Produce Related Foodborne Infections: Review of the Centers for Disease Control Foodborne Outbreak Surveillance

FDA Public Meeting on Produce Safety
March 20, 2007

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Public health burden of foodborne disease

- Each year an estimated 76 million cases (1999 estimate)
  - 1 in four Americans gets a foodborne illness each year
  - 1 in 1000 Americans is hospitalized each year
  - $6.5 billion in medical and other costs

- Prevention depends on efforts from farm to table to reduce contamination of food

- Increasingly recognize a problem in fresh produce
Recent outbreaks associated with produce

- **September, 2006** *E. coli* O157:H7 infections in multiple states due to fresh bagged spinach
- **November, 2006** *Salmonella* Typhimurium infections associated with tomatoes served in restaurants
- **December, 2006** *E. coli* O157:H7 infections due to shredded iceberg lettuce served at fast food restaurants
Foodborne pathogens and their reservoirs

- Infection with a variety of different pathogens
- Each pathogen has a characteristic reservoir
  - Some have a **human** reservoir: *Shigella*, hepatitis A, Norwalk virus
  - Some have an **animal** reservoir: *Salmonella*, *Campylobacter*, *E. coli* O157:H7, *Listeria*, *Vibrio*, *Yersinia*, *Toxoplasma*
- Transmitted by several different pathways
  - Foods, water, contact with animals, contact with humans
Foodborne outbreak surveillance

- Most outbreaks detected, investigated and controlled by local and state health departments

- CDC collects reports of outbreaks investigated
  - Reporting is voluntary and incomplete
  - Definition of an outbreak:
    2 or more cases of a similar illness resulting from the ingestion of a common food
  - Data collected: No of cases, implicated food, etiology
  - Received reports of 400-600/year before 1998
Foodborne-disease outbreaks reported to CDC, 1990 - 2004

1 By states to the Foodborne Disease Outbreak Surveillance System
Foodborne outbreaks related to fresh produce, 1973-1997*

- Fresh produce defined as: uncooked produce items, or “salad” without eggs, cheeses, seafood or meat

1973-1997
- 190 foodborne outbreak linked to fresh produce
- 16,058 illnesses
- 598 hospitalizations
- 8 deaths

- 3.2 % of all outbreaks of determined source
- 6.2 % of those outbreak-associated cases

*Sivapalasingam, J Food Prot, 2004
Foodborne outbreaks related to fresh produce, 1973-1997: Trends in burden

<table>
<thead>
<tr>
<th></th>
<th>1970’s</th>
<th>1990’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of outbreaks/yr</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>Median cases/outbreak</td>
<td>21</td>
<td>43</td>
</tr>
<tr>
<td>% of OB of known vehicle</td>
<td>0.7%</td>
<td>6%</td>
</tr>
<tr>
<td>% of outbreak associated cases</td>
<td>0.6%</td>
<td>12%</td>
</tr>
</tbody>
</table>
Foodborne outbreaks related to fresh produce, 1973-1997: Food vehicles implicated in 190 outbreaks

- Generic or multiple: 105 outbreaks
- One specific vehicle: 85 outbreaks

<table>
<thead>
<tr>
<th>Food Vehicle</th>
<th>Outbreaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lettuce</td>
<td>25</td>
</tr>
<tr>
<td>Melon</td>
<td>13</td>
</tr>
<tr>
<td>Seed sprouts</td>
<td>11</td>
</tr>
<tr>
<td>Apple or orange juice</td>
<td>11</td>
</tr>
<tr>
<td>Berry</td>
<td>9</td>
</tr>
<tr>
<td>Tomato</td>
<td>3</td>
</tr>
<tr>
<td>Green onion</td>
<td>3</td>
</tr>
<tr>
<td>Carrot</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
</tr>
</tbody>
</table>

88% of outbreaks with one specific vehicle
### Foodborne Outbreaks Related to Fresh Produce, 1973-1997: Etiologies Identified

**Bacterial** 62:
- *Salmonella* 30
- *E. coli* O157 13
- Shigella 10
- Campylobacter 4
- Other 5

**Viral** 21
- Hepatitis A 12
- Norovirus 9

**Parasite** 16
- Cyclospora 8
- Other 8

**Chemicals** 4

Pathogens with **animal** reservoir = 48 outbreaks

Pathogens with **human** reservoir = 34 outbreaks

Pathogens or agents with uncertain reservoir = 21 outbreaks
Foodborne-disease outbreaks reported to CDC, 1990 - 2004

1 By states to the Foodborne Disease Outbreak Surveillance System

1 By states to the Foodborne Disease Outbreak Surveillance System
Foodborne outbreaks related to produce, reported to CDC, 1998-2004*

- Produce defined as food items that are classified as either fruit or vegetables

- 1998-2004
  - 384 outbreaks linked to produce items (28 multistate outbreaks)
  - 15,856 Illnesses
  - 716 Hospitalizations
  - 15 Deaths

- 7% of all outbreaks of determined source
- 14% of those outbreak-associated cases

*eFORS, preliminary analysis and subject to change
Proportion of Foodborne Outbreaks Related to Produce, by Major Produce Category, 1998-2004*

*eFORS, preliminary analysis and subject to change
Foodborne outbreaks related to produce, 1998-2004*:
Food vehicles implicated in 384 outbreaks

- Generic or mixed: 216 outbreaks
- One specific food: 168 outbreaks
  - Lettuce: 29
  - Sprouts: 20
  - Tomatoes: 11
  - Melons: 11
  - Juice: 8
  - Berries: 7
  - Green onions: 4
  - Other produce items: 78

*eFORS, preliminary analysis and subject to change
Foodborne outbreaks related to produce 1998-2004*:  
Reported etiologies in 190 (49%) of 384 outbreaks

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial:</td>
<td>97</td>
</tr>
<tr>
<td>• Salmonella</td>
<td>53</td>
</tr>
<tr>
<td>• E. coli O157</td>
<td>19</td>
</tr>
<tr>
<td>• Shigella</td>
<td>6</td>
</tr>
<tr>
<td>• Campylobacter</td>
<td>6</td>
</tr>
<tr>
<td>• Other</td>
<td>13</td>
</tr>
<tr>
<td>Viral:</td>
<td>81</td>
</tr>
<tr>
<td>• Calicivirus/Norovirus</td>
<td>73</td>
</tr>
<tr>
<td>• Hepatitis A</td>
<td>8</td>
</tr>
<tr>
<td>Parasitic:</td>
<td>6</td>
</tr>
<tr>
<td>• Cyclospora</td>
<td>5</td>
</tr>
<tr>
<td>• Other</td>
<td>1</td>
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<tr>
<td>Chemical:</td>
<td>6</td>
</tr>
</tbody>
</table>

*eFORS, preliminary analysis and subject to change

Pathogens with animal and human reservoirs

Increased availability of Norovirus diagnostic testing
Conclusions

- A greater proportion of the burden than in the past
- 14% of outbreak-associated cases
- Both larger outbreaks, and a larger number of outbreaks
- Variety of fruits and vegetables (lettuce, melons, tomatoes, sprouts)
- Spectrum of pathogens reflects contamination with human and animal feces
- Contamination and amplification can occur from farm to table
"THE FINDINGS AND CONCLUSIONS IN THIS PRESENTATION HAVE NOT BEEN FORMALLY DISSEMINATED BY CDC AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY."

Thank-You
### Foodborne outbreaks reported to CDC, 1998-2004*: Spectrum of produce categories implicated in 384 outbreaks

<table>
<thead>
<tr>
<th>Produce Categories</th>
<th>Number of Outbreaks</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Leafy greens—e.g. lettuce:</td>
<td>155 (40%)</td>
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</tr>
<tr>
<td>Fruits-Nuts—melons:</td>
<td>115 (30%)</td>
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<tr>
<td>Vine—tomatoes:</td>
<td>43 (11%)</td>
<td></td>
</tr>
<tr>
<td>Sprouts—alfalfa:</td>
<td>21 (5%)</td>
<td></td>
</tr>
<tr>
<td>Root—onions:</td>
<td>41 (11%)</td>
<td></td>
</tr>
<tr>
<td>Fungus—mushrooms:</td>
<td>9 (2%)</td>
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</tbody>
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