MICHIGAN HATCHERY INVESTIGATION: HATCHING A PLAN TO PREVENT SALMONELLA

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HUMAN SALMONELLA INFECTIONS

- *Salmonella* is spread by the fecal-oral route & can be transmitted by:
  - Food and water (94% of cases)
  - Direct animal contact
  - Person-to-person (rare)

- Individuals diagnosed with salmonellosis are interviewed by local and/or state public health officials and asked about symptoms and possible sources of exposure

- Reported *Salmonella* cases underestimate the total number of cases
  - For every one case of diagnosed *Salmonella*, there are potentially 30 more cases that are not reported or not diagnosed.

- *Salmonella* bacteria is submitted to state public health lab for serotyping and DNA fingerprinting
  - DNA fragments produce a DNA fingerprint with a specific pattern
  - The specific pattern is compared to PulseNet national database to see if it is part of an outbreak

- If an outbreak is identified, environmental sampling and traceback then take place

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1 The Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases, Division of Foodborne, Waterborne, and Environmental Disease.
“Three-Legged Stool” Technique
1. Environmental (sampling & traceback)
2. Epidemiology
3. Laboratory
MDHHS EDUCATIONAL EFFORTS

• Annual mailings to agriculture retail stores throughout Michigan
  • Each store is sent an introductory letter emphasizing the potential human risk associated with contact with live poultry and CDC posters to display
  • 2013-2019

• Educational stickers, posters, and handouts available to order, free of charge, to Michigan residents

• Michigan Emerging Diseases Website: Keeping Backyard Poultry page which links to CDC syndicated material
# Historic Human Salmonella Outbreaks Linked to Michigan Hatchery

<table>
<thead>
<tr>
<th>Year</th>
<th>Serotype</th>
<th>Laboratory Confirmed</th>
<th>Publications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td># Human Cases U.S. / (MI Cases)</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>S. Enteritidis (JEGX01.0004)</td>
<td>67 / (12)*</td>
<td>CDC Website</td>
</tr>
<tr>
<td></td>
<td>S. Litchfield (JGXX01.0009, JGXX01.0315, JGXX01.0478)</td>
<td>9 / (3)</td>
<td>CDC Website</td>
</tr>
<tr>
<td>2017</td>
<td>S. Enteritidis (JEGX01.0004)</td>
<td>74 / (4)*</td>
<td>CDC Website</td>
</tr>
<tr>
<td></td>
<td>S. Litchfield (JGXX01.0009)</td>
<td>18 / (5)</td>
<td>CDC Website</td>
</tr>
<tr>
<td></td>
<td>S. Braenderup (JBPX01.0039)</td>
<td>56 / (4)*</td>
<td>CDC Website</td>
</tr>
<tr>
<td>2016</td>
<td>S. Enteritidis (JEGX01.0004, JEGX01.0021)</td>
<td>163 / (35)*</td>
<td>CDC Website</td>
</tr>
<tr>
<td></td>
<td>S. Mbandaka (TDRX01.0529, TDRX010067)</td>
<td>46 / (3)</td>
<td>CDC Website</td>
</tr>
<tr>
<td></td>
<td>S. Muenster (TDSX01.0188)</td>
<td>25 / (5)</td>
<td>CDC Website</td>
</tr>
<tr>
<td></td>
<td>S. Braenderup (JBPX01.0039)</td>
<td>129 / (8)</td>
<td>CDC Website</td>
</tr>
<tr>
<td>2015</td>
<td>S. Muenchen (JJ6X01.3780)</td>
<td>18 / (3)</td>
<td>CDC Website</td>
</tr>
<tr>
<td></td>
<td>S. Muenster (TDSX01.0189)</td>
<td>23 / (2)</td>
<td>CDC Website</td>
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<td></td>
<td>S. Enteritidis (JEGX01.0005, JEGX01.0004)</td>
<td>65 / (0)</td>
<td>CDC Website</td>
</tr>
<tr>
<td>2006</td>
<td>S. 4, 5, 12, i-</td>
<td>(21)</td>
<td>Scientific Pub1</td>
</tr>
<tr>
<td>2000</td>
<td>S. Infantis</td>
<td>(5)</td>
<td>Scientific Pub2</td>
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<tr>
<td>1999</td>
<td>S. Infantis</td>
<td>(21)</td>
<td>Scientific Pub3</td>
</tr>
</tbody>
</table>

*Estimate based on human cases with identified PFGE pattern on CDC SEDRIC linelist.


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**Positive Environmental Samples**
NUMBER OF ILLNESSES LINKED TO LIVE-POULTRY BY STATE OF RESIDENCE
JANUARY 1, 2018 TO JUNE 15, 2018 (N = 24)
AGRICULTURE RETAIL STORE SAMPLING IN MICHIGAN

- **Process:**
  - Using gloves, collect the bedding/liner from chick shipment boxes upon arrival to retail store locations
  - Bedding/liner is placed in sterile collection bag
  - Take photos of box shipment labels to determine shipment origin
  - MDHHS Bureau of Labs: test bedding/liners for the presence of *Salmonella*

- **Sampling occurred:**
  - Springtime
  - All regions of the state
### RESULTS OF AGRICULTURE RETAIL STORE SAMPLING*

<table>
<thead>
<tr>
<th>Year</th>
<th>Date Range</th>
<th>Percent of stores with positive samples (total no. of stores sampled)</th>
<th>Total no. of samples collected</th>
<th>No. of samples with MI Hatchery shipping origin</th>
<th>Total no. of laboratory confirmed positive samples</th>
<th>Serotype of positive samples</th>
<th>Associated with Human Illness</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>4/12/16-6/16/16</td>
<td>100% (n=5)</td>
<td>33</td>
<td>20 (61%)</td>
<td>14</td>
<td>S. Enteritidis JEGX01.0004 (n=4) S. Enteritidis JEGX01.0222 (n=7) S. Braenderup JBPX01.0039 (n=1) YES S. Muenster TDSX01.0188 (n=1) YES S. Kentucky (n=1)</td>
<td>YES</td>
</tr>
<tr>
<td>2017</td>
<td>8/22/17-8/24/17</td>
<td>50% (n=6)</td>
<td>20</td>
<td>5 (25%)</td>
<td>3</td>
<td>S. Enteritidis JEGX01.0004 (n=1) S. Kentucky (n=2)</td>
<td>YES</td>
</tr>
<tr>
<td>2018</td>
<td>2/22/18-3/28/18</td>
<td>47% (n=15)</td>
<td>83</td>
<td>60 (72%)</td>
<td>18</td>
<td>S. Enteritidis JEGX01.0004 (n=8) S. Enteritidis JEGX01.0222 (n=3) S. Kentucky 135kyXB.001 (n=5) S. Senftenberg JMPX01.0090 (n=1) YES S. Typhimurium JPXX01.3477 (n=1)</td>
<td>YES</td>
</tr>
</tbody>
</table>

*Bedding/liner from chick shipment boxes upon arrival to retail store locations

Based on shipment labels, one or more positive samples originated from MI Hatchery
MDHHS and CDC sent letters to the hatchery advising that they were linked to one or more human *Salmonella* outbreaks associated with live poultry contact

- Provided recommendations based on USDA National Poultry Improvement Plan (NPIP) Best Practices
- MDHHS offered to test hatchery samples for the presence of *Salmonella* for free

MDHHS held at least two conference calls with the hatchery, state agriculture agency, NPIP representatives, and hatchery veterinary consultant to discuss human outbreaks and mitigation steps
Thus, after…

- Multiple years of human *Salmonella* cases sourced from MI hatchery
- Multiple states with human *Salmonella* illness linked to MI hatchery
- Multiple years of MI hatchery poultry shipment boxes with identical *Salmonella* strains to what was found in ill people
- Multiple agriculture retail stores with *Salmonella* positive poultry shipment boxes originating from MI hatchery

The epidemiological data leads to one common source for *Salmonella* contamination.

It was decided to ask the Centers for Disease Control and Prevention for assistance with an investigation of risk factors for *Salmonella* infections in humans linked to live poultry traced back to MI hatchery.
CDC EPI-AID
JUNE 2018
EPI-AID OBJECTIVES

- **Assess**: Perform a site assessment
- **Sample**: Conduct environmental sampling
- **Records**: Conduct a record review
- **Feedback**: Provide specific public health recommendations
PERFORM A SITE ASSESSMENT

• Police escort to hatchery with search warrant
• Tour facility and observe work flow process
• Administer hatchery questionnaires:
  • NPIP Best Management Practices
  • CDC Supplemental Hatchery Questionnaire
• Workflow process and physical facility observations based on USDA National Poultry Improvement Plan (NPIP) Best Practices
• Observations made directly or with input by hatchery president
• Recommendations made in 4 categories:
  • Biosecurity
  • Sanitation
  • Quality assurance
  • Education of consumers
CONDUCT ENVIRONMENTAL SAMPLING

Sampling Priorities:

1. Chick Environment
   - Chick liners/incubators
   - Chick housing/pre-shipping

2. Adult Bird Environmental
   - Bedding/Food/Water

3. Trucks

*Focus on Cornish Rock breed when possible!*
ENVIRONMENTAL SAMPLING RESULTS

• 45 samples collected
• 4 *Salmonella* positive samples
  • 1 *Salmonella Enteritidis* isolate
    • Cornish Rocks
    • Related to human clinical isolates and environmental isolates from birds supplied by hatchery
  • 3 *Salmonella Typhimurium* isolates
    • Related to each other and same strain as the Poulvac ST vaccine
    • No human clinical isolates related
CONDUCT A RECORD REVIEW

• Description of the measures taken to reduce the burden of *Salmonella* in the hatchery

• *Salmonella* test results from January 2016 to June 2018

• Commercial and non-commercial operations that the hatchery obtained eggs and chicks from for the 2018 season

• A list of hatcheries used for drop-shipping
HATCHERY VISIT: GENERAL THOUGHTS

WHAT WENT WELL:

• Local health department willing to lead aid investigation based on multi-year, multi-state outbreaks linked to business in their jurisdiction
• Epi-Aid: fantastic, dedicated, hard working team
• Game plans set in advance
• Organized & continual communication

WHAT WE WOULD DO DIFFERENTLY:

• Verify that all personnel have necessary PPE (i.e. respirators in barns with live birds)
• Use both wet and dry swabs for sample collections
• Collect additional environmental samples from more of the hatchery buildings
Recommendations to Hatchery

PUBLIC HEALTH RECOMMENDATIONS

- After reviewing the hatchery’s records and based on the site assessment findings, in addition to the environmental sampling results, recommendations were given to the hatchery

- CDC, state, and local partners held in-person meeting with the hatchery in October 2018
  - PowerPoint presentation
  - Written recommendations
  - Discussion of future inspections
CURRENT PROGRESS

- Local Health Department is enforcing their recommendations following NPIP standards
  - Periodic inspections, hatchery is developing SOP's and developing a worker education and protection program
  - Similar as to what they would do for food establishments
- Continuation of chick box liner sampling at agricultural feed stores—Spring 2019
- Multiple publications in progress:
  - *MMWR Notes from the Field*: Live Poultry Shipment Box Sampling at Feed Stores as an Indicator for Salmonella Infections in Humans. In progress.
  - Onsite Investigation at a Mail-Order Hatchery following a Multistate Salmonella Illness Outbreak Linked to Live Poultry—United States, 2018. In progress.
Any Questions?