Chikungunya epidemiology in U.S. territories and states with risk of transmission

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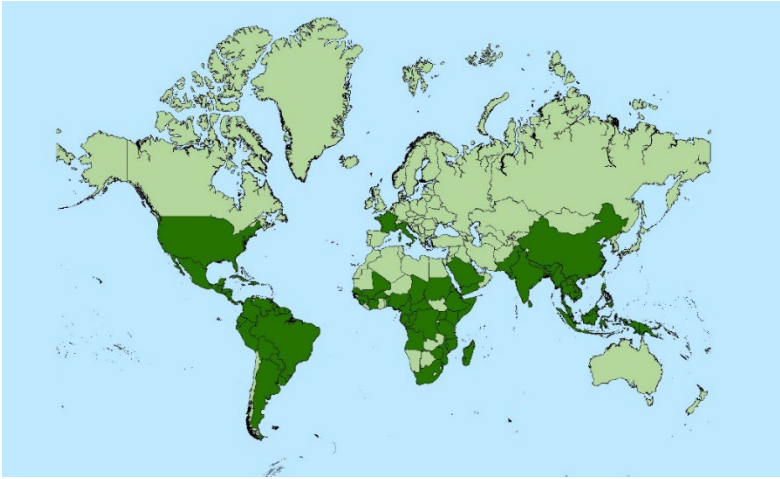
Chikungunya

- Mosquito-borne disease
- Key vectors are *Aedes aegypti* and *Aedes albopictus* mosquitoes

Distribution and disease burden in endemic areas

- Typically tropical and subtropical regions
- Periodically causes large outbreaks
  - Often high attack rates
- Virus transmission usually highest during wet season



Countries and territories with current or past transmission of chikungunya virus

Clinical features of acute chikungunya virus infection

- Febrile illness with typically severe arthralgia, can be debilitating
- Other symptoms include headache, rash, myalgia, anorexia
- No anti-viral treatment available

Complications of chikungunya

- Rare serious complications (e.g., myocarditis, hepatitis, neurologic illness)
- Deaths rare and reported mostly in
  - Older adults, particularly those with comorbidities
  - Young infants infected perinatally or by mosquito bites

Images from : https://www.paho.org/en/topics/chikungunya

Chronic arthralgia following chikungunya

- Acute symptoms usually resolve in 7–10 days
- Some patients have continuation or relapse of symptoms
- Ongoing arthralgia of variable severity possibly present in up to ~50% at 3 months and ~30% at 12 months

Puerto Rico

Puerto Rico

- Largest U.S territory
  - Population ~3.2 million persons
  - Area ~3,500 miles^2
- Tropical climate
- *Aedes aegypti* present
- Dengue endemic

Data sources

- Data from passive and sentinel surveillance systems
- No single data source provides accurate and complete information
- Surveillance activities, reporting practices, and laboratory testing approaches changed during outbreak
  - When laboratory capacity exceeded, testing prioritized for certain groups
  - When number of suspected cases reached thousands per week, limitation on types of cases to be reported
- Key points
  - Numbers of cases often substantial underestimate of true cases
  - Data provide reasonable representation of actual disease epidemiology

Laboratory criteria for chikungunya cases

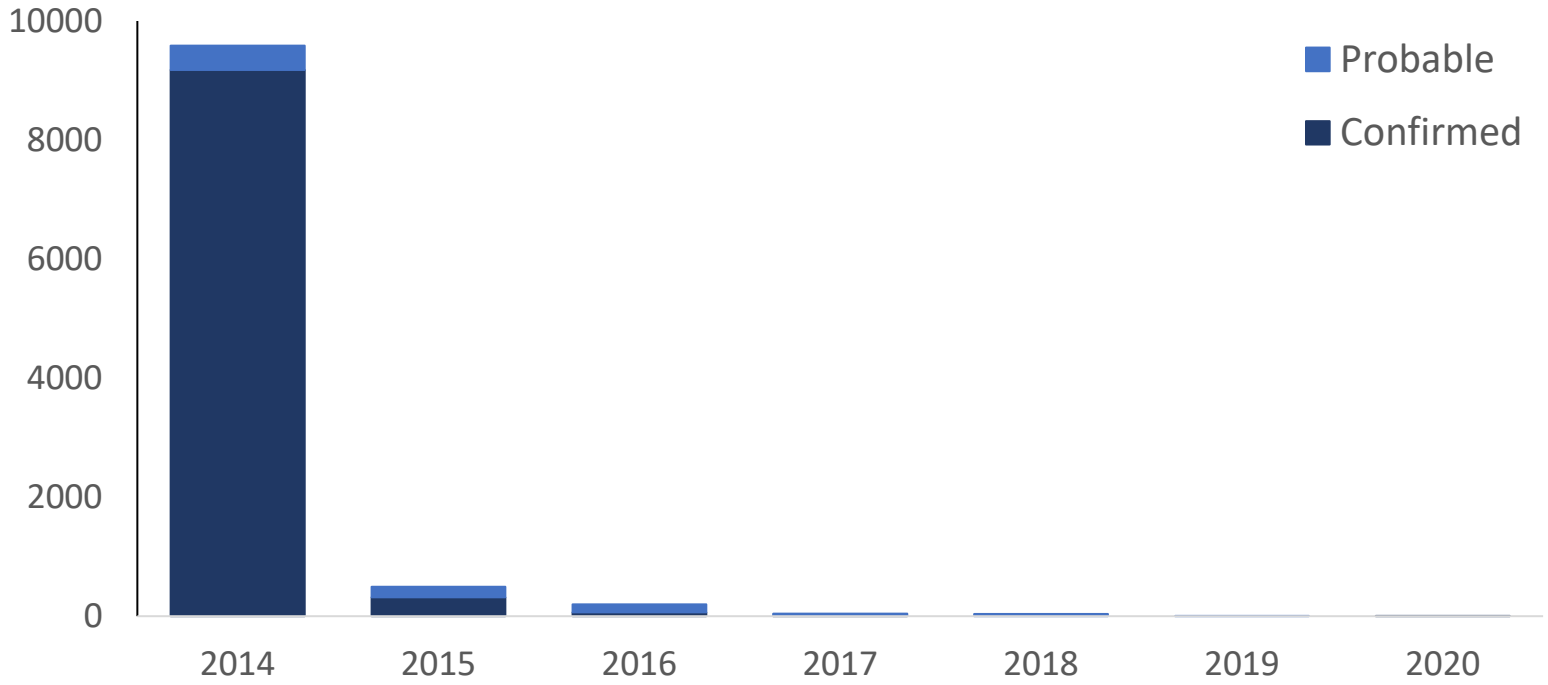
- **Confirmed cases**: detection of nucleic acid by RT-PCR
- **Probable cases**: IgM antibodies in serum or cerebrospinal fluid
- Chikungunya IgM antibodies can persist after acute infection
    - 13–18 months: 56% with IgM[1]
    - 2–3 years: 11% with IgM[2]

1. Grivard et al, Path Biol 2007; 2. Costa et al, Rev Soc Bras Med Trop 2021

Chikungunya emergence in the Caribbean

- Chikungunya emerged in 2013
  - First case reported in Saint Martin island in December
- Rapid increase in countries and territories reporting transmission
- In Puerto Rico, first laboratory-confirmed case in May 2014

Chikungunya cases reported by year and case status, Puerto Rico, 2014–2020



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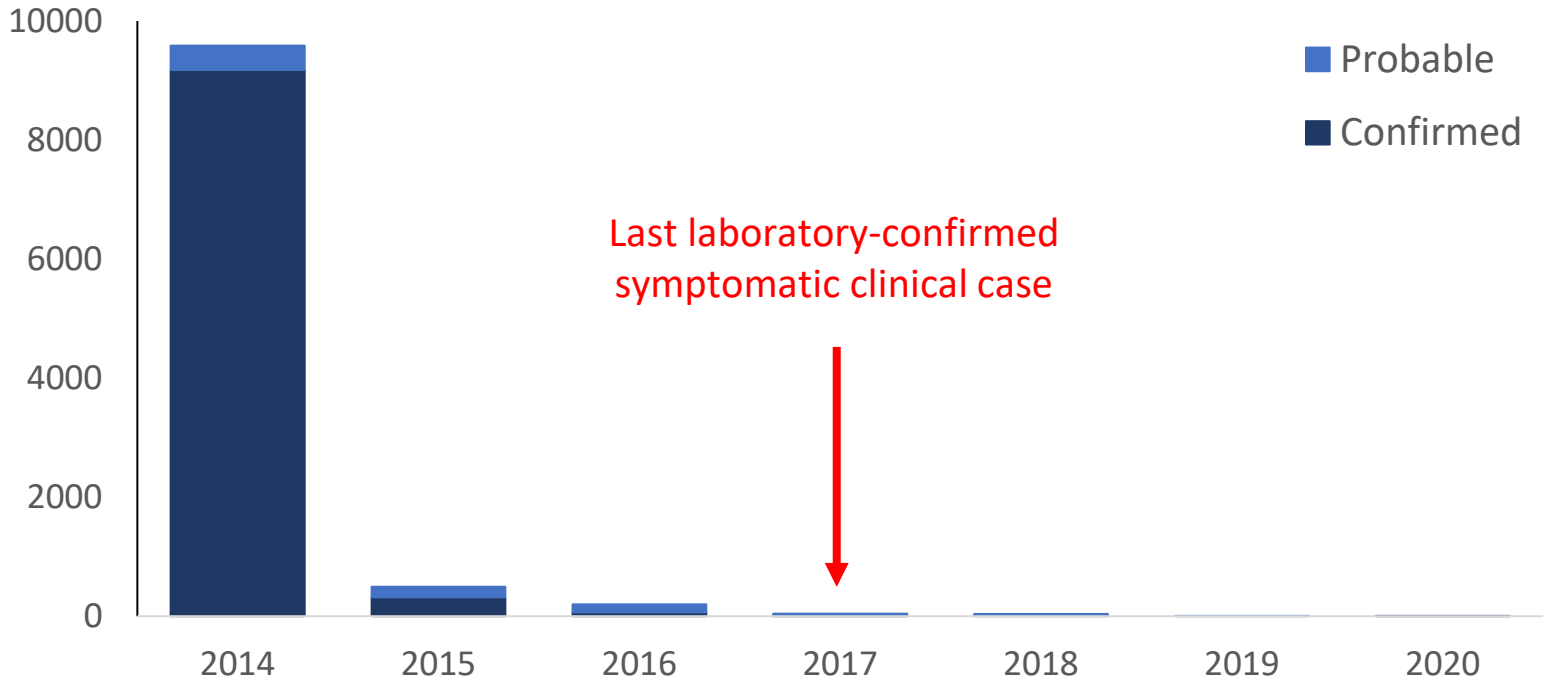
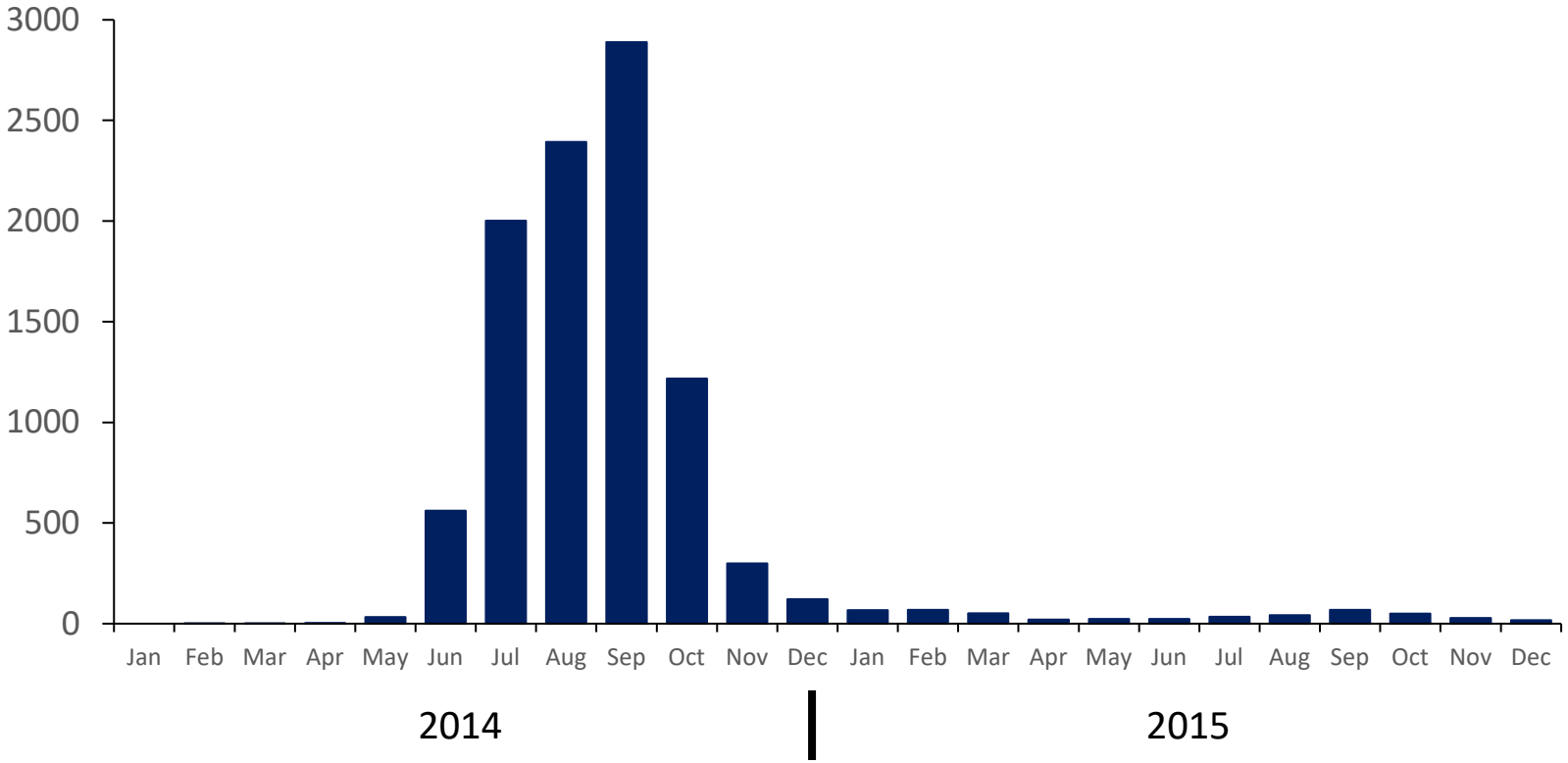


Chikungunya cases by month of illness onset during two main outbreak years, 2014–2015



Chikungunya cases by sex, Puerto Rico, 2014–2020 (N=10,293)*

Sex	No.	(%)
Female	5,116	(52%)
Male	4,708	(48%)

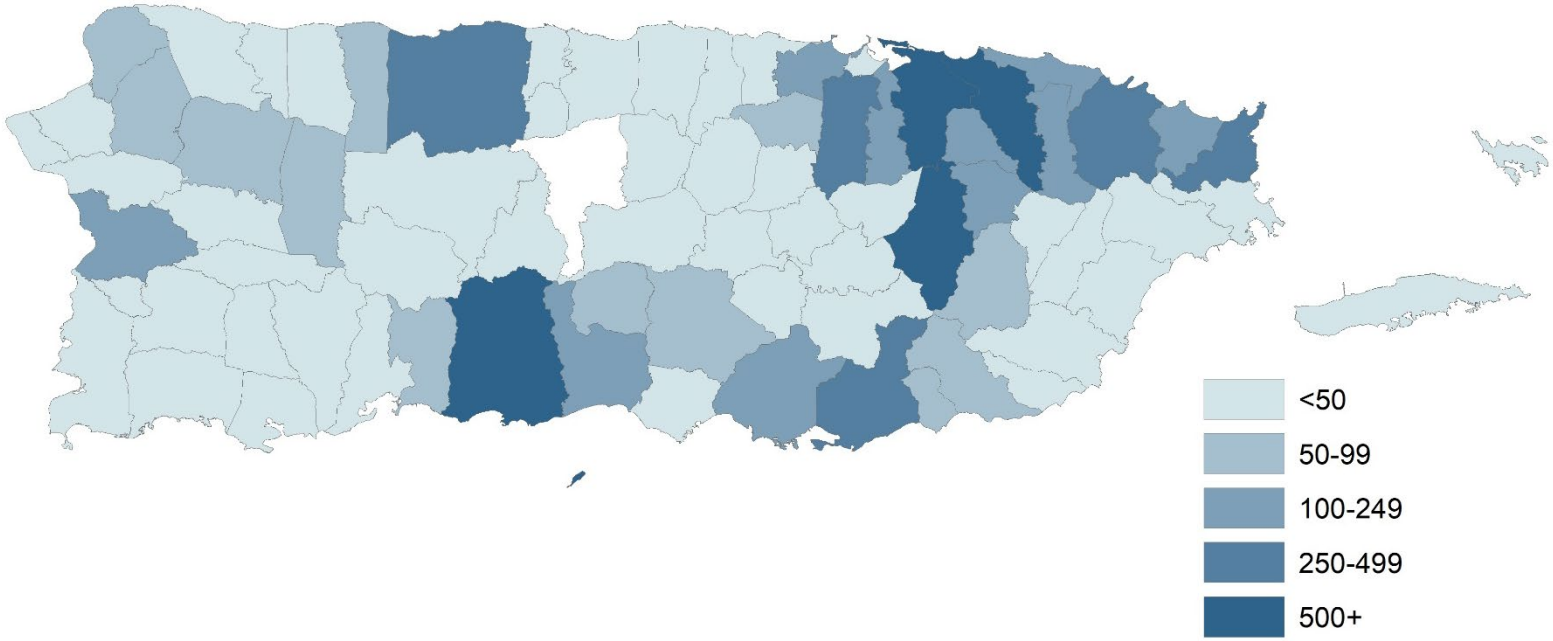
*n=469 with unknown sex

Chikungunya cases by age group, Puerto Rico, 2014–2020 (N=10,293)*

Years	No. (%)
0–19	4,328 (42%)
20–39	2,055 (20%)
40–59	1,931 (19%)
≥60	1,865 (18%)

*n=114 with unknown age

Chikungunya cases by municipality, Puerto Rico, 2014–2020



Proportion of Puerto Rico population infected

- Household cluster survey among persons aged 1–50 years in one municipality in southern Puerto Rico in 2018–2019
  - **31% seroprevalence**[1]

- Samples from blood donors aged ≥16 years collected in March 2015[2]
  - **23% seroprevalence**[2]

- Based on 30% seroprevalence rate, **~1 million** persons estimated to have been **infected** during outbreak
  - **~650,000–850,000 clinical cases**

1. 1,268 of 4,035 participants (Adams LE at al, PLoS NTD 2022); 2. 242 of 1,031 samples (Simmons G et al, Emerg Infect Dis 2016)

United States Virgin Islands (USVI)

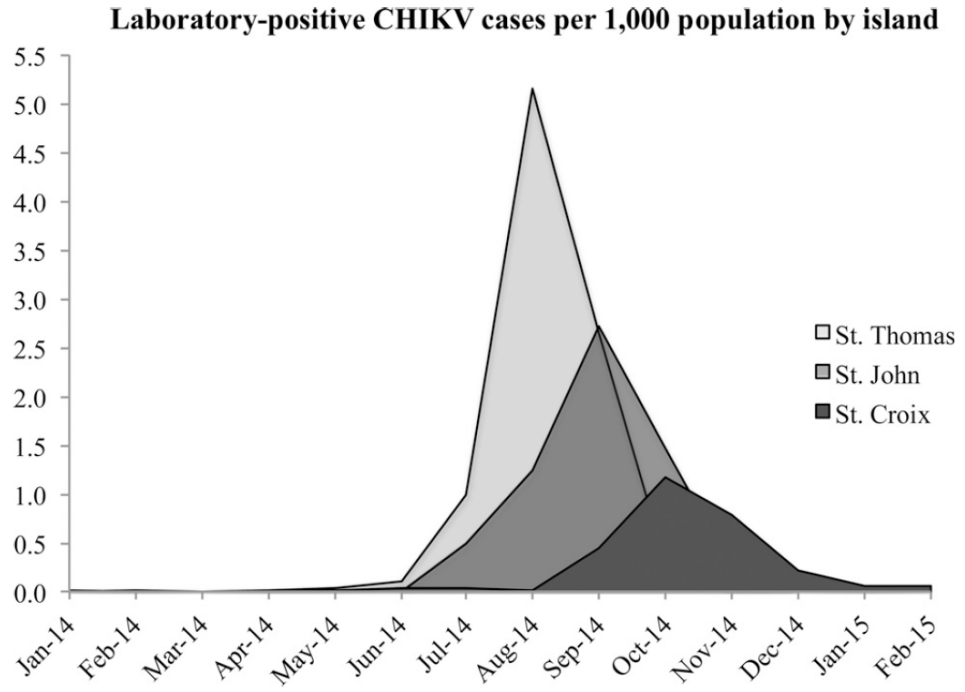
Initial transmission of chikungunya in USVI

- First locally acquired case detected in early June 2014[1]
- Initial transmission on Saint Thomas

Source: https://ontheworldmap.com/virgin-islands-us/

1. Feldstein LR et al, Am J Trop Med Hyg 2016

Epidemic curve of chikungunya cases* by island, USVI, 2014–2015 (N=637)



Last laboratory-positive case February 2015

Feldstein LR et al, Am J Trop Med Hyg 2016

*Confirmed or probable

Proportion of USVI population infected, 2014–2015

- 31% persons had evidence of past infection in seroprevalence survey approximately 1-year post-outbreak[1]
- **~33,000** persons estimated to have been **infected** during outbreak
  - **~21,000–28,000 clinical cases during 8-month** outbreak period

1. Hennessey MJ e al, Am J Trop Med Hyg 2018

*Laboratory confirmed or probable

Other U.S. territories and freely associated states

Other U.S. territories

- **American Samoa[1]**
  - Outbreak began June 2014
  - Unconfirmed information suggested ≥823 suspected cases
  - Unclear duration but no evidence of transmission by end of 2015
- **Guam and Commonwealth of the Northern Mariana Islands (CNMI)**
  - No cases reported

1. Roth A et al, Eurosurveillance 2014; ArboNET data

Freely associated states

- **Federated States of Micronesia (Yap State)[1]**
  - Outbreak from Aug 2013–Aug 2014 with peak Oct–Dec 2013
  - 1,761 suspected cases reported
  - Attack rate of 155 clinical cases per 1,000 population, so ~15% population sought care for suspected illness
- **Marshall Islands[2]**
  - Outbreak began February 2015
  - Unclear duration and extent but unconfirmed information suggests >1,000 suspected cases
- **Palau**
  - No cases reported

1. Pastula DM et al, PLoS NTD 2017; 2. Ministry of Health Republic of the Marshall Islands Chikungunya Report, April 2015.

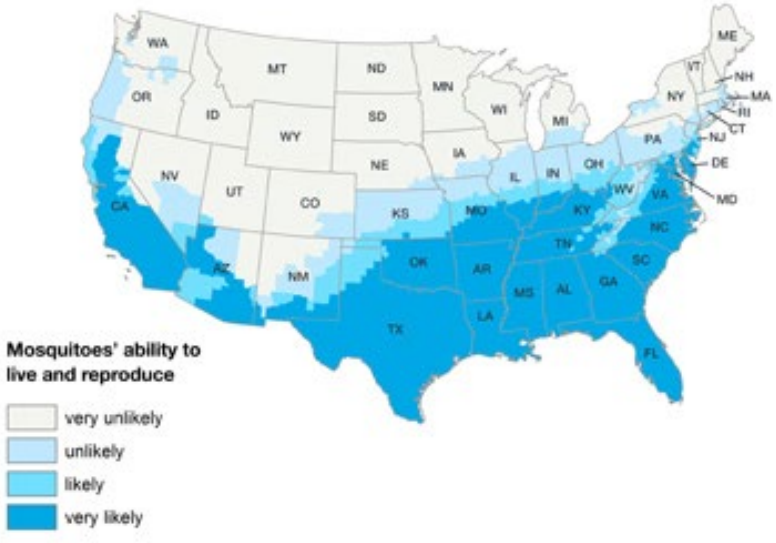
Summary:
Chikungunya in U.S territories and affiliated states

- 3 territories and 2 affiliated states have had chikungunya outbreaks
- Outbreaks were explosive
- For Puerto Rico and USVI, ~30% of population was likely infected, with 20%–25% of the population having clinical illness mainly during a period ~6 months
- All outbreaks began 2013–2015
- No evidence of confirmed transmission since 2017 (Puerto Rico) or earlier in islands with smaller populations
- Timing of future transmission or outbreaks and likely pattern unknown

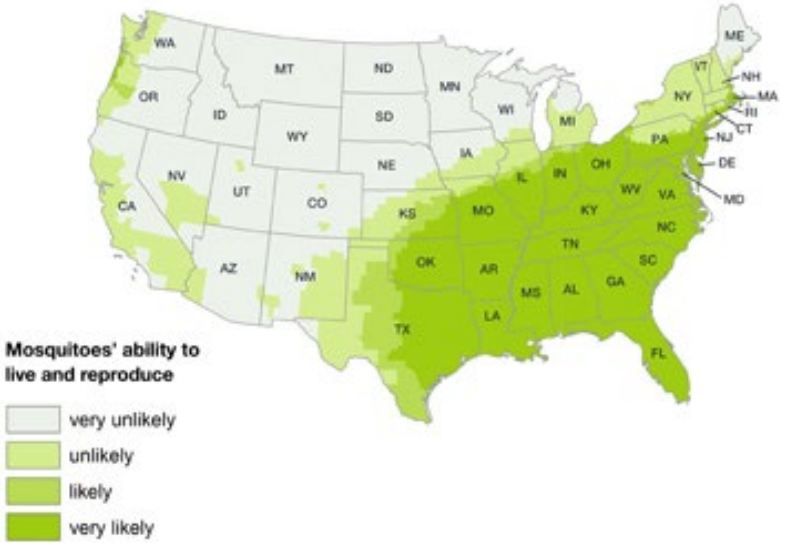
Locally-acquired cases in U.S states

Estimated potential range of *Aedes aegypti* and *Aedes albopictus* in the United States, 2017

Aedes aegypti



Aedes albopictus



https://www.cdc.gov/mosquitoes/php/toolkit/potential-range-of-aedes.html

Florida (N=12)*#

- First local transmission of chikungunya virus in continental United States was in 2014
- Occurred in context of chikungunya outbreak in Americas and increase in traveler cases
- After 1st locally-acquired case in June, 11 additional cases identified in 4 counties in southern Florida
- Two patients lived within 1,500 feet of each other and other cases were sporadic reports

*11 cases described in MMWR and one case reported after MMWR published
#Does not include one case from different area of Florida published by clinician in 2021 (Am J Emerg Med, 2021) as IgM positive result not confirmed when tested by neutralizing antibody testing

Notes from the Field

Transmission of Chikungunya Virus in the Continental United States — Florida, 2014

Katherine Kendrick, MPH[1], Danielle Stanek, DVM[1], Carina Blackmore, DVM, PhD[1] (Author affiliations at end of text)

On June 27, 2014, the Florida Department of Health in Miami-Dade County was notified by the Florida Poison Information Center Network of a patient with travel to Southeast Asia who was suspected of having chikungunya virus infection. After further investigation and additional testing, it was determined that the patient had not recently traveled to an endemic area, and this case was confirmed as the first locally acquired chikungunya case in the continental United States. Since the first case of locally acquired chikungunya virus infection in the Americas was reported on the Caribbean island of

Kendrick K, et al. MMWR 2014;63(48):1137

Texas (N=1)

- One case in Cameron County
- Occurred in November 2015

Location of Cameron County, Texas

Acknowledgments

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