Salmonellosis linked to Backyard Poultry
United States, 2016

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CDC Enteric Zoonoses Team

- Rapid response and management of zoonotic enteric disease outbreaks
  - *Salmonella*
  - *E. coli*
  - Occasionally other pathogens (e.g., *Listeria, Campylobacter*)
- Focused on dispersed multistate zoonotic outbreaks
- Coordinate efforts of local, state, and federal health officials
  - CDC PulseNet
  - State and local health departments
  - USDA Food Safety Inspection Service (FSIS) – *meat and poultry*
  - USDA Animal Plant Health Inspection Service
  - FDA Centers for Veterinary Medicine – *animal feed and products*
  - Other countries
What is an outbreak?

• An incident in which two or more unrelated people experience a similar illness after contact a common exposure, and epidemiologic analysis implicates the exposure as the source of the illness.
Outbreak investigations are a major driver for reducing disease burden

• Prevent additional cases in current outbreak
• Identify a new pathogen or problem
• Determine what went wrong in order to prevent future similar outbreaks
  • Define risks associated with ownership of certain animals
  • Identify areas for education of owners and consumers
  • Stimulate further specific research
  • New processes or regulations
Timeline for Reporting *Salmonella* Infections

- **Person is exposed to Salmonella**
  - Time to Illness: 1–3 days

- **Stool sample requested**
  - Time to Diagnosis: 1–3 days

- **Public health lab receives Salmonella strain**
  - Serotyping and “DNA Fingerprinting” Time: 2–10 days

- **Person becomes ill**
  - Time to Health Care: 1–5 days

- **Salmonella identified**
  - Shipping Time: 0–7 days

- **Case reported as part of outbreak**

Total time: 2–4 weeks
Detecting Outbreaks with PulseNet

- National network of 87 state public health and regulatory laboratories, established in 1996

- When bacteria are collected from an ill person, labs create “DNA fingerprints” using pulsed-field gel electrophoresis (PFGE) and other techniques

- Bacteria with the same DNA fingerprint are more likely to come from a common source
Conceptual Framework for PFGE Subtyping

• Analogous to comparing two books based on the number of words in each chapter
Whole Genome Sequencing Provides a Higher Resolution View of the Bacterial Genome

PFGE only gives information at a “cut” site via the banding pattern.

WGS has the ability to give us information at (nearly) every position in the bacterial genome.

• Analogous to comparing two books based on all the words in the book.

• Can identify resistance and other genes directly from sequence data when subtyping is performed.
Detecting Outbreaks with PulseNet

• PFGE patterns or WGS data from illness-causing bacteria uploaded to the PulseNet USA database
• Monitored for temporal clusters with the same pattern
• When a cluster is identified, PulseNet notifies epidemiologists to investigate
PulseNet-Confirmed Cases: The Tip of the Iceberg

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Under-reporting / under-diagnosis multiplier*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-typhoidal <em>Salmonella</em></td>
<td>29.3</td>
</tr>
</tbody>
</table>

Detecting Outbreaks: Poultry Industry Role

- Industry role in detecting *multistate* outbreaks
  - Are you seeing what we’re seeing?
    - Routine environmental test results
    - Consumer complaints
- Understanding industry practices
- Ensuring adequate record keeping
Process repeated for every single ill person reported
Traceback to a hatchery takes 60–90 days
Only a fraction of ill people know the location and date of purchase, breed of poultry
Only a fraction of stores have records regarding suppliers of poultry
Drop-shipping and trans-shipping complicate this process
Outbreak of *Salmonella* Infections Linked to Backyard Poultry
Salmonellosis

- Most common bacterial enteric illness in United States
  - 1.2 million illnesses per year
  - Multiple sources
    - Food
    - Water
    - Animal contact
- 11% results from animal contact, or zoonotic
  - Direct or indirect
  - Highest morbidity and mortality among enteric zoonoses
  - Children disproportionately affected
Poultry Hosts

• Poultry carrying certain strains of *Salmonella* might not exhibit signs of illness
  • Appear healthy and clean
• Poultry shed *Salmonella* bacteria intermittently
  • Stress increases shedding
• Commingling of birds spreads *Salmonella*
• Young birds often have higher prevalence
• Environmental contamination
Outbreaks of Salmonellosis Linked to Backyard Poultry

- 61 outbreaks 1990–2015
  - Involve young children
  - Start in spring, continue through fall
  - Pets, backyard flocks
  - Contact at agricultural feed stores
- Multiple *Salmonella* serotypes associated
- Multiple outbreak strains linked to single hatchery
- Multiple hatcheries with distinct strains
Age Distribution of *Salmonella* Illnesses Linked to Backyard Poultry—United States, 2008–2016 (n=849)
Month of Poultry Purchase among Illnesses linked to Backyard Poultry—United States, 2008–2016*
Year of Poultry Purchase among Illnesses Linked to Backyard Poultry—United States, 2008–2016*

*Missing 2015 data.
## Type of Poultry Exposure among Illnesses linked to Backyard Poultry—United States, 2008–2016 (n=921)

<table>
<thead>
<tr>
<th>Types of Poultry</th>
<th>No.</th>
<th>Percent**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicks/Chickens</td>
<td>686</td>
<td>75</td>
</tr>
<tr>
<td>Ducklings/Ducks</td>
<td>274</td>
<td>30</td>
</tr>
<tr>
<td>Gosling/Geese</td>
<td>28</td>
<td>3</td>
</tr>
<tr>
<td>Poults/Turkeys</td>
<td>45</td>
<td>5</td>
</tr>
<tr>
<td>Other</td>
<td>27</td>
<td>3</td>
</tr>
</tbody>
</table>

**Percent is out of total 921 cases (18 missing), adds up to >100% as some own >1 type of poultry**
# Reasons for Poultry Purchase among Illnesses Linked to Backyard Poultry—United States, 2008–2016 (n=681)

<table>
<thead>
<tr>
<th>Reasons for Purchase of Baby Poultry</th>
<th>n</th>
<th>Percent*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggs</td>
<td>421</td>
<td>62</td>
</tr>
<tr>
<td>Keep as pets</td>
<td>204</td>
<td>30</td>
</tr>
<tr>
<td>Meat</td>
<td>79</td>
<td>12</td>
</tr>
<tr>
<td>Fun or Hobby</td>
<td>69</td>
<td>10</td>
</tr>
<tr>
<td>Fair or Exhibitions</td>
<td>21</td>
<td>3</td>
</tr>
<tr>
<td>Easter</td>
<td>13</td>
<td>2</td>
</tr>
</tbody>
</table>
Distribution of Length of Ownership among Illnesses Linked to Backyard Poultry—United States, 2008–2016 (n=297)

- N = 297
- Mean = 5.20
- Median = 1.00
2016 Outbreaks Linked to Backyard Poultry

- Highest number illnesses observed in a single year
- 8 outbreaks
  - *Salmonella* serotypes Hadar, Indiana, Muenster, Mbandaka, Infantis, Braenderup, Enteritidis
    - Serotype mostly linked to foodborne illness now linked to live poultry
  - >800 people affected
  - More children aged 0–9 years impacted than any other age groups
  - Multiple poultry breeds
  - 4 hatcheries linked to illnesses
Factors in 2016 Outbreaks

- Commercial production
- Hatcheries
- Feed stores
- Consumers
Factors in 2016 Outbreaks—Commercial Production

- Egg suppliers do not participate in *Salmonella* monitoring or control programs
- Egg suppliers with *Salmonella* do not inform hatcheries
Factors in 2016 Outbreaks—Hatcheries

- Not all hatcheries participating in NPIP Voluntary *Salmonella* monitoring and control program
- NPIP participant hatcheries are receiving products (e.g. day old chicks) and drop-shipping from non-participatory hatcheries
- Hatcheries are unregulated
- Hatcheries involved in outbreaks might not inform other hatcheries, stores or consumers
Factors in 2016 Outbreaks—Stores

• From 2008–2014, 10% of ill people reported contact with baby poultry at a feed store
• Past outbreaks have included ill feed store employees who only had contact with live poultry at work
• Agricultural feed stores, which display and sell live poultry, should play a key role in prevention of illness
  — Sourcing from non-NPIP hatcheries
  — Lack of awareness regarding where poultry are truly sourced
  — Challenges with record keeping
Factors in 2016 Outbreaks—Consumers

- High risk practices
- Keeping poultry indoors
- Close contact such as holding and kissing poultry
Prevention and Control

• Industry involvement is critical
• Dialog with egg suppliers regarding impact of vertically transmitted *Salmonella* serotypes on hatcheries
  ─ What percentage of eggs at hatcheries come from large, commercial suppliers?
  ─ Certain breeds?
  ─ “Discard birds” or overhatch?
Potential *Salmonella* Sources at Hatcheries

- Chicks
- Other Poultry, Livestock & Pets
- Feed
- Housing
- Rodents
- Water
- Wild birds
- Equipment & Vehicles
- Hatchery
- People
- Litter
- Insects

Slide courtesy of Dr. Andrew Rhorer
Reducing Burden of *Salmonella* in Hatcheries

- Participate in the NPIP Voluntary *Salmonella* Monitored Program
  - Ensure compliance with the program if already participating
- Conduct routine environmental sampling
  - Consider increasing frequency of testing when hatchery is implicated in an outbreak
- Autogenous vaccine to address outbreak strains of *Salmonella*
- Testing eggs brought in from outside the hatchery
- Maintain accurate records
- Ensure feed is free of pathogens
- Insect and rodent control programs.
- Educate consumers
National Poultry Improvement Plan

• Voluntary *Salmonella* Monitoring Program to prevent and control *Salmonella* in mail-order hatcheries
  • Addresses *Salmonella* strains of human health concern
  • Retailers can choose to buy from participating source hatcheries


• However—many are not aware of program or how to implement
Agricultural Stores—Before
Agricultural Feed Stores—After
USE CAUTION WHEN HANDLING BABY CHICKS

To avoid the possibility of infection and help stop the spread of Salmonella, clean your hands immediately after touching chicks and ducklings. Use the hand sanitizer provided near the Chick Days display or wash your hands with soap and water.

- Chicks & ducklings are not appropriate pets for children under 5 years old.
- Don’t nuzzle or kiss chicks & ducklings.
- Call your health care provider if you think you have a Salmonella infection.

Children under 5 years old, people with weakened immune systems and women who are pregnant or may be pregnant, should not handle poultry.

If you have any questions, please see a Team Member.
Consumer Recommendations

- Wash your hands
  - Touching live poultry
  - Contacting anything in the area where they live and roam
- Poultry ownership might not be right for all people
  - Children younger aged <5 years
  - Older adults
  - People with weak immune systems
- Do not let live poultry inside the house
Partners to Address *Salmonella* Illness Outbreaks

- **Public health agencies**
  - CDC
  - State and local health departments
  - Public Health Agency of Canada

- **Agriculture agencies**
  - United States Department of Agriculture (USDA)
  - State departments of agriculture

- **Industry**
  - Egg suppliers
  - Mail-order hatcheries
  - Agricultural feed stores

- **Consumers**
Additional Resources

http://www.cdc.gov/zoonotic/gi/education.html
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National Center for Emerging and Zoonotic Infectious Diseases