Chikungunya in the United States

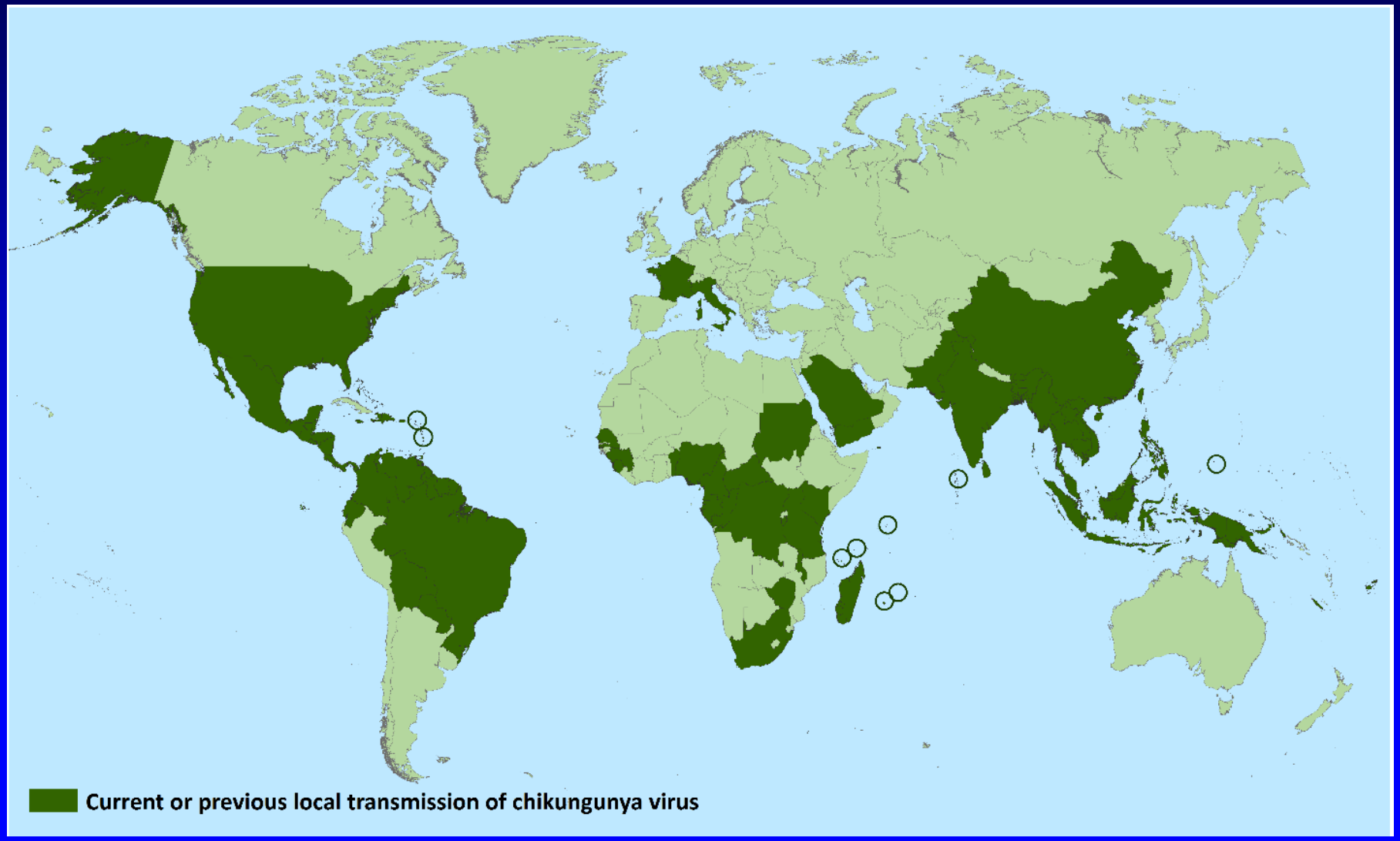
Arboviral Diseases Branch
Division of Vector-Borne Diseases
Centers for Disease Control and Prevention

April 8, 2015

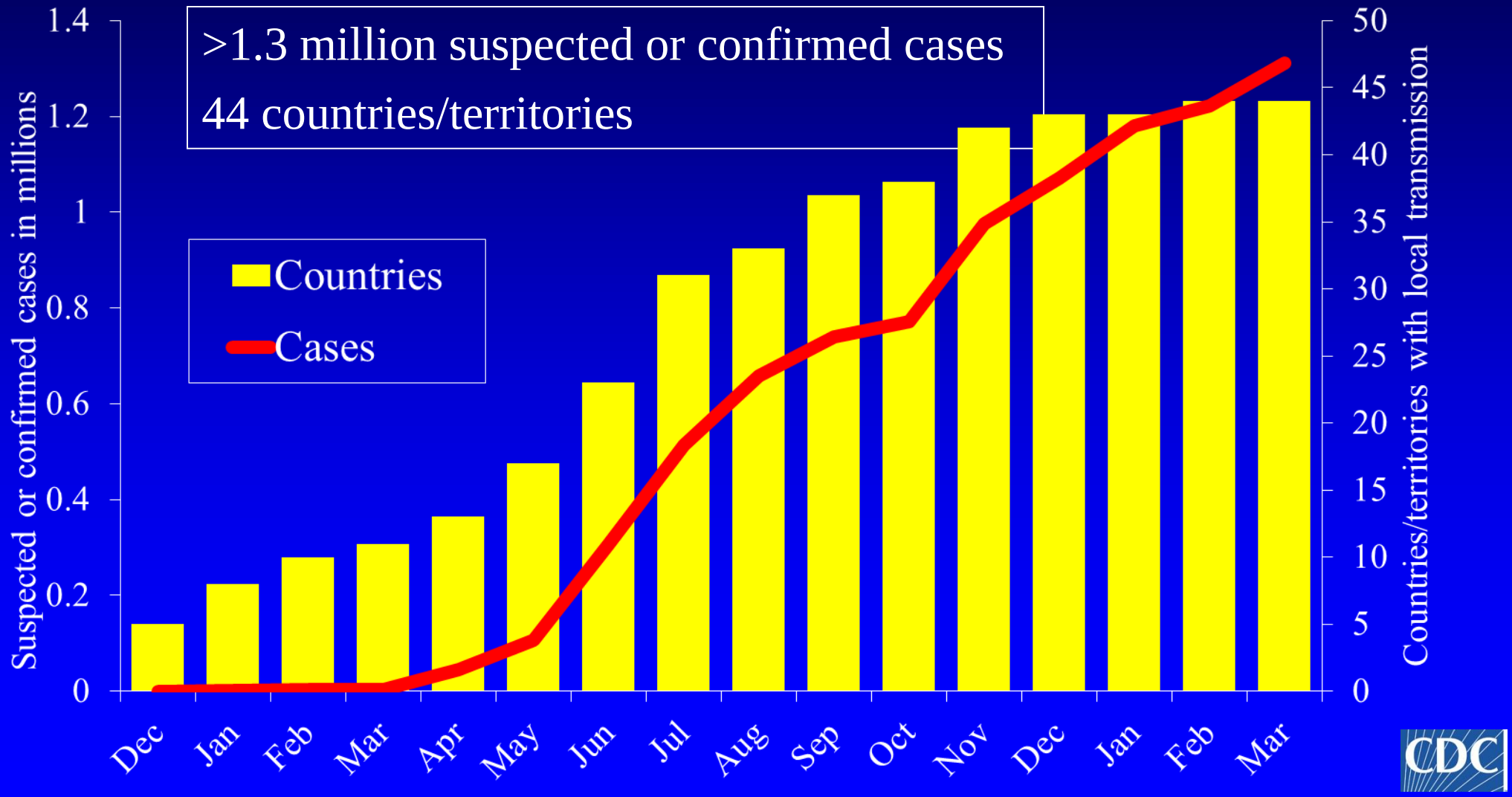
Chikungunya virus disease

- Mosquito-borne viral disease characterized by acute onset of fever and severe polyarthralgia
- Often occurs in large outbreaks with high attack rates
- Outbreaks have occurred in countries in Africa, Asia, Europe, and the Indian and Pacific Oceans
- In 2013, first locally-acquired cases in the Americas reported on islands in the Caribbean

Countries with reported local transmission of chikungunya virus disease



Reported chikungunya cases and number of countries/territories with local transmission in the Americas, Dec 2013–Mar 2015



Chikungunya virus disease cases reported to PAHO from selected countries in the Americas, Dec 2013–Apr 2015

	Suspected (N=1,322,693)	Confirmed* (N=30,309)
Dominican Republic	539,138 (41%)	84 (<1%)
Colombia	243,060 (18%)	1,531 (5%)
El Salvador	144,335 (11%)	157 (<1%)
Guadeloupe	81,350 (6%)	430 (1%)
Martinique	72,520 (5%)	1,515 (5%)
Haiti	64,695 (5%)	14 (<1%)

*≤1% of all reported cases are laboratory-confirmed

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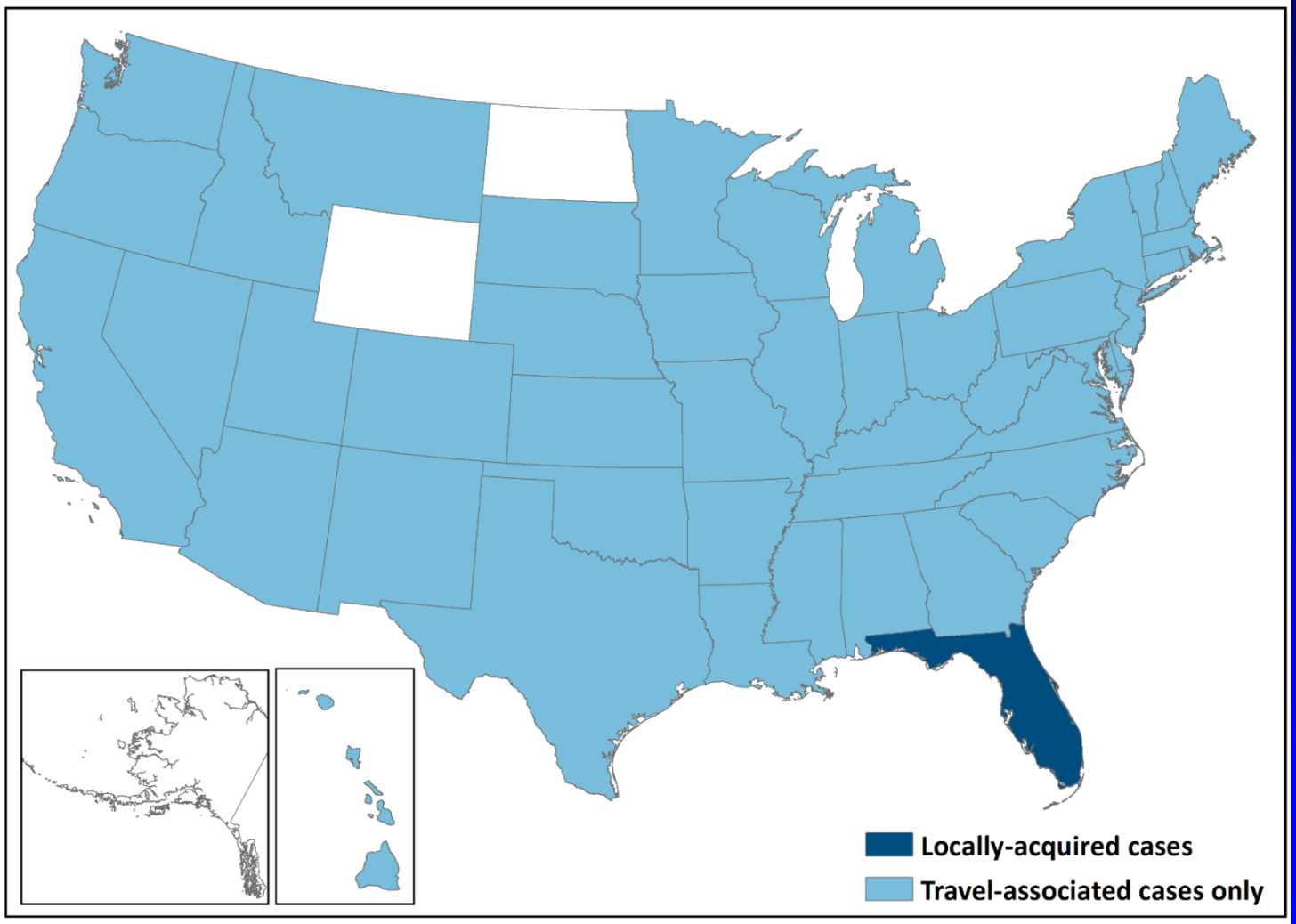
Chikungunya virus in the United States

- Prior to 2006, chikungunya rarely identified in U.S. travelers.
- From 2006–2013, average of 28 cases per year in the United States
  - All were travelers to affected areas in Asia, Africa, or Indian Ocean
  - None resulted in known local transmission in the United States
- In 2014, after chikungunya virus local transmission was first identified in Caribbean countries and territories
  - Number of chikungunya cases in U.S. travelers increased significantly
  - Local transmission was identified in Florida, Puerto Rico, and USVI

States reporting chikungunya virus disease cases — United States, 2014 (as of February 10, 2015)



	Cases (N=2,492)
Local	11 (<1%)
Imported	2,481 (99%)

Chikungunya virus disease cases reported by state — United States, 2014 (as of February 10, 2015)

	Travel-associated (N=2,481)	Locally-transmitted (N=11)
New York	740 (30%)	0 (0%)
Florida	447 (18%)	11 (100%)
New Jersey	171 (7%)	0 (0%)
Massachusetts	158 (6%)	0 (0%)
Pennsylvania	96 (4%)	0 (0%)
43 other states	869 (35%)	0 (0%)

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Chikungunya virus disease cases reported by territory — United States, 2014 (as of February 10, 2015)

	Travel-associated (N=46)	Locally-transmitted (N=4,467)
Puerto Rico*	32 (70%)	4,216 (94%)
US Virgin Islands†	14 (30%)	251 (6%)

*30,983 suspected cases also reported to Puerto Rico Dept of Health

†1,321 suspected cases also reported to USVI Dept of Health

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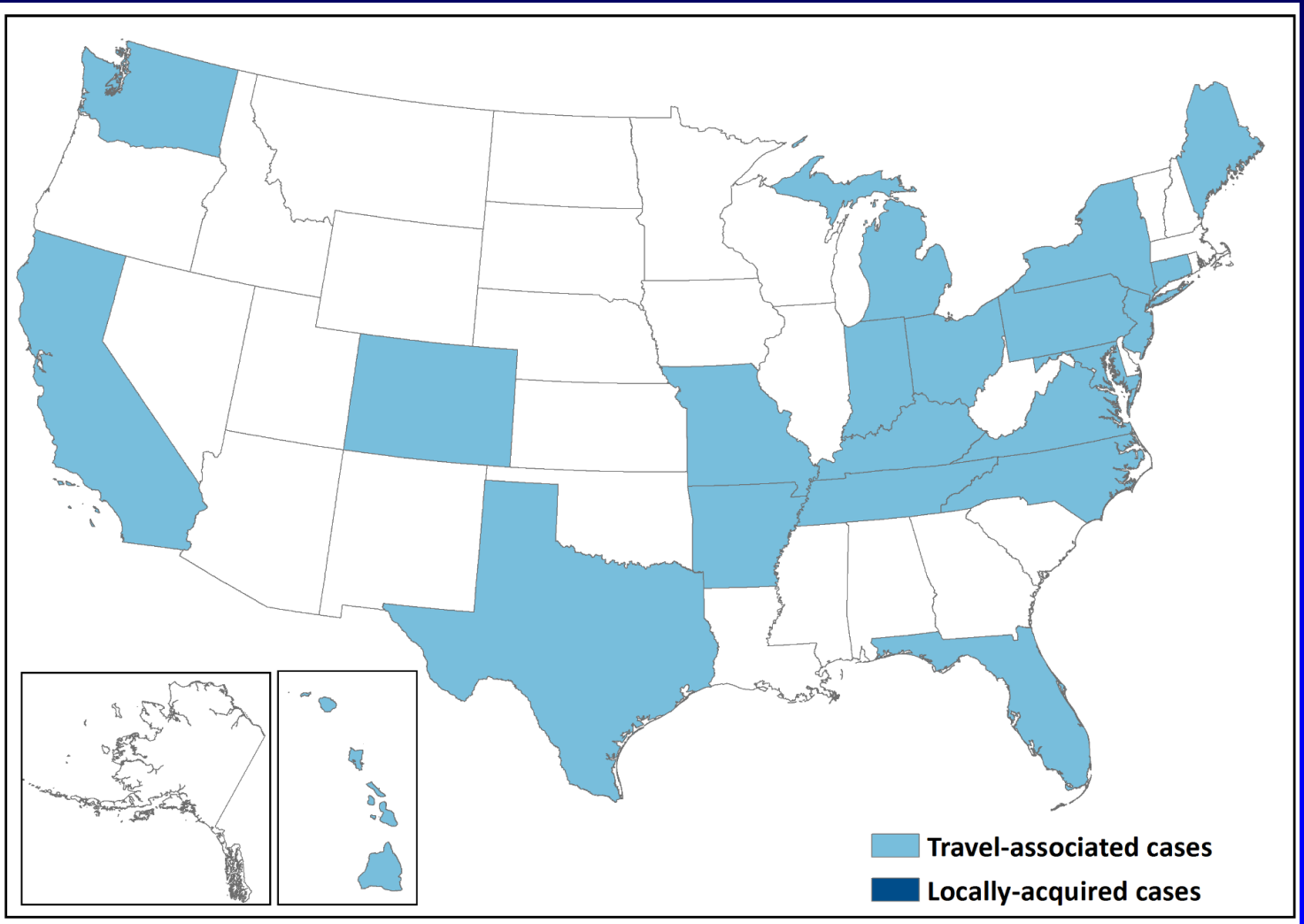
States reporting chikungunya virus disease cases — United States, 2015 (as of April 7, 2015)



	Cases (N=77)
Local	0 (0%)
Imported	77 (100%)

Chikungunya virus disease cases reported by state — United States, 2015 (as of April 7, 2015)

	Travel-associated (N=77)	Locally-transmitted (N=0)
Florida	16 (22%)	0 (0%)
New York	12 (18%)	0 (0%)
Maryland	7 (10%)	0 (0%)
California	6 (9%)	0 (0%)
Texas	4 (6%)	0 (0%)
14 other states	32 (42%)	0 (0%)

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Chikungunya virus disease cases reported by territory — United States, 2015 (as of April 7, 2015)

	Travel-associated (N=0)	Locally-transmitted (N=56)
Puerto Rico*	0 (0%)	51 (91%)
US Virgin Islands†	0 (0%)	5 (9%)

*341 suspected cases also reported to Puerto Rico Dept of Health

†18 suspected cases reported to USVI Dept of Health

Chikungunya virus

- Single stranded RNA virus
- Genus *Alphavirus*
- Family *Togaviridae*
- Closely related to Mayaro, O'nyong-nyong and Ross River viruses

Chikungunya virus vectors

- Transmitted by *Aedes aegypti* and *Aedes albopictus*
- Also transmit dengue virus
- Larvae develop in discarded tires and household containers
- Aggressive daytime-biting mosquitoes

Aedes aegypti

Aedes albopictus

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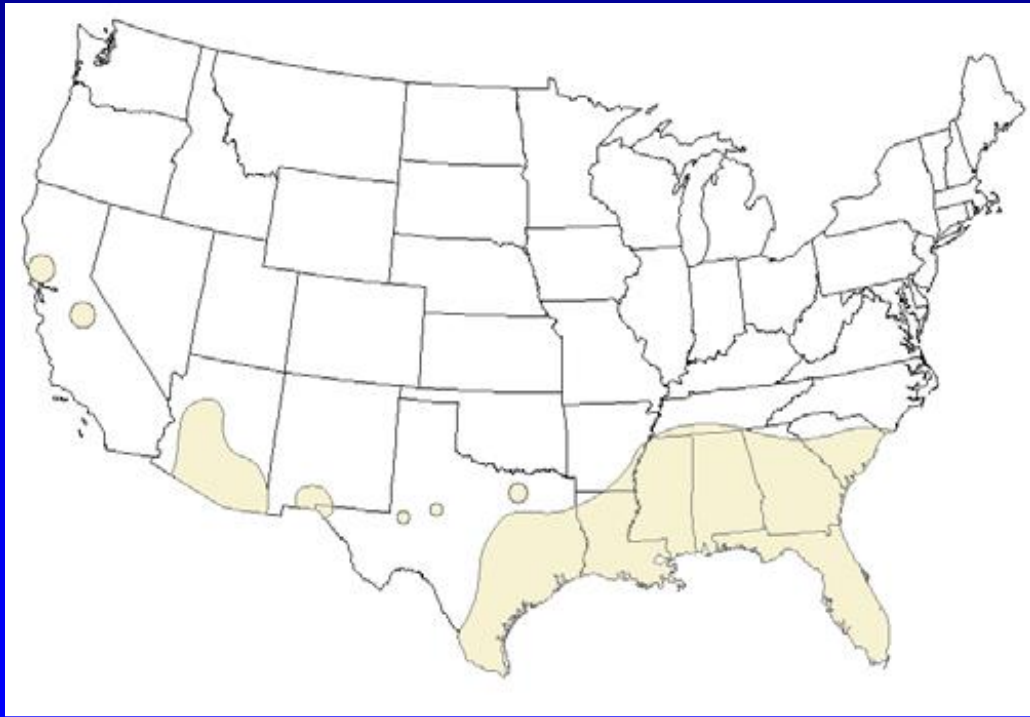
Approximate geographic distribution of *Aedes aegypti* and *Aedes albopictus* mosquitoes in the United States

Aedes aegypti



Aedes albopictus

Primary transmission cycle

Anthroponotic transmission
(person to mosquito to person)

Other modes of transmission

- Documented rarely
  - Intrapartum from viremic mother to child
  - *In utero* transmission resulting in miscarriage
  - Percutaneous needle stick
  - Laboratory exposure
- Theoretical concern
  - Blood transfusion
  - Organ or tissue transplantation
- No evidence of virus in breast milk

Primary clinical symptoms

- Majority (72%–97%) of infected people symptomatic
- Incubation period usually 3–7 days (range 1–12 days)
- Primary clinical symptoms are fever and polyarthralgia
- Arthralgia usually bilateral and symmetric
- Pain can be severe and debilitating

Other common clinical signs and symptoms

- Headache
- Myalgia
- Arthritis
- Conjunctivitis
- Nausea/vomiting
- Maculopapular rash

Clinical laboratory findings

- Lymphopenia
- Thrombocytopenia
- Elevated creatinine
- Elevated hepatic transaminases

Atypical disease manifestations

- Uveitis
- Retinitis
- Hepatitis
- Nephritis
- Myocarditis
- Hemorrhage
- Myelitis
- Cranial nerve palsies
- Guillain-Barre syndrome
- Meningoencephalitis
- Bullous skin lesions*

*Primarily described in infants

Risk factors for hospitalization or atypical disease

- Neonates exposed intrapartum
- Older age (e.g., >65 years)
- Underlying medical conditions (e.g., diabetes, hypertension, or cardiovascular disease)

Clinical outcomes

- Acute symptoms typically resolve in 7–10 days
- Mortality is rare; occurs mostly in older adults
- Some patients have relapse of rheumatologic symptoms* in months following acute illness
- Studies report variable proportions of patients with persistent joint pains for months or years

*Polyarthralgia, polyarthritis, tenosynovitis, Raynaud's syndrome

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Diagnostic testing

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

*Virus should be handled under biosafety level (BSL) 3 conditions
†Determined by plaque reduction neutralization test (PRNT) or immunofluorescence assay (IFA)

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Timing for diagnostic testing

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

Laboratories for diagnostic testing

- Healthcare providers should contact their local health department to facilitate diagnostic testing
- Testing performed at CDC, state health departments, and commercial laboratories
- Commercial laboratories will only perform tests that are ordered by healthcare provider
- Several IgM antibody assays are commercially-available but not yet FDA-cleared

CDC evaluation of commercially-available chikungunya virus IgM antibody assays

Manufacturer	Assay	Type	Performance†
Euroimmun*	Anti-CHIKV IgM	IFA	High
Euroimmun*	Anti-CHIKV IgM	ELISA	High
Inbios*	CHIKjj Detect MAC	ELISA	High
Abcam (NovaTec)*	Anti-CHIKV IgM human	ELISA	Inconsistent
Genway (NovaTec)*	CHIKV IgM μ-capture	ELISA	Low
CTK Biotech	RecombiLISA CHIK IgM	ELISA	Low
SD Diagnostics	CHIKa IgM	ELISA	Low
CTK Biotech	On-site CHIK IgM Combo	Rapid	Low
SD Diagnostics	SD BIOLINE CHIK IgM	Rapid	Low

*Available for purchase in the United States but not FDA-cleared

†Compared to CDC IgM capture ELISA

CDC steps to increase public health testing capacity

- Publish results of the commercially-available IgM antibody assay evaluations
- Provide reagents for CDC MAC-ELISA until commercial kit evaluation is published
- Provide protocol, primers/probe sequences, and RNA lysate for CDC RT-PCR
- Distribute RT-PCR and antibody test proficiency panels

Distinguishing chikungunya from dengue

- Viruses transmitted by same mosquitoes
- Diseases have similar clinical features
- Viruses can circulate in same area 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

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Clinical features of chikungunya virus infections compared to dengue virus infections

	Chikungunya	Dengue
Fever (>39°C)	+++	++
Arthralgia	+++	+/-
Arthritis	+	-
Headache	++	++
Rash	++	+
Myalgia	+	++
Hemorrhage	+/-	++
Shock	-	+

Clinical laboratory features of chikungunya virus infections compared to dengue virus infections

	Chikungunya	Dengue
Lymphopenia	+++	++
Neutropenia	+	+++
Thrombocytopenia	+	+++
Hemoconcentration	-	++

Differential diagnosis for chikungunya

- Dengue
- Leptospirosis
- Malaria
- Rickettsia
- Parvovirus
- Enterovirus
- Group A streptococcus
- Rubella
- Measles
- Adenovirus
- Post-infectious arthritis
- Rheumatologic conditions
- Other alphavirus infections (e.g., Mayaro, Ross River, Barmah Forest, O'nyong-nyong, and Sindbis viruses)

Initial assessment and treatment

- No specific antiviral therapy; treatment is supportive
- Assess hydration and hemodynamic status
- Evaluate for other serious conditions and treat or manage appropriately
- Collect specimens for diagnostic testing for chikungunya and dengue
- Manage as dengue until it is ruled out

Use of aspirin and other NSAIDs

- Aspirin and other NSAIDs can increase risk of hemorrhage in patients with dengue
- If dengue in the differential diagnosis, do not use aspirin or other NSAIDs until afebrile ≥48 hours and no dengue warning signs*
- Use acetaminophen for initial fever and pain control
- Persistent joint pain may benefit from the use of NSAIDs, corticosteroids, or physiotherapy but no clinical trials

*Warning signs for severe dengue include bleeding, pleural effusion or ascites, lethargy, enlarged liver, and hemoconcentration with thrombocytopenia

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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

Reporting chikungunya cases

- Chikungunya and dengue are nationally notifiable conditions
- Healthcare providers and reference laboratories report laboratory-confirmed cases to state health departments
- State health departments report cases to CDC through ArboNET
- Timely reporting allows health departments to assess and reduce the risk of local transmission or mitigate further spread

Preventive measures

- No vaccine or medication available to prevent infection or disease
- Primary prevention measure is to reduce mosquito exposure
- Consider advising people at risk for severe disease to avoid travel to areas with ongoing outbreaks
- Protect infected people from further mosquito exposure during first week of illness

Mosquito prevention and control

- Use air conditioning or window/door screens
- Use mosquito repellents on exposed skin
- Wear long-sleeved shirts and long pants
- Mosquito habitat control
- Appropriate applications of larvicide and adulticide

Future course of chikungunya in the Americas

- Virus will continue to spread in areas with competent vectors
  - Local transmission recently identified in Mexico
  - Anticipate some spread into U.S. border states
- Travel-associated cases will introduce virus into the U.S.
  - Imported cases will result in local transmission and outbreaks
  - Air conditioning may limit the size and scope of outbreaks
  - Colder temperatures will interrupt and possibly stop further spread
- Dengue might provide predictive model
  - In 2013, 2.4 million cases of dengue reported in the Americas
  - 773 travel-related and 49 locally transmitted cases in U.S. states

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Remaining questions

- Role of *Aedes albopictus* in temperate areas
- Will enzootic cycle be established to maintain virus
- Impact of chikungunya and dengue virus co-circulation
- Burden of longer term morbidity

Chikungunya virus in the Americas summary

- Chikungunya virus continues to spread in the Americas
- Primary prevention measure to reduce mosquito exposure
- Consider in patients with acute fever and polyarthralgia, especially travelers who recently returned from areas with known local virus transmission
- Laboratory-confirmed cases should be reported to state health departments and CDC

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Additional resources

- General information about chikungunya virus and disease: http://www.cdc.gov/chikungunya/
- Protection against mosquitoes: http://wwwnc.cdc.gov/travel/yellowbook/2014/chapter-2-the-pre-travel-consultation/protection-against-mosquitoes-ticks-and-other-insects-and-arthropods
- Travel notices: http://wwwnc.cdc.gov/travel/notices
- Information for travelers and travel health providers: http://wwwnc.cdc.gov/travel/yellowbook/2014/chapter-3-infectious-diseases-related-to-travel/chikungunya
- Chikungunya preparedness and response guidelines: http://new.paho.org/hq/index.php?option=com_docman&task=doc_download&gid=16984&Itemid

Questions

Phone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348

E-mail: cdcinfo@cdc.gov Web: http://www.cdc.gov

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