The Mosquitoes We Live With and the Diseases They Harbor (Part 2)

WCLN Webinar 5/10/17

Surveillance of Arboviral Infections in Wisconsin

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Overview

- Diseases and characteristics
- Data and statistics
- Diagnosis and treatment
- Disease control and prevention
- Zika virus update

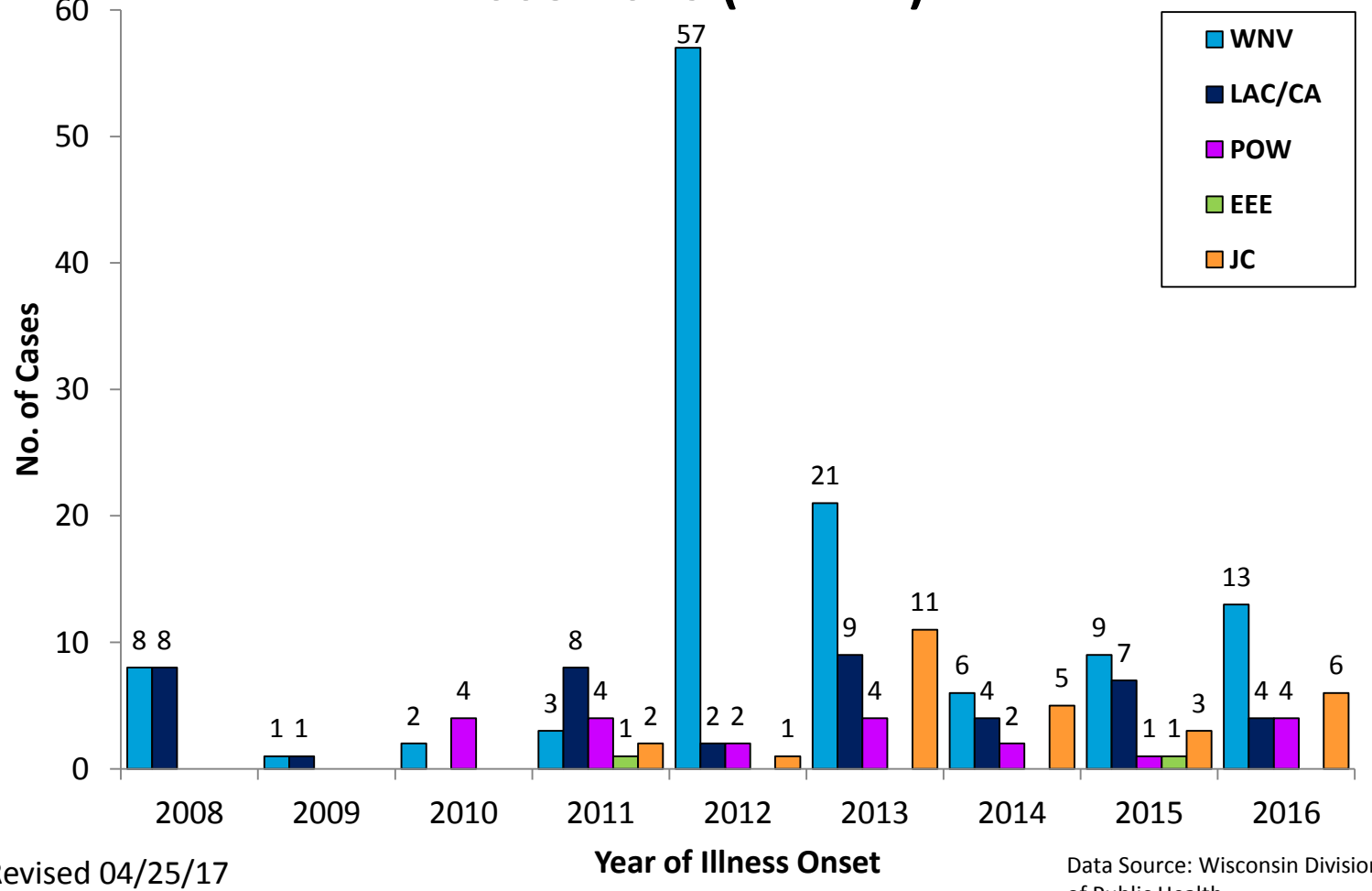
Endemic Arboviral Infections

- Arboviruses acquired in Wisconsin include:
  - La Crosse virus (LACV)/California encephalitis virus (CAV)
  - Jamestown Canyon virus (JCV)
  - West Nile virus (WNV)
  - Powassan virus(POWV)
  - St. Louis encephalitis virus (SLEV)
  - Eastern equine encephalitis virus (EEEV)
- All IgM and IgG arboviral positive results are reported to the Wisconsin Electronic Disease Surveillance System (WEDSS) implemented since 2007.
- As part of our enhanced surveillance, the Division of Public Health (DPH) collaborates with Wisconsin State Laboratory of Hygiene (WSLH) to offer fee-exempt testing for the arbovirus IgM panel testing including POWV and JCV.
- CDC confirmatory testing for arboviruses includes MAC-ELISA IgM and IgG antibody panel, microsphere immuno assay (MIA), and plaque reduction neutralization (PRNT).

Surveillance in Wisconsin, 2002-2016

Confirmed and Probable Cases Infections/year	Total Cases (%) 2016 *(n= 27)*	2002-2015 *(n= 390)*
• West Nile virus	13 (48)	236 (61)
• La Crosse /California serogroup	4 (15)	97 (25)
• Jamestown canyon virus	6 (22)	33 (8)
• St. Louis, eastern equine, and western equine	0	3 (0.8)
• Non-specified Flavivirus	0	1 (0.2)
• Powassan virus	4 (15)	20 (5)

Wisconsin Reported Arboviral Diseases 2008-2016 (N= 214)



Revised 04/25/17

Data Source: Wisconsin Division of Public Health

Arbovirus Diagnosis and Treatment

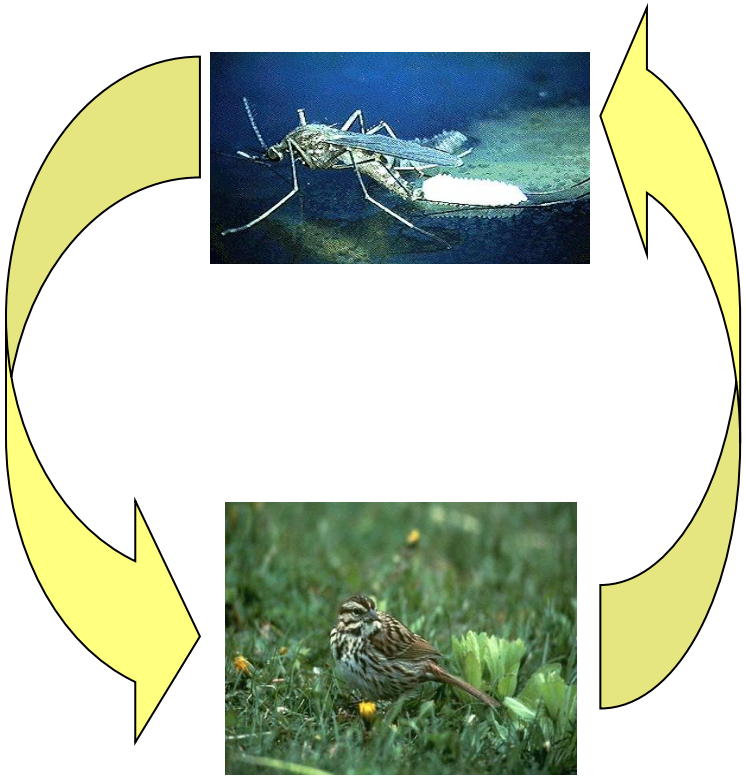
- Arboviral infections are diagnosed by clinical presentation and laboratory tests (blood and CSF).
- There are no specific treatments for arboviral infections; supportive care and relief of symptoms is all that is available.
- In general, infection with an arbovirus can provide life-long immunity to that specific virus.
- There are no available vaccines.

West Nile Virus

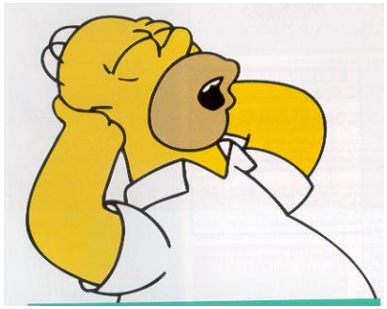
West Nile Virus (WNV)

- Originally isolated from West Nile province of Uganda in 1937
- Introduced to the US (New York City) in 1999
- Now endemic to most of the United States
- First WNV outbreak in WI in 2002 with 52 confirmed cases
  - Average of 13 (range = 1 - 57) WNV cases/year in the last 10 years

WNV Transmission Cycle



Incidental infections



CDC

Wisconsin WNV Surveillance

- Three major components:
  - Human disease surveillance
  - Veterinary and wild corvid (crow, raven, and blue jay) surveillance
  - Mosquito surveillance

- Human surveillance is based on laboratory positive results or clinician reporting to the Wisconsin Electronic Disease Surveillance System (WEDSS) or via hard copy of a case report form.

- Non-human activities are coordinated among numerous partners: Local health departments, Wisconsin Department of Natural Resources, USDA-Wildlife Services, Wisconsin State Laboratory of Hygiene (WSLH), UW-Veterinary Diagnostic Laboratory (WVDL), Department of Agriculture Trade and Consumer Protection (DATCP), and UW-Medical Entomology Laboratory.

- All arbovirus activities are reported to CDC via ArboNet system.

WNV Infections

- WNV symptoms usually occur 3-14 days from a bite of an infected mosquito.
- About 20% of the people infected with WNV will have symptoms that can be mild and include headache, fever, fatigue, muscle aches and swollen lymph nodes; about 80% of the people may not have any symptoms.
- Severe neuroinvasive illness occurs in <1% of the people - paralysis, encephalitis (swelling of the brain) and meningitis, confusion, coma, and death.
- Children, the elderly, and people with compromised immune systems are at increased risk of severe disease.
- Other types of transmission include blood transfusion; organ transplantation; from mother to baby during pregnancy, delivery, or breastfeeding; and laboratory exposure.

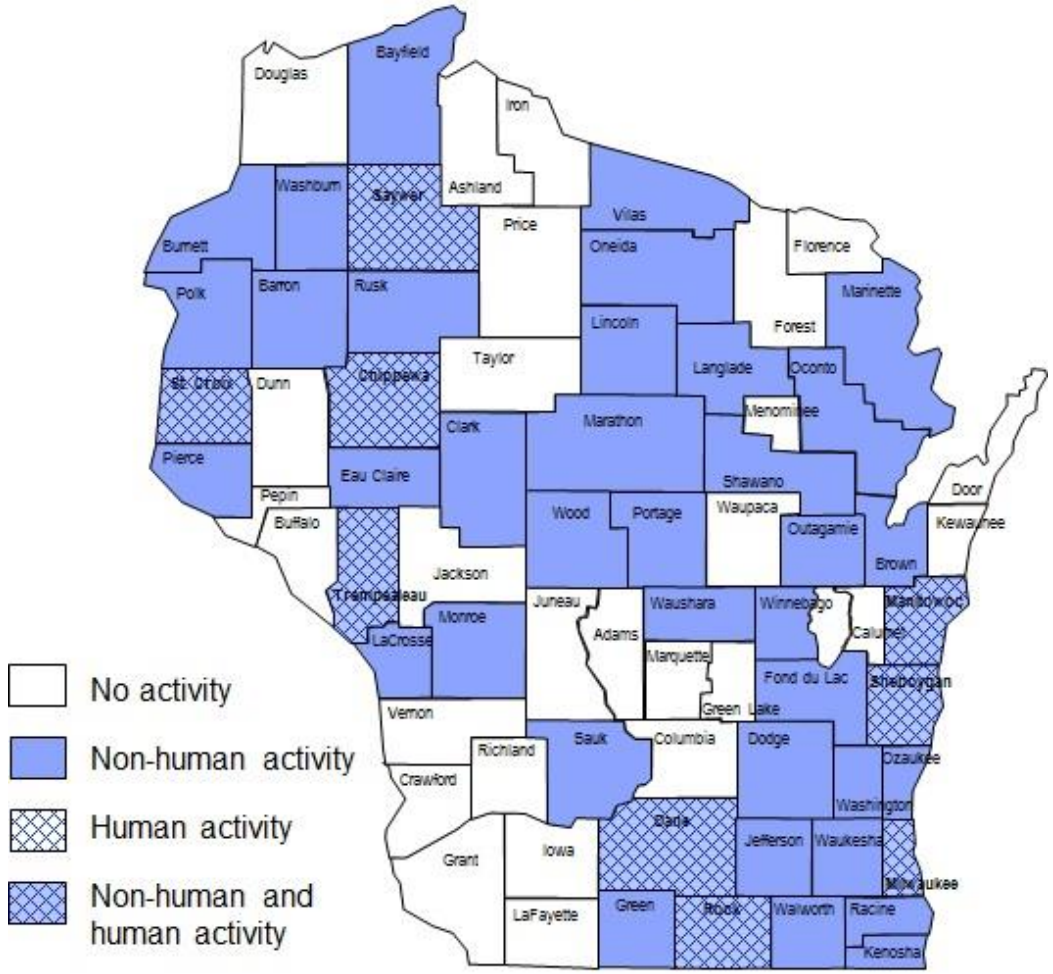
Human Disease Surveillance, WI

WNV characteristics	2016	2015
Total	13	9
Neuroinvasive	10/77%	6/67%
Fever	12/92%	7/77%
Age range (median)	14-72(64)	14-87(59)
Hospitalizations	10/77%	4/44%
Deaths	2/15%	1/11%
Males	10/77%	4/44%
Positive viremic donor	7	1

West Nile Virus Activity Wisconsin 2016

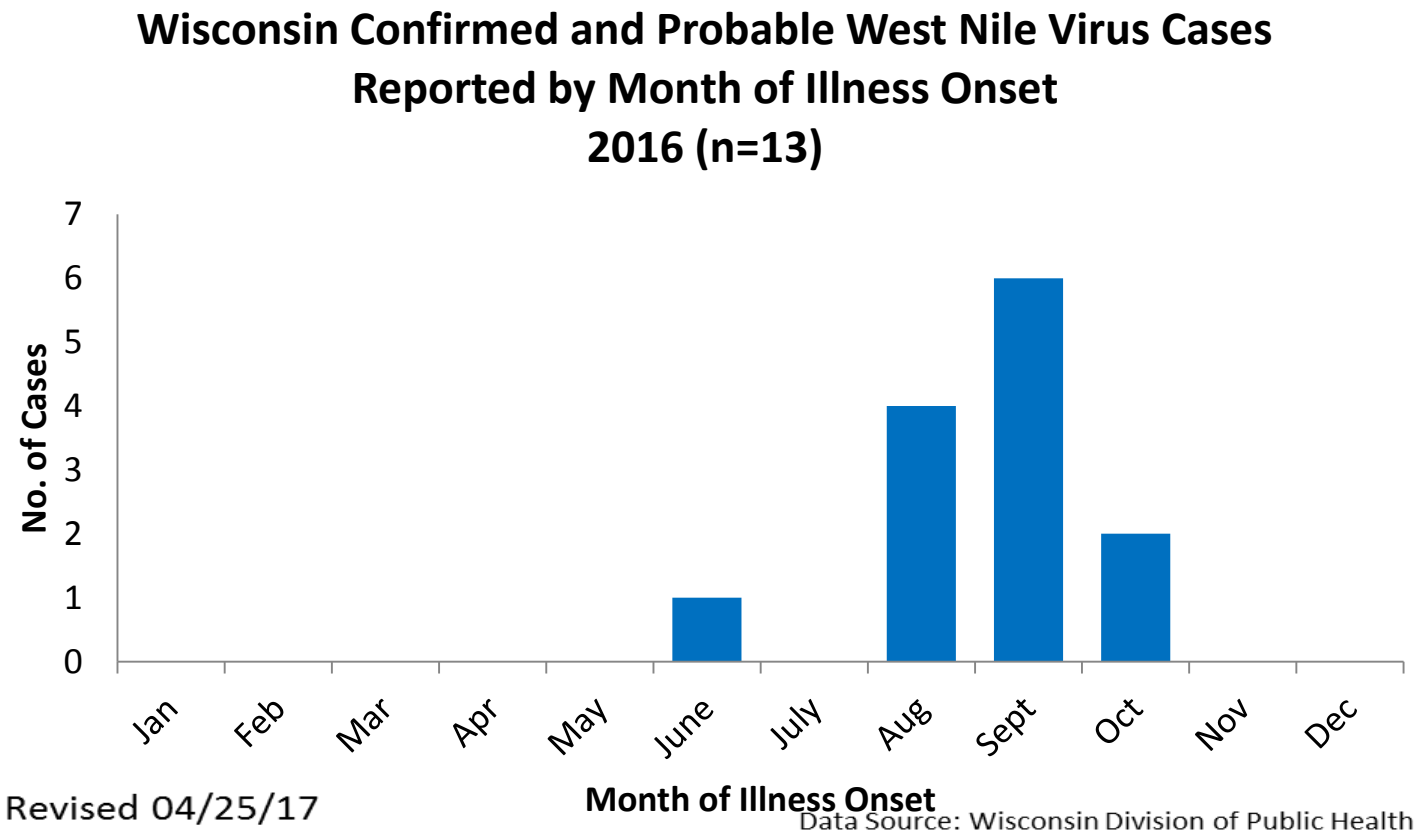
Human and Non-human (Birds, Horses, Mosquitoes)

Updated March 15, 2017

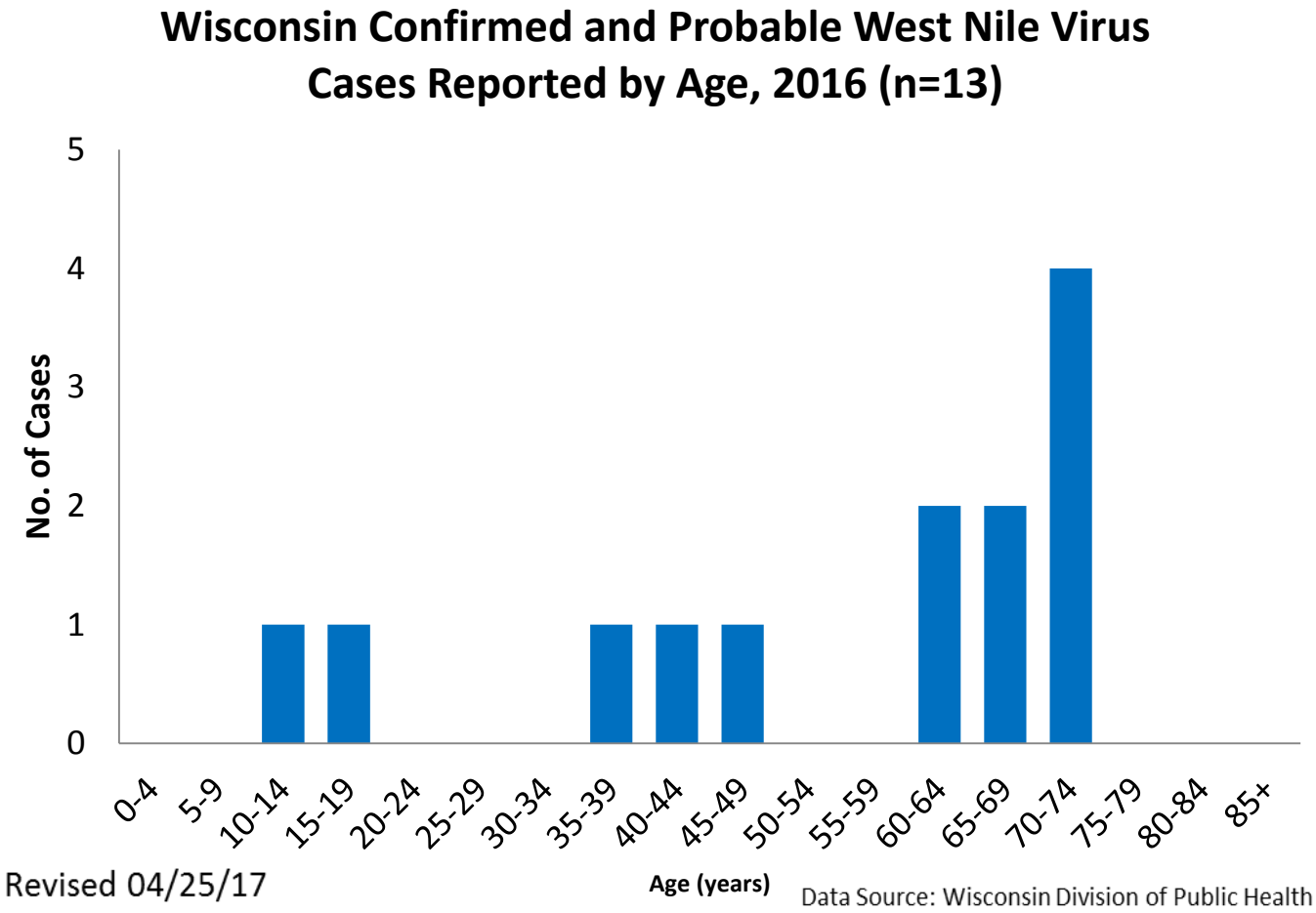


Data Source: Wisconsin Division of Public Health

WNV Reported by Month of Illness Onset, 2016



WNV Reported by Age, 2016



Bird Surveillance, 2013

Statewide Dead Bird Reporting Hotline

1-800-433-1610

- From May 1 - October 31, 2016, a total of 438 phone calls were entered into WEDSS compared to 783 phone calls in 2015 (44% decrease).
- 59 birds collected from 44 counties tested positive for WNV in 2016.
- Program also monitors for unusually large number of bird deaths (e.g., avian influenza outbreaks).



Mosquito Surveillance

- Mosquito surveillance can be expensive and labor intensive.
- It can be helpful to know the different types of mosquito species circulating in Wisconsin but data suggest that it is not a good system for early warning.
- Monitor in man-made or artificial habitats for mosquito species transmitting WNV and LACV.
- Monitor for long term natural breeding areas- ditches, storm sewers, woodland, ponds, and wetland areas.
- In 2016, Dane and Milwaukee Counties submitted over 700 *Culex* sp. to the UW Medical Entomology Laboratory for testing, with 12 pools (</= 50 mosquitoes) testing positive for WNV.

Jamestown Canyon virus

Jamestown Canyon Virus

- In 2003, a cluster of Jamestown Canyon virus infections was identified in WI.
- Jamestown Canyon virus is part of the California serogroup viruses (California encephalitis, La Crosse, Keystone, snowshoe hare, and trivittatus).
- Although the infection is rarely reported and under recognized (commercial testing currently is not available), recent improved testing at WSLH and CDC has helped to identify human cases.
- The DPH has conducted enhanced surveillance for more rare arboviral illnesses, including Jamestown Canyon virus and Powassan virus infections since 2008.
- Fee-exempt serologic testing is conducted for those patients' samples that meet the criteria for testing at the WSLH and CDC.

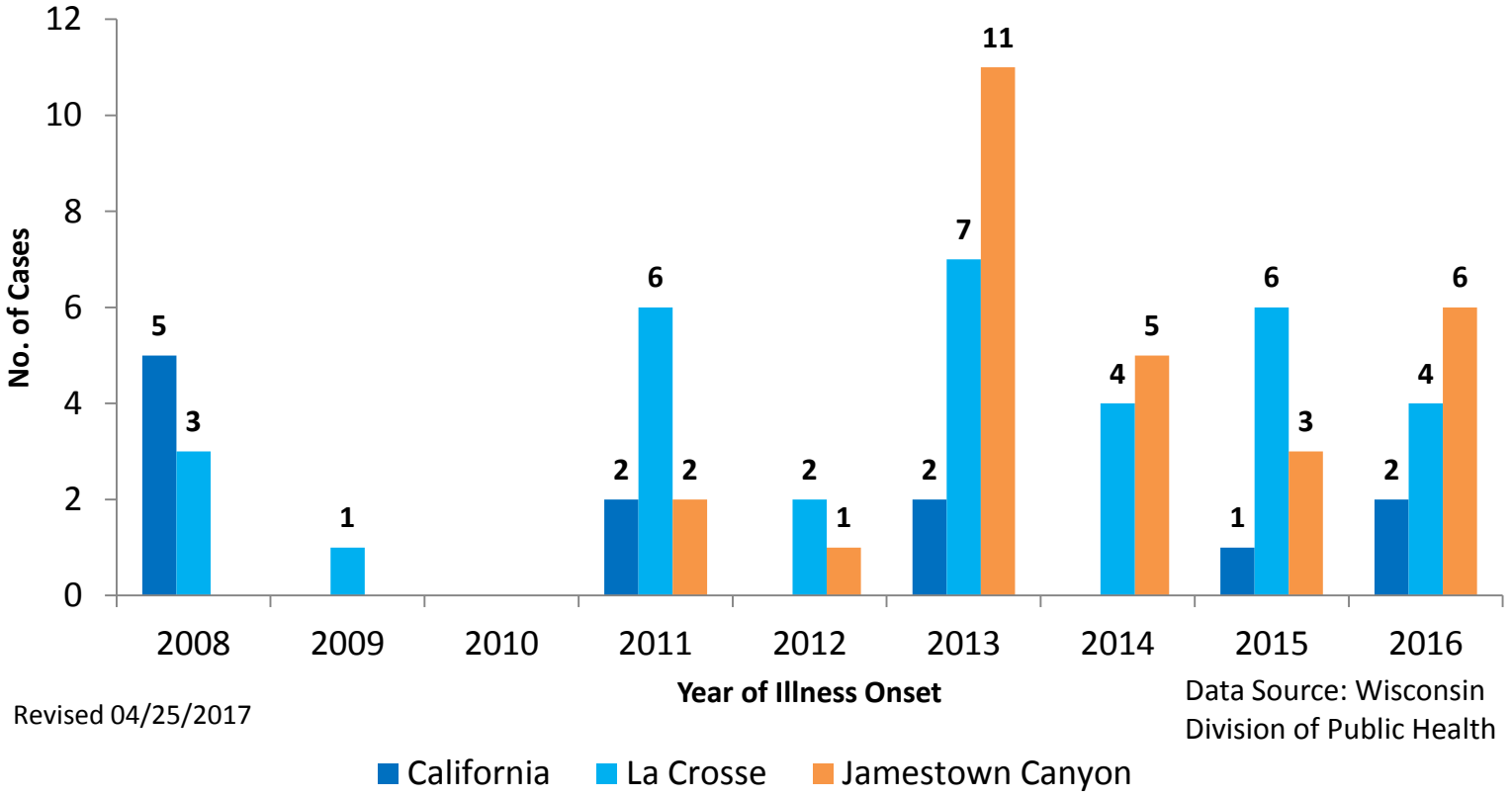
Jamestown Canyon Virus Case Identification

- In 2016, 174 arboviral positive laboratory reports were entered and processed in WEDSS.
- 107 (61%) samples were available at the commercial laboratories for WSLH/CDC testing.
- A total of 27 (16%) arboviral cases were identified. Of these, 6 (22%) of the national reported cases) case-patients met the national surveillance case definition for Jamestown canyon virus.
- Five of the Jamestown canyon virus samples were initially reported as IgG positive and IgM negative results for other arboviruses.

JC Virus Surveillance, 2016, Wisconsin (n=6)

Characteristics	2016 case(%)
Neuroinvasive	3 (60)
Fever, other clinical	4 (67),1(9)
Age range (median)	33-82 years(64)
Hospitalizations	4 (67)
Deaths	0
Males	5 (83)
Traveled	2 (40)

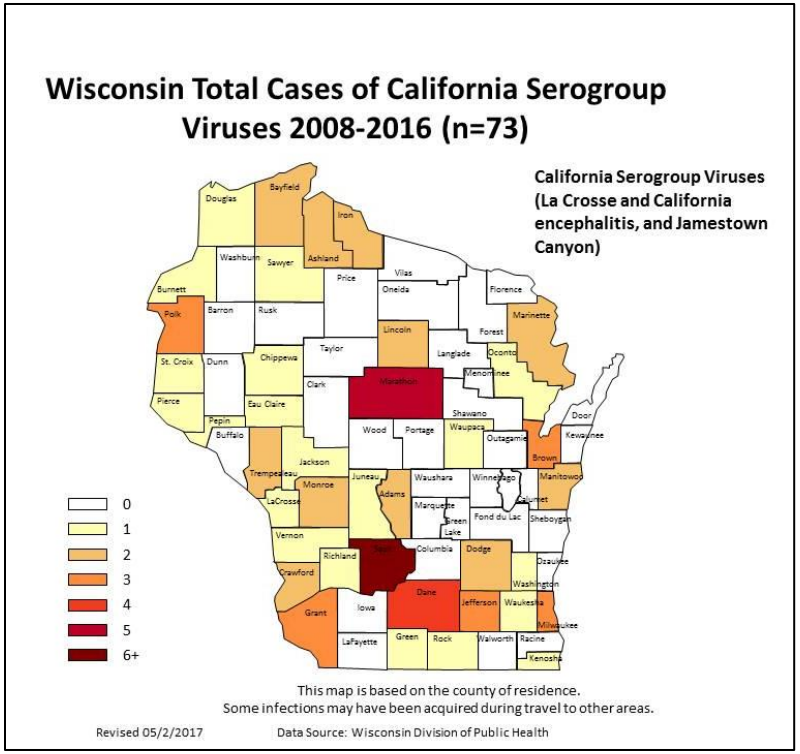
Wisconsin Total Cases of California Serogroup Viruses 2008 - 2016 (n=73)

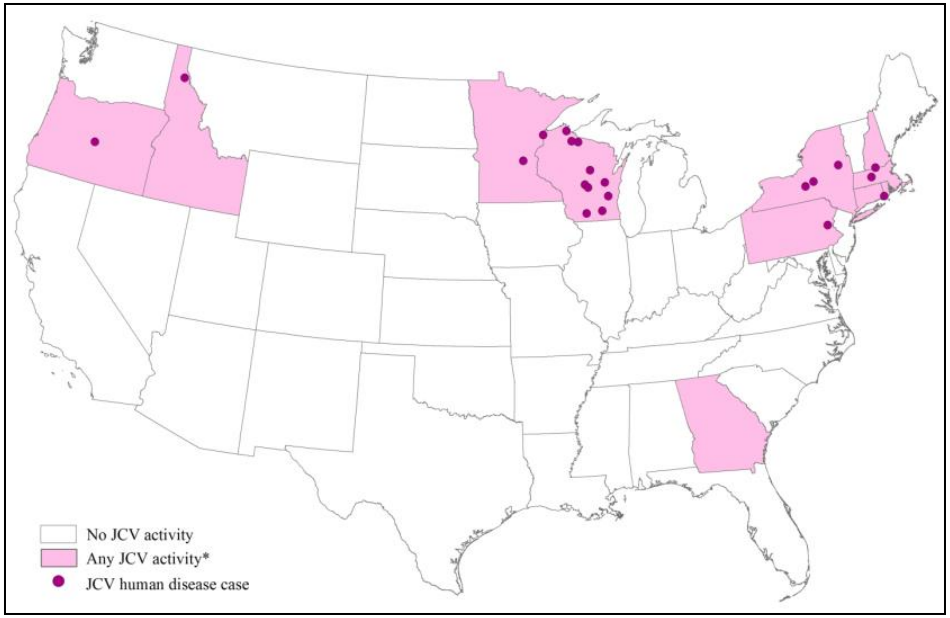


Revised 04/25/2017

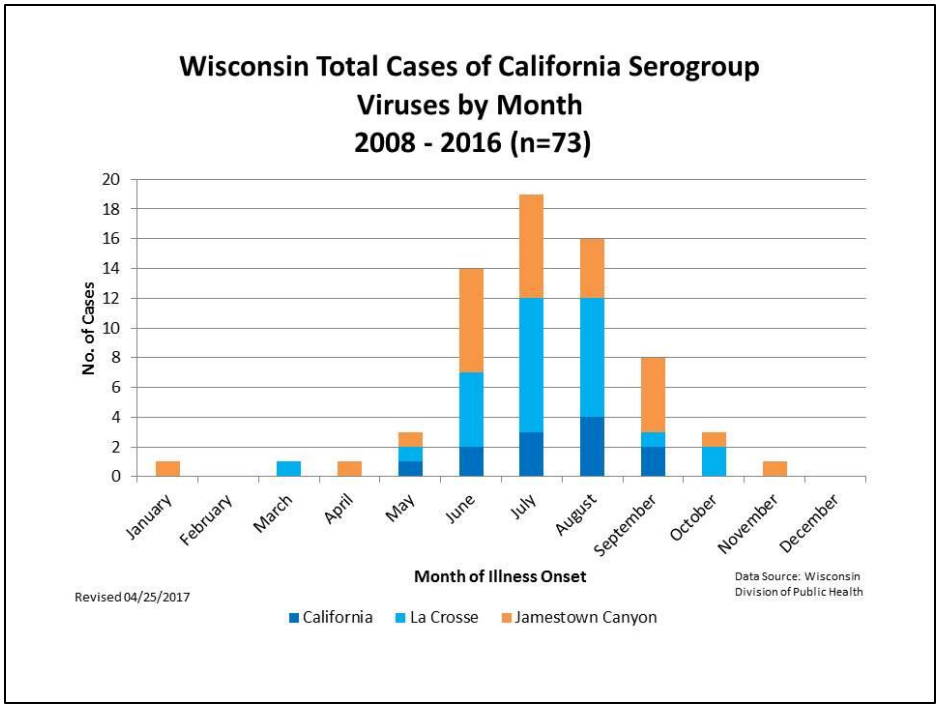
Data Source: Wisconsin Division of Public Health

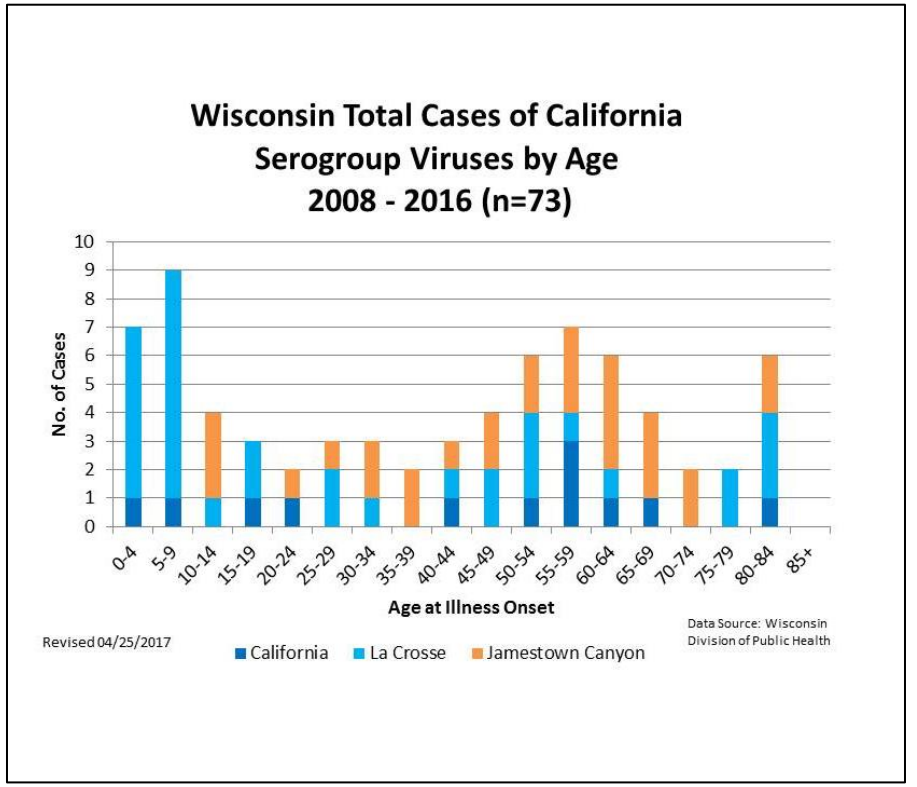
JC Virus and CA/LAC Distribution Maps





JC Virus Cases by Year of Illness Onset and Age Distribution, 2011-2016, Wisconsin





Powassan Virus Infection

Powassan Virus Infection

- Rare tickborne arbovirus infection
- Initially isolated in 1958, in Northern Ontario
- First case in US in New Jersey in 1970.
- Cases have been reported in northern regions of United States (Maine, Michigan, Minnesota, New York, Vermont, and Wisconsin).

- Reservoir is small mammals
- Vector is blacklegged tick (*Ixodes scapularis)*

Ixodes scapularis (Blacklegged or Deer Tick)

Adult female deer tick

Adult male deer tick

Nymph

Larva

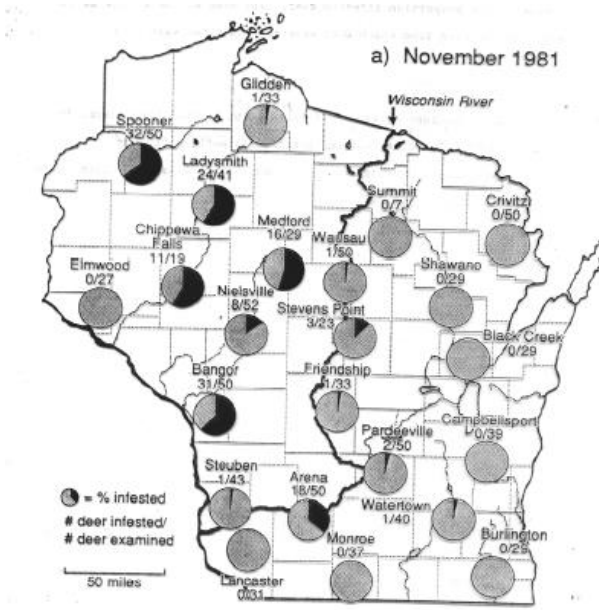
One Inch

Smaller than a American dog/wood tick, adult blacklegged tick females and nymphs can transmit infection through a bite for a blood meal.

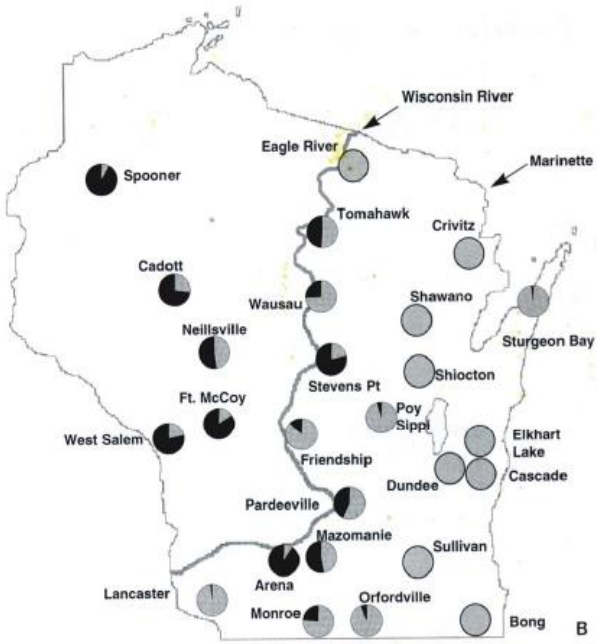
Dermacentor variabilis **(American dog or wood tick)**

UW-Medical Entomology Laboratory
Tick Surveys

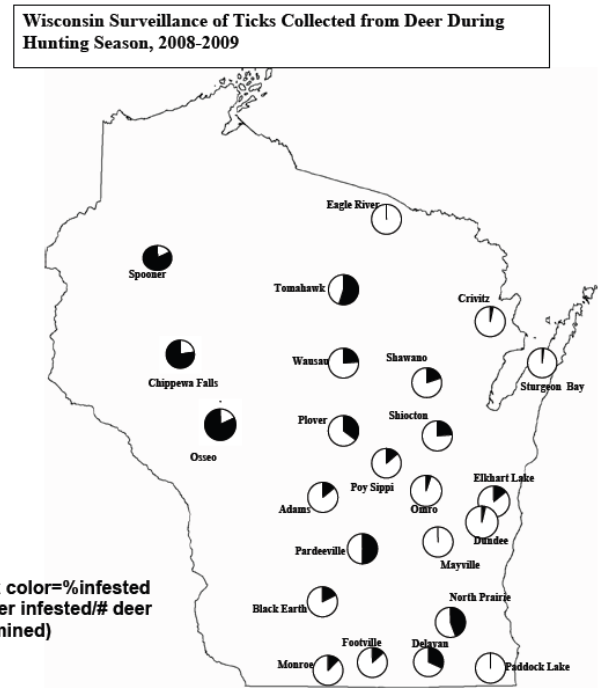
1981



1994



2008-2009

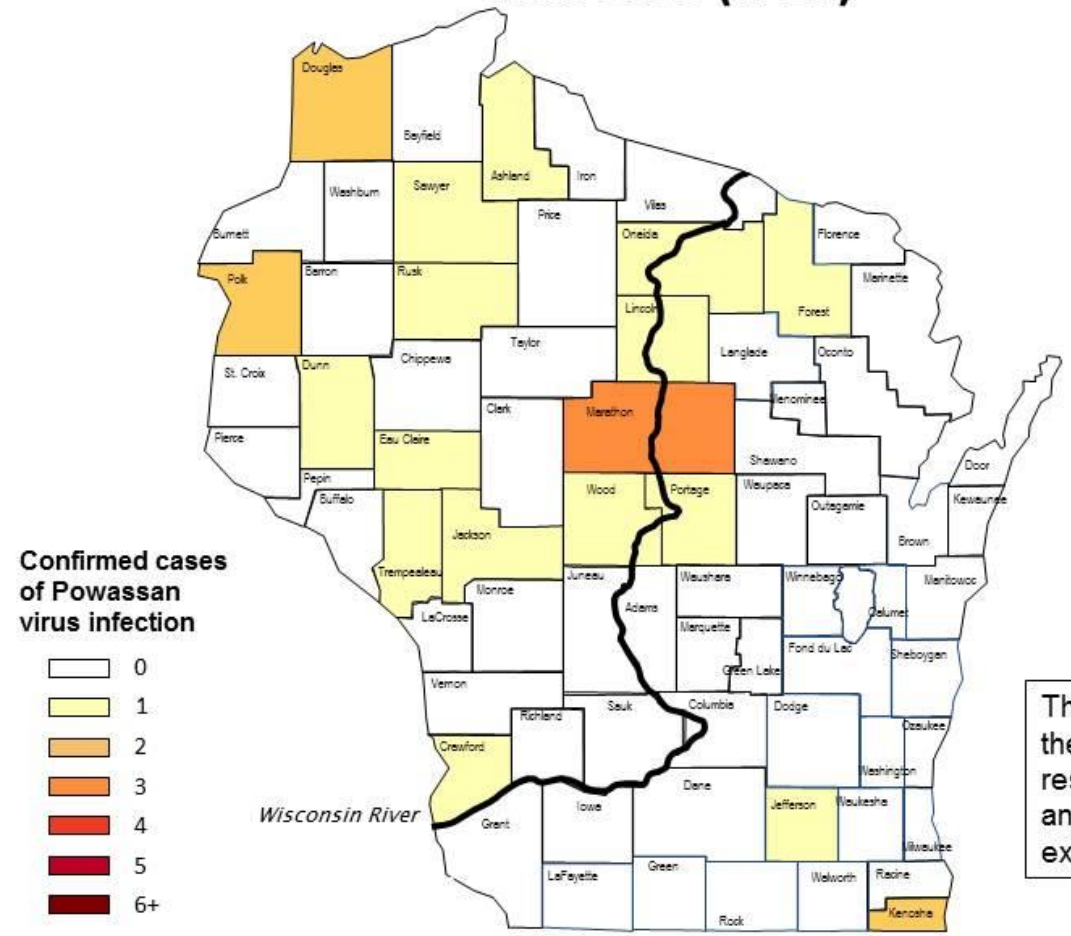


Dark color of the pie= % deer infested with *Ixodes* ticks.

Powassan Infection Clinical Diagnosis

- Incubation period is usually >/= 1 week (range from 8-34 days).
- Acute onset of fever, muscle weakness, confusion, headache, nausea, vomiting, and stiff neck.
- Severe signs and symptoms include respiratory distress, tremors, seizures, gait imbalance, confusion, paralysis, and coma.
- Most of the cases of POWV neuroinvasive disease reported meningoencephalitis leading to long-term neurologic sequelae.
- 10%-15% of POWV cases are fatal.
- Only supportive treatment is available; there is no vaccine.

Wisconsin Total Cases of Powassan Virus Infections 2003-2016 (n=24)



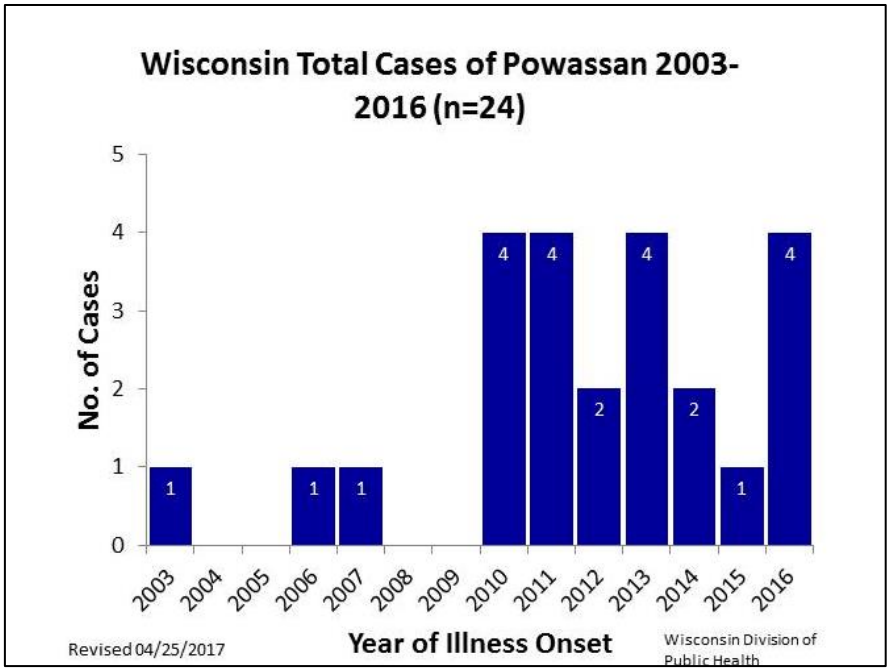
Confirmed cases of Powassan virus infection

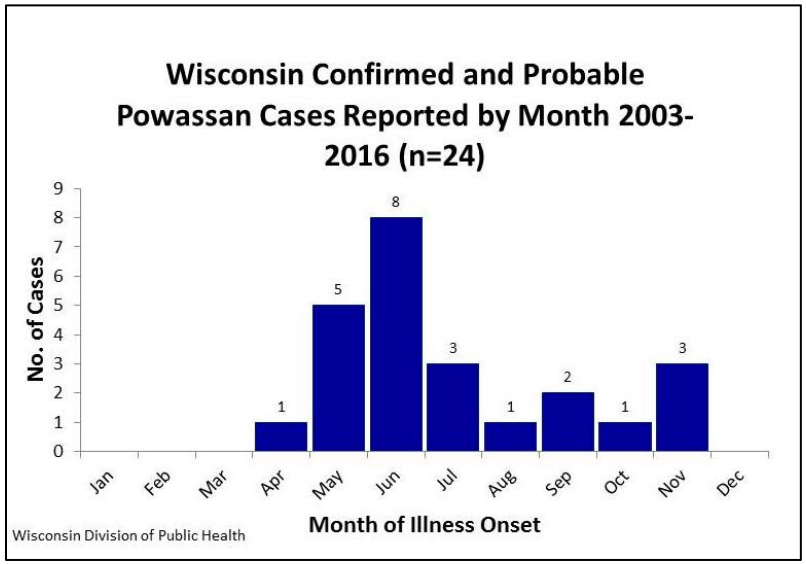
- 0
- 1
- 2
- 3
- 4
- 5
- 6+

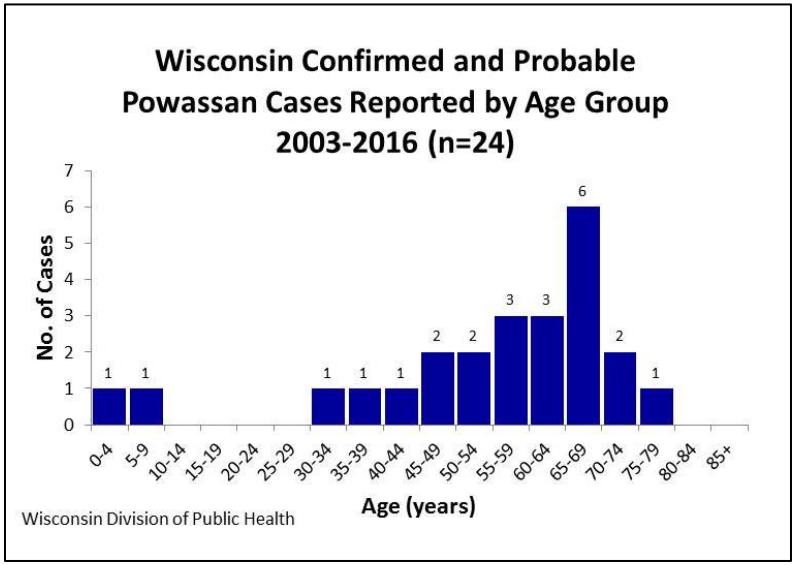
Revised 05/04/17

Data Source: Wisconsin Division of Public Health

This map is based on the county of residence of cases and not by county of exposure.


Wisconsin Total Cases of Powassan 2003-2016 (n=24)
No. of Cases
0
1
2
3
4
5
1
1
1
4
4
2
4
2
1
4
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Year of Illness Onset
Revised 04/25/2017
Wisconsin Division of Public Health


Wisconsin Confirmed and Probable Powassan Cases Reported by Month 2003-2016 (n=24)
No. of Cases
0
1
2
3
4
5
6
7
8
9
1
5
8
3
1
2
1
3
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month of Illness Onset
Wisconsin Division of Public Health


Wisconsin Confirmed and Probable Powassan Cases Reported by Age Group 2003-2016 (n=24)
No. of Cases
0
1
2
3
4
5
6
7
1
1
1
1
1
2
2
3
3
6
2
1
0-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85+
Age (years)
Wisconsin Division of Public Health

Powassan Virus Testing

- There are a limited number of clinical laboratories that offer diagnostic tests for Powassan virus.
- CDC will perform testing for Powassan upon state's request if symptoms are consistent with an arbovirus-like illness.
- All commercial positive results for arbovirus agents need to be confirmed at Wisconsin State Laboratory of Hygiene (WSLH) and CDC.
- POWV IgM and IgG testing can be performed on serum or CSF using MAC-ELISA at WSLH and plaque-reduction neutralization test (PRNT) at CDC.
- Physician should consider requesting POWV testing if commercial tests resulted in non-specific reactivity to an arbovirus agent or a negative result and patient continues to exhibit signs and symptoms consistent with an arboviral infection.

Arbovirus Prevention

Avoid Mosquito Bites to Prevent Infection

- Limit time spent outdoors at dawn and dusk.
- Avoid shady areas where mosquito may be resting.
- Wear protective clothing.
- Apply insect repellent (DEET, Picaridin, IR3535, oil of lemon eucalyptus), follow product instructions.
- Use permethrin on clothing, following label instructions. Permethrin products are available at sporting good, outdoor stores.
- For more information on effective repellents, visit the CDC website: https://wwwnc.cdc.gov/travel/yellowbook/2016/the-pre-travel-consultation/protection-against-mosquitoes-ticks-other-arthropods

Effective Mosquito Control Methods

- Prevent mosquitoes from getting inside of your homes by making sure window and door screens don't have any holes.
- Remove breeding sites such as containers filled with water, such as toys, pots, wading pools, or discarded tires.
- Change the water in birdbaths and pet dishes at least every three days.
- Clean roof gutters and downspouts for proper drainage.
- Landscape to prevent water from pooling; trim tall grasses, weeds and vines.

Mosquito Control Products

Repellents that work: CDC recommends EPA registered products.

- DEET
- Picaridin
- Oil of lemon eucalyptus
- IR3535

Products that do not work:

- Carbon dioxide baited mosquito traps
- Citrosa plants
- Eating garlic or taking vitamin B
- Scented personal products
- Alcohol

Tick Bite Prevention

- Check for ticks after being outdoors.
- Take showers to wash off crawling ticks.
- When in wooded areas, walk on cleared pathways and trails to reduce the chance of coming in contact with ticks.
- Wear protective clothing, long pants and sleeves.
- Tuck shirts into pants and pants into socks or boots to prevent ticks from crawling under clothing and attaching to skin.
- Use repellents per label instructions (20-30% DEET).
- Permethrin spray for clothing.

Environmental Tick Control

- Utilize integrated pest management.
- Landscape to create tick-safe areas.
- Remove leaf litter.
- Trim bushes and shrubs.
- Spray acaricides from EPA registered companies.
- Apply natural products with biocidal activities (nootkatone - yellow cedar, grapefruit and orange peel) or botanical products (oil of rosemary).

Additional Questions

Feel free to contact:

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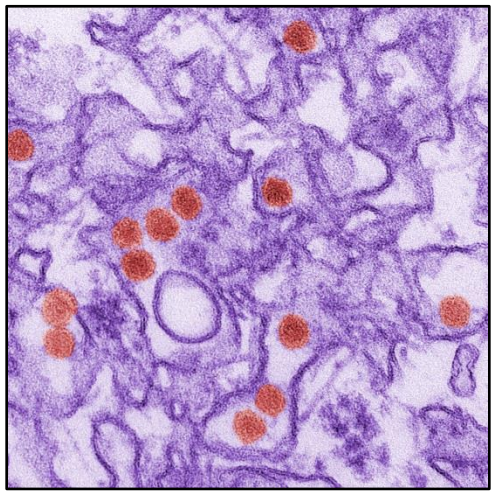
Zika Virus Surveillance Update



Transmission

- *Aedes* species mosquito
  - Aggressive daytime biters, prefer to bite people, live indoors and outdoors, also bite at night
  - Also transmit dengue and chikungunya viruses
  - Lay eggs in water-holding containers
  - Live in and around households

- Other modes of transmission
  - Documented – Maternal-fetal (intrauterine and perinatal), sexual, laboratory exposure, blood transfusion
  - Theoretical – organ or tissue transplantation, breast milk

Zika Surveillance in Wisconsin

Fee-exempt laboratory testing is currently performed by the Wisconsin State Laboratory of Hygiene (WSLH) for qualifying patients.

Wisconsin Travel-related Zika Virus Updated May 3, 2017	**2016**	**2017**
Confirmed Cases	62	3
Probable Cases*	0	3
Total Tested	1061	402

*Probable cases have presumptive positive laboratory results without confirmatory CDC testing.

Patients Approved for Zika Virus Testing in Wisconsin

- **Symptomatic patients:**
  - History of travel to a Zika affected area OR unprotected sexual contact with a traveler within 2 weeks of illness onset, and at least one of the following signs and symptoms: fever, rash, arthralgia, and conjunctivitis.
- **Asymptomatic pregnant patients:**
  - History of travel to a Zika affected area OR unprotected sexual contact with a traveler, and specimens collected within 12 weeks of last possible exposure.
- **Other:**
  - Epidemiologically linked cases deemed appropriate for testing by an epidemiologist (e.g., infant born to a mother with a suspect Zika infection).

Zika Virus Testing

- Molecular testing for viral RNA detection:
  - Specimens collected within the first 2 weeks of illness onset or last possible exposure.
- Serologic testing for detection of IgM antibodies:
  - Specimens collected between 2-12 weeks after illness onset or last possible exposure.
  - Positive IgM serology must be confirmed using plaque reduction neutralization test (PRNT) for neutralizing antibodies.
- On occasion, histopathology, immunohistochemical staining, and molecular testing are performed on fixed tissue specimens.

Specimens for Zika Testing

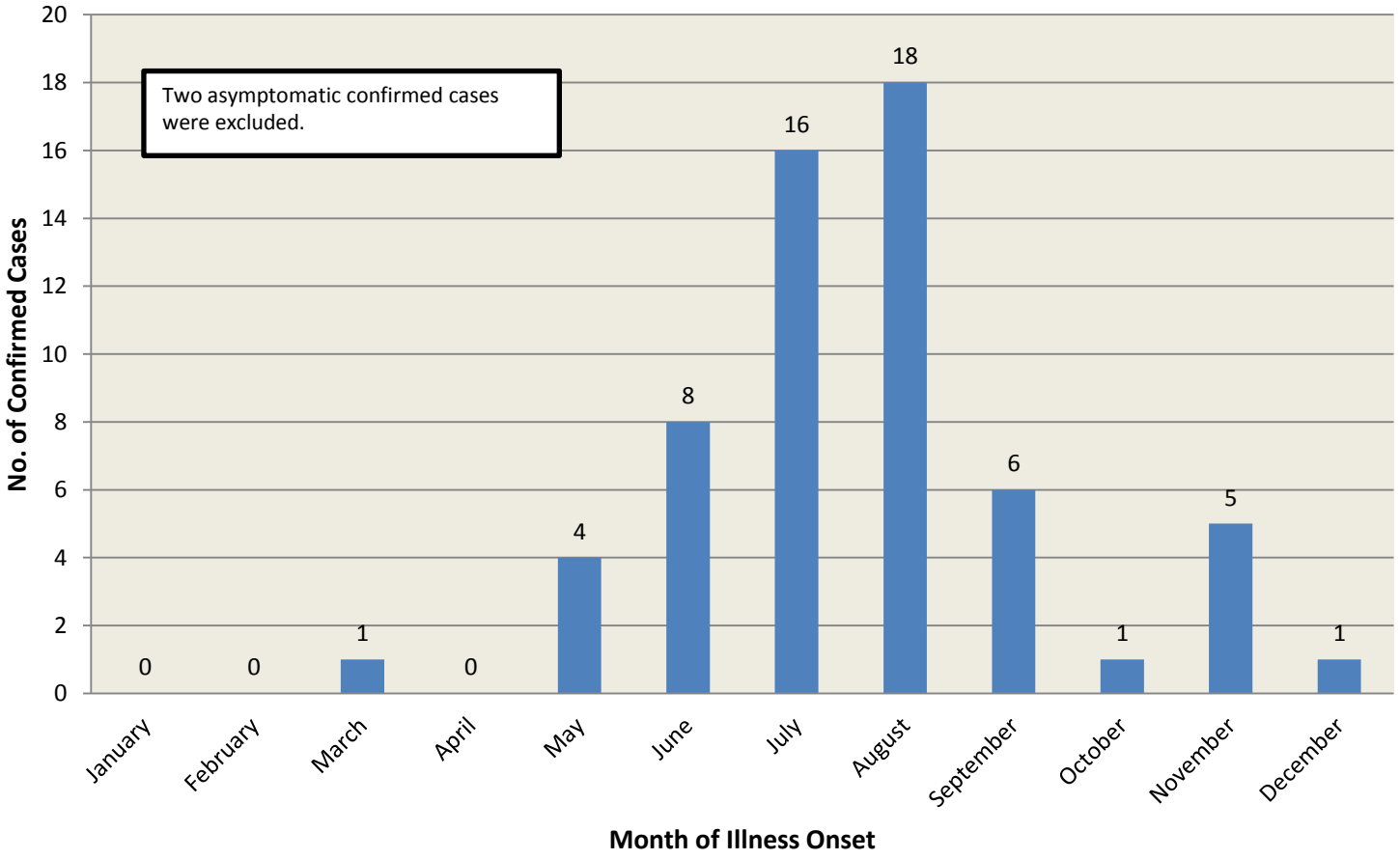
- **Approved for diagnostic testing:**
  - Serum and urine
  - CSF
  - Amniotic fluid (collected after 15 weeks gestation)
  - Placental and umbilical cord tissues (fixed or frozen)

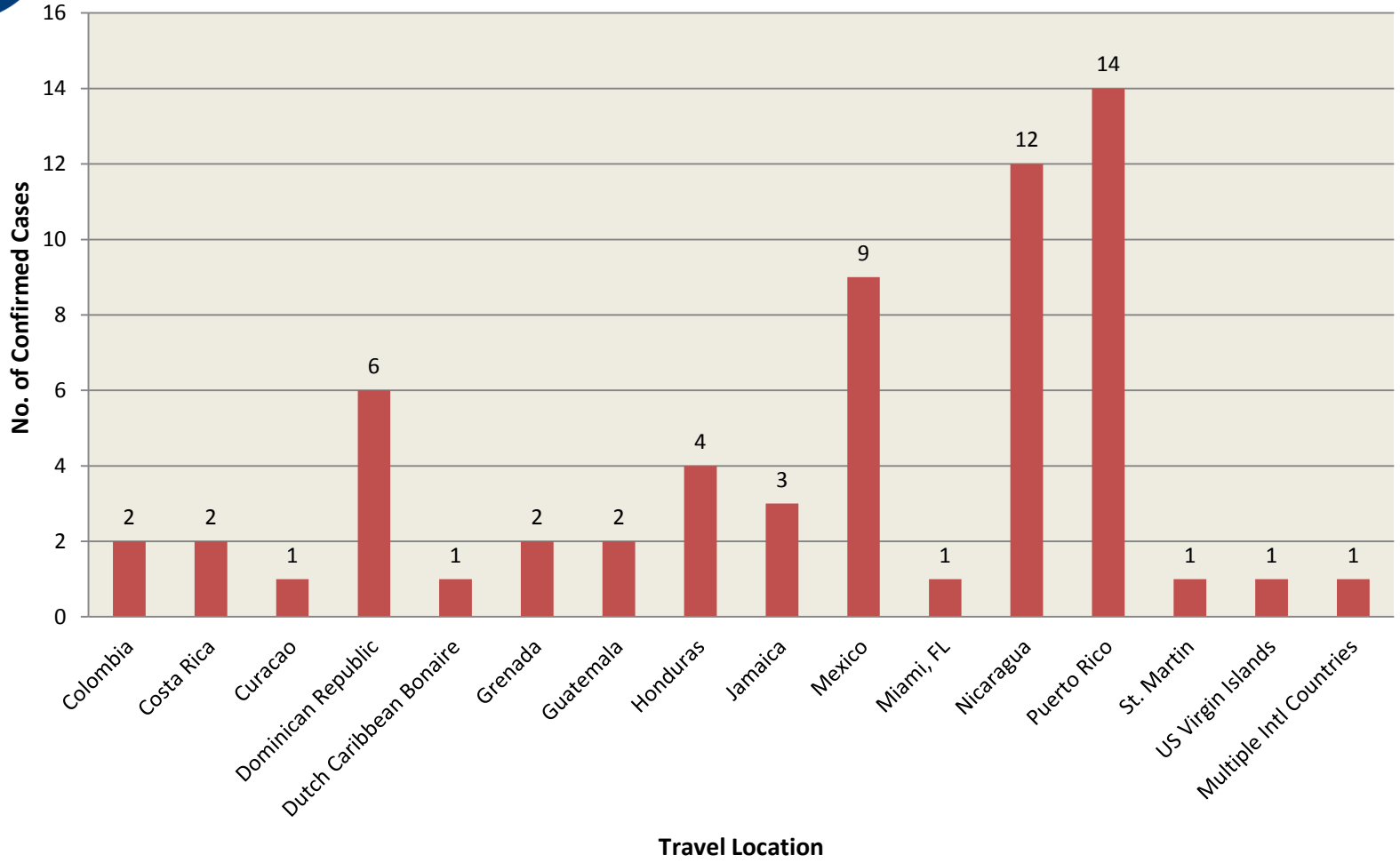
- **Not approved for diagnostic testing:**
  - Semen and saliva are only for research purposes at this time.

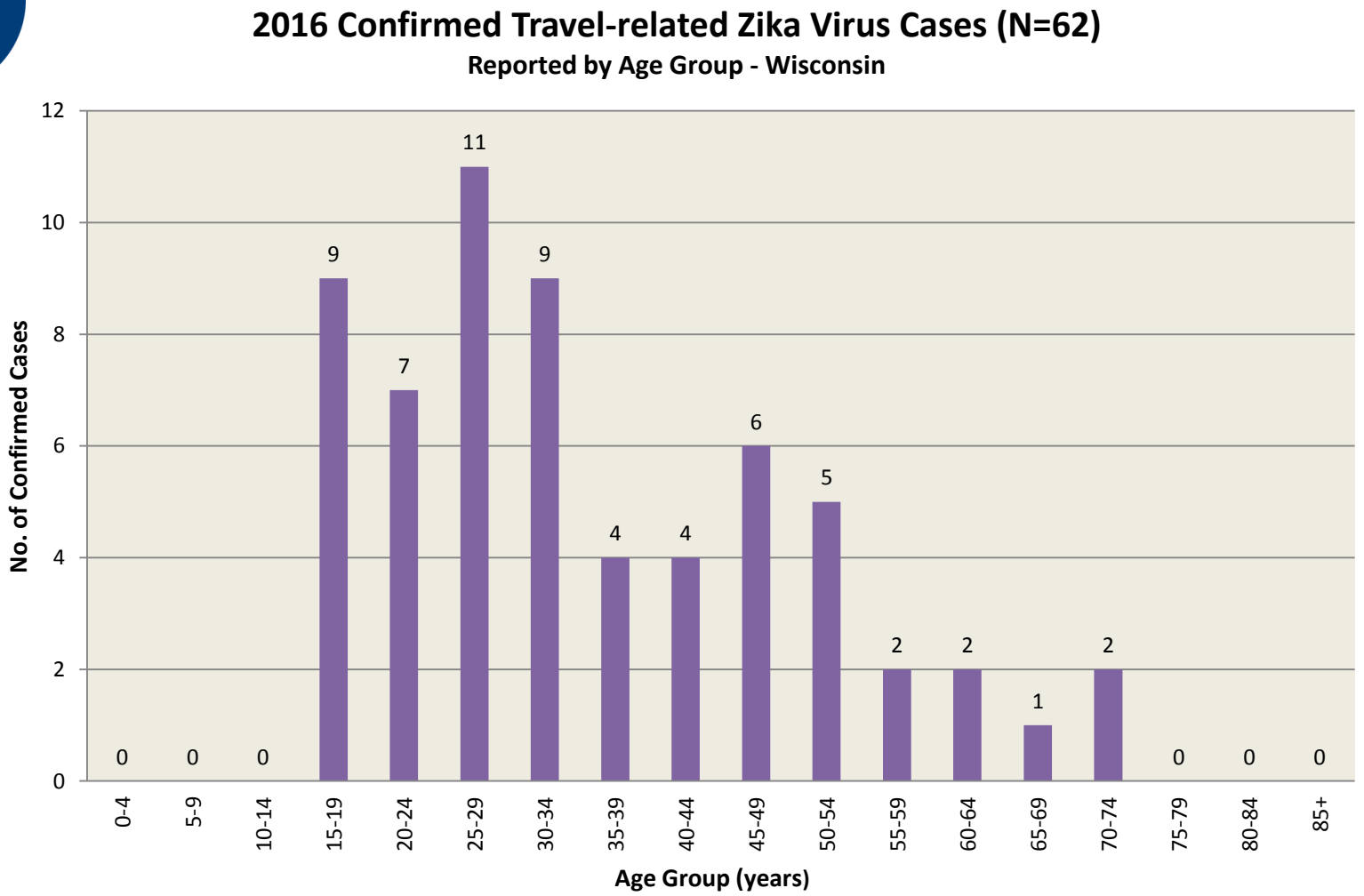
- **DHS does not approve testing for the purpose of preconception screening.**

2016 Confirmed Travel-related Zika Virus Cases (N=60)

Reported by Month - Wisconsin

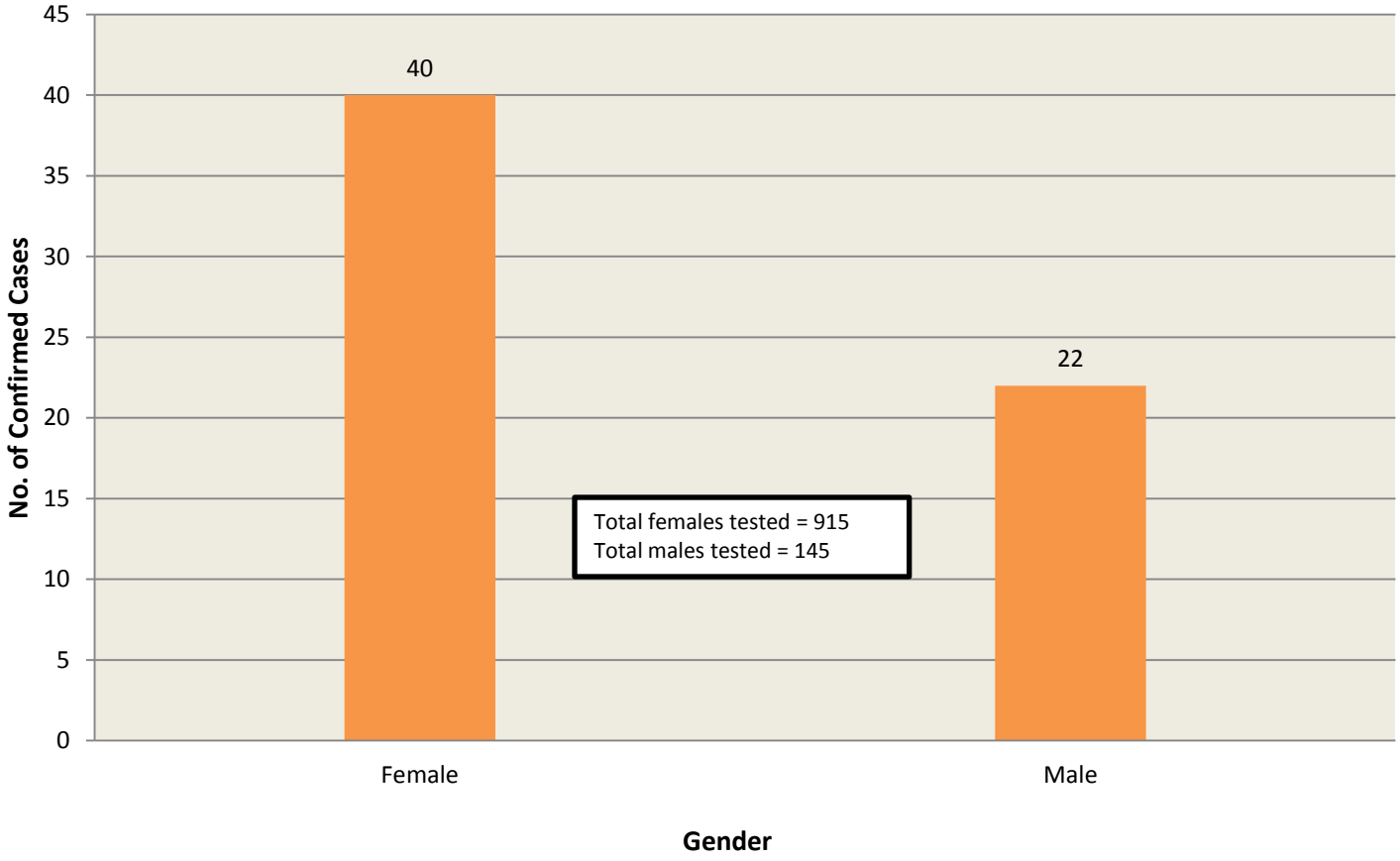



2016 Confirmed Travel-related Zika Virus Cases (N=62)
Reported by Travel Location - Wisconsin
No. of Confirmed Cases
0
2
4
6
8
10
12
14
16
2
2
1
6
1
2
2
4
3
9
1
12
14
1
1
1
Colombia
Costa Rica
Curacao
Dominican Republic
Dutch Caribbean Bonaire
Grenada
Guatemala
Honduras
Jamaica
Mexico
Miami, FL
Nicaragua
Puerto Rico
St. Martin
US Virgin Islands
Multiple Intl Countries
Travel Location


2016 Confirmed Travel-related Zika Virus Cases (N=62)
Reported by Age Group - Wisconsin
No. of Confirmed Cases
0
2
4
6
8
10
12
0
0
0
9
7
11
9
4
4
6
5
2
2
1
2
0
0
0
0-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85+
Age Group (years)

2016 Confirmed Travel-related Zika Virus Cases (N=62)

Reported by Gender - Wisconsin



The Challenge of Diagnosing Zika

- ~80% of infections are asymptomatic
- Clinical illness is usually mild and does not require medical care
- Signs and symptoms of Zika virus infection are non-specific:
  - Rash
  - Fever
  - Joint pain
  - Headache
  - Conjunctivitis

- Serologic cross-reactivity with related viruses

Provider prevention messages for all exposed persons to be recommended at first patient visit

- Avoid mosquito bites by staying indoors or using insect repellent for 3 weeks after onset or exposure.
- Abstain from sexual contact or use condoms during sex for 8 weeks (women) or for 6 months (men).
- If you are considering getting pregnant, avoid conception for at least 8 weeks (women) or for 6 months (men).
- Males who have traveled to areas where Zika virus transmission is occurring and who have a partner who is pregnant should abstain from sexual contact or use condoms for the entire duration of the pregnancy.