for ≥ 4 -fold rise in virus-specific quantitative antibody titers on paired sera†

*Virus should be handled under biosafety level (BSL) 3 conditions

†Determined by plaque reduction neutralization test (PRNT) or immunofluorescence assay (IFA)

Optimal Timing for Diagnostics

Diagnostic Assay	Days post-illness onset
Viral culture	≤ 3 days
RT-PCR	≤ 8 days
IgM antibody test	≥ 4 days

Distinguishing Dengue from Chikungunya

- Viruses transmitted by same mosquitoes
- Diseases have similar clinical features
- Viruses can circulate in same areas and cause co-infections
- Important to rule out dengue, as proper clinical management can improve outcome*

*WHO dengue clinical management guidelines:

http://whqlibdoc.who.int/publications/2009/9789241547871_eng.pdf

Investigation: Patient with clinical illness but chikungunya virus testing not yet performed

- Establish if a patient has a clinically compatible illness
- Assess for possible travel-associated versus locally-acquired infection
- Ensure lab testing for CHIK and Dengue
- Obtain test results and determine case classification

Investigation: Patient with chikungunya virus test results

- Establish if patient has a clinically compatible illness
- Determine case classification

Final Investigation: Patient with confirmed or probable chikungunya virus infection

- Obtain clinical and epi data
- Determine organ, tissue, blood donation or recipient status → notify
- Obtain travel history with particular attention to two weeks prior to illness onset → possible new areas of transmission
- Assess risk of being viremic while in US or NC
- If evidence of viremia, assess risk of local transmission
- If there is evidence of local transmission → implement control measures

Reporting of Chikungunya Cases

- Suspected cases should be reported to state or local health departments to
- Facilitate diagnosis
- Mitigate risk of local transmission
- State health departments encouraged to report laboratory-confirmed or probable cases to CDC

Questions?