Three Outbreaks of *E. coli* O157 Infections Due to Retail Ground Beef in Minnesota, 2000: Detection, Investigation, and Characteristics

Ellen Swanson, MPH
Minnesota Department of Health
E. coli O157 Surveillance in Minnesota

- Isolates must be submitted to the Minnesota Department of Health (MDH)
- Real-time pulsed-field gel electrophoresis (PFGE) subtyping of all isolates
- Routine interviews of all cases
### Daily Report from Lab to Epi

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>City</th>
<th>County</th>
<th>Pathogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. Doe</td>
<td>3</td>
<td>Blaine</td>
<td>Anoka</td>
<td>E. coli O157</td>
</tr>
<tr>
<td>H. Smith</td>
<td>26</td>
<td>St. Paul</td>
<td>Ramsey</td>
<td>E. coli O157</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MN501</td>
</tr>
<tr>
<td>R. Jones</td>
<td>21</td>
<td>Luverne</td>
<td>Rock</td>
<td>C. jejuni</td>
</tr>
<tr>
<td>C. Grant</td>
<td>62</td>
<td>Stockton</td>
<td>Winona</td>
<td>S. Typhimurium</td>
</tr>
<tr>
<td>B. Brown</td>
<td>55</td>
<td>Winona</td>
<td>Winona</td>
<td>S. Typhimurium</td>
</tr>
</tbody>
</table>
4. Where did you shop for groceries eaten during the week before your illness?

________________________________________

5. Where and when did you purchase any hamburger you ate the week before your illness?

________________________________________

6. What type of hamburger was it (extra lean, % fat, etc.)?

________________________________________

What size package?

1/2 lb. _____ 1 lb. _____ 2 lb. _____ Other_______
### Meats & Poultry

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Ate</th>
<th>Did not eat</th>
<th>May have eaten</th>
<th>How prepared</th>
<th>Variety or brand</th>
<th>Grocery store where purchased</th>
<th>Date purchased (mo/da/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamburger</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>_______</td>
<td>_______</td>
<td>_______</td>
<td><em><strong>/</strong></em>/___</td>
</tr>
<tr>
<td>Hamburger as an ingredient: type of dish:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Hamburger:</td>
<td></td>
<td></td>
<td></td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

- raw
- rare (red in middle)
- medium (pink in middle)
- well done (no pink)

| Other beef: | | | | | | | |
| ___________ | ___________ | ___________ | ___/___/___ |
E. coli O157 Subtype Surveillance, Minnesota, 2000
*E. coli* O157:NM subtype MN454 Cases by Date of Onset, Minnesota, December 1999-February 2000

No. of Cases

Date of Onset

<table>
<thead>
<tr>
<th>Date</th>
<th>Dec 1999</th>
<th>Jan 2000</th>
<th>Feb 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date of Onset
Cases of *E. coli* O157:NM subtype MN454 by County of Residence
Outbreak 1:
December 1999 – February 2000

• Median age of cases: 18 years (range, 4 to 62 years)
• Based on initial interviews, no obvious common source identified
Outbreak 1

• Community case-control study done to determine risk factors for infection
  – two age-matched controls per case selected by sequentially dialing telephone numbers with the same prefix as the case’s number
  – standardized interview about food consumption and other potential exposures in the 7 days prior to case’s onset of illness
Outbreak 1

Nine of 10 cases ate ground beef from one major chain of grocery stores (Grocery Chain A) versus four of 20 controls

- matched OR, 11.8; 95% CI, 1.5 – 92.9; p = 0.019
Outbreak 1

- Ground beef was purchased from eight different Grocery Chain A stores
  - packages varied in weight and fat content
- Ground beef samples tested by Minnesota Department of Agriculture (MDA) were negative for O157
Ground Beef Flow Through Retail System

Supplier

Distributor

Warehouse

Individual
grocery stores

10 lb. chubs (in cases)

10 lb. chubs (in cases)

10 lb. chubs

Regrind

- various size packages
- various % lean
E. coli O157 Subtype Surveillance, Minnesota, 2000

Month

No. of cases

Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec
Outbreak 2

FRIDAY, SEPTEMBER 1

• MDH lab reported 3 *E. coli* O157:H7 isolates with indistinguishable PFGE pattern (MN501)
  – specimens collected in previous week

• 2 cases attended same barbecue, ate undercooked hamburgers
  – brand A frozen hamburger patties

• 3rd case not linked to barbecue, but had consumed Brand A patties in the week before onset
  – box with leftover patties submitted to MDA
Outbreak 2

TUESDAY, SEPTEMBER 5

- *E. coli* O157 isolated from patties

WEDNESDAY, SEPTEMBER 6

- Hamburger isolates confirmed as MN501 by PFGE (matched case isolates)
- Recall of 30,000 lbs. of product from implicated production date
- MDA later isolated MN501 from intact packages
E. coli O157 Subtype Surveillance, Minnesota, 2000
Outbreak 3: November 2000 – February 2001

MONDAY - TUESDAY, NOVEMBER 27-28

- MDH lab reported 5 *E. coli* O157:H7 isolates with indistinguishable PFGE pattern (MN9)
- Community case-control study initiated

WEDNESDAY, NOVEMBER 29

- MDH lab reported 5 additional isolates of MN9
Outbreak 3

FRIDAY, DECEMBER 1

• Consumption of ground beef purchased at Grocery Chain A associated with illness
  – 8 of 9 cases vs. 5 of 16 controls; matched OR, 10.0; 95% CI, 1.04-434; p=0.04
Outbreak 3

• Majority of ground beef exposures not hamburgers, but rather casseroles, spaghetti sauce, tacos, etc.

• Most exposures occurred 3 to 4 days before illness onset

• Multiple Grocery Chain A stores identified as sources of ground beef for cases

• Ground beef varied in weight and fat content
Outbreak 3

FRIDAY, DECEMBER 1

- Grocery Store A/Distributor A voluntarily recalled all ground beef from grocery stores that received product from Supplier A since November 1
- Case-control study discontinued

MONDAY, DECEMBER 4

- Supplier A issued a voluntary nationwide recall of 1.1 million lbs. of ground beef with November 2–3 production dates
E. coli O157:H7 subtype MN9 Cases by Date of Onset, Minnesota, November 2000 - February 2001
Cases of *E. coli* O157:H7 subtype MN9 by County of Residence
Outbreak 3

• Median age was 20 years (range, 1 to 87 years)
  - 24 cases hospitalized
  - 3 cases of hemolytic uremic syndrome
  - 2 colectomies
  - no deaths

• 20 grocery stores identified as sources of ground beef for cases
Outbreak 3

• MDA isolated *E. coli* O157:H7 from 23 ground beef samples
  – 4 samples from 3 case households (opened and intact packages; meatballs) were positive
  – 19/43 samples from intact packages returned to 3 different stores were positive
  – 19 positive samples yielded the MN9 subtype; 5 samples yielded isolates with other PFGE subtypes (not associated with human cases)
Discussion

• Outbreaks due to retail ground beef can be difficult to identify
  – cases may not be tightly clustered in time and space

• Strategies exist to enhance outbreak detection and investigation
Discussion (cont.)

- Real-time PFGE subtyping of all *E. coli* O157 isolates
- Rapid interviewing of cases about potential exposures, including detailed questions about ground beef
- Community case-control studies
  - consider when there is a temporal cluster of at least 5 cases with no obvious common source
Discussion (cont.)

- Aggressive culturing of ground beef
  - from case households
  - from retail sources
- Ground beef sold in numerous grocery stores, in packages of varying weight and fat content, may be from a common source
  - store grind records
Co-Investigators, Minnesota Department of Health

• Kirk Smith
• Liz Wagstrom
• Fe Leano
• David Boxrud
• Jennifer Adams
• John Besser
• Richard Danila
• Harry Hull