Shiga-toxin producing E. coli : Thanksgiving 2011 outbreak

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Great Lakes Border Health Initiative Annual Conference
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Where are we?

- Counties of Wellington & Dufferin + City of Guelph
- Approximately 260,000 people
Overview

• Canadian Thanksgiving weekend: Friday Oct 7-Mon Oct 10 (Thanksgiving Day) 2011
• Notified Fri Oct 14 (pm): family gathering
• Serious GI illness (bloody stools, ER visit) in family member of hostess
• Other guests reported illness including some US residents
The Investigation

• Informal conversations with hostess, immediate family members, caterers, other guests
• Review of food ingredients & handling
• Formal interviews (outbreak questionnaire)
• Collection of stool, environmental, water & leftover food samples, submission to labs
• Trace-back of foods where possible, inspections of premises used to store & prepare
The Event

- 59 guests
- Started arriving Friday Oct 7; left Mon Oct 10
- Stayed in various places, attended several major gatherings over the weekend
- Some meals separately (e.g. breakfast), some all together

<table>
<thead>
<tr>
<th>Health Area</th>
<th>Number of Guests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wellington-Dufferin-Guelph</td>
<td>24</td>
</tr>
<tr>
<td>Michigan</td>
<td>14</td>
</tr>
<tr>
<td>Illinois</td>
<td>9</td>
</tr>
<tr>
<td>Simcoe-Muskoka</td>
<td>8</td>
</tr>
<tr>
<td>North Carolina</td>
<td>2</td>
</tr>
<tr>
<td>Halton</td>
<td>1</td>
</tr>
<tr>
<td>Leeds-Grenville</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>59</strong></td>
</tr>
</tbody>
</table>
Areas of residence of guests
The Communal Meals

• **Fri Oct 7 dinner**: home-made lasagnas (chicken, beef & gluten-free), salads, cake

• **Sat Oct 8 lunch**: Pig roast + professionally catered meal

• **Sat Oct 8 dinner**: Pizza, home-made ice cream, cookies

• **Sun Oct 9 lunch**: Turkey (smoked/roasted), potatoes & veg, salads, desserts

• **Sun Oct 9 dinner**: Left-over turkey & pork, sweet potato, buns
Results of Investigation: Inspections, Trace-back & Informal Interviews

No red flags except:

- **Pig roast** - Roasted for 12 h outdoors above heat source without shed, undocumented probe readings (?182°C/360°F); low overnight (4°C/39°F) & morning air temps.

- **Home-made ice-cream** - Used 27 raw eggs from hobby farm (De Schrijver et al., 2008)

- **Ingredients of lasagnas and other ‘high-risk foods’** raised no red flags
Results:
Laboratory Analyses

• Stool samples: Shiga-toxin-producing *E. coli* (STEC) O157:H7 in 11 clinical specimens = two PFGE patterns, differing by one band. *Clostridium perfringens* in two.

• Food samples: Pork, turkey, potato, beets & carrots submitted. Everything ‘clean’ except pork: STEC (identical to 8/11 clinical isolates) and *C. perfringens*.

• Environmental, water & faecal samples from hobby farm (poultry & goats): All ‘clean’ – no STEC.
Results:
Outbreak questionnaire

- High attack rate: 29 of 59 guests ill = 49%
- First illness Monday morning
- Incubation period 1.5 to 7.5 d (from Sat lunch), median 4 d
Results: Outbreak questionnaire

- Four guests developed complications, incl. 3 with signs indicative of HUS (hemolytic-uremic syndrome)

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Number of Guests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>24 (Bloody ≥ 6)</td>
</tr>
<tr>
<td>Abdominal cramps</td>
<td>20</td>
</tr>
<tr>
<td>Nausea</td>
<td>7</td>
</tr>
<tr>
<td>Fever</td>
<td>6</td>
</tr>
<tr>
<td>Muscle aches</td>
<td>6</td>
</tr>
<tr>
<td>Vomiting</td>
<td>5</td>
</tr>
<tr>
<td>Blood in urine</td>
<td>1</td>
</tr>
</tbody>
</table>
Results:

Outbreak questionnaire

Food exposures highly correlated

Highest attack rate difference and odds ratio + strongest statistical significance: left-over pork

<table>
<thead>
<tr>
<th>Food or Beverage</th>
<th>Group A: Persons who ate / were exposed</th>
<th>Group B: Persons who did not eat /non-exposed</th>
<th>Attack Rate Difference</th>
<th>Odds Ratio*</th>
<th>Confidence Interval of Odds Ratio*</th>
<th>p(chi)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ill</td>
<td>Not ill</td>
<td>Total</td>
<td>Attack Rate (%)</td>
<td>Ill</td>
<td>Not ill</td>
</tr>
<tr>
<td>Fri – Event Day 1 (dinner):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ate at Fri dinner</td>
<td>25</td>
<td>17</td>
<td>42</td>
<td>59.5</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Garlic bread</td>
<td>23</td>
<td>12</td>
<td>35</td>
<td>65.7</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Sat –Day 2 (dinner):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ate at Sat dinner</td>
<td>25</td>
<td>17</td>
<td>42</td>
<td>59.5</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Pizza (various)</td>
<td>25</td>
<td>17</td>
<td>42</td>
<td>59.5</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Sun –Day 3 (lunch):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ate at Sun lunch</td>
<td>25</td>
<td>17</td>
<td>42</td>
<td>59.5</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Roasted turkey</td>
<td>22</td>
<td>15</td>
<td>37</td>
<td>59.5</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Mashed potato</td>
<td>23</td>
<td>16</td>
<td>39</td>
<td>59.0</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Blueberry pie</td>
<td>11</td>
<td>4</td>
<td>15</td>
<td>73.3</td>
<td>14</td>
<td>19</td>
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<tr>
<td>Sun –Day 4 (dinner):</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ate at Sun dinner</td>
<td>22</td>
<td>13</td>
<td>35</td>
<td>62.9</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Left-over pork</td>
<td>18</td>
<td>4</td>
<td>22</td>
<td>81.8</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Buns</td>
<td>18</td>
<td>5</td>
<td>23</td>
<td>78.3</td>
<td>5</td>
<td>11</td>
</tr>
</tbody>
</table>
More about the pork

• Pig was from provincially-inspected plant that processed only pigs; no cattle

• Pig roast - Roasted for 12 h outdoors above heat source without shed, undocumented probe readings (?182°C/360°F); low overnight (4°C/39°F)& morning air temps.

• Anecdotal information: some parts undercooked, rubbery, at Sat lunch

• Left-overs sliced & stored in full fridge. Fri (Oct 16) temp reading 5.0 -7.9°C (41-46°F)

• Some left-overs served cold at Sun dinner
Shiga-toxin producing *E. coli* (STEC) in people

- Diarrhea, hemorrhagic colitis, HUS (8% of children with O157:H7)
- O157:H7 is prototype STEC & most virulent
- Initially severe cramps, diarrhea → visible or occult blood
- Fever in less than 33% of cases
- Fecal-oral transmission
- Incubation period 1 to >7 d; median 3 to 4d

(Salmon et al. 1989; WHO 2008)
Shiga-toxin producing *E. coli* (STEC) in animals

- Zoonosis (animals → man)
- Can cause diarrhea esp young animals
- Very often asymptomatic esp older animals = carriers/intermittent shedders
- Contact with manure/intestinal contents → contamination of carcase at slaughter
- Poor hand hygiene or inadequate cooking or poor food handling → human illness
STEC in animals

- Cattle, other ruminants, swine, poultry (Doane et al., 2007)
- Swine:
  - O157:H7 in 8.9% of swine samples from 16 farms in 5 states vs. 3.6% of beef cattle (Doane et al., 2007)
  - O157:H7 in 1.2% of 1,102 swine; 11.4% of 1,407 cattle from 29 county fairs in 2 states + 3 state fairs (Keen et al., 2006)
  - O157: H7 in feral swine near spinach fields in California (Jay et al., 2007)
  - O157 in 36.5% of 359 swine samples in SW Ontario (Farzan et al., 2010)
Hypothesis

FARM
- STEC-infected pig

Improper/no re-heating
- Improper storage of leftovers

Served Sunday (inner meat)

PLANT
- Contamination of carcase at slaughter

Improper/no re-heating
- Served Sat: little or no illness (outer meat: less contaminated, better cooked)

SUPERMARKET
- Transportation & storage

EVENT
- Incomplete cooking

ILLNESS
Recommendations

• Don’t always assume cattle source when investigating *E. coli*
• Ideally, trace-back to farms/processing plants for testing where strong indications of plant or farm source
• Cross-border notification: a bit slow. Direct contact between provincial and state authorities? (e.g. PHO & State Departments of Health)
• More (info on) collection of samples from U.S. cases, notification of results & access to clinical updates
• Cross-border data sharing agreements b/t front-line organizations if necessary
• Better guidelines for cooking of large joints of meat in outdoor environments
Thanks to:

- PHIs and PHNs of Ontario public health units
- U.S. State Health Departments
- Public Health Ontario, Ontario Ministry of Health & Long-Term Care (including laboratory staff)
- Public Health Agency of Canada (including Laboratory for Foodborne Zoonoses)
- Centers for Disease Control
- Ontario Ministry of Agriculture, Food & Rural Affairs
- University of Guelph (Ontario Veterinary College: Dept of Population Medicine)
References

Questions??