Epidemiology of West Nile Virus in Georgia

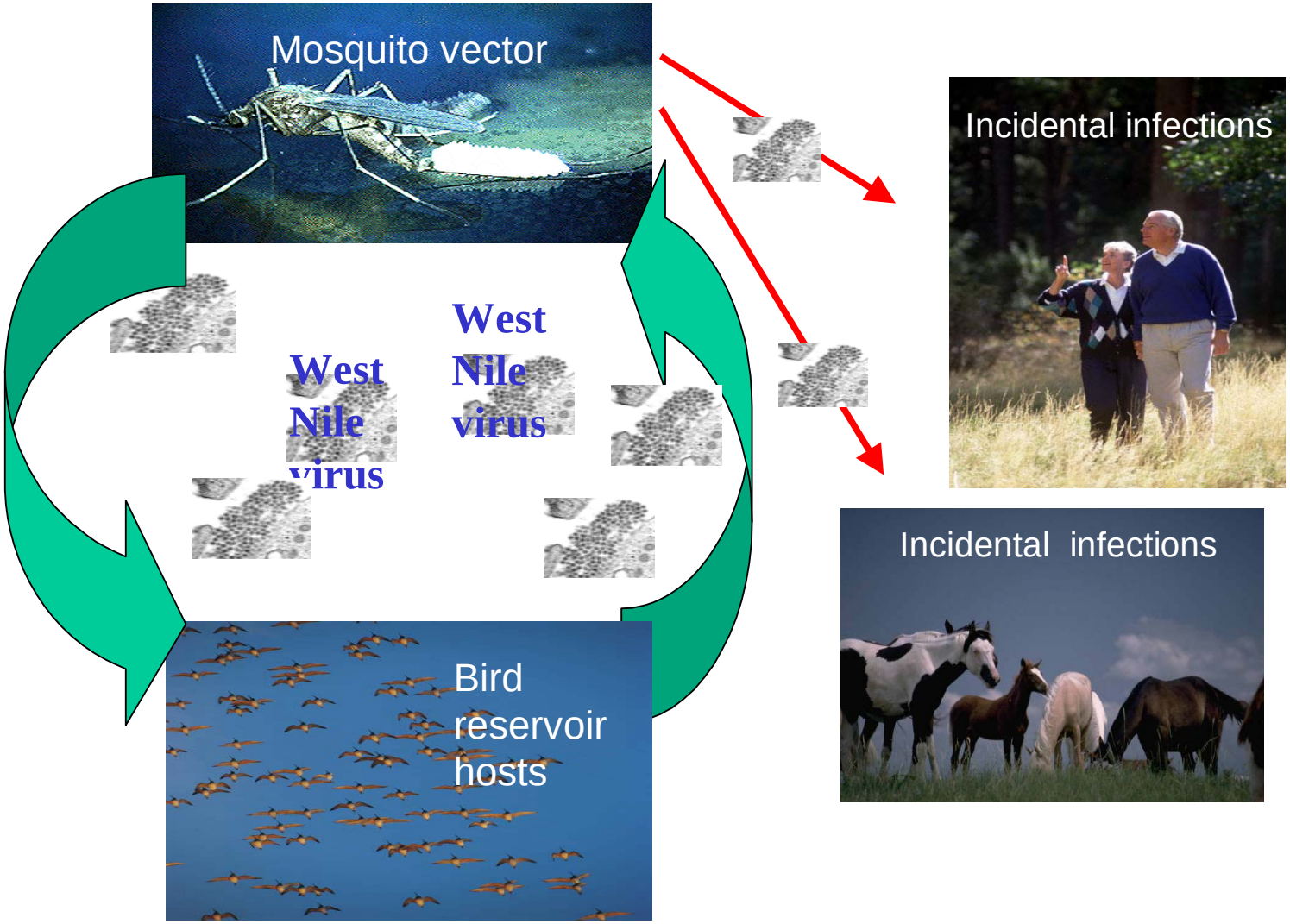
What is West Nile Virus?

- Member of the genus *Flavivirus*
  - Genus includes Yellow Fever, Dengue, and Hepatitis C viruses
- Japanese Encephalitis Serocomplex within genus
  - Includes closely-related viruses such as Saint Louis Encephalitis virus (SLE), Japanese Encephalitis virus (JE), and Kunjin virus, among others

What is West Nile Virus? (2)

- WNV is an arbovirus (*ar*thropod-*bo*rne *virus*)
  - Arboviruses are transmitted by mosquitoes or ticks
- Zoonotic life cycle – humans are not part of the WNV life cycle, they are incidental hosts
- Birds are the primary amplifier hosts, or reservoirs of West Nile Virus (WNV)
- Migratory birds play a role in distribution of WNV

West Nile Virus Transmission Cycle



CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

How is WNV Spread?

- Most common mode of transmission is by bite of an infected mosquito
  - Uninfected mosquito bites infected bird and acquires virus
  - Virus replicates in mosquito
  - Mosquito bites uninfected bird and transmits virus, infecting the bird
  - Occasionally, mosquito cannot find bird to feed on and bites humans, horses, or other mammals, causing incidental infection

How is WNV Spread? (2)

- No direct person-to-person transmission
- Bite of infected mosquito (most commonly)
- Organ transplant / blood transfusion from infected donor
- Mother-to-infant during pregnancy or through breast milk
- Occupational exposure (laboratory workers, bird or alligator handlers)

How is WNV Spread? (3)

- The mosquito species *Culex quinquefasciatus* is the most common WNV vector in Georgia
  - Also known as the Southern House mosquito, *C. quinquefasciatus* is most active at dusk and dawn

WNV History

- Virus was first isolated in Uganda in 1937
  - Believed to cause only minor short-term illness
- First recorded outbreak of WNV was in Israel in the 1950s:
  - Outbreak in Israel, 1957:
    - First correlation between WNV infection and severe central nervous system (CNS) disease
    - First correlation between older patients and more severe disease
- Soon recognized as one of the most widespread *Flaviviruses* in the world

WNV Infection in Humans

- Humans are incidental hosts
  - Not part of WNV life cycle
- Humans are dead-end hosts
  - Humans do not develop high enough levels of virus in their blood to infect mosquitoes that bite them

WNV Infection in Humans (2)

- 80% of people infected with WNV will not have any symptoms
- 20% of people infected with WNV will develop a mild, flu-like illness for a few days (“West Nile Fever”)
- Less than 1% of people infected with WNV will develop severe disease, such as encephalitis (“West Nile Neurologic Disease”)

WNV Infection in Humans (3)

- Incubation period is 3-15 days after being bitten by an infected mosquito
- Case fatality rate among people with more severe disease is 3-15%

WNV in the U.S.

- First identified in New York City in 1999
- WNV spread rapidly to other states, stretching from coast to coast by 2002
- WNV caused an unprecedented outbreak of human meningitis/encephalitis in 2002 which more than doubled in 2003

WNV in the U.S. (1)

	1999	2000	2001	2002	2003	2004	2005
Number of human cases	**62**	**21**	**66**	**4008**	**9389**	**2470**	2949
Case fatality rate	**11.3%**	**9.5%**	**13.6%**	**6.6%**	**2.6%**	**3.6%**	3.9%
Range of onset dates	**Aug – Sept**	**July-Sept**	**July – Dec**	**May – Dec**	**May-Dec**	**Apr-Nov**	Jan-Dec
Number of states with human cases	**1**	**3**	**10**	**39**	**45**	**41**	42
Number of states reporting any WNV activity	**1**	**12**	**27**	**44**	**46**	**48**	48

WNV in the U.S. (2)

	2006	2007	2008	2009	2010	2011	2012
Number of human cases	**4219**	**3598**	**1356**	**720**	**1021**	**712**	5387
Case fatality rate	**3.8%**	**3.4%**	**3.2%**	**4.4%**	**4.6%**	**6.0%**	4.5%
Range of onset dates	**Jan - Dec**	**Jan - Dec**	**Jan-Dec**	**Jan-Dec**	**Jan-Dec**	**Jan-Dec**	Jan-Dec
Number of states with human cases	**43**	**43**	**45**	**37**	**40**	**43**	48
Number of states reporting any WNV activity	**48**	**47**	**47**	**47**	**48**	**48**	48

WNV in the U.S. (3)

	2013						
Number of human cases	2,374						
Case fatality rate	**4.8%**						
Range of onset dates	**Jan - Dec**						
Number of states with human cases	**46**						
Number of states reporting any WNV activity	**48**						

How Did WNV Enter the U.S.?

- Exact mode of introduction unknown
- Possible modes of introduction:
  - Migrating or storm-transported bird (most likely)
  - Imported mosquito or larvae
  - Migrating infected human
  - Imported animal
  - Intentional introduction

WNV in Georgia

- First detected in a bird from Lowndes county in July, 2001
- WNV has caused human disease each year since it arrived in Georgia
- WNV is now considered endemic in Georgia (meaning it can be expected to occur each year in Georgia)

WNV in Georgia (1)

	2001	2002	2003	2004	2005
Number of human infections	**6**	**36**	**55**	**22**	**24**
Case Fatality Rate	**17%**	**16%**	**7%**	**4%**	**8%**
Range of onset dates	**Jul – Dec**	**Jul – Nov**	**Jun – Dec**	**Jul-Nov**	**June-Nov**
Number of counties reporting human cases	**5**	**20**	**27**	**9**	**8**
Number of counties reporting any WNV activity	**58**	**124**	**92**	**29**	**17**

WNV in Georgia (2)

	2006	2007	2008	2009	2010
Number of human infections	**8**	**51**	**12**	**6**	**14**
Case Fatality Rate	**11%**	**2%**	**0%**	**33%**	**0%**
Range of onset dates	**Jul – Sept**	**June - Nov**	**July-Oct**	**Aug-Oct**	**March -Dec**
Number of counties reporting human cases	**5**	**22**	**9**	**5**	**9**
Number of counties reporting any WNV activity	**9**	**24**	**11**	**11**	**11**

WNV in Georgia (3)

	2011	2012	2013		
Number of human infections	**25**	**117**	**20**		
Case Fatality Rate	**12%**	**5%**	**0%**		
Range of onset dates	**July-Oct**	**May-Nov**	**May-Oct**		
Number of counties reporting human cases	**9**	**45**	**15**		
Number of counties reporting any WNV activity	**14**	**50**	**22**		

WNV Surveillance in Georgia

- Purpose
  - Detect the presence of WNV in Georgia
  - Monitor the spread of WNV throughout Georgia
  - Predict risk to human and animal populations so control measures may be implemented

WNV Surveillance in Georgia (2)

- Human Arboviral Infections Surveillance
- Avian Mortality Surveillance
- Equine Surveillance
- Mosquito Surveillance

Human WNV Surveillance in Georgia

- Arboviral infection is a notifiable condition
  - *Immediately* report to public health

- Active surveillance was conducted in metro Atlanta area until 2005
- Enhanced passive surveillance in other areas of Georgia
- Testing is available at most commercial labs as well as at the Georgia Public Health Laboratory

Avian Mortality Surveillance

- Public health asks the public to report dead birds with no obvious cause of death
- Birds were tested for WNV until 2012
  - *All* bird reports are noted for surveillance purposes, even if the bird is not picked up
- Useful in tracking spread of WNV
- Assists in predicting risk for human illness

Avian Mortality Surveillance (2)

- High rate of birds dying from WNV in U.S. is unusual compared to other countries that experienced WNV outbreaks
- Crows and blue jays are especially susceptible to WNV
- Bird mortality rate may decrease in future due to herd immunity or host or virus adaptation

WNV in Georgia

	2001	2002	2003	2004	2005
Number of positive birds reported	**322**	**939**	**479**	**105**	**23**
Percent positive birds of all birds tested	**21%**	**39%**	**22%**	**18%**	**7%**
Number of positive animals reported	66	175	60	3	1
Number of positive mosquito pools reported	13	107	109	126	67

WNV in Georgia (2)

	2006	2007	2008	2009	2010
Number of positive birds reported	**282**	**12**	**5**	**1**	**4**
Percent positive birds of all birds tested	**5.3%**	**12%**	**24%**	**4.8%**	**44%**
Number of positive animals reported	0	0	0	3	2
Number of positive mosquito pools reported	81	75	51	24	99

WNV in Georgia (3)

	2011	2012	2013		
Number of positive birds reported	**1**	**1**	**0**		
Percent positive birds of all birds tested	**17%**	**10%**	**0%**		
Number of positive animals reported	3	11	8		
Number of positive mosquito pools reported	438	125	166		

Equine Surveillance

- Testing is available for horses with clinical central nervous system disease symptoms
- Surveillance for WNV in horses is a sensitive tool to recognize foci of viral activity
  - Especially useful in rural areas for surveillance
- There is a WNV vaccine for horses, which limits the ability to use WNV disease in horses for surveillance

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Mosquito Surveillance

- Larval and adult mosquito surveillance assesses the populations sizes of mosquitoes
  - Increase in mosquito populations indicates increased local human risk
  - Some adult mosquito pools are tested to see if mosquitoes in a certain geographic area are carrying WNV
- Mosquito control programs are planned in response to large mosquito populations or positive mosquito pools

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Preventing West Nile Virus

- Avoiding mosquito bites is the best way to prevent infection with West Nile virus.
  - Personal precautions against mosquito bites
    - Wear long sleeves, pants, and DEET-based repellent
    - Avoid being outdoors at dusk and dawn when mosquitoes are most active
  - Source reduction to reduce mosquito breeding habitats
    - Empty stagnant water around your home (flower pots, bird baths, gutters)
    - Treat ponds with larvacide or stock with fish

Resources

- Georgia Division of Public Health Mosquito-Borne Diseases website:
  - http://dph.georgia.gov/mosquito-borne-viral-diseases
- CDC West Nile Virus website
  - http://www.cdc.gov/ncidod/dvbid/westnile/index.htm
- Still have questions about West Nile Virus? Call the Georgia Division of Public Health at 404-657-2588