Outbreaks of *E. coli* O157 Infections Associated with Lettuce and Other Leafy Greens

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Tracy L. Ayers
Enteric Diseases and Epidemiology Branch
Centers for Disease Control and Prevention,
Atlanta, GA
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 – 2005

- **Paper forms**
- **Web-based (EFORS)**

*Preliminary data

1 By states to the Foodborne Disease Outbreak Surveillance System
Cases in Foodborne Disease Outbreaks, eFORS 1998-2005*

* Preliminary data, not all states have completed reporting; data subject to change.
# Example of Simple and Complex Outbreaks

<table>
<thead>
<tr>
<th>Outbreak #</th>
<th>Simple or Complex</th>
<th>Commodity</th>
<th>Implicated Food</th>
<th>Contaminated Ingredient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Simple</td>
<td>Beef</td>
<td>hamburger</td>
<td>beef</td>
</tr>
<tr>
<td>2</td>
<td>Complex</td>
<td>Beef</td>
<td>hamburger</td>
<td>Unknown</td>
</tr>
<tr>
<td>2</td>
<td>Complex</td>
<td>Vegetable/Leafy</td>
<td>hamburger</td>
<td>Unknown</td>
</tr>
<tr>
<td>3</td>
<td>Simple</td>
<td>Vegetable</td>
<td>hamburger</td>
<td>lettuce</td>
</tr>
</tbody>
</table>
Number of Simple Food Outbreaks by Major Commodity Grouping, 1998-2004

- Game
- Oil-Sugar
- Grains-Beans
- Eggs
- Dairy
- Pork
- Shellfish
- Beef
- Produce
- Finfish
- Poultry
Number of Simple Food Illnesses by Major Commodity Grouping, 1998-2004

- **Game**
- **Oil-Sugar**
- **Grains-Beans**
- **Shellfish**
- **Finfish**
- **Eggs**
- **Dairy**
- **Pork**
- **Beef**
- **Poultry**
- **Produce**
Foodborne outbreaks related to 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

Source: Sivapalasingam 2004, J of Food Protection
Foodborne outbreaks related to produce, 1998-2005

- Produce defined as food items that are classified as either fruit or vegetables
- 1998-2005
  - 411 Outbreaks linked to produce items
  - 16,555 Illnesses
  - 724 Hospitalizations
  - 15 Deaths
- 7% of all outbreaks of determined source
- 14% of those outbreak-associated cases
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>
Number of Simple Produce Food Outbreaks by Major Grouping, 1998-2004

[Bar chart showing the number of outbreaks per year and category of produce, including leafy, fruits, root, vine, sprout, and fungus.]

CDC
Foodborne outbreaks related to lettuce/leafy green, 1998-2005: Spectrum of pathogens identified in 79 outbreaks

- **Bacterial** 35:
  - *E. coli O157* 20
  - *Salmonella* 7
  - *Campylobacter* 3
  - *Shigella* 3
  - *C. Perfringens* 1
  - *S. aureus* 1

- **Viral** 42:
  - *Norovirus* 38
  - *Hepatitis A* 4

- **Parasite** 2:
  - *Cyclospora* 2

Norovirus increasingly identified as etiology of foodborne outbreaks

O157 the second most common pathogen identified
Number of Foodborne *E. coli* O157 Outbreaks by Food Commodity, 1998-2005

Year | Number of Outbreaks
---|---
1998 | 25
1999 | 18
2000 | 23
2001 | 20
2002 | 22
2003 | 21
2004 | 17
2005 | 20
Number of Lettuce/Leafy Green and Lettuce/Leafy-Associated *E. coli* O157 Outbreaks, 1998-2005

![Graph showing the number of outbreaks from 1998 to 2005 for Lettuce/Leafy (Simple) and Lettuce/Leafy-Associated (Complex).]
Summary of Lettuce/Leafy Green-Associated *E. coli* O157 outbreaks

- Twenty-six lettuce/leafy green-associated *E. coli* outbreaks 1995-2005
  - 751 ill
  - 94 hospitalized
  - 2 HUS
  - 1 death

- Lettuce second most common food vehicle in *E. coli* O157 outbreaks
Lettuce/Leafy Green associated \textit{E. coli} O157 Outbreak Scenarios

**Scenario 1: WA, 2002, 55 illnesses**

Case isolate PFGE pattern indistinguishable from cases in another area also linked to romaine lettuce.

Contamination most likely occurred pre-point of preparation.

**Scenario 2: CA, 2003, 51 illnesses**

Multiple patrons from restaurant A consumed contaminated lettuce.

Point of contamination?

Highlights need for ability model point of contamination, current limitation to data.
## List of Types of Lettuce/Leafy Green Implicated in Simple* Foodborne *E.coli* O157 Outbreaks, 1995-2005

<table>
<thead>
<tr>
<th>Type of Lettuce/Leafy Green</th>
<th># of OBs</th>
<th>Illnesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>cabbage</td>
<td>3</td>
<td>188</td>
</tr>
<tr>
<td>iceberg lettuce</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>lettuce, unspecified</td>
<td>13</td>
<td>392</td>
</tr>
<tr>
<td>lettuce, unspecified; parsley</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>mesclun mix</td>
<td>2</td>
<td>68</td>
</tr>
<tr>
<td>romaine lettuce</td>
<td>3</td>
<td>72</td>
</tr>
<tr>
<td>spinach</td>
<td>1</td>
<td>16</td>
</tr>
</tbody>
</table>

* where lettuce/leafy green was the only commodity implicated in the outbreak
Types of Lettuce/Leafy Green Associated with *E. coli* O157 Outbreaks, 1995-2005*

(n=26)

- Iceberg: 2
- Mesclun/mix: 2
- Romaine: 3
- Unspecified Lettuce: 13
- Cabbage: 3
- Spinach: 1
- Iceberg: 2
- Romaine: 3

*EFORS, 2005 data preliminary*
Outbreaks of Lettuce Associated *E. coli* O157 by State, 1995-2005

(N= 26)

Includes 4 multi-state outbreaks
Number of Lettuce Associated *E. coli* O157 outbreaks by Month, United States, 1995-2005*

(n=26)

*efORS, 2005 data preliminary
Place where food eaten in lettuce/leafy green – associated
E. coli O157 outbreaks, 1995-2005

<table>
<thead>
<tr>
<th>Place food eaten (n= 20)</th>
<th>Number of outbreaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restaurant</td>
<td>17</td>
</tr>
<tr>
<td>Nursing home</td>
<td>2</td>
</tr>
<tr>
<td>Private Home*</td>
<td>2</td>
</tr>
<tr>
<td>Camp</td>
<td>1</td>
</tr>
<tr>
<td>School*</td>
<td>1</td>
</tr>
<tr>
<td>Unknown</td>
<td>4</td>
</tr>
</tbody>
</table>

*2 outbreaks reported more than one location of consumption
Conclusions

- Lettuce most commonly identified food vehicle in produce-associated foodborne disease outbreaks
- Norovirus most common pathogen in lettuce associated outbreaks
- *E. coli* O157 most common bacterial etiology of outbreaks associated with lettuce
- Prevention of lettuce associated outbreaks requires efforts from farm to table
Acknowledgements

State and local health department outbreak investigators and eFORS reporters

Staff of the Enteric Disease Epidemiology Branch

"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