Healthy Kansans living in safe and sustainable environments.
Measles: No Passport Required

Chelsea Raybern, MPH
Senior Epidemiologist
Bureau of Epidemiology and Public Health Informatics
Measles

- Transmission: airborne and droplet
  - Breathing, coughing, sneezing
  - Survives up to 2 hours on environmental surfaces
  - Contagious 4 days before until 4 days after rash onset

- 90% of susceptible contacts infected

- Complications: <5 and >20 years
  - Ear infections
  - Diarrhea
  - Pneumonia
  - Encephalitis
Signs and Symptoms

- **Prodrome**: fever, cough, coryza, conjunctivitis
- **Maculopapular rash** that begins on face at the hairline, spreads downward and outward
  - 3-5 days after prodrome
  - Fades in same order it appears
Timeline

Notified of measles patient #1

29 30 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 18 21 24 27 30 3 16

Jun Jul Aug
Measles #1 – Notification

- Travel to Europe
  - Landed in Wichita, KS
- Unvaccinated child
- Butler County resident
- Fever, runny nose, cough → 5 days
- Rash → 3 days
- Conjunctivitis
Measles #1 – Notification

- Hospital A collected blood for IgM testing
- Hospital A began line list of ER contacts
- Patient transferred to hospital B in Sedgwick County
  - Respiratory isolation
- Butler County Health Department (BCHD) notified
  - Followed up with family to determine exposure and get flight information
Measles #1 – Notification

- Sedgwick County Division of Health (SCDH)
- CDC EOC and CDC DGMQ
Notified of measles patient #1

Timeline

- **Jun 29**: Throat swab collected: PCR (+)
- **Jul**: Additional details needed
- **Aug**: Further action or notes needed
Measles #1 – Investigation

- 4 separate flights from Europe to Wichita
  - BCHD having difficult time obtaining accurate flight information from patient’s family

- Family and travel companion contacts
  - 9 contacts → 3 unvaccinated, received MMR on 6/30

- Hospital contacts
  - 18 contacts → 3 unsure of vax status, titers pulled
    - 1 with negative titer → 21 day quarantine

- Patient discharged from hospital B on 7/1, isolated at home
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jun 29</td>
<td>Notified of measles patient #1</td>
</tr>
<tr>
<td>Jul 30</td>
<td>Throat swab collected: PCR (+)</td>
</tr>
<tr>
<td>Aug 1</td>
<td>Flight info provided to DGMQ</td>
</tr>
</tbody>
</table>
Notified of measles patient #1

Flight info provided to DGMQ

Throat swab collected: PCR (+)

Flight contacts received from DGMQ, IgM (+)
Flight Exposure Determination by CDC
Measles #1 – Flight Contacts

- Counties
  - Sedgwick – 22 contacts
  - Butler – 2 contacts
  - Harvey – 2 contacts
  - McPherson – 1 contact
  - Pawnee – 1 contact

- KDHE provided recommendations to LHDs on contact investigation
Timeline

- Notified of measles patient #1
- Throat swab collected: PCR (+)
- Flight contacts received from DGMQ, IgM (+)
- Flight info provided to DGMQ
- LHD assessed contacts for immunity/sx

Timeline: Rail 29, 30, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 18, 21, 24, 27, 30, 3, 16

June (Jun) July (Jul) August (Aug)
Measles #1 – Flight Contact Follow Up

- Outside 72 hour window for MMR

- Immune globulin (IG) effective if given within 6 days
  - IGIM located, but discussion with CDC revealed not effective in persons >30 kg (66 lbs)
  - IGIV recommended for high risk persons

- 20/28 flight contacts reached → all immune
Notified of measles patient #1

Throat swab collected: PCR (+)

Flight info provided to DGMQ

LHD assessed contacts for immunity/sx

Flight contacts received from DGMQ, IgM (+)

All flight contacts reached

Timeline
Back to Europe?

- Older sibling of measles patient planned to go to Europe on 7/12

- Received MMR on 6/30 (12 days prior to planned trip)

- Public health repeatedly discouraged travel
Notified of measles patient #1

Flight info provided to DGMQ

PCR (+)

Throat swab collected:

Sibling of patient #1 traveled to same place in Europe

LHD assessed contacts for immunity/sx

Flight contacts received from DGMQ, IgM (+)

All flight contacts reached

Timeline

29 30 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 18 21 24 27 30 3 16

Jun | Jul | Aug
Notified of measles patient #1

Flight info provided to DGMQ

LHD assessed contacts for immunity/sx

Sibling of patient #1 traveled to same place in Europe

Flight contacts received from DGMQ, IgM (+)

Throat swab collected: PCR (+)

All flight contacts reached

Pennsylvania flight contact: PCR (+)
Notified of measles patient #1

Flight info provided to DGMQ

Notified of measles patient #1

Flight contacts received from DGMQ, IgM (+)

LHD assessed contacts for immunity/sx

Sibling of patient #1 traveled to same place in Europe

Flight contacts reached

Throat swab collected: PCR (+)

Pennsylvania flight contact: PCR (+)

Flight info provided to DGMQ

Notified of measles patient #2, throat swab collected
Measles #2 - Notification

- Flight contact to 1st measles patient
- Vaccinated with autoimmune disorder
- Had oral surgery performed 7/7
- Fever
- Koplick spots
- Rash (neck behind ear, progressed to thighs and chest)
Notified of measles patient #1
Throat swab collected: PCR (+)

Flight info provided to DGMQ

Notified of measles patient #2, throat swab collected

Sibling of patient #1 traveled to same place in Europe

LHD assessed contacts for immunity/sx

Flight contacts received from DGMQ, IgM (+)

All flight contacts reached

Measles patient #2: PCR (+), New York flight contact: PCR (+)

Pennsylvania flight contact: PCR (+)
Flight Exposure of Measles #2

CDC considers exposed
Measles #2 - Investigation

- Lamar’s Donuts
- Pathway Church
- Walmart
- Kwik Shop
- Jason’s Deli
- Jiffy Lube
- Academy Sports
- Michael’s
- Family Video
- Moxley and Wagle Periodontics
- Vermillion Elementary
Notified of measles patient #1, throat swab collected: PCR (+)

Flight info provided to DGMQ

Notified of measles patient #2, throat swab collected

Flight contacts received from DGMQ, IgM (+)

LHD assessed contacts for immunity/sx

Sibling of patient #1 traveled to same place in Europe

Measles patient #2: PCR (+), New York flight contact: PCR (+)

Flight contacts reached

All flight contacts reached

ICS implemented, press release distributed

Pennsylvania flight contact: PCR (+)
Goals of Incident Command Structure

- Create and maintain surge capacity
- Provide consistent prevention recommendations
  - Susceptible
    - Out of 72 hour time frame for MMR for most
    - Recommended to get IG, but consult with PCP
    - Mandatory quarantine vs voluntary quarantine
  - Immune
    - Monitor for symptoms for 21 days
Measles #2 – ICS

- Received ~900 calls in July
  - On average, receive <200 calls/month

- >400 persons considered potentially exposed
  - 19 recommended IG → 7 received
  - 10 tested for measles → all negative

- Concluded on 7/17
Notified of measles patient #1, throat swab collected: PCR (+).

Flight info provided to DGMQ.

Flight contacts received from DGMQ, IgM (+).

LHD assessed contacts for immunity/sx.

Sibling of patient #1 traveled to same place in Europe.

End of contact monitoring for patient #1, genotype B3.

Pennsylvania flight contact: PCR (+).

ICS implemented, press release distributed.

Measles patient #2: PCR (+), New York flight contact: PCR (+).

Notified of measles patient #2, throat swab collected.
Notified of measles patient #1, throat swab collected.

Flight info provided to DGMQ.

LHD assessed contacts for immunity/sx.

Notified of measles patient #2, throat swab collected.

Sibling of patient #1 traveled to same place in Europe.

Flight contacts received from DGMQ, IgM (+).

End of contact monitoring for patient #1, genotype B3.

Flight contacts reached.

Pennsylvania flight contact: PCR (+).

ICS implemented, press release distributed.

End of contact monitoring for patient #2.

Measles patient #2: PCR (+), New York flight contact: PCR (+).
Notified of measles patient #1

Flight contacts received from DGMQ, IgM (+)

LHD assessed contacts for immunity/sx

Flight contacts reached

End of contact monitoring for patient #1, genotype B3

Sibling of patient #1 traveled to same place in Europe

Throat swab collected: PCR (+)

End of symptom monitoring for sibling

Measles patient #2: PCR (+), New York flight contact: PCR (+)

ICS implemented, press release distributed

Pennsylvania flight contact: PCR (+)

End of contact monitoring for patient #2

Flight info provided to DGMQ
Measles #1 – Summary

- Unvaccinated child traveled to Europe
- Exposed 55 persons in Kansas
  - 9 family → 3 unvaccinated received MMR
  - 18 hospital → 1 staff in quarantine
  - 28 flight → all immune
- 3 exposed flight contacts developed measles
  - Kansas
  - Pennsylvania
  - New York
- Vaccinated sibling traveled to Europe
  - Did not develop measles
Measles #2 – Summary

- Vaccinated, autoimmune disorder exposed on flight
  - 10 rows away

- ICS implemented

- Exposed >400 persons in Sedgwick County
  - 19 recommended IG ➔ 7 received

- 0 developed measles
Questions
The Lumps and Bumps of Mumps

Kansas 2017

Chelsea Raybern, MPH
Senior Epidemiologist
Bureau of Epidemiology and Public Health Informatics
Mumps

- Transmission: droplet, direct and indirect contact
  - Coughing, sneezing, talking, sharing utensils
  - Contagious 2 days before until 5 days after parotitis onset

- Complications:
  - Testicular inflammation
  - Ovarian inflammation
  - Meningitis
  - Encephalitis
  - Deafness
Signs and Symptoms

- Prodrome: fever, headache, muscle aches, fatigue, loss of appetite

- Parotitis (swelling of salivary glands)
  - Develops several days after prodrome
  - Unilateral or bilateral
December 2016 – July 2017

- 168 cases in 27 counties
## Characteristics of Mumps Cases

<table>
<thead>
<tr>
<th>Gender</th>
<th># of Cases</th>
<th>% of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>73</td>
<td>43%</td>
</tr>
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<thead>
<tr>
<th>Symptoms/Complications</th>
<th># of Cases</th>
<th>% of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parotitis</td>
<td>165</td>
<td>98%</td>
</tr>
<tr>
<td>Fever</td>
<td>74</td>
<td>44%</td>
</tr>
<tr>
<td>Meningitis</td>
<td>1</td>
<td>0.6%</td>
</tr>
<tr>
<td>Orchitis</td>
<td>13</td>
<td>8%</td>
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### Symptoms/Complications

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</tr>
</tbody>
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### Vaccination Status

<table>
<thead>
<tr>
<th>Vaccination Status</th>
<th># of Cases</th>
<th>% of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccinated</td>
<td>143</td>
<td>85%</td>
</tr>
<tr>
<td>2 doses</td>
<td>(89)</td>
<td>(62%)</td>
</tr>
<tr>
<td>1 dose</td>
<td>(10)</td>
<td>(7%)</td>
</tr>
<tr>
<td>No documented doses</td>
<td>(44)</td>
<td>(31%)</td>
</tr>
<tr>
<td>Not Vaccinated</td>
<td>9</td>
<td>5%</td>
</tr>
<tr>
<td>Unknown</td>
<td>16</td>
<td>10%</td>
</tr>
</tbody>
</table>
Test Results

- 430 specimens for mumps testing at KHEL
  - 82 (19%) PCR positive
  - 25 forwarded to CDC → genotype G

- 155 specimens for RP testing at KHEL
  - 43 (28%) PCR positive
    - 21 influenza A
    - 14 rhinovirus/enterovirus
    - 7 coronavirus
    - 1 influenza B

- 4 co-infections
Mumps Outbreaks

- 133 (79%) associated with an outbreak
Timeline of Outbreak Investigations

- Douglas
- Riley
- Crawford
- Finney
- Thomas
- Marshall
- Johnson (2)
- Johnson (1)
- Trego
- Johnson (3)
- Wyandotte


- Active Outbreak
- Continued Investigation and Monitoring for Cases
KU Outbreak – December 12, 2016

- 20 cases
  - 16 students
  - 3 staff
  - 1 contact to student
- 10 (50%) male
- 18 (90%) fully immunized
- Parotitis duration: 2 – 6 days
- 2 complications (1 hospitalization)
  - Orchitis
  - Meningitis
KU Outbreak
Number of Cases by Onset Date (n=20)
KU Outbreak

After-Action Meeting

- **Strengths**
  - Communication
  - Existing vaccination policy

- **Weaknesses**
  - Educating healthcare providers
  - Specimen collection
KSU Outbreak – February 20, 2017

- 17 cases
  - 13 students
  - 2 staff
  - 2 contacts to student

- 8 (52%) male

- 17 (100%) fully immunized

- Parotitis duration: 3 – 7 days

- No complications or hospitalizations
KSU Outbreak
Number of Cases by Onset Date (n=17)
KSU Outbreak

3rd MMR Dose Recommendation

- 3 vaccination clinics
  - April 7
  - April 11
  - April 12

- 415 total MMR doses administered
Marshall County High School Outbreak – March 2, 2017

- 35 cases
  - 20 students
  - 3 staff
  - 12 contacts to student
- 20 (57%) male
- 25 (71%) fully immunized
- Parotitis duration: 2 – 8 days
- 2 complications (no hospitalizations)
  - Orchitis
Marshall County High School Outbreak
Number of Cases by Onset Date (n=35)
Marshall County High School Outbreak

3rd MMR Dose Recommendation

- 3 vaccination clinics
  - May 1
  - May 8
  - May 10

- 197 total MMR doses administered
Questions
Healthy Kansans living in safe and sustainable environments.

www.kdheks.gov

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Bureau of Epidemiology and Public Health Informatics
Kansas Department of Health and Environment
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Outbreak of Shiga Toxin-Producing *E. coli* O157:H7 Associated with a Cider Festival — Kansas, 2016

Lindsey Martin Webb, MPH
Advanced Epidemiologist
Bureau of Epidemiology and Public Health Informatics
It’s always a Friday...

- Friday, October 21, 2016 at 4:56 pm KDHE received a call
- 6 persons with Shiga toxin-producing *Escherichia coli* (STEC) O157:H7 with indistinguishable pulsed-field gel electrophoresis (PFGE)
Shiga toxin-producing *E. coli* (STEC)

- **Incubation**: 1 to 10 days
- **Duration**: 5 to 10 days

- **Diarrhea**
- **Bloody Stool**
- **Abdominal Pain**

- **Hemolytic Uremic Syndrome (HUS)**
STEC

265,000 cases/year

100 cases/year
STEC

- Common sources
  - Contaminated sprouts
  - Raw/undercooked ground beef
  - Animals (cattle, sheep, goats)

- Recent outbreaks
  - Soynut butter
  - Flour
  - Sprouts
STEC Outbreak Identification

- Epidemiology: increase in the number of cases in a geographic area in a period of time, or identification of common exposures through case interviews

- PFGE: pulsed-field gel electrophoresis (DNA fingerprint)
Investigation Initiation

- 5 of 6 persons attended Ciderfest at Louisburg Cider Mill in Louisburg, KS on September 24, 2016
- Outbreak investigation initiated October 24, 2016
Ciderfest

Cluster Notification

Investigation Initiated
Ciderfest

Pumpkin Patch & Corn Maze
Admission $9 (tax included)

3 yrs old and under FREE

Admission includes:
10 Acre Ghost of the Corn Maze
Access to the Pumpkin Patch
Wagon Rides
Hill Slide
Pallet Maze
Play Areas
Trike Track
Farm Animals
Corn Bin

9/24 9/25 10/1 10/2

Ciderfest

MENU

Cider Drinks-One Size
Hard, Cold or Bath

Apple Slippers-Cold Only

Lost Trail Soda

丧葬品

Orange Cream, Raspberry

Single

$2.25

$3.75

$2.00

$4.50

Kansas

Department of Health and Environment
Cider Mill Inspection
Cider Mill Inspection
Environmental Sampling Results
Case finding

Experts investigate E. coli cases linked to Louisburg Cider Mill Ciderfest

People who felt ill after attending event asked to call officials

Archive for Wednesday, November 2, 2016

State investigating E. coli outbreak connected to festival at Louisburg Cider Mill

Kansas Department of Health investigating E. coli outbreak at Louisburg Cider Mill Ciderfest

BY: 41 Action News Staff
POSTED: 5:20 PM Nov 2, 2016

9/24 9/25 10/1 10/2 10/21 10/24 10/27 11/2

Cluster Notification

Cider Mill Inspection

Investigation Initiated

Press Release

Ciderfest
Methods

- Case definition: diarrhea in a person beginning ≥1 day after attending Ciderfest and lasting ≥2 days
- Matched case-control study
  - Friend-and-family group controls
  - Interviewed with outbreak-specific questionnaire
- Calculated matched odds ratios and 95% confidence intervals
  - Conditional logistic regression with exact estimates
Matched Case-Control Study
Matched Case-Control Study
Matched Case-Control Study

73 persons reported illness
Matched Case-Control Study

73 persons reported illness
Matched Case-Control Study

73 persons reported illness
Matched Case-Control Study

73 persons reported illness
17 excluded
Matched Case-Control Study
Matched Case-Control Study

73 persons reported illness
56 cases
55 controls
17 excluded
Matched Case-Control Study

73 persons reported illness

17 excluded

56 cases

55 controls

41 attendance groups
## Study Population Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Case-Patients, n=56</th>
<th>Control Subjects, n=55</th>
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</thead>
<tbody>
<tr>
<td><strong>Median age</strong></td>
<td>22</td>
<td>29</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>18 (32%)</td>
<td>26 (47%)</td>
</tr>
<tr>
<td>Female</td>
<td>38 (68%)</td>
<td>29 (53%)</td>
</tr>
<tr>
<td><strong>State of residence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kansas</td>
<td>37 (66%)</td>
<td>37 (67%)</td>
</tr>
<tr>
<td>Missouri</td>
<td>19 (34%)</td>
<td>18 (34%)</td>
</tr>
<tr>
<td><strong>Date of attendance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>September 24, 2016</td>
<td>32 (57%)</td>
<td>36 (65%)</td>
</tr>
<tr>
<td>September 25, 2016</td>
<td>3 (5%)</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>October 1, 2016</td>
<td>5 (9%)</td>
<td>4 (7%)</td>
</tr>
<tr>
<td>October 2, 2016</td>
<td>16 (29%)</td>
<td>12 (24%)</td>
</tr>
</tbody>
</table>
Symptoms and Outcomes (n=56)

- Diarrhea: 100%
- Abdominal pain: 77%
- Nausea: 57%
- Fever: 41%
- Headache: 36%
- Myalgia: 32%
- Other symptoms: 29%
- Vomiting: 29%
- Blood in stool: 25%
- HUS: 4%
Number of cases by onset date (n=56)

Ciderfest

9/24/2016
9/25/2016

10/1/2016
10/2/2016

Ciderfest
Number of cases by onset date (n=56)

- Attended Ciderfest September 24-25, 2016

Kansas Department of Health and Environment
Number of cases by onset date (n=56)

- Attended Ciderfest September 24-25, 2016
- Attended Ciderfest October 1-2, 2016
## Associations between Illness and Exposures

<table>
<thead>
<tr>
<th>Exposure/Food Item</th>
<th>Matched Odds Ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any type of cold cider</td>
<td>6.6</td>
<td>1.2 - infinity</td>
</tr>
<tr>
<td>cup of cold cider</td>
<td>2.1</td>
<td>0.4 - 11.6</td>
</tr>
<tr>
<td>cider slush</td>
<td>4.5</td>
<td>0.7 - infinity</td>
</tr>
<tr>
<td>Hot cider</td>
<td>1.2</td>
<td>0.2 - 8.6</td>
</tr>
<tr>
<td>Pre-packaged bottle of cider</td>
<td>3.3</td>
<td>0.3 - 39.1</td>
</tr>
<tr>
<td>Cider doughnuts</td>
<td>10.3</td>
<td>1.1 - 94.8</td>
</tr>
<tr>
<td>Caramel apples</td>
<td>1.3</td>
<td>0.1 - 17.3</td>
</tr>
<tr>
<td>Pony ride</td>
<td>1.0</td>
<td>0 - 19</td>
</tr>
<tr>
<td>Contact with farm animals</td>
<td>4.7</td>
<td>0.5 - infinity</td>
</tr>
<tr>
<td>Pumpkin patch</td>
<td>2.2</td>
<td>0.1 - 157</td>
</tr>
<tr>
<td>Mobile food vendors</td>
<td>0.3</td>
<td>0.3 - 2.4</td>
</tr>
</tbody>
</table>
Conclusions

- 56 persons with STEC O157 after Ciderfest
- Cider and cider doughnuts were associated with illness
- Onsite inspection was essential for identifying un-pasteurized cider was served during the cider festival
Recommendations

- All tanks holding unpasteurized cider should be labeled
- Employees should be cross-trained about all processes on site
After-Action Review

- February 2017

- KDA
  - Food Safety and Lodging
  - Laboratory

- KDHE
  - Epidemiology
  - Laboratory
This apple pulp is then pressed by a continuous belt press, and the juice is expressed.

After screening and filtering out the largest pulp particles from the juice, it is ready to be pasteurized and filled.

Most important to the whole process of pressing apples and bottling cider is doing so in a safe manner. The Louisburg Cider Mill has a thorough Food Safety Program and many experienced staff members that are employed to ensure that products manufactured are not only to a high standard of quality, but meet the requirements of Good Manufacturing Practice.

Key production staff are all trained in Cider HACCP (Hazard Analysis Critical Control Points) and through FSPCA (Food Safety Preventative Controls Alliance) as “preventative controls qualified individuals”.
Investigation Follow-up

- No reports of illness were received following the 2017 cider festival
- No cases were found to be associated with the mill's nationally-distributed finished cider products
Acknowledgments

- Kansas Department of Health and Environment
  - Charlie Hunt
  - Ingrid Trevino-Garrison
  - IDER Staff

- Kansas Department of Agriculture
  - Amber Barham*
  - Adam Inman*
  - Autumn Schuck
  - Steve Moris

- Centers for Disease Control and Prevention
  - Jessica Nadeau Tomov**
  - Andrea Winquist
  - Rashida Hassan

- Missouri Department of Health and Senior Services
  - Elizabeth Anderson
  - CJon Hinkle
  - Mark Buxton

- United States Food and Drug Administration
  - Sam Gibbons
  - Jeffrey Moody
  - Erin Dugan

**Lead Author
*Co-Author
West Nile Virus Investigation
Turon, Kansas

Sheri Tubach and Amie Worthington
Epidemiologist
Bureau of Epidemiology and Public Health Informatics
West Nile Virus

- Leading cause of domestically acquired arboviral disease in the United States
- Arthropod-borne virus (arbovirus) spread by infected mosquitoes
- *Culex* species are the primary vector for West Nile virus (WNV)
WNV Clinical Information

- Incubation period: 3-15 days
- 80% asymptomatic
- Symptoms include:
  - Fever
  - Headache
  - Weakness
  - Myalgia
  - Arthralgia
  - Rash
- Less than 1% develop neuroinvasive disease
  - Meningitis
  - Encephalitis
  - Acute flaccid paralysis
- Persons over 50 years are at greater risk for complications and death
WNV Epidemiology

<table>
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<th></th>
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<tr>
<td>Cases</td>
<td>46,086</td>
<td>590</td>
</tr>
<tr>
<td>Deaths</td>
<td>2,017</td>
<td>30</td>
</tr>
</tbody>
</table>

https://www.cdc.gov/westnile/statsmaps/cumMapsData.html#eight
WNV Transmission

https://www.cdc.gov/westnile/transmission/index.html
<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg</td>
<td>Rafts float on surface of water and hatch into larvae within 48 hours</td>
</tr>
<tr>
<td>Larvae</td>
<td>Live in water and float at surface of water to breathe oxygen</td>
</tr>
<tr>
<td>Pupae</td>
<td>Resting non-feeding state of the life cycle</td>
</tr>
<tr>
<td>Adult</td>
<td>Flying, biting mosquito</td>
</tr>
</tbody>
</table>
Mosquito Control and Prevention

Personal Protection
- Insect repellent
- Wear long-sleeved shirts and long pants

Property Protection
- Ensure screens are in good repair
- Empty items that can collect water once a week
- Larvicide can be used in standing water that cannot be dumped
- Adulticide can be used in outbreak situations
Mosquito Control

- In Kansas mosquito control may be performed by the city or county
  - There is no state vector control program
- A 2015 survey of city and county mosquito control programs found
  - 53% cities performed mosquito control
  - 20% counties performed mosquito control
  - None of these entities used mosquito surveillance data to direct control efforts
Mosquito Surveillance in Kansas

KDHE began surveillance
Mosquito Surveillance in Kansas

KDHE began surveillance

1st WNV positive mosquito

Mosquito surveillance performed in at least one county in each region by K-State, funded by KDHE through CDC grant. (Method used did not act as an ‘early warning system’)

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- Surveillance focused on Sedgwick County which acted as a sentinel site for WNV activity for the state

- Mosquito surveillance conducted in 9 counties (1 trap in each county)
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Surveillance in Atchison and Doniphan counties due to floods

No mosquito surveillance

Surveillance expanded to include Johnson (WNV mosquito testing only), Reno, and Shawnee counties

Surveillance focused on Sedgwick County which acted as a sentinel site for WNV activity for the state

Mosquito surveillance conducted in 9 counties (1 trap in each county)
Family: Turon man had West Nile Virus when he died last month

The Hutchinson News
2nd Reno resident who had virus dies
Turon, KS

- City Area: 294 acres (0.46 sq mi)
- Population: 378
- 3 counties: Reno, Stafford, Pratt
- Median age: 39.6 years
  - 17.8% were 65 years of age or older
- Median household income: $25,228
## WNV Turon Cases

<table>
<thead>
<tr>
<th>Disease Type</th>
<th>Year</th>
<th>County</th>
<th>Hospitalization</th>
<th>Died</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroinvasive</td>
<td>2003</td>
<td>Reno</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Non-neuroinvasive</td>
<td>2004</td>
<td>Reno</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Non-neuroinvasive</td>
<td>2004</td>
<td>Pratt</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Non-neuroinvasive</td>
<td>2013</td>
<td>Reno</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Neuroinvasive</td>
<td>2013</td>
<td>Reno</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Neuroinvasive</td>
<td>2016</td>
<td>Pratt</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Neuroinvasive</td>
<td>2016</td>
<td>Stafford</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Turon, KS – Past Mosquito Control

- Adulticide sprayed once a week for ~6 weeks
  - Begin spraying once they receive complaints about mosquito bites from citizens
  - Same adulticide product used for numerous years
- Larvicide dunks used in areas of standing water

http://www.shaw.af.mil/News/Article-Display/Article/1179159/how-to-prepare-for-mosquito-season/
Turon, KS – Mosquito Surveillance

- Mosquito surveillance last performed by KDHE in 2003 (Reno), 2005 (Stafford), 2009 (Pratt)

- In 2017, Reno county was added to the Kansas mosquito surveillance program
  - Due to the number of WNV neuroinvasive disease cases
  - Focused mosquito surveillance conducted by the Kansas Biological Survey (KBS) to evaluate ecological factors that may contribute to WNV transmission
  - 2/6 traps were set in Turon
Turon, KS – Mosquito Surveillance

- Mosquito surveillance training on May 10, 2017 for Reno County Health Department staff

- Two traps placed overnight for the training in Turon
  - ~600 female *Culex* mosquitoes in each trap
    - Above treatment threshold for adult mosquitoes
    - Previous Kansas surveillance data evaluation showed increased risk of WNV transmission when female *Culex* mosquitoes > 40 per trap
Response

- May 17: Call with Reno County Health Department, KDHE, and KBS

- May 25: Call with CDC, Reno County Health Department and City of Turon
  - Recommendation to spray 2X per week based on surveillance data
Response

- **May 30 – June 2: Focused larval surveillance by RCHD**
  - To try and identify primary source(s) of mosquito breeding habitat

- **June 4 – June 6: Focused larval and adult surveillance by KBS**
  - To try and identify primary source(s) of mosquito breeding habitat
  - Significant sources of larval *Culex* mosquitoes in Turon, south of Turon, and north of Turon
  - To determine if adulticide efforts were effective
Community Outreach

- Door-to-door campaign by city officials
  - Educational materials
  - Larvicidal dunks

- Media
  - Local papers
  - Local TV channels
  - Social media
  - Website
  - Radio

- RCHD gave two presentations to their health department advisory group
Success

- Near real-time mosquito surveillance used to guide mosquito control efforts may have decreased human cases of WNV in 2017
  - No WNV cases reported in Turon
  - No WNV cases reported in Reno or Stafford county

- Active, engaged outreach to community and city officials on WNV prevention
  - Consistent, timely messaging
Mosquito Surveillance in Turon, KS, 2017
Weekly Results from Two Trap Locations

Number of Mosquitoes

Trap Week

Total # of Culex

Total Mosquitoes

≥1200 Culex spp. mosquitoes during May 10th training
Conclusions

- Mosquito surveillance is resource intensive but works when data is shared with partners

- Cities and counties should use surveillance data to guide control and outreach efforts
  - Adulticide spraying
  - Messaging to public
Acknowledgements

- Kansas Department of Health and Environment
  - Ingrid Trevino-Garrison
  - Sheri Tubach

- Kansas Biological Survey
  - D. Christopher Rogers

- Reno County Health Department
  - Darcy Bayse
  - Nick Baldetti
  - Megan Hammersmith
  - RCHD Environmental Staff

- Centers for Disease Control and Prevention
  - Janet McAllister

- City of Turon
Questions

Measles

Mumps

STEC

WNV

... or anything else!

1-877-427-7317