



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

WCLN Webinar 5/10/17




WISCONSIN STATE LABORATORY OF HYGIENE - UNIVERSITY OF WISCONSIN 1

Wisconsin Department of Health Services



## Surveillance of Arboviral Infections in Wisconsin

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Wisconsin Department of Health Services  
May 10, 2017



Protecting and promoting the health and safety of the people of Wisconsin

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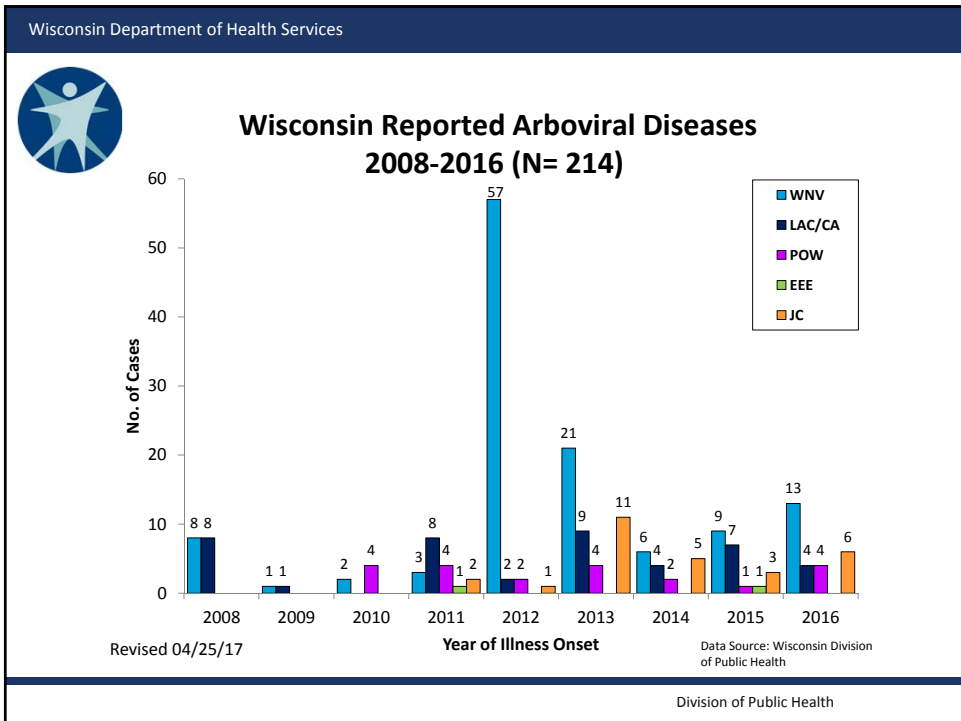
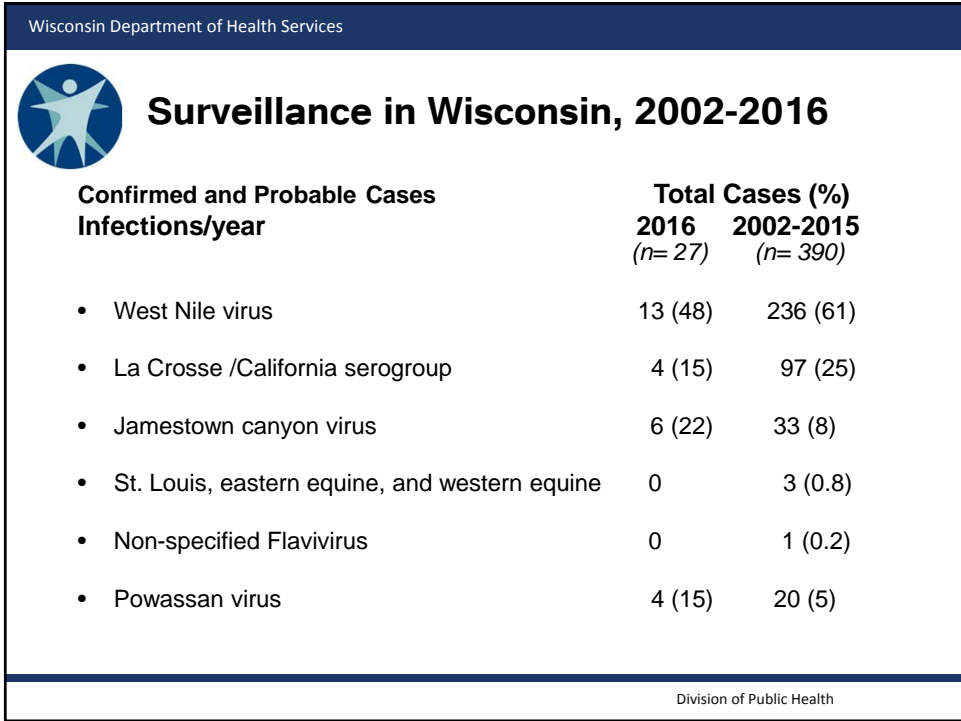
## Overview

- **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).





## 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



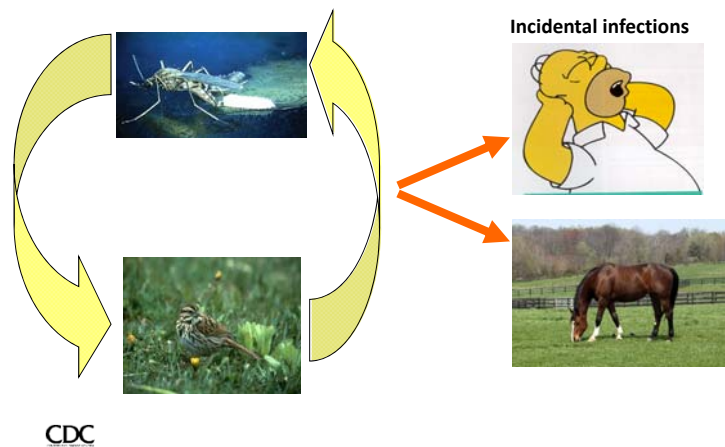


## West Nile Virus (WNV)

- 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





## 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.

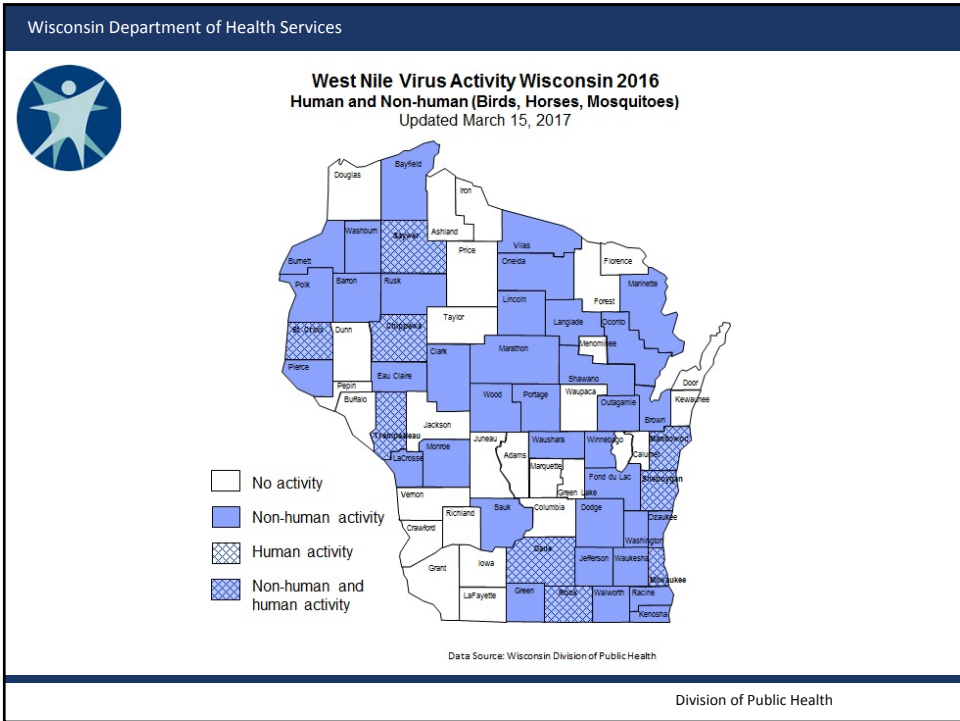
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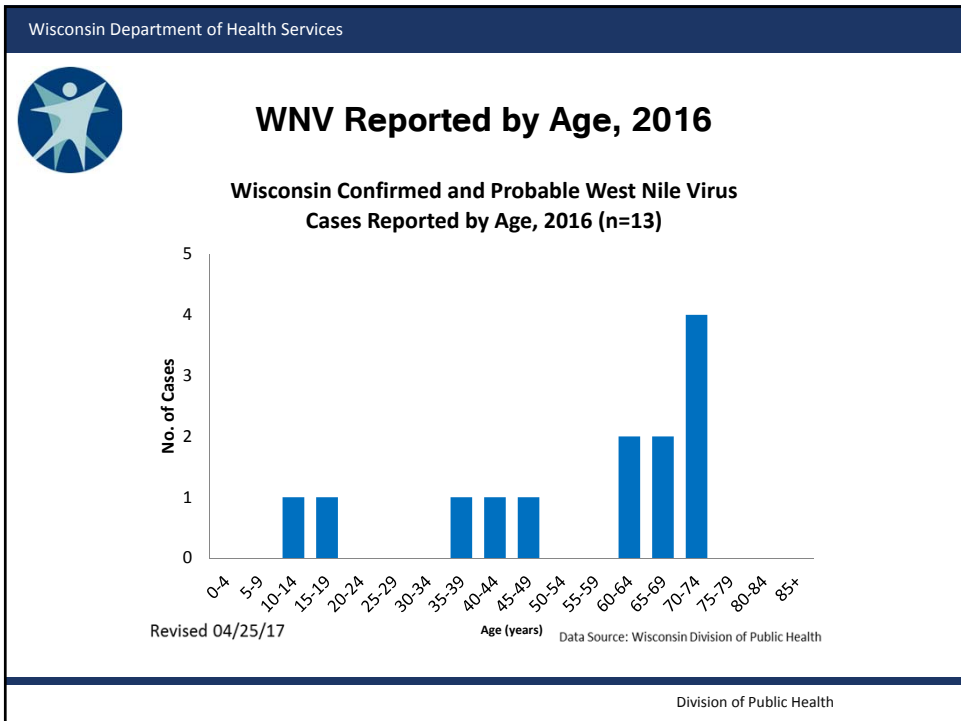
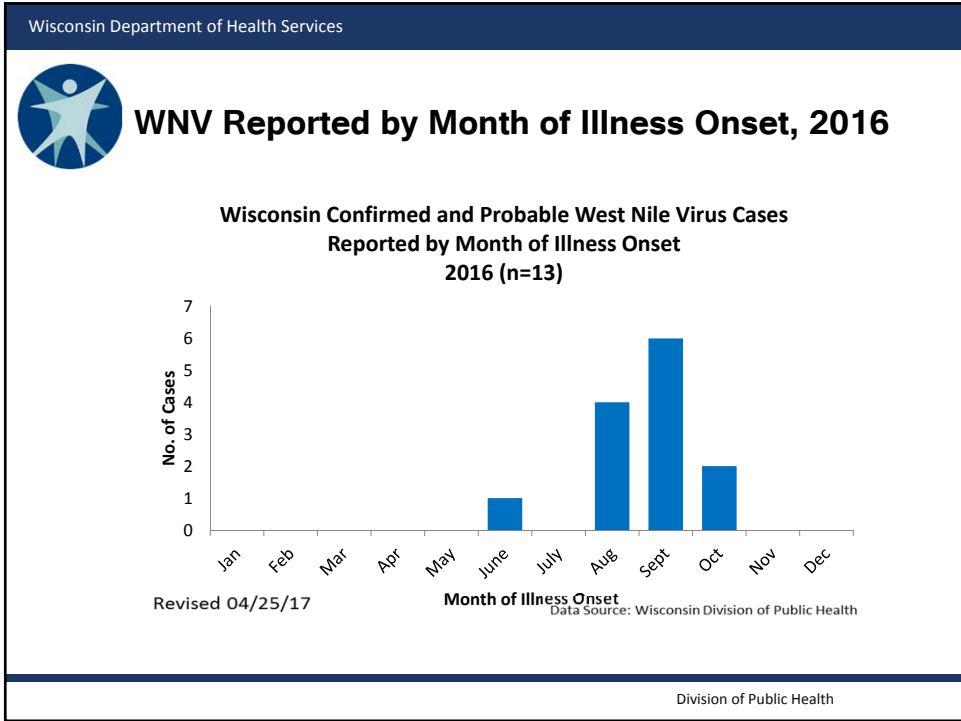


## Human Disease Surveillance, WI

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

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## 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).



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## 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 (<math>\leq 50</math> mosquitoes) testing positive for WNV.

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## 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.

ORA1 Wisconsin Department of Health Services




## 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.

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## 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)

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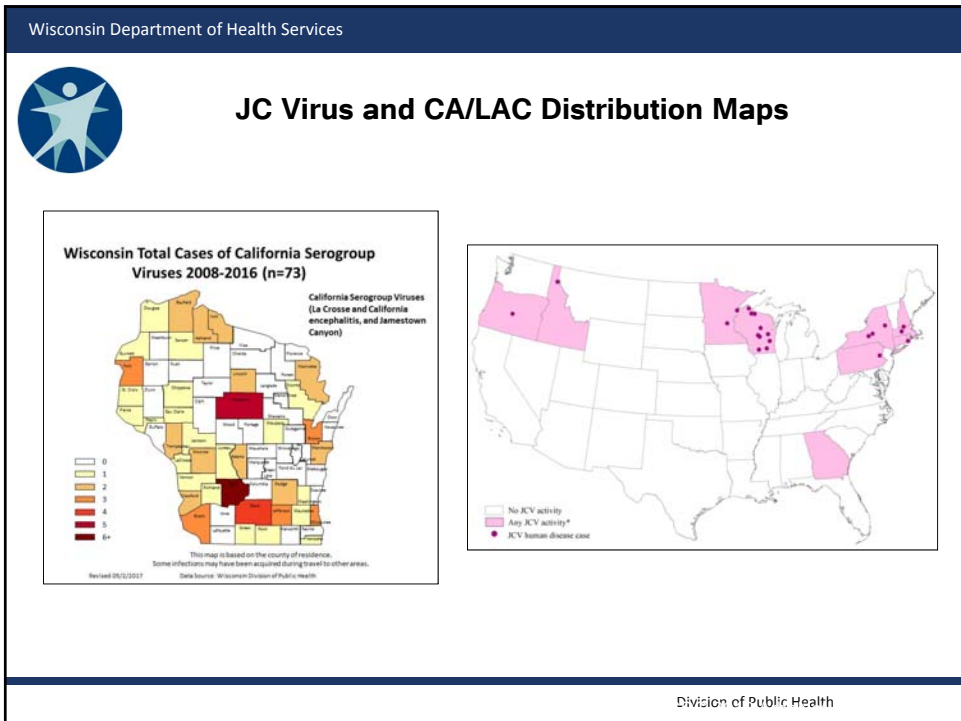
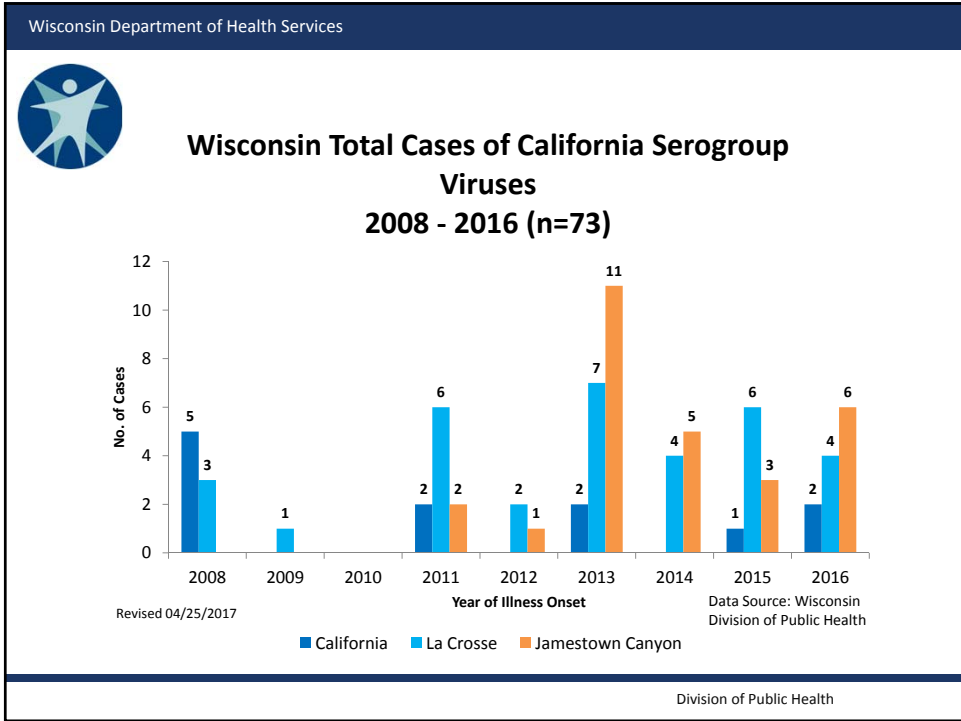
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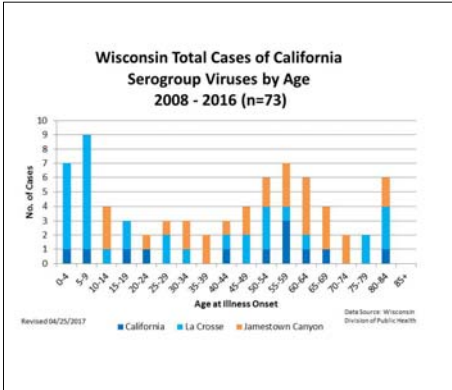
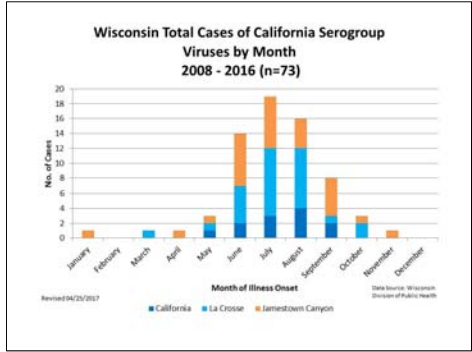
**Update data!**

Osborn, Rebecca A, 5/8/2017





### 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*)



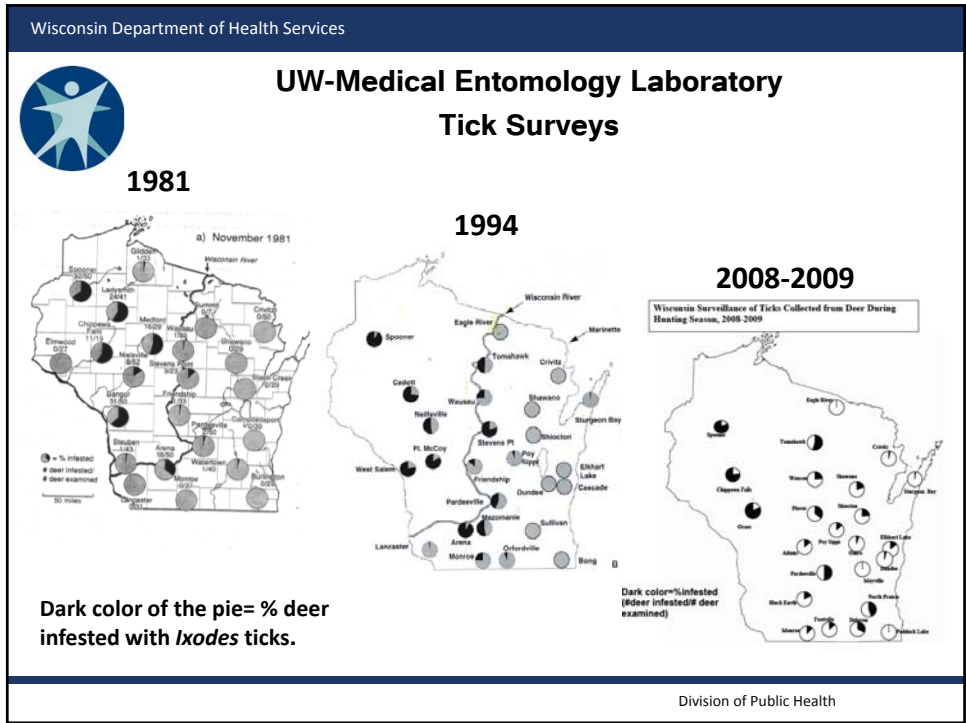
## *Ixodes scapularis* (Blacklegged or Deer Tick)

Adult female deer tick      Adult male deer tick      Nymph      Larva


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)

One Inch



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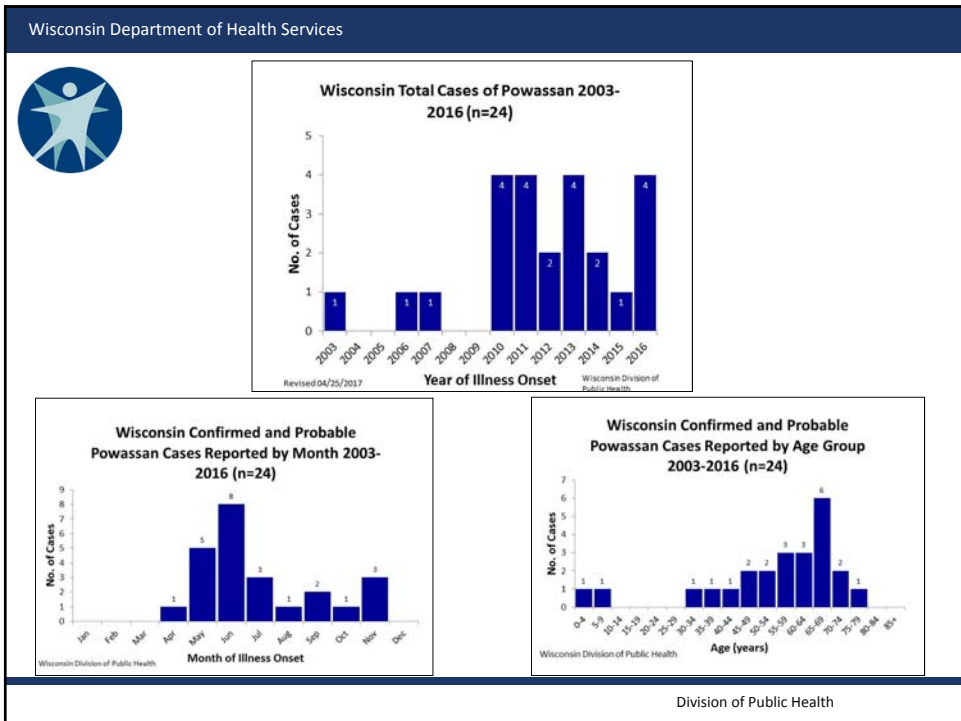
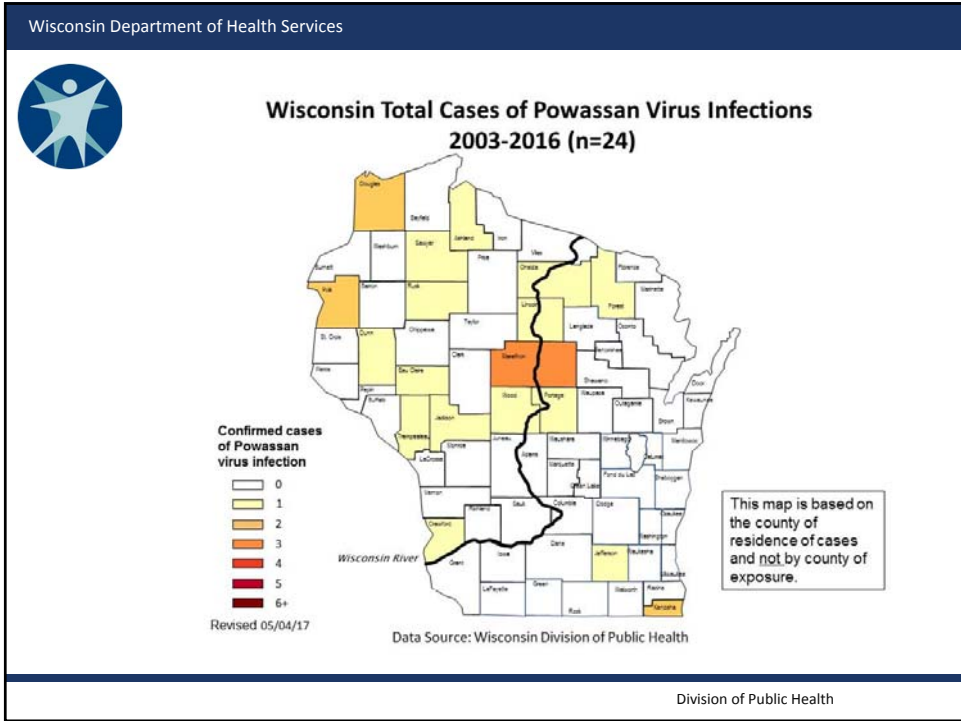


### Powassan Infection Clinical Diagnosis

- Incubation period is usually  $\geq 1$  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.

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## 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

**Protect yourself from mosquito bites**

**Stay in air conditioning**  
Mosquitoes can't enter air-conditioned spaces, and the air circulation helps to keep them away from your body.

**Use insect repellent**  
Look for the following on the repellent label: DEET, Picaridin, IR3535.

**Wear protective clothing**  
Wear long-sleeved shirts and long pants and use insect repellent on your protective wear (including your permiesh).

**Mosquito proof your home**  
Use screens on windows and doors. Use air conditioning. Keep mosquitoes from being brought in on your clothing items.

For more information:  
[www.dhs.gov/ohsurgency](http://www.dhs.gov/ohsurgency) • [www.cdc.gov/dpdx](http://www.cdc.gov/dpdx) • [www.wisconsin.gov/dhs](http://www.wisconsin.gov/dhs)

U.S. Department of Health and Human Services





## 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:**

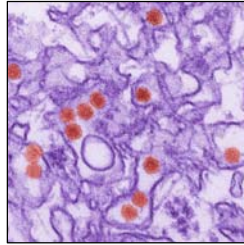
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Office: 608-261-6388



## 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

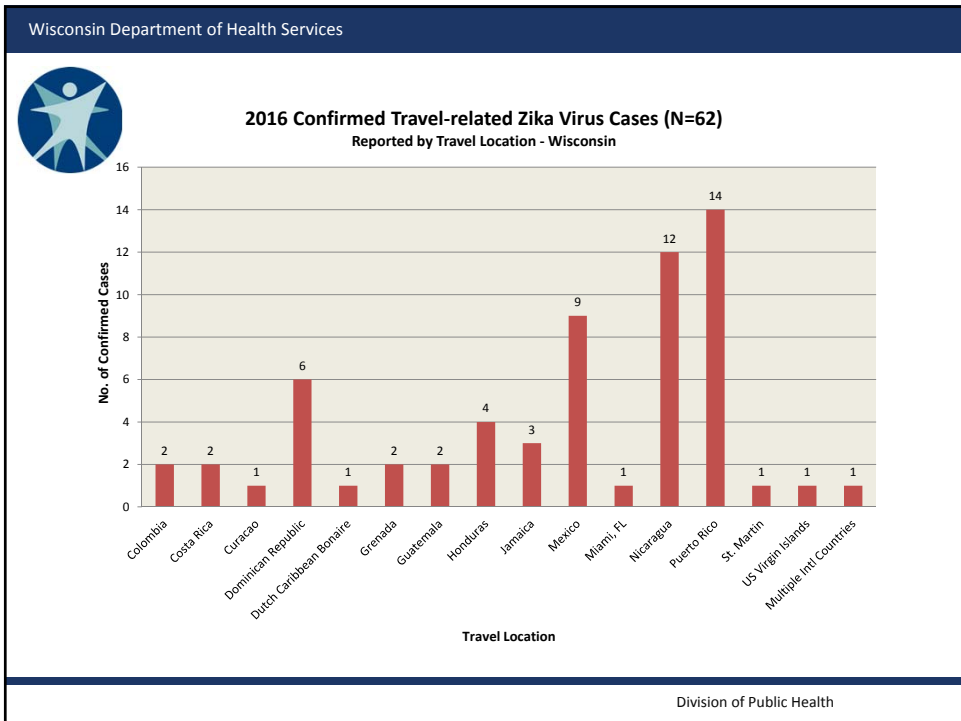
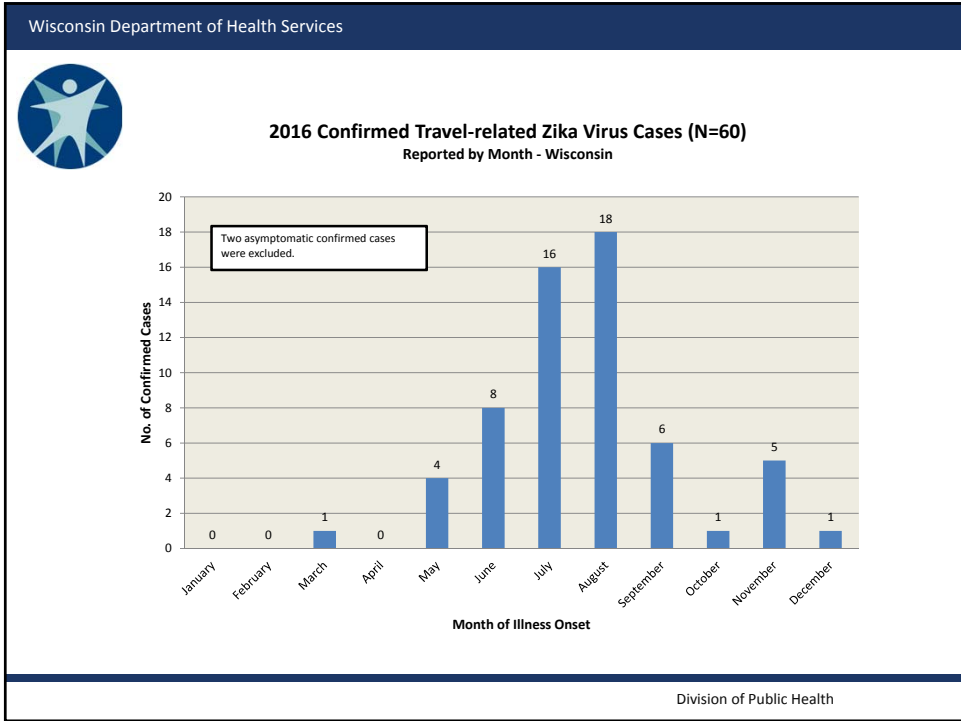
- **Molecular testing for viral RNA detection:**
  - Specimens collected within the first 2 weeks of illness onset or last possible exposure.
  
- **Serologic testing for detection of IgM antibodies:**
  - Specimens collected between 2-12 weeks after illness onset or last possible exposure.
  - Positive 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.

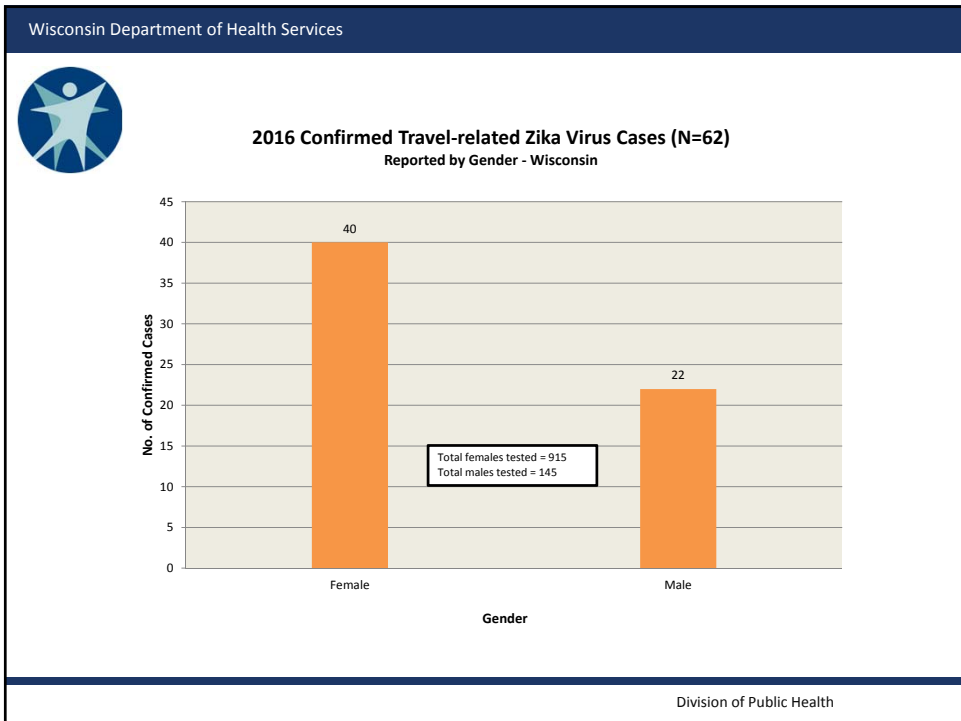
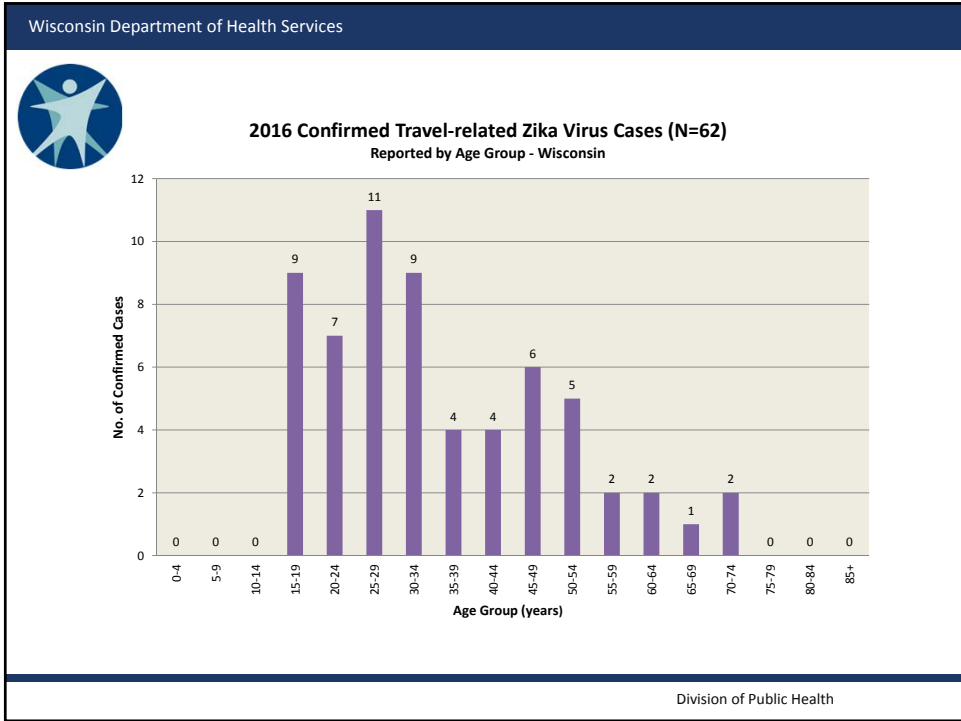


## Specimens for Zika Testing

- **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.**









## 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.

