FDA/NSTA Web Seminar:
Teach Science Concepts and Inquiry with Food

Tuesday, December 4, 2007
Outbreak Investigation

“Be the Detective”

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Food & Drug Administration
Emergency Response & Coordination
U.S. Dept of Health and Human Services
## Summary of Foodborne Outbreaks

<table>
<thead>
<tr>
<th>Year</th>
<th>Produce</th>
<th>Sprouts</th>
<th>Dairy</th>
<th>Eggs</th>
<th>Processed foods</th>
<th>Seafood</th>
<th>Cosmetics</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>1996</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>34</td>
<td>4</td>
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<td>3</td>
<td>1</td>
<td>32</td>
<td>1</td>
<td>8</td>
<td>0</td>
<td>49</td>
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<tr>
<td>1998</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>25</td>
<td>1</td>
<td>6</td>
<td>0</td>
<td>41</td>
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<tr>
<td>1999</td>
<td>9</td>
<td>6</td>
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<td>30</td>
<td>3</td>
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<td>0</td>
<td>56</td>
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<tr>
<td>2000</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>28</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>45</td>
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<tr>
<td>2001</td>
<td>8</td>
<td>3</td>
<td>3</td>
<td>16</td>
<td>1</td>
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<td>2002</td>
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<td>20</td>
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<td>2004</td>
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<td>2</td>
<td>6</td>
<td>2</td>
<td>5</td>
<td>9</td>
<td>1</td>
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<tr>
<td>2005</td>
<td>7</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>26</td>
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<tr>
<td>2006</td>
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<td>0</td>
<td>4</td>
<td>8</td>
<td>0</td>
<td>18</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>71</strong></td>
<td><strong>27</strong></td>
<td><strong>21</strong></td>
<td><strong>206</strong></td>
<td><strong>31</strong></td>
<td><strong>98</strong></td>
<td><strong>3</strong></td>
<td><strong>457</strong></td>
</tr>
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</table>
Foodborne Illness in US

• CDC estimates (Mead et al, 1999)
  – 1.4 episodes of diarrhea/person/year
  – 76 million illnesses
  – 323,000 hospitalizations
  – 5,200 deaths
Are outbreaks in national news the most common types of outbreaks?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Maybe</th>
</tr>
</thead>
</table>

E. coli Outbreak Source Located, Outbreak Hits Nearly 20 states - CBS News

Source: cbsnews.com
What are the most common types of outbreaks?

A. Widespread, multi-state, on-farm contamination
B. Local, within state, banquet/church supper

50 sickened after Orland Park banquet
Leah Hope abc7chicago.com
February 20, 2004 - A mystery virus sickens at least 50 people in the southwest suburbs. All became ill after attending a wedding celebration at a banquet hall in Orland Park.
What are the **most** common causes of foodborne outbreaks?

<table>
<thead>
<tr>
<th>Eating raw but yummy cookie batter</th>
<th>Worker not wearing hairnets</th>
<th>Ill worker</th>
<th>Temp. abuse</th>
<th>None of the above</th>
</tr>
</thead>
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</table>
Contamination at Retail

• Ill workers
• Poor handwashing practices (or none)
• Temperature abuse
Anatomy of an Outbreak Investigation

- Disease Surveillance
- Epidemiological investigation
- Laboratory analysis
- Environmental investigation
- Traceback/traceforward
- Farm investigation
Knowing your pathogen:

• Zoonotic
  – Salmonella
  – E. coli O157
  – Campylobacter

• Human
  – Shigella
  – Hepatitis A virus
  – Norovirus
  – Cyclospora
Detecting outbreaks

• Laboratory Tools:
  ➢ Standard methods to detect pathogens
  ➢ National database and historical patterns
    ➢ PHLIS
    ➢ Pulsed-field gel electrophoresis
      (DNA fingerprint of bacteria)

• Associations and unusual spikes
  ➢ Clustering in time
  ➢ same Genus species and DNA fingerprint
Is the Association solely based on laboratory analysis?

- Epidemiological evidence
  - Ill and well individuals food history
  - Common food

- Challenges:
  - Memory
  - Willingness to participate
  - Common ingredients
Let’s Pause for Two Questions.

Please type your questions on the chat.
Outbreak: Case Histories

Be the Detective
Contamination at Retail
Norovirus

- 332 ill
- 46 wedding cakes, common bakery
- Georgia, February 2000
- Direct hand contact in mixing frosting
- 2 workers ill the week before weddings
- Norovirus detected patients and ill worker
How can this be prevented?

1.

2.

3.
Contamination at Processor
Salmonella in Toasted Oats Cereal

• **Outbreak:**
  – 11 states
  – 209 ill, 47 hospitalized
  – April to May, 1998
  – *Salmonella* Agona with matching pfge

• How can this be? Cereal is processed.
  – Ideas?
How does science play a role?

1.

2.

3.
Outbreaks linked to Processed Foods: 2007

• Salmonella in peanut butter
  – events lead to conditions for growth
• Salmonella in Veggie booty snack food
  – marketed to children
• Botulinum toxin in hot dog chili sauce
  – Joint recall with USDA
  – Unprecedented outreach to consumers and industry
Contamination at the Farm
What’s the goal of the investigation?

<table>
<thead>
<tr>
<th>Avoid stepping in manure</th>
<th>Avoid a sunburn</th>
<th>Find the source of the contamination that caused the outbreak</th>
<th>All columns</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
E. coli O157:H7 outbreak linked to fresh bagged spinach

- 205 ill, 103 hospitalized
  - 31 with HUS, and 3 deaths
- 26 states involved
- Illness linked to fresh bagged spinach
- 13 bags supplied by patients yielded the outbreak strain (Genus, species, pfge).
What is reservoir for E. coli O157?

<table>
<thead>
<tr>
<th>Animal and human</th>
<th>Fish</th>
<th>Human only</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

Why is this important?
Farm Findings

• Cattle nearby and evidence of Feral swine

• Detectives:
  – Why is this important?
  – What does it have to do with the spinach fields?

Connecting the dots and evidence…..
How does science play a role?

• Type of scientists needed
  – Wildlife biologist, Microbiologist, Agriculturist, Environmental engineer/sanitarian

• Equipment
  – GPS, microbiological sampling, and chemical field testing equipment

• Laboratory testing
  – Found same pfge in environment as patients and bagged spinach
Summary
Anatomy of an Outbreak Investigation

- Surveillance
- Epidemiological investigation
- Laboratory analysis
- Environmental investigation
- Traceback/traceforward
- Farm investigation
Outbreak Investigations

• Teamwork!
• Right kind of scientists
• Right kind of scientific equipment/testing
• Solve the Puzzle
• Alert consumers, remove product from distribution
• Develop policies, guidance, etc, based on sound science to prevent future outbreaks
Reality Check

Seldom do we find the “smoking gun”

Why not?

| Delay between when the outbreak was detected and when consumers ate the contaminated food | Pathogens can’t talk | Conditions at the source not the same as when the contamination occurred |
Let’s Pause for Two Questions.

Please type your questions on the chat.
Conclusion

• Science plays a major role in detecting outbreaks and investigating the source of contamination in foodborne outbreaks

• Understanding how contamination occurred is critical in developing measures to minimize ongoing outbreaks and prevent future ones

• Consumers, government, academia, and industry all play a vital role in protecting public health
Resources

- [www.fda.gov](http://www.fda.gov) – Bad bug book, food safety, press releases on outbreaks, education, and more…
- [www.cdc.gov](http://www.cdc.gov) – PulseNet, surveillance, pathogens, education, and more…
- [www.foodsafety.gov](http://www.foodsafety.gov)
Thank You
FDA
http://www.elluminate.com
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