Escherichia coli O157:H7 Outbreak Associated with Bagged Salad, Tennessee, 2012

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**E. coli O157:H7**

- Most common serotype of Shiga toxin-producing *E. coli*
- Causes diarrhea, bloody stool, cramps
  - Children <5 years at highest risk of HUS
- Outbreaks associated with beef, lettuce, spinach, sprouts
May 3, 2012

- Routine surveillance identified cluster of 3 cases of *E. coli* O157:H7, PFGE pattern “A”
- All attended “Daycare 1”
May 20, 2012

- 14 cases in Tennessee
  - 2 daycares
  - 2 private schools
  - 2 public schools
<table>
<thead>
<tr>
<th></th>
<th>MLVA_composite</th>
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<tbody>
<tr>
<td>YNTR. 1,3</td>
<td>9.0 9.0 10.0 4.0 8.0 4.0 12.0 8.0</td>
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<tr>
<td>YNTR. 1,4</td>
<td>9.0 9.0 10.0 4.0 8.0 4.0 12.0 8.0</td>
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<td>YNTR. 1,9</td>
<td>9.0 9.0 10.0 4.0 8.0 4.0 12.0 8.0</td>
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<td>YNTR. 1,17</td>
<td>9.0 9.0 10.0 4.0 8.0 4.0 12.0 8.0</td>
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<td>YNTR. 1,36</td>
<td>9.0 9.0 10.0 4.0 8.0 4.0 12.0 8.0</td>
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<td>YNTR. 1,37</td>
<td>9.0 9.0 10.0 4.0 8.0 4.0 12.0 8.0</td>
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<tr>
<td>TN, GA, OH</td>
<td>11.0 9.0 10.0 3.0 7.0 4.0 9.0 7.0</td>
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<td>OR, NY</td>
<td>12.0 9.0 10.0 4.0 9.0 6.0 -2.0 2.0</td>
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Case Definition

• Confirmed case definition
  • *E. coli* O157:H7
  • PFGE pattern “A”
  • Identical MLVA pattern
  • Illness onset on or after April 15

• Probable case definition
  • Clinically compatible illness
  • Epidemiologically linked to confirmed case
*E. coli* O157:H7 pattern “A”
Infections by Illness Onset Date

**Graph:**
- X-axis: Illness Onset Date (from 4/20 to 5/14)
- Y-axis: Number
- Data points:
  - 4/28: 3
  - 4/30: 2
  - 5/2: 1
  - 5/4: 1
  - 5/6: 3
  - 5/8: 1
  - 5/10: 1
  - 5/12: 1
  - 5/14: 1

*Probable case*
E. coli O157:H7 pattern “A”
Infections by Illness Onset Date

![Bar chart showing the number of infections by illness onset date.](chart.png)

- **Number**
  - 4
  - 3
  - 2
  - 1
  - 0

- **Illness Onset Date**
  - 4/20
  - 4/22
  - 4/24
  - 4/26
  - 4/28
  - 4/30
  - 5/2
  - 5/4
  - 5/6
  - 5/8
  - 5/10
  - 5/12
  - 5/14

- **Probable case**
Descriptive Epidemiology

• 16 confirmed cases, 1 probable case
  • TN: 14 (includes 1 probable case)
  • GA: 2
  • OH: 1
• Median age: 23 years (range: 3-88 yrs)
• Female: 76%
• Hospitalized: 35%, 2 deaths
Subclusters and Epi Traceback

School A
(n=4)
Subclusters and Epi Traceback

School A (n=4)

Daycare 1 (n=3)
Subclusters and Epi Traceback

School A (n=4)

Daycare 1 (n=3)

School B (n=1)

Caterer

School C (n=1)
Subclusters and Epi Traceback

- School A (n=4)
- Daycare 1 (n=3)
- School B (n=1)
- School C (n=1)
- Daycare 2 (n=2)
- Caterer
Subclusters and Epi Traceback

School A (n=4)
Daycare 1 (n=3)
School B (n=1)
School C (n=1)
Daycare 2 (n=2)
Caterer
School D (n=1)
Subclusters and Epi Traceback

- School A (n=4)
- Daycare 1 (n=3)
- School B (n=1)
- School C (n=1)
- Caterer
- Daycare 2 (n=2)
- School D (n=1)
- GA Case 1
- GA Case 2
- OH Case
Subclusters and Epi Traceback

- School A (n=4)
- Daycare 1 (n=3)
- School C (n=1)
- School D (n=2)
- Caterer (n=1)
- School B (n=1)
- GA Case 1
- GA Case 2
- OH Case

Bagged Salad from Producer A
Matched Case-Control Study

• 7 cases included
• 3 controls: 1 case, matched on school and grade
• Exposures common among ≥ 25% on initial questionnaire
### Initial Interview Responses with ≥ 25% of Cases Exposed

<table>
<thead>
<tr>
<th>LEAD-IN QUESTIONS</th>
<th>FRESH AND FROZEN MEATS</th>
<th>EATING AND SHOPPING VENUES</th>
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<tbody>
<tr>
<td>Worked/attended daycare or school</td>
<td>Any pre-packaged deli meats</td>
<td>Ate any restaurants</td>
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<td>Ate food prepared by daycare or school</td>
<td>Any bologna, corned beef, or other processed meats</td>
<td>Ate at fast-food restaurants</td>
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<td>Any fresh pork (not ham)</td>
<td>Ate at cafeteria/dining room other than school</td>
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<tr>
<td>FRESH VEGETABLES</td>
<td></td>
<td>EFFECTIVE &amp; MISCELLANEOUS</td>
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<td>Ate at a pizzeria</td>
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<td>SOURCES OF FOOD AT HOME</td>
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<td>RESTAURANT GENRES</td>
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<td>SPECIFIC FOODS EATEN OUT</td>
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<tr>
<td>LIVE ANIMAL CONTACT, PETS, AND PET FOOD</td>
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**Table:**

<table>
<thead>
<tr>
<th>Item</th>
<th>No.</th>
<th>Percent</th>
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<tbody>
<tr>
<td>Worked/attended daycare or school</td>
<td>5</td>
<td>62.5</td>
</tr>
<tr>
<td>Ate food prepared by daycare or school</td>
<td>6</td>
<td>75.0</td>
</tr>
<tr>
<td>Ate any restaurants</td>
<td>4</td>
<td>50.0</td>
</tr>
<tr>
<td>Ate at fast-food restaurants</td>
<td>2</td>
<td>25.0</td>
</tr>
<tr>
<td>Ate at cafeteria/dining room other than school</td>
<td>2</td>
<td>25.0</td>
</tr>
<tr>
<td>Ate from grocery store/supermarket</td>
<td>6</td>
<td>75.0</td>
</tr>
<tr>
<td>Ate at a pizzeria</td>
<td>3</td>
<td>37.5</td>
</tr>
<tr>
<td>Ate eggs</td>
<td>2</td>
<td>25.0</td>
</tr>
<tr>
<td>Ate eggs at home</td>
<td>2</td>
<td>25.0</td>
</tr>
<tr>
<td>Drank any pasteurized milk</td>
<td>4</td>
<td>50.0</td>
</tr>
<tr>
<td>Drank any pasteurized 2% milk</td>
<td>3</td>
<td>37.5</td>
</tr>
<tr>
<td>Any pre-shredded cheese</td>
<td>4</td>
<td>50.0</td>
</tr>
<tr>
<td>Any contact with dogs or puppies</td>
<td>3</td>
<td>37.5</td>
</tr>
</tbody>
</table>

**Note:** The highlighted entry indicates the specific food item that was consumed by the highest percentage of cases exposed.
Results Implicating Bagged Lettuce

- Descriptive epi
  - 75% female
  - Temporal distribution - produce shelf life
- Epi traceback - complex but compelling
- Matched subcluster case-control study
  - One unique exposure identified
  - “Ate lettuce provided by the school cafeteria?”, mOR=9.4, p<0.05
Bagged Lettuce Producer A

• Epi traceback and FDA traceback converged
  • Lot information, single production day identified
  • Specific produce growing areas identified
Interventions

• Presented findings to Producer A:
  • No voluntary recall
  • Unsure of other industry actions

• FDA scheduled heightened inspections of produce growing areas
Conclusions

• Outbreak of *E. coli* O157:H7 associated with bagged lettuce from Producer A

• Outlier investigation can support or refute hypotheses

• Institution-level subcluster epidemiologic traceback and case-control study utilized

• Multiple epidemiologic approaches can be helpful during foodborne outbreak investigations
Thank You

Amanda Ingram
Katie Garman
John Dunn
FoodCORE Team

TENNESSEE DEPARTMENT OF HEALTH