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**Escherichia coli O157:H7**

- Illness characterized by:
  - Diarrhea, often bloody
  - Abdominal cramps
- Estimate 73,000 illnesses annually in the United States
- Of reported cases
  - ~15% in recognized outbreaks
  - ~85% “sporadic”
Previously Identified Risk Factors for Sporadic Infection

- 1996-1997 FoodNet case-control study
  - Exposure to farms
  - Cattle
  - Consumption of pink hamburgers
  - Eating at table service restaurant
  - Using immune suppressive medication
  - Beef from private slaughter arrangement
Study Objectives and Population

- Matched case-control study of sporadic infections in 1999-2000 in FoodNet sites
- Identify changes in risk factors
Methods

• **Cases**
  - Culture-confirmed *E. coli* O157 infection with diarrhea in resident of FoodNet catchment area
  - Not part of outbreak

• **Controls**
  - 2 age and telephone exchange matched controls per case
  - Excluded if diarrhea or culture-confirmed case in household
  - Interviewed within 7 days of matched case interview
Methods

• Interviews
  • Conducted by telephone
  • Written questionnaire

• Collected information
  • Demographics
  • Clinical illness
  • Food, water, and animal exposures
  • In 7 days before patient’s illness
Reasons for exclusion from study

531 cases of *E. coli* O157

141 did not meet inclusion criteria:
- Outbreak associated (79)
- Family member with +culture/bloody diarrhea (26)
- Unable to answer questions/ non-English speaker (24)
- Diarrhea onset > 10 days before collection (8)
- Asymptomatic or could not give onset of diarrhea (4)

390 eligible cases

57 not included in study:
- Unable to interview within 21 days of collection (37)
- Refused (9)
- No matched control found (4)
- Unable to contact patient (7)

333 enrolled cases
<table>
<thead>
<tr>
<th>Demographics</th>
<th>Enrolled</th>
<th>Not Enrolled</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 333</td>
<td>N = 198</td>
<td>N = 591</td>
<td></td>
</tr>
<tr>
<td>Median age (yrs)</td>
<td>19 (0-87)</td>
<td>13 (1-86)</td>
<td>24 (1-93)</td>
</tr>
<tr>
<td>White</td>
<td>94%</td>
<td>87%</td>
<td>92%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>5%</td>
<td>6%</td>
<td>5%</td>
</tr>
<tr>
<td>Female</td>
<td>54%</td>
<td>57%</td>
<td>62%</td>
</tr>
<tr>
<td>Income (median)</td>
<td>$40-55,000</td>
<td>$40-55,000</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Some college</td>
<td>Some college</td>
<td></td>
</tr>
</tbody>
</table>
Distribution of Enrolled Cases by FoodNet Site (N=333)

% of Enrolled Cases

Cases enrolled in study

FoodNet site

CA  CT  GA  MD  MN  NY  OR
# Clinical Features of Enrolled Cases (N=333)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood in stool</td>
<td>91%</td>
</tr>
<tr>
<td>Fever</td>
<td>49%</td>
</tr>
<tr>
<td>Vomiting</td>
<td>46%</td>
</tr>
<tr>
<td>Visited ER</td>
<td>63%</td>
</tr>
<tr>
<td>Admitted</td>
<td>40%</td>
</tr>
<tr>
<td>Median duration of diarrhea</td>
<td>6 days (range 1-74)</td>
</tr>
<tr>
<td>Median # workdays missed</td>
<td>4 days (range 0-18)</td>
</tr>
<tr>
<td>Median length of hospital stay</td>
<td>4 days (range 1-24)</td>
</tr>
</tbody>
</table>
Univariate Analysis

- Food
- Water
- Environment
## Food Risk Factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Cases / Controls</th>
<th>mOR</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microwave thawing of frozen ground beef</td>
<td>25% / 19%</td>
<td>1.5</td>
<td>1.0-2.2</td>
</tr>
<tr>
<td>Pink hamburger</td>
<td>17% / 11%</td>
<td>1.6</td>
<td>1.1-2.5</td>
</tr>
<tr>
<td>Pink hamburger eaten in home</td>
<td>9% / 6%</td>
<td>1.7</td>
<td>1.0-3.0</td>
</tr>
<tr>
<td>Pink hamburger eaten in restaurant</td>
<td>3% / 2%</td>
<td>1.7</td>
<td>0.8-3.6</td>
</tr>
</tbody>
</table>
## Water Risk Factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Cases/ Controls</th>
<th>mOR</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swimming in surface water with cattle nearby</td>
<td>3% / 0.4%</td>
<td>15.8</td>
<td>1.9-127.7</td>
</tr>
<tr>
<td>Drinking surface water</td>
<td>6% / 2%</td>
<td>3.5</td>
<td>1.6-7.6</td>
</tr>
</tbody>
</table>
## Environmental Risk Factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Cases/ Controls</th>
<th>mOR</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living on farm</td>
<td>11% / 7%</td>
<td>1.9</td>
<td>1.1-3.4</td>
</tr>
<tr>
<td>Living on farm with cows present</td>
<td>6% / 3%</td>
<td>2.4</td>
<td>1.1-4.9</td>
</tr>
<tr>
<td>Visited farm 1 to &lt;12 times per year</td>
<td>4% / 1%</td>
<td>3.0</td>
<td>1.1-8.3</td>
</tr>
</tbody>
</table>
Factors Associated with Decreased Risk of Illness

Consumption of:

- Ground turkey
- Pork chops / Roast pork
- Organic produce
- Bottled water
- Any of 12 produce items
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>mOR</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pink hamburger</td>
<td>2.0</td>
<td>1.2-3.4</td>
</tr>
<tr>
<td>Microwave thawing of frozen ground beef</td>
<td>1.6</td>
<td>1.1-2.5</td>
</tr>
<tr>
<td>Swimming in surface water with cattle nearby</td>
<td>18.6</td>
<td>2.1-165.4</td>
</tr>
<tr>
<td>Living on farm with cows present</td>
<td>2.2</td>
<td>1.0-5.0</td>
</tr>
</tbody>
</table>
Summary

- Pink hamburger, surface water, and farms continue to be sources of sporadic *E. coli* O157 infections.
- Home food preparation practices such as microwave thawing of frozen ground beef play a role in illness.
- Restaurant consumption of pink hamburger was not associated with infection.
Recommendations: Food

• Encourage the continuation of meat industry efforts to reduce *E. coli* O157 contamination of ground beef

• Support ongoing educational efforts to promote safe preparation and adequate cooking of ground beef
Recommendations: Water

• Discourage recreational use of surface waters likely to be contaminated with cattle feces
Recommendations: Environment

- Encourage hand washing practices among farm visitors and residents
  - Alcohol-based hand washing gels
  - Hand washing stations
FoodNet Working Group, 2000

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Distribution of Cases by FoodNet Site

Number of cases

- Case control study
- Surveillance

FoodNet site:
- CA
- CT
- GA
- MD
- MN
- NY
- OR

The figure shows the distribution of cases by FoodNet site, comparing case control study and surveillance methods. MN has the highest number of cases under surveillance.
## Univariate Analysis

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>mOR</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>0.59</td>
<td>(0.43-0.82)</td>
</tr>
<tr>
<td>Broccoli</td>
<td>0.64</td>
<td>(0.43-0.94)</td>
</tr>
<tr>
<td>Cantaloupe</td>
<td>0.53</td>
<td>(0.36-0.77)</td>
</tr>
<tr>
<td>Carrots</td>
<td>0.59</td>
<td>(0.43-0.8)</td>
</tr>
<tr>
<td>Cilantro</td>
<td>0.43</td>
<td>(0.19-0.98)</td>
</tr>
<tr>
<td>Honeydew</td>
<td>0.55</td>
<td>(0.31-0.97)</td>
</tr>
<tr>
<td>Green onions</td>
<td>0.49</td>
<td>(0.3-0.81)</td>
</tr>
<tr>
<td>Parsley</td>
<td>0.33</td>
<td>(0.13-0.86)</td>
</tr>
<tr>
<td>Raw cabbage</td>
<td>0.45</td>
<td>(0.27-0.73)</td>
</tr>
<tr>
<td>Red leaf lettuce</td>
<td>0.40</td>
<td>(0.19-0.84)</td>
</tr>
<tr>
<td>Romaine lettuce</td>
<td>0.53</td>
<td>(0.33-0.86)</td>
</tr>
<tr>
<td>Strawberries</td>
<td>0.46</td>
<td>(0.31-0.69)</td>
</tr>
<tr>
<td>Watermelon</td>
<td>0.69</td>
<td>(0.48-0.99)</td>
</tr>
</tbody>
</table>
## Previously Identified Risk Factors for Sporadic Infection

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th># of Cases</th>
<th>Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>1985-86</td>
<td>24</td>
<td>Rare ground beef, raw milk</td>
</tr>
<tr>
<td>Canada</td>
<td>1986-87</td>
<td>81</td>
<td>Undercooked meat</td>
</tr>
<tr>
<td>USA</td>
<td>1990-92</td>
<td>73</td>
<td>Eating undercooked hamburger</td>
</tr>
<tr>
<td>USA</td>
<td>1994</td>
<td>23</td>
<td>Hamburgers prepared in the home, not washing hands after handling ground beef</td>
</tr>
<tr>
<td>England</td>
<td>1994-96</td>
<td>142</td>
<td>Hamburger from restaurant other than fast food A, cold cooked sliced meat from caterer</td>
</tr>
<tr>
<td>England</td>
<td>1996-97</td>
<td>369</td>
<td>Farm contact</td>
</tr>
<tr>
<td>USA (FoodNet)</td>
<td>1996-97</td>
<td>196</td>
<td>Farms, cattle, pink burgers, eating at table service restaurant, using immune suppressive medication and obtaining beef through private slaughter arrangement</td>
</tr>
<tr>
<td>Scotland</td>
<td>1996-99</td>
<td>183</td>
<td>Contact with animal feaces</td>
</tr>
</tbody>
</table>