
Evaluation of the West Nile Surveillance System for the State of Kansas



MPH Capstone Experience
Conducted at
Kansas Department of Health and Environment

Presented By
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Public Health Surveillance

- Ensure that problems of public health importance are being monitored efficiently and effectively and to insure that public health resources are being utilized to their fullest extent.
 - Evaluating surveillance systems help improve the quality, efficiency, and usefulness of the program.
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West Nile Virus

- Arboviral disease in the *Flaviviridae* family
- Member of the Japanese encephalitis virus antigenic complex
- Maintained in enzootic bird-mosquito-bird cycle
 - *Culex species*



West Nile Virus

- First isolated in 1937 from a febrile woman in Uganda
 - Implicated in sporadic outbreaks of encephalitis in humans and horses in Africa, the Middle East, western Asia, and Australia
 - Usually mild disease in children
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Signs and Symptoms

- Asymptomatic Infections
 - West Nile Fever (WNF)
 - Non-specific flu-like symptoms
 - West Nile Neuroinvasive Disease (WNND)
 - WNF with development of neurological symptoms
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WNV in the United States

- Entered New York City area in 1999
 - Spread to all lower 48 states by 2005
 - Has caused an estimated
 - 29,624 reported cases
 - 16,765 (56.6%) West Nile Fever
 - 12,088 (40.8%) West Nile Neuroinvasive Disease
 - 771 (2.6%) Clinically Unspecified
 - 1, 161 (3.9%) Fatal
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Surveillance

- Center for Disease Control and Prevention
 - Started to provide funding for state surveillance in 2000

 - Original surveillance used to track spread of virus
 - Determine potential vectors, seasonality, geographic areas of high activity, and susceptible species.
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Surveillance in Kansas

- 2001, Kansas Department of Health and Environment started statewide surveillance
 - Funded by the CDC's Epidemiology Laboratory Capacity (ELC) grant
 - Included: Dead bird testing, mosquito pool collection, and reporting of human, equine and other animal cases
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2009 Surveillance

- Passive human disease reporting
 - K.S.A. 65-118 and K.S.A. 65-128 all arboviral disease are reported within 7 days of diagnosis

 - Mosquito pool collection and testing
 - 13 of 105 counties
 - May through late Fall
 - Collection by Kansas State University Entomology Department
 - Testing conducted at KDHE Laboratory
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WNV Surveillance

- Positive human laboratory data submitted to KDHE
 - All mosquito results submitted to KDHE
 - All data entered into Kansas's Electronic Disease Surveillance System (KS-EDSS)
 - Shared with CDC through ArboNet
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Materials and Methods

- CDC's 2001 document: *Updated Guidelines for Evaluating Public Health Surveillance Systems*
 - CDC's 2003 document: *Epidemic/Epizootic West Nile Virus in the United States: Guidelines for Surveillance, Prevention, and Control*
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Goals of Mosquito-based Surveillance

- 1) Use data on mosquito populations and virus infection rates to assess the threat of human disease;
- 2) Identify geographic areas of high risk;
- 3) Assess the need for and timing of interventions;
- 4) Identify larval habitats for targeted control;
- 5) Monitor the effectiveness of this type of surveillance and improve prevention and control measures; and
- 6) Develop a better understanding of transmission cycles and potential vector species.

Engage the Stakeholders

- KDHE, Bureau of Surveillance and Epidemiology
 - Dr. Ludek Zurek, KSU Entomology Department
 - Supervisor and coordinator for mosquito collection
 - Dr. Roman Ganta, KSU Dept. Diagnostic Medicine/Pathobiology
 - Supervises virology laboratory and animal WNV testing
 - Local Health Departments with positive mosquito pools
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Describe Public Health Importance

- Human case data retrieved from KS-EDSS
 - January 1, 2002 to December 31, 2009
 - Cases are classified as confirmed, probable or suspect for surveillance purposes
 - Only confirmed and probable cases included
 - Exported to Microsoft Excel[®] spread sheets
 - Names and address excluded to protect privacy
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Describe Public Health Importance

- Data separated into case classification and year
 - Evaluated by clinical classification, age, and sex
 - Cases from 2002-2009 were plotted on epi-curve by MMWR week
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Timeliness

- Time between mosquito collection and reporting of test results to KDHE
 - 2008 and 2009

 - Data analyzed to determine number of days between positive non-human case report dates and human case onset of illness dates in the same county
 - SAS 9.1.3
 - Avian, Animal, Mosquito
 - 2003-2009
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Timeliness

- Onset dates for human illness and mosquito pool result dates were plotted by MMWR for 2003-2006 and 2008-2009
 - No mosquito pools collected in 2007
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Neighboring States

- Public health officials from Oklahoma, Nebraska, Missouri and Colorado were interviewed regarding their state's WNV surveillance program
 - Main focus on type of surveillance and sources of funding
 - Will surveillance be continued without ELC grant?
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Results: Stakeholders

- KSU Entomology Department
 - Not gaining any new information from the data that is collected
 - As incidence goes down, more difficult to find the virus in mosquito populations

 - KSU Virology Lab
 - Equine testing decreased with no positive in last few years

 - Counties with positive mosquito pools
 - None indicated that they released PSAs or increased vector control measures
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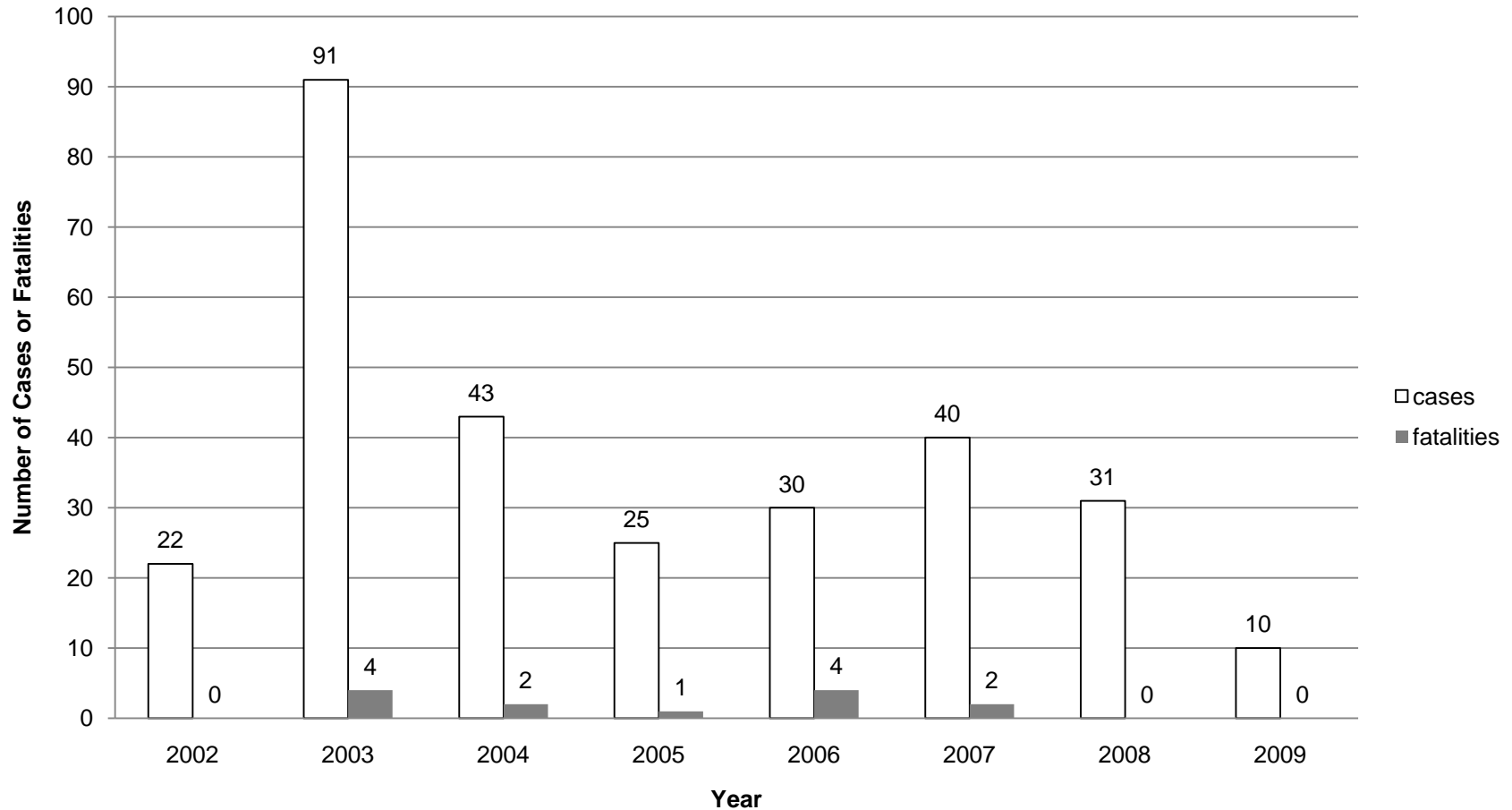
Results: Public Health Importance

- 890 human reports in EDSS
 - 153 confirmed
 - 142 probable

 - 295 human cases since 2002
 - 194 (65.7%) WNND
 - 99 (33.6%) WNF
 - 2 (0.68%) were clinically unspecified
 - 13 (4.4%) Fatalities
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Results: Public Health Importance

Human Cases and Fatalities in Kansas 2002-2009



Results: Public Health Importance

■ Age

- Range 1 – 94 years
- Median 52

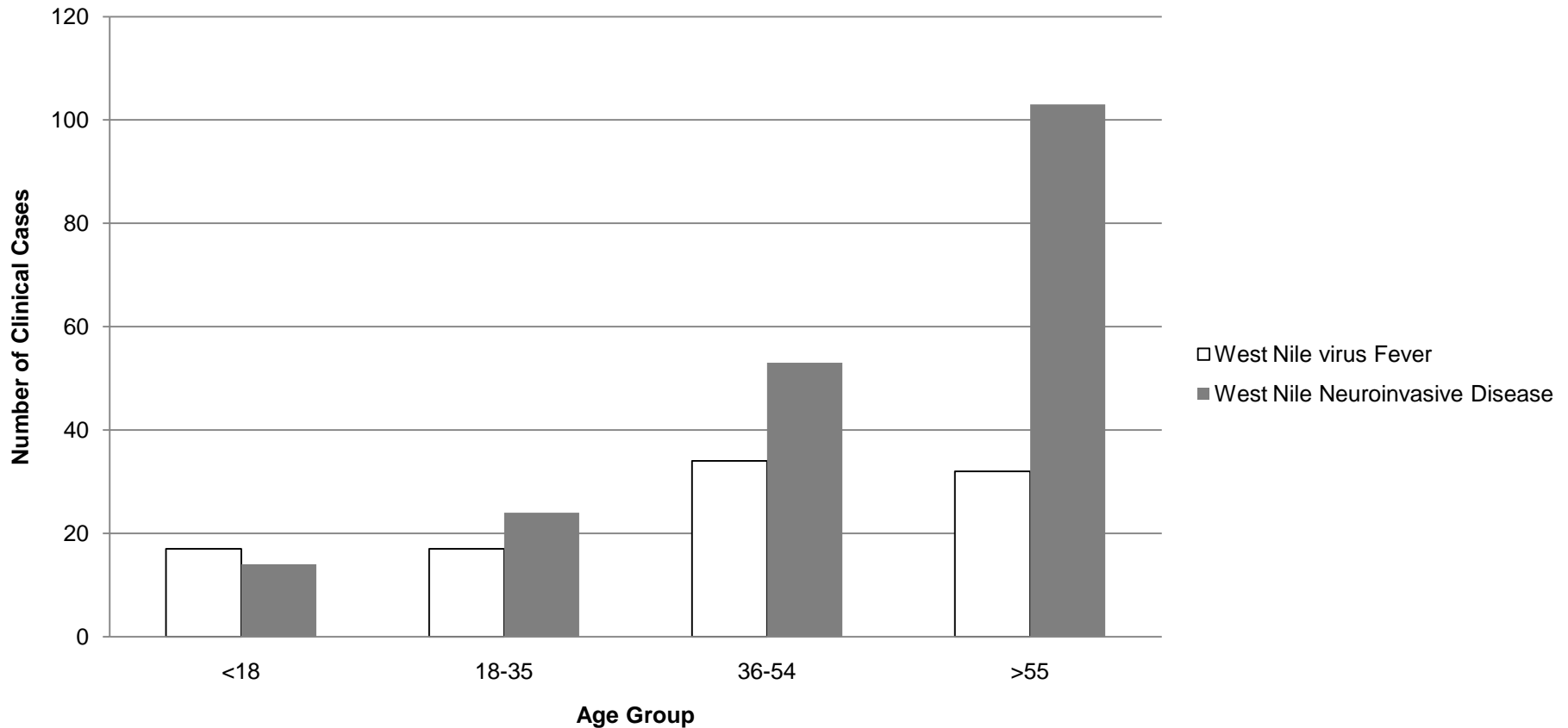
■ Sex

- 59.2% Male
- 39.8% Female
- 1% unspecified



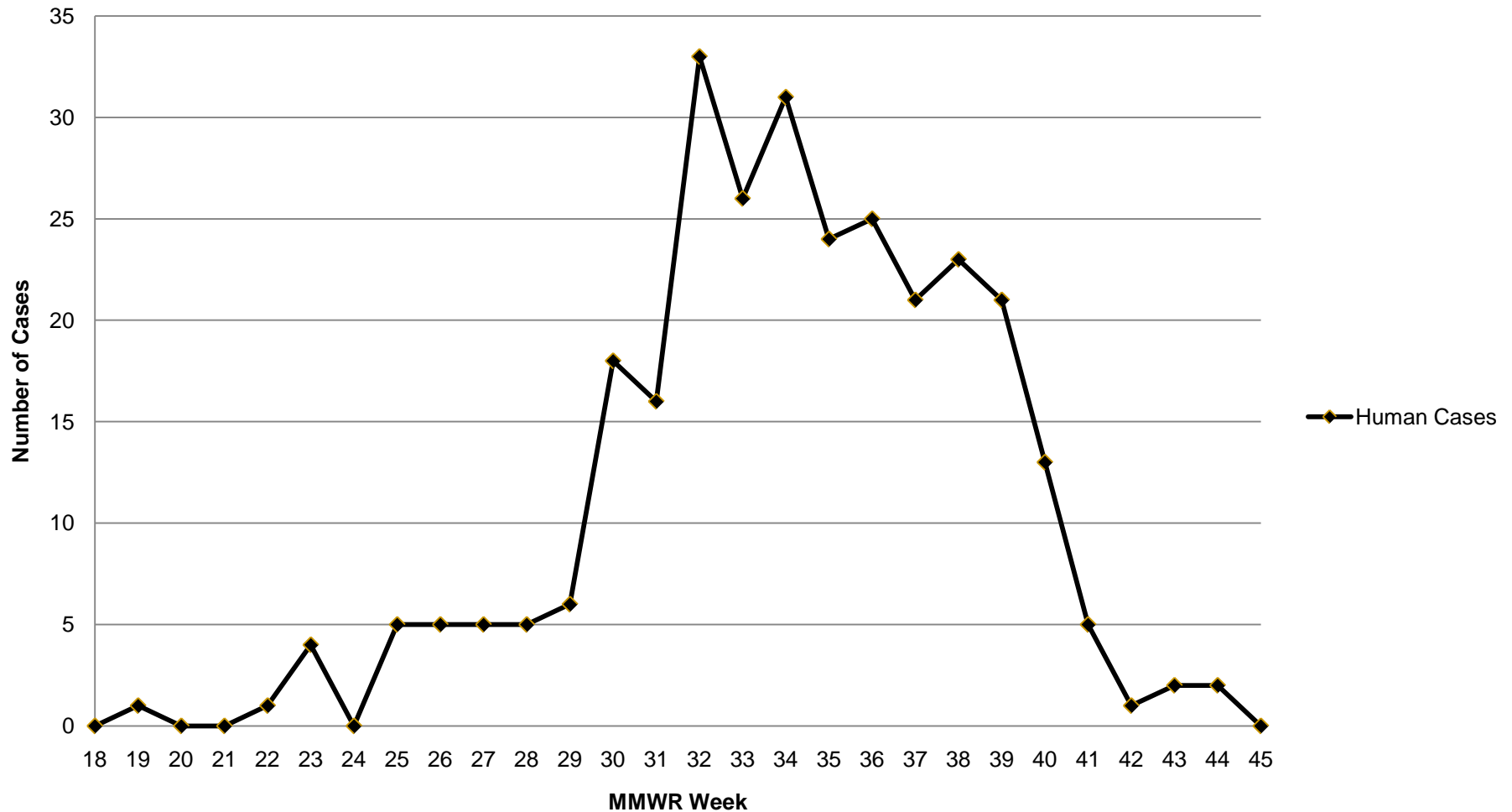
Results: Public Health Importance

Age Comparison for West Nile Fever and West Nile Neuroinvasive Disease 2002-2009



Results: Public Health Importance

Human Cases by MMWR Week for 2002-2009



Results: Timeliness

Days between mosquito pool collection and report date of test results

Year	Range (days)	Median (days)
2009	6-87	22
2008	6-43	24

Both years combined the range was 6-87 days with a median of 23 days

Results: Timeliness

- Time between positive non-human cases and positive human cases in the same county
 - 890 human reports in KS-EDSS
 - 456 had a onset of illness date
 - 288 were either confirmed or probable cases
 - 122 animal cases
 - 365 avian reports, 205 positives
 - 2992 mosquito pools, 115 positives
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Results: Timeliness

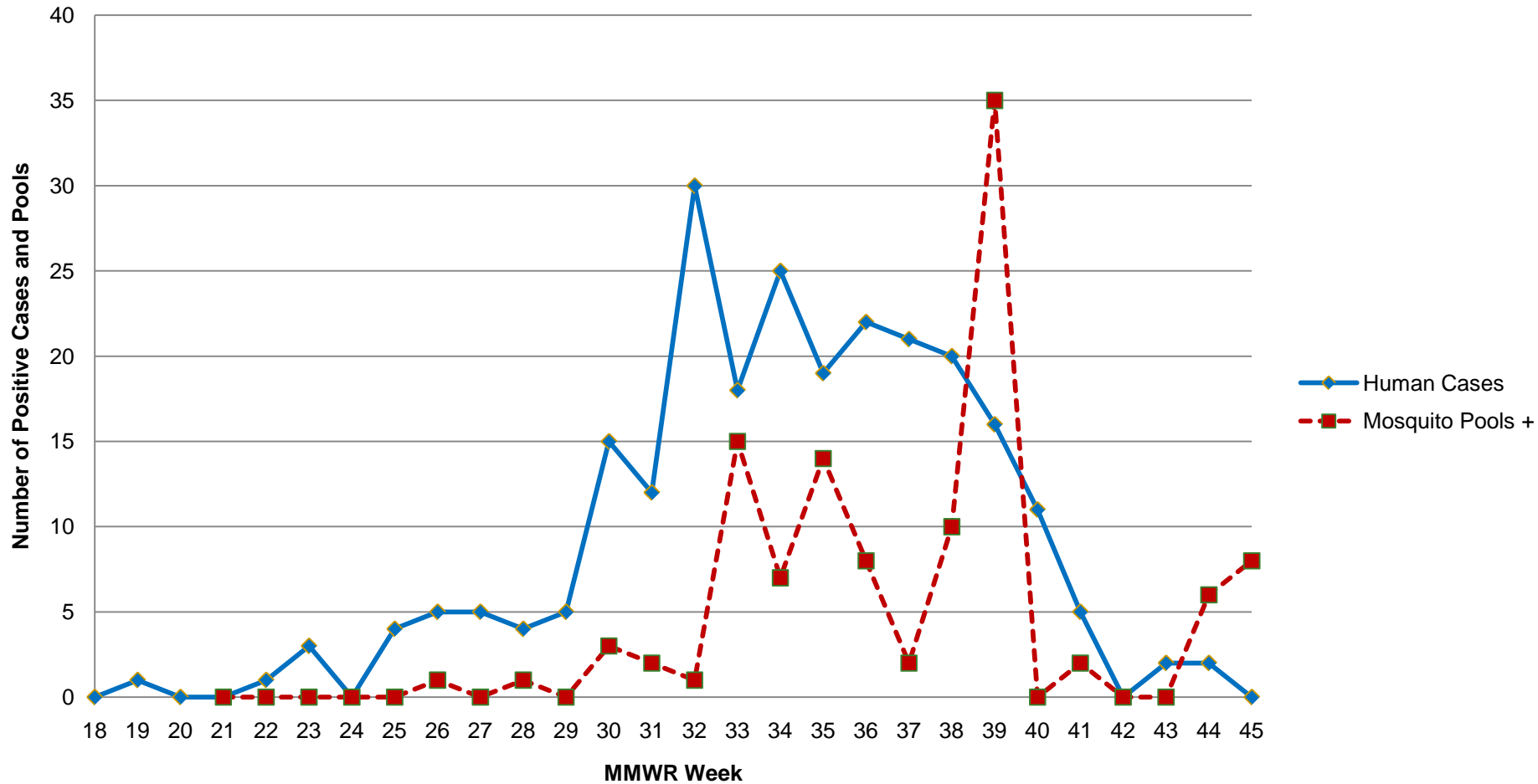
- Animal Cases
 - Ranged from 49 days prior to 110 after human cases
 - Median 22.5 days after

 - Avian Cases
 - Ranged from 60 days prior to 58 after human cases
 - Median 1 day after

 - Mosquito Pools
 - Ranged from 36 days prior to 82 days after human cases
 - Median 24 days after
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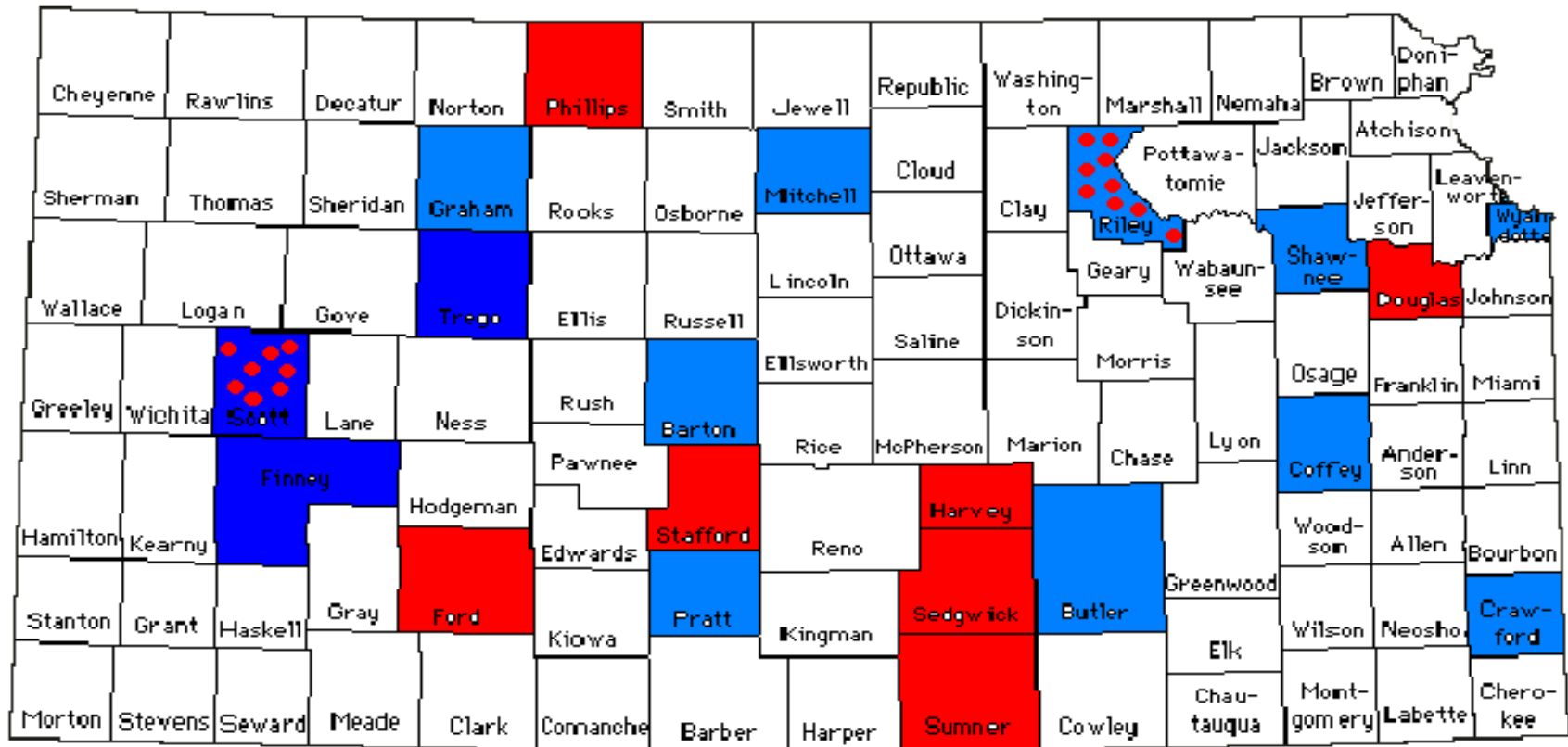
Results: Timeliness

Positive Human Cases and Positive Mosquito Pools by MMWR Week for 2003-2009*



* Excludes data from 2007 – Mosquito pool collection was not performed in 2007

Mosquito Pools and Human Cases in 2009



Results: Neighboring States

- Equine Cases reported in all 4 states
 - Required in 3 of 4 states

 - Dead bird reporting in 2 of 4
 - Testing done in 1 of 4

 - Mosquito pool testing in all 4 states
 - Number of counties tested
 - 27/93 (29%)
 - 19/64 (29.7%)
 - 4/77 (5.2%)
 - 14/114 (12.3%)
 - 13/105 (12.4%) – Kansas
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Results: Neighboring States

- All funded by ELC grant
 - Only one state indicated that surveillance would continue if federal funding is cut – others were unsure at this time but not optimistic

 - Other thoughts
 - Concerned about having to start surveillance again if another arbovirus enters the US
 - National Pollutant Discharge Elimination System
 - Hard for cities to obtain permits without documented positive mosquito pools
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Conclusion

- Mosquito based surveillance is not a useful tool for prediction of human illness
 - Time between collection and reporting of results is prolonged
 - Human cases can and have occurred and even peaked before mosquito activity is reported
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Conclusion

- Animal and avian cases are not reliable sentinels for human infections
 - Vaccination of horses
 - Decrease in susceptible bird populations and/or herd immunity
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Recommendations

- Discontinue mosquito pool testing
 - Not providing adequate public health data

 - Move in the direction of public education and vector control
 - Update and maintain website
 - Maps last updated in 2006
 - Provide public service announcements to county extension offices and Master Gardener programs
 - Release timely statewide PSAs in late June and again in August about personal protection
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- Revamp avian and animal results from KSU

Closing Comments

- West Nile virus is now endemic in Kansas
 - We can stop looking for it and move to continuing education to the public
- Current methods will not detect other arboviral disease
 - Resources are now known and a could be reinitiated if needed
- Education should include all vector diseases, not only WNV

In Addition

- Daily activities of State Health Department
 - Press Releases
 - Outbreak Investigation
 - H1N1
 - Food-borne
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Thank You

- Dr. Ingrid Garrison, DVM, MPH, DACVPM
 - State Public Health Veterinarian and Environmental Health Officer

 - Mr. Charlie Hunt, MPH
 - State Epidemiologist

 - All the Ladies (and Dan) in the Bureau of Surveillance and Epidemiology
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Questions

